

**\*\* WARNING \*\* WARNING \*\* WARNING \*\* WARNING \*\***  
**This document is intended for informational purposes only.**

Users are cautioned that Caltrans does not assume any liability or responsibility based on these electronic files or for any defective or incomplete copying, excerpting, scanning, faxing or downloading of the contract documents. As always, for the official paper versions of the bidders and non-bidder packages, write to the California Department of Transportation, Plans and Bid Documents, Room 0200, P.O. Box 942874, Sacramento, CA 94272-0001, telephone (916) 654-4490 or fax (916) 654-7028. Office hours are 7:30 a.m. to 4:15 p.m. When ordering bidder or non-bidder packages it is important that you include a telephone and fax number, P.O. Box and street address so that you can receive addenda.

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 BUILDING CONSTRUCTION IN  
TRINITY COUNTY IN WEAVERVILLE AT THE WEAVERVILLE  
MAINTENANCE STATION AT 203 MEMORIAL DRIVE**

**DISTRICT 02, ROUTE 299**

---

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

---

**CONTRACT NO. 02-341604**

**02-Tri-299-5733**

**Bids Open: June 5, 2001**  
**Dated: May 7, 2001**

**OSD**

\*\*\*\*\*

# IMPORTANT SPECIAL NOTICES

\*\*\*\*\*

- Attention is directed to the Notice to Contractor and Section 1, "Plans and Specifications," of the special provisions regarding references to the District and District Director's Office. The Office of the District Director for the Northern Region is located at Marysville.
- **Payment Bonds**  
Attention is directed to Section 5 of the Special Provisions, regarding contract bonds. The payment bond shall be in a sum not less than one hundred percent of the total amount payable by the terms of the contract.



# TABLE OF CONTENTS

NOTICE TO CONTRACTORS.....	1
COPY OF ENGINEER'S ESTIMATE .....	3
SPECIAL PROVISIONS .....	6
SECTION 1. SPECIFICATIONS AND PLANS .....	6
SECTION 2. PROPOSAL REQUIREMENTS AND CONDITIONS.....	6
2-1.01 GENERAL.....	6
2-1.02 DISABLED VETERAN BUSINESS ENTERPRISE (DVBE).....	6
2-1.03 DVBE GOAL FOR THIS PROJECT.....	7
2-1.04 SUBMISSION OF DVBE INFORMATION .....	8
2-1.05 SMALL BUSINESS PREFERENCE.....	8
2-1.06 CALIFORNIA COMPANY PREFERENCE.....	9
SECTION 3. AWARD AND EXECUTION OF CONTRACT.....	9
SECTION 4. BEGINNING OF WORK, TIME OF COMPLETION AND LIQUIDATED DAMAGES .....	10
SECTION 5. GENERAL .....	10
SECTION 5-1. MISCELLANEOUS .....	10
5-1.01 PLANS AND WORKING DRAWINGS .....	10
5-1.011 EXAMINATION OF PLANS, SPECIFICATIONS, CONTRACT, AND SITE OF WORK .....	11
5-1.012 DIFFERING SITE CONDITIONS.....	11
5-1.015 LABORATORY .....	11
5-1.017 CONTRACT BONDS .....	11
5-1.018 EXCAVATION SAFETY PLANS .....	11
5-1.019 COST REDUCTION INCENTIVE.....	12
5-1.02 LABOR NONDISCRIMINATION .....	12
5-1.03 INTEREST ON PAYMENTS .....	12
5-1.031 FINAL PAYMENT AND CLAIMS.....	13
5-1.04 PUBLIC SAFETY .....	13
5-1.05 SURFACE MINING AND RECLAMATION ACT.....	14
5-1.06 REMOVAL OF ASBESTOS AND HAZARDOUS SUBSTANCES .....	14
5-1.07 YEAR 2000 COMPLIANCE.....	15
5-1.08 SUBCONTRACTOR AND DVBE RECORDS.....	15
5-1.086 PERFORMANCE OF DVBE SUBCONTRACTORS AND SUPPLIERS .....	15
5-1.09 SUBCONTRACTING.....	15
5-1.10 PROMPT PROGRESS PAYMENT TO SUBCONTRACTORS .....	16
5-1.11 PARTNERING .....	16
5-1.12 AREAS FOR CONTRACTOR'S USE .....	16
5-1.13 PAYMENTS.....	16
SECTION 6. (BLANK).....	17
SECTION 7. (BLANK).....	17
SECTION 8. MATERIALS .....	17
SECTION 8-1. MISCELLANEOUS .....	17
8-1.01 SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS .....	17
8-1.02 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS .....	23
PAVEMENT MARKERS, PERMANENT TYPE .....	24
PAVEMENT MARKERS, TEMPORARY TYPE.....	24
STRIPING AND PAVEMENT MARKING MATERIAL .....	24
CLASS 1 DELINEATORS.....	25
CHANNELIZERS .....	25
CONICAL DELINEATORS, 1070 mm.....	26
OBJECT MARKERS.....	26
TEMPORARY RAILING (TYPE K) REFLECTORS AND CONCRETE BARRIER MARKERS .....	26
THREE BEAM BARRIER MARKERS.....	26
CONCRETE BARRIER DELINEATORS, 400 mm .....	26
CONCRETE BARRIER-MOUNTED MINI-DRUM (260 mm x 360 mm x 570 mm).....	27
SOUND WALL DELINEATOR.....	27

GUARD RAILING DELINEATOR.....	27
RETROREFLECTIVE SHEETING.....	27
SPECIALTY SIGN (All Plastic).....	28
SIGN SUBSTRATE FOR CONSTRUCTION AREA SIGNS .....	28
8-1.03 ASPHALT .....	28
8-1.04 ENGINEERING FABRICS.....	31
SECTION 8-2. CONCRETE.....	31
8-2.01 PORTLAND CEMENT CONCRETE.....	31
SECTION 8-3. WELDING .....	31
8-3.01 WELDING ELECTRODES .....	31
8-3.02 WELDING QUALITY CONTROL .....	31
SECTION 9. (BLANK).....	35
SECTION 10. CONSTRUCTION DETAILS.....	35
SECTION 10-1. GENERAL .....	35
10-1.01 ORDER OF WORK.....	35
10-1.02 WATER POLLUTION CONTROL.....	35
WATER POLLUTION CONTROL PROGRAM PREPARATION, APPROVAL AND UPDATES .....	36
WPCP IMPLEMENTATION .....	37
MAINTENANCE .....	38
PAYMENT .....	38
10-1.03 TEMPORARY FENCE (TYPE CL-1.8).....	38
10-1.04 PROGRESS SCHEDULE (CRITICAL PATH METHOD).....	39
10-1.05 OBSTRUCTIONS .....	41
10-1.06 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES .....	42
10-1.07 CONSTRUCTION AREA SIGNS .....	42
10-1.08 MAINTAINING TRAFFIC.....	43
10-1.09 EXISTING HIGHWAY FACILITIES .....	43
REMOVE METAL BEAM GUARD RAILING.....	43
RELOCATE CHAIN LINK FENCE.....	43
RELOCATE GATE .....	43
ADJUST MANHOLE TO GRADE.....	43
ADJUST FRAME AND GRATE TO GRADE.....	43
REMOVE CONCRETE.....	43
10-1.10 CLEARING AND GRUBBING.....	43
10-1.11 STRUCTURE DEMOLITION .....	44
ASBESTOS.....	44
PERMITS.....	44
LEAD BASED PAINT .....	44
DISPOSING OF ELECTRICAL EQUIPMENT .....	45
PAYMENT .....	46
10-1.12 EARTHWORK.....	46
10-1.13 CONTROLLED LOW STRENGTH MATERIAL .....	46
10-1.14 STRUCTURE EXCAVATION (CONTAMINATED).....	47
10-1.15 SUBGRADE ENHANCEMENT FABRIC .....	49
10-1.16 ROCK BLANKET.....	50
MATERIALS.....	50
SITE PREPARATION.....	50
PLACEMENT.....	50
MEASUREMENT AND PAYMENT .....	50
10-1.17 EROSION CONTROL (TYPE D).....	50
MATERIALS.....	50
APPLICATION .....	52
MEASUREMENT AND PAYMENT .....	53
10-1.18 IRRIGATION CROSSOVERS .....	53
10-1.19 AGGREGATE BASE.....	53
10-1.20 ASPHALT CONCRETE .....	53
10-1.21 LIQUID ANTI-STRIP TREATMENT OF ASPHALT CONCRETE .....	55
GENERAL.....	55
MATERIALS.....	55

STORING AND PROPORTIONING .....	56
MEASUREMENT AND PAYMENT .....	57
10-1.22 CONCRETE STRUCTURES.....	57
10-1.23 REINFORCED CONCRETE PIPE.....	57
10-1.24 GEOMEMBRANE (WATER BARRIER).....	58
MATERIALS.....	58
SEAMS .....	58
INSTALLATION.....	59
MEASUREMENT .....	59
PAYMENT .....	59
10-1.25 GEOTEXTILE (CUSHION FABRIC).....	59
INSTALLATION .....	59
MATERIALS.....	60
MEASUREMENT.....	60
PAYMENT.....	60
10-1.26 CORRUGATED STEEL PIPE ELBOW.....	60
10-1.27 MISCELLANEOUS FACILITIES.....	60
10-1.28 SLOPE PROTECTION .....	60
10-1.29 MISCELLANEOUS IRON AND STEEL.....	60
10-1.30 CHAIN LINK FENCE (TYPE CL-1.8, SLATTED).....	61
10-1.31 GUARD POST .....	61
SECTION 10-2. HIGHWAY PLANTING AND IRRIGATION SYSTEMS .....	61
10-2.01 GENERAL.....	61
PROGRESS INSPECTIONS.....	61
COST BREAK-DOWN .....	62
10-2.02 HIGHWAY PLANTING.....	64
ROADSIDE CLEARING .....	64
PESTICIDES .....	64
10-2.03 IRRIGATION SYSTEMS .....	65
VALVE BOXES.....	65
ELECTRIC AUTOMATIC IRRIGATION COMPONENTS .....	65
IRRIGATION SYSTEMS FUNCTIONAL TEST .....	66
PIPE .....	66
BACKFLOW PREVENTER ASSEMBLIES.....	66
TESTING BACKFLOW PREVENTERS .....	66
SPRINKLERS.....	67
WYE STRAINERS.....	67
FINAL IRRIGATION SYSTEM CHECK .....	67
SECTION 11. MODIFIED STANDARD SPECIFICATION SECTIONS .....	67
SECTION 11-1. QUALITY CONTROL / QUALITY ASSURANCE .....	67
SECTION 11-1. (BLANK) .....	67
SECTION 11-2. PORTLAND CEMENT CONCRETE.....	67
11-2.01 GENERAL.....	67
SECTION 90: PORTLAND CEMENT CONCRETE .....	67
90-1 GENERAL.....	67
90-1.01 DESCRIPTION .....	67
90-2 MATERIALS.....	69
90-2.01 CEMENT.....	69
90-2.02 AGGREGATES.....	69
90-2.02A Coarse Aggregate.....	70
90-2.02B Fine Aggregate.....	71
90-2.03 WATER .....	71
90-2.04 ADMIXTURE MATERIALS.....	72
90-3 AGGREGATE GRADINGS.....	72
90-3.01 GENERAL.....	72
90-3.02 COARSE AGGREGATE GRADING.....	72
90-3.03 FINE AGGREGATE GRADING.....	73
90-3.04 COMBINED AGGREGATE GRADINGS.....	73

90-4	ADMIXTURES .....	74
90-4.01	GENERAL.....	74
90-4.02	MATERIALS.....	74
90-4.03	ADMIXTURE APPROVAL .....	74
90-4.04	REQUIRED USE OF CHEMICAL ADMIXTURES AND CALCIUM CHLORIDE .....	75
90-4.05	OPTIONAL USE OF CHEMICAL ADMIXTURES.....	75
90-4.06	REQUIRED USE OF AIR-ENTRAINING ADMIXTURES .....	75
90-4.07	OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES.....	75
90-4.08	REQUIRED USE OF MINERAL ADMIXTURES .....	75
90-4.09	BLANK.....	76
90-4.10	PROPORTIONING AND DISPENSING LIQUID ADMIXTURES .....	76
90-4.11	STORAGE, PROPORTIONING, AND DISPENSING OF MINERAL ADMIXTURES .....	76
90-5	PROPORTIONING .....	77
90-5.01	STORAGE OF AGGREGATES .....	77
90-5.02	PROPORTIONING DEVICES .....	77
90-5.03	PROPORTIONING .....	78
90-5.03A	Proportioning for Pavement.....	78
90-6	MIXING AND TRANSPORTING.....	79
90-6.01	GENERAL.....	79
90-6.02	MACHINE MIXING .....	79
90-6.03	TRANSPORTING MIXED CONCRETE.....	80
90-6.04	TIME OR AMOUNT OF MIXING.....	81
90-6.05	HAND-MIXING.....	81
90-6.06	AMOUNT OF WATER AND PENETRATION .....	81
90-7	CURING CONCRETE .....	82
90-7.01	METHODS OF CURING.....	82
90-7.01A	Water Method .....	82
90-7.01B	Curing Compound Method .....	82
90-7.01C	Waterproof Membrane Method .....	84
90-7.01D	Forms-In-Place Method.....	84
90-7.02	CURING PAVEMENT .....	84
90-7.03	CURING STRUCTURES.....	84
90-7.04	CURING PRECAST CONCRETE MEMBERS.....	85
90-7.05	CURING PRECAST PRESTRESSED CONCRETE PILES.....	85
90-7.06	CURING SLOPE PROTECTION .....	86
90-7.07	CURING MISCELLANEOUS CONCRETE WORK .....	86
90-8	PROTECTING CONCRETE.....	86
90-8.01	GENERAL.....	86
90-8.02	PROTECTING CONCRETE STRUCTURES.....	86
90-8.03	PROTECTING CONCRETE PAVEMENT.....	86
90-9	COMPRESSIVE STRENGTH .....	87
90-9.01	GENERAL.....	87
90-10	MINOR CONCRETE .....	89
90-10.01	GENERAL.....	89
90-10.02	MATERIALS.....	89
90-10.02A	Cementitious Material .....	89
90-10.02B	Aggregate.....	89
90-10.02C	Water.....	89
90-10.02D	Admixtures .....	89
90-10.03	PRODUCTION.....	89
90-10.04	CURING MINOR CONCRETE.....	90
90-10.05	PROTECTING MINOR CONCRETE.....	90
90-10.06	MEASUREMENT AND PAYMENT .....	90
90-11	MEASUREMENT AND PAYMENT .....	90
90-11.01	MEASUREMENT.....	90
90-11.02	PAYMENT.....	90
	SECTION 12. BUILDING WORK.....	90
	SECTION 12-1. GENERAL REQUIREMENTS .....	90
12-1.01	SCOPE.....	90

12-1.02	ABBREVIATIONS .....	91
12-1.03	GUARANTEE .....	91
12-1.04	COOPERATION .....	92
12-1.05	SUBMITTALS .....	92
12-1.06	PROGRESS SCHEDULE .....	93
12-1.07	SCHEDULE OF VALUES .....	93
12-1.08	INSPECTION .....	93
12-1.09	OBSTRUCTIONS .....	93
12-1.10	PRESERVATION OF PROPERTY .....	93
12-1.11	UTILITY CONNECTION .....	94
12-1.12	TEMPORARY UTILITIES .....	94
12-1.13	SANITARY FACILITIES .....	94
12-1.14	REFERENCES .....	94
12-1.15	MEASUREMENT AND PAYMENT .....	94
12-1.16	FIELD ENGINEERING .....	94
12-1.17	SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS .....	95
SECTION 12-2.	SITework .....	106
12-2.01	REMOVING PORTIONS OF EXISTING FACILITIES .....	106
12-2.02	RELOCATING MATERIALS AND EQUIPMENT .....	106
12-2.03	EARTHWORK FOR BUILDING WORK .....	107
12-2.04	AGGREGATE BASE .....	111
12-2.05	FREE DRAINING GRANULAR MATERIAL .....	112
12-2.06	CAST-IN-DRILLED-HOLE CONCRETE PILES .....	112
12-2.07	PAINTED PAVEMENT MARKINGS .....	113
12-2.08	SANITARY SEWAGE DISPOSAL SYSTEM .....	114
12-2.09	GUARD POSTS .....	117
12-2.10	PARKING BUMPERS .....	118
12-2.11	ACCESSIBLE PARKING AND AUTHORIZATION SIGNS .....	118
SECTION 12-3.	CONCRETE AND REINFORCEMENT .....	119
12-3.01	CAST-IN-PLACE CONCRETE .....	119
SECTION 12-4.	MASONRY .....	126
12-4.01	CONCRETE MASONRY UNITS .....	126
SECTION 12-5.	METALS .....	131
12-5.01	STRUCTURAL STEEL FOR BUILDINGS .....	131
12-5.02	OPEN WEB STEEL JOISTS .....	135
12-5.03	COLD FORMED METAL FRAMING .....	137
12-5.04	BUILDING MISCELLANEOUS METAL .....	139
SECTION 12-6.	WOOD AND PLASTICS .....	142
12-6.01	ROUGH CARPENTRY .....	142
12-6.02	FINISH CARPENTRY .....	145
12-6.03	CABINETS .....	147
SECTION 12-7.	THERMAL AND MOISTURE PROTECTION .....	149
12-7.01	WATER REPELLENT COATING .....	149
12-7.02	INSULATION (GENERAL) .....	150
12-7.02A	BATT AND BLANKET INSULATION .....	151
12-7.02B	RIGID WALL INSULATION .....	153
12-7.02C	RIGID ROOF INSULATION .....	154
12-7.03	ROOF BOARD .....	155
12-7.04	THROUGH-PENETRATION FIRESTOPPING .....	156
12-7.05	METAL ROOFING .....	158
12-7.06	SHEET METAL FLASHING .....	161
12-7.07	SEALANTS AND CAULKING .....	162
SECTION 12-8.	DOORS AND WINDOWS .....	164
12-8.01	HINGED DOORS .....	164
12-8.02	ACCESS DOORS .....	165
12-8.03	ALUMINUM ENTRANCE DOOR AND STOREFRONT .....	165
12-8.04	SECTIONAL OVERHEAD DOORS .....	167
12-8.05	WINDOWS .....	170
12-8.06	FINISH HARDWARE .....	171

12-8.07 GLAZING.....	177
SECTION 12-9. FINISHES .....	178
12-9.01 GYPSUM WALLBOARD .....	178
12-9.02 CERAMIC TILE.....	180
12-9.03 RUBBER BASE .....	186
12-9.04 RUBBER TILE.....	186
12-9.05 PAINTING.....	187
12-9.06 FIBERGLASS REINFORCED PLASTIC PANELS .....	191
12-9.07 ACOUSTIC CEILING TILE.....	192
12-9.08 SUSPENDED CEILINGS .....	192
SECTION 12-10. SPECIALTIES .....	193
12-10.01 TACKBOARDS .....	193
12-10.02 MARKER BOARDS .....	194
12-10.03 SOLID PLASTIC TOILET PARTITIONS .....	194
12-10.04 LOUVERS.....	196
12-10.05 METAL SIGNS .....	196
12-10.06 SIGNS.....	197
12-10.07 WARDROBE LOCKERS .....	198
12-10.08 FIRE EXTINGUISHERS AND CABINETS .....	199
12-10.09 FREE STANDING STEEL SHELVING .....	200
12-10.10 TOILET AND SHOWER ACCESSORIES .....	201
SECTION 12-11. EQUIPMENT.....	202
12-11.01 HIGH PRESSURE WASHER (STATIONARY).....	202
12-11.02 LUBRICATION AND COMPRESSED AIR SYSTEMS.....	204
12-11.03 PORTABLE WELDING FILTRATION SYSTEM.....	207
12-11.04 WORKBENCH.....	208
SECTION 12-12. FURNISHINGS .....	209
12-12.01 HORIZONTAL BLINDS .....	209
SECTION 12-13. (BLANK) .....	210
SECTION 12-14. CONVEYING SYSTEMS.....	210
12-14.01 BRIDGE CRANE AND HOIST.....	210
SECTION 12-15. MECHANICAL .....	213
12-15.01 MECHANICAL WORK.....	213
12-15.02 PIPE, FITTINGS AND VALVES .....	216
12-15.03 MECHANICAL INSULATION.....	225
12-15.04 AUTOMATIC FIRE SPRINKLER SYSTEM (DRY) .....	228
12-15.05 PLUMBING FIXTURES .....	231
12-15.06 WHEELCHAIR ACCESSIBLE SHOWER UNIT.....	234
12-15.07 LIQUEFIED PETROLEUM GAS (LPG) SYSTEM.....	235
12-15.08 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT AND SYSTEMS .....	237
SECTION 12-16. ELECTRICAL .....	243
12-16.01 ELECTRICAL WORK.....	243
12-16.02 BASIC MATERIALS AND METHODS.....	244
12-16.03 SERVICE AND DISTRIBUTION .....	251
12-16.04 ELECTRICAL EQUIPMENT.....	252
12-16.05 LIGHTING .....	257
12-16.06 ANTENNA POLE.....	260
12-16.07 INTRUSION ALARM SYSTEM.....	260

# STANDARD PLANS LIST

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

A10A	Abbreviations
A10B	Symbols
A20A	Pavement Markers and Traffic Lines, Typical Details
A24C	Pavement Markings - Symbols and Numerals
A62A	Excavation and Backfill - Miscellaneous Details
A62D	Excavation and Backfill - Concrete Pipe Culverts
RSP A62DA	Excavation and Backfill - Concrete Pipe Culverts
A77A	Metal Beam Guard Railing – Typical Wood Post With Wood Block
A77B	Metal Beam Guard Railing - Standard Hardware
A85	Chain Link Fence
A86	Barbed Wire and Wire Mesh Fences
A87	Curbs, Dikes and Driveways
A90	Accessible Parking
D75B	Pipe Inlets
D75C	Pipe Inlets
D77B	Bicycle Proof Grate Details
D79	Precast Reinforced Concrete Pipe - Direct Design Method
D88	Construction Loads On Culverts
D94A	Metal and Plastic Flared End Sections
D94B	Concrete Flared End Sections
D97E	Corrugated Metal Pipe Coupling Details No. 5 - Standard Joint
D97H	Reinforced Concrete Pipe or Non-Reinforced Concrete Pipe - Standard and Positive Joints
H1	Planting and Irrigation - Abbreviations
H2	Planting and Irrigation - Symbols
H5	Planting and Irrigation Details
H6	Planting and Irrigation Details
H7	Planting and Irrigation Details
H8	Planting and Irrigation Details
T1A	Temporary Crash Cushion, Sand Filled (Unidirectional)
T1B	Temporary Crash Cushion, Sand Filled (Bidirectional)
RSP T2	Temporary Crash Cushion, Sand Filled (Shoulder Installations)
T3	Temporary Railing (Type K)



**DEPARTMENT OF TRANSPORTATION**

---

**NOTICE TO CONTRACTORS**

---

**CONTRACT NO. 02-341604**

**02-Tri-299-5733**

Sealed proposals for the work shown on the plans entitled:

**STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROJECT PLANS FOR BUILDING  
CONSTRUCTION IN TRINITY COUNTY IN WEAVERVILLE AT THE WEAVERVILLE  
MAINTENANCE STATION AT 203 MEMORIAL DRIVE**

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 June 5, 2001, at which time they will be publicly opened and read in Room 0100 at the same address.

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

**STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROPOSAL AND CONTRACT FOR  
BUILDING CONSTRUCTION IN TRINITY COUNTY IN WEAVERVILLE AT THE WEAVERVILLE  
MAINTENANCE STATION AT 203 MEMORIAL DRIVE**

General work description: Construct a equipment office building, resident mechanic building, wash rack, rinse slab and two covered storage canopies.

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

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

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

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.

The District in which the work for this project is located has been incorporated into the Department's Northern Region. References in the Standard Specifications or in the special provisions to the district shall be deemed to mean the Northern Region. The office of the District Director for the Northern Region is located at Marysville.

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

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

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

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 May 7, 2001

FTN

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

**02-341604**

Item	Item Code	Item	Unit of Measure	Estimated Quantity
1	071322	TEMPORARY FENCE (TYPE CL-1.8)	M	240
2	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM
3	150662	REMOVE METAL BEAM GUARD RAILING	M	6
4	152380	RELOCATE CHAIN LINK FENCE	M	160
5	152381	RELOCATE GATE	EA	1
6	152439	ADJUST FRAME AND GRATE TO GRADE	EA	2
7	152440	ADJUST MANHOLE TO GRADE	EA	2
8	153210	REMOVE CONCRETE	M3	11
9	160101	CLEARING AND GRUBBING	LS	LUMP SUM
10	160132	DEMOLISH BUILDING	LS	LUMP SUM
11	190101	ROADWAY EXCAVATION	M3	3000
12	193006	STRUCTURE BACKFILL (SLURRY CEMENT)	M3	13
13	194001	DITCH EXCAVATION	M3	80
14	198200	SUBGRADE ENHANCEMENT FABRIC	M2	5000
15 (S)	200002	ROADSIDE CLEARING	LS	LUMP SUM
16 (S)	200114	ROCK BLANKET	M2	102
17 (S)	203003	STRAW (EROSION CONTROL)	TONN	0.3
18 (S)	203014	FIBER (EROSION CONTROL)	KG	56
19 (S)	203024	COMPOST (EROSION CONTROL)	KG	150
20 (S)	203045	PURE LIVE SEED (EROSION CONTROL)	KG	7.5

Item	Item Code	Item	Unit of Measure	Estimated Quantity
21 (S)	203056	COMMERCIAL FERTILIZER (EROSION CONTROL)	KG	7.8
22 (S)	203061	STABILIZING EMULSION (EROSION CONTROL)	KG	7.8
23 (S)	208000	IRRIGATION SYSTEM	LS	LUMP SUM
24 (S)	208742	200 MM CORRUGATED STEEL PIPE CONDUIT (1.63 MM THICK)	M	17
25	260201	CLASS 2 AGGREGATE BASE	M3	1540
26	390102	ASPHALT CONCRETE (TYPE A)	TONN	1910
27	394002	PLACE ASPHALT CONCRETE (MISCELLANEOUS AREA)	M2	5
28	394040	PLACE ASPHALT CONCRETE DIKE (TYPE A)	M	180
29 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	M3	0.8
30	650069	450 MM REINFORCED CONCRETE PIPE	M	29
31	021279	GEOMEMBRANE	M2	420
32	021280	GEOTEXTILE (CUSHION FABRIC)	M2	840
33	692446	450 MM CORRUGATED STEEL PIPE ELBOW (0.6 M X 0.9 M)	EA	1
34	021281	1200 MM SINGLE BARREL SAND TRAP	EA	2
35	705044	450 MM STEEL FLARED END SECTION	EA	1
36	705222	450 MM CONCRETE FLARED END SECTION	EA	1
37	707133	900 MM PRECAST CONCRETE PIPE INLET	M	1.7
38	721012	ROCK SLOPE PROTECTION (BACKING NO. 3, METHOD B)	M3	60
39 (S-F)	750001	MISCELLANEOUS IRON AND STEEL	KG	1082
40	800395	CHAIN LINK FENCE (TYPE CL-1.8, SLATTED)	M	18

Item	Item Code	Item	Unit of Measure	Estimated Quantity
41	869050	GUARD POST	EA	4
42	994650	BUILDING WORK	LS	LUMP SUM

**STATE OF CALIFORNIA**  
**DEPARTMENT OF TRANSPORTATION**

---

**SPECIAL PROVISIONS**

**Annexed to Contract No. 02-341604**

**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.

The District in which the work for this project is located has been incorporated into the Department's Northern Region. References in the Standard Specifications or in these special provisions to the district shall be deemed to mean the Northern Region. The office of the District Director for the Northern Region is located at Marysville.

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, P.O. Box 911, Marysville, CA 95901, Attn: NRCO/Contract Administration Engineer, 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 Sections 8-1.03, "Beginning of Work," 8-1.06, "Time of Completion," and 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.

Designated portions of the work specified in "Order of Work" of these special provisions shall be diligently prosecuted to completion before the expiration of **40 WORKING DAYS** beginning on the fifteenth calendar day after approval of the contract.

The Contractor shall pay to the State of California the sum of \$250 per day, for each and every calendar day's delay in finishing the designated portions of the work (except plant establishment work) in excess of the number of working days prescribed above.

The Contractor shall diligently prosecute all work to completion before the expiration of **315 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 \$500 per day, for each and every calendar day's delay in completing the work in excess of the number of working days prescribed above.

In no case will liquidated damages of more than \$500 per day be assessed.

#### **SECTION 5. GENERAL**

##### **SECTION 5-1. MISCELLANEOUS**

###### **5-1.01 PLANS AND WORKING DRAWINGS**

When the specifications require working drawings to be submitted to the 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.

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

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

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

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

### **5-1.012 DIFFERING SITE CONDITIONS**

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

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

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

### **5-1.015 LABORATORY**

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

### **5-1.017 CONTRACT BONDS**

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

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

### **5-1.018 EXCAVATION SAFETY PLANS**

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

#### **5-1.02A Excavation Safety Plans**

- The Construction Safety Orders of the Division of Occupational Safety and Health shall apply to all excavations. For all excavations 1.5 m or more in depth, the Contractor shall submit to the Engineer a detailed plan showing the design and details of the protective systems to be provided for worker protection from the hazard of caving ground during excavation. The detailed plan shall include any tabulated data and any design calculations used in the preparation of the plan. Excavation shall not begin until the detailed plan has been reviewed and approved by the Engineer.

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

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

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

#### **5-1.019 COST REDUCTION INCENTIVE**

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

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

#### **5-1.02 LABOR NONDISCRIMINATION**

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

### **NOTICE OF REQUIREMENT FOR NONDISCRIMINATION PROGRAM**

#### **(GOV. CODE, SECTION 12990)**

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

#### **5-1.03 INTEREST ON PAYMENTS**

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

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

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

### **5-1.031 FINAL PAYMENT AND CLAIMS**

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

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

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

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

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

### **5-1.04 PUBLIC SAFETY**

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

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

- A. Excavations.—The near edge of the excavation is 3.6 m or less from the edge of the lane, except:
  1. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
  2. Excavations less than 0.3-m deep.
  3. Trenches less than 0.3-m wide for irrigation pipe or electrical conduit, or excavations less than 0.3-m in diameter.
  4. Excavations parallel to the lane for the purpose of pavement widening or reconstruction.
  5. Excavations in side slopes, where the slope is steeper than 1:4 (vertical:horizontal).
  6. Excavations protected by existing barrier or railing.
- B. Temporarily Unprotected Permanent Obstacles.—The work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or the Contractor, for the Contractor's convenience and with permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.
- C. Storage Areas.—Material or equipment is stored within 3.6 m of the lane and the storage is not otherwise prohibited by the provisions of the Standard Specifications and these special provisions.

The approach end of temporary railing (Type K), installed in conformance with the provisions in this section "Public Safety" and in Section 7-1.09, "Public Safety," of the Standard Specifications, shall be offset a minimum of 4.6 m from the edge of the traffic lane open to public traffic. The temporary railing shall be installed on a skew toward the edge of the traffic

lane of not more than 0.3-m transversely to 3 m longitudinally with respect to the edge of the traffic lane. If the 4.6-m minimum offset cannot be achieved, the temporary railing shall be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules shall be installed at the approach end of the temporary railing.

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

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

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

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

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

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

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

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

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

**5-1.05 SURFACE MINING AND RECLAMATION ACT**

Attention is directed to the Surface Mining and Reclamation Act of 1975, commencing in Public Resources Code, Mining and Geology, Section 2710, which establishes regulations pertinent to surface mining operations, and to California Public Contract Code Section 10295.5.

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

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

**5-1.06 REMOVAL OF ASBESTOS AND HAZARDOUS SUBSTANCES**

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

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

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

### **5-1.07 YEAR 2000 COMPLIANCE**

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

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

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

### **5-1.08 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 third paragraph of Section 8-1.01 of the Standard Specifications shall not apply to this contract.

The DVBE information furnished under Section 2-1.04, "Submission of DVBE Information," of these special provisions is in addition to the subcontractor information required to be furnished in Section 8-1.01, "Subcontracting," and Section 2-1.054, "Required Listing of Proposed Subcontractors," of the Standard Specifications.

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

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

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

#### **5-1.10 PROMPT PROGRESS PAYMENT TO SUBCONTRACTORS**

Attention is directed to the provisions in Sections 10262 and 10262.5 of the Public Contract Code 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 is to maintain a cooperative communication and to mutually resolve conflicts at the lowest responsible management level.

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

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

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

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

#### **5-1.12 AREAS FOR CONTRACTOR'S USE**

Attention is directed to the provisions in Section 7-1.19, "Rights in Land and Improvements," of the Standard Specifications and these special provisions.

The highway right of way shall be used only for purposes that are necessary to perform the required work. The Contractor shall not occupy the right of way, or allow others to occupy the right of way, for purposes which are not necessary to perform the required work.

No State-owned parcels adjacent to the right of way are available for the exclusive use of the Contractor within the contract limits. The Contractor shall secure, at the Contractor's own expense, areas required for plant sites, storage of equipment or materials, or for other purposes.

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, and the State shall not be held liable for damage to or loss of materials or equipment located within such areas.

#### **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.

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

- A. Clearing and Grubbing \$2,000.00
- B. Roadside Clearing \$1,000.00

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

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

- A. Irrigation items
- B. Culvert pipe
- C. Miscellaneous drainage facilities
- D. Miscellaneous iron and steel

**SECTION 6. (BLANK)**

**SECTION 7. (BLANK)**

**SECTION 8. MATERIALS**

**SECTION 8-1. MISCELLANEOUS**

**8-1.01 SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS**

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

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

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

**SUBSTITUTION TABLE FOR SIZES OF HIGH STRENGTH STEEL FASTENERS**

ASTM Designation: A 325M

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

**SUBSTITUTION TABLE FOR PLAIN WIRE REINFORCEMENT**

ASTM Designation: A 82

METRIC SIZE SHOWN ON THE PLANS mm <sup>2</sup>	SIZE TO BE SUBSTITUTED inch <sup>2</sup> 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 <sup>1</sup> SHOWN ON THE PLANS	BAR DESIGNATION NUMBER <sup>2</sup> TO BE SUBSTITUTED
13	4
16	5
19	6
22	7
25	8
29	9
32	10
36	11
43	14
57	18

<sup>1</sup>Bar designation numbers approximate the number of millimeters of the nominal diameter of the bars.

<sup>2</sup>Bar numbers are based on the number of eighths of an inch included in the nominal diameter of the bars.

No adjustment will be required in spacing or total number of reinforcing bars due to a difference in minimum yield strength between metric and non-metric bars.

**SUBSTITUTION TABLE FOR SIZES OF:**

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

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

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

**SUBSTITUTION TABLE FOR NOMINAL THICKNESS OF SHEET METAL**

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

**SUBSTITUTION TABLE FOR WIRE**

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

**SUBSTITUTION TABLE FOR PIPE PILES**

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

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

**SUBSTITUTION TABLE FOR STRUCTURAL TIMBER AND LUMBER**

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

**SUBSTITUTION TABLE FOR NAILS AND SPIKES**

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

SUBSTITUTION TABLE FOR IRRIGATION  
COMPONENTS

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

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

**8-1.02 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS**

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

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

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

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

## **PAVEMENT MARKERS, PERMANENT TYPE**

### **Retroreflective**

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

## **PAVEMENT MARKERS, TEMPORARY TYPE**

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

- A. Apex Universal, Model 924 (100 mm x 100 mm)
- B. 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 MATERIAL**

### **Permanent Traffic Striping and Pavement Marking Tape**

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

- F. 3M, "Stamark" Series 380 and 5730
- G. 3M, "Stamark" Series 420 (For transverse application only)

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

- A. Advanced Traffic Marking, Series 200
- B. Brite-Line, Series 100
- C. P.B. Laminations, Aztec, Grade 102
- D. Swarco Industries, "Director-2"
- E. 3M, "Stamark," Series 620
- F. 3M Series A145 Removable Black Line Mask  
(Black Tape: For use only on Asphalt Concrete Surfaces)
- G. Advanced Traffic Marking Black "Hide-A-Line"  
(Black Tape: For use only on Asphalt Concrete Surfaces)
- H. Brite-Line "BTR" Black Removable Tape  
(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

**Ceramic Surfacing Laminate, 150 mm x 150 mm**

- A. Safeline Industries/Highway Ceramics, Inc.

**CLASS 1 DELINEATORS**

**One Piece Driveable Flexible Type, 1700 mm**

- A. Carsonite, Curve-Flex CFRM-400
- B. Carsonite, Roadmarker CRM-375
- C. Davidson Plastics, "Flexi-Guide Models 400 and 566"
- D. FlexStake, Model 654 TM
- E. GreenLine Models HWD1-66 and CGD1-66
- F. J. Miller Industries, Model JMI-375 (with soil anchor)

**Special Use Flexible Type, 1700 mm**

- A. Carsonite, "Survivor" (with 450 mm U-Channel base)
- B. FlexStake, Model 604
- C. GreenLine Models HWD and CGD (with 450 mm U-Channel base)
- D. Safe-Hit with 200 mm pavement anchor (SH248-GP1)
- E. Safe-Hit with 380 mm soil anchor (SH248-GP2) and with 450 mm soil anchor (SH248-GP3)

**Surface Mount Flexible Type, 1200 mm**

- A. Bent Manufacturing Company, Masterflex Model MF-180EX-48
- B. Carsonite, "Super Duck II"
- C. FlexStake, Surface Mount, Models 704 and 754 TM

**CHANNELIZERS**

**Surface Mount Type, 900 mm**

- A. Bent Manufacturing Company, Masterflex Models MF-360-36 (Round) and MF-180-36 (Flat)
- B. Carsonite, "Super Duck" (Flat SDF-436, Round SDR-336)
- C. Carsonite, "Super Duck II" Model SDCF203601MB "The Channelizer"
- D. Davidson Plastics, Flex-Guide Models FG300LD and FG300UR
- E. FlexStake, Surface Mount, Models 703 and 753 TM
- F. GreenLine, Model SMD-36

- G. Hi-Way Safety, Inc. "Channel Guide Channelizer" Model CGC36
- H. The Line Connection, "Dura-Post" Model DP36-3 (Permanent)
- I. The Line Connection, "Dura-Post" Model DP36-3C (Temporary)
- J. Repo, Models 300 and 400
- K. Safe-Hit, Guide Post, Model SH236SMA

### **CONICAL DELINEATORS, 1070 mm**

(For 700 mm Traffic Cones, see Standard Specifications)

- A. Bent Manufacturing Company "T-Top"
- B. Plastic Safety Systems "Navigator-42"
- C. Roadmaker Company "Stacker"
- D. Traffix Devices "Grabber"

### **OBJECT MARKERS**

#### **Type "K", 450 mm**

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

#### **Type "K-4" / "Q" Object Markers, 600 mm**

- A. Bent Manufacturing "Masterflex" Model MF-360-24
- B. Carsonite, Super Duck II
- C. FlexStake, Model 701KM
- D. Repo, Models 300 and 400
- E. Safe-Hit, Models SH8 24SMA\_WA and SH8 24GP3\_WA
- F. The Line Connection, Model DP21-4Q

### **TEMPORARY RAILING (TYPE K) REFLECTORS AND CONCRETE BARRIER MARKERS**

#### **Impactable Type**

- A. ARTUK, "FB"
- B. 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
- C. Sun-Lab Technology, "Safety Guide Light, Model TM," 130 mm x 130 mm x 80 mm

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

- A. Stinson Equipment Company "SaddleMarker"

**SOUND WALL DELINEATOR**

(Applied vertically. Place top of 75 mm x 300 mm reflective element at 1200 mm above roadway)

- A. Davidson Plastics, PCBM S-36
- B. Sun-Lab Technology, "Safety Guide Light, Model SM12," 130 mm x 130 mm x 80 mm

**GUARD RAILING DELINEATOR**

(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. Avery Dennison T-6500 (Formerly Stimsonite Series 6200)

**Signs: Type VII, High-Intensity Prismatic Grade**

- A. 3M Series 3900

**Signs: Type VI, Roll-Up Signs**

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

**SPECIALTY SIGN (All Plastic)**

- A. All Sign Products, STOP Sign, 750 mm

**SIGN SUBSTRATE FOR CONSTRUCTION AREA SIGNS**

**Aluminum**

**Fiberglass Reinforced Plastic (FRP)**

- A. Sequentia, "Polyplate"
- B. Fiber-Brite

**8-1.03 ASPHALT**

The first paragraph and tables following the first paragraph in Section 92-1.02, "Grades," of the Standard Specifications shall not apply.

The grade of asphalt to be used will be specified in "Asphalt Concrete" of these special provisions. The safe transportation, storage, use, and disposal of the asphalt specified shall be the responsibility of the Contractor.

A Certificate of Compliance, as specified in Section 92-1.03, "Test Report," of the Standard Specifications, shall accompany each shipment of asphalt to the project. When PBA Grade 6a, 6b or 7 is specified, the Certificate of Compliance shall include actual results of tests completed by the producer in addition to the items enumerated in Section 92-1.03 of the Standard Specifications. The Certificate of Compliance shall verify that the results of AASHTO Test Method T240 (Mass Loss after Rolling Thin Film Oven Test) indicate a maximum mass loss of 0.6 percent and that AASHTO Test Method T48 (Flash Point, Cleveland Open Cup) indicate a minimum flash point of 232°C. The actual formulation used by the asphalt producer shall be available to the Department upon written request. The Department will execute a non-disclosure agreement if requested by the asphalt producer.

For PBA Grades 6a, 6b or 7, if the results of mass loss after Rolling Thin Film Oven Test (AASHTO Test Method T240) or Flash Point, Cleveland Open Cup (AASHTO Test Method T48), shown on the Certificate of Compliance are not within the limits specified in the table entitled "PERFORMANCE BASED ASPHALT BINDER GRADES" or if the results are not shown on the Certificate of Compliance, the individual shipment of asphalt will be rejected. Rejected asphalt shall not be used on the project. Should rejected asphalt be unloaded into bulk storage tanks, asphalt from the tanks shall not be used on the project until tests and a Certificate of Compliance are furnished for the material and indicate compliance with the specifications.

Asphalt to be used as a binder for asphalt concrete will be sampled using the sampling device specified in Section 39-3.01C, "Asphalt Binder Storage," of the Standard Specifications. Two samples per operating day, each consisting of 2 one-liter containers, will be taken from the bulk storage tank feeder line.

For PBA Grades 6a, 6b or 7, if the test result of samples taken from the bulk storage tank, indicate mass loss greater than 0.6 percent, the material containing the paving asphalt represented by the tests shall be removed. However, if requested in writing by the Contractor and approved by the Engineer, the material containing the paving asphalt with mass loss greater than 0.6 percent may remain in place, and the Contractor shall pay to the State the amount calculated by the formulae listed below.

- A. For mass loss test results over 0.6 percent but less than or equal to 1.0 percent:
  - 1. (25 percent multiplied by 25 tonne average multiplied by the invoice price of paving asphalt)
- B. For mass loss test results over 1.0 percent:
  - 1. (100 percent multiplied by 25 tonne average multiplied by the invoice price of paving asphalt).
- C. The Department may deduct this amount from any moneys due, or that may become due, the Contractor under the contract. Each sample from the bulk storage shall represent 25 tonne average. The delivered price of the paving asphalt shall be based on a certified invoice provided by the Contractor.

**PERFORMANCE BASED ASPHALT BINDER GRADES**

Specification Designation	AASHTO Test Method	PBA Grade				
		1	4	6a	6b	7
Penetration (25°C, 100 g, 5 s), dmm RTFO Aged Residue, Min (Note 1)	T49	25	20	—	—	—
Absolute Viscosity (60°C), Pa•s(x10 <sup>-1</sup> ) (Note 2) Original Binder, min RTFO Aged Residue	T202 T202	800 2500-5000 (Note 3)	2800 14000 Max	2000 5000 Min	2000 5000 Min	1100 3000 Min
Kinematic Viscosity (135°C), m <sup>2</sup> /s(x10 <sup>-6</sup> ) Original Binder, Max RTFO Aged Residue, Min	T201 T201	— 275	— 350	2000 275	2000 275	2000 275
Absolute Viscosity Ratio (60°C), Max RTFO Visc./Orig. Visc.	—	4.0	4.0	4.0	4.0	4.0
Flash Point, Cleveland Open Cup, °C, (Note 4) Original Binder, Min	T48	232	232	232	232	232
Mass Loss After RTFO Test, % (Note 5)	T240	Report (Note 6)	Report	0.60	0.60	0.60
Solubility in Trichloroethylene, % Original Binder, Min	T44	99.0	99.0	Report	Report	Report
Ductility (25°C, 5 cm/min), cm RTFO Aged Residue, Min	T51	75	50	60	60	75
On Residue from Pav @: or Residue from Tilt Oven @ 113°C for: (hours)	PP1 (Note 7)	90°C 18	100°C 36	100°C 36	100°C 36	110°C 72
SSD -115(SSV)-50.6	(Note 9)	—	—	—	—	25°C
Stiffness, 300 MPa, Max @: and M-value, 0.30, Min	TP1	-6°C	-6°C	-24°C	-30°C	-6°C

Notes:

1. "RTFO Aged Residue" means the asphaltic residue obtained using the Rolling Thin Film Oven Test (RTFO Test), AASHTO Test Method T240 or ASTM Designation: D 2827.
2. The Absolute Viscosity (60°C) of PBA 6a, 6b, and 7 will be determined at 1 sec-1 using ASTM Designation: D 4957 with Asphalt Institute Vacuum Capillary Viscometers.
3. Where actual limits (e.g., 2500-500) are indicated, the actual test results shall be part of the certified copy of test results, or shall be furnished with the Certificate of Compliance.
4. Actual results of the test shall be part of the certified copy of test results and when PBA Grade 6a, 6b, or 7 is used an additional statement verifying an acceptable flash point shall be included with the Certificate of Compliance.
5. Actual results of the test shall be part of the certified copy of test results and when PBA Grade 6a, 6b, or 7 is used an additional statement verifying an acceptable mass loss shall be included with the Certificate of Compliance.
6. Where "Report" is indicated, there is no requirement; however the actual results of the test shall be part of the certified copy of test results, or shall be furnished with the Certificate of Compliance.
7. "Tilt Oven Residue" means the asphalt obtained using California Test 374, Method B, "Method for Determining Asphalt Durability Using the California Tilt-Oven Durability Test."
8. SSD = Shear susceptibility of Delta, SSV = Shear susceptibility of Viscosity.
9. California Test 381.

### 8-1.04 ENGINEERING FABRICS

Engineering fabrics shall conform to the provisions in Section 88, "Engineering Fabrics," of the Standard Specifications.

## SECTION 8-2. CONCRETE

### 8-2.01 PORTLAND CEMENT CONCRETE

References to Section 90-2.01, "Portland Cement," of the Standard Specifications shall mean Section 90-2.01, "Cement," of the Standard Specifications.

Mineral admixture shall be combined with cement in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures," of the Standard Specifications for the concrete materials specified in Section 56-2, "Roadside Signs," of the Standard Specifications.

The requirements of Section 90-4.08, "Required Use of Mineral Admixture," of the Standard Specifications shall not apply to Section 19-3.025C, "Soil Cement Bedding," of the Standard Specifications.

Unless otherwise specified, mineral admixture will not be required in portland cement concrete used for precast concrete girders.

The Contractor will be permitted to use Type III portland cement for concrete used in the manufacture of precast concrete members.

## 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 55, "Steel Structures," of the Standard Specifications.

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. (BLANK)**

## **SECTION 10. CONSTRUCTION DETAILS**

### **SECTION 10-1. GENERAL**

#### **10-1.01 ORDER OF WORK**

Order of work shall conform to the provisions in Section 5-1.05, "Order of Work," of the Standard Specifications and these special provisions.

Prior to demolition of existing buildings, ballast shall be removed from fluorescent lamps and disposed of. Attention is directed to "Structure Demolition" of these specifications regarding the handling and disposal of ballast.

The maintenance yard shall remain secure with fence around the perimeter at all times.

Power shall be provided at all times to the sand storage building.

The following designated portions of the work shall be completed within the number of working days specified in Section 4 of these special provisions for completion of designated portions.

1. Construction of bay covered material storage area and covered storage bins area.
2. Placement of all but the top lift of AC pavement around the covered storage areas.
3. Placement of AC paving on the entrance driveway shall be completed to within 6 meters of the maintenance building.
4. Construction of drainage system No. 2.
5. Placement of structure backfill (slurry cement) around sewer line.
6. Placement of AC dike on the north side of the covered storage bin areas.
7. Remove 2 concrete walls at sand storage building and complete AC paving.

Upon completion of this work, Caltrans maintenance crews shall have exclusive use of the area from the west fence to 27 meters east of the sand storage building and from the south fence to the back right of way line including the new covered storage areas as shown on the plans. This area shall be designated by a painted line on the AC pavement, as directed by the Engineer.

#### **10-1.02 WATER POLLUTION CONTROL**

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

Water pollution control work shall conform to the requirements in the "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual" and the "Construction Site Best Management Practices (BMPs) Manual", and addenda thereto issued up to, and including, the date of advertisement of the project, hereafter referred to respectively as the "Preparation Manual" and the "Construction Site BMP Manual" and collectively as the "Manuals." Copies of the manuals and the Permits may be obtained from the Department of Transportation, Material Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520.

Copies of the Manuals are also available for review at the Northern Region Construction Office at 379-A Colusa Highway, Yuba City, California 95991.

The Contractor shall know and fully comply with the applicable provisions of the Manuals and Federal, State, and local regulations that govern the Contractor's operations and storm water discharges from both the project site and areas of disturbance outside the project limits during construction.

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

The Contractor shall be responsible for the costs and for liabilities imposed by law as a result of the Contractor's failure to comply with the requirements set forth in this section "Water Pollution Control" including, but not limited to, compliance with the applicable provisions of the Manuals and Federal, State, and local regulations. For the purposes of this paragraph, costs and liabilities include, but are not limited to, fines, penalties, and damages whether assessed against the State or the Contractor, including those levied under the Federal Clean Water Act and the State Porter Cologne Water Quality Act.

In addition to the remedies authorized by law, an amount of the money due the Contractor under the contract, as determined by the Department, may be retained by the State of California until disposition has been made of the costs and liabilities.

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

- A. The Department will give the Contractor 30 days notice of the Department's intention to retain funds from partial payments which may become due to the Contractor prior to acceptance of the contract. Retention of funds from payments made after acceptance of the contract may be made without prior notice to the Contractor.
- B. No retention of additional amounts out of partial payments will be made if the amount to be retained does not exceed the amount being withheld from partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications.
- C. If the Department has retained funds and it is subsequently determined that the State is not subject to the costs and liabilities in connection with the matter for which the retention was made, the Department shall be liable for interest on the amount retained at the legal rate of interest for the period of the retention.

Conformance with the provisions in this section "Water Pollution Control" shall not relieve the Contractor from the Contractor's responsibilities as provided in Section 7, "Legal Relations and Responsibilities," of the Standard Specifications.

#### **WATER POLLUTION CONTROL PROGRAM PREPARATION, APPROVAL AND UPDATES**

As part of the water pollution control work, a Water Pollution Control Program, hereafter referred to as the "WPCP," is required for this contract. The WPCP shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications, the requirements in the Manuals, and these special provisions.

No work having potential to cause water pollution, as determined by the Engineer, shall be performed until the WPCP has been approved by the Engineer.

Within 7 days after the approval of the contract, the Contractor shall submit 3 copies of the WPCP to the Engineer. The Engineer will have 4 days to review the WPCP. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the WPCP within 3 days of receipt of the Engineer's comments. The Engineer will have 3 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 Manuals.

The Contractor shall consider the objectives and minimum requirements presented in the Manuals for each of the above categories. When minimum requirements are listed for any category, the Contractor shall incorporate into the WPCP and implement on the project, one or more of the listed minimum controls required in order to meet the pollution control objectives for the category. In addition, the Contractor shall consider other control measures presented in the Manuals 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 Manuals.

The WPCP shall include, but not be limited to, the following items as described in the Manuals:

- A. Project description and Contractor's certification;
- B. Project information;
- C. Pollution sources, control measures, and water pollution control drawings; and
- D. Amendments, if any.

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

The Contractor shall keep a copy of the WPCP, together with updates, revisions and amendments at the project site.

#### **WPCP IMPLEMENTATION**

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

Soil stabilization practices and sediment control measures, including minimum requirements, shall be provided throughout the 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 1.9 hectares. The Engineer may approve, on a case-by-case basis, expansions of the active, soil-disturbed area limit. The Contractor shall demonstrate the ability and preparedness to fully deploy soil stabilization practices and sediment control measures to protect soil-disturbed areas on the project site before the onset of precipitation. A quantity of soil stabilization and sediment control materials shall be maintained on site equal to 125 percent of that sufficient to protect unprotected, soil-disturbed areas on the project site. A detailed plan for the mobilization of sufficient labor and equipment shall be maintained to fully deploy control measures required to protect unprotected, soil-disturbed areas on the project site prior to the onset of precipitation. A current inventory of control measure materials and the detailed mobilization plan shall be included as part of the WPCP.

Throughout the 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 Preparation Manual shall be used to ensure that the necessary measures are being properly implemented, and to ensure that the control measures are functioning adequately. One copy of each site inspection record shall be submitted to the Engineer.

During the 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.

### **10-1.03 TEMPORARY FENCE (TYPE CL-1.8)**

Temporary fence shall be furnished, constructed, maintained, and later removed as shown on the plans, as specified in these special provisions and as directed by the Engineer.

Except as otherwise specified in this section, temporary fence shall conform to the plan details and the specifications for permanent fence of similar character as provided in Section 80, "Fences," of the Standard Specifications.

Used materials may be installed provided the used materials are good, sound and are suitable for the purpose intended, as determined by the Engineer.

Materials may be commercial quality provided the dimensions and sizes of the materials are equal to, or greater than, the dimensions and sizes shown on the plans or specified herein.

Posts shall be either metal or wood at the Contractor's option.

Galvanizing and painting of steel items will not be required.

Treating wood with a wood preservative will not be required.

Concrete footings for metal posts will not be required.

Temporary fence that is damaged during the progress of the work shall be repaired or replaced by the Contractor at the Contractor's expense.

When no longer required for the work, as determined by the Engineer, temporary fence shall be removed. Removed facilities shall become the property of the Contractor and shall be removed from the site of the work, except as otherwise provided in this section.

Removed temporary fence materials that are not damaged may be constructed in the permanent work provided the materials conform to the requirements specified for the permanent work and such materials are new when used for the temporary fence.

Holes caused by the removal of temporary fence shall be backfilled in conformance with the provisions in the second paragraph of Section 15-1.02, "Preservation of Property," of the Standard Specifications.

The temporary fence (Type CL-1.8) will be measured and paid for in the same manner specified for permanent fence of similar character as provided in Section 80, "Fences," of the Standard Specifications.

Full compensation for maintaining, removing, and disposing of temporary fence (Type CL-1.8) shall be considered as included in the contract prices paid per meter for the various types of temporary fence and no additional compensation will be allowed therefor.

#### **10-1.04 PROGRESS SCHEDULE (CRITICAL PATH METHOD)**

The Contractor shall submit to the Engineer practicable critical path method (CPM) progress schedules in conformance with these special provisions. Whenever the term "schedule" is used in this section it shall mean CPM progress schedule.

The provisions in Section 8-1.04, "Progress Schedule," of the Standard Specifications shall not apply.

#### **DEFINITIONS**

The following definitions shall apply to this section:

- A. **ACTIVITY.**—A task, event or other project element on a schedule that contributes to completing the project. Activities have a description, start date, finish date, duration and one or more logic ties.
- B. **BASELINE SCHEDULE.**—The initial schedule representing the Contractor's work plan on the first working day of the project.
- C. **CONTRACT COMPLETION DATE.**—The current extended date for completion of the contract shown on the weekly statement of working days furnished by the Engineer in conformance with the provisions in Section 8-1.06, "Time of Completion," of the Standard Specifications.
- D. **CRITICAL PATH.**—The longest continuous chain of activities for the project that has the least amount of total float of all chains. In general, a delay on the critical path will extend the scheduled completion date.
- E. **CRITICAL PATH METHOD (CPM).**—A network based planning technique using activity durations and the relationships between activities to mathematically calculate a schedule for the entire project.
- F. **DATA DATE.**—The day after the date through which a schedule is current. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."
- G. **FLOAT.**—The difference between the earliest and latest allowable start or finish times for an activity.
- H. **MILESTONE.**—An event activity that has zero duration and is typically used to represent the beginning or end of a certain stage of the project.
- I. **NEAR CRITICAL PATH.**—A chain of activities with total float exceeding that of the critical path but having no more than 10 working days of total float.
- J. **SCHEDULED COMPLETION DATE.**—The planned project finish date shown on the current accepted schedule.
- K. **TOTAL FLOAT.**—The amount of time that an activity or chain of activities can be delayed before extending the scheduled completion date.
- L. **UPDATE SCHEDULE.**—A current schedule developed from the baseline or subsequent schedule through regular monthly review to incorporate as-built progress and any planned changes.

#### **GENERAL REQUIREMENTS**

The Contractor shall submit to the Engineer baseline, monthly update and final update schedules, each consistent in all respects with the time and order of work requirements of the contract. The project work shall be executed in the sequence indicated on the current accepted schedule.

Schedules shall show the order in which the Contractor proposes to carry out the work with logical links between time-scaled work activities, and calculations made using the critical path method to determine the controlling operation or operations. The Contractor is responsible for assuring that all activity sequences are logical and that each schedule shows a coordinated plan for complete performance of the work.

The Contractor shall produce schedules using computer software and shall furnish compatible software for the Engineer's exclusive possession and use. The Contractor shall furnish network diagrams and schedule data as parts of each schedule submittal.

Schedules shall include, but not be limited to, applicable activities that show the following:

- A. Project characteristics, salient features, or interfaces, including those with outside entities, that could affect time of completion.
- B. Project start date, scheduled completion date and other milestones.
- C. Work performed by the Contractor, subcontractors and suppliers.

- D. Submittal development, delivery, review and approval, including those from the Contractor, subcontractors and suppliers.
- E. Procurement, delivery, installation and testing of materials, plants and equipment.
- F. Testing and settlement periods.
- G. Utility notification and relocation.
- H. Erection and removal of falsework and shoring.
- I. Major traffic stage switches.
- J. Finishing roadway and final cleanup.

Schedule activities shall include the following:

- A. A clear and legible description.
- B. Start and finish dates.
- C. A duration of not less than one working day, except for event activities, and not more than 20 working days, unless otherwise authorized by the Engineer.
- D. At least one predecessor and one successor activity, except for project start and finish milestones.
- E. Required constraints.

The Engineer's review and acceptance of schedules shall not waive any contract requirements and shall not relieve the Contractor of any obligation thereunder or responsibility for submitting complete and accurate information. Schedules that are rejected shall be corrected by the Contractor and resubmitted to the Engineer within 5 working days of notification by the Engineer, at which time a new review period of one week will begin.

Errors or omissions on schedules shall not relieve the Contractor from finishing all work within the time limit specified for completion of the contract. If, after a schedule has been accepted by the Engineer, either the Contractor or the Engineer discover that any aspect of the schedule has an error or omission, it shall be corrected by the Contractor on the next update schedule.

#### **COMPUTER SOFTWARE**

The Contractor shall submit to the Engineer for approval a description of proposed software before delivery. The software shall be the current version of Primavera SureTrak Project Manager for Windows, or equal, and shall be compatible with Windows NT (version 4.0) operating system. If software other than SureTrak is proposed, it shall be capable of generating files that can be imported into SureTrak.

The Contractor shall furnish schedule software and all original software instruction manuals to the Engineer with submittal of the baseline schedule. The schedule software will be returned to the Contractor within 4 weeks of submittal of the final update schedule. The State will compensate the Contractor in conformance with the provisions in Section 4-1.03, "Extra Work," of the Standard Specifications for replacement of software which is damaged, lost or stolen after delivery to the Engineer.

#### **NETWORK DIAGRAMS, REPORTS AND DATA**

The Contractor shall include the following for each schedule submittal:

- A. Two sets of originally plotted, time-scaled network diagrams.
- B. One 1.44-megabyte 90 mm (3.5 inch) floppy diskette containing the schedule data.

The time-scaled network diagrams shall conform to the following:

- A. Show a continuous flow of information from left to right.
- B. Be based on early start and early finish dates of activities.
- C. Clearly show the primary paths of criticality using graphical presentation.
- D. Be prepared on B-size sheets, 280 mm x 430 mm (11 inch x 17 inch), or larger size.
- E. Include a title block and a timeline on each page.

#### **BASELINE SCHEDULE**

The Contractor shall submit to the Engineer a baseline schedule within 20 working days of approval of the contract. The Contractor shall allow 3 weeks for the Engineer's review after the baseline schedule and all support data are submitted. Beginning the week the baseline schedule is first submitted, the Contractor shall meet with the Engineer weekly to discuss and resolve schedule issues until the baseline schedule is accepted.

The baseline schedule shall include the entire scope of work and shall show how the Contractor plans to complete all work contemplated. The baseline schedule shall show the activities that define the critical path. Multiple critical paths and near-critical paths shall be kept to a minimum. A total of not more than 50 percent of the baseline schedule activities shall be critical or near critical, unless otherwise authorized by the Engineer.

The baseline schedule shall not extend beyond the number of working days originally provided in these special provisions. The baseline schedule shall have a data date of the first working day of the contract and not include any completed work to date. The baseline schedule shall not attribute negative float or negative lag to any activity.

**UPDATE SCHEDULE**

The Contractor shall submit an update schedule and meet with the Engineer to review contract progress, on or before the first day of each month, beginning one month after the baseline schedule is accepted. The Contractor shall allow 2 weeks for the Engineer's review after the update schedule and all support data are submitted, except that the review period shall not start until any previous month's required schedule is accepted. Update schedules that are not accepted or rejected within the review period will be considered accepted by the Engineer.

The update schedule shall have a data date of the twenty-first day of the month or other date established by the Engineer. The update schedule shall show the status of work actually completed to date and the work yet to be performed as planned. In addition, the update schedule shall show any proposed schedule modifications including adding or deleting activities or changing activity constraints, durations or logic. The Contractor shall state in writing the reasons for any changes to activities and the critical path that result in a delay to the scheduled completion date compared to the previous accepted schedule.

**FINAL UPDATE SCHEDULE**

The Contractor shall submit a final update, as-built schedule with actual start and finish dates for the activities, within 30 days after completion of contract work. The Contractor shall provide a written certificate with this submittal signed by the Contractor's project manager and an officer of the company stating, "To my knowledge and belief, the enclosed final update schedule reflects the actual start and finish 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.

**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 an acceptable schedule conforming to the requirements of these special provisions as determined by the Engineer. Schedule retentions will be released for payment on the next monthly estimate for partial payment following the date that acceptable schedules are submitted to the Engineer or as otherwise specified herein. Upon completion of all contract work and submittal of the final update schedule and certification, any remaining retained funds associated with this section, "Progress Schedule (Critical Path Method)", will be released for payment. Retentions held in conformance with this section shall be in addition to other retentions provided for in the contract. No interest will be due the Contractor on retention amounts.

**PAYMENT**

Full compensation for the required schedules and software 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.

**10-1.05 OBSTRUCTIONS**

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

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire or other structure. Regional notification centers include, but are not limited to, the following:

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

### 10-1.06 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

Flagging, signs, and all other traffic control devices furnished, installed, maintained, and removed when no longer required shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Category 1 traffic control devices are defined as those devices that are small and lightweight (less than 45 kg), and have been in common use for many years. The devices shall be known to be crashworthy by crash testing, crash testing of similar devices, or years of demonstrable safe performance. Category 1 traffic control devices include traffic cones, plastic drums, portable delineators, and channelizers.

If requested by the Engineer, the Contractor shall provide written self-certification for crashworthiness of Category 1 traffic control devices. Self-certification shall be provided by the manufacturer or Contractor and shall include the following: date, Federal Aid number (if applicable), expenditure authorization, district, county, route and kilometer post of project limits; company name of certifying vendor, street address, city, state and zip code; printed name, signature and title of certifying person; and an indication of which Category 1 traffic control devices will be used on the project. The Contractor may obtain a standard form for self-certification from the Engineer.

Category 2 traffic control devices are defined as those items that are small and lightweight (less than 45 kg), that are not expected to produce significant vehicular velocity change, but may otherwise be potentially hazardous. Category 2 traffic control devices include: barricades and portable sign supports.

Category 2 devices purchased on or after October 1, 2000 shall be on the Federal Highway Administration (FHWA) Acceptable Crashworthy Category 2 Hardware for Work Zones list. This list is maintained by FHWA and can be located at the following internet address: <http://safety.fhwa.dot.gov/fourthlevel/hardware/listing.cfm?code=workzone>. The Department maintains a secondary list at the following internet address: <http://www.dot.ca.gov/hq/traffops/signtech/signdel/pdffiles.htm>.

Category 2 devices that have not received FHWA acceptance, and were purchased before October 1, 2000, may continue to be used until they complete their useful service life or until January 1, 2003, whichever comes first. Category 2 devices in use that have received FHWA acceptance shall be labeled with the FHWA acceptance letter number and the name of the manufacturer by the start of the project. The label shall be readable. After January 1, 2003, all Category 2 devices without a label shall not be used on the project.

Full compensation for providing self-certification for crashworthiness of Category 1 traffic control devices and labeling Category 2 devices as specified shall be considered as included in the prices paid for the various contract items of work requiring the use of the Category 1 or Category 2 traffic control devices and no additional compensation will be allowed therefor.

### 10-1.07 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 "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Type II retroreflective sheeting shall not be used on construction area sign panels.

The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 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 "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

### **10-1.08 MAINTAINING TRAFFIC**

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

No work that would require a lane closure shall be performed.

### **10-1.09 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.

#### **REMOVE METAL BEAM GUARD RAILING**

Existing metal beam guard railing, where shown on the plans to be removed, shall be removed and disposed of.

#### **RELOCATE CHAIN LINK FENCE**

Existing chain link fence, at the locations shown on the plans, shall be removed and relocated.

Fence removed in excess of that required for relocating chain link fence shall be disposed of.

Full compensation for removing and disposing of excess fence shall be considered as included in the contract price paid per meter for relocate chain link fence and no separate payment will be made therefor.

#### **RELOCATE GATE**

Existing gates, at the locations shown on the plans, shall be removed and relocated.

The contract unit price paid for relocate gate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in relocate gate, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **ADJUST MANHOLE TO GRADE**

Existing manholes shall be adjusted to grade in conformance with the provisions in Section 15-2.05, "Reconstruction," of the Standard Specifications.

#### **ADJUST FRAME AND GRATE TO GRADE**

Frames and grates of existing drainage inlets or other facilities shall be adjusted to grade in conformance with the provisions in Section 15-2.05, "Reconstruction," of the Standard Specifications.

#### **REMOVE CONCRETE**

Concrete, where shown on the plans to be removed, shall be removed.

Concrete removed shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Concrete removed at the following locations will be measured and paid for by the cubic meter, measured before and during removal operations:

- A. Valley gutter.
- B. Liquid petroleum gas tank pedestals.

Other concrete to be removed will not be measured nor paid for as remove concrete. Attention is directed to Section 16, "Clearing and Grubbing," and Section 19-1.04, "Removal and Disposal of Buried Man-Made Objects," of the Standard Specifications.

Where no joint exists between concrete to be removed and concrete to remain in place, the concrete shall be cut on a neat line to a minimum depth of 50 mm with a power driven saw before the concrete is removed.

Concrete to be removed which has portions of the same structure both above and below ground will be considered as concrete above ground for compensation.

### **10-1.10 CLEARING AND GRUBBING**

Clearing and grubbing shall conform to the provisions in Section 16, "Clearing and Grubbing," of the Standard Specifications.

### **10-1.11 STRUCTURE DEMOLITION**

This work shall consist of demolition and removal of all improvements remaining either wholly or partially within the project limits, including, but not limited to, buildings, foundations, slabs above ground and other features shown to be removed. The building to be removed contains lead based paint, pcb ballasts, and asbestos containing materials. Removal of said hazardous materials shall be in accordance with the codes and regulations defined below.

#### **ASBESTOS**

Asbestos-containing material (ACM), as defined in Section 1529, "Asbestos," of the Construction Safety Orders, Title 8, of the California Code of Regulations, is not present within the Equipment Building,. Window putty in the equipment building has trace amounts of asbestos and is considered Asbestos containing material (ACM) according to Cal-OSHA.

#### **PERMITS**

The Contractor shall prepare and submit a NESHAP notification form and attachments to the North Coast Unified Air Quality Management District (NCUAQMD), 2300 Myrtle Ave., Eureka, California as required by NESHAP, 40CFR Part 61, and California Air Resources Control Board rules. A copy of the notification form and attachments shall be provided to the Engineer a minimum of 20 days prior to demolition. No demolition of the structure shall take place until the Contractor has received written confirmation from the Engineer that notification has been approved by the NCUAQMD. If the Contractor does not receive direction from the Engineer within 20 days after submittal that changes to the notification are required, or written confirmation of receipt and approval by the NCUAQMD, then an extension of time commensurate with the delay in completion of the work thus caused will be granted and the Contractor shall be relieved from any claim for liquidated damages, or engineering and inspection charges or other penalties for the period covered by that extension of time; provided that the Contractor shall notify the Engineer in writing of the causes of delay within 15 days from the beginning of the delay. The Engineer shall ascertain the facts and the extent of the delay, and the Engineer's findings thereof shall be final and conclusive.

#### **Removal and management of ACM**

All work shall be performed by a Contractor who is registered pursuant to Section 6501.5 of the Labor Code and certified pursuant to Section 7058.6 of the Business and Professions Code. Asbestos removal shall conform to Cal/ OSHA requirements in Title 8 Sections 1529 and 341. Packaging, storage, transporting, and disposing of ACM shall conform to Title 22 , Division 4, Chapter 30.

All friable material shall be removed in a manner which conforms to OSHA Class II work practice requirements. All non-friable ACM shall be removed and handled to prevent breakage.

#### **Safety**

Attention is directed to Section 7-1.06, "Safety and Health Provisions," of the Standard Specifications. Work practices and worker health and safety during any work that results in disturbance of ACM shall conform to Section 1529, "Asbestos," of the Construction Safety Orders, Title 8, of the California Code of Regulations. Written notification of exposure monitoring results shall be submitted to the Engineer upon completion of the work. Any required written certification of the adequacy of alternative work practices shall be submitted to the Engineer before performing any work. The Contractor shall certify in writing that the personnel performing the work have completed a training program appropriate for the work involved.

The requirements of subsection (d), "Multi-Employer Worksites," of Section 1529, "Asbestos," of the Construction Safety Orders, Title 8, of the California Code of Regulations shall be observed during performance of the work. This shall not be construed as relieving the Contractor from the Contractor's responsibilities as provided in Section 8-1.01, "Subcontracting," of the Standard Specifications.

#### **LEAD BASED PAINT**

##### **Health and safety**

A Code of Safe Practices, an Injury and Illness Prevention Program, and a Hazard Communication Program in accordance with the provisions of Construction Safety Orders 1509 and 1510 shall be submitted for approval.

##### **Codes and standards**

Codes which govern removal and disposal of materials containing lead include, but are not limited to the following:

1. California Health and Safety Code, Division 20, Chapter 6.5, "Hazardous Waste Control Act."
2. California Code of Regulations, Title 22, Division 4, Chapter 30, "Minimum Standards for Management of Hazardous and Extremely Hazardous Material."
3. California Code of Regulations, Title 8, General Industry Safety Order, Section 1532.1, Lead.
4. Occupational Safety and Health Administration, Part 26 (amended), of Title 29 of the Code of Federal Regulations.

### **Compliance program**

The Contractor shall submit the compliance programs required in subsection (e)(2), "Compliance Program," of said Section 1532.1, "Lead," to the Engineer for approval before starting removal work on the project and at such times when revisions to the program are ordered by the Engineer. The compliance programs shall be prepared by an industrial hygienist certified by the American Council of Industrial Hygiene. The Engineer will notify the Contractor of the approval or rejection of any submitted or revised compliance program in not more than 10 working days.

If measures being taken by the Contractor are inadequate to provide for worker safety and the containment and collection of residue from existing paint systems, the Engineer will direct the Contractor to revise his operations and the compliance program. Such directions will be in writing and will specify the items of work for which the Contractor's compliance programs are inadequate. No further work shall be performed on said items until the compliance programs are adequate and, if required, a revised compliance program has been approved.

The State will not be liable to the Contractor for failure to approve all or any portion of an originally submitted or revised compliance program for worker safety and the containment and collection of residue from existing paint systems, nor for any delays to the work due to the Contractor's failure to submit an acceptable compliance program.

The Contractor shall notify the Engineer 3 working days in advance of commencement of removal operations of material containing lead or lead based materials.

Painted materials shall be removed using the wet process removal equipment and methods, to a depth required to remove all paint and provide clean substrate suitable for a new finish.

Removed material and water used for removal shall be collected. Removed material shall be separated from water using approved filters.

The Contractor shall comply with all Federal, State and local requirements for safety which shall include providing employees with coveralls (preferably disposable plastic coated), rubber gloves (to be discarded after use), rubber boots (to be washed thoroughly after use), and respirators.

The Contractor shall be responsible for verifying that all employees, who are involved in removal operations, wear the required protective devices during removal operations.

The Contractor shall dispose of materials containing lead paint at an appropriately permitted facility.

Parties receiving materials containing lead paint for recycling must be provided with written notification of the presence of lead paint. The resident Engineer shall be provided a copy of a written acknowledgement signed by the recipient of the materials and the Contractor.

### **DISPOSING OF ELECTRICAL EQUIPMENT**

Ballasts and transformers and fluorescent and mercury lamps shall be disposed of in conformance with California Department of Health Services Regulations set forth in Title 22, Division 4, Chapter 30, of the California Code of Regulations.

Ballasts and transformers that contain polychlorinated biphenyl (PCB) are designated as extremely hazardous wastes and fluorescent tubing and mercury lamps are designated as hazardous wastes under Title 22, Chapter 30, Article 9, Section 66680, of the California Code of Regulations.

The following electrical materials on the project are known to contain polychlorinated biphenyl (PCB):

#### **A. Ballasts**

When 25 or more fluorescent lamps and mercury lamps, in combination, are to be disposed of, the lamps shall be treated as recyclable hazardous waste and shall be recycled within the State of California in conformance with Title 22, Chapter 30, Article 12, of the California Code of Regulations by a currently certified recycler such as, but not limited to, the following:

- A. Exceltrans Inc., P.O. Box 866, Benicia, CA 94510, Telephone (707) 745-8907.
- B. Roberts Enterprises, 2021 South Myrtle Avenue, Monrovia, CA 91016, Telephone (818) 303-2053.

The recyclable hazardous waste shall be packaged and then shipped via a currently certified hauler in conformance with Title 22, Chapter 30, Article 12, of the California Code of Regulations and other applicable local, State, and Federal regulations.

The Engineer shall be furnished with a statement noting which certified hauler and which certified recycler is proposed for utilization, together with a copy of the recycler's interim status document or a copy of the variance letter from the Department of Health Services. The statement shall be furnished within 15 calendar days after the contract has been approved by the Attorney General.

The State assumes generator responsibility for these wastes. The Engineer will prepare the Hazardous Waste Manifest for Shipment.

## **PAYMENT**

Full compensation for structure demolition conforming to the requirements of this section shall be considered as included in the contract lump sum price paid for Demolish Building including removal, handling and disposing of asbestos, lead base paint and electrical material containing polychlorinated biphenyl (PCB) and no additional compensation will be allowed therefor.

### **10-1.12 EARTHWORK**

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

Surplus excavated material shall become the property of the Contractor and shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Where a portion of the existing surfacing is to be removed, the outline of the area to be removed shall be cut on a neat line with a power-driven saw to a minimum depth of 50 mm before removing the surfacing. Full compensation for cutting the existing surfacing shall be considered as included in the contract price paid per cubic meter for roadway excavation and no additional compensation will be allowed therefor.

### **10-1.13 CONTROLLED LOW STRENGTH MATERIAL**

Controlled low strength material shall consist of a workable mixture of aggregate, cementitious materials, and water and shall conform to the provisions for slurry cement backfill in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications and these special provisions.

At the option of the Contractor, controlled low strength material may be used as structure backfill for pipe culverts, except that controlled low strength material shall not be used as structure backfill for aluminum and aluminum-coated culverts nor for culverts having a diameter or span greater than 6.1 m.

When controlled low strength material is used for structure backfill, the width of the excavation shown on the plans may be reduced so that the clear distance between the outside of the pipe and the side of the excavation, on each side of the pipe, is a minimum of 300 mm. This minimum may be reduced to 150 mm when the height of cover is less than or equal to 6.1 m or the pipe diameter or span is less than 1050 mm.

Controlled low strength material in new construction shall not be permanently placed higher than the basement soil. For trenches in existing pavements, permanent placement shall be no higher than the bottom of the existing pavement permeable drainage layer. If a drainage layer does not exist, permanent placement in existing pavements shall be no higher than 25 mm below the bottom of the existing asphalt concrete surfacing or no higher than the top of base below the existing portland cement concrete pavement. The minimum height that controlled low strength material shall be placed, relative to the culvert invert, is 0.5 diameter or 0.5 height for rigid culverts and 0.7 diameter or 0.7 height for flexible culverts.

When controlled low strength material is proposed for use, the Contractor shall submit a mix design and test data to the Engineer for approval prior to excavating the trench for which controlled low strength material is proposed for use. The test data and mix design shall provide for the following:

- A. A 28-day compressive strength between 345 kPa and 690 kPa for pipe culverts having a height of cover of 6.1 m or less and a minimum 28-day compressive strength of 690 kPa for pipe culverts having a height of cover greater than 6.1 m. Compressive strength shall be determined in conformance with the requirements in ASTM Designation: D 4832.
- B. When controlled low strength material is used as structure backfill for pipe culverts, the sections of pipe culvert in contact with the controlled low strength material shall conform to the requirements of Chapter 850 of the Highway Design Manual using the minimum resistivity, pH, chloride content, and sulfate content of the hardened controlled low strength material. Minimum resistivity and pH shall be determined in conformance with the requirements of California Test 643. The chloride content shall be determined in conformance with the requirements of California Test 422 and the sulfate content shall be determined in conformance with the requirements of California Test 417.
- C. Cement shall be any type of portland cement conforming to the requirements in ASTM Designation: C 150; or any type of blended hydraulic cement conforming to the requirements in ASTM Designation: C 595M or the physical requirements in ASTM Designation: C 1157M. Testing of cement will not be required.

- D. Admixtures may be used in conformance with the provisions in Section 90-4, "Admixtures," of the Standard Specifications. Chemical admixtures containing chlorides as Cl in excess of one percent by mass of admixture, as determined in conformance with the requirements of California Test 415, shall not be used. If an air-entraining admixture is used, the maximum air content shall be limited to 20 percent. Mineral admixtures shall be used at the Contractor's option.

Materials for controlled low strength material shall be thoroughly machine-mixed in a pugmill, rotary drum or other approved mixer. Mixing shall continue until the cementitious material and water are thoroughly dispersed throughout the material. Controlled low strength material shall be placed in the work within 3 hours after introduction of the cement to the aggregates.

When controlled low strength material is to be placed within the traveled way or otherwise to be covered by paving or embankment materials, the material shall achieve a maximum indentation diameter of 76 mm prior to covering and opening to public traffic. Penetration resistance shall be measured in conformance with the requirements in ASTM Designation: D 6024.

Controlled low strength material used as structure backfill for pipe culverts will be considered structure backfill for compensation purposes.

#### **10-1.14 STRUCTURE EXCAVATION (CONTAMINATED)**

##### **Scope**

Structure Excavation (Contaminated) shall conform to the provisions in "Earthwork for Building Work" of these special provisions.

Soil with motor oil will be encountered during the excavation necessary for construction of this project. Concentrations of up to 6,230 mg/kg TPH-Motor Oil have been found in the soil underlying the existing Equipment Building in a limited area. TPH-Gasoline, TPH-Diesel, Benzene, Toluene, Ethylbenzene, Xylene, and Ethyl Glycol were not reported in any of the test samples analyzed.

When excavated, this material will become classified as designated waste. Excavated soil material that is designated waste shall be disposed of at an appropriately permitted facility. Attention is directed to "Earthwork for Building Work" elsewhere in these special provisions.

A Site Investigation Report has been completed and copies of the report may be obtained at the Department of Transportation, Plans and Bid Documents, Room 0200, Transportation Building, 1120 N Street, P.O. Box 942874, Sacramento, California 94274-001, Telephone No. (916) 654-4490, and are available for inspection at the office of the District Director of Transportation at 703 B Street, Marysville, California. The applicable report is entitled, Supplemental Site Investigation Report - Weaverville Maintenance Station, Weaverville, California, prepared by GEOCON - Geotechnical & Environmental Consultants, under Contract 43A0012, GEOCON Project No. S8225-06-09A, dated June 1999.

##### **Applicable rules and regulations**

Excavation, transport and disposal of hazardous waste material and designated waste material shall be in accordance with the rules and regulations of the following agencies:

- Department of Toxic Substance Control (DTSC)
- Integrated Waste Management Board
- Regional Water Quality Control Board (RWQCB)
- State Air Resources Board
- United States Department of Transportation (USDOT)
- United States Environmental Protection Agency (USEPA)
- California Environmental Protection Agency (CAL-EPA)
- California Division of Occupational Safety & Health Administration (CAL-OSHA)
- Trinity County Department Environmental Health

##### **Permits and licenses**

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

## **Health, Safety and Work Plan**

The Contractor shall prepare a detailed Health, Safety and Work Plan for site personnel. The Health, Safety and Work Plan shall include mandatory personal protective equipment training, equipment decontamination procedures, spill plan, site clean up procedures, and physical barrier requirements in accordance with California Code of Regulations (CCR), Title 8. The Health, Safety and Work Plan shall also include a description of the order of work, material handling, material segregation, stockpile locations, sampling protocols, transportation and disposal sites for petroleum hydrocarbon material and shall be submitted for review and acceptance by the Engineer at least 15 working days prior to beginning any excavation work. If the plan is unacceptable it shall be returned, within 15 working days of submittal to the Contractor for revision. The Engineer shall have 5 working days to review and accept or reject the revised plan from the date the revised plan is received from the Contractor. No work shall proceed until the plan is accepted by the Engineer. Prior to submittal, the Contractor shall have the Health, Safety and Work Plan for all excavation work approved by a Certified Industrial Hygienist. Water from decontamination procedures shall be collected and disposed of at an appropriate disposal site by the Contractor. Non-reusable protective equipment, once used by any personnel, including State personnel, shall be collected and disposed of at an appropriate disposal site by the Contractor.

### **Safety training**

Prior to performing any excavation work, all personnel working on the project, including State Personnel, shall complete required training specified in the Contractor's compliance program covering the potential hazards as identified. Any required training shall be provided by the Contractor who shall provide a certification of the completion of the Safety Training Program for all personnel. Personal protective equipment required by the Contractor's Health, Safety and Work Plan for personnel working on the project will also be supplied to State personnel by the Contractor. The number of State personnel requiring the above mentioned safety training program and personal protective equipment will be two (2). Full compensation for safety training shall be considered as included in the contract price paid for Building Work and no additional compensation will be allowed therefor.

### **Segregation of designated waste**

All excavated material shall be stockpiled in a fenced area on two layers of 10-mil thick (minimum) black polyethylene. A perimeter berm for the stockpile shall be constructed by wrapping the edges of the plastic over hay bales, or equivalent, to prevent contaminated water runoff and infiltration. The stockpiles shall be covered with one layer of 10-mil (minimum) black polyethylene at all times. The plastic shall be sufficiently weighted with sandbags to prevent wind damage to the plastic. Stockpiled petroleum impacted material shall be tested and disposed of within 30 days of completion of excavation work.

### **Sampling and analysis requirements**

The Contractor shall test soil. If any of this material is found through testing to contain concentrations above 1.0 mg/kg of either TPH-Motor Oil, TPH-Diesel, or TPH-Gasoline, or concentrations above 5.0 µg/kg of either Benzene, Toluene, Ethylbenzene, or Xylene, the material shall be disposed of at an appropriately permitted facility. The material shall become the property of the Contractor if testing shows contaminant concentrations below those mentioned above. The Contractor's sampling and testing analysis shall be performed using the sampling and testing analysis procedure required by the regulatory agencies in the locality of the job and any acceptance requirements put forth by a disposal facility. At a minimum, a sample shall be collected for every 25 cubic meters of stockpiled soil. A minimum of five (5) samples shall be taken from stockpiled soil.

Samples shall be analyzed for Motor Oil (TPH-MO) by Test Method Modified EPA 8015 and Total Petroleum Hydrocarbons Diesel (TPH-D) and Gasoline (TPH-G) by Test Method Modified EPA 8015 and BTEX by EPA Method 8021.

The laboratory used shall be certified by the California Department of Health Services for the required analyses.

If additional Structural Excavation (Contaminated) is required at the direction of the Engineer, such extra excavation will be paid for as extra work in conformance with Section 4-1.03D, "Extra Work," of the Standard Specifications.

No water (except groundwater) shall be allowed to enter excavated areas. In the case such water does enter this area, such water shall be tested prior to discharge. No disposal of such water by pumping or other means shall be performed until the results of such testing have been submitted to the Engineer for review and approval. If the results of such testing indicate that the level of petroleum hydrocarbon products exceeds levels considered allowable by the applicable regulatory agencies, the water shall be handled in accordance with all applicable laws and regulations. Should testing of water be required as a result of the failure of the Contractor's measures to prevent uncontrolled water from entering the excavated area, this testing and disposal shall be performed at the Contractor's expense and no additional compensation will be allowed therefor. Should testing of water be required as a result of groundwater entering the excavated area, testing groundwater will be paid for as extra work in conformance with Section 4-1.03D, "Extra Work," of the Standard Specifications. Disposal of contaminated

groundwater will be paid for as extra work in conformance with Section 4-1.03D, "Extra Work," of the Standard Specifications.

**Payment**

Full compensation for Structure Excavation (Contaminated), (including furnishing all labor, training, materials, tools, equipment, and incidentals, and for doing all the work involved in excavation of designated waste material, including sampling, testing, transporting, constructing containment facility and stockpiling, sorting the material into it's appropriate classification, loading from stockpiles, transporting and disposing, including disposal fees, as specified in these special provisions, and as directed by the Engineer), shall be considered as included in the contract lump sum price paid for Building Work and no separate payment will be made therefor.

**10-1.15 SUBGRADE ENHANCEMENT FABRIC**

Subgrade enhancement fabric shall be placed where shown on the plans and in accordance with these special provisions.

Subgrade enhancement fabric shall be manufactured from one or more of the following materials: polyester, nylon or polypropylene.

Subgrade enhancement fabric shall conform to the following:

	Woven	Non-Woven
Weight, Grams per Square Meter, Min. ASTM Designation: D3776	200	200
Grab Tensile Strength, Kilograms, Min. ASTM Designation: D4632	90	82
Modulus (Tensile Strength at 10% Elongation) Kilograms, Min. ASTM Designation: D4632	50	—
Elongation at Break, Percent, Maximum ASTM Designation: D4632	35 Max.	50 Min.

Subgrade enhancement fabric shall be furnished in an appropriate protective cover which shall protect it from ultraviolet radiation and from abrasion due to shipping and handling, and shall remain in said cover until installation.

Subgrade enhancement fabric shall be accompanied by a Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificate of Compliance," of the Standard Specifications.

The subgrade to receive the fabric, immediately prior to placing, shall conform to the compaction and elevation tolerance specified in Section 25-1.03, "Subgrade," of the Standard Specifications and these special provisions and shall be free of loose or extraneous material and sharp objects that may damage the fabric during installation.

Subgrade enhancement fabric shall be handled and placed in accordance with the manufacturer's recommendation and shall be positioned longitudinally along the alignment, pulled taut to form a tight wrinkle-free mat.

Adjacent borders of the fabric shall be overlapped a minimum of 450 mm.

The amount of subgrade enhancement fabric placed shall be limited to that which can be covered with aggregate subbase material within 72 hours.

Should the fabric be damaged during placing, the damaged section shall be repaired by placing a new piece of fabric over the damaged area. Said piece of fabric shall be large enough to cover the damaged area and provide a minimum 900 mm overlap on all edges.

Damage to the fabric resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor's expense.

During spreading and compaction of the aggregate subbase material, vehicles or equipment shall not be driven directly on the fabric. A sufficient thickness of material shall be maintained between the fabric and the equipment to prevent damage to the fabric.

The quantity of subgrade enhancement fabric to be paid for will be measured by the square meter of area covered, not including additional fabric for overlap.

The contract price paid per square meter for subgrade enhancement fabric shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in placing the fabric, complete in place as shown on the plans, as specified in these special provisions, and as directed by the Engineer.

**10-1.16 ROCK BLANKET**

Rock blanket shall be placed as shown on the plans and in conformance with these special provisions.

**MATERIALS**

Rock for the rock blanket shall be clean, smooth rock obtained from a single source.

Rock for the rock blanket shall conform to the following grading:

Screen Size (Millimeters)	Percentage Passing (By Mass)
355	100
254	90-100
200	0-10

A sample of the rock shall be submitted to the Engineer for approval prior to delivery of the rock to the project site.

**SITE PREPARATION**

Prior to beginning rock blanket work, areas to receive the rock blanket shall be cleared in conformance with the provisions in "Roadside Clearing" of these special provisions.

After clearing, the areas shall be excavated to the depth shown on the plans, graded to a smooth uniform surface and compacted to a minimum relative compaction of 90 percent.

**PLACEMENT**

Rock shall be placed atop slope and spaced a maximum of 10 mm apart and imbedded in the soil 1/3 of the volume of the rock. Rock found in a loose condition shall be reset at the Contractor's expense by methods determined by the Engineer.

**MEASUREMENT AND PAYMENT**

Rock blanket will be measured by the square meter.

The contract price paid per square meter for rock blanket shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing rock blanket, complete in place, including minor grading, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**10-1.17 EROSION CONTROL (TYPE D)**

Erosion control (Type D) shall conform to the provisions in Section 20-3, "Erosion Control," of the Standard Specifications and these special provisions.

Erosion control (Type D) work shall consist of applying erosion control materials to embankment and excavation slopes and other areas disturbed by construction activities. Erosion control (Type D) shall be applied during the period starting August 15th and ending October 15th or, if the slope on which the erosion control is to be placed is finished during the winter season as specified in "Water Pollution Control" of these special provisions, the erosion control shall be applied immediately; or, if the slope on which the erosion control is to be placed is finished outside both specified periods and the contract work will be completed before September 15th, the erosion control shall be applied as a last item of work.

Prior to installing erosion control materials, soil surface preparation shall conform to the provisions in Section 19-2.05, "Slopes," of the Standard Specifications, except that rills and gullies exceeding 50 mm in depth or width shall be leveled. Vegetative growth, temporary erosion control materials and other debris shall be removed from areas to receive erosion control.

**MATERIALS**

Materials shall conform to the provisions in Section 20-2, "Materials," of the Standard Specifications and these special provisions.

**Seed**

Seed shall conform to the provisions in Section 20-2.10, "Seed," of the Standard Specifications. Individual seed species shall be measured and mixed in the presence of the Engineer.

Seed shall be delivered to the project site in unopened separate containers with the seed tag attached. Containers without a seed tag attached will not be accepted.

A sample of approximately 30 g of seed will be taken from each seed container by the Engineer.

**Legume Seed**

Legume seed shall be pellet-inoculated or industrial-inoculated and shall conform to the following:

- A. Inoculated seed shall be inoculated in conformance with the provisions in Section 20-2.10, "Seed," of the Standard Specifications.
- B. Inoculated seed shall have a calcium carbonate coating.
- C. Industrial-inoculated seed shall be inoculated with Rhizobia and coated using an industrial process by a manufacturer whose principal business is seed coating and seed inoculation.
- D. Industrial-inoculated seed shall be sown within 180 calendar days after inoculation.
- E. Legume seed shall consist of the following:

**LEGUME SEED**

Botanical Name (Common Name)	Percent Germination (Minimum)	Kilograms Pure Live Seed Per Hectare (Slope Measurement)
Triticum X elymus Wheatgrass hybrid (sterile)	60%	40
Lotus purshianus Spanish Clover	60%	20
Lupinus bicolor Dwarf Lupine	50%	10

**Non-Legume Seed**

Non-legume seed shall consist of the following:

**NON-LEGUME SEED**

Botanical Name (Common Name)	Percent Germination (Minimum)	Kilograms Pure Live Seed Per Hectare (Slope Measurement)
Bromus carinatus California Brome	60%	20
Elymus glaucus Blue Wild Rye Grass	60%	20
Festuca idahoensis California Blue Fescue	50%	10

**Commercial Fertilizer**

Commercial fertilizer shall conform to the provisions in Section 20-2.02, "Commercial Fertilizer," of the Standard Specifications and shall have a guaranteed chemical analysis within 2 percent of 25 percent nitrogen, 5 percent phosphoric acid and 5 percent water soluble potash and shall be a slow release type.

**Straw**

Straw shall conform to the provisions in Section 20-2.06, "Straw," of the Standard Specifications and these special provisions.

Wheat and barley straw shall be derived from irrigated crops.

Prior to delivery of wheat or barley straw to the project site, the Contractor shall provide the date of harvest and the name, address and telephone number of the grower.

Straw shall be derived from wheat or barley.

## Compost

Compost shall be derived from green material consisting of chipped, shredded or ground vegetation or clean processed recycled wood products or a Class A, exceptional quality biosolids composts, as required by the United States Environmental Protection Agency (EPA), 40 CFR, Part 503c regulations or a combination of green material and biosolids compost. The compost shall be processed or completed to reduce weed seeds, pathogens and deleterious material, and shall not contain paint, petroleum products, herbicides, fungicides or other chemical residues that would be harmful to plant or animal life. Other deleterious material, plastic, glass, metal or rocks shall not exceed 0.1 percent by weight or volume. A minimum internal temperature of 57°C shall be maintained for at least 15 continuous days during the composting process. The compost shall be thoroughly turned a minimum of 5 times during the composting process and shall go through a minimum 90-day curing period after the 15-day thermophilic compost process has been completed. Compost shall be screened through a maximum 9.5-mm screen. The moisture content of the compost shall not exceed 35 percent. Moisture content shall be determined by California Test 226. Compost products with a higher moisture content may be used provided the weight of the compost is increased to equal the compost with a moisture content of 35 percent. Compost will be tested for maturity and stability with a solvita test kit. The compost shall measure a minimum of 6 on the maturity and stability scale.

## Stabilizing Emulsion

Stabilizing emulsion shall conform to the provisions in Section 20-2.11, "Stabilizing Emulsion," of the Standard Specifications and these special provisions. Stabilizing emulsion shall be nonflammable and shall have an effective life of at least one year.

Stabilizing emulsion shall be in a dry powder form, may be reemulsifiable, and shall be a processed organic adhesive used as a soil tackifier.

## APPLICATION

Erosion control materials shall be applied in three separate applications in the following sequence:

- A. The following mixture in the proportions indicated shall be applied with hydro-seeding equipment within 60 minutes after the seed has been added to the mixture:

Material	Kilograms Per Hectare (Slope Measurement)
Fiber	450
Non-Legume Seed	50
Legume Seed	70
Compost	1200

- B. Straw shall be applied at the rate of 4 tonnes per hectare based on slope measurements. Incorporation of straw will not be required.
- C. The following mixture in the proportions indicated shall be applied with hydro-seeding equipment:

Material	Kilograms Per Hectare (Slope Measurement)
Fiber	450
Compost	1200
Commercial Fertilizer Slow Release (25-5-5)	125
Stabilizing Emulsion (Solids)	125

- D. The ratio of total water to total stabilizing emulsion in the mixture shall be as recommended by the manufacturer.

Once straw work is started in an area, stabilizing emulsion applications shall be completed in that area on the same working day.

The proportions of erosion control materials may be changed by the Engineer to meet field conditions.

## MEASUREMENT AND PAYMENT

The contract price paid per kilogram for compost (erosion control) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in applying compost for erosion control, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### 10-1.18 IRRIGATION CROSSOVERS

Irrigation crossovers shall conform to the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications and these special provisions.

Conduits shall be placed in open trenches in conformance with the provisions in Section 20-5.03B, "Conduit for Irrigation Crossovers," of the Standard Specifications.

Conduits shall be corrugated steel pipe.

Water line crossovers shall conform to the provisions in Section 20-5.03C, "Water Line Crossovers," of the Standard Specifications.

Sprinkler control crossovers shall conform to the provisions in Section 20-5.027D, "Sprinkler Control Crossovers," of the Standard Specifications.

Installation of pull boxes shall conform to the provisions in Section 20-5.027I, "Conductors, Electrical Conduit and Pull Boxes," of the Standard Specifications. When no conductors are installed in electrical conduits, pull boxes for irrigation crossovers shall be installed on a foundation of compacted soil.

### 10-1.19 AGGREGATE BASE

Aggregate base shall be Class 2 and shall conform to the provisions in Section 26, "Aggregate Bases," of the Standard Specifications and these special provisions.

The restriction that the amount of reclaimed material included in Class 2 aggregate base not exceed 50 percent of the total volume of the aggregate used shall not apply. Aggregate for Class 2 aggregate base may include reclaimed glass. Aggregate base incorporating reclaimed glass shall not be placed at locations where surfacing will not be placed over the aggregate base.

### 10-1.20 ASPHALT CONCRETE

Asphalt concrete shall be Type A and shall conform to the provisions in Section 39, "Asphalt Concrete," of the Standard Specifications and these special provisions.

Attention is directed to "Liquid Anti-Strip Treatment of Asphalt Concrete" elsewhere in these special provisions.

The grade of asphalt binder to be mixed with aggregate for Type A asphalt concrete shall be AR8000 and shall conform to the provisions in "Asphalt" of these special provisions, except at the Contractor's option asphalt binder used in asphalt concrete placed in constructing miscellaneous areas and dikes may be either Performance Based Asphalt (PBA) Grade 1 or AR4000.

California Test 367 is modified by amending Section C, "Optimum Bitumen Content," as follows:

#### C. OPTIMUM BITUMEN CONTENT

1. Plot asphalt content versus void content for each specimen on Form TL-306 (Figure 3), and connect adjacent points with straight lines.
2. Modify Form TL-306 (Figure 3) to show stability on the vertical axis beginning with a stability value of 20 on the bottom horizontal line and ending with a value of 60 on the top horizontal line.
3. Plot stability versus asphalt content for each specimen on Form TL-306 (Figure 3) as modified in step 2 above and connect adjacent points with straight lines.
4. Select the theoretical asphalt content which is at the point passing through the minimum specification for stability from modified Figure 3.
5. Optimum asphalt content is determined as follows:
  - a. If voids are less than 4.0% at the asphalt content selected in Step 4, then select the asphalt content at 4.0% voids from Figure 3. Selected optimum asphalt content should be as close to 4.0% voids as possible.
6. To establish a recommended range, use the Optimum Bitumen Content (OBC) as the high value and 0.3% less as the low value where the OBC is 7.9% or less. When the OBC is between 8.0% and 8.6%, use it as the high value of the range and use 7.6% as the low value. When the OBC is greater than 8.6%, use it as the high value and 1.0% less as the low value.

If the recommended bitumen ratio range, as determined by California Test 367, is increased or decreased by the Engineer beyond the recommended range by more than 0.1 percent by weight of the dry aggregate, the compensation payable to the Contractor for asphalt concrete will be increased or decreased on the basis of the total increase or decrease in tonnes of asphalt binder times the cost of asphalt binder per tonne, f.o.b. the asphalt binder plant (including sales tax) plus the freight cost per tonne, at the carrier's established rates, for the delivery of the asphalt binder from the asphalt binder plant to the asphalt concrete plant being used for the project. In determining the cost of the asphalt binder, any cash or trade discount offered or available will be credited to the State notwithstanding the fact that such discount may not have been taken by the purchaser. The highest value of the specified range will be considered to be the specified asphalt content for determining the total increase in asphalt binder and the lowest value of the specified range will be considered to be the specified asphalt content for determining the total decrease in asphalt binder.

The amount of asphalt binder used in asphalt concrete placed in dikes shall be increased one percent by mass of the aggregate over the amount of asphalt binder determined for use in asphalt concrete placed on the traveled way.

The aggregate for Type A asphalt concrete shall conform to the 19-mm maximum, medium grading specified in Section 39-2.02, "Aggregate," of the Standard Specifications

At least four weeks prior to their intended use, the Contractor shall furnish samples of aggregates, in the quantity requested by the Engineer, from the source or sources he proposes to use for the project.

Aggregate from each source shall conform to the following quality requirements:

Test	California Test	Asphalt Concrete Type A
Los Angeles Rattler	211	
Loss at 500 Rev. (Max)		25%

Fine aggregate shall be obtained from a source or sources that meet the requirements for California Test Method 211 specified for coarse aggregate and shall also conform to the following quality requirement:

Test	California Test	Requirement
Durability Index (Df)	229	50 Min

The miscellaneous areas to be paid for at the contract price per square meter for place asphalt concrete (miscellaneous area), in addition to the prices paid for the materials involved, shall be limited to the areas listed on the plans.

Aggregate for asphalt concrete dikes shall be in conformance with the provisions for 9.5-mm Maximum grading in Section 39-2.02, "Aggregate," of the Standard Specifications.

If the Contractor selects the batch mixing method, asphalt concrete shall be produced by the automatic batch mixing method in conformance with the provisions in Section 39-3.03A(2), "Automatic Proportioning," of the Standard Specifications.

If the finished surface of the asphalt concrete does not meet the specified surface tolerances, the surfacing shall be brought within tolerance by either (1) abrasive grinding (with fog seal coat on the areas which have been ground), (2) removal and replacement or (3) placing an overlay of asphalt concrete. The method will be selected by the Engineer. The corrective work shall be at the Contractor's expense.

If abrasive grinding is used to bring the finished surface to the specified surface tolerances, additional grinding shall be performed, as necessary, to extend the area ground in each lateral direction so that the lateral limits of grinding are at a constant offset from, and parallel to, the nearest lane line or pavement edge, and in each longitudinal direction so that the grinding begins and ends at lines normal to the pavement centerline, within any ground area. Ground areas shall be neat rectangular areas of uniform surface appearance. Abrasive grinding shall conform to the provisions in the first paragraph and the last 4 paragraphs in Section 42-2.02, "Construction," of the Standard Specifications.

In addition to the provisions in Section 39-5.01, "Spreading Equipment," of the Standard Specifications, asphalt paving equipment shall be equipped with automatic screed controls and a sensing device or devices.

When placing asphalt concrete to the lines and grades established by the Engineer, the automatic controls shall control the longitudinal grade and transverse slope of the screed. Grade and slope references shall be furnished, installed, and maintained by the Contractor. Should the Contractor elect to use a ski device, the minimum length of the ski device shall be 9 m. The ski device shall be a rigid one piece unit and the entire length shall be utilized in activating the sensor.

When paving contiguously with previously placed mats, the end of the screed adjacent to the previously placed mat shall be controlled by a sensor that responds to the grade of the previously placed mat and will reproduce the grade in the new mat within a 3-mm tolerance. The end of the screed farthest from the previously placed mat shall be controlled in the same way it was controlled when placing the initial mat.

Should the methods and equipment furnished by the Contractor fail to produce a layer of asphalt concrete conforming to the provisions, including straightedge tolerance, of Section 39-6.03, "Compacting," of the Standard Specifications, the paving operations shall be discontinued and the Contractor shall modify the equipment or methods, or furnish substitute equipment.

Should the automatic screed controls fail to operate properly during a day's work, the Contractor may manually control the spreading equipment for the remainder of that day. However, the equipment shall be corrected or replaced with alternative automatically controlled equipment conforming to the provisions in this section before starting another day's work.

The area to which paint binder has been applied shall be closed to traffic. Care shall be taken to avoid tracking binder material onto existing pavement surfaces beyond the limits of construction.

Asphalt concrete surfacing shall be placed on existing surfacing shown on the plans, unless otherwise directed by the Engineer.

## **10-1.21 LIQUID ANTI-STRIP TREATMENT OF ASPHALT CONCRETE**

### **GENERAL**

This work shall consist of furnishing and treating asphalt binder with liquid anti-strip additives in conformance with these special provisions.

### **MATERIALS**

Liquid anti-strip additive shall be added to the asphalt concrete mixture at a rate of 0.5 percent by mass of the asphalt binder. The type and brand of liquid anti-strip additive to be used in the treated asphalt concrete mixture shall be proposed by the Contractor and approved by the Engineer.

The type and brand of the liquid anti-strip additive shall be proposed in writing by the Contractor at least 2 weeks prior to its use. The proposal shall be accompanied by 2 one-liter samples of liquid anti-strip additive and 2 one-liter samples of the proposed asphalt binder.

Changes in the type and brand of the liquid anti-strip additive shall be proposed in writing by the Contractor and shall meet the requirements for submittal and review of these special provisions. Changes in the type and brand of liquid anti-strip additive shall be allowed only with the written approval of the Engineer.

Liquid anti-strip additives shall conform to the following requirements:

#### **Physical Characteristics**

- e. Anti-strip additive shall be low odor.
- f. Department of Transportation shipping classification: Non Regulated

#### **Chemical Characteristics**

- 8. Minimum total amine value of 325 as measured by ASTM D2074
- 9. Formulation with no solvents used as cut-back

#### **Performance Characteristics**

Liquid anti-strip additive shall not change the aged residue viscosity of the proposed asphalt binder by more than 600 pascal seconds ( $\times 10^{-1}$ ) as measured by ASTM D217.

At least two weeks prior to their intended use, the Contractor shall furnish the following:

- A. Material Safety Data Sheet
- B. 2 one-liter samples of the proposed liquid anti-strip additive
- C. 2 one-liter samples of the proposed asphalt binder
- D. Infrared analysis including copy of absorption spectra

A Certificate of Compliance, as specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, shall accompany each shipment of liquid anti-strip to the project and shall include actual results of tests completed to demonstrate compliance with these special provisions. The certificate shall include the shipment number, type of material, specific gravity of the material, refinery, consignee, destination, quantity, contract or purchase order number, and date of

shipment. The certificate shall state that the material complies with the specifications detailed in this section and shall be signed by the Contractor or the Contractor's representative.

Liquid anti-strip additives furnished without a Certificate of Compliance shall not be used.

The safe transportation, storage, use, and disposal of liquid anti-strip additives shall be the responsibility of the Contractor.

## **STORING AND PROPORTIONING**

### **Storing**

Liquid anti-strip additives shall be stored and introduced into the asphalt binder stream at the asphalt concrete plant, during asphalt concrete production, and in accordance with the manufacturer's recommendations.

Anti-strip additives shall have a suitable sampling device provided in the liquid anti-strip feed lines connecting plant storage tanks to the anti-strip metering system. The sampling device shall consist of a valve with a nominal diameter between 9 and 13 mm, constructed in a manner such that a sample may be withdrawn slowly at any time during plant operations. The valve shall be maintained in good condition. The sampling device shall be readily accessible and in an area free of dangerous obstructions. A drainage receptacle shall be provided for flushing the device prior to sampling.

Asphalt binder shall be sampled at a point prior to the addition of liquid anti-strip.

### **Proportioning**

The asphalt concrete proportioning operation shall be of the batch type proportioning operation or a continuous mixing proportion operation and the use of liquid anti-strip shall be in conformance with the following:

#### **Proportioning for Batch Mixing**

Dispensers for liquid anti-strip shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of asphalt concrete. Each dispenser shall include a graduated measuring unit into which liquid anti-strip is measured to within +/- 2 percent of the prescribed quantity for each batch. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at which proportioning operations are controlled to permit a visual check of batching accuracy prior to discharge. Each measuring unit shall be clearly marked for the type and quantity of admixture.

Dispensers for liquid anti-strip shall operate automatically with the batching control equipment. The dispensers shall be equipped with an automatic warning system which will provide a visible or audible signal at the point at which proportioning operations are controlled when the quantity of anti-strip measured for each batch of asphalt concrete varies from the pre-selected dosage by more than 1 percent, or when the entire contents of the measuring unit are not emptied from the dispenser into each batch of asphalt concrete.

The dispensing of liquid anti-strip into the batch shall be arranged to flow into the stream of the asphalt binder at any point along the asphalt feed line between the storage tank and the pugmill. Liquid anti-strip additive shall be introduced into the asphalt binder stream in a uniform manner such that the liquid anti-strip additive is dispersed throughout the batch.

#### **Proportioning for Continuous Mixing**

Liquid anti-strip shall be proportioned by mass and added to the asphalt at a point in the production stream after the proportioning of the asphalt but before the asphalt is added to the aggregate. Liquid anti-strip shall be proportioned with a mass flow meter of the Coriolis effect type. The meter shall have been Type-approved by the California Department of Agriculture, Division of Measurement Standards prior to its use. The meter shall be of the appropriate size for the flow intended. The transmitter for the meter shall be located and maintained at the point where the asphalt concrete proportioning operations are controlled. A device shall be provided which will display the meter set points. This device shall be located at the point where the asphalt concrete proportioning operations are controlled.

The meter shall perform with such accuracy that, when operating between 30 percent and 100 percent of production capacity, the average difference between the indicated mass of material delivered and actual mass delivered will not exceed 0.5 percent of the actual mass for 3 individual runs. For any of the 3 individual runs, the indicated mass of the material delivered shall not vary from the actual mass delivered by more than 1 percent of the actual mass. Test run duration shall be for a minimum of 35 kg. Test run material shall be liquid anti-strip and shall be weighed on a platform scale located at the asphalt concrete plant. The platform scale shall have a maximum capacity not exceeding 2.5 tonnes and shall have a maximum graduation size of 0.5 kg. The platform scale shall have been Type-approved by the California Department of Agriculture, Division of Measurement Standards prior to its use, and shall be error tested within 4 hours of meter calibration.

The storage for liquid anti-strip shall be equipped with a device for automatic plant cut-off when the level of the liquid is lowered sufficiently to expose the pump suction line.

The belt scale for the combined aggregate, the proportioning devices for supplemental fine aggregate, if used, the asphalt proportioning meter, and the liquid anti-strip proportioning meter shall be interlocked so that the rates of feed of the aggregates, asphalt, and liquid anti-strip will be adjusted automatically (at all production rates and production rate changes) to maintain the bitumen ratio (kilograms of asphalt per 100 kilograms of dry aggregate including supplemental fine aggregate used) and the liquid anti-strip ratio (grams liquid anti-strip per kilogram asphalt) designated by the Engineer. The plant shall not be operated unless this automatic system is operating and in good working condition.

The meter used for proportioning liquid anti-strip shall be equipped with a rate of flow indicator to show the rate of delivery and a resettable totalizer so that the total amount of liquid anti-strip introduced into the mixture can be determined. The liquid anti-strip totalizer shall not register when the metering system is not delivering liquid anti-strip to the mixer.

## MEASUREMENT AND PAYMENT

Full compensation for the liquid anti-strip for mixing with asphalt concrete shall be considered as included in the contract price paid per tonne for asphalt concrete of the type involved and no separate payment will be made therefor.

### 10-1.22 CONCRETE STRUCTURES

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

### 10-1.23 REINFORCED CONCRETE PIPE

Reinforced concrete pipe shall conform to the provisions in Section 65, "Reinforced Concrete Pipe," of the Standard Specifications and these special provisions.

Where embankment will not be placed over the top of the pipe, a relative compaction of not less than 85 percent shall be required below the pipe spring line for pipe installed using Method 1 backfill in trench, as shown on Standard Plan A62D. Where the pipe is to be placed under the traveled way, a relative compaction of not less than 90 percent shall be required unless the minimum distance between the top of the pipe and the pavement surface is the greater of 1.2 m or one half of the outside diameter of the pipe.

Except as otherwise designated by classification on the plans or in the specifications, joints for culvert and drainage pipes shall conform to the plans or specifications for standard joints.

When reinforced concrete pipe is installed in conformance with the details shown on Revised Standard Plan A62DA, the fifth paragraph of Section 19-3.04, "Water Control and Foundation Treatment," of the Standard Specifications shall not apply.

When solid rock or other unyielding material is encountered at the planned elevation of the bottom of the bedding, the material below the bottom of the bedding shall be removed to a depth of 1/50 of the height of the embankment over the top of the culvert, but not less than 150 mm nor more than 300 mm. The resulting trench below the bottom of the bedding shall be backfilled with structure backfill material in conformance with the provisions in Section 19-3.06, "Structure Backfill," of the Standard Specifications.

The excavation and backfill below the planned elevation of the bottom of the bedding will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

The Outer Bedding shown on Revised Standard Plan A62DA shall not be compacted prior to placement of the pipe.

Timber bulkheads shall be constructed and placed across the ends of unconnected reinforced concrete pipe as shown on the plans. Wood for timber bulkheads shall be construction heart grade redwood at least 25 mm thick. Full compensation for constructing and placing timber bulkheads shall be considered as included in the contract price paid per meter for the reinforced concrete pipe involved and no separate payment will be made therefor.

Special reinforced concrete pipe, having concrete cover over the steel reinforcement greater than the cover specified in AASHTO Designation: M 170M, shall conform to the provisions in Section 65-1.02, "Materials," and Section 65-1.02A, "Circular Reinforced Concrete Pipe," of the Standard Specifications, except the width of crack produced by the D-load test specified in AASHTO Designation: M 170M shall be the width determined by the following formula:

$$b = \frac{t - 3 / 8d}{t - 3 / 8d - C} \times 0.3\text{-mm}$$

Where:

b = Width of crack to be produced in lieu of the 0.3-mm crack specified in AASHTO Designation: M 170M

t = Wall thickness of pipe, mm

d = Effective depth of the section to be tested, m

C = Concrete cover over steel reinforcement in excess of cover specified in AASHTO Designation: M 170M

Reinforced concrete pipe that is to be hydrostatically tested shall be strength tested by the 3-edge bearing method to a maximum D-load of 10 percent greater than the 0.3-mm cracking D-load specified in AASHTO Designation: M 170M or to the actual D-load required to produce a 0.3-mm crack, whichever is the lesser.

**10-1.24 GEOMEMBRANE (WATER BARRIER)**

Geomembrane shall function as a leak free water barrier to prevent infiltration. The geomembrane shall have the shape and dimensions as shown on the plans. The dimensions shall be adequate to cover the facility, including transverse anchor trenches at the beginning and end of the facility and longitudinal anchor trenches along its length.

**MATERIALS.**

Geomembrane shall be textured on both sides. Geomembrane shall consist of a single ply material. The major polymer component of geomembrane shall be either polyvinyl chloride (PVC), very low density polyethylene (VLDPE) or other comparable flexible materials or combinations thereof. The geomembrane shall be flexible enough to bend in anchor trenches and to conform to subgrade irregularities by its own weight, in ambient job-site air temperatures, without any overburden placed on it, and without additional heating and bending.

Geomembrane shall be manufactured from either virgin raw materials or from a combination of virgin and recycled materials. None of the materials, whether virgin or recycled, shall contain biodegradable filler materials that degrade the physical or chemical characteristics of the finished roll products, such that they no longer function as leak-free water barriers. To confirm the absence of biodegradable filler materials the engineer may order tests such as ASTM E 204 (Fourier Transformed Infrared Spectroscopy-FTIR) or other appropriate tests.

Geomembrane shall be free from holes or punctures and shall conform to the following requirements:

Specification	Requirement
Thickness, mm, min. ASTM Designation: D 1593 *	0.68
Grab tensile strength at break, KiloNewtons, min.-both machine and cross directions (25 mm wide strip of material) ASTM Designation: D 882 *	0.267
Elongation at break, percent (%) min. ASTM Designation: D 882 *	50
Toughness, kilonewtons, min. (Percent elongation x grab tensile strength)  example 0.30 kn x 100 % = 30 kN-%	17.8
Puncture resistance, kilonewtons, min. FTMS 101C Method 2065 *	0.13

\* or appropriate test method for a comparable geomembrane polymer material

A Certificate of Compliance shall be furnished in accordance with the provision of Section 6-1.07, "Certificates of Compliance" of the Standard Specifications. It shall state that the geomembrane complies with all of the above conditions and material requirements.

**SEAMS**

Geomembrane seams shall be leak free, as tested by the VACUUM BOX METHOD, ASTM 4437, or other comparable seam test for the specific polymer. Leaky geomembrane, as determined by the engineer, shall be replaced at the expense of the contractor.

Geomembrane sheets shall be welded (heat or ultrasonic or other), or shall be solvent-bonded with a material that is compatible with the geomembrane as recommended by the manufacturer, to meet the required shape and dimensions as shown on the plans. Actual bonding along the entire length of any seam shall be at least 25 mm wide. Additional overlapped material is permitted, but will not be considered as additional area for compensation. Filler-sealer compounds shall not be permitted for factory or field seams.

## **INSTALLATION.**

Geomembrane shall conform to the following installation requirements:

### **Subgrade**

Subgrade shall be free of sharp protruding materials and objects.

### **Material configuration**

Geotextile cushion fabric, geomembrane, and another geotextile cushion fabric shall be placed on the subgrade, as specified in "Geotextile (Cushion Fabric)" elsewhere in these special provisions, such that the geomembrane is sandwiched between the geotextiles.

### **Anchor trenches**

The transverse and longitudinal edges of the sandwiched geomembrane and geotextile cushion fabric shall be anchored in trenches at least 150 millimeters deep, as shown on the plans.

### **Damage**

No construction equipment shall drive directly on the geomembrane. Damage to the geomembrane that results from the Contractor's vehicles, equipment, or operations shall be replaced or repaired by the Contractor at his expense. Damaged geomembrane shall be either completely replaced or repaired with new material according to the specifications for SEAMS, except 450 mm of patch material shall extend beyond any damage.

## **MEASUREMENT**

Geomembrane shall be measured by the square meter of area covered including anchor trench dimensions. Overlapped area of factory seams, field seams, or overlapped joints shall not be included.

## **PAYMENT**

The contract price paid per square meter for geomembrane shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing the geomembrane, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer. There shall be no extra compensation for overlaps.

### **10-1.25 GEOTEXTILE (CUSHION FABRIC)**

Geotextile cushion fabric shall consist of a separate geotextile and shall be placed as shown on the plans and in conformance with these special provisions.

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

## **INSTALLATION**

Installation shall be done in accordance with the following requirements:

### **Material Configuration**

A separate geotextile cushion fabric shall first be placed directly on the prepared subgrade and other surfaces. Geomembrane shall then be placed. Then another separate geotextile cushion fabric shall be placed on top of the geomembrane.

### **Anchor trenches**

The transverse and longitudinal edges of the sandwiched geomembrane and geotextile cushion fabrics shall be anchored in trenches at least 150 millimeters deep, as shown on the plans.

### **Joints**

Segments of fabric shall be shingled as shown on the plans. Overlaps shall be a minimum of 300 millimeters.

## Damage

No construction equipment shall drive directly on the geotextile cushion fabric. Damage to the material resulting from the Contractor's vehicles, equipment, or operations shall be replaced or repaired by the Contractor at his expense. Any damaged material shall be either completely replaced or repaired with new material according to the above specifications for joints, except that 450 mm of patching material shall extend beyond any damage.

## MATERIALS.

Geotextile cushion fabric shall be a nonwoven, needle-formed fabric, free of any needles which may have broken off during manufacturing. It can be manufactured from either virgin polymer materials, (for example, polypropylene or polyester), recycled materials, or a combination of recycled and virgin polymer materials, (for example, polyester polyethylene terephthalate "PETE"). None of the materials, whether virgin or recycled, shall contain biodegradable filler materials that degrade the physical or chemical characteristics of the finished roll products. To confirm the absence of biodegradable filler materials the engineer may order tests such as ASTM E 204 (Fourier Transformed Infrared Spectroscopy-FTIR) or other appropriate tests.

Geotextile cushion fabric shall meet the following physical requirements:

Property	Value	ASTM Designation*
Weight (grams/square meter), min	271	D 5261
Grab Tensile Strength (kN), min (25 mm grip min, both directions)	0.89	D 4632
Elongation at Break (percent), min	50	D 4632
Toughness (kN-%), min (percent elongation times grab tensile strength)	53	

\* or appropriate test method for comparable geotextile polymer material

A Certificate of Compliance shall be furnished in accordance with the provision of Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

## MEASUREMENT.

Geotextile (cushion fabric) shall be measured by the square meter of area covered including anchor trench dimensions. Overlapped area of field joints shall not be included.

## PAYMENT.

The contract price paid per square meter for geotextile (cushion fabric) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing the geotextile (cushion fabric), complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer. There shall be no extra compensation for overlaps.

### 10-1.26 CORRUGATED STEEL PIPE ELBOW

Corrugated steel pipe elbow shall conform to the provisions in Section 69, "Overside Drains," of the Standard Specifications and these special provisions.

Corrugated steel pipe elbow will be paid for by the contract unit price of the sizes shown in the Engineer's Estimate.

### 10-1.27 MISCELLANEOUS FACILITIES

Single barrel sand traps, steel flared end sections, concrete flared end sections, and concrete pipe inlets shall conform to the provisions in Section 70, "Miscellaneous Facilities," of the Standard Specifications.

### 10-1.28 SLOPE PROTECTION

Slope protection shall be placed or constructed in conformance with the provisions in Section 72, "Slope Protection," of the Standard Specifications.

### 10-1.29 MISCELLANEOUS IRON AND STEEL

Miscellaneous iron and steel shall conform to the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications.

**10-1.30 CHAIN LINK FENCE (TYPE CL-1.8, SLATTED)**

Chain link fence (Type CL-1.8, slatted) consisting of chain link fence (Type CL-1.8) with plastic slats inserted vertically in the chain link fabric shall conform to the provisions in Section 80, "Fences," of the Standard Specifications and these special provisions.

Chain link fence fabric shall be woven from 3.76 mm (9-gage) galvanized steel wire. Mesh openings in the chain link fence fabric shall be approximately 83 mm vertically and 133 mm horizontally.

Plastic slats shall be manufactured from a high density virgin polyethylene with ultraviolet inhibitors, shall be brown in color, and shall conform to the following:

- A. Plastic slats shall have a flat tubular cross section with a wall thickness of approximately 0.8-mm; depth of approximately 8.3 mm; width of approximately 60.5 mm; and a length equal to the designated fence height.
- B. The plastic slats shall have the following material specifications:

Property	Value	ASTM Designation
Melt Index	0.24	D 1238
Density	0.951	D 1505
Low Temperature Brittleness	-60°C	D 746
Tensile Strength	25.5 MPa	D 638

**10-1.31 GUARD POST**

Guard posts shall be constructed of 200-mm galvanized standard pipe 2.4 m long. Posts shall be set 1.2 m in a block of portland cement concrete, as shown on the plans, and the pipe shall be filled with portland cement concrete.

Pipe used for guard posts shall conform to the specifications of ASTM Designation: A 53.

The contract unit price paid for guard post shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing guard posts, complete in place, as shown on the plans, as specified in these special provisions, and as directed by the Engineer.

**SECTION 10-2. HIGHWAY PLANTING AND IRRIGATION SYSTEMS**

**10-2.01 GENERAL**

The work performed in connection with irrigation systems shall conform to the provisions in Section 20, "Erosion Control and Highway Planting," of the Standard Specifications and these special provisions.

**PROGRESS INSPECTIONS**

Progress inspections will be performed by the Engineer for completed irrigation system work at designated stages during the life of the contract.

Progress inspections will not relieve the Contractor of responsibility for installation in conformance with the special provisions, plans and Standard Specifications. Work within an area shall not progress beyond each stage until the inspection has been completed, corrective work has been performed, and the work is approved, unless otherwise permitted by the Engineer.

The requirements for progress inspections will not preclude additional inspections of work by the Engineer at other times during the life of the contract.

The Contractor shall notify the Engineer, in writing, at least 4 working days prior to completion of the work for each stage of an area and shall allow a minimum of 3 working days for the inspection.

Progress inspections will be performed at the following stages of work:

- A. During pressure testing of the pipelines on the supply side of control valves.
- B. During testing of low voltage conductors.

## **COST BREAK-DOWN**

The Contractor shall furnish the Engineer a cost break-down for the contract lump sum item of irrigation system.

The cost break-down shall be completed and furnished in the format shown in the sample of the cost break-down included in this section. Unit descriptions of work shown in the samples are the minimum to be submitted. Additional unit descriptions of work may be designated by the Contractor. If the Contractor elects to designate additional unit descriptions of work, the quantity, value and amount for those units shall be completed in the same manner as for the unit descriptions shown in the samples. The units and quantities given in the sample are to show the manner of preparing the cost break-down to be furnished by the Contractor.

The Contractor shall determine the quantities required to complete the work shown on the plans. The quantities and their values shall be included in the cost break-down submitted to the Engineer for approval. The Contractor shall be responsible for the accuracy of the quantities and values used in the cost break-down submitted for approval.

No adjustment in compensation will be made in the contract lump sum price paid for irrigation system due to differences between the quantities shown in the cost break-down furnished by the Contractor and the quantities required to complete the work as shown on the plans and as specified in these special provisions.

The sum of the amounts for the units of work listed in the cost break-down for irrigation system work shall be equal to the contract lump sum price bid for the work. Overhead and profit shall be included in each individual unit listed in the cost break-down. Cost break-downs shall be submitted to the Engineer for approval within 15 working days after the contract has been approved. Cost break-downs shall be approved, in writing, by the Engineer before partial payment for the item of irrigation system will be made.

Approved cost break-downs will be used to determine partial payments during the progress of the work and as the basis for calculating the adjustment in compensation for the item of irrigation system due to changes ordered by the Engineer. When an ordered change increases or decreases the quantities of an approved cost break-down, the adjustment in compensation will be determined in the same manner specified for increases and decreases in the quantity of a contract item of work in conformance with the provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

**IRRIGATION SYSTEM COST BREAK-DOWN**

**Contract No. 02-341604**

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
EXISTING IRRIGATION FACILITIES (MAINLINE-BACKFLOW) /CHECK, TEST, & LOCATE	LS	LUMP SUM		
CONTROL & NEUTRAL CONDUCTORS	LS	LUMP SUM		
50 MM ELECTRIC REMOTE CONTROL VALVES	EA	5		
WALL MOUNTED CONTROLLER (6 STATION)	EA	1		
20 MM PLASTIC PIPE (PR 200) SUPPLY LINE	M	285		
25 MM PLASTIC PIPE (PR 200) SUPPLY LINE	M	80		
32 MM PLASTIC PIPE (PR 200) SUPPLY LINE	M	80		
40 MM PLASTIC PIPE (PR 315) PRESSURE LINE	M	98		
40 MM BACKFLOW PREVENTER ASSEMBLY	EA	1		
SPRINKLER (TYPE C-2)	EA	61		
SPRINKLER (TYPE A-6)	EA	16		
40 MM GATE VALVE	EA	1		
40 MM WYE STRAINER	EA	1		
20 MM FREEZE DRAIN DEVICE	EA	18		

**TOTAL** \_\_\_\_\_

## **10-2.02 HIGHWAY PLANTING**

The work performed in connection with highway planting shall conform to the provisions in Section 20-4, "Highway Planting," of the Standard Specifications and these special provisions.

### **ROADSIDE CLEARING**

Prior to preparing rock blanket areas, seeding areas, or commencing irrigation trenching operations for planting areas, trash and debris shall be removed from the entire project limits, excluding paved areas, medians and existing landscape.

In addition to removing trash and debris, the project area shall be cleared as specified herein:

- A. Weeds shall be killed and removed within project bounds.

After the initial roadside clearing is complete, additional roadside clearing work shall be performed as necessary to maintain the areas, as specified above, in a neat appearance until the completion of contract. This work shall include the following:

- A. Trash and debris shall be removed.
- B. Rodents shall be controlled.
- C. Weed growth shall be killed before the weeds reach the seed stage of growth or exceed 150 mm in length.
- D. Weeds in plant basins, including basin walls, shall be removed by hand pulling, after the plants have been planted.
- E. Areas outside the areas specified to be cleared of weeds shall be killed.

### **Weed Control**

Weed control shall also conform to the following:

- A. Stolon type weeds shall be killed with glyphosate.
- B. Removed shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

### **PESTICIDES**

Pesticides used to control weeds shall conform to the provisions in Section 20-4.026, "Pesticides," of the Standard Specifications. Except as otherwise provided in these special provisions, pesticide use shall be limited to the following materials:

Cacodylic Acid  
Diquat  
Fluazifop-butyl  
Glyphosate  
Isoxaben (Preemergent)  
Sethoxydim  
Oxadiazon - 50 percent WP (Preemergent)  
Oryzalin (Preemergent)  
Pendimethalin (Preemergent)  
Prodiamine (Preemergent)  
Trifluralin (Preemergent)  
Ammonium Sulfate  
Magnesium Chloride  
Melfluidide (Growth regulator)  
Napropamide (Preemergent)

Glyphosate shall be used to kill stolon type weeds.

Oxadiazon shall be of the emulsifiable concentration or wettable powder type.

If the Contractor elects to request the use of other pesticides on this project, the request shall be submitted, in writing, to the Engineer not less than 15 days prior to the intended use of the other pesticides. Except for the pesticides listed in these special provisions, no pesticides shall be used or applied without prior written approval of the Engineer.

### **10-2.03 IRRIGATION SYSTEMS**

Irrigation systems shall be furnished and installed in conformance with the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications, except materials containing asbestos fibers shall not be used.

Attention is directed to the provisions in "Obstructions" of these special provisions, regarding work over or adjacent to existing underground facilities. Excavation for proposed irrigation facilities shall not be started until the existing underground facilities have been located.

Gate valves, 75 mm and larger in size, shall be furnished with a square lug and shall be operated by use of long shank keys. Prior to acceptance of the contract, 3 long shank keys shall be delivered to the Engineer.

#### **VALVE BOXES**

Valve boxes shall conform to the provisions in Section 20-2.24, "Valve Boxes," of the Standard Specifications, except as otherwise provided herein.

Valve boxes shall be fiberglass or reinforced plastic.

Covers for plastic valve boxes shall be glass fiber reinforced plastic or plastic.

Valve boxes shall be identified on the top surface of the covers by branding the appropriate abbreviations for the irrigation facilities contained in the valve boxes as shown on the plans. Valve boxes that contain remote control valves shall be identified by the appropriate letters and numbers (controller and station numbers). The letters and numbers shall be 50 mm in height.

### **ELECTRIC AUTOMATIC IRRIGATION COMPONENTS**

#### **Irrigation Controllers**

Irrigation controllers shall be single, solid-state independent controllers conforming to the following:

- A. Irrigation controllers shall be fully automatic and shall operate a complete -32 day irrigation program.
- B. A switch or switches shall be provided on the face of the control panel that will turn the irrigation controller "on" or "off" and provide for automatic or manual operation. Manual operation shall allow cycle start at the desired station and shall allow activation of a single station.
- C. The watering time of each station shall be displayed on the face of the control panel.
- D. The irrigation controller and the low voltage output source shall be protected by fuses or circuit breakers.
- E. The irrigation controller mechanism, panel and circuit board shall be connected to the low voltage control and neutral conductors by means of plug and receptacle connectors located in the irrigation controller enclosure.
- F. Each station shall have a variable or incremental timing adjustment with a range of 1400 minutes to a minimum of one minute.
- G. Irrigation controllers shall be capable of a minimum of 4 independent program schedules.
- H. Where direct burial conductors are to be connected to the terminals strip, the conductors shall be connected with the proper size open-end crimp-on wire terminals. No exposed wire shall extend beyond the crimp of the terminal and the wires shall be parallel on the terminal strip.

#### **Electric Remote Control Valves**

Electric remote control valves shall conform to the provisions in Section 20-2.23, "Control Valves," of the Standard Specifications and the following:

- A. Valves shall be brass construction.
- B. Valves shall be straight pattern (side inlet) as shown on the plans.
- C. Valves shall have a self-flushing screen that cleans itself and resists debris build-up.

#### **Pull Boxes**

Pull box installations shall conform to the provisions in Section 20-5.027I, "Conductors, Electrical Conduits and Pull Boxes," of the Standard Specifications.

#### **Conductors**

Low voltage, as used in this section "Conductors," shall mean 36 V or less.

Low voltage control and neutral conductors in pull boxes and valve boxes, at irrigation controller terminals, and at splices shall be marked as follows:

- A. Conductor terminations and splices shall be marked with adhesive backed paper markers or adhesive cloth wrap-around markers, with clear, heat-shrinkable sleeves sealed over the markers.

Markers for the control conductors shall be identified with the appropriate number or letter designations of irrigation controllers and station numbers. Markers for neutral conductors shall be identified with the appropriate number or letter designations of the irrigation controllers.

The color of low voltage neutral and control conductor insulation, except for the striped portions, shall be homogeneous throughout the entire thickness of the insulation.

Insulation for conductors may be UL listed polyethylene conforming to UL44 test standards with a minimum insulation thickness of 1.05 mm for wire sizes 10AWG and smaller.

**IRRIGATION SYSTEMS FUNCTIONAL TEST**

Functional tests for the irrigation controllers and associated automatic irrigation systems shall conform to the provisions in Section 20-5.027J, "Testing," of the Standard Specifications and these special provisions.

Tests shall demonstrate to the Engineer, through one complete cycle of the irrigation controllers in the automatic mode, that the associated automatic components of the irrigation systems operate properly. If automatic components of the irrigation systems fail a functional test, these components shall be repaired at the Contractor's expense and the testing repeated until satisfactory operation is obtained.

Associated automatic components shall include, but not be limited to the remote control valves and electronic controller.

Upon completion of work on an irrigation system, including correction of deficiencies and satisfactory functional tests for the systems involved, the plants to be planted in the area watered by the irrigation system may be planted provided the planting areas have been prepared as specified in these special provisions.

**PIPE**

**Plastic Pipe**

Plastic pipe supply lines shall be polyvinyl chloride (PVC) 1120 or 1220 pressure rated pipe with the minimum pressure rating (PR) shown on the plans.

Plastic pipe supply lines and fittings that are 100 mm or larger in diameter on the supply side of control valves shall be the rubber ring gasket type, except when pressure rating (PR) 315 plastic pipe supply line is required.

Plastic pipe supply lines less than 100 mm in diameter shall have solvent cemented type joints. Primers shall be used on the solvent cemented type joints.

Plastic pipe supply lines (main) shall have a minimum cover of 0.45 m.

Plastic pipe (irrigation lines) shall be installed not less than 300 mm below the finished grade, measured to the top of the pipe.

A nonhardening joint compound shall be used in place of the pipe thread sealant tape conforming to the provisions in Section 20-5.03E, "Pipe," of the Standard Specifications. Joint compounds shall be applied in conformance with the manufacturer's recommendations.

Fittings for plastic pipe supply lines with a pressure rating (PR) of 315 shall be Schedule 80.

**BACKFLOW PREVENTER ASSEMBLIES**

Backflow preventers shall conform to the provisions in Section 20-2.25, "Backflow Preventers," of the Standard Specifications and these special provisions.

Pressure loss through the backflow preventers shall not exceed the following:

BACKFLOW PREVENTER SIZE (mm)	FLOW RATE (L/min)	PRESSURE LOSS (kPa)
40	112	85

Backflow preventer assemblies shall be painted with a minimum of 2 applications of a commercial quality enamel paint. The color of the paint shall be light brown.

**TESTING BACKFLOW PREVENTERS**

The backflow preventer installed by the Contractor shall be tested for proper operation in conformance with the provisions in Section 20-5.03J, "Check and Test Backflow Preventers," of the Standard Specifications and these special provisions.

Tests for new backflow preventer shall be satisfactorily completed after installation of the backflow preventer assembly. Retesting of backflow preventers after satisfactory completion of the first tests will not be required.

### **SPRINKLERS**

Sprinklers shall conform to the type, pattern, material, and operating characteristics listed in the "Sprinkler Schedule" shown on the plans.

A freeze drain device shall be installed at all low head or lateral line low spot. The drain device shall be situated so that lateral pipes servicing pop up sprinkler heads will drain after closure of the remote control valve for the line. A 0.6-cubic meter drain filled completely with pea gravel shall be placed beneath the drainage device.

### **WYE STRAINERS**

Wye strainers shall be installed on the upstream side of the electric remote control valves as shown on the plans.

Removable stainless steel strainers for wye strainers shall be 30 µm size mesh.

When garden valves are opened, discharge shall be up and out of the valve box.

### **FINAL IRRIGATION SYSTEM CHECK**

A final check of existing and new irrigation facilities shall be performed not more than 7 working days prior to acceptance of the contract.

The length of watering cycles using potable water measured by water meters for the final check of irrigation facilities will be determined by the Engineer.

Remote control valves connected to existing and new irrigation controllers shall be checked for automatic performance when the controllers are in automatic mode.

Unsatisfactory performance of irrigation facilities installed or modified by the Contractor shall be repaired and rechecked at the Contractor's expense until satisfactory performance is obtained, as determined by the Engineer.

Repair or replacement of existing irrigation facilities due to unsatisfactory performance shall conform to the provisions in "Existing Highway Irrigation Facilities" of these special provisions.

Nothing in this section "Final Irrigation System Check" shall relieve the Contractor of full responsibility for making good or repairing defective work or materials found before the formal written acceptance of the entire contract by the Director.

Full compensation for checking the irrigation systems prior to the acceptance of the contract shall be considered as included in the contract lump sum price paid for the various contract items of irrigation systems involved.

## **SECTION 11. MODIFIED STANDARD SPECIFICATION SECTIONS**

### **SECTION 11-1. (BLANK)**

### **SECTION 11-2. PORTLAND CEMENT CONCRETE**

#### **11-2.01 GENERAL**

Portland cement concrete shall conform to the provisions in this Section 11-2, "Portland Cement Concrete," and the section entitled "Portland Cement Concrete" in Section 8, "Materials," of these special provisions. Section 90, "Portland Cement Concrete," of the Standard Specifications is deleted. Section 90, "Portland Cement Concrete," of the Standard Specifications is amended to read as follows.

### **SECTION 90: PORTLAND CEMENT CONCRETE**

#### **90-1 GENERAL**

##### **90-1.01 DESCRIPTION**

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

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

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

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

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

- Class 1 concrete shall contain not less than 400 kg of cementitious material per cubic meter.
- Class 2 concrete shall contain not less than 350 kg of cementitious material per cubic meter.
- Class 3 concrete shall contain not less than 300 kg of cementitious material per cubic meter.
- Class 4 concrete shall contain not less than 250 kg of cementitious material per cubic meter.
- Minor concrete shall contain not less than 325 kg of cementitious material per cubic meter unless otherwise specified in these specifications or the special provisions.

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

Use	Cementitious Material Content (kg/m <sup>3</sup> )
Concrete designated by compressive strength:	
Deck slabs and slab spans of bridges	400 min., 475 max.
Roof sections of exposed top box culverts	400 min., 475 max.
Other portions of structures	350 min., 475 max.
Concrete not designated by compressive strength:	
Deck slabs and slab spans of bridges	400 min.
Roof sections of exposed top box culverts	400 min.
Prestressed members	400 min.
Seal courses	400 min.
Other portions of structures	350 min.
Concrete for precast members	350 min., 550 max.

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

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

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

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

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

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

## 90-2 MATERIALS

### 90-2.01 CEMENT

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

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

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

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

- A. The cement shall not contain more than 0.60 percent by mass of alkalis, calculated as the percentage of  $\text{Na}_2\text{O}$  plus 0.658 times the percentage of  $\text{K}_2\text{O}$ , when determined by either direct intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in conformance with the requirements in ASTM Designation: C 114;
- B. The autoclave expansion shall not exceed 0.50 percent; and
- C. Mortar, containing the cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not expand in water more than 0.010 percent and shall not contract in air more than 0.048 percent, except that when cement is to be used for precast prestressed concrete piling, precast prestressed concrete members, or steam cured concrete products, the mortar shall not contract in air more than 0.053 percent.

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

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

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

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

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

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

### 90-2.02 AGGREGATES

- Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.
- Natural aggregates shall be thoroughly and uniformly washed before use.
- The Contractor, at the Contractor's expense, shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.

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

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

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

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

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

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

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

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

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

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

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

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

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

**90-2.02A Coarse Aggregate**

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

- Coarse aggregate shall conform to the following quality requirements:

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

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

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

**90-2.02B Fine Aggregate**

- Fine aggregate shall consist of natural sand, manufactured sand produced from larger aggregate or a combination thereof. Manufactured sand shall be well graded.
- Fine aggregate shall conform to the following quality requirements:

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

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

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

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

**90-2.03 WATER**

- In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO<sub>4</sub>, when tested in conformance with California Test 417. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO<sub>4</sub>, when tested in conformance with California Test 417. In no case shall the water contain an amount of impurities that will cause either: 1) a change in the setting time of cement of more than 25 percent when tested in conformance with the requirements in ASTM Designation: C 191 or ASTM Designation: C 266 or 2) a reduction in the compressive strength of mortar at 14 days of more than 5 percent, when tested in conformance with the requirements in ASTM Designation: C 109, when compared to the results obtained with distilled water or deionized water, tested in conformance with the requirements in ASTM Designation: C 109.

- In non-reinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1500 parts per million of sulfates as SO<sub>4</sub>, when tested in conformance with California Test 417.

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

- Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis ( $\text{Na}_2\text{O} + 0.658 \text{K}_2\text{O}$ ) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than  $\pm 0.010$  during a day's operations.

**90-2.04 ADMIXTURE MATERIALS**

- Admixture materials shall conform to the requirements in the following ASTM Designations:
  - A. Chemical Admixtures—ASTM Designation: C 494.
  - B. Air-entraining Admixtures—ASTM Designation: C 260.
  - C. Calcium Chloride—ASTM Designation: D 98.
  - D. Mineral Admixtures—Coal fly ash; raw or calcined natural pozzolan as specified in ASTM Designation: C618; silica fume conforming to the requirements in ASTM Designation: C1240, with reduction of mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.
- Unless otherwise specified in the special provisions, mineral admixtures shall be used in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."

**90-3 AGGREGATE GRADINGS**

**90-3.01 GENERAL**

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

Primary Aggregate Nominal Size	Sieve Size	Limits of Proposed Gradation
37.5-mm x 19-mm	25-mm	19 - 41
25-mm x 4.75-mm	19-mm	52 - 85
25-mm x 4.75-mm	9.5-mm	15 - 38
12.5-mm x 4.75-mm	9.5-mm	49 - 78
9.5-mm x 2.36-mm	9.5-mm	50 - 85
Fine Aggregate	1.18-mm	55 - 75
Fine Aggregate	600- $\mu\text{m}$	34 - 46
Fine Aggregate	300- $\mu\text{m}$	16 - 29

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

**90-3.02 COARSE AGGREGATE GRADING**

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

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

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

### 90-3.03 FINE AGGREGATE GRADING

- Fine aggregate shall be graded within the following limits:

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

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

### 90-3.04 COMBINED AGGREGATE GRADINGS

- Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein. Within these limitations, the relative proportions shall be as ordered by the Engineer, except as otherwise provided in Section 90-1.01, "Description."
- The combined aggregate grading used in portland cement concrete pavement shall be the 37.5-mm, maximum grading.
- The combined aggregate grading used in concrete for structures and other concrete items, except when specified otherwise in these specifications or the special provisions, shall be either the 37.5-mm, maximum grading, or the 25-mm, maximum grading, at the option of the Contractor.

**Grading Limits of Combined Aggregates**

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

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

**90-4 ADMIXTURES**

**90-4.01 GENERAL**

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

**90-4.02 MATERIALS**

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

**90-4.03 ADMIXTURE APPROVAL**

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

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

#### **90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES AND CALCIUM CHLORIDE**

- When the use of a chemical admixture or calcium chloride is specified or ordered by the Engineer, the admixture shall be used at the dosage specified or ordered, except that if no dosage is specified or ordered, the admixture shall be used at the dosage normally recommended by the manufacturer of the admixture.
- Calcium chloride shall be dispensed in liquid, flake, or pellet form. Calcium chloride dispensed in liquid form shall conform to the provisions for dispensing liquid admixtures in Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures."

#### **90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES**

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

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

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

#### **90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES**

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

#### **90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES**

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

#### **90-4.08 REQUIRED USE OF MINERAL ADMIXTURES**

- Unless otherwise specified, mineral admixture shall be combined with cement to make cementitious material.
- The calcium oxide content of mineral admixtures shall not exceed 10 percent and the available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 618.
- The amounts of cement and mineral admixture used in cementitious material shall be sufficient to satisfy the minimum cementitious material content requirements specified in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and shall conform to the following:

- A. The minimum amount of cement shall not be less than 75 percent by mass of the specified minimum cementitious material content;
- B. The minimum amount of mineral admixture to be combined with cement shall be determined using one of the following criteria:
  1. When the calcium oxide content of a mineral admixture is equal to or less than 2 percent by mass, the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix;

2. When the calcium oxide content of a mineral admixture is greater than 2 percent, the amount of mineral admixture shall not be less than 25 percent by mass of the total amount of cementitious material to be used in the mix;
  3. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," is used, the amount of mineral admixture shall not be less than 10 percent by mass of the total amount of cementitious material to be used in the mix
- C. The total amount of mineral admixture shall not exceed 35 percent by mass of the total amount of cementitious material to be used in the mix. Where Section 90-1.01, "Description," specifies a maximum cementitious content in kilograms per cubic meter, the total mass of cement and mineral admixture per cubic meter shall not exceed the specified maximum cementitious material content.

#### **90-4.09 BLANK**

#### **90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES**

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

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

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

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

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

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

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

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

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

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

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

- When concrete is completely mixed in stationary paving mixers, the mineral admixture shall be weighed in a separate weigh hopper conforming to the provisions for cement weigh hoppers and charging and discharging mechanisms in Section 90-5.03A, "Proportioning for Pavement," and the mineral admixture and cement shall be introduced simultaneously into the mixer proportionately with the aggregate. If the mineral admixture is not weighed in a separate weigh hopper, the

Contractor shall provide certification that the stationary mixer is capable of mixing the cement, admixture, aggregates and water uniformly prior to discharge. Certification shall contain the following:

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

## **90-5 PROPORTIONING**

### **90-5.01 STORAGE OF AGGREGATES**

- Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size shall be avoided and also that the various sizes shall not become intermixed before proportioning.
- Aggregates shall be stored or stockpiled and handled in a manner that shall prevent contamination by foreign materials. In addition, storage of aggregates at batching or mixing facilities that are erected subsequent to the award of the contract and that furnish concrete to the project shall conform to the following:

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

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

### **90-5.02 PROPORTIONING DEVICES**

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

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

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

- Equipment for cumulative weighing of aggregate shall have a zero tolerance of  $\pm 0.5$  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  $\pm 0.5$  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  $\pm 0.5$  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  $\pm 0.5$  percent of their designated individual batch masses. Equipment for measuring water shall have a zero tolerance of  $\pm 0.5$  percent of its designated mass or volume.

- The mass indicated for any batch of material shall not vary from the preselected scale setting by more than the following:
  - A. Aggregate weighed cumulatively shall be within 1.0 percent of the designated total batch mass of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch masses; and
  - B. Cement shall be within 1.0 percent of its designated batch mass. When weighed individually, mineral admixture shall be within 1.0 percent of its designated batch mass. When mineral admixture and cement are permitted to be weighed cumulatively, cement shall be weighed first to within 1.0 percent of its designated batch mass, and the total for cement and mineral admixture shall be within 1.0 percent of the sum of their designated batch masses; and
  - C. Water shall be within 1.5 percent of its designated mass or volume.
- Each scale graduation shall be approximately 0.001 of the total capacity of the scale. The capacity of scales for weighing cement, mineral admixture, or cement plus mineral admixture and aggregates shall not exceed that of commercially available scales having single graduations indicating a mass not exceeding the maximum permissible mass variation above, except that no scale shall be required having a capacity of less than 500 kg, with 0.5-kg graduations.

### **90-5.03 PROPORTIONING**

- Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cement, mineral admixture, and water as provided in these specifications. Aggregates shall be proportioned by mass.
  - At the time of batching, aggregates shall have been dried or drained sufficiently to result in a stable moisture content such that no visible separation of water from aggregate will take place during transportation from the proportioning plant to the point of mixing. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry mass.
    - Should separate supplies of aggregate material of the same size group, but of different moisture content or specific gravity or surface characteristics affecting workability, be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting upon another.
    - Bulk "Type IP (MS) Modified" cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer.
    - Bulk cement and mineral admixture may be weighed in separate, individual weigh hoppers or may be weighed in the same weigh hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer. If the cement and mineral admixture are weighed cumulatively, the cement shall be weighed first.
    - When cement and mineral admixtures are weighed in separate weigh hoppers, the weigh systems for the proportioning of the aggregate, the cement, and the mineral admixture shall be individual and distinct from all other weigh systems. Each weigh system shall be equipped with a hopper, a lever system, and an indicator to constitute an individual and independent material weighing device. The cement and the mineral admixture shall be discharged into the mixer simultaneously with the aggregate.
    - The scales and weigh hoppers for bulk weighing cement, mineral admixture, or cement plus mineral admixture shall be separate and distinct from the aggregate weighing equipment.
    - For batches with a volume of one cubic meter or more, the batching equipment shall conform to one of the following combinations:
      - A. Separate boxes and separate scale and indicator for weighing each size of aggregate.
      - B. Single box and scale indicator for all aggregates.
      - C. Single box or separate boxes and automatic weighing mechanism for all aggregates.
- In order to check the accuracy of batch masses, the gross mass and tare mass of batch trucks, truck mixers, truck agitators, and non-agitating hauling equipment shall be determined when ordered by the Engineer. The equipment shall be weighed at the Contractor's expense on scales designated by the Engineer.

#### **90-5.03A Proportioning for Pavement**

- Aggregates and bulk cement, mineral admixture, and cement plus mineral admixture for use in pavement shall be proportioned by mass by means of automatic proportioning devices of approved type conforming to these specifications.
  - The Contractor shall install and maintain in operating condition an electronically actuated moisture meter that will indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by mass of the fine aggregate.

- The batching of cement, mineral admixture, or cement plus mineral admixture and aggregate shall be interlocked so that a new batch cannot be started until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers and the cement and mineral admixture hoppers or the cement plus mineral admixture hopper are charged with masses that are within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- When interlocks are required for cement and mineral admixture charging mechanisms and cement and mineral admixtures are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of mineral admixture until the mass of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- The discharge gate on the cement and mineral admixture hoppers or the cement plus mineral admixture hopper shall be designed to permit regulating the flow of cement, mineral admixture, or cement plus mineral admixture into the aggregate as directed by the Engineer.
- When separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.
- Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and so that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.
- When the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required mass is discharged into the weigh box, after which the gate shall automatically close and lock.
- The automatic weighing system shall be designed so that all proportions required may be set on the weighing controller at the same time.

## **90-6 MIXING AND TRANSPORTING**

### **90-6.01 GENERAL**

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

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

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

### **90-6.02 MACHINE MIXING**

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

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

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

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

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

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

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

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

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

- A. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in truck agitators or in non-agitating hauling equipment (central-mixed concrete).

- B. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer (shrink-mixed concrete).

- C. Mixed completely in a truck mixer (transit-mixed concrete).

- D. Mixed completely in a paving mixer.

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

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

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

### **90-6.03 TRANSPORTING MIXED CONCRETE**

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

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

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

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

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

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

- When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time allowed may be less than 1.5 hours.
- When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.
- Each load of concrete delivered at the jobsite shall be accompanied by a weighmaster certificate showing the mix identification number, non-repeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale masses (kilograms) for the ingredients batched. Theoretical or target batch masses shall not be used as a substitute for actual scale masses.
- Weighmaster certificates shall be provided in printed form, or if approved by the Engineer, the data may be submitted in electronic media. Electronic media shall be presented in a tab-delimited format on a 90 mm diskette with a capacity of at least 1.4 megabytes. Captured data, for the ingredients represented by each batch shall be "line feed, carriage return" (LFCR) and "one line, separate record" with allowances for sufficient fields to satisfy the amount of data required by these specifications.
- The Contractor may furnish a weighmaster certificate accompanied by a separate certificate that lists the actual batch masses or measurements for a load of concrete provided that both certificates are imprinted with the same non-repeating load number that is unique to the contract and delivered to the jobsite with the load.
- Weighmaster certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities."

#### **90-6.04 TIME OR AMOUNT OF MIXING**

- Mixing of concrete in paving or stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture, if added with the water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall not be counted as part of the required mixing time.
- The required mixing time, in paving or stationary mixers, of concrete used for concrete structures, except minor structures, shall be not less than 90 seconds or more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.
- The required mixing time, in paving or stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds or more than 5 minutes.
- The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete conforming to the provisions for uniformity in Section 90-6.01, "General."

#### **90-6.05 HAND-MIXING**

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

#### **90-6.06 AMOUNT OF WATER AND PENETRATION**

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

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

- The amount of free water used in concrete shall not exceed  $183 \text{ kg/m}^3$ , plus 20 kg for each required 100 kg of cementitious material in excess of  $325 \text{ kg/m}^3$ . The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.

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

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

## 90-7 CURING CONCRETE

### 90-7.01 METHODS OF CURING

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

#### 90-7.01A Water Method

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

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

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

#### 90-7.01B Curing Compound Method

- Surfaces of the concrete that are exposed to the air shall be sprayed uniformly with a curing compound.
- Curing compounds to be used shall be as follows:

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

5. Non-pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class A.
6. Non-pigmented curing compound with fugitive dye conforming to the requirements in ASTM Designation: C 309, Type 1-D, Class A.

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

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

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

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

- Curing compound shall be applied at a nominal rate of 3.7 m<sup>2</sup>/L, unless otherwise specified.

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

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

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

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

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

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

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

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

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

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

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

- When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.
- Curing compound will be sampled by the Engineer at the source of supply or at the jobsite or at both locations.
- Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.
- Tests will be conducted in conformance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

#### **90-7.01C Waterproof Membrane Method**

- The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.
- Sheeting material for curing concrete shall conform to the requirements in AASHTO Designation: M 171 for white reflective materials.
- The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. Joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 100 mm.
- The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer.
- Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.
- Sections of membrane that have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

#### **90-7.01D Forms-In-Place Method**

- Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 0.5-m in least dimension the forms shall remain in place for a minimum period of 5 days.
- Joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

### **90-7.02 CURING PAVEMENT**

- The entire exposed area of the pavement, including edges, shall be cured by the waterproof membrane method, or curing compound method using curing compound (1) or (2) as the Contractor may elect. Should the side forms be removed before the expiration of 72 hours following the start of curing, the exposed pavement edges shall also be cured. If the pavement is cured by means of the curing compound method, the sawcut and all portions of the curing compound that have been disturbed by sawing operations shall be restored by spraying with additional curing compound.
- Curing shall commence as soon as the finishing process provided in Section 40-1.10, "Final Finishing," has been completed. The method selected shall conform to the provisions in Section 90-7.01, "Methods of Curing."
- When the curing compound method is used, the compound shall be applied to the entire pavement surface by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator that provides for continual agitation of the curing compound during the time of application. The spray shall be adequately protected against wind, and the nozzles shall be so oriented or moved mechanically transversely as to result in the minimum specified rate of coverage being applied uniformly on exposed faces. Hand spraying of small and irregular areas, and areas inaccessible to mechanical spraying equipment, in the opinion of the Engineer, will be permitted. When the ambient air temperature is above 15°C, the Contractor shall fog the surface of the concrete with a fine spray of water as specified in Section 90-7.01A, "Water Method." The surface of the pavement shall be kept moist between the hours of 10:00 a.m. and 4:30 p.m. on the day the concrete is placed. However, the fogging done after the curing compound has been applied shall not begin until the compound has set sufficiently to prevent displacement. Fogging shall be discontinued if ordered in writing by the Engineer.

### **90-7.03 CURING STRUCTURES**

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

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

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

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

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

#### **90-7.04 CURING PRECAST CONCRETE MEMBERS**

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

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

#### **90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES**

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

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

### **90-7.06 CURING SLOPE PROTECTION**

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

### **90-7.07 CURING MISCELLANEOUS CONCRETE WORK**

- Exposed surfaces of curbs shall be cured by pigmented curing compounds as specified in Section 90-7.01B, "Curing Compound Method."
- Concrete sidewalks, gutter depressions, island paving, curb ramps, driveways, and other miscellaneous concrete areas shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."
- Shotcrete shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."
- Mortar and grout shall be cured by keeping the surface damp for 3 days.
- After placing, the exposed surfaces of sign structure foundations, including pedestal portions, if constructed, shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

## **90-8 PROTECTING CONCRETE**

### **90-8.01 GENERAL**

- In addition to the provisions in Section 7-1.16, "Contractor's Responsibility for the Work and Materials," the Contractor shall protect concrete as provided in this Section 90-8.
- Concrete shall not be placed on frozen or ice-coated ground or subgrade nor on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.
- Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage.
- Concrete that has been frozen or damaged by other causes, as determined by the Engineer, shall be removed and replaced by the Contractor at the Contractor's expense.

### **90-8.02 PROTECTING CONCRETE STRUCTURES**

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

### **90-8.03 PROTECTING CONCRETE PAVEMENT**

- Pavement concrete shall be maintained at a temperature of not less than 4°C for 72 hours. When required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.
- Except as provided in Section 7-1.08, "Public Convenience," the Contractor shall protect concrete pavement against construction and other activities that abrade, scar, discolor, reduce texture depth, lower coefficient of friction, or otherwise damage the surface. Stockpiling, drifting, or excessive spillage of soil, gravel, petroleum products, and concrete or asphalt mixes on the surface of concrete pavement is prohibited unless otherwise specified in these specifications, the special provisions or permitted by the Engineer.
- When ordered by the Engineer or shown on the plans or specified in the special provisions, pavement crossings shall be constructed for the convenience of public traffic. The material and work necessary for the construction of the crossings, and their subsequent removal and disposal, will be paid for at the contract unit prices for the items of work involved and if there are no contract items for the work involved, payment for pavement crossings will be made by extra work as provided in Section 4-1.03D, "Extra Work." Where public traffic will be required to cross over the new pavement, Type III portland cement may be used in concrete, if permitted in writing by the Engineer. The pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 3.8 MPa. The modulus of rupture will be determined by California Test 523.

- No traffic or Contractor's equipment, except as hereinafter provided, will be permitted on the pavement before a period of 10 days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 3.8 MPa. Concrete that fails to attain a modulus of rupture of 3.8 MPa within 10 days shall not be opened to traffic until directed by the Engineer.
- Equipment for sawing weakened plane joints will be permitted on the pavement as specified in Section 40-1.08B, "Weakened Plane Joints."
  - When requested in writing by the Contractor, the tracks on one side of paving equipment will be permitted on the pavement after a modulus of rupture of 2.4 MPa has been attained, provided that:
    - A. Unit pressure exerted on the pavement by the paver shall not exceed 135 kPa;
    - B. Tracks with cleats, grousers, or similar protuberances shall be modified or shall travel on planks or equivalent protective material, so that the pavement is not damaged; and
    - C. No part of the track shall be closer than 0.3-m from the edge of pavement.
  - In case of visible cracking of, or other damage to the pavement, operation of the paving equipment on the pavement shall be immediately discontinued.
    - Damage to the pavement resulting from early use of pavement by the Contractor's equipment as provided above shall be repaired by the Contractor at the Contractor's expense.
    - The State will furnish the molds and machines for testing the concrete for modulus of rupture, and the Contractor, at the Contractor's expense, shall furnish the material and whatever labor the Engineer may require.

## **90-9 COMPRESSIVE STRENGTH**

### **90-9.01 GENERAL**

- Concrete compressive strength requirements consist of a minimum strength that shall be attained before various loads or stresses are applied to the concrete and, for concrete designated by strength, a minimum strength at the age of 28 days or at the age otherwise allowed in Section 90-1.01, "Description." The various strengths required are specified in these specifications or the special provisions or are shown on the plans.
  - The compressive strength of concrete will be determined from test cylinders that have been fabricated from concrete sampled in conformance with the requirements of ASTM Designation: C 172. Test cylinders will be molded and initially field cured in conformance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in conformance with the requirements of ASTM Designation: C 39. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, that cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.
    - When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in conformance with Method 1 of California Test 540. The compressive strength of concrete determined for these purposes will be evaluated on the basis of individual tests.
    - When concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete strength to be used as a basis for acceptance of other than steam cured concrete will be determined from cylinders cured in conformance with Method 1 of California Test 540. If the result of a single compressive strength test at the maximum age specified or allowed is below the specified strength but is 95 percent or more of the specified strength, the Contractor shall, at the Contractor's expense, make corrective changes, subject to approval of the Engineer, in the mix proportions or in the concrete fabrication procedures, before placing additional concrete, and shall pay to the State \$14 for each in-place cubic meter of concrete represented by the deficient test. If the result of a single compressive strength test at the maximum age specified or allowed is below 95 percent of the specified strength, but is 85 percent or more of the specified strength, the Contractor shall make the corrective changes specified above, and shall pay to the State \$20 for each in place cubic meter of concrete represented by the deficient test. In addition, such corrective changes shall be made when the compressive strength of concrete tested at 7 days indicates, in the judgment of the Engineer, that the concrete will not attain the required compressive strength at the maximum age specified or allowed. Concrete represented by a single test that indicates a compressive strength of less than 85 percent of the specified 28-day compressive strength will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials."

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

- No single compressive strength test shall represent more than 250 m<sup>3</sup>.

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

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

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

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

- Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.

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

- A. Date of mixing.

- B. Mixing equipment and procedures used.

- C. The size of batch in cubic meters and the mass, type, and source of all ingredients used.

- D. Penetration of the concrete.

- E. The air content of the concrete if an air-entraining admixture is used.

- F. The age at time of testing and strength of all concrete cylinders tested.

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

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

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

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

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

## 90-10 MINOR CONCRETE

### 90-10.01 GENERAL

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

### 90-10.02 MATERIALS

- Minor concrete shall conform to the following requirements:

#### 90-10.02A Cementitious Material

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

#### 90-10.02B Aggregate

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

#### 90-10.02C Water

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

#### 90-10.02D Admixtures

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

### 90-10.03 PRODUCTION

- Cementitious material, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice that will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and that conforms to requirements specified herein. Recognized standards of good practice are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or the Department.
- The cementitious material content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."
- The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer.
- Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before stiffening occurs. An elapsed time of 1.5 hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cementitious material to the aggregates, or a temperature of concrete of more than 32°C will be considered conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.
- The required mixing time in stationary mixers shall be not less than 50 seconds or more than 5 minutes.
- The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.

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

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

#### **90-10.04 CURING MINOR CONCRETE**

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

#### **90-10.05 PROTECTING MINOR CONCRETE**

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

#### **90-10.06 MEASUREMENT AND PAYMENT**

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

### **90-11 MEASUREMENT AND PAYMENT**

#### **90-11.01 MEASUREMENT**

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

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

#### **90-11.02 PAYMENT**

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

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

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

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

## **SECTION 12. BUILDING WORK**

### **SECTION 12-1. GENERAL REQUIREMENTS**

#### **12-1.01 SCOPE**

Building work described herein and as shown on the plans shall conform to the requirements of these special provisions and Sections 1 through 9 of the Standard Specifications. Sections 10 through 95 of the Standard Specifications shall not apply to the work in this Section 12 except when specific reference is made thereto.

The building work to be done consists, in general, of constructing an equipment building with concrete foundation, concrete masonry unit walls, pre-engineered steel joist, and metal roofing; constructing a resident mechanic building with concrete foundation, concrete masonry walls, pre-engineered steel joist, metal roofing; constructing an equipment storage building with concrete foundation, concrete masonry unit walls, pre-engineered steel joist, and metal roofing; constructing covered storage bins with concrete foundation and canopy; constructing an evaporative cooler platform with concrete foundation and steel channel framing; constructing a wash rack slab and mud rinse slab; including mechanical and electrical and such other items or details, not mentioned above, that are required by the plans, Standard Specifications, or these special provisions shall be performed, placed, constructed or installed.

**12-1.02 ABBREVIATIONS**

Section 1-1.02, "Abbreviations," of the Standard Specifications is amended by adding the following:

AAMA	American Architectural Manufacturers' Association
ACI	American Concrete Institute
AGA	American Gas Association
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association
APA	American Plywood Association
ARI	American Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
CBC	California Building Code
CEC	California Electrical Code
CMC	California Mechanical Code
CS	Commercial Standards (US Department of Commerce)
ESO	Electrical Safety Orders
FGMA	Flat Glass Marketing Association
FM	Factory Mutual
FS	Federal Specification
ICBO	International Conference of Building Officials
NAAMM	National Association of Architectural Metal Manufacturers
NBFU	National Board Fire Underwriters
NEC	National Electrical Code
NFPA	National Fire Protection Association
PEI	Porcelain Enamel Institute
PS	Product Standard (US Department of Commerce)
RIS	Redwood Inspection Service
SCPI	Structural Clay Products Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSPC	Steel Structures Paint Council
TCA	Tile Council of America
TPI	Truss Plate Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau (stamped WCLB)
WCLB	Grade stamp for WCLIB
WIC	Woodwork Institute of California
WWPA	Western Wood Products' Association

When reference is made to the Uniform Building Code (UBC) on the plans or in the special provisions, it shall be the 1997 Uniform Building Code as amended by the 1998 Title 24 California Building Standards Code.

**12-1.03 GUARANTEE**

The Contractor hereby unconditionally guarantees that the building work will be done in accordance with the requirements of the contract, and further guarantees the building work of the contract to be and remain free of defects in workmanship and materials for a period of one year from the date of acceptance of the contract, unless a longer guarantee period is required elsewhere in these special provisions. The Contractor hereby agrees to repair or replace any and all building work, together with any other adjacent work which may be displaced in so doing, that may prove to be not in accordance with the requirements of the contract or that may be defective in its workmanship or material within the guarantee

period specified, without any expense whatsoever to the Department, ordinary wear and tear and unusual abuse or neglect excepted.

The performance bond for contract price of the building work, shall remain in full force and effect during the guarantee period.

The Contractor further agrees, that within 10 calendar days after being notified in writing by the Department of any building work not in accordance with the requirements of the contract or any defects in the building work, he shall commence and prosecute with due diligence all work necessary to fulfill the terms of this guarantee, and shall complete the work within a reasonable period of time, and, in the event he fails to comply, he does hereby authorize the Department to proceed to have such work done at the Contractor's expense and he shall honor and pay the cost and charges therefor upon demand. The Department shall be entitled to all costs and expenses, including reasonable attorney's fees, necessarily incurred upon the Contractor's refusal to honor and pay the above costs and charges.

#### **12-1.04 COOPERATION**

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

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

The Contractor shall comply with all security policies of the State concerning the Weaverville Maintenance Station.

The Contractor shall plan his work to minimize interference with State forces and the public. Interruptions to any services for the purpose of making or breaking a connection shall be made only after consultation with and for such time periods as directed by the Engineer.

#### **12-1.05 SUBMITTALS**

Working drawings, material lists, descriptive data, samples and other submittals specified in these special provisions shall be submitted for approval in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions.

Unless otherwise permitted in writing by the Engineer, all submittals required by these special provisions shall be submitted within 35 days after the contract has been approved.

Attention is directed to the provisions in Section 5-1.01, "Authority of Engineer," of the Standard Specifications. The Engineer may request submittals for materials or products where submittals have not been specified in these special provisions, or may request that additional information be included in specified submittals, as necessary to determine the quality or acceptability of such materials or products.

Attention is directed to Section 6-1.05, "Trade Names and Alternatives," of the Standard Specifications. The second indented paragraph of the first paragraph of said Section 6-1.05 is amended to read:

Whenever the specifications permit the substitution of a similar or equivalent material or article, no test or action relating to the approval of such substituted material will be made until the request for substitution is made in writing by the Contractor accompanied by complete data as to the equality of the material or article proposed. Such request shall be made within 35 days after the date the contract has been approved and in ample time to permit approval without delaying the work, but need not be made in less than 35 days after award of the contract.

Work requiring the submittal of working drawings, material lists, descriptive data, samples, or other submittals shall not begin prior to approval of said submittal by the Engineer. Fifteen working days shall be allowed for approval or return for correction of each submittal or resubmittal. Should the Engineer fail to complete his review within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in review, an extension of time commensurate with the delay in completion of the work thus caused will be granted as provided in Section 8-1.07, "Liquidated Damages," of the Standard Specifications.

Submittals shall be delivered to the locations indicated in these special provisions. If a specific location is not indicated, the submittal shall be delivered to the Division of Structure Design, Documents Unit, Fourth Floor, Mail Station 9-4/4I, 1801 30th Street, Sacramento, California 95816, telephone (916) 227-8252, or the submittals shall be mailed to the Division of Structure Design, Documents Unit, Mail Station 9, P. O. Box 942874, Sacramento, California 94274-0001.

Each submission of drawings, material lists and descriptive data shall consist of at least 5 copies. Two copies will be returned to the Contractor either approved for use or returned for correction and resubmittal.

Each separate item submitted shall bear a descriptive title, the name of the project, district, county, and contract number. Plans and detailed drawings shall be not larger than 559 mm x 914 mm.

The material list shall be complete as to name of manufacturer, catalog number, size, capacity, finish, all pertinent ratings, and identification symbols used on the plans and in the special provisions for each unit.

Parts lists and service instructions packaged with or accompanying the equipment installed in the work shall be delivered to the Engineer at the jobsite. Required operating and maintenance instructions shall be submitted in triplicate.

Manufacturer's warranties for products installed in the work shall be delivered to the Engineer at the jobsite.

Unapproved samples and samples not incorporated in the work shall be removed from State property, when directed by the Engineer.

#### **12-1.06 PROGRESS SCHEDULE**

A progress schedule shall be submitted in duplicate for the building work in accordance with the requirements in Section 8-1.04, "Progress Schedule," of the Standard Specifications.

#### **12-1.07 SCHEDULE OF VALUES**

The Contractor shall prepare and submit to the Engineer 2 copies of a Schedule of Values covering each lump sum item for building work. The Schedule of Values, showing the value of each kind of work, shall be acceptable to the Engineer before any partial payment estimate is prepared.

The sum of the items listed in the Schedule of Values shall equal the contract lump sum price for building work. Overhead, profit, bond premium, temporary construction facilities, and plant shall not be listed.

#### **12-1.08 INSPECTION**

All items covered or all stages of work that are not to remain observable must be inspected and approved before progress of work conceals portions to be inspected. The Contractor shall notify the Engineer not less than 72 hours in advance of when such inspection is needed.

#### **12-1.09 OBSTRUCTIONS**

Attention is directed to Sections 7-1.11, "Preservation of Property," 7-1.12, "Responsibility for Damage," 7-1.16, "Contractor's Responsibility for the Work and Materials," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

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

Underground Service Alert  
Northern California (USA)  
Telephone: 1(800)642-2444

Underground Service Alert  
Southern California (USA)  
Telephone: 1(800)422-4133

South Shore Utility  
Coordinating Council (DIGS)  
Telephone: 1(800)541-3447

Western Utilities  
Underground Alert, Inc.  
Telephone: 1(800)424-3447

#### **12-1.10 PRESERVATION OF PROPERTY**

Attention is directed to Sections 7-1.11, "Preservation of Property," 7-1.12, "Responsibility for Damage," 7-1.16, "Contractor's Responsibility for the Work and Materials," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

Operations shall be conducted in such a manner that existing facilities, surfacing, installations, and utilities which are to remain in place will not be damaged. Temporary surfacing, facilities, utilities and installations shall also be protected until they are no longer required. The Contractor, at his expense shall furnish and install piling, sheet piling, cribbing, bulkheads, shores, or whatever means may be necessary to adequately support material carrying such facilities, or to support the facilities themselves and shall maintain such support until they are no longer needed.

### **12-1.11 UTILITY CONNECTION**

The Contractor shall make all arrangements, and obtain all permits and licenses required for the extension of and connection to each utility service applicable to this project, shall furnish all labor and materials necessary for such extensions which are not performed or provided by the utility, and shall furnish and install any intermediate equipment required by the serving utilities.

Upon written request by the Contractor, the State will pay all utility permits, licenses, connection charges, and excess length charges directly to the utility. Such request shall be submitted not less than 45 days before service connections are required.

The costs incurred by the Contractor for the extensions of utilities beyond the limits shown on the plans, and in furnishing and installing any intermediate equipment required by the serving utilities, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Full compensation for any costs incurred by the Contractor to obtain the permits and licenses shall be considered as included in the contract lump sum price paid for building work and no additional compensation will be allowed therefor.

### **12-1.12 TEMPORARY UTILITIES**

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

The Contractor shall make his own arrangements to obtain any additional electrical power and water or other utilities required for his operations and shall make and maintain the necessary service connections at his own expense.

When existing utility systems are being modified, periods of shutdown will be determined by the Engineer.

The Contractor shall provide adequate temporary lighting to perform the work and allow the Engineer to inspect the project as each portion is completed.

The Contractor shall provide and pay for telephone service he may require. State telephone facilities shall not be used.

### **12-1.13 SANITARY FACILITIES**

When operational, State sanitary facilities will be available for use by the Contractor's employees, during normal State working hours. Tools shall not be cleaned nor shall cleaning liquids be disposed of in State sanitary facilities or sewers.

### **12-1.14 REFERENCES**

When reference is made to the Uniform Building Code (UBC) on the plans or in the special provisions, it shall be the 1997 Uniform Building Code as amended by the 1998 Title 24 California Building Standards Code.

### **12-1.15 MEASUREMENT AND PAYMENT**

The contract lump sum price paid for building work shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the building work, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for any incidental materials and labor, not shown on the plans or specified, which are necessary to complete the buildings and appurtenances shall be considered as included in the contract lump sum price paid for building work and no additional compensation will be allowed therefor.

### **12-1.16 FIELD ENGINEERING**

This section specifies administrative and procedural requirements for field engineering services to be performed by the Contractor.

**Lines and grades.**--Attention is directed to Section 5-1.07 "Lines and Grades," of the Standard Specifications.

Such stakes or marks will be set by the Engineer as he determines to be necessary to establish the lines and grades required for the completion of the work shown on the plans and as specified in these special provisions. In general, these will consist of the primary vertical and horizontal control points.

Stakes and marks set by the Engineer shall be carefully preserved by the Contractor. In case such stakes and marks are destroyed or damaged they will be replaced at the Engineer's earliest convenience. The Contractor will be charged for the cost of necessary replacement or restoration of such stakes and marks which in the judgment of the Engineer were carelessly or willfully destroyed or damaged by the Contractor's operations. This charge will be deducted from any moneys due or to become due the Contractor.

All other stakes or marks required to establish the lines and grades required for the completion of the work shall be the responsibility of the Contractor.

**Existing utilities and equipment.**--The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, the Contractor shall investigate and verify the existence and location of underground utilities and other construction.

Prior to construction, the Contractor shall verify the location and invert elevation at points of connection of sanitary and septic sewers, storm sewer, and water or fire service piping.

**Surveys for layout and performance.**--The Contractor shall perform all surveys for layout and performance, reduce field notes, and make all necessary calculations and drawings necessary to carry out the work.

The Contractor shall locate and layout site improvements, and other work requiring field engineering services, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

Batter boards shall be located and laid out for structures, building foundations, column grids and locations, floor levels and, control lines and levels required for mechanical and electrical work.

**Survey accuracy and tolerances.**--The tolerances generally applicable in setting survey stakes for foundations, slabs, and underground work shall not exceed the following:

Survey Stakes or Markers	Tolerance
Rough grading or excavation	30 mm
Trimming or preparation of subgrade for roadways	15 mm
Roadway surfacing, steel or concrete pipe	6 mm
Structures or building construction	3 mm

Such tolerance shall not supersede stricter tolerances required by the plans or special provisions, and shall not otherwise relieve the Contractor of responsibility for measurements in compliance therein.

#### **12-1.17 SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS**

Only materials and products conforming to the requirements of the specifications shall be incorporated in the work. When metric materials and products are not available, and when approved by the Engineer, and at no cost to the State, materials and products in the inch-pound (imperial) system which are of equal quality and of the required properties and characteristics for the purpose intended, may be substituted for the equivalent metric materials and products, subject to the following requirements:

Materials and products shown on the plans or in the special provisions as being equivalent may be substituted for the metric materials and products specified or detailed on the plans.

Before other non-metric materials and products will be considered for use the Contractor shall furnish, at the Contractor's expense, evidence satisfactory to the Engineer that the materials and products proposed for use are equal to or better than the materials and products specified or detailed on the plans. The burden of proof as to the quality and suitability of substitutions shall be upon the Contractor and the Contractor shall furnish all information necessary as required to the Engineer. The Engineer will be the sole judge as to the quality and suitability of the substituted materials and products and the Engineer's decision shall be final.

When the Contractor elects to substitute non-metric materials and products, including materials and products shown on the plans or in the special provisions as being equivalent, a list of substitutions to be made shall be submitted for approval.

The following substitutions of materials and products will be allowed:

SUBSTITUTION TABLE FOR SIZES OF HIGH STRENGTH STEEL FASTENERS, ASTM Designation: A 325M	
METRIC SIZE SHOWN ON THE PLANS mm x thread pitch	IMPERIAL SIZE TO BE SUBSTITUTED inch
M16 x 2	5/8
M20 x 2.5	3/4
M22 x 2.5	7/8
M24 x 3	1
M27 x 3	1-1/8
M30 x 3.5	1-1/4
M36 x 4	1-1/2

SUBSTITUTION TABLE FOR REINFORCEMENT	
METRIC BAR DESIGNATION NUMBER AS SHOWN ON THE PLANS	IMPERIAL BAR DESIGNATION NUMBER TO BE SUBSTITUTED
10	3
13	4
16	5
19	6
22	7
25	8
29	9
32	10
36	11
43	14
57	18

SUBSTITUTION TABLE FOR WELDED PLAIN WIRE REINFORCEMENT, ASTM DESIGNATION: A 185	
	US CUSTOMARY UNITS SIZE TO BE SUBSTITUTED inch <sup>2</sup> x 100
MW9	W1.4
MW10	W1.6
MW13	W2.0
MW15	W2.3
MW19	W2.9
MW20	W3.1
MW22	W3.5
MW25	W3.9, except W3.5 in piles only
MW26	W4.0
MW30	W4.7
MW32	W5.0
MW35	W5.4
MW40	W6.2
MW45	W6.5
MW50	W7.8
MW55	W8.5, except W8.0 in piles only
MW60	W9.3
MW70	W10.9, except W11.0 in piles only
MW80	W12.4
MW90	W14.0
MW100	W15.5

The sizes in the following tables of materials and products are exact conversions of metric sizes of materials and products and are listed as acceptable equivalents:

CONVERSION TABLE FOR SIZES OF: (1) STEEL FASTENERS FOR GENERAL APPLICATIONS, ASTM Designation: A 307 or AASHTO Designation: M 314, Grade 36 or 55, and (2) HIGH STRENGTH STEEL FASTENERS, ASTM Designation: A 325 or A 449	
DIAMETER	
METRIC SIZE SHOWN ON THE PLANS mm	EQUIVALENT IMPERIAL SIZE inch
6, or 6.35	1/4
8 or 7.94	5/16
10, or 9.52	3/8
11, or 11.11	7/16
13 or 12.70	1/2
14, or 14.29	9/16
16, or 15.88	5/8
19, or 19.05	3/4
22, or 22.22	7/8
24, 25, or 25.40	1
29, or 28.58	1-1/8
32, or 31.75	1-1/4
35, or 34.93	1-3/8
38 or 38.10	1-1/2
44, or 44.45	1-3/4
51, or 50.80	2
57, or 57.15	2-1/4
64, or 63.50	2-1/2
70 or 69.85	2-3/4
76, or 76.20	3
83, or 82.55	3-1/4
89 or 88.90	3-1/2
95, or 95.25	3-3/4
102, or 101.60	4

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

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

CONVERSION TABLE FOR COMMON NAILS				
NAIL SIZE	METRIC		ENGLISH	
	mm		inch	
	Length	Diameter	Length	Diameter
8d	63.5	3.33	2 1/2	0.131
10d	76.2	3.76	3	0.148
16d	88.9	4.11	3 1/2	0.162

CONVERSION TABLE FOR LUMBER	
METRIC NOMINAL SURFACE DRY SIZE	EQUIVALENT NOMINAL SURFACE DRY U S SIZE
mm	inch
51	2
102	4
152	6
203	8
254	10
305	12

CONVERSION TABLE FOR PLYWOOD	
METRIC mm	ENGLISH inch
6.4	1/4
7.9	5/16
9.5	3/8
11.1	7/16
11.9	15/32
12.7	1/2
15.1	19/32
15.9	5/8
18.3	23/32
19.1	3/4
22.2	7/8
25.4	1
28.6	1 1/8

CONVERSION TABLE FOR INSULATION R-VALUE	
METRIC (K m <sup>2</sup> /W)	ENGLISH (HR FT <sup>2</sup> F/BTU)
0.5	3
0.7	4
1.4	8
1.9	11
2.3	13
2.5	14
3.3	19
5.3	30

CONVERSION TABLE FOR VAPOR TRANSMISSION RATING	
METRIC (Perm-m)	ENGLISH (perm-inch)
0.29	0.02

CONVERSION TABLE FOR LOW PRESSURE	
METRIC (Pa)	ENGLISH (Inches of Water Column)
30	0.125
60	0.25
90	0.375
120	0.50
150	0.60
155	0.625
175	0.70
185	0.75
200	0.80
250	1.00
310	1.25

CONVERSION TABLE FOR PRESSURE	
METRIC (kPa)	ENGLISH (psi)
10	1.5
210	30
280	40
350	50
690	100
860	125
1040	150
1100	160
1210	175
1380	200
1730	250
2070	300
2170	315
2410	350
2590	375
2760	400
4830	700
5170	750
5520	800
13800	2000
17200	2500
20700	3000
27600	4000
34500	5000
137900	20000

CONVERSION TABLE FOR MIL THICKNESS	
METRIC (mm)	ENGLISH (inch/1000)
0.10	4
0.13	5
0.15	6
0.50	20
0.75	30
1.00	40

CONVERSION TABLE FOR HVAC DUCTING.	
METRIC (mm)	ENGLISH (inch)
100	4
125	5
150	6
175	7
200	8
225	9
250	10
300	12
360	14
410	16
460	18
510	20
560	22
610	24
660	26
710	28
760	30

CONVERSION TABLE FOR MECHANICAL PIPING		
METRIC (GSP, PVC, BSP, DUCTILE IRON)	METRIC (mm)	ENGLISH (inch)
NPS 1/2	15	1/2
NPS 3/4	20	3/4
NPS 1	25	1
NPS 1 1/4	32	1 1/4
NPS 1 1/2	40	1 1/2
NPS 2	50	2
NPS 2 1/2	65	2 1/2
NPS 3	75	3
NPS 4	100	4
NPS 6	150	6

CONVERSION TABLE FOR LUBRICATION PIPING TUBING WALL THICKNESS	
METRIC (mm)	ENGLISH (inch)
2.1	0.083
0.9	0.035

CONVERSION TABLE FOR HOSE/TUBING SIZES O. D.	
METRIC (mm)	ENGLISH (inch)
6	1/4
10	3/8
13	1/2
16	5/8
19	3/4
22	7/8
25	1

CONVERSION TABLE FOR DRUM SIZES			
METRIC		ENGLISH	
L	kg	gallons	pounds
205	180	55	400
60	55	16	120
19	16	5	35

CONVERSION TABLE FOR POWER	
METRIC (kW)	ENGLISH (HP)
0.037	1/20
0.075	1/10
0.18	1/4
0.25	1/3
0.37	1/2
0.55	3/4
0.75	1
1.1	1 1/2
1.5	2
2.2	3
3.7	5
5.5	7 1/2
7.5	10
11	15
15	20
18.5	25
22	30
30	40
37	50
45	60
55	75
75	100
90	120
110	150

CONVERSION TABLE FOR IMPELLER BALANCE		
SYNCHRONOUS RPM	METRIC (g mm/kg)	ENGLISH (ounce- inch/pound)
720	94	0.059
900	73	0.046
1200	54	0.034
1800	41	0.026
3600	17	0.011

CONVERSION TABLE FOR ELECTRICAL CONDUIT	
METRIC SIZE SHOWN ON THE PLANS mm	EQUIVALENT IMPERIAL SIZE inch
16	1/2
21	3/4
27	1
35	1 1/4
41	1 1/2
53	2
103	4

## SECTION 12-2. SITEWORK

### 12-2.01 REMOVING PORTIONS OF EXISTING FACILITIES

#### PART 1.- GENERAL

**Scope.--**This work shall consist of removing portions of the existing facilities, including removal of existing work to gain access to or for new work, in accordance with the details shown on the plans and these special provisions.

#### PART 2.- PRODUCTS (Not applicable)

#### PART 3.- EXECUTION

##### PREPARATION.--

**General.--**The limits of removal shall be located and identified. Items to be removed and the interface of items to be removed and items to remain intact shall be identified and marked.

Prior to removing concrete, a saw cut approximately 25 mm deep shall be made along the limits of removal on all faces that will be visible in the completed work.

##### REMOVAL.--

**General.--**Removal shall be to the limits shown on the plans. Removal shall be done carefully to minimize damage to the portions to remain. Remaining portions that are damaged by the Contractor's operation shall be restored to original condition at the Contractor's expense.

Existing apparatuses, devices, or accessories which would be functionally impaired by new construction or remodeling shall be moved, brought out to new surfaces, or provided with new access covers, as necessary to restore apparatuses, devices, or accessories to their original usefulness.

Piping and conduits to be abandoned shall be capped or plugged.

Surfaces that are exposed to view at the limits of removal work shall be patched, bumps shall be removed and depressions filled, and the surface shall be finished to match the existing surrounding surfaces. Depressions in concrete less than 25 mm deep shall be deepened to 25 mm minimum depth before filling with cement mortar.

Anchor bolts and reinforcement shall be removed at least 25 mm below the surrounding surfaces, and the resulting hole shall be patched with cement mortar.

Existing reinforcement that is to be incorporated into the new work shall be protected from damage and thoroughly cleaned before being embedded in new concrete.

##### DISPOSAL.--

**General.--**Materials that are to be removed, shall become the property of the Contractor and shall be disposed of outside the highway right of way in accordance with the requirements in Section 7-1.13, "Disposal of Material Outside of the Highway Right of Way," of the Standard Specifications.

### 12-2.02 RELOCATING MATERIALS AND EQUIPMENT

#### PART 1.- GENERAL

##### SUMMARY.--

**Scope.--**This work shall consist of relocating existing materials and equipment in accordance with the details shown on the plans and these special provisions.

**PART 2.- PRODUCTS (Not applicable)**

**PART 3.- EXECUTION**

**RELOCATION.--**

**General.--**Materials or equipment to be relocated shall be removed carefully to avoid damage to the materials or equipment or to the materials or equipment which are to remain. Assemblies to be relocated which require dismantling for removal shall be matchmarked before dismantling.

The Contractor shall notify the Engineer prior to the relocation work in order that the materials or equipment may be inspected for existing damage.

Materials or equipment to be relocated shall have all adhering concrete, mastics, earth or other deleterious materials removed and shall have all exterior surfaces cleaned.

Materials or equipment which are damaged by the Contractor's operations shall be replaced or restored to match the condition of the materials or equipment prior to the beginning of the Contractor's operations. Replacement or restoration of damaged materials or equipment shall be at the Contractor's expense.

Connections, anchorages and fasteners for relocated materials and equipment shall match existing and shall be furnished and installed by the Contractor. Assemblies which have been dismantled shall be reassembled to match the existing installation. Relocated materials and equipment shall be installed as required for new work.

Modifications to wiring and plumbing to accommodate relocated items shall be as shown on the plans. Ends of piping and conduits to be abandoned shall be capped.

Surfaces that are exposed to view upon removal or relocation of materials or equipment shall be patched. Bumps shall be removed and depressions filled, and the surface finished to match the existing surfaces. Depressions in concrete less than 25 mm deep shall be deepened to 25 mm minimum depth before filling with cement mortar.

**DISPOSAL.--**

**General.--**Materials from existing facilities to be reused in the work, in the opinion of the Engineer, is unsuitable for use shall become the property of the Contractor and disposed of as provided in Section 7-1.13, "Disposal of Material Outside of the Highway Right of Way," of the Standard Specifications. The unsuitable material shall be replaced as ordered by the Engineer and will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

**12-2.03 EARTHWORK FOR BUILDING WORK**

**PART 1.- GENERAL**

**SUMMARY.--**

**Scope.--**This work shall consist of performing earthwork for building work in accordance with the details shown on the plans and these special provisions.

Earthwork for building work shall consist of structure excavation and structure backfill. Structure excavation shall include excavation for footings, foundations, walls, slabs, tanks, drywells, manholes, oil/water separators, clarifiers, and trenches. Structure backfill shall include backfilling under slabs; backfilling under and around footings; backfilling for walls, backfilling for pipes and conduits; backfilling holes resulting from removal of existing facilities. In addition to structure excavation and structure backfill, earthwork for building work shall include any other earthwork, not mentioned, but necessary to complete the building work.

Attention is directed to the requirements of "Field Engineering" in Section 12-1, "General Requirements," of these special provisions.

**QUALITY ASSURANCE.--**

**Samples.--**Samples of sand, pea gravel, or crushed stone, weighing not less than 11 kg, shall be submitted to the Engineer at the jobsite for approval.

## SITE CONDITIONS.--

**Existing underground piping and conduit.--**The location of existing underground piping and conduit is based on the best records available. Before beginning work, the Contractor shall accurately locate the piping and conduit involved in the work. If the location of the existing piping or conduit deviates from the location shown on the plans by more than 1.5 meters, or, if no elevations are indicated and the piping or conduit is more than 0.9 meter below grade, the cost of the additional excavation, backfill, piping or conduit, and removal and replacement of concrete, if any, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

**Existing surfaced areas.--**Existing surfaced areas that are removed, broken or damaged by the Contractor's operations shall be restored to their original condition except as otherwise shown on the plans or specified herein.

Restoration materials shall be equal to or better than the original materials. Surfacing shall be replaced to match the material thickness, grades, and finish of the adjacent surrounding surfaces.

## PART 2.- PRODUCTS

### BACKFILL MATERIALS.--

#### Structure backfill.--

Structure and trench backfill shall be free of organic and other deleterious material and shall be suitable for the required compaction. Gravel without sand matrix shall not be used except as free draining granular material beneath slabs and footings.

#### Sand.--

Sand shall be clean, washed sand, free from clay or organic material graded such that 100 percent passes the 6 mm sieve, 90 percent to 100 percent passes the 4.75 mm sieve and not more than 5 percent passes the 75  $\mu$ m sieve size.

#### Pea gravel (naturally rounded).--

Pea gravel (naturally rounded) shall be clean, washed, dry density of not less than 1522 kg/m<sup>3</sup>, free from clay or organic material and shall conform to the following grading as determined by California Test 202:

Sieve or Screen Size	Percentage Passing
19 mm	100
13 mm	90-100
9.5 mm	40-70
4.75 mm	0-15
2.36 mm	0-3

Pea gravel shall conform to the following requirements:

Test	California Test No.	Test Requirements
Durability Index	229	35 Min.

#### Crushed stone.--

Crushed stone shall be clean, washed, dry density of not less than 1522 kg/m<sup>3</sup>, crushed stone or crushed gravel with an angular particle size not less than 3 mm or more than 13 mm.

Sieve or Screen Size	Percentage Passing
13 mm	100
9.5 mm	85-100
4.75 mm	10-30
2.36 mm	0-3

Crushed stone shall conform to the following requirements:

Test	California Test No.	Test Requirements
Durability Index	229	35 Min.

### PART 3.- EXECUTION

#### PREPARATION & RESTORATION.--

**Sawcutting.--**Prior to excavation or trenching, existing surfacing shall be removed to saw cut lines, or to existing wood dividers or expansion joints, if any. The saw cut shall be to a neat line and have a depth not less than 25 mm.

**Restoration.--**Surfacing shall be replaced to match the thickness, grades and finish of the adjacent surrounding surfaces.

#### STRUCTURE EXCAVATION.--

**General.--**Unless otherwise noted, all excavation for building work shall be classified as structure excavation.

**Footing excavation.--**The bottom of excavation shall not be disturbed. The contractor shall excavate by hand to the final grade. The bottom of concrete footings shall be poured against undisturbed material. Unless otherwise noted, compaction of the bottom of footing excavation is not required unless the material is disturbed. The footing depths shown on the plans shall be changed to suit field conditions when directed by the Engineer. Solid rock at or near required depths shall not be disturbed. Unsuitable material shall be excavated down to firm bearing as directed by the Engineer. Work and materials required because of excavation in excess of the depths shown on the plans, when such excavation has been ordered by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Excavate to the elevations and dimensions within a tolerance of  $\pm 12$  mm. Limits of the excavation shall allow for adequate working space for installing materials and as required for safety of personnel. Such working space excavation shall be replaced in kind and compacted at the Contractor's expense.

Overdepth excavation for footings shall be backfilled with concrete or such other material recommended by the Contractor and approved by the Engineer. Relative compaction shall be not less than 95 percent.

**Excavation for pipes and conduits.--**Pipes or conduits in the same trench shall have a minimum clear distance between pipes or conduits of 150 mm. Pipes or conduits shall have not less than 0.75 meter of cover from top of pipes or conduits to finished grade unless otherwise shown on the plans or specified.

Trenching shall be of sufficient depth to permit placing a minimum depth of 100 mm of compacted sand under all pipes and conduits.

**Dewatering.--**Excavations shall be kept clear of standing water. Water shall be removed by pumping if necessary. Water removed from excavation shall be carried away from the building site and disposed of in a manner that will not harm State or adjacent property.

## **STRUCTURE BACKFILLING.--**

**General.--**Unless otherwise noted, all backfill for building work shall be classified as structure backfill. Backfill shall be placed and compacted in horizontal layers, not more than 150 mm thick prior to compaction, and to the lines and grades shown on the plans or to original ground.

**Structure backfill.--**After structures are in place and forms are removed, wood and other debris shall be removed from excavations before placing structure backfill.

Unless approved in writing by the Engineer, compaction of structure backfill by jetting or ponding will not be permitted.

**Backfilling pipes and conduits.--**Backfill placed under pipe and conduits shall be compacted sand, 100 mm minimum depth. Backfill material placed to a level 150 mm above tops of pipes and conduits shall be sand or fine earth and particles shall not exceed 13 mm in greatest dimension. For wrapped, coated, or plastic pipe or conduits, sand shall be used for backfill. Backfill material placed higher than 150 mm above tops of pipes or conduits shall consist of material free of stones or lumps exceeding 100 mm in greatest dimension except:

- (a) The top 300 mm of backfill under roads, walks or paving shall consist of aggregate base material.
- (b) The top 150 mm of backfill in planted areas shall consist of topsoil.

Unless otherwise shown on the plans, pipe under roads, with less than 0.75 m of cover over the top of pipe, shall be backfilled with concrete to a level 100 mm above the top of pipe. Concrete for backfill shall be commercial quality concrete containing not less than 350 kg/m<sup>3</sup> of cement.

## **COMPACTION.--**

**General.--**Relative compaction shall be determined in accordance with California Test 216 or 231.

Unless otherwise noted below, all backfill shall be compacted to a minimum relative compaction of 90 percent.

**Compact original ground.--**Original ground surface under fill with surfacing of concrete and asphalt concrete shall be compacted to a relative compaction of not less than 95 percent for a minimum depth of 150 mm.

**Subgrade preparation.--**Preparation of subgrade material for placing aggregate base, surfacing, or slabs thereon shall include fine grading, compaction, reworking as necessary. The upper 150 mm of the subgrade shall have the same compaction as the fill to be placed over it.

The prism of backfill directly underneath the building foundation and sloping downward at 1:1 shall be compacted to 95 percent.

**Structure backfill.--**Structure backfill shall be compacted to not less than 95 percent relative compaction.

**Trench backfill.--**Trench backfill placed beneath slabs or paved areas shall be compacted to a relative compaction of not less than 95 percent.

## **DISPOSAL.--**

**Surplus material.--**Surplus material from the excavation shall be removed and disposed of outside the right-of-way in accordance with Section 7-1.13 of the Standard Specifications.

## **FIELD QUALITY CONTROL.--**

**Inspection.--**When the excavation is substantially completed to grade, the Contractor shall notify the Engineer. No concrete shall be placed until the foundation has been approved by the Engineer.

**Testing.--**The State will conduct compaction tests during the backfilling and compacting operations.

## 12-2.04 AGGREGATE BASE

### PART 1.- GENERAL

#### SUMMARY.--

**Scope.--**This work shall consist of furnishing, spreading and compacting aggregate base in accordance with the details shown on the plans and these special provisions.

### PART 2.- PRODUCTS

#### Aggregate base.--

Aggregate base shall be commercial quality aggregates consisting of broken stone; crushed gravel; natural, clean, rough-surfaced gravel and sand; or a combination thereof.

Aggregate base shall conform to the following grading as determined by California Test 202:

Sieve or Screen Size	Percentage Passing
25 mm	100
19 mm	90 - 100
4.75 mm	35 - 60
600 µm	10 - 30
75 µm	2 - 9

Aggregate base shall also conform to the following quality requirements:

Tests	California Test No.	Test Requirements
Durability Index	229	35 Min.
Resistance (R-Value)	301	78 Min.
Sand Equivalent	217	22 Min.

### PART 3.- EXECUTION

#### SPREADING AND COMPACTING.--

**Spreading.--**Aggregate base shall be placed and compacted to the lines and grades shown on the plans.

Spreading and compacting shall be performed by methods that will produce a uniform base, free from pockets of coarse or fine material.

**Compaction.--**Relative compaction of each layer of compacted base material shall be not less than 95 percent, as determined by California Test 216 or 231.

## **12-2.05 FREE DRAINING GRANULAR MATERIAL**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and placing free draining granular material beneath slabs in accordance with the details shown on the plans and these special provisions.

### **PART 2.- PRODUCTS**

#### **Free draining granular material.--**

Free draining granular material shall be clean, hard, durable, free-draining rock. The material gradation shall be such that all passes the 25 mm screen, and not more than 10 percent passes the 4.75 mm sieve as determined by California Test 202. Granular material shall be free from organic material, clay balls or other deleterious substances.

### **PART 3.- EXECUTION**

#### **SPREADING AND CONSOLIDATING.--**

**General.--**Free draining granular material shall be placed, spread and consolidated by tamping or vibrating.

## **12-2.06 CAST-IN-DRILLED-HOLE CONCRETE PILES**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of constructing cast-in-drilled-hole concrete piles in accordance with the details shown on the plans and these special provisions.

### **PART 2.-PRODUCTS**

#### **Concrete and reinforcement.--**

Concrete and reinforcement shall conform to the requirements specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

### **PART 3.-EXECUTION**

#### **CONSTRUCTION.--**

**Drilling holes.--**All holes for concrete piles shall be drilled to the tip elevations or depths shown on the plans. All holes shall be examined for straightness and any hole which on visual inspection from the top shows less than 1/2 the diameter of the hole at the bottom of the hole shall be rejected. Suitable casings shall be furnished and placed when required to prevent caving of the hole.

All loose material existing at the bottom of the hole after drilling operations have been completed shall be removed before placing concrete in the hole.

Material resulting from drilling holes shall be wasted on the job site as directed by the Engineer.

Surface water shall not be permitted to enter the hole and all water which may have infiltrated into the hole shall be removed before placing concrete therein.

**Placing reinforcement.**--The reinforcing cage shall be placed and secured symmetrically about the center of the pile and shall be securely blocked to clear the sides of the hole.

Longitudinal reinforcing steel shall be continuous for the entire length of pile, including pile extensions.

**Placing concrete.**--The concrete filling shall be vibrated to a dense and homogeneous condition. Concrete placed in drilled holes shall be placed against undisturbed material except when portions of the pile will be exposed to view. Surfaces exposed to view and adjacent surfaces within 250 mm of finished grade shall be formed.

Casing, if used in drilling operations, shall be removed from the hole as concrete is placed therein. The bottom of the casing shall be maintained not more than 1.5 meter nor less than 0.3 meter below the top of the concrete during withdrawal and placing operations, unless otherwise permitted by the Engineer. Separation of the concrete during withdrawal operations shall be avoided by hammering or otherwise vibrating the casing.

Formed surfaces shall conform to the requirements specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

## **12-2.07 PAINTED PAVEMENT MARKINGS**

### **PART 1.- GENERAL.--**

**Scope.**--This work shall consist of furnishing and applying paint for pavement markings in accordance with the details shown on the plans and these special provisions.

Pavement markings include, but are not limited to, word and symbol markings, and parking stall markings.

**Alternatives.**--At the option of the Contractor, striping tape may be placed instead of the painted pavement markings specified herein.

### **PART 2.- PRODUCTS.--**

#### **Paint.--**

Paint shall be top commercial quality for pavement marking, formulated for the use intended, and manufactured by a nationally recognized manufacturer of paint and other coating products.

The kind of paint to be used (solvent or water borne) shall be determined by the Contractor, based on local air pollution control regulations and weather conditions.

#### **Striping tape.--**

Striping tape shall be permanent type striping tape. Striping tape shall be Brite-Line, Series 1000; Swarco Industries, Director; 3M Stamark Brand, Pliant Polymer Grade Series 5730; 3M Stamark Brand, Bisymmetric 1.75 Grade Series 5730; or equal.

### **PART 3.- EXECUTION.--**

**ALIGNMENT AND LAYOUT.**--All necessary alignment and layout work shall be performed by the Contractor, in a manner that will not damage the pavement.

Unless otherwise shown on the plans, the width of parking stall markings shall be 105 mm.

**EQUIPMENT AND OPERATION.**--Mechanical means shall be used to paint pavement markings.

All equipment used in the application of paint shall produce pavement markings of uniform quality.

All spray equipment shall be the proper type and of adequate capacity for the work involved.

Air atomized spray equipment shall be equipped with oil and water extractors and pressure regulators, and shall have adequate air volume and compressor recovery capacity. Spray gun tip needle assemblies and orifices shall be the proper size.

Rapid dry paint shall be applied only with airless type equipment.

Stencils and hand spray equipment shall be used to paint word and symbol markings. Stencils shall be furnished by the Contractor. The stencil layout shall conform to the dimensions shown on the plans.

**SURFACE PREPARATION.**--Surfaces which are to receive paint shall be cleaned of all dirt and loose material.

**APPLICATION.**--Paint shall be applied only on dry surfaces, and only during periods of favorable weather, in accordance with the manufacturer's recommendations.

On new surfacing, paint shall be applied in 2 coats. The first coat shall be dry before application of the second coat is applied.

On existing surfacing, paint shall be applied in one coat.

Completed pavement markings shall have clean and well-defined edges, and shall conform to the dimensions shown on the plans or as specified in these special provisions.

Drips, oversprays, improper markings, and paint material tracked by traffic shall be immediately removed from the pavement by methods approved by the Engineer. All such removal shall be at the Contractor's expense.

If used, striping tape shall be applied in accordance with the manufacturer's specifications.

**APPLICATION RATES.**--Each application of paint shall be applied at the rates recommended by the paint manufacturer for the type of surface involved.

**PROTECTION.**--Newly placed pavement markings shall be protected from damage by traffic or other causes until the paint is thoroughly dry.

**DISABLED ACCESSIBLE PARKING STALL SYMBOL.**--Each parking space reserved for persons with physical disabilities shall have a minimum 0.9 m x 0.9 m surface identification with the international symbol of accessibility. The symbol and border shall be white and the background shall be blue conforming to Federal Standard 595B, Color No. 15090.

## **12-2.08 SANITARY SEWAGE DISPOSAL SYSTEM**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.**--This work shall consist of furnishing, installing and constructing a sanitary sewage system in accordance with the details shown on the plans and these special provisions.

Sanitary sewage system shall include piping, cleanouts and other fittings and appurtenances, not mentioned, which are required for the complete installation and proper operation of the system.

**Related work.**--Sewer pipes in buildings and to a point 1.5 meters beyond the building shall be as specified in Section 12-15, "Mechanical," of these special provisions.

**Order of work.**--Work which will curtail the use of the existing sewage system shall not be done until the facilities utilizing the system are closed and are no longer required.

#### **SUBMITTALS.--**

**Product data.**--Materials list for materials to be used shall be submitted for approval and shall include the name of the manufacturer and the source, model number, description, and standard of manufacture.

Manufacturer's descriptive data and catalog cuts shall be submitted for the following:

- Underground tracer tape
- Sewer pipe and fittings
- Drain pipe and fittings
- Gravity check valve
- Valve box
- Meter box
- Cleanouts
- Transfer pump

## **QUALITY ASSURANCE.--**

**Codes and standards.--**All sanitary sewage work shall conform to the applicable portions of the 1994 Uniform Plumbing Code, as amended by the 1995 Title 24 California Building Standards Code, pertaining to the selection and installation of sanitary sewage system materials and products.

**Certificates of Compliance.--**Certificates of Compliance shall be furnished for manhole covers and frames in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

## **PART 2.- PRODUCTS**

### **IDENTIFICATION.--**

#### **Underground tracer tape.--**

Underground tracer tape shall be permanent, bright colored, continuous printed plastic tape with integral metallic strip or wire, intended for direct burial service; not less than 50 mm wide; lettering shall read "CAUTION SEWER BURIED BELOW".

### **PIPES AND PIPE FITTINGS.--**

**General.--**Provide pipes of one of the following materials, of weight and class indicated. Provide pipe fittings and accessories of same material and weight and class as pipes, with joining method as indicated.

#### **Sewer and drain pipe.--**

Sewer pipe and fittings shall be polyvinyl chloride (PVC) gravity sewer plastic pipe and fittings conforming to ASTM Designation: D 3034, Standard Dimension Ratio (SDR) 35, with integral bell and bell and spigot rubber gasketed joints or conforming to ASTM Designation: D2665 with solvent welded fittings. Rubber gaskets shall conform to ASTM Designation: F 477. Stainless steel clamps with rubber boots shall not be used.

#### **Transfer pump.--**

Transfer pump shall be a hand-operated, non-sparking, self-priming pump capable of handling granular and stringy solids without clogging. Pump shall be capable of 3.6 m suction lift and a 3.6 m delivery head. Pump housing shall be Delrin (injection molded) with a Buna-N diaphragm. Anodized aluminum handles shall have a non slip grip. All ports (25 mm OD.) have a non-slip hose connection and shall be adapted for 19 mm garden hose threads (male and female).

#### **Sewer pipe adapters.--**

Sewer pipe adapters for PVC, cast iron soil pipe or clay piping shall be PVC-DWV adapters, conforming to ASTM Designation: D 2665; or PVC sewer pipe adapters, conforming to ASTM Designation: D 3034. Rubber boot and clamps shall not be used.

### **VALVE AND METER BOXES.--**

#### **Valve box and cover .--**

Valve box and cover shall be precast concrete box with cast iron cover. Cover shall be factory marked "SEWER," "SS," or "SANITARY SEWER" and shall be traffic rated where shown on the plans. Valve box and cover shall be Cook Concrete Products, No. 10-T-12; Christy No. G-5C; Brooks, No. 3-RT; or equal with extensions as required.

#### **Meter box and cover (for cleanouts).--**

Meter box and cover shall be precast concrete with cast iron cover. Cover shall be factory marked "SEWER," "SS," or "SANITARY SEWER" and shall be traffic rated where shown on the plans. Meter box and cover shall be Bes, No. C9W with C15 cover; Christy, No. B9 with B9C cover; Cook Concrete Products, No. 14 with 14-T cover; or equal.

## **CLEANOUTS AND VALVES.--**

### **Cleanout to grade.--**

Cleanout piping shall terminate with an appropriately sized flexible PVC access cap and stainless steel band coupler with hex tightening screw. Rubber coupling or cap will not be allowed. Access cap shall be Indiana Seal; Fernco; or equal.

### **Gravity check valve.--**

Gravity check valve shall be NPS 4, hub ends, polyvinyl chloride (PVC) body, rated for 860 kPa minimum back pressure, no metallic parts, angled viton compound rubber or fluorocarbon compound seat and removable flapper rated for horizontal or vertical usage, unseated pressure opens on contact, full flow design. Valve shall be Flo Control Inc., R and G Sloane, NDS Inc., or equal.

## **PART 3.- EXECUTION**

### **INSTALLATION OF IDENTIFICATION.--**

**General.--**Continuous underground tracer tape shall be installed directly above buried line and 150 mm to 300 mm below finished grade during backfilling operations.

### **INSTALLATION OF SEWER PIPES AND FITTINGS.--**

**General.--**Sewer pipe shall be installed upgrade unless otherwise permitted by the Engineer.

**Sewers near water lines.--**Sewers near water lines shall be installed below water lines in the same trench, in parallel trenches less than 3 meters apart, or at any crossing.

When water lines cross above a sewer line, a vertical separation of not less than 300 mm shall be maintained between the top of the sewer pipe and the bottom of the water line.

**Cleaning pipe.--**Interior of pipes shall be cleaned of dirt and other materials as the work progresses. Lines between manholes shall be flushed as necessary to remove collected material.

**Joint adapters.--**Joints between different types of pipes shall be made with standard manufactured adapters and fittings intended for that purpose.

**Closing abandoned utilities.--**Open ends of abandoned underground utilities which are indicated to remain in place shall be closed. Sufficiently strong closures shall be placed to withstand hydro-static pressure which may result after the pipes are closed.

**Interior inspection.--**Damaged or misaligned pipe shall be corrected prior to use.

### **INSTALLATION OF VALVE BOXES.--**

**General.--**Manufactured valve boxes shall be installed in accordance with the manufacturer's recommendations.

Where new valve boxes or meter boxes are to be installed to grade in areas to be paved or surfaced, no individual structure shall be constructed to final grade until the paving or surfacing has been completed in the immediate area.

### **INSTALLING THRUST BLOCKS.--**

**General.--**Cast-in-place concrete thrust blocks shall be installed at PVC pipe fittings in accordance with the details as shown on the plans and in conformance to applicable codes and standards.

## **INSTALLATION OF CLEANOUTS.--**

**General.--**Cleanouts shall be installed 90 degrees to finished grade and shall terminate in a meter box. A concrete pad, 450 mm long and 100 mm thick, shall be provided full width of the trench under a wye branch. A concrete collar shall be formed and cast-in-place around each cleanout valve box.

Cleanouts to grade shall be a combination of fittings as shown on the plans. Piping and fittings for NPS 4 pipe shall be sewer pipe and for NPS 3 and smaller shall be drain pipe. Cleanout piping shall terminate below grade in a valve box.

Collars shall be broom surface finished. Collars shall match existing/finished grade. Compaction prior to form work shall be as specified elsewhere in these special provisions.

Where cleanouts are to be installed to grade in areas to be paved or surfaced, no individual structure shall be constructed to final grade until the paving or surfacing has been completed in the indicated area.

## **TAP CONNECTION.--**

**General.--**Connections to existing systems shall be as shown on the plans and subject to approval by the local agency.

## **FIELD QUALITY CONTROL.--**

**Testing pipes.--**All sewer and drain pipes shall be tested for obstructions before covering the pipes by balling and flushing the pipes with an approved commercial sewer cleaning ball. The ball shall be moved slowly through the sewer with a tag line. NPS 4 sewer pipe shall be tested by pulling an appropriate sized inflatable plug through the pipe. Obstructions or irregularities shall be removed or repaired.

Sewer, drain and vent pipes shall be tested for leakage for a minimum period of 4 hours by filling with water to an elevation of 1.2 meters above the average invert of sewer, or to the top of the manholes where less than 1.2 meters deep. The system shall show no visible leaks, and the leakage rate shall not exceed the rate allowed by the local agency. In the absence of such requirements, leakage shall not exceed 0.5 liters per 24 hours, per millimeter diameter, per 30 meters of pipe. Sewers may be tested in sections with the test water progressively passed down the sewers if feasible. Water shall be released at a rate which will not create water hammer or surge in the plugged section of sewer.

In lieu of hydrostatic test with water, the air test method, as outlined in the Uniform Plumbing Code (UPC), "Low Pressure Air Test for Building Sewers," may be used.

## **12-2.09 GUARD POSTS**

### **PART 1.- GENERAL**

**Scope.--**This work shall consist of constructing guard posts in accordance with the details shown on the plans and these special provisions.

### **PART 2.- PRODUCTS**

#### **Steel posts.--**

Steel posts for guard posts shall be standard weight, galvanized steel pipe conforming to the details shown on the plans.

#### **Concrete.--**

Concrete for guard posts shall be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 300 kilograms of cement per cubic meter.

### **PART 3.- EXECUTION**

**Installation.--**The length and diameter of the guard posts shall conform to the details shown on the plans.

Guard posts shall be placed in holes excavated to the depth and cross section shown on the plans, and shall be installed plumb.

Guard posts shall be backfilled with concrete as shown on the plans.

**Painting.**--Guard posts shall be prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

## **12-2.10 PARKING BUMPERS**

### **PART 1.- GENERAL**

**Scope.**--This work shall consist of furnishing and installing precast concrete parking bumpers in accordance with the details shown on the plans and these special provisions.

### **PART 2.- PRODUCTS**

#### **Parking bumpers.--**

Parking bumpers shall be commercially available precast parking bumpers.

Parking bumpers shall be 1220 mm long, nominal 200 mm wide and 150 mm high with both top longitudinal corners continuously chamfered, and anchor holes 230 mm from each end.

### **PART 3.- EXECUTION**

**Layout.**--Arrangement of parking bumpers shall be coordinated with the layout of parking stalls and traffic aisles, providing the proper angle to engage wheels and proper location to prevent overtravel of vehicles.

Parking bumpers shall be anchored with two 19 mm diameter reinforcing bars 380 mm in length. The reinforcing bars shall be installed such that the top of the bars is flush with the top of the parking bumper.

## **12-2.11 ACCESSIBLE PARKING AND AUTHORIZATION SIGNS**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.**--This work shall consist of furnishing and installing accessible parking and authorization signs in accordance with the details shown on the plans and these special provisions.

#### **SUBMITTALS.--**

**Product data.**--Manufacturer's descriptive data and sign fastening details shall be submitted for approval.

### **PART 2.- PRODUCTS**

#### **Accessible parking stall identification sign.--**

Accessible parking stall identification sign shall be a metal sign with baked enamel finish and the international symbol of accessibility. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Symbol, lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

#### **Van accessible sign.--**

Van accessible sign shall be a metal sign with baked enamel finish and the international symbol of accessibility. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

**Unauthorized vehicles parking sign.--**

Unauthorized vehicles parking sign shall be a metal sign with baked enamel finish. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886. Lettering shall be not less than 25 mm in height and shall read as shown on the plans.

**Support post.--**

Support post shall be commercial quality, standard weight, galvanized steel pipe. Pipe diameter shall be 35 mm.

**Fastening hardware.--**

Fastening hardware shall be galvanized or cadmium plated.

**Concrete.--**

Concrete for support posts shall be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 300 kilograms of cement per cubic meter.

**PART 3.- EXECUTION**

**Installation.--**Support posts shall be placed in holes excavated to the depth and cross-section shown on the plans. Posts shall be set vertical and shall be firmly embedded in concrete backfill. The top of the concrete backfill around the post shall be crowned to drain water.

Support posts shall be fitted with a rainproof top.

Sign shall be fastened rigidly and securely to the support post.

The Engineer will provide the Contractor with the necessary information for the disabled authorization sign.

**SECTION 12-3. CONCRETE AND REINFORCEMENT****12-3.01 CAST-IN-PLACE CONCRETE****PART 1.- GENERAL****SUMMARY.--**

**Scope.--**This work shall consist of constructing cast-in-place concrete facilities in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data for admixtures, expansion joint material, vapor barrier, hardener, and sealer shall be submitted for approval.

Descriptive data shall be delivered to the Engineer at the jobsite.

**QUALITY ASSURANCE.--**

**Certificates of Compliance.--**Certificates of Compliance shall be furnished for cement, reinforcement, admixtures, freeze-thaw aggregates and epoxy products in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

A Certificate of Compliance shall be furnished for each shipment of epoxy-coated reinforcing bars certifying that the coated bars conform to the requirements of ASTM Designation: D 3963. Said Certificate of Compliance shall include all certifications specified in ASTM Designation: D 3963 and a statement that the coating material has been prequalified by acceptance testing performed by the National Bureau of Standards or by the Valley Forge Laboratories, Inc., Devon, Pennsylvania.

**Samples.**--Prior to coating, the Contractor shall furnish to the Engineer a representative 0.11 kg sample from each batch of epoxy coating material used. The sample shall be packaged in an airtight container identified with the manufacturer's name and batch number.

After coating, two 800 mm long samples of epoxy-coated reinforcing steel from each size and from each load shipped to the jobsite shall be submitted to the Engineer. The samples shall be representative of the material furnished. The samples, as well as any additional random samples taken by the Engineer, may be tested for specification compliance. Such additional sampling, and all tests performed by the Engineer, may be performed at any location deemed appropriate by the Engineer. Failure of any sample to meet the requirements of the specification will be cause for rejection of all reinforcing bars represented by the sample.

## **PART 2.- PRODUCTS**

### **CONCRETE MIXES.--**

#### **Concrete (structural work).--**

Commercial quality concrete shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 350 kg/m<sup>3</sup> of cement; 0 to 50 mm penetration, inclusive, as determined by California Test 533.

The air content of the freshly mixed concrete shall be  $6 \pm 1 \frac{1}{2}$  percent, as determined by California Test 504.

#### **Concrete (minor work).--**

Commercial quality concrete for collars shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 300 kg/m<sup>3</sup> of cement; 0 to 50 mm penetration, inclusive, as determined by California Test 533.

The air content of the freshly mixed concrete shall be  $6 \pm 1 \frac{1}{2}$  percent, as determined by California Test 504.

#### **Concrete (sewer structures).--**

Commercial quality concrete for sewer structures, vehicle washracks and mudrinse slabs, shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 400 kg/m<sup>3</sup> of a mixture of Type II cement and 15 percent by weight of a mineral admixture or Type IP (MS) Modified cement; 0 to 50 mm penetration, inclusive, as determined by California Test 533.

The air content of the freshly mixed concrete shall be  $6 \pm 1 \frac{1}{2}$  percent, as determined by California Test 504.

### **CONCRETE MATERIALS.--**

#### **Cement.--**

Cement shall conform to ASTM Designation: C 150, Types II, or III portland cement; or Type IP (MS) Modified cement. Type IP (MS) Modified shall conform to ASTM Designation: C 595 and shall be comprised of an intimate mixture of Type II Modified cement and not more than 20 percent of a pozzolanic material.

#### **Aggregates.--**

Aggregates shall be free from deleterious coatings, clay balls and other extraneous materials.

Aggregates proposed for use in portland cement concrete shall conform to the requirements for freezing and thawing as determined by California Test 528.

A list of sources of aggregates which have previously passed the freeze-thaw test is available in the District Office in Redding.

#### **Admixtures.--**

Admixtures used in portland cement concrete shall be included on the Department's current list of approved admixtures, and shall conform to ASTM Designation: C 494, Types A, B, D, F or G for chemical admixtures; ASTM Designation: C 260 for air-entraining admixtures; and ASTM Designation: C 618 for mineral admixtures, except loss on ignition shall not exceed 4 percent. Properties of admixtures shall be uniform in each lot.

## **FORM MATERIALS.--**

### **Forms for exposed finish concrete.--**

Forms for exposed surfaces shall be plywood, metal or other panel type materials. Plywood shall be not less than 16 mm thick and without scars, dents, and delaminations. Forms shall be furnished in largest practical pieces to minimize number of joints.

Plywood shall conform to the requirements of U. S. Product Standard PS-1 for Exterior B-B (Concrete Form) Class I.

Forms for edges of slabs shall be nominal 50 mm solid stock lumber, plywood, or metal forms.

### **Forms for unexposed finish concrete.--**

Forms for unexposed finish concrete surfaces shall be plywood, lumber, metal or other acceptable material.

### **Form ties.--**

Form ties shall be factory fabricated, removable or snapoff metal ties for use as necessary to prevent spreading of forms during concrete placement.

### **Form oil.--**

Form oil shall be commercial quality form oil which will permit the ready release of the forms and will not discolor the concrete.

## **REINFORCING MATERIALS.--**

### **Bar reinforcement.--**

Bar reinforcement shall conform to ASTM Designation: A 615/A 615M, Grade 60 [420], or ASTM Designation: A 706/A 706M.

### **Epoxy coated reinforcement.--**

Slab reinforcement in mud rinse and washrack area shall be epoxy coated. The reinforcing steel to be coated shall conform to ASTM Designation: A 615/A 615M, Grade 60 [420], or A 706/A 706M. Epoxy-coated reinforcement shall conform to ASTM Designation: D 3963, except that the thickness of the coating shall be 0.2 mm plus or minus 0.05 mm. The coating shall have a light pastel color.

Welded wire fabric.--Welded wire fabric shall conform to ASTM Designation: A 185.

### **Bar supports.--**

Bar supports for reinforcement shall be precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads.

## **EPOXY.--**

**General.--**Epoxy shall be furnished as 2 components which shall be mixed together at the site of the work.

### **Epoxy resin adhesive.--**

Epoxy resin adhesive shall conform to State of California Specification No. 8040-21M-08 or other epoxy suitable for bonding new concrete to old.

### **Epoxy mortars.--**

Epoxy mortar and epoxy mortar surface treatment shall consist of a commercial quality, trowelable mixture consisting of epoxy and sand. Epoxy shall have a pull-off strength of not less than 6895 MPa and a 90-percent cure in 24 hours. Epoxy shall be of the type that requires no primer as a bonding agent.

**Sand.--**

Sand for use in epoxy mortars shall be clean and shall have a moisture content of not more than 0.50-percent when tested in accordance with California Test 226.

Sand for epoxy mortar surface treatment shall be graded such that 100-percent passes the 150 µm sieve.

**RELATED MATERIALS.--****Anchor bolts, nuts, and washers.--**

Nonheaded anchor bolts shall conform to ASTM Designation: A 36/A 36M, with a minimum hook length of 6.2 diameters.

Headed anchor bolts shall conform to ASTM Designation: A 307.

Nuts shall conform to ASTM Designation: A 563M, Grade A.

Washers for anchor bolts shall be commercial quality.

Exposed anchor bolts, nuts, and washers shall be hot dipped galvanized.

**Expansion joint material.--**

Expansion joint material shall be commercial quality asphalt impregnated pressed fiber sheets, 13 mm minimum thickness.

**Vapor barrier.--**

Vapor barrier shall be commercial quality polyethylene sheets not less than 0.15 mm thick.

**Bond breaker.--**

Bond breaker shall be Type I asphalt saturated organic felt or such other material approved by the Engineer.

**Type A control joints.--**

Type A control joints shall be commercial quality, preformed, T-shaped plastic strips with detachable top flange.

**Keyed construction joint forms.--**

Keyed construction joint forms shall be commercial quality, galvanized metal, factory fabricated construction joint forms. Forms shall produce a rabbeted key type joint.

**Divider and edger strips.--**

Divider and edger strips shall be foundation grade redwood.

**Mortar.--**

Mortar shall consist of one part cement to 2 parts clean sand and only enough water to permit placing and packing.

**Curing compound.--**

Curing compound shall be a non-pigmented curing compound with fugitive dye conforming to the requirements of ASTM Designation: C 309, Type 1-D, Class A.

**Concrete hardener.--**

Concrete hardener shall be commercial quality water borne penetrating type magnesium fluosilicate, zinc fluosilicate or combination thereof.

**Concrete sealer.--**

Concrete sealer shall be commercial quality VOC-compliant, silane type sealer with hydrophobic and oleophobic properties. Concrete sealer shall be ProSoCo, Inc., Standoff Tile and Masonry Protector (TMP); Tamms Industries, Hey'Di H.O.S.; Textured Coatings of America, Inc., Rainstopper 1750W-Clear; or equal.

## **ADMIXTURES.--**

**General.--**Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option to conserve cement or to facilitate any construction operation.

Calcium chloride shall not be used in any concrete.

Admixtures shall be combined with concrete materials by methods that produce uniform properties throughout the concrete.

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

Mineral admixtures may be used to replace up to 15 percent of Type II portland cement provided the weight of mineral admixture used is not less than the weight of cement replaced. Mineral admixtures shall not be used to replace Type IP (MS) Modified or Type III cements. Chemical admixtures may be used to reduce up to 5 percent of the portland cement except that the cement content shall not be less than 300 kg/m<sup>3</sup>. When both chemical and mineral admixtures are used with Type II cement, the weight of cement replaced by mineral admixture may be considered as cement in determining the resulting cement content.

Mineral admixtures will be required in the manufacture of concrete containing aggregates that are determined to be "deleterious" or "potentially deleterious" when tested in accordance with ASTM Designation: C 289. The use of mineral admixture in such concrete shall conform to the requirements in this section except that the use of set retarding admixtures will not be permitted.

When the use of a chemical admixture is specified or is ordered by the Engineer, the admixture shall be used at the rate specified or ordered. If no rate is specified or ordered, or if the Contractor uses a chemical admixture for his own convenience, the admixture shall be used at the dosage normally recommended by the admixture manufacturer.

When air-entrainment is specified or is ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce concrete having the specified or ordered air content as determined by California Test 504. If the Contractor uses air-entrainment for his own convenience, the average air content shall not exceed 4 percent and no single test shall exceed 5 1/2 percent.

Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers shall have sufficient capacity to measure at one time the total quantity required for each batch. If more than one liquid admixture is used in the concrete, a separate measuring unit shall be provided for each liquid admixture and dispensing shall be such that the admixtures are not mixed at high concentrations. When air-entraining admixtures are used with other liquid admixtures, the air-entraining admixtures shall be the first to be incorporated into the mix. Unless liquid admixtures are added to premeasured water for the batch, they shall be discharged to flow into the stream of water so that the admixtures are well dispersed throughout the batch.

## **BAR REINFORCING STEEL.--**

**Bending.--**Reinforcing steel bars shall accurately conform to the dimensions shown on the plans.

Bars shall be bent or straightened in a manner that will not crack or break the material. Bars with kinks or improper bends shall not be used.

Hooks, bends and splices shall conform to the provisions of the Building Code Requirements for Reinforced Concrete of the American Concrete Institute.

**Epoxy-coated Reinforcing Steel.--**In fabricating, handling, shipping, and placing of epoxy-coated reinforcing bars, adequate care shall be taken to avoid damage to the coating. Handling and shipping equipment shall have padded contact areas. All bundling bands shall be padded or suitable banding shall be used to prevent damage to the coating. All bundles of coated bars shall be lifted with a strongback or multiple support system to prevent bar-to-bar abrasion from sags in the bundles. Bars or bundles shall not be dropped or dragged.

All damage to the coating caused by handling and fabrication prior to shipment to the jobsite shall be repaired as required by ASTM Designation: D 3963. Damage to the coating occurring during shipment or installation, or both, need not be repaired where the damaged areas are 6 mm by 6 mm or smaller and the sum of all damaged areas in each 300 mm length of bar does not exceed 2 percent of the bar surface area. All bars with total damage greater than 2 percent of the bar surface area will be rejected and shall be removed. On bars with a total damaged coating area not exceeding 2 percent of the bar surface area, all damaged areas larger than 6 mm square and all damage in sections of bar with more than 2 percent coating damage in a 300 mm length shall be repaired with patching material. The bar surface area covered by patching material shall not exceed 5 percent of the total surface area of the bar.

Patching material shall be compatible with the coating material, not harmfully reactive with the concrete, and shall be feasible for repairs by the coating applicator or bar fabricator or in the field. The patching material shall be prequalified as required for the coating material and shall be either identified on the container as meeting the requirements of Annex A1 of ASTM Designation: D 3963 or shall be accompanied by a Certificate of Compliance certifying that the material meets the requirements of said Annex A1. Patching of damaged areas shall be performed in accordance with the patching material manufacturer's recommendations.

### **MIXING AND TRANSPORTING CONCRETE.--**

**General.--**When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be complete within 1 1/2 hours, or before 250 revolutions of the drum or blades, whichever comes first, after the introduction of cement to the aggregates.

Truck mixers or agitator shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified. The counters shall be of the continuous-registering type, which accurately register the number of revolutions and shall be mounted on the truck so that the Engineer may safely and conveniently inspect them from alongside the truck. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, a time less than 1 1/2 hours may be required.

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

Each load of concrete for the work shall be accompanied by a trip ticket, a copy of which shall be delivered to the Engineer at the jobsite. The trip ticket shall show volume of concrete, weight of cement and aggregates, quantity of each admixture, quantity of water including water added at the jobsite, time of day the concrete is batched, and revolution counter readings on transit mix trucks at the times the truck is charged and unloaded.

### **PART 3.- EXECUTION**

#### **PREPARATION.--**

**Existing concrete construction.--**Where fresh concrete joins existing or previously placed concrete or masonry, the contact surfaces of the existing or previously placed material shall be roughened, cleaned, flushed with water and allowed to dry to a surface dry condition immediately prior to placing the fresh concrete. The roughened surface shall be no smoother than a wood trowelled surface. Cleaning of the contact surfaces shall remove laitance, curing compounds, debris, dirt and such other substances or materials which would prevent bonding of the fresh concrete.

Abrasive blast methods shall be used to clean horizontal construction joints to the extent that clean aggregate is exposed.

Exposed reinforcing steel located at the contact surfaces which is to be encased in the fresh concrete shall be cleaned to remove any substance or material that would prevent bonding of the fresh concrete.

**Forms.--**Forms shall be mortar tight, true to the dimensions, lines, and grades shown on the plans, securely fastened and supported, and of adequate rigidity to prevent distortion during placing of concrete.

Forms for exposed surfaces shall be constructed with triangular fillets not less than 19 mm x 19 mm attached so as to prevent mortar runs and to produce smooth straight chamfers at all sharp edges of the concrete.

Form fasteners shall be removable without chipping, spalling, heating or otherwise damaging the concrete surface. Form ties shall be removed to a depth of at least 25 mm below the surface of the concrete.

The inside surfaces of forms shall be cleaned of all dirt, mortar and foreign material. Forms shall be thoroughly coated with form oil prior to use.

Forms shall not be stripped until at least 40 hours after placing concrete.

Anchorage and embedded items shall be placed and rigidly secured at their planned locations prior to placing concrete.

Reglets or embedded flashing shall be installed on concrete forms before the concrete is placed.

Redwood dividers shall have 4 mm x 89 mm galvanized nails partially driven into both vertical faces at 450 mm on centers.

**Vapor barrier.--**Vapor barrier shall be lapped 150 mm and securely taped at splices. Vapor barrier shall be protected with a 75 mm layer of clean uncompacted sand cover.

Unless otherwise shown on the plans, vapor barrier shall be placed under portions of the floor slab scheduled to receive finish flooring.

**Placing reinforcing steel.**--Reinforcing steel bars shall be accurately placed to the dimensions shown on the plans.

Bar reinforcement conforming to ASTM Designation: A 615/A 615M, Grade 420, or A 706//A 706M shall be lapped at least 45 diameters.

Bars shall be firmly and securely held in position by means of wiring and approved bar supports. The spacing of supports and ties shall prevent displacement of the reinforcing or crushing of supports.

Tie wire shall be clear of concrete formwork and concrete surfaces.

All reinforcing steel shall be in place and inspected before concrete placement begins. Placing of bars on fresh layers of concrete will not be permitted.

Within areas where epoxy-coated reinforcement is required, tie wire and bar chairs or other metallic devices used to secure or support the reinforcement shall be plastic or epoxy-coated to prevent corrosion of the devices or damage to the coated reinforcement.

**Ground bar.**--A continuous reinforcing steel bar shall be installed in the building foundation at the location indicated on the plans for the electrical ground bar. The use of epoxy coated reinforcing bar is not permitted. The end of the ground bar shall extend beyond the concrete surface and shall be protected from damage by construction operations.

### **PLACING CONCRETE.--**

**General.**--Concrete shall be placed and consolidated by means of internal vibrators to form dense, homogeneous concrete free of voids and rock pockets.

Forms and subgrade shall be thoroughly moistened with water immediately before placing concrete.

Concrete shall be placed as nearly as possible to its final location and the use of vibrators for extensive shifting of the concrete will not be permitted.

Concrete shall be deposited and consolidated in a continuous operation within limits of construction joints, until the placing of the panel or section is completed.

When concrete is to be placed in large areas requiring more than two pours, concrete shall be placed in alternate long strips between construction joints and the final slab infilled.

Vibrators used to consolidate concrete containing epoxy-coated bar reinforcement shall have a resilient covering to prevent damage to such reinforcement.

### **FINISHING CONCRETE SURFACES.--**

**Finishing unformed surfaces.**--Slabs shall be placed full thickness to finish elevation and leveled to screeds by use of long straightedges. The screeds shall be set to grade at approximately 1.8 meter centers. After leveling, screeds shall be removed and the surface shall be floated with wooden floats.

Type A control joint strips shall be inserted into the floated concrete so that the bottom of the top flange is flush with the finish elevation. Strips shall be standard manufactured lengths and shall be placed on an approximate straight line. The top flange of the strips shall be removed after the concrete has set and cured.

The floated surface shall be trowelled with steel trowels. Troweling shall form a dense, smooth and true finish. Walkways, pedestrian ramps, stairs and outdoor slabs for pedestrian traffic shall be given a non-slip broom finish unless a different finish is called for on the plans or in these special provisions.

The application of cement dust coat will not be permitted.

Steel trowel finish and broom finish will not be required for slabs to be covered with ceramic tile.

Concrete floor surfaces to receive ceramic tile shall be floated to grade and then, before final set of the concrete, the floated surfaces shall be roughened with stiff bristled brushes or rakes.

Finished surfaces of floor slabs shall not deviate more than 3 mm from the lower edge of a 3-meter long straight edge.

**Finishing formed surfaces.**--Formed concrete surfaces shall be finished by filling holes or depressions in the surface, repairing all rock pockets, and removing fins. All surfaces of formed concrete exposed to view shall have stains and discolorations removed, unsightly bulges removed, and all areas which do not exhibit the required smooth, even surface of uniform texture and appearance shall be sanded with power sanders or other approved abrasive means until smooth, even surfaces of uniform texture and appearance are obtained.

Cement mortar, patching and finishing materials used to finish exposed surfaces of concrete shall closely match the color of surrounding surfaces.

## **CURING CONCRETE.--**

**General.--**Freshly placed concrete shall be protected from premature drying and excessive cold or hot temperatures.

Initial curing of floor slabs shall start as soon as free water has disappeared from the concrete surface. The concrete shall be kept continuously wet by the application of water for not less than 7 days after the concrete has been placed.

Cotton mats, rugs, carpets, or sand blankets may be used as a curing medium to retain the moisture during the curing period. Curing materials that will stain or discolor concrete shall not be used on surfaces exposed to view.

Prior to placing the curing medium, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.

Concrete surfaces, other than floor slabs, shall be kept moist for a period of at least 5 days by leaving the forms in place or by covering the exposed surfaces using moist rugs, cotton mats or other curing materials approved by the Engineer.

Concrete collars may be cured with a curing compound.

## **PROTECTING CONCRETE.--**

**General.--**Concrete shall not be placed on frozen or frost covered surfaces.

Concrete shall be protected from damage due to rain, freezing or inclement weather, and shall be maintained at a temperature of not less than 4°C for 72 hours. When required by the Engineer, the Contractor shall provide a written outline of his proposed methods of protecting concrete.

Vehicles, equipment, or concentrated loads weighing more than 140 kg individually and material stockpiles weighing more than 240 kg/m<sup>2</sup> will not be permitted on the concrete within 10 calendar days after placing.

## **SPECIAL TREATMENTS.--**

**Concrete hardener.--**Chemical concrete hardener shall be applied to the floor surfaces shown on the plans, prior to the application of concrete sealer. Surfaces shall be clean and dry before the application of hardener.

The solution shall be applied in accordance with the manufacturer's instructions.

After the hardener has dried, the surface shall be mopped with water to remove encrusted salts.

**Concrete sealer.--**Concrete sealer shall be applied to the concrete surfaces designated on the plans in accordance with the manufacturer's instructions for heavy duty use. The sealer shall be applied to dry concrete surfaces.

**Epoxy mortars.--**Epoxy for use as a binder in epoxy mortars shall be thoroughly mixed together before the aggregate is added, and unless otherwise specified, the mix proportions shall consist of one part binder to approximately 4 parts of aggregate, by volume.

All surfaces against which epoxy mortars are to be applied shall be free of rust, paint, grease, asphalt, and loose or deleterious material.

## **SECTION 12-4. MASONRY**

### **12-4.01 CONCRETE MASONRY UNITS**

#### **PART 1.- GENERAL**

##### **SUMMARY.--**

**Scope.--**This work shall consist of constructing reinforced hollow concrete masonry units in accordance with the details shown on the plans and these special provisions.

**Related work.--**Water repellent coating shall be applied in accordance with the requirements specified under "Water Repellent Coating" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

## **PERFORMANCE REQUIREMENTS.--**

**Unit Strength.--**Provide masonry units that develop the following installed compressive strengths (f'm) at 28 days:

Based on net area f'm = 10.34 MPa

## **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data for each type of masonry unit, accessory, and other manufactured products shall be submitted for approval.

**Samples.--**Two samples of masonry units of each color and architectural finish shall be submitted for approval.

## **QUALITY ASSURANCE.--**

**Masonry preconstruction testing service.--**The Contractor shall employ and pay all costs for the services of a testing laboratory acceptable to the Engineer and experienced in performing preconstruction masonry tests. The testing laboratory shall comply with the requirements of ASTM Designation: E 329.

Preconstruction tests shall be performed on the following materials by the Unit Test Method as defined by Section 2105, "Quality Assurance," of the Uniform Building Code:

Concrete masonry units shall be tested in accordance with ASTM Designation: C 140.

Grout shall be tested in accordance with ASTM Designation: C 1019.

In addition:

Mortar shall be tested in accordance with Uniform Building Code Standard: 21-16

Test results shall be reported in writing to the Engineer and the Contractor on the same day the tests are made.

**Single source responsibility.--**Exposed masonry units of uniform color and texture shall be obtained from one manufacturer for each different product required for each continuous surface or visually related surfaces.

Mortar ingredients of uniform quality, including color for exposed masonry, shall be obtained from one manufacturer for each cementitious component and from one source and producer for each aggregate.

**Certificates of Compliance.--**Certificate of Compliance shall be furnished for masonry units, aggregate for grout and transit mixed grout in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

## **DELIVERY, HANDLING AND STORAGE.--**

**Delivery.--**Masonry materials shall be delivered to the project in an undamaged condition.

**Storage and handling.--**Masonry units shall be stored and handled in order to prevent deterioration or damage due to moisture, temperature changes, contamination, corrosion or other causes.

## **PART 2.- PRODUCTS**

### **CONCRETE MASONRY UNITS.--**

#### **Concrete masonry units.--**

Concrete masonry units shall be nominal size, color and architectural finish as shown on plans; hollow load bearing, light weight or medium weight, Grade N, Type II, conforming to ASTM Designation: C 90; standard or open ended masonry units.

Special shapes shall be provided where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.

## **MORTAR AND GROUT MATERIALS.--**

### **Cement.--**

Cement for mortar shall be Type II, low alkali portland cement conforming to ASTM Designation: C 150; or masonry cement conforming to ASTM Designation: C 91.

Cement for grout shall be Type II portland cement conforming to ASTM Designation: C 150 with maximum 15 percent Class N, F, or C mineral admixture conforming to ASTM Designation: C 618 except that the loss on ignition shall not exceed 4 percent; or Type IP(MS) blended hydraulic cement conforming to ASTM Designation: C 595.

### **Aggregate.--**

Aggregate for mortar shall conform to ASTM Designation: C 144, except not more than 10 percent shall pass the No. 100 sieve.

Aggregate for grout shall conform to ASTM Designation: C 404, except 100 percent of the coarse aggregate shall pass the 9.5 mm sieve. Soundness loss shall not exceed 10 percent as determined by California Test 214.

### **Coloring for mortar.--**

Coloring for mortar shall be chemically inert, fade resistant mineral oxide or synthetic type.

### **Lime.--**

Lime shall conform to ASTM Designation: C 207, Type S.

### **Premixed mortar or grout.--**

A premixed packaged blend of cement, lime, and sand, with or without color, that requires only water to prepare for use as masonry mortar or grout may be furnished. Packages of premix shall bear the manufacturer's name, brand, contents, weight, and color identification.

### **Transit mixed grout.--**

Transit mixed grout shall conform to ASTM Designation: C 94, except aggregate shall be as specified herein for aggregate for grout. The minimum compressive strength shall be 17236 kPa at 28 days when tested in accordance with ASTM Designation: C 39. Admixtures, if used, shall conform to ASTM Designation: C 494, Types A, E or F and shall not contain chlorides.

## **REINFORCEMENT, TIES AND ANCHORING DEVICES.--**

### **Bar reinforcement.--**

Bar reinforcement shall conform to ASTM Designation: A 615/A 615 M, Grade 60 [420], or ASTM Designation: A 706/A 706 M.

### **Anchor bolts.--**

Anchor bolts shall conform to ASTM Designation: A 307, and shall be 12 mm diameter unless otherwise shown on the plans.

### **Anchors, ties, angles, and metal lath.--**

Anchors, ties, angles, and metal lath shall be commercial quality, and shall be galvanized.

### **Dry pack.--**

Dry pack to set items into masonry shall be one part portland cement to not over 3 parts of clean sand and with a minimum amount of water for hydration and packing.

## **PROPORTIONING MORTAR AND GROUT.--**

**General.--**Mortar shall be proportioned by loose volume and shall have one part cement, one quarter part of hydrated lime and 2 1/4 to 3 parts aggregate. Mortar shall be tinted with coloring to match the masonry units.

Grout, except transit mixed and packaged premix grout, shall be proportioned by loose volume and shall have one part cement, not more than 1/10 part hydrated lime, 2 1/4 to 3 parts sand aggregate, and not more than 2 parts gravel aggregate.

Aggregate shall be measured in a damp loose condition.

Grout shall be mixed with sufficient water to produce a mix consistency suitable for pumping without segregation. Slump shall not exceed 229 mm.

## **PART 3.- EXECUTION**

### **CONSTRUCTION.--**

**General.--**Masonry units shall be laid in running bond, except as otherwise shown on the plans.

Surfaces of metal, glass, wood, completed masonry, and other such materials exposed to view shall be protected from spillage, splatters and other deposits of cementitious materials from masonry construction. All such deposits shall be removed without damage to the materials or exposed surfaces.

Construction will comply with Section 2104 Construction of the Uniform Building Code. Tolerances specified in Section 2104 shall be in affect unless otherwise shown on the plans.

Where fresh masonry joins concrete or masonry, the contact surfaces of existing material shall be roughened, cleaned and lightly wetted. The roughened surface shall be no smoother than a wood troweled surface. Cleaning shall remove laitance, curing compounds, debris, dirt and any substance which decreases bond to the fresh masonry.

Masonry shall not be erected when the ambient air temperature is below 5° C.

Surfaces of masonry erected when the ambient air temperature exceeds 38° C. shall be kept moist with water for a period of not less than 24 hours. Water shall be uniformly applied with a fog spray at the intervals required to keep the surfaces moist but not to exceed 3 hours unless otherwise approved by the Engineer.

All anchors, bolts, dowels, reglets and other miscellaneous items to be cast into the wall, shall be firmly secured in place before grout is poured.

Shoring for concrete masonry lintels shall remain in place a minimum of 15 days after the wall has been completed.

**Laying masonry units.--**Concrete masonry units shall be laid dry.

During laying of units all cells shall be kept dry in inclement weather by suitably covering incomplete walls. Wooden boards and planks shall not be used as covering materials. The covering shall extend down each side of masonry walls approximately 600 mm.

Chases shall be kept free from debris and mortar.

Bond beam units with an opening at each cross web shall be used at all horizontal reinforcing bars.

Where masonry unit cutting is necessary, all cuts shall be made with a masonry saw to neat and true lines. Blocks with excessive cracking or chipping of the finished surfaces exposed to view will not be acceptable.

**Lintels.--**Masonry lintels shall be as shown on the plans. Lintels shall be formed using U-shaped lintel units with reinforcing bars placed as shown on the plans. Formed-in-place lintels shall be temporarily supported.

**Bar reinforcement.--**Bar reinforcement shall be accurately positioned in the center of the cell and securely held in position with either wire ties or spacing devices near the ends of bars and at intervals not exceeding 192 bar diameters. Wire shall be 16-gage or heavier. Wooden, aluminum, or plastic spacing devices shall not be used. Tolerances for the placement of vertical reinforcement in walls and flexural elements shall be  $\pm 12$  mm. Tolerance for longitudinal reinforcement in walls shall be  $\pm 50$  mm.

The minimum spacing for splices in vertical reinforcement for masonry walls shall be 1220 mm plus lap.

Bar reinforcement shall not be placed in the plane of mortar joints.

**Mortar.--**Mortar joints shall be approximately 9.5 mm wide. Units shall be laid with all head and bed joints filled solidly with mortar for the full width of masonry unit shell. Head joints shall be shoved tight. Exposed joints shall be concave, tooled smooth, unless otherwise shown on the plans.

Mortar that has been mixed more than one hour shall not be retempered.

Mortar placed in joints shall preserve the unobstructed vertical continuity of the concrete filling. Any overhanging mortar projecting more than 12 mm, or other obstruction or debris shall be removed from the inside of such cells.

## **GROUTING.--**

**General.--**All cells shall be filled solidly with grout. All grout in the cells shall be consolidated at the time of placement by vibrating and reconsolidated after excess moisture has been absorbed but before plasticity is lost. Slicing with a trowel is not acceptable.

Masonry units may be placed full height of the masonry work before grouting, or they may be placed in increments for individual grout pours.

Cleanouts shall be provided for all grout pours over 1524 mm in height. Such cleanouts shall be provided in the bottom course at every cell containing vertical reinforcement. After cell inspection, the cleanouts shall be sealed before filling with grout.

Masonry units shall be placed full height of the grout pour. Grout shall be placed in a continuous pour in grout lifts not exceeding 1828 mm. The interruption between placing successive lifts of grout shall be not more than one hour.

Between grout pours, a horizontal construction joint shall be formed by stopping the grout a minimum of 38 mm below the top of the last course, except if the joint is at a bond beam, it shall be 12 mm below the top of the bond beam unit, or at the top of the wall.

## **CLEANING AND PROTECTING MASONRY.--**

**General.--**Splashes, stains or spots on the faces of the masonry exposed to view shall be removed. Completed masonry shall be protected from freezing for a period of at least 5 days.

## **FIELD QUALITY CONTROL.--**

**General.--** The Contractor shall employ, at his own expense, a special inspector and testing laboratory to perform structural tests and inspections of masonry to verify that the construction conforms to the Uniform Building Code in accordance with the requirements in Section 1701, "Special Inspections," and Section 2105, "Quality Assurance," of the Uniform Building Code. The contractor shall submit a written Field Quality Control Plan that identifies the inspector, the lab, and the procedures used. The Field Quality Control Plan shall conform to these specifications and the 1997 Uniform Building Code. The contractor's Field Quality Control Plan shall be submitted to the Engineer for approval. The Engineer shall have three weeks to approve the plan.

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

The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer.

The QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

Masonry special inspection personnel or testing firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for the following conditions:

**Special Inspector.--**The special inspector shall be, as a minimum, an International Conference of Building Officials (ICBO) certified Special Masonry Inspector. The special masonry inspector shall perform the inspections required under Section 1701.5.7., "Structural masonry" of the Uniform Building Code. The special inspector shall prepare a "Daily Field Report" providing information regarding the specific operations witnessed, including placing of masonry units and bar reinforcing, grouting, fabrication of test specimens, and other observations of importance to the work. A "Daily Field Report" is required for each day that the Special Inspector is on the jobsite. A copy of these reports shall be delivered to the Engineer on the day following the preparation. The special inspector shall submit a final signed report to the Engineer and Contractor stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications, and the applicable workmanship provisions of these specifications and the Uniform Building Code.

**Testing.**--The testing laboratory shall comply with the requirements of ASTM Designation: E 329. Test results shall be reported in writing to the Engineer and the Contractor on the same day the tests are made. Testing shall be done in accordance with Section 2105.3,"Compliance with fm" of the UBC. The contractor can establish fm by either Sections 2105.3.2, 2105.3.3, or 2105.3.3. A set of tests shall be done for each 465 m<sup>2</sup> of wall area, but not less than one test per project. Tests shall be performed on the following materials by the Unit Test Method as defined:

Concrete masonry units shall be tested in accordance with ASTM Designation: C 140.  
Grout shall be tested in accordance with ASTM Designation: C 1019.

In addition:

Mortar shall be tested in accordance with Uniform Building Code Standard: 21-16

Any work not meeting the requirements of section 2105 shall be redone and retested. Sampling, inspecting, reworking and retesting of material will be done at the contractor's expense.

## **SECTION 12-5. METALS**

### **12-5.01 STRUCTURAL STEEL FOR BUILDINGS**

#### **PART 1.- GENERAL**

##### **SUMMARY.--**

**Scope.**--This work shall consist of fabricating, assembling, furnishing and erecting structural steel in accordance with the details shown on the plans and these special provisions.

Structural steel consists of:

Wide flange beams, angles, channels, steel tube columns, metal roof decking.

**Source quality control.**--Materials and fabrication procedures are subject to inspection and tests in mill, shop and field, conducted by the Engineer or a qualified inspection agency. The Contractor or fabricator shall provide access to the Engineer or testing agency to places where the structural steel work is being fabricated or produced so that the required inspection and testing can be accomplished. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. The testing agency may inspect the structural steel at the plant before shipment; however, the Engineer reserves the right, at any time before final acceptance to reject the material that does not conform to the contract requirements.

##### **REFERENCES.--**

**General.**--Structural steel shall be fabricated, assembled and erected in accordance with American Institute of Steel Construction (AISC), "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."

Welding shall be in accordance with American Welding Society (AWS) D1.1, "Structural Welding Code - Steel."

Dimensional details and workmanship for welded joints in tubular and pipe connections shall conform to Part C, Structural Details; Part D, Special Provision for Welding Tubular Joints; and Part E, Workmanship, in Section 10 of AWS D1.1.

##### **SUBMITTALS.--**

**Product data.**--Product data for items to be incorporated into the work, including structural steel, high strength bolts, nuts and washers and alternative connectors, shall be submitted for approval.

**Working drawings.**--Working drawings and calculations shall be submitted for approval.

Working drawings shall show any changes proposed in the work, details of connections and joints exposed to the weather, details for connections not dimensioned on the plans, the sequence of shop and field assembly and erection, welding

sequences and procedures. If required, the location of butt welded splices on a layout drawing of the entire structure, and the location and details of any temporary supports that are to be used.

Calculations and working drawings for falsework to be used for the erection of structural steel shall be submitted for approval. The falsework shall be designed and constructed to provide the necessary rigidity and to support loads which will be applied. Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown.

#### **QUALITY ASSURANCE.--**

**Qualifications for welding.--**A certified copy of qualification test record for welders shall be submitted to the Engineer at the jobsite. Descriptive data for equipment for field welding structural steel, including type and electric power requirements, shall be submitted for approval.

**Certificates of Compliance.--**Certificate of Compliance shall be furnished for structural steel products in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. Certificate of Compliance shall include mill test certificates for each heat number used in the work.

#### **DELIVERY, HANDLING AND STORAGE.--**

Structural materials shall be loaded, transported, unloaded and stored so that it is kept clean and undamaged. Material shall be stored above ground on platforms, skids, or other supports. Covers and protection shall be provided to protect the materials from corrosion.

Anchorage and anchor bolts, which are to be embedded in concrete or masonry, shall be delivered in ample time to not delay the work.

### **PART 2.- PRODUCTS**

#### **MATERIALS.--**

##### **Steel bars, plates and shapes.--**

Steel bars, plates and shapes shall conform to ASTM Designation: A 36/A 36M or A 572/A 572M, Grade 50 [345].

##### **Metal roof decking.--**

Metal roof decking shall be galvanized sheet steel conforming to ASTM Designation: A 446, Grade E, and the requirements shown on the plans.

##### **Steel tubing.--**

Steel tubing shall conform to ASTM Designation: A 500, Grade B, or A 501.

##### **Stud connectors.--**

Stud connectors shall conform to ASTM Designation: A 108, Grades 1018 through 1020, cold drawn, either semi- or fully killed.

##### **Anchor bolts, nuts and washers.--**

Nonheaded anchor bolts shall conform to ASTM Designation: A 36/A 36M, with a minimum hook length of 6.2 diameters.

Headed anchor bolts shall conform to ASTM Designation: A 307.

Nuts shall conform to ASTM Designation: A 563M, Grade A.

Washers for anchor bolts shall be commercial quality.

**Machine bolts, nuts and washers.--**

Machine bolts and nuts shall conform to ASTM Designation: A 307.

Washers for machine bolts shall be commercial quality.

**High strength (HS) bolts, nuts and washers.--**

High strength (HS) bolts, nuts and washers shall conform to ASTM Designation: A 325M.

**Direct tension indicators.--**

Direct tension indicators shall conform to ASTM Designation: F 959.

**Tension control fasteners.--**

Tension control bolts shall have a splined end extending beyond the threaded portion of the bolt and which shears off when the specified bolt tension is attained.

**Inorganic zinc primer.--**

Inorganic zinc primer shall be a waterborne inorganic zinc primer conforming to the requirements of AASHTO Designation: M 300-92 I, Type II. Inorganic zinc primer shall be listed on the qualified products list which may be obtained from the Transportation Laboratory, (916) 227-7000.

**Mortar.--**

Mortar shall consist of one part cement, measured by volume, to 2 parts clean sand and only enough water to permit placing and packing.

**FABRICATION.--**

**Shop fabrication and assembly.--**Workmanship and finish shall be equal to the best general practice in modern shops.

Cuts shall not deviate more than 2 mm from the intended line. Roughness, notches or gouges shall be removed.

Bearing stiffeners at points of loading shall be square with the web and shall have at least 75 percent of the stiffener in contact with the flanges.

Finished members shall be true to line, shall have square corners and smooth bends and shall be free from twists, kinks, warps, dents and open joints.

Exposed edges and ends of metal shall be dressed smooth, with no sharp edges and with corners slightly rounded.

**Stud connectors.--**Steel surfaces shall be prepared as recommended by the manufacturer of the stud connectors. Stud connectors shall be welded to the flanges of beams or girders as shown on the plans. Automatic end welding of headed stud connectors shall be in accordance with the manufacturer's instructions.

**Connections.--**Abutting surfaces at connections shall be clean.

Cutting and welding at the jobsite will not be allowed except as shown on the approved drawings or specifically approved by the Engineer.

Finished holes for bolts shall be cylindrical and perpendicular to the plane of the connection. Subpunched and subdrilled holes shall be 6 mm smaller in diameter than the diameter specified for the finished hole.

**Bolted Connections.--**Bolts for connecting steel to steel shall be machine bolts conforming to ASTM Designation: A 307 or high-strength bolts conforming to ASTM Designation: A 325M as shown on the plans.

High-strength structural steel bolts, or equivalent fasteners, other bolts attached to structural steel, nuts, and washers shall be galvanized by mechanically deposited coating.

**Holes for other work.--**Holes for securing other work to structural steel and passage of other work through steel framing members shall be as shown on the approved drawings.

Threaded nuts or specialty items for securing other work to steel members shall be as shown on the approved drawings.

Holes shall be cut, drilled or punched perpendicular to metal surfaces. Holes shall not be flame cut or enlarged by burning. Holes are to be drilled in bearing plates.

## **SHOP PAINTING.--**

**General.--**Structural steel members, except those to receive sprayed-fireproofing, shall be painted.

**Surface preparation.--**Surfaces of structural steel to be receive inorganic zinc primer shall be blast cleaned in accordance with Steel Structures Painting Council, SSPC-SP 10, "Near-White Blast Cleaning."

**Bolted connections.--**Contact surfaces of high strength bolted connections and ungalvanized anchor bolt assemblies shall be blast cleaned and coated with waterborne inorganic zinc primer before assembly. The total thickness of primer on each surface shall be between 0.025 mm to 0.076 mm and may be applied in one application.

**Painting.--**Immediately after surface preparation, surfaces of structural steel shall receive an undercoat of waterborne inorganic zinc primer. Color shall essentially match Federal Standard 595B, No. 36373.

The manufacturer's published mixing and application instructions for inorganic zinc primer shall be followed.

## **PART 3.- EXECUTION**

### **ERECTION AND ASSEMBLY.--**

**Field splices.--**Field splices shall be made only at the locations shown on approved working drawings.

The parts shall be accurately assembled in their final position as shown on the plans and in true alignment with related and adjoining work before final fastening.

All parts shall be supported adequately and at locations to provide a vibration free, rigid, and secure installation.

**Bolted connections.--**All high strength bolted connections shall be made with high strength bolts installed with direct tension indicator washers or tension control fasteners.

When used, one mechanically galvanized direct tension washer shall be installed with each high strength bolt. Bolts shall be tightened until a direct tension indicator washer gap is 0.13 mm or less. A zero gap will not be cause for rejection.

During installation of tension control bolts, the torque required to turn the nut on the tension control bolt shall be counterbalanced by the torsion shear resistance of the splined end of the bolt.

The bolt head type and head location shall be consistent within a joint.

Nuts shall be on side of member least exposed to view.

**Setting bases and bearing plates.--**Concrete and masonry surfaces shall be cleaned and roughened to improve bond. Bottom of base and bearing plates shall be clean.

Base plates and bearing plates for structural members shall be set on wedges or other adjusting devices.

Anchor bolts shall be wrench tightened after supported members have been positioned and plumbed.

Mortar shall be solidly packed between bearing surfaces and base or bearing plates to ensure that no voids remain. Exposed surfaces shall be finished and allowed to cure.

### **FIELD PAINTING.--**

**Touch-up painting.--**After erection, the Contractor shall clean field welds, bolted connections, and abraded areas of shop paint and apply the same materials as applied for shop painting.

Surfaces that are scheduled to receive finish coats shall be painted with an additional prime coat and finish coats in accordance with the requirements specified for shop primed steel under "Painting" in Section 12-9.

### **QUALITY CONTROL.--**

**Testing and inspection.--**Ultrasonic examination shall be performed by the Contractor on at least 50 percent of all full penetration butt-welded splices in accordance with the requirements of AWS D1.1 and these special provisions.

Welding procedures and methods shall be subject to inspection for conformance with AWS D1.1.

Butt welds shall be tested in accordance with AWS D1.1, Chapter 6, Part C, Ultrasonic Testing of Groove Welds.

Examination, reporting and disposition of tests shall be in accordance with the provisions of 6.12, AWS D1.1.

In addition to ultrasonic examinations by the Contractor, welds may be subject to inspection or non-destructive testing by the Engineer.

When additional inspection or non-destructive testing is required by the Engineer, the Contractor shall provide sufficient access facilities in the shop and at the jobsite to permit the Engineer or his agent to perform such inspection and testing.

The Contractor shall correct all deficiencies in the structural steel work which inspections and laboratory test reports have indicated to be not in compliance with these special provisions. Additional tests shall be performed by the Contractor at his expense to reconfirm any non-compliance of original work, and to show compliance of the corrected work.

## **12-5.02 OPEN WEB STEEL JOISTS**

### **PART 1.- GENERAL**

**Scope.--**This work shall consist of designing, fabricating, furnishing and erecting pre-engineered, factory fabricated steel joists and accessories in accordance with the detail shown on the plans and these special provisions.

#### **SUBMITTALS.--**

**Product data.--**Manufacturers descriptive data, layout and anchorage details, quality control manual, welder qualifications, and installation instructions shall be submitted for approval.

**Working drawings.--**Complete working drawings and design calculations for the pre-engineered steel joists, permanent bracing, continuity angles and connection details shall be submitted for approval. Submittals shall be approved prior to the start of fabrication.

Design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown.

Working drawings shall show the size and shape of the truss members and temporary and permanent bracing members. Joint and connection details shall be shown.

Working drawings shall include a location plan which shows the location and identification of each steel joist.

Calculations for the design of the steel joists, bracing and connections shall include a list of applied loads and load combinations with the resulting member forces and member stresses. Steel joists and connections shall be designed for the chord forces shown on the plans.

If the design calculations contain or consist of computerized or tabulated calculations, the values pertaining to the design shall be identified, described or indexed in such a manner that a design review can be performed.

#### **QUALITY ASSURANCE.--**

**Manufacturer Qualification.--**Steel joists shall be manufactured by a firm experienced in manufacturing steel joists similar to those indicated for this contract and with a record of successful in-service performance. Manufacturer shall be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.

**Codes and Standards.--**Steel joists and permanent bracing shall be designed for the loads shown on the plans and other applied loads, including fire sprinkler systems. The design shall be in accordance with the requirements of the California Building Code (CBC) and the Steel Joist Institute "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders" (SJI-01).

**Certificates of Compliance.--**Certificates of Compliance shall be furnished for steel joists in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

#### **DELIVERY, STORAGE AND HANDLING.--**

**General.--**Steel joists shall be delivered to the site in undamaged condition and stored off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling. Covers shall be provided to protect the materials from corrosion.

Steel joists shall be handled in such a manner as to prevent damage due to bending and warping.

## **PART 2.- PRODUCTS**

### **Open web steel joists.--**

Open web steel joists shall conform to SJI-01, K-Series. Joists shall be tapered and shall be designed to support the loads shown on the plans.

### **Bearing plates, fasteners and accessories.--**

Bearing plates, fasteners and accessories shall be as shown on the approved working drawings.

### **Anchors.--**

Anchors shall conform to the requirements in "Building Miscellaneous Metal" specified under Division 5, "Metals," of these special provisions.

Anchors shall conform to the requirements in "Building Miscellaneous Metal" specified under Section 12-5, "Metals," of these special provisions.

### **Primer.--**

Primer shall be Steel Structures Painting Council, SSPC-Paint 15; Type I, red oxide.

## **FABRICATION.--**

**General.--**Workmanship and finish shall be equal to the best general practice in modern steel fabrication shops. Construction shall conform to the SJI Code of Standard Practice.

Camber, if required by the design, shall be built into the joists.

## **CLEANING AND SHOP PAINTING.--**

**Painting.--**Immediately after cleaning, surfaces of steel joists shall receive a one-coat shop applied steel prime coat of red oxide ferrous metal primer at a rate to provide a dry film thickness of not less than 0.04 mm.

Contact surfaces of bolted connections and ungalvanized anchor bolt assemblies shall be primed with organic zinc-rich primer. The total thickness on each surface shall be between one and 3 mils.

Each joist shall be stamped or marked with a location identification mark or symbol and with the name and address of the manufacturer.

## **PART 3.- EXECUTION**

### **EXAMINATION.--**

**General.--**Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### **ERECTION.--**

**General.--**Installation of joists shall be in accordance with the approved working drawings. Steel joists and bracing members shall be accurately cut to provide tightly fitted joints and connections.

Joists shall be handled in a manner to avoid damage. Damaged joists shall be removed from the site, except when field repair is approved by the Engineer and such repairs are satisfactorily made in accordance with the manufacturer's recommendations.

**Installation.--**Steel joists shall be erected plumb and true and shall be secured rigidly in place in accordance with the approved working drawings. Joists shall not be field cut or otherwise altered without the written approval of the Engineer.

Temporary bracing shall be installed during erection to hold the joists plumb and true and in a safe position until sufficient permanent construction is in place to provide full stability.

Bearing plates shall have full bearing after the supporting members have been plumbed and properly positioned, prior to placing superimposed loads.

Connectors, fasteners and other hardware accessories shall be coordinated for placement in the proper locations and positions.

Joist bridging and anchoring shall be secured in place prior to the application of any construction loads. Any temporary loads shall be distributed so that the design carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging during construction or in the completed work.

All permanent bracing shall be secured in place before any sustained permanent loads are applied to the joist system.

Welding shall be by the tungsten inert gas arc welding method or the consumable electrode inert gas method. Welding processes that require the use of flux are not permitted.

All welds shall conform to the requirements of Section 8.15, "Quality of Welds," of the American Welding Society publication No. AWS D 1.1, "Structural Welding Code."

Exposed welds shall be ground smooth and flush.

Abraded, corroded, and field welded areas shall be cleaned and touched up with the same type of paint used in the shop painting.

#### **CLEANING.--**

Immediately after erection, clean and touchup paint; field welds, bolted connections, and abraded shop primed areas of shop painted steel.

### **12-5.03 COLD FORMED METAL FRAMING**

#### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing cold formed metal framing, including load-bearing and non-bearing steel studs, and "C"-shaped steel joists and rafters, in accordance with the details shown on the plans and these special provisions.

#### **SYSTEM DESCRIPTION.--**

**Loadings.--**Components shall be sized to withstand the design loads shown on the plans.

Wall system shall be designed to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclical day/night temperature range.

Wall system design shall accommodate construction tolerance, deflection of building structural members, and clearances of intended openings.

#### **REFERENCES.--**

**Component design.--**Structural properties of studs and joists shall be computed in accordance with American Iron and Steel Institute (AISI), "Specification for Designing of Cold-Formed Steel Structural Members."

**Welding.--**Welding shall be in accordance with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

Welders shall be qualified in accordance with "Welder Qualification," procedures of AWS D1.1, "Structural Welding Code-Steel."

#### **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data and installation instructions for each item of cold-formed metal framing and accessories shall be submitted for approval.

Installation instructions shall include instructions for securing studs to tracks and other framing connections.

**Working drawings.--**Working drawings and calculations for cold formed metal framing components not fully dimensioned in manufacturer's descriptive data shall be submitted for approval.

Working drawings shall include framing members showing size and gage designations, number, type, location and spacing. Working drawings shall include supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

The cold formed metal framing supplier shall submit drawings and calculations stamped by an Engineer who is registered as a Civil or Structural Engineer in the State of California showing that the metal framing and fasteners comply with seismic and wind uplift requirements of the Uniform Building Code as amended by Title 24, Part 2, California Code of Regulations.

#### **QUALITY ASSURANCE.--**

**Fire-rated assemblies.--**Where cold formed metal framing units are components of assemblies indicated to be fire-rated, provide units which have been approved for the rating indicated on the plans.

#### **DELIVERY, STORAGE AND HANDLING.--**

**General.--**Cold formed metal framing components shall be protected from rusting and damage. Components shall be delivered to the jobsite in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Components shall be stored off ground in a dry ventilated space.

### **PART 2.- PRODUCTS**

#### **COLD FORMED METAL FRAMING.--**

##### **Steel studs, joists and rafters.--**

Load-bearing studs shall be formed to channel shape, punched web, and knurled faces, conforming to ASTM Designation: A 653M, Grade 340 (50). Studs shall be 1.52 mm (16-gage) minimum thickness and size as shown on the drawings.

Joists, rafters, and other framing components, 1.21 mm (18-gage) or lighter, shall be fabricated of commercial quality galvanized steel sheets; conforming to ASTM Designation: A 653M, Grade 230 (33).

##### **Steel Track.--**

Track shall be formed steel, channel shape, and same width as studs; solid web; not less than 1.21 mm (18-gage) thickness.

#### **ACCESSORIES.--**

##### **Fasteners.--**

Fasteners shall be hot-dipped galvanized, self-drilling, self-tapping screws, or bolts, nuts and washers.

##### **Anchorage.--**

Anchorage shall be ICBO approved for the purpose intended, integral stud type, powder driven or drilled expansion bolts.

#### **FINISHES.--**

##### **Studs, track and headers.--**

Studs, tracks and headers shall be hot-dipped galvanized to conform to ASTM Designation: A 653M, G60.

##### **Miscellaneous metal parts.--**

Miscellaneous parts, including, bracing, furring, plates, gussets, and bridging, shall be hot-dipped galvanized to not less than 381 kilograms per square meter.

## **FABRICATION.--**

**General.--**Cold formed metal framing components shall be fabricated in place or prefabricated into panels to the maximum extent possible prior to erection. Panels shall be fabricated plumb, square, true to line and braced against racking with joints welded. Lifting of prefabricated panels shall be performed in a manner to prevent damage or distortion.

Panels shall be fabricated in jig or templates to hold members in proper alignment and position to assure accurate placement.

**Fastenings.--**Components shall be fastened by shop welding, bolting or screw fasteners as shown on the approved drawings.

## **PART 3.- EXECUTION**

### **INSTALLATION.--**

**Studs.--**Studs shall be erected plumb, except as needed for diagonal bracing or similar requirements. Channel tracks shall be aligned accurately to the wall layout at both floor and ceiling. Tracks shall be secured to floor and ceiling with fasteners spaced at not more than 406 mm intervals. Fasteners shall be provided at corners and ends of track.

Studs shall extend from floor to underside of ceiling except at wall openings. Each stud shall be secured to tracks at both top and bottom by bolting or screw fastening at both inside and outside flanges. Field welding shall not be permitted. A 12 mm clearance shall be provided at the top shoes. Door openings shall have double studs continuous across head and from floor to ceiling on each jamb.

Studs at openings shall be fastened solidly and securely to floor clips. Floor clips shall be fastened to the floor with 2 anchors unless otherwise shown on the plans.

Supplemental framing, blocking and bracing shall be installed in steel stud system wherever walls or partitions are to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition.

One continuous, horizontal 19 mm channel reinforcement shall be placed approximately 152 mm above all wall openings. The reinforcement shall pass through the web openings in the studs and shall extend through the first stud located beyond the double studs at either side of the opening and shall be saddle tied to each stud it passes through.

**Joists and rafters.--**Joists and rafters shall be installed directly over bearing studs or a load distribution member shall be installed at the top track.

Web stiffeners shall be provided at reaction points where shown on the plans.

Ends of joists shall be reinforced with end clips, steel hangers, steel angle clips, steel stud section, or as otherwise recommended by the manufacturer.

Joists shall be secured to interior support systems to prevent lateral movement of bottom flanges.

## **12-5.04 BUILDING MISCELLANEOUS METAL**

### **PART 1.- GENERAL**

**Scope.--**This work shall consist of fabricating, furnishing and installing building miscellaneous metal in accordance with the details shown on the plans and these special provisions.

Building miscellaneous metal shall consist of the following:

- Interceptor grating and grating frame
- Guardrail

including all anchors, fastenings, hardware, accessories and other supplementary parts necessary to complete the work.

## **REFERENCES.--**

**Codes and standards.--**Welding of steel shall be in accordance with American Welding Society (AWS) D 1.1, "Structural Welding Code-Steel" and D 1.3, "Structural Welding Code-Sheet Steel."

## **SUBMITTALS.--**

**Product data.--**Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications.

**Working drawings.--**Working drawings of fabricated items shall be submitted for approval.

## **QUALITY ASSURANCE.--**

**Shop assembly.--**Preassemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark all units for reassembly and installation.

**Inspection and tests.--**Materials and fabrication procedures shall be subject to inspection and tests by the Engineer, in mill, shop and field. Such tests will not relieve the Contractor of responsibility of providing materials and fabrication procedures in compliance with specified requirements.

## **PART 2.- PRODUCTS**

### **MATERIALS.--**

#### **Steel bars, plates and hot-rolled shapes.--**

Steel bars, plates and hot-rolled shapes shall conform to ASTM Designation: A 36/A 36M.

#### **Grate and frame.--**

Grate and frame shall be traffic rated. Grate and frame shall be Neenah, R4990CX with Type A grate, AFC, A-2422; or equal.

#### **Stainless steel cable.--**

Stainless steel cable shall be Type 304 stainless steel wire rope with diameter as shown on the plans.

#### **Galvanized sheet steel.--**

Galvanized sheet steel shall conform to ASTM Designation: A 446M having a minimum yield strength of 228 MPa. Galvanizing shall be G60.

#### **Checkered floor plates.--**

Checkered floor plates shall be commercial quality steel with standard raised pattern.

#### **Pipe.--**

Pipe shall be commercial quality standard steel pipe.

#### **Bolts, studs, threaded rods, nuts and washers.--**

Bolts, studs, threaded rods, and nuts for general application shall conform to ASTM Designation: A 307.

Washers shall be commercial quality.

#### **Fittings.--**

Brackets, bolt, threaded studs, nuts, washers, and other fittings for railings and handrailings shall be commercial quality pipe and fittings.

**Expansion anchors.--**

Expansion anchors shall be ICBO approved for the purpose intended, integral stud type anchor or internally threaded type with independent stud, hex nut and washer.

**Powder driven anchors.--**

Powder driven anchors shall be plated, spring steel alloy drive pin or threaded stud type anchors for use in concrete or steel. Spring steel shall conform to ASTM Designation: A 227M, Class 1. The diameter, length and type of shank and the number and type of washer shall be as recommended by the manufacturer for the types and thickness of material being anchored or fastened.

**Resin capsule anchors.--**

Stud anchors for resin capsule anchors shall conform to ASTM Designation: A 307 threaded steel rod with hex nut and washer and sealed glass capsule or cartridge containing an adhesive composed of unsaturated polyester resin and benzol peroxide coated quartz sand. Resin capsule shall be Hilti; Molly; or equal.

**Drainage grates.--**

Drainage grates shall be fabricated from steel bars as specified herein; ductile iron castings conforming to ASTM Designation: A 536, Grade 65-45-12; or carbon steel castings conforming to ASTM Designation: A 27M, Grade 65-35.

**Mortar.--**

Mortar shall consist of one part cement, measured by volume, to 2 parts clean sand and only enough water to permit placing and packing.

**FABRICATION.--**

**Workmanship and finish.--**Workmanship and finish shall be equal to the best general practice in modern shops.

Miscellaneous metal shall be clean and free from loose mill scale, flake rust and rust pitting, and shall be well formed and finished to shape and size with sharp lines and angles. Bends from shearing or punching shall be straightened.

The thickness of metal and details of assembly and support shall give ample strength and stiffness.

Built-up parts shall be true to line and without sharp bends, twists and kinks. Exposed ends and edges of metal shall be milled or ground smooth, with corners slightly rounded.

Joints exposed to the weather shall be made up to exclude water.

**Galvanizing.--**Items indicated on the plans to be galvanized shall be hot-dip galvanized after fabrication. The weight of galvanized coating shall be at least 460 grams per square meter of surface area, except drainage grates shall have at least 610 grams per square meter of surface area.

**Painting.--**Building miscellaneous metal items not galvanized shall be cleaned and prime painted prior to erection in accordance with the requirements specified for steel and other ferrous metals under "Painting" in Section 12-9, "Finishes," of these special provisions.

**Loose bearing and leveling plates.--**Loose bearing and leveling plates shall be furnished for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Plates shall be drilled to receive anchor bolts. Galvanize after fabrication.

**Drainage pipes, frames and grates.--**Drain piping shall have connections sealed watertight.

Drainage grates shall have end bars of the same cross section as support bars. Connections between end bars and support bars of structural steel shall be welded all around.

Drainage frames shall be angles and plates as shown on the plans.

Drainage grates and frames shall be match marked.

## **PART 3.- EXECUTION**

### **GENERAL.--**

**Anchorage.**--Anchorage devices and fasteners shall be provided for securing miscellaneous metal in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws and other connectors.

Cutting, drilling and fitting shall be performed as required for installation of miscellaneous metal fabrications. Work is to set accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

**Loose leveling and bearing plates.**--Plates shall be set on wedges or other adjustable devices. Anchor bolts shall be wrench tightened after the plates have been positioned and plumbed. Mortar shall be packed solidly between bearing surfaces and plates to ensure that no voids remain.

**Powder driven anchors.**--Powder driven anchors shall be installed with low velocity powder actuated equipment in accordance with the manufacturer's instructions and State and Federal OSHA regulations.

**Resin capsule anchors.**--Resin capsule anchors shall be installed in accordance with the manufacturer's instructions.

### **DAMAGED SURFACES.--**

**General.**--Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating, after which the clean areas shall be painted with 2 applications of unthinned zinc-rich primer (organic vehicle type). Aerosol cans shall not be used.

## **SECTION 12-6. WOOD AND PLASTICS**

### **12-6.01 ROUGH CARPENTRY**

#### **PART 1.- GENERAL**

##### **SUMMARY.--**

**Scope.**--This work shall consist of furnishing and installing materials and performing rough carpentry work including wood framing, furring, and sheathing in accordance with the details shown on the plans and these special provisions.

Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed.

##### **SUBMITTALS.--**

**Product Data.**--Manufacturer's material data and installation instructions shall be submitted for gypsum sheathing, framing hardware and underlayments.

**Wood treatment data.**--Chemical treatment manufacturer's instructions shall be submitted for the handling, sorting, installation, and finishing of treated materials.

For each type of preservative treatment used, certification by treating plant shall include type of preservative solution and pressure process used, net amount of preservative retained and conformance with the applicable standards of the American Wood Preservers Association.

For each type of fire-retardant treatment, include certification by treating plant that the treated material complies with the applicable standards and other requirements.

## **DELIVERY, HANDLING AND STORAGE.--**

**Delivery and storage.--**Materials shall be kept under cover and dry. All materials shall be protected from exposure to weather and contact with damp or wet surfaces with blocking and stickers. All lumber, plywood and other panels shall be stacked in such a manner to provide air circulation within and around the stacks.

## **PART 2.- PRODUCTS**

### **LUMBER.--**

**General.--**Lumber shall be manufactured to comply with PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection.

Softwood lumber shall be quality grade stamped or shall be accompanied by a certificate of inspection. Inspection certificates or grade stamps shall indicate compliance with the grading requirements of WWPA, WCLIB, RIS, or other approved lumber inspection agencies.

All lumber used shall be nominal sized and dressed S4S unless otherwise specified in these special provisions.

Framing lumber shall be solid stock lumber, Douglas Fir-Larch, and the grades indicated under WCLIB or WWPA rules. Moisture content shall not exceed 19 percent and shall be grade stamped "S-Dry."

### **Miscellaneous lumber.--**

Miscellaneous lumber for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members shall be not less than No. 2 or better.

Lumber in contact with concrete or masonry construction shall be pressure treated Douglas Fir-Larch.

### **PLYWOOD PANELS.--**

**General.--**Plywood panels shall comply with Voluntary Product Standard PS1, "U.S. Product Standard for Construction and Industrial Plywood."

Plywood panels shall be Group 1 unless otherwise noted.

Each plywood panel shall be factory marked with APA or other trademark evidencing compliance with grade requirements.

### **Structural plywood wall sheathing.--**

Structural plywood wall sheathing for walls shall be APA RATED SHEATHING, Exposure 1. Thickness and grade shall be as shown on the plans.

### **Structural plywood roof sheathing.--**

Structure plywood roof sheathing shall be APA RATED SHEATHING, Exposure 1. Span rating, thickness and grade shall be as shown on the plans.

Structure plywood roof sheathing in exposed overhangs shall be APA RATED SHEATHING, A-C, Exterior, Group 1. Thickness shall be the same as the remainder of the sheathing.

### **Plywood backing panels.--**

Plywood backing panels for mounting electrical or telephone equipment shall be 19 mm plywood panels APA C-D PLUGGED, Exposure 1, touch-sanded.

## **MISCELLANEOUS MATERIALS.--**

### **Rough Carpentry Hardware.--**

Steel plates and rolled sections shall be mild, weldable steel, conforming to AISI grades 1016 through 1030 except 1017.

Nails, screws, bolts, nuts, washers shall be commercial quality. Exposed fasteners shall be hot-dipped galvanized or stainless steel.

Joist hangers, clips and other standard framing hardware shall be ICBO approved, commercial quality, galvanized sheet steel or hot dipped galvanized, of the size shown on the plans.

Expansion anchors and powder driven anchors shall be as specified under "Building Miscellaneous Metal," in Section 12-5, "Metals," of these special provisions.

**Nails.--**

Nails shall conform to ASTM F 1667-95. "Common" nails shall conform to the following table:

Nail Size	Length (mm)	Diameter (mm)
8d	63.5	3.33
10d	76.2	3.76
16d	88.9	4.11

**Building paper.--**

Building paper shall be kraft type waterproofing building paper, Type I (No. 15) asphalt saturated roofing felt or high density, bonded polyethylene fiber building paper.

**Adhesive.--**

Adhesive for plywood glue-nailed systems shall conform to APA Specification: AFG-01.

**WOOD TREATMENT BY PRESSURE PROCESS.--**

**Preservative treatment.--**

Preservative treatment shall be copper naphthenate, pentachlorophenol or water-borne arsenicals (ACA, CCA or ACZA).

The following items shall be treated:

Wood cants, nailers, curbs, equipment support bases, blocking, stripping and similar members in connection with roofing, flashing, vapor barriers and waterproofing.

Wood sills, sleepers, blocking, furring and other similar members in contact with concrete or masonry.

All holes, daps and cut ends of treated lumber shall be thoroughly swabbed with 2 applications of copper naphthenate.

**Fire retardant treatment.--**

Fire retardant treatment shall be paintable, odorless fire retardant preservative applied by pressure treating methods.

**PART 3.- EXECUTION**

**INSTALLATION.--**

**Wood framing.--**Wood framing shall be in accordance with Chapter 23 of the California Building Code.

Framing members shall be of sizes and spacing shown on the plans. Unless otherwise shown on the plans, structural members shall not be spliced between supports.

Wood framing shall be accurately cut and assembled to provide closely fitted members. Framing shall be erected true to the lines and grades shown on the plans and shall be rigidly secured in place as shown and as required by recognized standards. Bracing shall be placed wherever necessary to support all loads on the structure during erection.

The size and spacing of fasteners and the edge distance for nails shall be as shown on the plans.

Nailing schedule shall be as shown on the plans and shall comply with the California Building Code.

**Plywood panels.**--Plywood panels shall be attached to the framing as shown on the plans and these special provisions. All structural plywood sheathing (both roof and wall) shall be nailed with "Common" nails.

Plywood decking shall be glued and nailed to the framing system.

Plywood sheathing shall be nailed to the framing system and shall be continuous over 2 or more supports. Roof and floor panels shall be installed with the long dimension across the supports, with end joints staggered 1.22 m. Wall sheathing shall have all edges blocked. Spacing between panels shall be 3 mm.

## **12-6.02 FINISH CARPENTRY**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.**--This work consists of furnishing and installing materials and performing finish carpentry, including exterior and interior trim, plywood soffits and panels and plywood and softwood paneling, as shown on the plans and these special provisions.

Finish carpentry includes carpentry work not specified as part of other sections and which is generally exposed to view.

#### **SUBMITTALS.--**

**Product data.**--Manufacturer's specifications and installation instructions for each item of factory-fabricated siding and paneling.

**Samples.**--One sample shall be submitted to the Engineer at the jobsite for each species and cut or pattern of finish carpentry as shown below:

Interior standing and running trim - 610 mm long by full board or molding width, finished on one side and one edge.

Plywood paneling - 610 mm long x full panel width, finished on one side.

#### **QUALITY ASSURANCE.--**

**Factory marks.**--Each piece of lumber and plywood shall be marked with type, grade, mill and grading agency identification. Marks shall be omitted from surfaces to receive transparent finish. A mill certificate stating that material has been inspected and graded in accordance with requirements shall be furnished if marks cannot be placed on concealed surfaces.

#### **PRODUCT DELIVERY, STORAGE AND HANDLING.--**

**Delivery.**--Carpentry materials shall be delivered after painting, wet work and similar operations have been completed.

**Protection.**--Finish carpentry materials shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

### **PART 2.- PRODUCTS**

#### **WOOD PRODUCT QUALITY STANDARDS.--**

**Softwood lumber.**--Softwood lumber shall conform to the requirements of PS 20, "American Softwood Lumber Standard," with applicable grading rules of inspection.

**Plywood.**--Plywood shall conform to the requirements of Voluntary Products Standard PS-1, "U.S. Product Standard for Construction and Industrial Plywood."

**Hardwood lumber.**--Hardwood lumber shall conform to the requirements of the National Hardwood Lumber Association (NHLA) rules.

**Woodworking.**--Woodworking shall conform to the requirements of Woodwork Institute of California (WIC), "Manual of Millwork."

## **MATERIALS.--**

**General.**--Lumber sizes indicated shall be nominal sizes except as indicated by detailed dimensions. Lumber which is to be dressed or worked and dressed shall be manufactured to the actual sizes as required by PS 20.

Lumber that is to be painted may be solid or glued-up lumber at the contractor's option.

### **Plywood paneling and wainscotting.--**

Plywood paneling and wainscotting shall be APA Interior Grade A-C, Group 1, Exposure 1 plywood. Thickness shall be as shown on the plans.

### **Interior standing and running trim.--**

Standing and running trim to be painted shall be paint-grade pine, solid stock or finger jointed.

Standing and running trim to have transparent finish shall be solid hardwood, species to be shown on the plans.

### **Miscellaneous Materials.--**

Nails, screws and other anchoring devices of the type, size, material and finish required shall be provided for secure attachment, concealed where possible.

Fasteners and anchorages for exterior use shall be hot dip galvanized.

Screens for soffit vents shall be 4 x 4 or 8 x 8 mesh, galvanized screen. Open area shall be not less than 50 percent.

### **Preservative treatment.--**

Preservative treatment shall be copper naphthenate, pentachlorophenol or water-borne arsenicals (ACA, CCA or ACZA).

Wood members, except those of redwood, in contact with mortar setting beds, concrete block walls, slab on grade and other concrete work, and wood used for roofing cant and curbs shall be pressure treated with leach resistant preservative. Each piece of pressure treated lumber shall bear the AWPA label.

All holes, daps, or cuts made after treating shall be thoroughly swabbed with copper naphthenate

### **Fire retardant treatment.--**

Fire retardant treatment shall be paintable, odorless fire retardant preservative applied by pressure treating methods.

## **PART 3.- EXECUTION**

### **INSTALLATION.--**

**General.**--All work shall be installed plumb, level and true with no distortions.

**Standing and running trim.**--Standing and running trim shall be installed with minimum number of joints possible, using full length pieces to the greatest extent possible.

**Anchor finish carpentry.**--Finish carpentry shall be anchored to framing or blocking built in or attached directly to the substrate.

Interior carpentry shall be attached to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing where required for complete installation. Fine finish nails shall be used for exposed nailing, countersunk and filled flush with finished surface and matching final finish where transparent finish is indicated.

## **ADJUSTMENT, CLEANING, FINISHING AND PROTECTION.--**

**General.--**Damaged and defective finish carpentry work shall be repaired or replaced.

All exposed or semi-exposed surfaces shall be cleaned.

Finish carpentry shall be finished in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

### **12-6.03 CABINETS**

#### **PART 1.- GENERAL**

##### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing wood cabinets and plastic laminate tops, splashes and returns as shown on the plans and in these special provisions.

##### **SUBMITTALS.--**

**Product data.--**Manufacturer's product data for plastic laminates and cabinet hardware shall be submitted for approval.

**Samples.--**Three samples shall be submitted for each of the items shown below:

Plastic laminate, 203 mm x 254 mm for each type, color, pattern and surface finish.

**Working drawings.--**Working drawings for cabinets showing location of cabinets, dimensioned plans and elevations, attachment devices and other components shall be submitted for approval. Working drawings shall bear the "WIC Certified Compliance Label" on the first sheet of the drawings.

##### **QUALITY ASSURANCE.--**

**Codes and standards.--**Cabinets shall be manufactured and installed in accordance with the Manual of Millwork of the Woodwork Institute of California (WIC) requirements for the grade or grades specified or shown on the plans.

**Certificates of Compliance.--**Prior to delivery to the jobsite, the cabinet manufacturer shall issue a WIC Certified Compliance Certificate indicating that the products he will furnish for this job and certifying that they will fully meet all the requirements of the grade or grades specified.

WIC Certified Compliance Label shall be stamped on all cabinet work and swinging gate.

Each plastic laminate top shall bear the WIC Certified Compliance Label.

Prior to completion of the contract, a WIC Certified Compliance Certificate for Installation shall be delivered to the Engineer.

##### **DELIVERY, STORAGE AND HANDLING.--**

**Protection.--**Cabinets shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

#### **PART 2.- PRODUCTS**

##### **ACCEPTABLE MANUFACTURERS.--**

**Manufacturers.--**Subject to compliance with these specifications, high pressure decorative laminates shall be Consoweld Corp.; Formica Corp.; Nevamar Corp.; or equal.

## **MANUFACTURED UNITS.--**

**General.--**Cabinets shall be fabricated to the dimensions, profiles, and details shown on the plans with openings and mortises precut, where possible to receive hardware and other items and work.

Fabrication, assembly, finishing, hardware application, and other work shall be completed to the maximum extent possible prior to shipment to the jobsite.

### **Laminate clad cabinets.--**

Laminate clad cabinets shall be custom grade, flush overlay construction.

Laminate cladding shall be high pressure decorative laminate complying with NEMA LD 3. Color, pattern and finish shall be as shown on the plans. Laminate surface and grade shall be as follows:

Horizontal and vertical surfaces other than tops shall conform to GP-50 (1.27 mm nominal thickness).

Postformed surfaces shall conform to PF-42 (1.07 mm nominal thickness).

### **Laminated counter tops and splashes.--**

Laminated counter tops and splashes shall be WIC custom grade.

Surface material shall be high pressure laminated plastic conforming to NEMA LD-3, 1.27 mm thickness.

Unless otherwise shown on the plans, splashes shall be 102 mm high from the surface of the deck. Back splashes shall be continuous formed and coved. Side splashes shall be top set.

Laminated counter tops self edged, counter tops to receive sinks or plumbing fixtures shall have a bullnose.

The underside of tops and backsides of splashes shall be covered with an approved backing sheet.

## **CABINET HARDWARE AND ACCESSORY MATERIALS.--**

**General.--**Cabinet hardware and accessory materials shall be provided for cabinets.

Hardware shall be provided with standard US 26D metal plated finish or matching sprayed finish where indicated.

### **Drawer slides.--**

Drawer slides shall be side mounting full extension with fully enclosed rolling balls and rollers. Concealed slides and bearings, and positive stop. Capacity shall be not less than 35 kg, except capacity shall be not less than 45 kg for heavy duty drawers.

### **Door guides.--**

Sliding door guides shall be continuous, dual channel, metal guides, top and bottom. Bottom guide shall have crowned track.

### **Shelf supports.--**

Shelf supports shall be adjustable, semi-recessed, chrome finished pressed metal, heavy duty standards and support clip, with one inch adjustment increments.

### **Cabinet hinges.--**

Cabinet hinges shall be steel. Length of jamb leaf shall be 64 mm. The type of hinge shall be as shown on the plans.

Cabinet hinge manufacturers shall be Stanley, Hager, McKinney, or equal.

**Cabinet catches.--**

Cabinet catches shall be self aligning magnetic type in aluminum case with zinc plated steel strike.

Cabinet catch manufacturers shall be Stanley, Hager, McKinney, or equal.

**Cabinet pulls.--**

Cabinet pulls shall be 8 mm diameter rod, with 33 mm projection and 75 mm center to center fastening.

Cabinet pull manufacturers shall be Stanley, Hager, McKinney, or equal.

**FABRICATION.--**

**Shop assembly.--**Nails shall be countersunk and the holes filled, molds shall be neatly mitered and all joints shall be tight and true.

As far as practicable, work shall be assembled at the mill and delivered to the building ready to be set in place. Parts shall be smoothly dressed and interior work shall be belt sanded at the mill and hand sanded at the building. After assembly, work shall be cleaned and made ready for the specified finish.

Veneer sequence matching shall be maintained of cabinets with transparent finish.

All work shall be prepared to receive finish hardware. Finish hardware shall be accurately fitted and securely fastened as recommended by the manufacturer. Finish hardware shall not be fastened with adhesives.

Drawers shall be fitted with dust covers of 6 mm plywood or hardboard above compartments and drawers except where located directly under tops.

**Precut openings.--**Openings for hardware, appliances, plumbing fixtures, and similar items shall be precut where possible. Openings shall be accurately located and templates used for proper size and shape. Edges of cutouts shall be smoothed and edges sealed with a water-resistant coating.

**PART 3.- EXECUTION****INSTALLATION.--**

**Cabinets.--**Cabinets shall be installed without distortion so that doors and drawers fit openings properly and are accurately aligned. Hardware shall be adjusted to center doors and drawers in openings and to provide unencumbered operation. Installation of hardware and accessory items shall be completed as indicated on the approved drawings.

**Laminate tops.--**Laminate tops shall be securely fastened to base units and other support systems as indicated on the approved drawings.

**Cabinet hardware.--**Doors for cabinets shall be equipped with one pair of hinges and one catch per leaf, unless otherwise shown on the plans. Each door leaf shall be equipped with one pull.

Drawers up to 610 mm wide shall have one pull and drawers over 610 mm wide shall have two pulls.

**SECTION 12-7. THERMAL AND MOISTURE PROTECTION****12-7.01 WATER REPELLENT COATING****PART 1.- GENERAL****SUMMARY.--**

**Scope.--**This work shall consist of furnishing and applying water repellent coating to concrete or masonry surfaces in accordance with the details shown on the plans and these special provisions.

The water repellent coating shall be applied to all exterior masonry surfaces as shown on the plans.

## **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data, application instructions and general recommendations for water repellents shall be submitted for approval.

## **QUALITY ASSURANCE.--**

**Codes and standards.--**Water repellent coatings shall comply with all rules and regulations concerning air pollution in the State of California.

**Certificates of Compliance.--**Certificates of Compliance shall be furnished with each shipment of water repellent coating materials in accordance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

## **PART 2.- PRODUCTS**

### **Water repellent coating.--**

Water repellent coating shall be clear, colorless, water-based sealer. Water repellent coating shall be Hydrozo Inc., Clear Double 7; Euclid Chemical Co., Architectural Seal VOX; Tamms Industries Co., Chemstop; or equal.

## **PART 3.- EXECUTION**

**Preparation.--**All surfaces to receive water repellent coating shall be dry and cleaned by removing contaminants that block pores of the surface. Cleaning methods shall be as recommended by the water repellent manufacturer.

**Application.--**The water repellent solution shall be applied in accordance with the manufacturer's printed instructions. The time period between applications of water repellent coating shall be not less than 24 hours.

**Protection.--**Surfaces of other materials surrounding or near the surfaces to receive the water repellent coating shall be protected from overspray or spillage from the waterproofing operation. Water repellent coating applied to surfaces not intended to be waterproofed shall be removed and the surfaces restored to their original condition.

## **12-7.02 INSULATION (GENERAL)**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing insulation in accordance with the details shown on the plans and these special provisions.

Insulation materials shall be as specified in these special provisions, and shall be compatible with existing or new materials incorporated in the building.

#### **SUBMITTALS.--**

**Product data.--**A list of materials, manufacturer's descriptive data, location schedule, and time schedule shall be submitted for approval.

The list of materials to be used shall include the trade name, manufacturer's name, smoke developed and flame spread classification, resistance rating and thickness for the insulation materials and accessories.

**Schedules.--**A location schedule and time schedule shall be submitted for approval.

The location schedule shall show where each material is to be installed.

The Contractor shall provide the Engineer at the jobsite with an accurate time schedule of the areas of the building to be insulated each day. The time schedule shall be submitted 3 working days in advance of the work.

**Samples.--**Samples of insulation material shall be submitted to the Engineer at the jobsite.

**QUALITY ASSURANCE.--**

**Codes and standards.--**All insulating materials shall be certified to comply with the California Quality Standards for Insulating Materials and shall be listed in the Department of Consumer Affairs publication "Consumer Guide and Directory of Certified Insulation Material."

**DELIVERY, STORAGE AND HANDLING.--**

**General.--**Insulating materials shall be delivered to the jobsite and stored in a safe dry location with labels intact and legible.

Insulating materials shall be protected from physical damage and from becoming wet or soiled.

In the event of damage, materials shall be repaired or replaced as necessary to comply with these specifications.

**PART 2.- PRODUCTS** (Not applicable.)

**PART 3.- EXECUTION** (Not applicable.)

**12-7.02A BATT AND BLANKET INSULATION**

**PART 1.- GENERAL**

**SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing batt or blanket insulation in accordance with the details shown on the plans and these special provisions.

Batt insulation shall include faced and unfaced batts in walls and ceilings, acoustical batts for sound control and exposed batt or blanket insulation for ceilings and walls.

**QUALITY ASSURANCE.--**

**Laminator's qualifications.--**Laminator for bonding polyethylene vapor-retarder to insulating batts shall be approved by the insulation manufacturer.

The name of the laminator shall be submitted with the Product Data.

**Codes and standards.--**All batt or blanket insulation, including facings such as vapor barriers, shall have a flame-spread rating not to exceed 25 and a smoke density not to exceed 450 when tested in accordance with CBC Standard No. 8-1.

The flame-spread and smoke density limitations do not apply to facings on batt insulation installed between ceiling joists, or in roof-ceiling or wall cavities, provided the facing is installed in substantial contact with the surface of the ceiling or wall finish.

**PART 2.- PRODUCTS**

**INSULATING MATERIALS.--**

**General.--**Fiberglass batts shall be thermal insulation produced by combining glass fibers with thermosetting resins to comply with ASTM Designation: C 665.

**Wall insulation.--**

Wall insulation shall be R-3.3 K• m<sup>2</sup>/W fiberglass batts with paper-laminate vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665, Type II, Class C.

**Ceiling insulation.--**

Ceiling insulation shall be R-5.3  $K \cdot m^2/W$  fiberglass batts with paper-laminate vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665, Type II, Class C.

**Acoustical insulation.--**

Acoustical insulation shall be 89 mm, unfaced fiberglass insulation batts. Insulation shall conform to ASTM Designation: C 665, Type I.

**Exposed insulation.--**

Exposed insulation shall be fiberglass batts with foil-paper vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665, Type III, Class A. Exposed insulation for ceilings shall be R-5.3  $K \cdot m^2/W$  and R-3.3  $K \cdot m^2/W$  for walls.

Exposed insulation shall be fiberglass batts with bonded polyethylene vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665, Type I. Exposed insulation for ceilings shall be R-5.3  $K \cdot m^2/W$  and R-3.3  $K \cdot m^2/W$  for walls.

**VAPOR-RETARDERS.--****Paper-laminate vapor-retarder.--**

Paper-laminate vapor-retarder shall be kraft paper sheets laminated together with asphalt or other vapor retarding compounds, scrim reinforced at edges of sheets.

**Foil-paper vapor-retarder.--**

Foil-paper vapor-retarder shall be 0.0076 mm reflective aluminum foil laminated with scrim reinforcing to plastic-coated kraft paper.

**Polyethylene vapor-retarder.--**

Polyethylene vapor-retarder shall be factory-applied, 0.076 mm, white polyethylene film, a blend of fiberglass and polyester yarn reinforcement, and metallized polyester film laminated with a flame resistant adhesive, and a Class I flame-spread classification.

**AUXILIARY INSULATION MATERIALS.--****Insulation tape.--**

Insulation tape shall be as recommended by the insulation manufacturer.

**Insulation adhesive.--**

Insulation adhesive shall be the type recommended by the insulation manufacturer and complying with the requirements for fire resistance.

**FABRICATION--**

**General.--**Polyethylene shall be factory laminated to fiberglass batts or blankets by an applicator approved by the manufacturer of the batts or blankets.

**PART 3.- EXECUTION****INSTALLATION.--**

**General.--**The vapor retarder on faced batts shall be toward the interior and shall be fastened to provide a sealed retarder. Punctures and holes in the retarder shall be repaired.

Unless otherwise shown on the plans or specified elsewhere in these special provisions, insulation shall be kept 75 mm to 100 mm clear of lighting fixtures and heat producing electrical appliances and equipment.

**Installing batt type insulation.--**Insulation batts shall be installed to completely fill the space between framing members. Apply a single layer of insulation of required thickness, unless otherwise shown on the plans or required to make up total thickness. Installation shall conform to the manufacturer's recommendations and these special provisions.

**Installing exposed insulation.--**Exposed insulation shall be installed on impaling pins adhered to the substrate at 406 mm centers each direction with a minimum distance of 102 mm to the edge of the batt. Retainer clips shall be placed onto the pins so that the batt is slightly compressed. Pins shall be cut within 13 mm of the retaining clips and protective rubber caps placed on the ends of the pins.

When line wire is shown on the plans, blankets shall be supported with line wire spaced at 405 mm on center.

Joints in exposed insulation shall be sealed by lapping not less than 100 mm. Exposed insulation shall be fastened to framing at top, end and bottom, at perimeter of wall openings and at lap joints.

Overlapping joints shall be sealed with insulation adhesives as recommended by vapor retarder manufacturer's printed directions. Butt joints and fastener penetrations shall be sealed with insulation tape of the type recommended by the vapor retarder manufacturer. Joints at pipes, conduits, electrical boxes and similar items penetrating the vapor retarder shall be sealed.

## **12-7.02B RIGID WALL INSULATION**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing rigid wall insulation in accordance with the details shown on the plans and these special provisions.

Rigid insulation shall include rigid insulation, wood nailers, fasteners and such other materials, not mentioned, which are required for the complete installation of the rigid insulation system.

#### **QUALITY ASSURANCE.--**

**Codes and standards.--**Rigid foam insulation shall have a flame-spread rating not to exceed 75 and a smoke density not to exceed 450 when tested in accordance with UBC Standard No. 8-1. Rigid foam insulation shall be approved in accordance with UBC Standard 26-3 to be installed exposed, or without a thermal barrier on the room side of the insulation.

### **PART 2.- PRODUCTS**

#### **Rigid insulation.--**

Rigid insulation shall be rigid rectangular boards of polyisocyanurate foam with vinyl facing on both sides and an aged thermal resistance of  $R-1.9 \text{ K} \cdot \text{m}^2/\text{W}$ .

#### **Wood nailers.--**

Wood nailers shall be Douglas fir, Hem-fir or equivalent western softwood. Nailers in contact with masonry or concrete shall be pressure treated after fabrication. Wood preservatives shall be waterborne type.

#### **Insulation tape.--**

Insulation tape shall be as recommended by the insulation manufacturer.

#### **Adhesive.--**

Adhesive shall be construction grade panel adhesive as recommended by the insulation manufacturer.

#### **PVC strips.--**

PVC strips shall be interlocking male and female white PVC strips.

**Fasteners.--**

Fasteners shall be concrete nails; Bostich, Pneumatic Nail System; Buildex, Tampon Fasteners; or equal.

**EXECUTION.--**

**Installation of rigid insulation.--** The preparation of the wall surfaces and the installation of insulation shall conform to the manufacturer's recommendations and these special provisions.

Rigid insulation placed behind plywood or gypsum board shall be tight fitting between nominal 51 mm x 102 mm wood nailers laid flat and spaced 0.6 meter on center. Wood nailers shall also be placed at the top and bottom of the plywood or gypsum board.

All joints between insulation boards and between insulation boards and wood nailers shall be taped.

Insulation panels with broken or crushed corners or edges shall be trimmed free of such defects or shall be discarded. Replacement boards less than 300 mm wide shall not be used.

Damaged insulation in the completed work shall be removed and replaced. Insulation that has been wet or is wet shall be considered damaged.

**12-7.02C RIGID ROOF INSULATION****PART 1.- GENERAL****SUMMARY.--**

**Scope.--** This work shall consist of furnishing and installing rigid roof insulation in accordance with the details shown on the plans and these special provisions.

Rigid insulation shall include rigid insulation, underlayment, wood nailers, fasteners and such other materials, not mentioned, which are required for the complete installation of the rigid insulation system. Materials and installation shall be coordinated with the roof covering system to meet the requirements for a Class 1 Factory Mutual approved assembly.

**PART 2.- PRODUCTS****Rigid roof insulation.--**

Rigid roof insulation shall be preformed board roof insulation. Insulation shall be polyisocyanurate foam-type rigid plastic insulation, 1.2 m by 2.4 m panels, with a minimum aged R value of 1.27 K• m<sup>2</sup>/W per 25.4 mm determined by ASTM Designation: C 518 test method at 23.9 °C on material conditioned in accordance with the 6-month conditioning procedure outlined in PIMA Technical Bulletin 101(RIC/TIMA Technical Bulletin 281-1).

Rigid foam insulation shall have a flame-spread rating not to exceed 75 and a smoke density not to exceed 450 when tested in accordance with UBC Standard No. 8-1.

**Insulation tape.--**

Insulation tape shall be as recommended by the insulation manufacturer.

**Nailers.--**

Nailers shall be Douglas fir, hem-fir or equivalent western softwood pressure treated after fabrication. Wood preservatives shall be waterborne type.

**Fastener (metal decking)--**

Fastener (metal decking) shall be as recommended by the manufacturer.

**PART 3.-EXECUTION**

**Preparation.--** The preparation of the deck surfaces shall conform to the manufacturer's recommendations and these special provisions.

The deck surface shall be made smooth and level.

**Installation.--**Insulation panels shall be placed with end joints staggered and with joints of the second layer offset at least 150 mm from joints in the first layer.

Insulation panels shall be oriented with the long side perpendicular to the decking flutes. End joints between panels shall be staggered.

Insulation clips and fasteners shall resist the wind uplift classification specified for the roof covering.

The first layer of insulation shall be mechanically fastened as recommended by the manufacturer to meet the requirements of the Factory Mutual Loss Prevention Data 1-28. At least one fastener per 0.2 square meter of insulation panel shall be used. Panels that are cracked or broken by the installation of the mechanical fasteners shall be replaced.

Additional layers of insulation, if multi-layer insulation is used, shall be secured with a solid uniform application of hot bitumen applied at the rate of 14.6 kilograms per 10 square meters.

The completed layer of insulation shall be smooth and level, and suitable for the proper bedding of succeeding layers of roofing material.

Continuous joints between insulation units and parallel to decking flutes shall not occur over the flute openings. Both units shall have full edge bearing on rib tops.

Insulation panels with broken or crushed corners or edges shall be trimmed free of such defects or shall be discarded. Replacement boards less than 305 mm wide shall not be used.

Damaged insulation in the completed work shall be removed and replaced. Insulation that has been wet or is wet shall be considered damaged.

## **12-7.03 ROOF BOARD**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing roof board in accordance with the details shown on the plans and these special provisions.

Roof board shall include, fasteners and such other materials, not mentioned, which are required for the complete installation of the roof board system. Materials and installation shall be coordinated with the roof covering system to meet the requirements for a Class 1 Factory Mutual approved assembly.

#### **SYSTEM DESCRIPTION.--**

**Design Requirements.--**The roof board installation shall conform to the wind design requirements for uplift in Chapter 16 of the Uniform Building Code for the wind speed and exposure shown on the plans.

#### **SUBMITTALS.--**

**Product Data.--**Manufacturer's technical product data, installation instructions, and recommendations for each type of roof board material shall be submitted for approval.

Product data shall include the manufacturer's name and a complete material description of all components of the roof board installation.

**Working Drawings.--**Working drawings showing the layout and details of the roof board installation shall be submitted for approval.

Working drawings shall show the shape, size, thickness, and method of attachment for each component used in the work; the layout and spacing of fasteners; and details of connections.

Design calculations for the fastening system with the metal roof decking shown on the plans shall be submitted to verify compliance with the design requirements.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown. The Engineer's signature shall be original.

## **QUALITY ASSURANCE.--**

**Certificates of Compliance.--**Certificates of Compliance shall be furnished for the roof board system in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

## **DELIVERY, HANDLING AND STORAGE.--**

**Delivery and handling.--**Panels shall be protected against damage and discoloration.

**Storage.--**Panels shall be stored above ground, with one end elevated for drainage and protected against standing water and condensation between adjacent surfaces.

## **PART 2.- PRODUCTS**

### **Roof board.--**

Roof board shall be panels 1.2 m by 2.4 m or greater long, 13 mm to 16 mm in thickness. Long edges of panels shall be interlocking and panels shall have guide markings clearly printed on the top surface of each board to facilitate the proper location and spacing of the screw fasteners. Roof board shall be Loadmaster, Mineral Board; Georgia Pacific, DensDeck; NRG Barriers, Inc., NRG nailboard; or equal. Alternatively, roof board may be minimum 12 mm plywood, APA Rated Sheathing, Exposure 1.

### **Fastener (metal decking)--**

Fastener (metal decking) shall be galvanized spring steel barbed clip driven through galvanized 25 mm minimum nominal diameter caps; galvanized hardened steel nail with 25 mm minimum nominal diameter head and serrated shank to provide breakout resistance; or threaded self tapping screw driven through 75 mm minimum nominal diameter galvanized cap.

## **EXECUTION.--**

**Preparation.--**The preparation of the insulation surfaces shall conform to the manufacturer's recommendations and these special provisions.

The insulation surface shall be made smooth and level.

**Installation.--**The roof board shall be mechanically fastened as shown on the approved working drawings. Panels that are cracked or broken by the installation of the mechanical fasteners shall be replaced.

The completed layer of roof board shall be smooth and level, and suitable for the proper bedding of succeeding layers of roofing material.

Continuous joints between roof board units and parallel to insulation units below shall be offset 150 mm.

Roof boards with broken or crushed corners or edges shall be trimmed free of such defects or shall be discarded. Replacement boards less than 305 mm wide shall not be used.

Damaged roof board in the completed work shall be removed and replaced. Roof board that has been wet or is wet shall be considered damaged.

## **12-7.04 THROUGH-PENETRATION FIRESTOPPING**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing firestopping materials at penetrations in fire-rated walls, floors, and ceilings in accordance with the details shown on the plans and these special provisions.

## **SUBMITTALS.--**

**Product data.--**A list of materials, manufacturer's descriptive data, and location schedule shall be submitted for approval.

Descriptive data shall include trade names, manufacturers' names, complete information on the materials to be applied, California State Fire Marshal Listing, the material thickness for the required fire resistance ratings, and the manufacturer's printed instructions for installation. Manufacturer's assembly shall be California State Fire Marshal approved.

## **QUALITY ASSURANCE.--**

**Certificates of Compliance.--**Certificates of Compliance shall be furnished with each shipment of firestopping materials in accordance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

## **DELIVERY, STORAGE AND HANDLING.--**

**Delivery.--**Materials to be applied shall be delivered in original unopened packages. Packages shall be identified by the manufacturer's label and shall bear proper labels for fire resistance classification.

**Storage.--**Materials shall be stored above ground, under cover, and in a dry location until ready for use. Packages which have been exposed to moisture before use shall be discarded.

## **PART 2.- PRODUCTS**

### **Fire-rated caulk.--**

Fire-rated caulk shall conform to ASTM Designation: E 814 and shall be rated for use in 2 and 3-hour fire-rated assemblies. Fire-rated caulk shall be 3M Brand, Fire Barrier Caulk; Dow Corning, Fire Stop Sealant; Standard Oil, Fyre Putty; or equal.

### **Wrap strip.--**

Wrap strip shall be nominal 6 mm thick intumescent elastomeric material in 50 mm wide strips, faced one side with aluminum foil, and rated for use in 1-hour and 2-hour fire-rated systems.

### **Packing material.--**

Packing material shall be polyethylene backer rod or nominal one inch thickness of tightly packed ceramic (alumina silica) fiber blanket, mineral-wool batt or glass fiber insulation material.

### **Fire-rated mortar.--**

Fire-rated mortar shall be non-asbestos, 753 to 913 kilograms per cubic meter air dried density portland cement fly ash through-penetration firestopping mortar. Fire-rated mortar shall conform to ASTM Designation: E 814 and shall be rated for use in 3-hour fire-rated systems at 75 mm minimum thickness.

### **Fire safing insulation.--**

Fire safing insulation shall be inorganic 56 kilograms per cubic meter minimum density, non-combustible fiber insulation conforming to Federal Specifications HH-1-521F, when tested in accordance with ASTM Designation: E 119 and ASTM Designation: E 136 for 3 hour fire resistance.

## **PART 3.-EXECUTION.--**

**Installation.--**Firestopping materials shall be installed to conform to the requirements of the California State Fire Marshal Listing and the manufacturer's recommendations.

## 12-7.05 METAL ROOFING

### PART 1.- GENERAL

#### SUMMARY.--

**Scope.--**This work shall consist of furnishing and installing preformed metal roofing in accordance with the details shown on the plans and these special provisions.

Metal roofing system shall consist of underlayment, prefinished metal roof panels, concealed fasteners, sealants, and other accessories and components, not mentioned, which are required for a complete, securely fastened and weathertight installation.

#### SYSTEM DESCRIPTION.--

**Design Requirements.--**The roofing system shall conform to the wind design requirements for uplift in Chapter 16 of the Uniform Building Code for the wind speed and exposure shown on the plans.

#### SUBMITTALS.--

**Product Data.--**Manufacturer's technical product data, installation instructions, and recommendations for each type of roofing material shall be submitted for approval.

Product data shall include the manufacturer's name and a complete material description of all components of the metal roofing system.

**Samples.--**Material samples shall include a 305 mm x 305 mm sample of the roofing panel for each color to be installed and a sample of each anchor clip and fastening device.

**Working Drawings.--**Working drawings showing the layout and details of the metal roofing shall be submitted for approval.

Working drawings shall show the shape, size, thickness, and method of attachment for each component used in the work; the layout and spacing of fasteners; details of connections and closures; and details for expansion joints and weathertight joints.

Design calculations for the fastening system with the substrate shown on the plans shall be submitted to verify compliance with the design requirements.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown. The Engineer's signature shall be original.

#### QUALITY ASSURANCE.--

**Certificates of Compliance.--**Certificates of Compliance shall be furnished for the metal roofing system in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

#### DELIVERY, HANDLING AND STORAGE.--

**Delivery and handling.--**Panels shall be protected against damage and discoloration.

**Storage.--**Panels shall be stored above ground, with one end elevated for drainage and protected against standing water and condensation between adjacent surfaces.

## **PART 2.- PRODUCTS**

### **MATERIALS.--**

#### **SHEET MATERIAL.--**

##### **Base metal.--**

Base metal shall be cold formed, 0.71 mm (24-gage), galvanized sheet steel with G90 coating, conforming to ASTM Designation: A 446, Grade A except where a higher strength is required for performance, extra smooth, or cold formed aluminum-zinc alloy-coated, commercial quality, sheet steel with AZ55 coating conforming to ASTM Designation: A 792, Grade 40, extra smooth.

##### **Configuration.--**

Metal roofing system shall be a standing seam system with standing rib a minimum of 38 mm high and spaced at 464.

#### **METAL FINISHES.--**

**General--**Coatings shall be applied before or after forming and fabricating panels, as required for maximum coating performance capability.

Colors or color matches shall be as shown on the plans or, if not otherwise shown, shall be as selected by the Architect from the manufacturer's standard color palette.

##### **Fluoropolymer coating.--**

Finish shall be the manufacturer's standard Kynar coating with a baked on primer (0.005 mm) and a finish coat of 0.02 mm nominal for a total dry film thickness of approximately 0.025 mm nominal.

Interior finish shall consist of a 0.004 mm epoxy primer and a backer coat.

#### **MISCELLANEOUS METAL SHAPES.--**

##### **Flashings.--**

Flashings shall be formed from the same material, gage and in the same finish as the roofing panels.

#### **MISCELLANEOUS MATERIALS--**

##### **Fastener clips.--**

Fastener clips shall be noncorrosive ferrous metal fasteners as recommended by the metal roofing system manufacturer to resist the design loads.

##### **Fasteners.--**

Fasteners shall be as recommended by the metal roofing system manufacturer. Sheet metal screws shall not be used except to fasten trim and flashings.

##### **Underlayment.--**

Underlayment shall be as recommended by the metal roofing system manufacturer, but not less than 7 kilograms minimum asphalt impregnated fiber glass mat roofing felt.

##### **Sealant and sealant tape.--**

Sealant and sealant tape shall be as recommended by the roofing manufacturer.

##### **Closures.--**

Closures shall be rubber, neoprene, closed cell plastic or prefinished metal.

## **FABRICATION.--**

**General.--**Unless otherwise shown on the plans, or specified herein, roof panels shall be fabricated in continuous lengths for the length of the roof, from ridge or peak to eave, except such length shall not exceed the manufacturer's maximum production length. Flashings shall be fabricated in the longest practical lengths.

Roofing panels shall be factory formed. Field formed panels are not acceptable.

## **PART 3.- EXECUTION.--**

### **INSTALLATION.--**

**Underlayment.--**The roof and fascia panels shall be installed over underlayment. Underlayment shall be laid parallel to the eaves, shingle fashion with 152 mm edge laps and 305 mm end laps and shall be fastened as recommended by the metal roofing system manufacturer.

**Roof panels.--**The roof system shall be installed and fastened in accordance with the details shown on the plans and the approved working drawings. Cutting and fitting shall present a neat and true appearance with exposed burrs removed. Openings through roof panels shall be cut square and shall be reinforced as recommended by the metal roofing system manufacturer.

Roof panels shall be adjusted in place and properly aligned for the detailed conditions before fastening. Panels shall not be warped, bowed or twisted. The surface finish on the panels shall not be cracked, blemished or otherwise damaged.

Gaskets, joint fillers, sealants and sealing tape shall be installed where indicated on the approved drawings or as required for weatherproof performance of panel systems.

Fasteners shall not be driven through roof panels or batten covers.

**Miscellaneous metal shapes.--**Trim, fascia, flashings, and other prefinished metal work shall be positioned to the correct alignment for each detailed condition. Metal work shall be securely attached to backing using fasteners at the spacing shown on approved working drawings. Prefinished metal to be installed over concrete, masonry or plaster shall be back-coated with asphaltic paint as recommended by the metal roofing system manufacturer.

Roof panels, trim, and other prefinished metal that are marred, punctured, incorrectly bent, or incorrectly installed will be considered damaged and shall be replaced with undamaged units.

Gutters shall be fabricated by the metal roofing system manufacturer to the shape and lengths shown on the plans. Expansion joints shall conform to the manufacturer's recommendations and to SMACNA "Architectural Sheet Metal Manual."

The metal roofing system shall be installed weathertight. Closures shall be tight fitting and shall be provided at the ends of panels, at the boundary of the roof, and as indicated on the approved working drawings.

### **CLEAN UP AND CLOSE OUT.--**

**Clean up.--**Adjacent surfaces shall be protected during the roofing system installation and sealant work. Excess sealant shall be removed as the installation progresses.

Roof panels, molding, trim, and other prefinished metal surfaces shall be cleaned after installation as recommended by the manufacturer. Exposed cuts shall be touched-up with a matching durable primer and paint as recommended by the metal roofing system manufacturer.

**Touch up.--**Damaged paint surfaces shall be touched up by using an air dry touch up paint supplied by the metal roofing system manufacturer. Only a small brush shall be used for touching up. No spraying of touch up paint is to be performed.

**Damaged units.--**Panels and other components of the work which have been damaged or have deteriorated beyond successful repair shall be removed and replaced.

## 12-7.06 SHEET METAL FLASHING

### PART 1.- GENERAL

#### SUMMARY.--

**Scope.--**This work shall consist of fabricating, furnishing and installing sheet metal flashing in accordance with the details shown on the plans and these special provisions.

Sheet metal shall include metal flashings, counterflashings, straps, and screen type vents.

#### QUALITY ASSURANCE.--

**Codes and standards.--**Sheet metal work shall in accordance with the requirements in the latest edition of the Sheet Metal and Air Conditioning Contractors National Association "Standard Practice in Architectural Sheet Metal Work."

### PART 2.- PRODUCTS

#### MATERIALS.--

##### Galvanized sheet steel.--

Galvanized sheet steel shall conform to ASTM Designation: A 361, not less than 0.71 mm (24-gage), unless otherwise shown on the plans. Surfaces to be painted shall not have factory coatings on galvanizing that cannot be removed by paint thinner.

##### Sheet aluminum.--

Sheet aluminum shall be not less than 0.81 mm thick, mill finish, 3003-H14 alloy, conforming to ASTM Designation: B 209.

##### Sheet lead.--

Sheet lead shall be not less than 1.6 mm thick, made from chemical lead, conforming to ASTM Designation: B 29.

##### Hardware and fastenings.--

Hardware and fastening for premolded roof flashings shall be stainless steel.

##### Solder.--

Solder shall conform to ASTM Designation: B 32, Alloy Grade Sn50.

##### Soldering flux.--

Soldering flux shall be acid type, conforming to Federal Specification: O-F-506C, Type I, Form A.

##### Insect screen.--

Insect screen shall be industrial wire cloth and screen, medium grade, 18 mesh, 0.43 mm diameter, 1 mm openings, plain weave, galvanized steel conforming to ASTM Designation: E 437.

##### Lap joint sealant.--

Lap joint sealant for concealed locations shall be a non-drying butyl.

##### Flashing cement.--

Flashing cement shall be a bituminous plastic cement, asbestos free, conforming to ASTM Designation: D 4586, Type II.

##### Sealant.--

Sealant for exposed locations shall be a silicone sealant conforming to ASTM Designation: C 920.

**Primer.--**

Primer shall be as recommended by the sealant manufacturer.

**Coal tar paint.--**

Coal tar paint shall be coal-tar epoxy coating conforming to U.S. Corps of Engineers Specification: C-200 or Steel Structures Painting Council Paint Specification: SSPC-16-68T.

**FABRICATION.--**

**General.--**Sheet metal shall be assembled to Sheet Metal and Air Conditioning Contractors National Association Standards.

Sheet metal shall be formed to the sizes, shapes and dimensions shown on the plans or as specified herein with angles and lines straight, sharp and in true alignment. The number of joints shall be kept to a minimum.

Angle bends and folds for interlocking the metal shall be made with full regard for expansion and contraction to avoid buckling or fullness in the metal after it is installed.

Joints in sheet metal work shall be closed watertight unless slip joints are specifically required. Watertight joints shall be mechanically interlocked and then thoroughly soldered for metals other than aluminum. Watertight joints in aluminum or between aluminum and other metals shall be sealed with acrylic sealant.

Sheet metal joints to be soldered shall be cleaned with steel wool or other means, pre-tinned and soldered watertight.

All joints shall be wiped clean of flux after soldering. Acid flux shall be neutralized by washing the joints with sodium bicarbonate.

Flashings shall have a 45 degree drip return at bottom edges. Unless otherwise shown on the plans, counterflashing shall extend not less than 100 mm over roofing or other materials protected by the counterflashing and shall be arranged so that roofing or materials can be repaired without damage to the counterflashing.

**PART 3.- EXECUTION**

**PREPARATION.--**Surfaces to receive sheet metal shall be clean, smooth and free from defects.

**PROTECTION.--**Aluminum surfaces to be in contact with concrete, mortar, or dissimilar metals shall be given a heavy coat of coal tar paint.

**INSTALLATION.--**

**Roof penetration flashings.--**All pipes, ducts, vents and flues passing through roofs shall be made waterproof with flashings of storm collars or counterflashings.

Roof penetration flashings shall be fabricated from galvanized sheet steel, not less than 0.71 mm (24-gage). Size and shape shall be as shown on the plans.

The lower flashing shall be galvanized sheet metal, 0.71 mm (24-gage), and extend 150 mm minimum from outside of the pipe in all directions and 38 mm above the top of the roofing.

The top flashing shall be galvanized sheet steel or sheet lead as shown on the plans.

**12-7.07 SEALANTS AND CAULKING****PART 1.- GENERAL****SUMMARY.--**

**Scope.--**This work shall consist of furnishing and applying sealants and caulking which are required for this project, but not specified elsewhere, in accordance with the details shown on the plans and these special provisions.

## **QUALITY ASSURANCE.--**

**Certificates of Compliance.--**Certificates of Compliance shall be furnished for the sealants and caulking in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

## **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data and installation instructions for all sealants shall be submitted for approval.

**Samples.--**Color samples of all sealants shall be submitted for approval. Unless otherwise shown on the plans, colors will be selected by the Engineer from the manufacturer's standard colors.

## **PART 2.- PRODUCTS**

### **MATERIALS.--**

**General.--**All sealants, primers and accessories shall be non-staining to adjacent exposed surfaces. Products having similar applications and usage shall be of the same type and same manufacturer. Gun consistency compound shall be used unless otherwise required by the job conditions.

#### **Acrylic sealant.--**

Acrylic sealant shall be one component, solvent release acrylic sealant.

#### **Butyl sealant.--**

Butyl sealant shall be one component, skinning type.

#### **Silicone sealant.--**

Silicone sealant shall be one component, low modulus building sealant. Sealant shall be tack-free in one hour, shall not sag or flow, shall be ozone resistant and capable of 100 percent extension without failure.

#### **Joint sealant.--**

Joint sealant shall be a two-part, non sag polysulfide base, synthetic rubber sealant formulated from liquid polysulfide polymer.

#### **Backer rod.--**

Backer rod shall be round, open or closed cell polyurethane. Backer rod shall be sized such that it must be compressed between 25 and 75 percent of its uncompressed diameter during installation in the joint.

#### **Neoprene.--**

Neoprene shall conform to the requirements of ASTM Designation: C 542.

## **PART 3.- EXECUTION**

### **APPLICATION.--**

**General.--**Unless otherwise shown on the plans, sealants shall be applied in accordance with the manufacturer's instructions.

Silicone sealants shall not be used in locations where painting is required.

Butyl sealants shall not be used in exterior applications, and acrylic sealants shall not be used in interior applications.

Sealants shall be applied in a continuous operation for the full length of the joint. Immediately following the application of the sealant, the sealant shall be tooled smooth using a tool similar to that used to produce concave masonry joints. Following tooling, the sealant shall remain undisturbed for not less than 48 hours.

## SECTION 12-8. DOORS AND WINDOWS

### 12-8.01 HINGED DOORS

**GENERAL.**--This work shall consist of furnishing and installing hinged doors and frames in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.**--Manufacturer's descriptive data, installation instructions for fire rated assemblies and a door schedule shall be submitted for approval. The door schedule shall include a description of the type, location and size of each door and frame.

#### **PRODUCTS.**--

##### **Metal door.**--

Metal door shall be flush, seamless steel door factory prepared and reinforced to receive hardware and having cold rolled stretcher leveled sheet steel face sheets not less than 1.2 mm thick (18-gage). Face sheets shall be bonded with thermosetting adhesive to rigid board honeycomb or precured foam core; or face sheets shall be welded to all parts of an assembled grid of cold formed pressed metal stiffeners and framing members located around edges, ends, openings and at all locations necessary to prevent buckling of face sheets. Seams shall be tack welded, filled and ground smooth. Bottom edge and internal stiffeners of grid type core shall have moisture vents. Welds on exposed surfaces shall be ground smooth. Louvered or glazed openings shall be provided where shown on the plans.

Where fire rated doors are required, doors shall be listed and labeled for the fire rating shown on the plans.

Active leaf of double door shall have a full height astragal of 3 mm flat bar or folded sheet strip, not less than 1.5 mm thick (16-gage), welded on the outside of the active leaf.

Door shall be cleaned and treated by the bonderized process or approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

##### **Aluminum door.**--

Aluminum door shall be glazed door with medium stiles of not less than 3 mm nominal wall thickness, clear anodized, thermally treated and artificially aged 6061 or 6063 extruded aluminum alloy tubing reinforced to receive hardware.

##### **Glazing for doors.**--

Glazing for doors shall be safety glass as specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions. Glazing shall be not less than 5 mm thick.

##### **Door louvers.**--

Door louvers shall be inverted V-type factory primed, galvanized sheet steel louvers. Exterior door louvers shall not be removable from outside of the building. Louvers at exterior doors shall have inside mounted bronze insect screens.

##### **Fire rated louvers.**--

Fire rated louvers shall be factory fabricated, multi-blade adjustable fire damper type units of galvanized steel sheet not less than 1.5 mm thick (16-gage) with a 71°C fusible link and removable bronze 16 x 16 mesh insect screen mounted on the inside of the units. Fire rated louvers shall be listed for the fire rating shown on the plans.

Louvers shall be cleaned and treated by the bonderized process or approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

**Pressed metal frame.--**

Pressed metal frame shall be not less than 1.5 mm thick (16-gage) sheet steel with integral stop, mitered corners, face welded and ground smooth corners. Frames shall be reinforced for all hardware and shall be cleaned and treated by the bonderized process or an approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Frames for fire rated doors shall be listed for the same rating shown on the plans for fire rated doors.

**Sealants.--**

Sealants shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, multicomponent, Federal Specification: TT-S-227.

**EXECUTION.--**

**INSTALLATION.--**Doors and frames shall be installed rigidly, securely, plumb and true and in such a manner that the doors operate freely without rubbing or binding. Clearance between frame and door shall be not more than 3 mm. The exterior frame shall be sealed weathertight.

Pressed metal frames shall be secured with clips and anchors as shown on the plans.

Fire rated assemblies shall be installed according to the manufacturer's recommendations.

Fire rated assemblies shall include doors, door frames, automatic smoke-actuated closers, self-closing mechanisms, panic hardware, wire glass, and fire rated louvers. Assemblies shall be approved by the California State Fire Marshal.

**PAINTING.--**Except for the primer application specified herein, doors and frames shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

**12-8.02 ACCESS DOORS**

**GENERAL.--**This work shall consist of furnishing and installing access doors in accordance with the details shown on the plans and these special provisions

**SUBMITTALS.--**Manufacturer's descriptive data and installation instructions shall be submitted for approval.

**PRODUCTS.--****Access doors.--**

Access doors shall be factory assembled and factory prime painted steel. Door panel shall be 1.90 mm thick (14-gage) and door frame shall be 1.5 mm thick (16-gage). The door and frame assembly shall have standard screw driver operated cam locks, concealed springs or continuous piano hinge and inside release handle. Access doors shall be by Babcock-Davis Hatchways, Bar-Co Access Doors, Inryco-Milcor, J.L. Industries, or equal.

**EXECUTION.--**

**INSTALLATION.--**Access doors shall be installed in accordance with the manufacturer's recommendations. The access door assemblies shall be painted to the match the color of the adjacent surrounding surfaces.

**12-8.03 ALUMINUM ENTRANCE DOOR AND STOREFRONT**

**GENERAL.--**This work shall consist of furnishing and installing aluminum entrance doors and storefront, including aluminum door frames with transom where shown on the plans, complete with all hardware and accessories necessary for a complete weathertight and operable installation, in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.**--Complete working drawings showing elevations of each door type; details of each frame type; typical and special details of construction; location installation requirements for hardware; size, shape, and thickness of materials; finishes; fastenings and method of anchoring; size and spacing of anchors; details of operating hardware; method and materials for weatherstripping; and details of installation.

Exposed surfaces shall be free from defects, scratches, streaks, or other surface blemishes. Color shall be uniform without light and dark spots.

Finish samples shall be a representative section of a specified window with the color finish specified applied to that section. Section shall be a minimum of 203 mm long complete with stops and glazing beads, fasteners and anchors for all substrates on the job.

**FINISHES.**--Finish on all exposed areas of aluminum windows and components shall be bronze anodized as shown on the plans.

Exposed surfaces shall be free from defects, scratches, streaks, or other surface blemishes.

## **PRODUCTS.--**

### **Entrance doors.--**

Entrance doors shall be prefinished extruded 6063-T5 aluminum alloy, narrow stile type. Kawneer, PPG, Northrop, or equal.

### **Storefront.--**

Storefront shall be prefinished extruded 6063-T5 aluminum alloy, frame size as indicated on the plans. Kawneer, PPG, Northrop, or equal.

### **Glazing.--**

Glazing shall conform to the requirements under "Glazing," in these special provisions.

### **Screws, fasteners, anchors and accessories.--**

Screws, fasteners, anchors and accessories shall be noncorrosive metals compatible with aluminum. Finish shall match adjacent surfaces.

### **Sealant.--**

Sealant shall be self-leveling, non-sag, single component, solvent type acrylic terpolymer, Federal Specification TT-S-230. Color shall match aluminum.

### **Door closer.--**

Door closure shall be LCN 4040, Norton 8400, or equal at each door leaf.

### **Security lock.--**

Security lock shall be a 3 point lock. Cylinders by finish hardware supplier.

**FABRICATION.**--Door stiles and rails shall be securely joined and reinforced by means of structural corner assemblies, accurately machined and fitted to hairline joinery that develops the members. Joints shall be factory sealed weathertight. Doors shall be adjustable vertically and front to back. All cut-out operations for door hardware operation shall be accurately made and reinforced at the factory. Glass stops for doors shall be snap-on type with non-stretch neoprene beads.

Entrance door hardware, unless otherwise shown on the plans, shall be provided and installed as part of the work. Hardware shall be factory installed as practicable.

## **EXECUTION.--**

**PROTECTION.**--Materials shall be delivered to the site of the work in original, unopened, unbroken containers, wrappings, or bags with labels intact and legible. Labels shall show the product name, brand, manufacturer, directions, color, and quality, all of which shall be legible at the time of use.

Materials and accessories shall be undamaged and shall be carefully stored off the ground to provide proper ventilation, drainage, and protection against weather, dampness, staining, soiling contamination, deterioration, chipping, and breakage.

**INSTALLATION.**--Entrance doors and storefront units shall be set straight, level, plumb and in true alignment in prepared openings in accordance with the installation instructions. Entrance doors and storefront shall be centered in the openings. Clearance between the unit and the building framing shall be from 4 mm to 6 mm at the sides and 13 mm at the top.

The installation shall be flashed and sealed weathertight.

Isolation coating shall be provided to separate adjoining incompatible materials.

Both inside and outside surfaces of metal shall be cleaned of all mortar, plaster, paint, and other foreign matter. Surfaces that are stained, discolored, or that cannot be satisfactorily cleaned and repaired shall be replaced with new materials at no additional cost to the State.

Offset pivot hinges shall have a 159 kg minimum capacity.

Push bar and pull handle shall be at each single-acting door leaf and shall be prefinished to match storefront.

**PERFORMANCE.**--Deflection of storefront system shall be limited to  $L/175$  when subjected to 718 Pa of wind pressure. Note: Higher wind load test pressures may be required. Comply with UBC and the American National Standard A58-1-1972 for applicable wind load test pressure. Provide wind load calculations. Calculations are to be signed by a California Licensed Engineer.

## **12-8.04 SECTIONAL OVERHEAD DOORS**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.**--This work shall consist of furnishing and installing sectional overhead doors in accordance with the details shown on the plans and these special provisions.

#### **SUBMITTALS.--**

**Product data.**--Manufacturer's descriptive data, roughing-in diagram and installation instructions for each size and type of door shall be submitted for approval.

Manufacturer's descriptive data shall include door panel construction and material thickness, door track size and material thickness, counterbalance spring service life and motor operator specifications.

Materials list shall contain all items proposed to be furnished and installed under this section of these special provisions.

Working drawings shall show details of special components and installations which are not fully dimensioned in manufacturer's descriptive data.

#### **QUALITY ASSURANCE.--**

**Single source.**--Each sectional door shall be provided as a complete unit produced by one manufacturer, including frames, sections, bracket guides, tracks, counterbalance mechanisms, hardware, operators and installation accessories, to suit opening and head room available.

**Wind loading.**--Design and reinforce section overhead doors to withstand a 960 PA wind load with a midspan deflection not to exceed  $1/120$  span.

### **PART 2.- PRODUCTS**

#### **MANUFACTURERS.--**

**Available manufacturers.**--Subject to compliance with the specifications, manufacturers offering products which may be incorporated into the work include, but are not limited to the following: Clopay Corp.; Overhead Door Corp.; Raynor Garage Doors.

## **STEEL SECTIONS.--**

### **Door sections.--**

Door sections shall be galvanized commercial quality steel sheets and a minimum of G60 zinc coating complying with ASTM Designation: A 525.

Face sheets shall be not less than 0.86mm (20-gage). Back sheet shall be not less than 0.45 mm (26-gage).

Sections shall be fabricated from a single sheet to provide sections not more than 610 mm high, and nominal 50 mm deep. Meeting horizontal edges shall be rolled to a continuous shiplap, rabbeted or keyed weather seal, with a reinforcing flange return.

Intermediate and end stiles shall be 1.52 mm (16-gage) galvanized steel welded in place. Intermediate stiles shall be spaced at not more than 1220 mm on center.

Bottom section shall be reinforced with a continuous channel or angle conforming to the bottom section profile.

### **Insulation.--**

Insulation shall be the manufacturer's glass fiber, polystyrene or polyurethane foam type insulation and have an R-Value not less than  $1.4 \text{ K}\cdot\text{m}^2/\text{W}$ .

### **Finish.--**

Finish shall be the manufacturer's standard baked on polyester or epoxy prime and finish coats, applied to interior and exterior faces.

## **TRACKS, SUPPORTS. AND ACCESSORIES.--**

### **Door tracks.--**

Door tracks shall be the manufacturers standard galvanized steel track system, sized for door size and weight, and designed for the clearances shown on the plans. Complete track assembly shall be provided, including brackets, bracing and reinforcing for rigid support of ball bearing roller guides, for required door type and size.

### **Track reinforcement and supports.--**

Track reinforcement and supports shall be galvanized steel. Tracks shall be reinforced and supported as required for the size and weight of door to provide strength and rigidity, and to ensure against sag, sway and vibration during operation.

### **Door seals.--**

Doors shall have perimeter gasket seals at head and jambs and seal shall have a replaceable vinyl or neoprene bottom seal.

### **Vision panels.--**

Vision panels shall be door manufacturer's standard glazed opening with wire safety glass, metal frame and vinyl or neoprene glazing gasket for water tight construction. The approximate size shall be as shown on the plans.

### **Louvers.--**

Louvers shall be 50 mm deep Z-shaped blades, formed from galvanized sheet steel not less than 0.68 mm thick (24-gage), set in a continuous channel frame, and with a 6 mm mesh bird-screen in a removable frame on inside.

## **HARDWARE.--**

**General.--**Hardware shall be heavy-duty, rust-resistant, with galvanized or cadmium-plated or stainless steel fasteners, to suit type of door.

**Hinges.--**

Heavy steel hinges shall be provided at each end stile and at intermediate stiles, per manufacturer's recommendations for size of door.

**Rollers.--**

Rollers shall be heavy-duty with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Rollers shall have case-hardened tires.

**Lifting handles, locks and latches.--**

Lifting handles for manually operated doors shall be galvanized steel.

Locking bars shall be single side operable from inside only.

Locking device assembly shall be fabricated with mortise lock, spring loaded dead bolt, chromium-plated operating handle, cam plate and adjustable locking bar to engage through slots in tracks.

**COUNTERBALANCE MECHANISMS.--****Counterbalance spring.--**

The door shall have a torsion spring counterbalance on a continuous cross header shaft; the entire assembly shall be all-bearing mounted. The spring shall have a rated service life of not less than 25,000 cycles.

**ELECTRIC DOOR OPERATORS.--**

Door operator shall be heavy duty, commercial type. Motor shall be a 208-volt, single-phase, high starting torque motor with single reduction worm gear, completely housed and running in an oil bath. Motor shall be of sufficient capacity to raise and lower the door at speed of approximately 0.2 m per second.

Door operator and assembly shall be equipped with solenoid brake, limit switches for upper and lower limits of door travel, emergency hand chain with electrical interlock to break motor circuit when hand chain is engaged, 3-button operating station in a NEMA Type 4 enclosure, and a factory wired NEMA Type 1 control panel.

Control panel shall contain an instrument transformer, reversing magnetic contractor with overload relay, and all necessary control relays and other devices required for complete automatic operation of the door. Motor shall be removable for repair without affecting emergency operation. Motor shall be centermounted or sidemounted as shown on the plans.

**Reversing door edge.--**

Reversing door edge shall be an electrically or pneumatically operated safety device extending across the full width of the bottom of the door which shall cause the door to stop automatically and return to open position upon contact with any obstruction.

**PART 3.- EXECUTION****INSTALLATION.--**

**General.--**Door, track, and operating equipment, complete with necessary hardware, jamb and head mold stops, anchors, inserts, hangers, and equipment supports, shall be installed in accordance with the final drawings, manufacturer's installation instructions and these special provisions.

Vertical track assembly shall be fastened to framing at not less than 610 mm on center. Horizontal track shall be hung from structural overhead framing with angle or channel hangers, welded or bolted into place. Sway bracing, diagonal bracing, and reinforcing as required for rigid installation of track and door operating equipment.

## 12-8.05 WINDOWS

### PART 1.- GENERAL

**SUMMARY.--**This work shall consist of furnishing and installing windows in accordance with the details shown on the plans and these special provisions.

Windows shall be commercial (C) grade aluminum prime windows unless otherwise shown on the plans.

Windows shall meet the requirement of NAFS-1, "Voluntary Performance Specification for Windows, Skylights, and Glass Doors," and shall meet the C30 (Commercial) product designation unless otherwise shown on the plans. Windows shall be labeled with the AAMA label.

Finish for windows shall be Architectural Class I, clear anodized finish meeting American Architectural Manufacturer's Association Standard 611 unless otherwise shown on the plans.

Glazing for windows shall be in accordance with the requirements specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions.

**CERTIFICATES OF COMPLIANCE.--**Certificates of Compliance shall be furnished for all windows in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

**SUBMITTALS.--**Manufacturer's descriptive data, installation instructions and schedule shall be submitted for approval.

Manufacturer's descriptive data and installation instructions shall show window elevations, plan views, full size sections, anchoring details to all substrates, anchors and hardware.

Installation schedule shall show location, size and type for each window.

### PART 2.- PRODUCTS

#### **Door and transom windows.--**

Door and transom windows shall be door or door frame manufacturer's standard window framing, glazing stops and glazing accessories.

#### **Fixed windows.--**

Fixed windows shall be non-operable glazed panel inserted into a frame to include muntins, glazing stops, and glazing accessories.

#### **Aluminum.--**

Aluminum shall be extruded 6063-T5 aluminum alloy.

#### **Screws, fasteners and window accessories.--**

Screws, fasteners and window accessories shall be non-corrosive metals compatible with aluminum except guides and rollers may be vinyl and nylon respectively. Finish for locks, operators, strikes, keepers and other metal hardware shall match window finish.

#### **Weatherstripping.--**

Weatherstripping shall be continuous, replaceable type, wool pile mounted in metal or double runs of ultraviolet resistant neoprene or vinyl.

#### **Vent screen.--**

Vent screen shall be aluminum frame with 18 x 14 mesh aluminum screening and polyvinyl-chloride splines. Screen frames shall be removable from interior of building. Finish of screen frame shall match window finish.

#### **Sealant.--**

Sealant shall be single-component, solvent type acrylic, self-leveling, non-sag, conforming to Federal Specification: TT-S-230.

**Tape.--**

Tape shall be compatible with sealant; Pecora, "B-44 Extra-Seal;" Pittsburg Plate Glass, "Duribbon;" Protective Treatment, "PTU 606;" Tremco, "440 Tape;" or equal.

**PART 3.- EXECUTION**

**FABRICATION.--**Frame and sash shall be accurately machined and fitted to hairline joinery that develops the members. Joints shall be factory sealed weathertight.

Sash shall be removable from the interior only. Sash shall have concealed condensation weeps to the outside.

**DELIVERY AND STORAGE.--**Windows shall be delivered in original, unopened, unbroken containers, wrappings, or bags with labels bearing the brand name, name of manufacturer or supplier, standard of manufacture, and product description.

Windows and accessories shall be stored off the ground, kept dry, fully protected from weather and damage.

**INSTALLATION.--**Window units shall be set straight, level, plumb and in true alignment in prepared openings. Windows shall be centered in openings. Clearance between the window unit and the building framing shall be from 4 mm to 6 mm at the sides and 13 mm at the top. Ventilator sash shall be adjusted after glazing for easy, smooth and proper operation.

The installation shall be flashed and sealed weathertight.

All aluminum surfaces in contact with masonry, steel or other incompatible materials shall be isolated with pressure sensitive tape, zinc chromate primer, bituminous paint or such other material recommended by the window manufacturer and approved by the Engineer.

**12-8.06 FINISH HARDWARE****PART 1.- GENERAL****SUMMARY.--**

This work shall consist of furnishing and installing hardware items for doors in accordance with the details shown on the plans and these special provisions.

Hardware assemblies shall comply with the fire code and the disabled accessibility requirements indicated on the plans and specified in these special provisions.

**SUBMITTALS.--**

Manufacturer's technical information and catalog cuts for each item of door hardware and a door hardware schedule shall be submitted for approval prior to installation.

Manufacturer's catalog cuts shall include catalog numbers, material, grade, type, size, function, design, quality and finish of hardware.

The door hardware schedule shall indicate the location and size of door opening, the door and frame material, and the size, style, finish and quantity of the hardware components required.

**FINISHES.--**

Hardware shall be provided with standard US 26D metal plated finish or matching sprayed finish where indicated.

**KEYING INSTRUCTIONS.--**

New locks shall be compatible with the master key system of the existing facility and shall be keyed to the existing lock system in use.

Locks and cylinders shall be provided with six pin "O" cylinders and blank keys. Cylinders and blank keys shall be delivered to the Engineer for combining of cylinders and cutting of keys.

The Contractor shall provide cylinders for use during construction. Construction cylinders shall remain in place until permanent cylinders are installed. Construction cylinders shall remain the property of the Contractor.

Key bows shall be stamped "State of California" and "Do Not Duplicate."

**PART 2.- PRODUCTS.--**

**GENERAL.--**

Door hardware equal in material, grade, type, size, function, design, quality and manufacture to that specified herein may be submitted for approval.

**Butt hinges.--**

Butt hinges shall be steel, 1 1/2-pair per door unless otherwise specified or shown on the plans. Nonremovable pins shall be provided at outswing exterior doors. Hinge size shall be 114 mm x 114 mm unless otherwise noted.

Standard weight hinges shall be:

Hager	BB 1279
McKinney	TB 2714
Stanley	BB 179
or equal.	

**Mortise locksets.--**

Mortise locksets shall be steel case with 32 mm x 203 mm face plate and 70 mm backset. Door and frame preparation for mortise locksets shall conform to ANSI A115.1.

Lever operated lockset shall be:

Best	35H 6FW 15H
Falcon	LM521 DG
Schlage	L9453P x 06
or equal.	

**Cylindrical locksets and privacy sets.--**

Cylindrical locksets and privacy sets shall be steel chassis, 54 mm diameter, 70 mm backset. Door and frame preparation for cylindrical lockset and privacy sets shall conform to ANSI A115.1.

Lever operated lockset shall be:

Best	83K6 AB 9C
Schlage	D53PD RHO
Falcon	LY501 DG
or equal.	

Lever operated privacy set shall be:

Best	83K OL 9C
Falcon	LY301 DG
Schlage	D40S RHO
or equal.	

**Flush bolts.--**

Flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors. Provide automatic bolts on UL rated pairs of doors.

Flush bolts for manual operation shall be:

Builders Brass	5020
Glynn Johnson	FB6
H.B. Ives	457
or equal.	

**Door closers.--**

Parallel arms for closers shall be installed at outswing exterior doors. Closers shall have sprayed finish to match other hardware on door.

Door closers shall be:

LCN	4040
Norton	85001
Dorma	7800
or equal.	

**Panic devices.--**

Rim type panic devices shall be installed at single doors and on the active leaf of pairs of doors, unless indicated otherwise. A vertical rod device shall be provided for the inactive leaf of pairs of doors. Dogging devices shall be omitted at UL rated door openings.

Panic devices with outside key operation shall be:

Corbin	3727
Monarch	XX-R-T
Von Duprin	88TP
or equal.	

**Pushplates and pullplates.--**

Pushplates and pullplates shall be 102 mm x 406 mm x 1.52 mm (16-gage). Grips shall be 25 mm diameter with 38 mm standoff and 203 mm center to center fastening, unless indicated otherwise.

Pushplates shall be:

Builders Brass	47
Quality	40
Trimco	1001-3
or equal.	

Pullplates shall be:

Builders Brass	47x290-1
Quality	1515
Trimco	01-3 x 1193-2
or equal.	

**Kickplates.--**

Kickplates shall be 254 mm in height x 51 mm less than door width x 1.52 mm (16-gage).

Kickplates shall be:

Builders Brass	37
Quality	48
Trimco	6000
or equal.	

**Floor mounted stops.--**

Floor mounted stops shall be dome type. The height of the stop shall be determined by the clearance required when a threshold is used or not used.

Stops for openings with thresholds shall be:

Builders Brass	8063
Quality	431
Trimco	1213
or equal.	

**Wall or door mounted door stop.--**

Wall or door mounted door stop shall have a 95 mm projection and 3-point anchoring.

Wall or door mounted door stop shall be:

Builders Brass	W96
Quality	38
Trimco	1236-1/4-2
or equal.	

**Wall mounted door stop and holder.--**

Wall mounted door stop and holder shall be:

Builders Brass	W140, W141X
Quality	36, 136
Trimco	1202, 1207
or equal.	

**Wall bumpers.--**

Wall bumpers base diameter shall be 64 mm with a 25 mm projection.

Bumpers shall be:

Builders Brass	WC9
Quality	302
Trimco	1272-1/4-CCS
or equal.	

**By-passing door hardware.--**

Door track shall be extruded aluminum:

Grant	8004
Johnson	2200
Stanley	72857
or equal.	

Carrier sets shall be single wheel, side mount carriers:

Grant	6320 and 6330
Johnson	2216 and 2238
Stanley	2850-1 and 2850-2
or equal.	

Finger pull shall be approximately 89 mm x 38 mm x 13 mm deep, recessed into the door:

Builders Brass	9365-aluminum
Ives	SP223-B26D
or equal.	

Floor guide shall be non-adjustable, 1.52 mm (16-gage) steel with nylon covered steel uprights, for 35 mm bypassing door.

**Automatic door bottom.--**

Automatic door bottom shall be heavy duty, full mortise.

Bottom shall be:

Pemko	434 AR
Zero	360
or equal.	

**Thresholds, rain drips, and door shoes.--**

Thresholds, rain drips, and door shoes shall conform to the sizes and configurations shown on plans. Thresholds at door openings with accessibility requirements shall not exceed 13 mm in height.

Threshold, rain drip, and door shoe manufacturers shall be Pemko, Reese, Zero, or equal.

**Threshold bedding sealant.--**

Threshold bedding sealant shall conform to Federal Specification: SS-C-153.

**Weatherstrip and draft stop.--**

Weatherstrip and draft stop shall conform to the sizes and shapes shown on plans. Assemblies shall be UL listed and shall be provided where shown on the plans or as specified in these special provisions.

Weatherstrip and draft stop manufacturers shall be Pemko, Reese, Zero, or equal.

**Door signs and name plates.--**

Door signs and name plates shall be as specified under "Signs" in Section 12-10, "Specialties," of these special provisions.

**PART 3.- EXECUTION**

**DOORS AND FRAMES.--**Doors and frames shall be set square and plumb and be properly prepared before the installation of hardware.

**INSTALLATION.--**Hardware items shall be accurately fitted, securely applied, and adjusted and lubricated in accordance with the manufacturer's instructions. Installation shall provide proper operation without bind or excessive play.

Hinges shall be installed at equal spacing with the center of the end hinges not more than 244 mm from the top and bottom of the door. Pushplates and door pulls shall be centered 1118 mm from the finished floor. Locksets, privacy sets and panic exit mechanisms shall be 1024 mm from the finished floor. Kickplates shall be mounted on the push side of the doors, 25 mm clear of door edges.

Thresholds shall be set in a continuous bed of sealant material.

Door controls shall be set so that the effort required to operate doors with closers shall not exceed 3.9 kg maximum for exterior doors and 2.7 kg maximum for interior doors. The effort required to operate fire doors may be increased above the values shown for exterior and interior doors but shall not exceed 6.8 kg maximum.

Door stops located on concrete surfaces shall be fastened rigidly and securely in place with expansion anchoring devices. Door stops mounted elsewhere shall be securely attached with wood screws or expansion devices as required.

Backing shall be provided in wall framing at wall bumper locations.

The location and inscriptions for door signs and name plates shall be as shown on the plans.

Hardware, except hinges, shall be removed from surfaces to be painted before painting.

Upon completion of installation and adjustment, the Contractor shall deliver to the Engineer all dogging keys, closer valve keys, lock spanner wrenches, and other factory furnished installation aids, instructions and maintenance guides.

**DOOR HARDWARE GROUPS AND SCHEDULE.**--Hardware groups specified herein shall correspond to those shown on the plans:

**GROUP 1**

3-pair butt hinges  
1 each cylindrical lockset  
1 each flush bolt top and bottom  
1 each weatherstripping  
1 each door shoe with drip

**GROUP 2**

1 1/2-pair butt hinges  
1 each mortise lockset  
1 each floor mounted door stop  
1 each automatic door bottom  
1 each weatherstripping  
1 each door shoe with drip  
1 each door closer  
1 each threshold

**GROUP 3**

1 1/2-pair butt hinges  
1 each cylindrical lockset  
1 each wall mounted door stop with holder  
1 each kickplate  
1 each door closer  
1 each smoke seal

**GROUP 4**

1 1/2-pair butt hinges  
1 each push and pull plate  
1 each kickplate  
1 each wall bumper

**GROUP 5**

1 1/2-pair butt hinges  
1 each cylindrical lockset  
1 each door mounted door stop

**GROUP 6**

1 1/2-pair butt hinges  
1 each cylindrical privacy set  
1 each wall bumper

**GROUP 7**

All hardware supplied by the sectional overhead door manufacturer.

## **GROUP 8**

All hardware supplied by the aluminum entrance door and storefront manufacturer.

### **12-8.07 GLAZING**

#### **PART 1.- GENERAL**

##### **SUMMARY.--**

This work shall consist of furnishing and installing glazing in accordance with the details shown on the plans and these special provisions.

Glazing shall consist of glass sheets for windows, doors and other glazed openings.

All glass shall conform to ASTM Designation: C 1036 and the classifications specified herein and shall be clear glass except as noted.

Safety glass shall be furnished and installed at all locations designated in Consumer Product Safety Commission's Safety Standard For Architectural Glazing Materials 16 CFR 1201.

##### **SUBMITTALS.--**

A detailed list of glazing materials including glass, sheet, sealants, tapes, setting blocks, shims, compression seals, and glazing channels shall be submitted for approval. The list shall include a schedule of the materials to be used at each location.

##### **LABELS.--**

Each individual pane of heat strengthened or fully tempered glass shall bear an identification label in accordance with ASTM Designation: C 1048.

#### **PART 2.- PRODUCTS**

##### **Sheet glass, float glass, or plate glass.--**

Sheet glass, float glass, or plate glass shall be Type I, Class 1, Quality q4 or better, double strength for panes to 0.93 m<sup>2</sup>, 5 mm thick for panes between 0.93 m<sup>2</sup> and 2.6 m<sup>2</sup>, and 6 mm thick for panes over 2.6 m<sup>2</sup>, except as otherwise shown on the plans.

##### **Safety glass.--**

Safety glass shall conform to Consumer Product Safety Commission Safety Standard For Architectural Glazing Materials: 16 CFR 1201, and ANSI Standard Z97.1 and shall be one of the following:

##### **Tempered glass.--**

Tempered glass shall conform to ASTM Designation: C 1048, Kind FT, Condition A, Type 1, Quality q4 or better.

##### **Wire glass.--**

Wire glass shall be Type II, Class 1, Form 1, Mesh m1; 6 mm thick clear polished wire glass with diamond mesh.

##### **Insulating glass assemblies.--**

Insulating glass assemblies shall be double pane units consisting of 2 pieces of glass separated by a spacer and hermetically sealed with double seal sealants. The entrapped air shall be at atmospheric pressure and maintained in a hydrated condition by a drying agent located in the spacer.

**Seals, caulks, putties, setting blocks, shims, tapes, compression seals, felt, spacers, and channels.--**

Seals, caulks, putties, setting blocks, shims, tapes, compression seals, felt, spacers, and channels shall be top grade, commercial quality, as recommended by the glass or sheet manufacturer and shall conform to the requirements in the publications of the Flat Glass Marketing Association.

**PART 3.- EXECUTION**

**INSTALLATION.--**

Glazing shall conform to the general conditions and applicable details in the publications of the Flat Glass Marketing Association.

Panes shall be bedded fully and evenly, set straight and square within panels in such a manner that the pane is entirely free of any contact with metal edges and surfaces.

For all panes on the exterior of the building, the glazing on both sides of window panes shall provide a watertight seal and watershed. Seals shall extend not more than 2 mm beyond the holding members. A void shall be left between the vertical edges of the panes and the glazing channel. Weep systems shall be provided to drain condensation to the outside.

Panes in assemblies using extruded gasket glazing shall be set in accordance with the assembly manufacturer's instructions using gaskets and stops supplied by the manufacturer.

Whenever welding or burning of metal is in progress within 4.6 m of glazing materials, a protective cover shall be provided over exposed surfaces.

**REPLACEMENT AND CLEANING.--**

All broken or cracked glass and glass with scratches which reduce the strength shall be replaced before completion of the project.

Panes shall be kept clean of cement and plaster products, cleansers, sealants, tapes and all other foreign material that may cause discoloration, etching, staining, or surface blemishes to the materials.

Excess sealant left on the surface of the glass or surrounding materials shall be removed during the work life of the sealant.

Solvents and cleaning compounds shall be chemically compatible with materials, coatings and glazing compounds to remain. Cleaners shall not have abrasives that scratch or mar the surfaces.

All panes shall be cleaned just before the final inspection. All stains and defects shall be removed. Paint, dirt, stains, labels (except etched labels), and surplus glazing compound shall be removed without scratching or marring the surface of the panes or metal work.

**SECTION 12-9. FINISHES**

**12-9.01 GYPSUM WALLBOARD**

**GENERAL.--**This work shall consist of furnishing, installing and finishing gypsum wallboard in accordance with the details shown on the plans and these special provisions.

Where assembly fire ratings are indicated on the plans, construction shall provide the fire resistance in accordance with the applicable standards in the Fire Resistance Design Manual published by the Gypsum Association.

Wallboard backing for use in restroom and shower areas shall be water-resistant gypsum backing board.

**PRODUCTS.--**

**Gypsum wallboard.--**

Gypsum wallboard shall conform to ASTM Designation: C 36.

**Gypsum backing board.--**

Gypsum backing board shall conform to ASTM Designation: C 442.

**Water-resistant gypsum backing board.--**

Water-resistant gypsum backing board shall conform to ASTM Designation: C 630.

**Gypsum sheathing board.--**

Gypsum sheathing board shall conform to ASTM Designation: C 79.

**Exterior gypsum soffit board.--**

Exterior gypsum soffit board shall conform to ASTM Designation: C 931.

**Joint tape and joint and finishing compound.--**

Joint tape and joint and finishing compound shall conform to ASTM Designation: C 475.

**Corner beads, metal trim and control joints.--**

Corner beads, metal trim and control joints shall be galvanized steel of standard manufacture.

**Resilient metal channel.--**

Resilient metal channel shall be galvanized sheet steel channels of standard manufacture for reducing sound transmission in wood frame partitions.

**Fasteners.--**

Fasteners shall be gypsum wallboard nails conforming to ASTM Designation: C 514 or steel drill screws conforming to ASTM Designation: C 1002.

**EXECUTION.--**

**DELIVERY AND STORAGE.--**Materials shall be delivered in original packages, containers or bundles bearing brand name, applicable standard of manufacture, and name of manufacturer or supplier and shall be kept dry and fully protected from weather and direct sunlight exposure. Gypsum wallboard shall be stacked flat with adequate support to prevent sagging or damage to edges, ends and surfaces.

**INSTALLATION.--**Wallboard panels to be installed on ceilings and soffits shall be installed with the long dimension of the panels perpendicular to the framing members. Wallboard panels to be installed on walls may be installed with the long dimension of the panels either parallel or perpendicular to the framing members. The direction of placing the panels shall be the same on any one wall or partition assembly.

Edges of wallboard panels shall be butted loosely together. All cut edges and ends shall be smoothed as needed for neat fitting joints.

All edges and ends of gypsum wallboard panels shall coincide with the framing members, except those edges and ends which are perpendicular to the framing members. End joints on ceiling and on the opposite sides of a partition assembly shall be staggered.

Except where closer spacings are shown on the plans, the spacing of fasteners shall not exceed the following:

Nails	175 mm
Screws	300 mm
Screws at perimeter of panels for fire resistive assemblies having metal framing	200 mm

Type S steel drill screws shall be used to fasten wallboard to metal framing. Nails or Type W steel drill screws shall be used to fasten wallboard to wood framing. Except as shown on the plans, screws shall not be used in fire resistive assemblies.

Adhesives shall not be used for securing wallboard to framing.

Gypsum wallboard panels shown on the plans for shear wall sheathing or for fire resistive assemblies shall be fastened to all framing members. Gypsum wallboard panels at other locations and gypsum wallboard finish over plywood sheathed shear walls shall be fastened to all framing members except at the following locations:

At internal angles formed by ceiling and walls; ceiling panels shall be installed first with the fasteners terminating at a row 175 mm from the walls, except for walls parallel to ceiling framing. Wall panels shall butt the ceiling panels. The top row of wall panel fasteners shall terminate 200 mm from the ceiling.

At internal vertical angles formed by the walls; fasteners shall not be installed along the edge or end of the panel that is installed first. Fasteners shall be installed only along the edge or end of the panel that butts and overlaps the panel installed first.

Fasteners shall be located at least 10 mm from wallboard panel edges and ends. Nails shall penetrate into wood framing at least 30 mm. All metal fasteners shall be driven slightly below surface level without breaking the paper or fracturing the core.

Metal trim shall be installed at all free edges of panels, at locations where wallboard panels abut dissimilar materials and at locations shown on the plans. Corner beads shall be installed at external corners. Control joints shall be installed at the locations shown on the plans.

Joints between face panels, the internal angles formed by ceiling and walls and the internal vertical angles formed by walls shall be filled and finished with joint tape and at least 3 coats of joint compound. Tape in the corners shall be folded to conform to the angle of the corner. Tape at joints and corners shall be embedded in joint compound.

Dimples at nail and screw heads, dents, and voids or surface irregularities shall be patched with joint compound. Each patch shall consist of at least 3 coats and each coat shall be applied in a different direction.

Flanges of corner beads, control joints and trim shall be finished with a least 3 coats of joint compound.

Each coat of joint compound shall be feathered out onto the panel surface and shall be dry and lightly sanded before applying the next coat. The finished surfaces of joint compound at the panel joints, internal angles, patches and at the flanges of trim, corner beads and control joints shall be flat and true to the plane of the surrounding surfaces and shall be lightly sanded.

Good lighting of the work area shall be provided during the final application and sanding of the joint compound.

Gypsum wallboard used as backing boards for tile or rigid sheet wall covering or wainscoting shall be water resistant. Joints in backing board shall not be taped or filled and dimples at the fastener heads shall not be patched. Edges of cuts and holes in backing board shall be sealed with a primer or sealer that is compatible with the wall covering or wainscoting adhesive to be used.

Surfaces of wallboard to be textured shall receive an orange peel texture, unless otherwise shown on the plans.

## **12-9.02 CERAMIC TILE**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing ceramic tile in accordance with the details shown on the plans and these special provisions.

Ceramic tile shall include glazed wall tile, matte porcelain tile, trim tile, setting materials, grouts and such other materials as maybe required for a complete installation.

#### **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data, a list of materials to be used, and installation instructions for all materials required for the work shall be submitted for approval.

Manufacturer's descriptive data shall be submitted for each type of tile, mortar bed materials, bond coat materials and additives, and grout materials and additives.

Materials list and installation instructions shall include all products and materials to be incorporated into the work.

Friction reports shall be submitted for tile products to be used on floors and other pedestrian surfaces.

**Samples.--**Samples shall include 2 individual samples of each type and color of tile and trim to be installed and shall be of the same size, shape, pattern and finish as the tile and trim to be installed.

#### **QUALITY ASSURANCE.--**

**Single source responsibility.--**Each type and color of tile, grout and setting materials shall be obtained from a single source.

**Master Grade Certificates.**--Each shipment of tile to the project site shall be accompanied by a Master Grade Certificate issued by the tile manufacturer.

**Certificates of Compliance.**--Certificates of Compliance shall be furnished for bond coat materials, setting bed materials and grout in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

#### **DELIVERY, STORAGE AND HANDLING.--**

**Delivery.**--Tile and packaged materials shall be delivered to the job site in sealed, unbroken, unopened containers with the labels intact. Tile containers shall bear the Standard Grade label.

**Storage and handling.**--Materials shall be stored and handled in such a manner as to prevent damage or contamination by water, freezing or foreign matter.

#### **PROJECT CONDITIONS.--**

**Protection.**--Tile work shall be protected and environmental conditions maintained during and after installation to comply with the reference standards and manufacturer's printed instructions.

**Temperatures.**--Unless otherwise specified in the manufacturer's installation instructions, the ambient temperature shall be maintained at not less than 10°C nor more than 38°C in tiled areas during installation and for 7 days after completion. Exterior work areas shall be shaded from direct sunlight during installation.

Tile shall not be installed when the temperature of the substrate is greater than 32°C or is frost covered.

**Illumination.**--Interior work areas shall be illuminated to provide the same level and angle of illumination as will be available during final inspection.

#### **PART 2.- PRODUCTS**

##### **MANUFACTURERS.--**

**Available manufacture's.**--Subject to compliance with the specifications, tile shall be American Olean Tile Co., Inc.; Summitville Tiles, Inc.; United States Ceramic Tile Co.; or equal.

##### **GENERAL.--**

**Ceramic tile.**--Ceramic tile shall conform to the requirements in ANSI Standard: A137.1, "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated.

Ceramic tile shall conform to the "Standard Grade" requirements.

**Tile installation materials.**--Tile installation materials shall conform to the requirements in ANSI standard referenced with products and materials indicated for setting and grouting.

**Tile color and size.**--Tile color shall be as shown on the plans; tile size shall be as indicated in the Schedule elsewhere in this special provision.

**Slip resistant tile.**--Slip resistant tile shall have sufficient abrasives added such that the static coefficient of friction, wet or dry, shall be not less than 0.6 for walking surfaces and 0.8 for ramps when tested in accordance with ASTM Designation: C 1028.

## **TILE PRODUCTS.--**

### **Glazed wall tile.--**

Glazed wall tile shall be machine made, dust pressed white body clay, and shall have a glossy glaze finish, plain face, and cushion edges. Tile shall be 8 mm nominal thickness.

Ceramic tile trim shall match material, size and finish of field tile. Free edges of tiled areas of walls shall have bullnose type trim. Outside corners shall have bullnose type runner trim (not beads). Reentrant corners shall have cove type trim.

### **Matte porcelain tile.--**

Matte porcelain tile shall be machine made, unpolished, dust pressed natural porcelain clay and shall have a plain face. Tile shall have a nominal thickness of 8 mm. Matte porcelain tile shall be slip resistant.

Matte porcelain trim tile shall include cove type base at walls and single piece intersecting cove base at corners.

## **SETTING MATERIALS.--**

### **Tile bond coat.--**

Tile bond coat shall be latex-portland cement bond coat.

Latex-portland cement mortar bond coat shall be a prepackaged mortar mix, conforming to ANSI Standard: A118.4, incorporating a dry acrylic resin, and to which only water is added at the job site. Mortar shall be suitable for exterior use and be labeled for the type of tile to be installed.

### **Epoxy bond coat.--**

Epoxy bond coat shall be a 2 part prepackaged epoxy mortar conforming to ANSI Standard: A118.3, suitable for exterior use. Mortar shall be labeled for the type of tile to be installed.

## **GROUTING MATERIALS.--**

### **Tile grout.--**

Tile grout shall be latex-portland cement grout.

Latex-portland cement grout shall be a prepackaged grout mix, conforming to ANSI Standard: A118.6, incorporating a dry acrylic resin, and to which only water is added at the jobsite. Epoxy grout shall be suitable for exterior use and labeled for the type of tile to be installed.

### **Epoxy grout.--**

Epoxy grout shall be a 2 part prepackaged epoxy mortar conforming to ANSI Standard: A118.3 and suitable for exterior use. Tile shall be labeled for the type of tile to be used.

### **Grout pigment.--**

Grout pigment shall be chemically inert, fade resistant mineral oxide or synthetic type. Color shall be as shown on the plans.

## **SEALANTS.--**

### **Sealant.--**

Sealant for vertical expansion joints shall be a medium modulus silicone or polyurethane. Sealant for horizontal joints shall be a 2-part polyurethane type material with a Shore Hardness of 35 to 45.

Color of exposed sealants shall match color of grout in tile adjoining sealed joints.

## **MORTAR BEDS.--**

### **Cement mortar bed.--**

Cement mortar bed for walls shall be proportioned of one part cement, 1/2 part hydrated lime, 6 parts damp sand by volume and only enough water to provide the necessary workability. Ingredients shall be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed shall be not less than 20 mm in thickness.

Cement mortar bed for floors shall be proportioned of one part cement, 1/10 parts hydrated lime, 5 parts damp sand by volume and only enough water added to provide the necessary workability. Ingredients shall be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed shall be not less than 32 mm in thickness.

## **MISCELLANEOUS MATERIALS.--**

### **Sand.--**

Sand shall be a natural or manufactured sand conforming to ASTM Designation: C 144, except that no more than 10 percent shall pass the No. 150  $\mu\text{m}$  sieve.

### **Sealers.--**

Sealer for unglazed quarry tile shall be water repellent, clear solution of ammonium cementitious compound, silicone base material, or other commercially manufactured sealer.

Sealer for grout shall be a penetrating proprietary compound designed for sealing grout. Silicone sealers shall not be used.

### **Cement.--**

Cement shall conform to ASTM Designation: C 150, Type I.

### **Hydrated lime.--**

Hydrated lime shall conform to ASTM Designation: C 206, Type S, or ASTM Designation: C 207, Type S.

### **Water.--**

Water shall be clean and potable.

### **Metal edge strips.--**

Metal edge strips shall be stainless steel terrazzo strips, 3 mm wide at top edge with integral provision for anchorage to mortar bed or substrate.

### **Cementitious tile backer board.--**

Cementitious backer board shall be a backing and underlayment panel composed of a concrete core with glass mesh reinforcing on both faces and conforming to the requirements of ANSI Standard: A118.9.

## **MIXING MORTAR AND GROUT.--**

**Mixing.--**Mortar and grout shall be mixed to comply with the requirements of referenced standards and manufacturers for accurately proportioning of materials, water or additive content, mixing equipment and mixer speeds, mixing containers, mixing time, and other procedures need to produce mortars and grout of uniform quality with optimum performance characteristics for application intended.

## **PART 3.- EXECUTION**

### **PREPARATION.--**

**General.--**Concrete, mortar, or masonry substrate surfaces which are to receive a mortar bed shall not vary more than 5 mm in 2.4 m from the required plane and shall be true, plumb at vertical surfaces, and square at intersection edges.

Surfaces to receive a mortar setting bed or a bond coat shall be cleaned adequately to assure a tight bond to the applied material. Such cleaning shall leave the surface thoroughly roughened and free from laitance, coatings, oil, sand, dust and loose particles.

The cleaned surfaces which are to receive a mortar bed shall be saturated with water just prior to placing mortar or the cleaned surfaces shall be coated with fresh neat cement slurry. If the surface is saturated with water, excess water shall be removed and the wetted surfaces uniformly dusted with portland cement. The slurry or wetted cement dust shall be broomed to completely coat the surface with a thin and uniform coating just prior to placing the mortar.

Substrates shall be inspected to insure that grounds, anchors, plugs, recessed frames, bucks, drains, electrical work, mechanical work, and similar items in or behind the tile have been installed before proceeding with installation of the tiles.

### **INSTALLATION.--**

**General.--**Tile installation shall conform to applicable parts of ANSI 108 Series of the tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" and Tile Council of American, "Handbook for Ceramic Tile Installation."

All tile shall be installed on a bond coat over a setting bed. The setting bed shall be a cured cement mortar bed or a prepared, dimensionally stable substrate of concrete, masonry, cementitious backer board, or other cementitious material.

The back face of the tile shall be free of paper, adhesives, fiber mesh, resins, or other materials affecting the bond of the tile to the bedding material.

Tile sheets shall have permanent edge bonding or temporary mounting materials on the exposed face. Water soluble or absorbent adhesives shall not be used for edge bonding. Temporary mounting materials shall allow observation during tile setting operations.

Tile work shall extend into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as shown on the plans. Work shall be terminated neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

Intersections and returns shall be accurately formed. Cutting and drilling of tile shall be performed without marring visible surfaces. Cut edges of tile abutting trim, finish or built-in items shall be carefully ground to produce straight aligned joints. Tile shall be closely fit to electrical outlets, piping, fixtures and other penetrations such that plates, collars, or covers overlap the tile.

**Cementitious backer board.--**Cementitious backer board shall be installed in accordance with the provisions of ANSI Standard: A118.11.

**Tile bond coat.--**The tile bond coat mortar shall be mixed according to the manufacturer's recommendations. The consistency of the mixture shall be such that ridges formed with the recommended notched trowel shall not flow or slump. Reworking will be allowed provided no water or materials are added. The setting bed surfaces shall be dampened before placing the bond coat as necessary tile installation, but the setting bed shall not be soaked. The setting bed surfaces for epoxy bond coat shall be dry.

The bond coat shall be floated onto the cured mortar bed surface with sufficient pressure to cover the surface evenly with no bare spots. The surface area to be covered with the bond coat shall be no greater than the area that can be tiled while the bond coat is still plastic. The bond coat shall be combed with a notched trowel as recommended by the manufacturer within 10 minutes before installing tile. Tile shall not be installed on a skinned over bond coat.

**Installing tiles.--**Tile shall be installed in accordance with the manufacturer's instructions and shall be set solid and shall be well bonded to the substrate.

Tile set on a tile bond coat shall be installed in accordance with ANSI Standard: A108.5, and tile set on an epoxy mortar shall be installed in accordance with ANSI Standard: A108.6.

If tiles are cut, the cuts shall be made with saws. Cut edges shall be rubbed with an abrasive stone to bring the edge of the glaze slightly back from the body of the tile. Cuts shall be accurately made to neatly fit the tile in place. Cut edges shall not be butted against other tile. Cut tile shall be at least half the size of a full size tile.

Tile shall completely cover wall areas behind mirrors and fixtures.

Tile shall be installed so that the finished tile surface does not vary more than 3 mm in 2.4 m from the finished tile surface shown on the plans. In no case shall there be offsets in adjoining tiles, low spots on finished tile surfaces that can pond water, or finished tile surfaces that are not plumb or true in the completed tile work.

Tiles shall be firmly pressed into the freshly notched bond coat. Tile on interior surfaces shall be tapped and beat into a true surface and to obtain at least 80 percent coverage by the mortar on the back of each tile. Tile on exterior surfaces shall have 100 percent coverage and shall be back-buttered immediately prior to setting the tile.

If tile is face mounted, the paper and glue shall be removed within one hour after tile is installed and all tiles that do not meet the requirements for joints and surface tolerance shall be adjusted or replaced.

Mortar that exudes into the grout spaces between tiles shall be removed to the bottom of tile.

**Joints.--**Joints between tile shall be continuous both vertically and horizontally. Joints shall be straight and of uniform and equal width. Where tiles on adjoining surface are the same size, the joints shall align, one with the other. Joint width shall be as recommended by the tile manufacturer.

**Grouting tile.--**Grout shall be mixed, applied and cured in accordance with the manufacturer's recommendations and ANSI Standard: A108.10 for cement grout and ANSI Standard: A108.9 for epoxy grout.

Spacers, strings, ropes, pegs, glue, paper, and face mounting material shall be removed before grouting. Joints between glazed wall tile shall be wetted if they have become dry. Joints for epoxy mortar shall be dry.

Grouting shall not begin until at least 48 hours after installing tile.

A maximum amount of grout shall be forced into the joints between tiles in accordance with the manufacturer's recommendations. The grout shall be finished to the depth of the cushion for cushion edge tile and finished flush with the surface for square edge tile. All gaps and skips in the grout spaces shall be filled.

Mortar or mounting mesh shall not show through the grouted joints.

The finished grout shall have a uniform color and shall be smooth without voids, pinholes or low spots.

Expansion joints shall be kept free of grout or mortar.

Grout shall be protected from freezing or frost for a least 5 days after installation.

**Expansion joints.--**Expansion joints shall be installed at the perimeter of all tile floors and at all substrate control joints and changes in the substrate material. Exterior expansion joint spacing shall not exceed 5 m in any direction.

All expansion joints shall be made with sealant over backer rods. The thickness of sealant at the center of expansion joints shall not exceed the width of the joint. Joint edges shall be primed as recommended by the sealant manufacturer.

**Edge strips.--**Edge strips shall be installed at openings where the threshold has not been shown on the plans, but where tile floor abuts other flooring materials at the same level. Edge strips shall be installed centered under the closed door, or where there is no door, centered in the opening.

**Sounding tile.--**Tiled surfaces shall be sounded with a metal bar or chain for improperly bonded tile or setting bed. Tile or setting bed that emits a hollow sound shall be replaced.

**Replacement.--**Cracked, chipped, broken, or otherwise defective tiles shall be removed and replaced. All tiles which differ more than 2 mm in elevation from adjacent tile edges shall be removed and replaced.

**Curing.--**After the installation of tile and the grouting of joints, the tile and grout shall be cured by keeping the surface continuously damp for at least 72 hours after grouting. Curing materials shall not stain the tile or grouted joints. Curing methods shall not erode away the grout.

After grouting, horizontal tiled surfaces shall be closed to traffic, and all tiled surfaces shall be kept free from impact, vibration or shock, for at least 72 hours.

## **CLEANING AND PROTECTION.--**

**Cleaning tile surfaces.--**All exposed tile surfaces shall be cleaned of all grout haze upon completion of grouting. Acids and chemicals used to clean tile shall conform to the tile manufacturer's recommendations. Cleaners shall not be harmful to materials on surfaces of abutting floors, walls, and ceilings. Tile work shall be rinsed thoroughly with clean water before and after using acid or chemical cleaners. After cleaning and rinsing, tile surfaces shall be polished using a soft cloth.

Tile work shall be cleaned and polished again immediately prior to completion of the contract. All dirt, grime, stains, paints, grease, and other discoloring agents or foreign materials shall be removed.

**Protection.--**After grouting, horizontal tiled surfaces shall be closed to traffic, and all tiled surfaces shall be kept free from impact, vibration or shock, for at least 72 hours after.

Tile surfaces damaged by construction operations shall be retiled.

### **12-9.03 RUBBER BASE**

**GENERAL.--**This work shall consist of furnishing and installing rubber base in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.--**Manufacturer's descriptive data, installation instructions, color palette, and samples of resilient base shall be submitted for approval. Samples shall be not less than 50 mm in length.

#### **PRODUCTS.--**

##### **Rubber base.--**

Rubber base shall be manufacturer's best grade, rubber, with premolded internal and external corner pieces. The height and color shall be as shown on the plans.

##### **Adhesive.--**

Adhesive shall be as recommended by base manufacturer.

#### **EXECUTION.--**

**INSTALLATION.--**Bases shall be firmly and totally attached to walls with adhesive and shall be accurately scribed to trim, molding and cabinets. All joints shall be tight fitting. Bases between premolded corners or other termini may be installed continuous or installed using one m minimum standard manufactured lengths. Filler pieces shall be not less than 0.5 m.

### **12-9.04 RUBBER TILE**

**GENERAL.--**This work shall consist of furnishing and installing rubber tile in accordance with the details shown on the plans and these special provisions.

Rubber tile shall consist of rubber tile, edger strips, and tile manufacturer's recommended primers and adhesives.

**SUBMITTALS.--**Manufacturer's descriptive data, installation instructions, color and pattern samples shall be submitted for approval. Samples of tile shall be 305 mm x 305 mm in size.

#### **PRODUCTS.--**

##### **Rubber tile.--**

Rubber tile shall be no wax, 3 mm thick, 500 mm x 500 mm (nominal) conforming to ASTM Designation: F1334 Class I, and Federal Specification: SS-T-312 Type II. Pattern shall be raised 0.25 mm x 27 mm (nominal) diameter studs. Color shall be as shown on the plans.

##### **Primer, leveling compound crack filler and adhesives.--**

Primer, leveling compound crack filler and adhesives shall be waterproof types as recommended by the tile manufacturer.

##### **Edger strips.--**

Edger strips shall be commercial quality, stainless steel or aluminum.

## **EXECUTION.--**

**PREPARATION.--**Before placing adhesives, all surfaces to receive tile shall be made free of localized depressions or bumps. Bumps shall be ground flat. Holes, depressions and cracks shall be filled with crack filler or leveling compound.

Immediately prior to application of the tile flooring, the surface to be covered shall be thoroughly dry, free of paint, oil, grease, mortar, plaster droppings, scaly surfaces or other irregularities and shall be broom clean. Primer, when recommended, shall be thoroughly brushed on the surface at the rate recommended by the adhesive manufacturer and shall be completely dry before the application of adhesives.

The rooms where tile is to be installed shall be maintained at a temperature of at least 21°C for not less than 72 hours before installation, during installation and for 5 days after installation.

**APPLICATION.--**Tile shall be laid to a true, straight, smooth and even finished surface in accordance with the manufacturer's instructions. Joints shall be tight fitting. Floor covering shall be placed before floor mounted fixtures are installed. After tile has been set, the finished surface shall be rolled and crossrolled with a roller weighing 45 kg or more.

Edger strips shall be installed at free edges.

Where tile patterns between rooms differ, the pattern break at openings shall occur at the centerline of the common wall.

Upon completion of the tile application, all stains, surplus adhesive, dirt and debris resulting from the work shall be removed and the floor left broom clean. Tile shall be protected from damage at all times during construction. As a last order of work, tile shall be washed with soap and warm water, rinsed, and then waxed in accordance with the tile manufacturer's printed instructions. Not less than 2 applications of wax shall be placed on the tile flooring.

## **12-9.05 PAINTING**

### **PART 1.- GENERAL**

**SUMMARY.--**This work shall consist of preparing surfaces to receive coatings, and furnishing and applying coatings, in accordance with the schedules and details shown on the plans, and these special provisions.

The coatings specified in this section are in addition to any factory finishes, shop priming, or surface treatment specified elsewhere in these special provisions.

**SUBMITTALS.--**Manufacturer's descriptive data, a materials list, and color samples shall be submitted for approval.

Product descriptive data shall include product description, manufacturer's recommendations for product mixing, thinning, tinting, handling, site environmental requirements, product application and drying time.

Materials list shall include manufacturer's name, trade name, and product numbers for each type coating to be applied.

Color samples shall be manufacturer's color cards, approximately 50 mm x 75 mm, for each color of coating shown on the plans.

**REGULATORY REQUIREMENTS.--**Coatings and applications shall conform to the rules for control of volatile organic compound emissions adopted by the air quality control district in the air basin in which the coatings are applied.

**SITE ENVIRONMENTAL REQUIREMENTS.--**Coatings shall not be applied when the air temperature is below 10°C (20°C for varnishes) or when the relative humidity exceeds 75 percent.

The surface to be coated shall be maintained at a minimum temperature of 7°C for a period of 24 hours prior to, and 48 hours after the application of the coating. Heating facilities shall be provided when necessary.

Continuous ventilation shall be provided during application of the coatings.

A minimum lighting level of 865 lux, measured 1 m from the surface to be coated, shall be provided while surfaces are being prepared for coatings and during coating applications.

**DELIVERY, STORAGE, AND HANDLING.--**Products shall be delivered to the site in sealed, labeled containers and stored in a well ventilated area at an ambient air temperature of not less than 7°C. Container labeling shall include manufacturer's name, type of coating, trade name, color designation, drying time, and instructions for tinting, mixing, and thinning.

**MAINTENANCE STOCK.--**Upon completion of coating work, a full 3.8 liter container of each type and color of finish coat and stain used shall be delivered to the location at the project site designated by the Engineer. Containers shall be tightly sealed and labeled with color, texture, and room locations where used, in addition to the manufacturer's standard product label.

## **PART 2.- PRODUCTS**

**GENERAL.**--The products shall be the best quality grade coatings of the specified types as regularly manufactured by nationally recognized paint and varnish manufacturers that have not less than 10 years experience in manufacturing paints and varnishes. Products that do not bear the manufacturer's identification as the best quality grade product shall not be used. Products for each coating system shall be by a single manufacturer and shall not contain lead type pigments.

Thinners, shellac, fillers, patching compounds, coloring tint, and other products required to achieve the specified finish shall be the manufacturer's best quality and shall be used as recommended.

## **PART 3.- EXECUTION**

**INSPECTION.**--Surfaces to be coated at the jobsite shall be approved by the Engineer prior to the application of coatings. The Contractor shall notify the Engineer at least 3 working days prior to the application of coatings.

**SURFACE PREPARATION.**--Surfaces scheduled to be coated shall be prepared in accordance with the following, except that the surfaces not specified herein shall be prepared as recommended by the coating manufacturer.

**GENERAL.**--Hardware, cover plates, light fixture trim, and similar items shall be removed prior to preparing surfaces for coating. Following the application of the finish coating, the removed items shall be reinstalled in their original locations.

**WOOD.**--Oil and grease shall be removed by solvent wash. Mildew shall be removed by mildew wash. Surfaces to be coated shall be cleaned of all dirt, excess material, or filler by hand cleaning. Smooth surfaced wood shall be sanded lightly.

A sealer composed of equal parts of shellac and alcohol shall be spot applied to knots, sap, pitch, tar, creosote, and other bleeding substances.

After the application of the prime coat, all nail holes, cracks, open joints, dents, scars, and surface irregularities shall be filled, hand cleaned, and spot primed to provide smooth surfaces for the application of finish coats.

**GALVANIZED METAL.**--Oils, grease, and fabrication lubricants shall be removed by solvent wash. Surfaces shall be cleaned of remaining surface treatments by hand cleaning. New surfaces shall be roughened by hand cleaning or light abrasive blasting.

Abraded or corroded areas shall be hand cleaned and spot coated with one coat of vinyl wash pretreatment. Abraded or corroded areas on new surfaces not scheduled to be painted shall be cleaned by solvent wash, hand cleaned, and given 2 spot applications of zinc rich paint.

**STEEL AND OTHER FERROUS METALS.**--Oils, grease, and fabrication lubricants shall be removed by solvent wash. Dirt, water soluble chemicals, and similar surface contamination shall be removed by detergent wash or steam cleaning. Mill scale and rust shall be removed by hand cleaning or abrasive blasting.

**ALUMINUM AND OTHER NON-FERROUS METALS.**--Oils, grease, and fabrication lubricants shall be removed by solvent wash. Dirt, water soluble chemicals, and similar surface contamination shall be removed by detergent wash.

**GYPSUM BOARD.**--Holes, cracks, and other surface imperfections shall be filled with joint compound or suitable filler prior to application of coatings. Taped joints and filled areas shall be hand sanded to remove excess joint compound and filler.

**SHOP PRIMED SURFACES.**--Dirt, oil, grease, or other surface contaminants shall be removed by water blasting, steam cleaning, or TSP wash. Minor surface imperfections shall be filled as required for new work. Mildew shall be removed by mildew wash. Chalking paint shall be removed by hand cleaning. The surfaces of existing hard or glossy coatings shall be abraded to dull the finish by hand cleaning or light abrasive blasting. Abrasive blasting shall not be used on wood or non-ferrous metal surfaces.

Chipped, peeling, blistered, or loose coatings shall be removed by hand cleaning, water blasting, or abrasive blasting. Bare areas shall be pretreated and primed as required for new work.

## **DEFINITIONS.--**

**DETERGENT WASH.--**Removal of dirt and water soluble chemicals by scrubbing with a solution of detergent and water, and removal of all solution and residues with clean water.

**HAND CLEANING.--**Removal of dirt, loose rust, mill scale, excess base material, filler, aluminum oxide, chalking paint, peeling paint, or paint which is not firmly bonded to the surfaces by using hand or powered wire brushes, hand scraping tools, power grinders, or sandpaper and removal of all loose particles and dust prior to coating.

**MILDEW WASH.--**Removal of mildew by scrubbing with a solution of detergent, hypochlorite-type household bleach, and warm water, and removal of all solution and residues with clean water.

**ABRASIVE BLASTING.--**Removal of oil, grease, form release agents, paint, dirt, rust, mill scale, efflorescence, weak concrete, or laitance, by the use of airborne abrasives, and removal of loose particles, dust, and abrasives by blasting with clean air.

Abrasives shall be limited to clean dry sand, mineral grit, steel grit, or steel shot, and shall be graded to produce satisfactory results. Unwashed beach sand containing salt or silt shall not be used.

Abrasive blasting shall conform to the requirements of SSPC-SP6-85, Commercial Blast Cleaning, as defined in the Steel Structures Painting Council Manual.

Light abrasive blasting shall conform to the requirements of SSPC-SP7-85, Brush-Off Blast Cleaning, as defined in the Steel Structures Painting Council Manual.

**SOLVENT WASH.--**Removal of oil, grease, wax, dirt, or other foreign matter by using solvents, such as mineral spirits or xylol, or other approved cleaning compounds.

**STEAM CLEANING.--**Removal of oil, grease, dirt, rust, scale, or other foreign matter by using steam generated by commercial steam cleaning equipment, from a solution of water and steam cleaning compounds, and removal of all residues and cleaning compounds with clean water.

**TSP WASH.--**Removal of oil, grease, dirt, paint gloss, and other foreign matter by scrubbing with a solution of trisodium phosphate and warm water, and removal of all solution and residues with clean water.

**WATER BLASTING.--**High pressure, low volume water stream for removing dirt, light scale, chalking or peeling paint. Water blasting equipment shall produce not less than a 13 800 MPa minimum output pressure when used. Heated water shall not exceed 66°C. If a detergent solution is used, it shall be biodegradable and shall be removed from all surfaces with clean water.

**PROTECTION.--**The Contractor shall provide protective devices, such as tarps, screens or covers, as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations.

Paint or paint stains on surfaces not designated to be painted shall be removed by the Contractor at his expense and the original surface restored to the satisfaction of the Engineer.

## **APPLICATION.--**

**GENERAL.--**Coatings shall be applied in accordance with the printed instructions and at the application rates recommended by the manufacturer to achieve the dry film thickness specified in these special provisions.

Mixing, thinning and tinting shall conform to the manufacturer's printed instructions. Thinning will be allowed only when recommended by the manufacturer.

Coatings shall be applied only when surfaces are dry and properly prepared.

Cleaning and painting shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

Materials required to be coated shall have coatings applied to all exposed surfaces, including the tops and bottoms of metal doors, the insides of cabinets, and other surfaces not normally visible from eye level.

**APPLICATION SURFACE FINISH.--**Each coat shall be applied to a uniform finish. Finished surfaces shall be free of surface deviations and imperfections such as skips, cloudiness, spotting, holidays, laps, brush marks, runs, sags, curtains, ropiness, improper cutting in, overspray, drips, ridges, waves, and variations in color and texture.

Each application of a multiple application finish system shall closely resemble the final color coat, except each application shall provide enough contrast in shade to distinguish the separate applications.

**WORK REQUIRED BETWEEN APPLICATIONS.**--Each application of material shall be cured in accordance with the coating manufacturer's recommendations before applying the succeeding coating. Enamels and clear finishes shall be lightly sanded, dusted, and wiped clean between applications.

Stain blocking primer shall be spot applied whenever stains bleed through the previous application of a coating.

**TIMING OF APPLICATIONS.**--The first application of the specified coating system shall be applied prior to any deterioration of the newly prepared surface. Metal surfaces shall be prepared and prime coated the same day that cleaning of bare metal is performed. Additional prime coats shall be applied as soon as drying time of the preceding coat permits.

Metal surfaces shall be prime coated within 12 hours of application of vinyl wash pretreatment.

Shellac sealer shall be allowed to dry at least 12 hours before applying the next coat.

Drying time between applications of water borne coatings shall be at least 12 hours.

**APPLICATION METHODS.**--Coatings shall be applied by brush, roller or spray. Rollers shall be of a type which do not leave a stippled texture in the paint film. Extension handles for rollers shall not be greater than 2 m in length.

If spray methods are used, surface deviations and imperfections such as, overspray, thickness deviations, lap marks, and orange peel shall be considered as evidence that the work is unsatisfactory and the Contractor shall apply the remainder of the coating by brush or roller, as approved by the Engineer.

**DRY FILM THICKNESS.**--

Vinyl wash pretreatment	0.007 mm to 0.13 mm, maximum.
Bituminous paint	0.1 mm, minimum.
Other primers, undercoats, sealers, and coatings	As recommended by the manufacturer.

**BACKPRIMING.**--The first application of the specified coating system shall be applied to all wood surfaces (face, back, edges, and ends) of wood materials that are not factory coated, immediately upon delivery to the project site, except surfaces of interior finish woodwork that adjoin concrete or masonry shall be coated with one application of alkyd exterior wood primer before installation.

When clear or stain type coatings are required on millwork, trim, or paneling, varnish, reduced 25 percent by mineral spirits, shall be used for coating the back faces.

All primed metal surfaces in contact with concrete or concrete block exterior walls shall be coated with a bituminous paint on those surfaces in contact with the wall.

**FINISHING MECHANICAL AND ELECTRICAL COMPONENTS.**--Shop primed mechanical and electrical components shall be finish coated in accordance with the coating system entitled, "Shop Primed Steel." Louvers, grilles, covers, and access panels on mechanical and electrical components shall be removed and coated separately.

Interior surfaces of air ducts which are visible through grilles or louvers shall be coated with one application of flat black enamel, to limit of the sight line.

Exposed conduit, piping, and other mechanical and electrical components visible in public areas shall be painted.

Both sides and all surfaces, including edges and back of wood mounting panels for electrical and telephone equipment shall be finish coated before installing equipment.

**CLEANING.**--Upon completion of all operations, the coated surfaces shall be thoroughly cleaned of dust, dirt, grease, or other unsightly materials or substances.

Surfaces marred or damaged as a result of the Contractor's operations shall be repaired, at his expense, to match the condition of the surfaces prior to the beginning of the Contractor's operations.

**COATING SYSTEMS.**--The surfaces to be coated shall be as shown on the plans and as specified elsewhere in these special provisions. When a coating system is not shown or specified for a surface to be finish coated, the coating system to be used shall be as specified for the substrate material. The number of applications specified for each coating system listed herein is a minimum. Additional coats shall be applied if necessary to obtain a uniform color, texture, appearance, or required dry film thickness.

**SYSTEM 1- ALUMINUM AND OTHER NON-FERROUS METALS.--**

1 pretreat coat: vinyl wash pretreatment  
1 prime coat: aluminum primer  
2 finish coats: acrylic, exterior enamel, semi-gloss

**SYSTEM 2- GALVANIZED METAL.--**

1 pretreat coat: vinyl wash pretreatment  
1 prime coat: galvanized metal primer  
2 finish coats: acrylic, exterior enamel, semi-gloss

**SYSTEM 3- GYPSUM BOARD.--**

1 prime coat: PVA wall sealer  
2 finish coats: acrylic, interior enamel, semi-gloss

**SYSTEM 4- SHOP PRIMED STEEL.--**

1 prime coat : red oxide ferrous metal primer  
2 finish coats: alkyd, exterior enamel, semi-gloss

**SYSTEM 5- STEEL AND OTHER FERROUS METALS.--**

2 prime coats: red oxide ferrous metal primer  
2 finish coats: alkyd, exterior enamel, semi-gloss

**SYSTEM 6- WOOD, PAINTED.--**

1 prime coat: alkyd, exterior wood primer  
2 finish coats: acrylic, exterior enamel, semi-gloss

**COLOR SCHEDULE.--**Colors shall be as shown on the plans.

**12-9.06 FIBERGLASS REINFORCED PLASTIC PANELS**

**GENERAL.--**This work shall consist of furnishing and installing fiberglass reinforced plastic (FRP) panels and trim molding in accordance with details shown on the plans and these special provisions.

**SUBMITTALS.--**Manufacturer's descriptive data, installation instructions, and finish options shall be submitted for approval.

Product descriptive data shall show the manufacturer's name and shall indicate conformance to these special provisions.

Installation instructions shall show the FRP panel manufacturer's recommended method of installation.

Finish options shall show the manufacturer's standard color palette for FRP panels and trim molding. Color shall be as shown on the plans.

**PRODUCTS.--**

**FRP panel.--**

FRP panel shall be Class I flame-spread, minimum nominal thickness of 2 mm; Marlite, Class A/I FRP; Kemlite, Fire-X Glasbord; or equal.

**Trim molding.--**

Trim molding shall be manufacturer's standard vinyl molding with nailing flanges and a 9 mm deep channel of sufficient width to receive panels and sealant.

**Adhesive and sealant.--**

Adhesive and sealant shall be as recommended by the FRP panel manufacturer.

**EXECUTION.--**

**INSTALLATION.--**The FRP panels and trim molding shall be installed in accordance with the manufacturer's installation instructions.

Trim molding shall be nailed through the flange into solid wood backing. All nails shall be concealed by FRP panels in the completed installation. Trim shall be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard trim length. If more than one piece is used on one wall, the pieces shall be approximately equal length, with no piece less than 1 m in length. All FRP panel edges shall be covered by a trim molding.

Panels shall be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard panel length. If more than one panel piece is used on one wall, the pieces shall be approximately equal length, with no piece less than one meter in length.

**CLEAN-UP.--**Adjacent surfaces shall be protected from adhesive or sealant. Excess adhesive and sealant shall be removed as the installation progresses using a solvent or cleaning agent recommended by the FRP panel manufacturer.

**12-9.07 ACOUSTIC CEILING TILE**

**GENERAL.--**This work consists of furnishing and installing acoustic tile on ceilings in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.--**Manufacturer's descriptive data, installation instructions and 2 samples of the acoustic tile shall be submitted for approval.

**PRODUCTS.--****Acoustic tile.--**

Acoustic tile shall be 305 mm x 305 mm x 15 mm minimum thickness, square edges, nondirectional natural fissured texture, factory applied, washable, off-white vinyl latex finish. Tile shall conform to ASTM Designation: E 1264, Type III, Form 2. Noise Reduction Coefficient (NRC) shall be minimum 0.65. Panels shall have a flame spread rating not exceeding 25.

**Adhesives.--**

Adhesives shall be as recommended by acoustic tile manufacturer.

**EXECUTION.--**

**PREPARATION.--**Surfaces to receive acoustic tile shall be clean, dry and level and shall be prepared in accordance with the adhesive manufacturer's recommendations.

**INSTALLATION.--**Tile shall be installed in accordance with the manufacturer's recommendations. Installation of tile shall be restricted to periods when the ambient room temperature is between 13°C and 35°C.

**12-9.08 SUSPENDED CEILINGS**

**GENERAL.--**This work shall consist of furnishing and installing suspended ceilings in accordance with the details shown on the plans and these special provisions.

Suspended ceilings shall consist of lay-in acoustical ceilings panels and an exposed grid suspension system. Listed fire rated assemblies shall be installed where shown on the plans.

**DESIGN.--**The suspension system shall be designed to support the weight of ceiling panels, lighting fixtures, air terminals, service assemblies and such other items, not mentioned, which are supported by the suspended ceiling system.

The deflection of any component of the suspension system shall not exceed 1/360 of the span.

The suspension system shall be designed for seismic restraint in accordance with ASTM Designation: E 580.

Lighting fixture attachments shall be designed for a capacity of 100 percent of the lighting fixture weight acting in any direction.

**SUBMITTALS.--**Manufacturer's descriptive data and installation instructions and complete working drawings of all supporting details, lighting fixture attachments, lateral force bracing, partition bracing and runner and panel layouts shall be submitted for approval.

## **PRODUCTS.--**

### **Acoustical panels.--**

Acoustical panels shall be factory produced, lay-in panels, 610 mm x 1219 mm x 16 mm thick with non-directional natural fissured random perforated surface texture and factory applied, washable, off-white, vinyl latex finish. Panels shall conform to ASTM E 1264 Type III, form 2. Noise Reduction Coefficient (NRC) shall be minimum 0.65. Panels shall have a flame spread rating not exceeding 25.

### **Suspension system.--**

Suspension system shall be galvanized steel, tee shaped main runners and cross runners and wall molding angles or channels conforming to ASTM Designation: C 635, intermediate duty or heavy duty. Runners shall have exposed flanges approximately one inch wide and positive interlocks between main runners and cross runners. Wall moldings shall have a 19 mm wide exposed face. Runners and moldings shall be bonderized and shall have a flat off-white color, factory painted finish unless otherwise shown on the plans.

### **Wire hangers.--**

Wire hangers shall be 2.7 mm (12-gage) minimum, galvanized, soft-annealed, mild steel wire.

### **Assembly devices, splices, intersection connectors and expansion devices.--**

Assembly devices, splices, intersection connectors and expansion devices shall be as recommended by the suspension system manufacturer.

## **EXECUTION.--**

**INSTALLATION.--**The suspended ceiling shall be installed square, level and true in accordance with the approved working drawings, the manufacturer's installation instructions and the requirements of ASTM Designations: C 636 and E 580 and Uniform Building Code (UBC) Standard No. 25-2.

Hangers for the suspension system shall be spaced at not more than 1.2 m on centers and shall be saddle tied or wrapped around the main runner members.

Except as specified herein, all lighting fixtures, air terminals, services or other ceiling supported items shall be positively attached to the suspension system.

Lighting fixtures, air terminals, services or other items weighing less than 25 kg shall have, in addition to the requirements specified herein, two 2.7 mm (12-gage) hangers connected from the housing of the fixture, terminal, service or other items to the structure above. These hanger wires may be slack.

Lighting fixtures, air terminals, services or other items weighing more than 25 kg shall be supported directly from the structure above.

The ceiling shall be leveled to within 3 mm in 3.6 m.

**MAINTENANCE STOCK.--**Upon completion of the suspended ceiling work, one unopened carton of acoustical panels shall be delivered to a location at the project site designated by the Engineer.

## **SECTION 12-10. SPECIALTIES**

### **12-10.01 TACKBOARDS**

**GENERAL.--**This work shall consist of furnishing and installing tackboards in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.**--Manufacturer's descriptive data, color and texture samples and installation instructions shall be submitted for approval. Color and texture will be selected by the Engineer after the award of the contract.

**PRODUCTS.--**

**Tackboards.--**

Tackboards shall be textured plastic coating on cotton-fabric, pressure laminated to 6 mm thick cork underlayment. Cork underlayment shall be bonded to a 6 mm thick hardboard backing. Tackboard dimensions shall be as shown on the plans.

**Border moldings.--**

Border moldings shall be factory applied, extruded clear anodized aluminum trim.

**EXECUTION.--**

**INSTALLATION.**--Tackboards shall be installed rigidly, securely, plumb and true, and in accordance with the manufacturer's recommendations.

**12-10.02 MARKER BOARDS**

**GENERAL.**--This work shall consist of furnishing and installing a marker boards in accordance with the details shown on the plans and these special provisions.

One felt eraser and 12 felt tipped liquid chalk markers of assorted colors shall be furnished for each marker board installed.

**SUBMITTALS.**--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

**PRODUCTS.--**

**Marker board.--**

Marker board shall conform to Porcelain Enamel Institute Standard PEI-S-104, and shall be porcelain enamel surface on 0.61 mm thick (24-gage) sheet steel pressure laminated to 6 mm thick tempered hardboard. Hardboard shall have a backing of 0.38 mm nominal thickness aluminum sheet. Enamel surface shall be suitable for marking with felt tipped liquid chalk markers and erasing with a felt eraser or dry cloth. The enamel surface shall be white in color.

Marker board dimensions shall be as shown on the plans.

**Trim and marker tray.--**

Trim and marker tray shall be factory installed, satin finish, clear anodized aluminum extrusions.

**EXECUTION.--**

**INSTALLATION.**--Marker boards shall be installed rigidly, securely, plumb and true in accordance with the manufacturer's instructions.

**12-10.03 SOLID PLASTIC TOILET PARTITIONS**

**GENERAL.**--This work shall consist of furnishing and installing solid plastic toilet partitions in accordance with the details shown on the plans and these special provisions.

Solid plastic toilet partitions shall consist of panels, doors, pilasters, headrails, urinal screens, fasteners, anchorages and hardware. Internal reinforcement shall be provided at all fasteners, anchorages, hardware and accessories.

**SUBMITTALS.**--Manufacturer's descriptive data, standard color palette, installation instructions and working drawings shall be submitted for approval.

Colors will be selected from the manufacturer's standard color palette by the Engineer after the award of the contract.

Working drawings shall show the plan layout, door and panel elevations and all details required for the complete installation and anchorage of the partition system.

## **PRODUCTS.--**

### **Doors and panels.--**

Doors and panels shall be flush, 25 mm minimum thickness, high density polyethylene.

Doors shall have controlled action hinges, with vertical pintle and ball bearing roller operating on adjustable cams, or moving parts of nylon and stainless steel. Top pivots shall be recessed into edges of doors.

Doors shall be provided with slide bar latch with lever type actuator and a combination coat-hat hook and door stop. Doors on stalls designed for use by the disabled shall also be provided with door pulls.

### **Pilasters.--**

Pilasters shall be 25 mm thick, of the same construction as the doors and panels, and shall have an adjustable, leveling base.

### **Headrails.--**

Headrails shall be anodized aluminum, 25 mm x 38 mm minimum, with exposed ends capped.

### **Urinal screens.--**

Urinal screens shall be wedge type, wall-mounted, and of the same construction as the doors and panels. All fasteners shall be concealed.

### **Fasteners and anchorages.--**

Fasteners and anchorages shall be stainless steel with vandal resistant heads.

### **Hardware.--**

Hardware shall be highly polished chromium plated, cast alloy, or heavy duty anodized aluminum.

### **Pilasters anchors.--**

Pilasters anchors shall be integral stud anchor type or internally threaded expansion sleeve type with single cone expander. Self-drilling type anchorage shall not be used.

### **Pilaster shoes.--**

Pilaster shoes shall be one-piece, stainless steel, with concealed hold down clips, and of sufficient height to completely cover the base and anchors.

## **EXECUTION.--**

**INSTALLATION.**--Solid plastic toilet partitions shall be installed rigidly, securely, plumb, and true and in accordance with the manufacturer's recommendations. Tops and bottoms of doors shall align with tops and bottoms of panels, and all horizontal lines shall be level.

Rigid backing shall be provided in walls to receive anchorages.

Panels shall be anchored with at least 3 brackets at each wall and pilaster. Two anchors shall be used to fasten each pilaster base to the floor.

Doors shall not bind during opening and closing. The clearance between the door edges and pilasters shall be uniform, equidistant, and shall not exceed 5 mm. Hinges shall be adjusted to hold doors ajar when unlatched. Doors on stalls designed for use by the disabled shall return to the closed position.

Drilling, cutting and fitting of wall and floor finishes shall be concealed by the completed installation.

**CLEAN-UP.**--Toilet partitions shall be cleaned, polished and free of all defects. Chipped, dented, scratched, or otherwise damaged work shall be replaced at the Contractor's expense.

#### **12-10.04 LOUVERS**

**GENERAL.**--This work consists of furnishing and installing louvers in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.**--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

#### **PRODUCTS.**--

##### **Louvers.**--

Louvers shall be factory fabricated units of extruded aluminum alloy not less than 2 mm thick (12-gage) or galvanized steel sheet not less than 1.63 mm thick (16-gage) with standard "Z" type blades, and removable bronze 16 x 16 mesh insect screens mounted on the inside of the units.

Gravity units shall have blades center pivoted on a 10 mm diameter aluminum rod set in stainless steel ball bearings with cadmium plated races. Blades of gravity louvers shall be equipped with vinyl bulb seals on the edges.

Louvers shall have integral caulking strips and retaining beads.

#### **EXECUTION.**--

**INSTALLATION.**--Louvers shall be installed in accordance with the manufacturer's instructions. The completed louver installation shall be weather tight.

**PAINTING.**--Louvers shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

#### **12-10.05 METAL SIGNS**

**GENERAL.**--This work shall consist of furnishing and installing metal signs in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.**--Manufacturer's descriptive data, colors, graphics and fastening details shall be submitted for approval.

#### **PRODUCTS.**--

##### **Signs.**--

Signs shall be sheet steel, not less than 1.22 mm thick (18-gage) with a baked-on enamel coating.

Signs shall have a white background with contrasting red letters. Letters and background color and size shall be as shown on the plans.

##### **Fasteners.**--

Fasteners shall be as recommended by the sign manufacturer.

**EXECUTION.**--Sign inscriptions shall read as shown on the plans.

Each sign shall be located as shown on the plans and shall be fastened in place with a minimum of 4 fasteners for each sign or as shown on the plans.

## 12-10.06 SIGNS

### PART 1.- GENERAL

#### SUMMARY.--

**Scope.--**This work shall consist of furnishing and installing signs in accordance with the details shown on the plans and these special provisions.

#### SUBMITTALS.--

**Product data.--**Manufacturer's descriptive data for sign materials, colors and graphics, and for fastening hardware and material shall be submitted for approval.

### PART 2.- PRODUCTS

#### Plastic signs (permanent room identification).--

Plastic signs for permanent room identification for other than restrooms shall be scratch resistant, non-static, fire retardent, washable melamine laminate with a non-glare surface, not less than 3 mm thick. Letters and numbers shall be upper case Helvetica, 25 mm in height, 0.80 mm above and integral with sign material, accompanied by Grade 2 Braille.

Grade 2 Braille dots shall be 2.5 mm on centers in each cell with 5 mm space between cells. Dots shall be raised a minimum of 0.6 mm above the background.

#### Plastic sign (restroom).--

Plastic sign for restroom shall be not less than 6 mm acrylic plastic. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Male/female symbol and lettering shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Male restroom identification shall be a male symbol on an equilateral triangle with edges 305 mm long and a vertex pointing upward.

Female restroom identification shall be a female symbol on a 305 mm diameter circle.

Unisex restroom identification shall be a male and female symbol on a 305 mm equilateral triangle superimposed on a 305 mm diameter circle.

#### Accessible building entrance sign.--

Accessible building entrance sign shall be not less than 3 mm acrylic plastic, not less than 102 mm x 102 mm , with the international symbol of accessibility.

Accessible building entrance sign shall be pressure sensitive decal, not less than 102 mm x 102 mm with the international symbol of accessibility.

Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Symbol and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

#### Self-luminous sign (exit).--

Self-luminous sign shall be internally illuminated, self-luminous exit sign powered by permanent integral tritium gas source. Sign shall be listed by the California State Fire Marshal, and UL or other approved testing laboratory.

Sign housing shall be ABS molding. Faceplate shall be acrylic.

**Fastening hardware and material.--**

Fastening hardware and material shall be as recommended by the sign manufacturer. Fasteners shall be noncorrosive.

**PART 3.- EXECUTION**

**Installation.--**Plastic signs for room identification and restrooms shall be fastened or secured to clean, finished surfaces in accordance with the sign manufacturer's instructions. Signs shall be installed at a location and height as shown on the plans.

Metal signs shall be attached securely with galvanized or cadmium plated fasteners.

Fastening hardware and material shall be installed within the sign as shown on the plans.

**12-10.07 WARDROBE LOCKERS**

**PART 1.- GENERAL**

**SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing wardrobe lockers in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data, installation instructions, and standard color palette shall be submitted for approval.

Unless otherwise shown on the plans, the color will be selected by the Engineer from the standard color palette after the award of the contract.

**PART 2.- PRODUCTS**

**ACCEPTABLE MANUFACTURERS.--**

**Available manufacturers.--**Subject to conformance with the contract provisions, metal lockers shall be Art Metal Products; Interior Steel Equipment Co.; Republic Storage Systems; or equal.

**Lockers.--**

Lockers shall be standard, factory fabricated steel units. Framing shall be 1.52 mm thick (16-gage) and face sheets shall be 0.61 mm (24-gage), except door face sheets shall be 1.5 mm (16-gage).

Lockers shall be equipped with the following: hat shelf located approximately 255 mm below the top of the wardrobe locker, side to side coat rod, coat hook, louver vents at top and bottom of door, nonbreakable handle with provisions for a padlock, lockbar with 3-point latching contact with door frame with lever type actuator and 1 1/2 pair full looped leaf hinges.

The approximate dimensions of the wardrobe lockers shall be 380 mm wide, 457 mm deep and 1829 mm high.

**Closed base.--**

Closed base shall be the manufacturer's standard continuous 152 mm base, fabricated of the same material and designed for use with the lockers provided. Bottoms shall be flanged inward for stiffening. Bases shall have the same finish as the locker units.

**Top.--**

Top shall be the manufacturer's standard continuous sloping top with end closure as needed, fabricated of the same material and designed for use with the lockers provided. Tops shall have the same finish as the locker units.

**FABRICATION.--**

**Shop assembly.--**Lockers shall be fabricated square, rigid, and without warp, with metal faces flat and free of dents or distortion.

Frame joints and seams shall be welded. Exposed welds shall be ground smooth. Hinge and latch connections shall be welded or riveted.

Bolts shall be used for assembly and mounting lockers components. Bolt or rivet heads on fronts of locker doors or frame shall not be exposed.

**Factory finish.--**Lockers shall be chemically pretreated with degreasing and phosphatizing process. Wardrobe lockers shall have a baked enamel finish on all surfaces, exposed and concealed.

**PART 3.- EXECUTION**

**Installation.--**Lockers shall be mounted on closed bases at locations shown in accordance with the manufacturer's instructions for plumb, level, rigid, and flush installation.

Wardrobe lockers shall be bolted together at tops and bottoms. The backs of the end lockers shall be bolted to wall anchors with 6 mm bolts installed near the tops of the wardrobe lockers as recommended by the locker manufacturer.

Trim, sloping tops, and metal filler panels, if required, shall be installed using concealed fasteners to provide flush, hairline joints against adjacent surfaces.

The number of lockers shall be as shown on the plans.

**12-10.08 FIRE EXTINGUISHERS AND CABINETS****PART 1.- GENERAL****SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing fire extinguishers with cabinets or mounting brackets in accordance with the details shown on the plans and these special provisions.

**REFERENCES.--**

**General.--**Fire Extinguishers shall conform to the requirements in California Code of Regulations, Title 19 Division 1, Chapter 3, "Portable Fire Extinguishers."

**SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data and installation instructions shall be submitted for approval.

**QUALITY ASSURANCE.--**

**Codes and standards.--**Fire extinguishers shall be Underwriters Laboratories or Factory Mutual Laboratories approved for the type, rating and classification of extinguisher specified.

## **PART 2.- PRODUCTS**

### **MANUFACTURER'S.--**

**Acceptable manufacturers.--**Subject to contract compliance, manufacturers shall be J. L. Industries; Larsen's Manufacturing; Potter-Roemer; or equal.

### **COMPONENTS.--**

#### **Fire extinguisher.--**

Fire extinguisher shall be fully charged, multi-purpose dry chemical type, with charge indicator, hose and nozzle, and attached service record tag. Fire extinguisher shall be of the capacity and type rating shown on the plans.

#### **Mounting bracket.--**

Mounting bracket shall be the manufacturer's standard painted, surface mounted type.

#### **Fire extinguisher cabinet.--**

Fire extinguisher cabinet shall be factory fabricated, constructed of steel with a clear plastic panel in a steel door frame, and shall have a baked enamel finish. Color to be selected by the Engineer from the manufacturer's standard colors.

Fire extinguisher cabinet shall be fully recessed as shown on the plans.

## **PART 3.- EXECUTION**

### **INSTALLATION.--**

**General.--**Fire extinguishers shall be installed in locations and at mounting heights shown on the plans, or if not shown, at a height of 1220 mm from the finished floor to the top of the fire extinguisher.

Fire extinguisher mounting brackets and cabinets shall be attached to structure, square and plumb, in accordance with the manufacturer's recommendations.

### **IDENTIFICATION.--**

**Bracket-mounted.--**Extinguishers shall be identified with red letter decals spelling "FIRE EXTINGUISHER" applied to wall surface. Letter size, style and location as selected by the Engineer.

**Cabinet-mounted.--**Extinguishers in cabinets shall be identified with letter spelling "FIRE EXTINGUISHER" applied to the cabinet door. Letter size, styles, and color shall be selected by the Engineer from manufacturer's standard arrangements.

### **SERVICING.--**

**General.--**Fire extinguishers shall be serviced, charged, and tagged not more than 5 days prior to contract acceptance.

## **12-10.09 FREE STANDING STEEL SHELVING**

**GENERAL.--**This work shall consist of furnishing and installing free standing steel shelving in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.--**Manufacturer's descriptive data, installation instructions and standard color palette shall be submitted for approval. The color will be selected by the Engineer after the award of the contract.

## **PRODUCTS.--**

### **Shelving.--**

Shelving shall be factory fabricated steel shelves and supports capable of supporting loads of 1200 Pa of shelf area. Shelves shall not deflect more than 8 mm when subjected to the loads specified herein and shall show no permanent deflection after removal of such loads. Shelves shall be supported and attached by means of clips. Studs or bolts shall not be used. Shelves shall be adjustable in vertical increments of 75 mm or less. Shelving shall be of the approximate dimensions and number shown on the plans and shall have a baked enamel finish.

**EXECUTION.--**Free standing steel shelving shall be installed in accordance with the manufacturer's instructions.

## **12-10.10 TOILET AND SHOWER ACCESSORIES**

### **PART 1.- GENERAL**

**Scope.--**This work shall consist of furnishing and installing toilet and shower accessories in accordance with the details shown on the plans and these special provisions.

### **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data and installation instructions and details shall be submitted for approval.

### **PART 2.- PRODUCTS**

#### **Toilet tissue dispenser.--**

Toilet tissue dispenser shall be dual roll, surface mounted, stainless steel with satin finish, approximately 150 mm x 290 mm x 150 mm deep. Dispenser shall utilize standard toilet tissue rolls. The top roll shall automatically drop into place after the bottom roll is depleted. One dispenser per toilet stall.

#### **Combination paper towel dispenser and waste receptacle.--**

Combination paper towel dispenser and waste receptacle shall be semi-recessed unit of stainless steel with satin finish. The approximate size shall be 355 mm x 1880 mm x 190 mm deep with 102 mm skirt. The paper towel dispenser shall have a capacity of 1000 single fold paper towels. The waste receptacle shall have a capacity of not less than 37 liters. One unit per lavatory.

#### **Toilet seat cover dispenser.--**

Toilet seat cover dispenser shall be white plastic dispenser, approximately 210 mm x 320 mm x 48 mm deep, single pack. One dispenser per toilet stall.

#### **Napkin receptacle.--**

Napkin receptacle shall be wall hung, white enameled sheet steel napkin receptacle with hinged top and bottom, disposable liner, approximate 3.8 liter capacity container. One receptacle per women's toilet stall.

#### **Clothes hook.--**

Clothes hook shall be stainless steel clothes hook with 2 prongs.

#### **Liquid soap dispenser.--**

Liquid soap dispenser shall be surface mounted, heavy duty plastic dispenser for industrial use with a capacity of at least 710 mL. One dispenser per lavatory.

**Mirror, wall hung.--**

Mirror, wall hung shall be Number 1 quality, 6 mm thick, electrolytically copper plated float or plate glass mirror with nonmoisture-absorbing filler. Mirror shall have a heavy gage galvanized steel back and stainless steel frame. The frame shall have a satin finish and shall be mitered and welded and the corners shall be ground smooth. Fasteners shall not penetrate surfaces of the frame exposed to view. Mirror shall conform to Federal Specification: DD-M-411b and shall be guaranteed against silver spoilage for not less than 10 years.

**Steel grab bars.--**

Steel grab bars shall be stainless steel, 38 mm diameter bars and escutcheon covered integral mounting flanges.

**Folding seat.--**

Folding seat shall be factory fabricated with teakwood or woodgrain phenolic slats, Type 304 stainless steel tube frame with satin finish, wall bracket and hinge. Wood slats shall be factory stained and varnished. Folding seat shall be Bradley, No. 9559; Bobrick, No. B5191; or equal.

**PART 3.- EXECUTION**

**Installation.--**Toilet and shower accessories shall be installed in accordance with the manufacturer's recommendations. Fasteners for mounting accessories shall be concealed and tamper proof.

Expansion anchors shall be used for mounting accessories on masonry or concrete walls.

Toilet and shower accessories shall be mounted after painting work is complete.

All toilet room accessories shall be mounted plumb, secure and rigid. Grab bars shall be supported adequately so the bars will withstand an applied load of 113 kg at any point.

Support assembly for folding seat shall bear solidly on the wall without rocking and shall be fastened rigidly and securely to the wall in accordance with the manufacturer's recommendations.

**SECTION 12-11. EQUIPMENT****12-11.01 HIGH PRESSURE WASHER (STATIONARY)****PART 1.- GENERAL****SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing a stationary high pressure washer and accessories in accordance with the details shown on the plans and these special provisions.

LPG gas piping and water piping shall be furnished and installed in accordance with the requirements specified under "Pipe, Fittings and Valves" in Section 12-15, "Mechanical," of these special provisions.

**SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data for high pressure washer shall be submitted for approval.

Manufacturer's descriptive data shall include a complete description, performance data and installation instructions for the materials and accessories specified herein.

**CLOSEOUT SUBMITTALS.--**

**Operation and maintenance manuals.--**Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

## **WARRANTY.--**

**Warranties and guarantees.--**Manufacturers warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

## **PART 2.- PRODUCTS**

### **MANUFACTURERS.--**

**Acceptable manufacturers.--**Subject to compliance with the requirements, products shall be Epps; Whitco; or equal.

### **MANUFACTURED UNITS.--**

#### **High pressure washer.--**

High pressure washer shall be stationary type, electric motor driven (208/220 volt AC, 3 phase), LPG fired, minimum 80 percent efficient, automatic operating type washer designed for continuous operation. The washer shall have a capacity of 38 liters per minute of hot water solution heated to 27°C at 13 800 kPa. Unit shall be rated for not less than 220 kilowatt. The washer burner shall be natural draft, with automatic electric ignition and flame monitoring system. Heater unit shall be factor preset to operate between 15.5°C and 27°C. The heating coil shall have an inside diameter of not less than 12 mm. The unit shall be completely housed in a steel cabinet with parts shielded from spray or splash.

Washer unit shall be equipped with a remote on/off pump motor and washer heater switch control panel. All controls including remote operator shall be 24-volt AC. Unit shall have a timer automatic shutdown system preset for two minutes.

The control panel shall display temperature and pressure gauges and shall mount the motor starter and the power disconnect breaker.

The unit shall be equipped with safety controls, safety valve, vent stack and the following accessories: 864 mm heavy duty dual lance wand with trigger control; 12.7 mm diameter by 15 meters in length, high pressure hose with 2 swivel ends rated for 24 100 kPa at 121°C; spray nozzles to allow flat, round and wide angle spray patterns at full flow at 13 800 kPa and full flow at 6 900 kPa (total 6); and a wall mounted hose reel and gun rack.

### **ACCESSORIES.--**

#### **Drum dolly.--**

Drum dolly shall have welded steel construction with a cross braced bottom and a 50 mm continuous perimeter lip, 4 ball bearing casters with steel or semi-steel wheels. Drum dolly shall be sized to match the liquid detergent drum with a minimum capacity of 450 kg.

#### **Vent stack.--**

Vent stack shall be listed Class B. Vent stack shall include back draft diverter, fire stop spacer, ventilating thimble with drip cap and listed vent cap.

#### **Hose and gun reel.--**

Hose and gun reel shall be heavy duty assembly of steel construction with connecting hose, locking automatic ratchet, guide rollers and heavy duty spring activated hose pickup. Hose and gun reel shall have bushings, swivels, ball stops, and sized for a 15 m delivery hose. The reel shall have a baked enamel finish. Manufacturers reel mounting brackets shall be supplied with reel.

**Soap/water mixing meter.--**

The soap/water mixing meter shall be wall mounted, have a blend center consisting of; siphon breaker; kick-off spring; stainless steel enclosure; vinyl tubing; proportioner; ceramic weight; pipe plug; magnetic housing; push button; spring; spacer; plunger valve body; pipe to garden hose adapter; foot valve; inlet screen; and meter tip kit.

**Non-emulsifying soap.--**

Non-emulsifying soap shall be a commercially formulated, concentrated liquid that removes surface dirt, road film, and bug residue from vehicle exteriors with minimal brushing when used in conjunction with a high pressure washer. The soap shall contain no solvents, caustics, acids or phosphates. It shall work with hot or cold water, rinse easily and leave no unsightly soap film or streaks. A drum containing 208 liters of the product shall be supplied by, or approved by the manufacturer of the recycle process unitoil/water separator system specified elsewhere in these special provisions. Product shall conform to the following:

Boiling point	>100°C
Specific Gravity	1.102
Solubility in water	100%
Evaporation rate	>1
pH	11-12

**Expansion anchors.--**

Expansion anchors shall be ICBO approved, integral stud type or internally threaded type with independent stud complete with hex nut and cut washer.

**PART 3.- EXECUTION**

**INSTALLATION.--**

**General.--**The high pressure washer shall be installed in accordance with the manufacturer's recommendations.

A reduced pressure backflow preventer shall be installed in the water line prior to the unit. Piping shall be installed to provide a minimum headroom clearance of 2.5 meters. Piping shall not be installed in travel areas at floor level.

Hose and gun reel assembly shall be attached to the wall with 6 mm (minimum) stud type expansion anchors. If hose and gun reel does not include brackets for the gun nozzle, wall brackets shall be installed at the Contractor's expense.

Factory fittings for mixing meter shall be installed on the 208 liter drum of non-emulsified soap and placed on the drum dolly. Soap and dolly shall be ready for use and placed in the equipment building or other location as designated by the Engineer.

**FIELD QUALITY CONTROL.--**

**Testing.--**Testing of the high pressure washer shall be conducted by the Contractor in the presence of the Engineer. The Contractor shall notify the Engineer in writing not less than 5 days prior to the time that testing is to be conducted.

**12-11.02 LUBRICATION AND COMPRESSED AIR SYSTEMS**

**PART 1.- GENERAL**

**SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing lubrication and compressed air systems in accordance with the details shown on the plans and these special provisions.

The lubrication system shall include drum dollies; and pneumatic pumps for dispensing chassis lubricant, motor oil, automatic transmission fluid, gear lubricant and anti-freeze; chassis lubricant hose and all connecting pipelines, hoses, accessories and mounting assemblies.

The compressed air system shall include a compressor, regulators, gauges and compressed air piping.

Pipes and fittings shall be in accordance with the requirements specified under "Pipes, Fittings, and Valves," in this Section 12-15, "Mechanical," of these special provisions.

**Permits to operate.--**Attention is directed to the latest Division of Industrial Safety (DIS) regulations regarding tank mounted air compressors.

The Contractor shall provide all permits to operate pressure vessels in accordance with the requirements of the DIS and shall pay all costs for such permits. Such permits shall be posted under glass at the work site.

#### **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive data shall include a complete description, performance data and installation instructions for the materials and equipment specified herein.

Performance data shall include the product delivery rate and discharge pressure for each type of pump assembly.

#### **CLOSEOUT SUBMITTALS.--**

**Operation and maintenance manuals.--**Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

#### **WARRANTY.--**

**Warranties and guarantees.--**Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

### **PART 2.- PRODUCTS**

#### **PUMP ASSEMBLIES.--**

**General.--**Pump assemblies shall be lubricant and oil type pump assemblies with air driven motors and shall be suitable for operation with stationary, exposed drums. Pump assemblies shall include pressure relief kits. Air connector hose shall be rated for 1720 kPa minimum working pressure. Product connector hose shall be as specified for the individual reel assembly. Pump assemblies shall produce the flowrates and pressures as specified under "Testing".

#### **Chassis lubricant pump assembly.--**

Chassis lubricant pump assembly shall be suitable for use with stationary, exposed 55 kg drums, complete with drum cover, air coupler and follower plate, and shall have a minimum pressure ratio of 45:1 and a maximum pressure ratio of 50:1. The chassis lubricant pump assembly shall be Lincoln, 918; Alemite, 8550; Graco, 225-014; or equal.

#### **Motor oil, ATF and gear oil pump assemblies.--**

Motor oil, ATF and gear oil pump assemblies shall be suitable for use with stationary, exposed 205 liter drums and equipped with a bung bushing and an air expeller in the pump tube and shall have a 76 mm air motor. The motor oil pump assembly shall be equipped with a flow compensator. Pump assemblies shall be Lincoln, 424; Alemite, 8569; Graco, 225-640; or equal.

#### **Anti-freeze pump assembly.--**

Anti-freeze pump assemblies shall be suitable for use with stationary, exposed 205 liter drums and equipped with a bung bushing, 316 stainless steel construction, and teflon packing. Pump assemblies shall be Lincoln, 84830; Aro, 612041; Graco, 226-942 and 213013; or equal.

**Recyclable oil transfer pump.--**

Recyclable oil transfer pump shall be an air operated double diaphragm pump with 25 mm inlet and outlet and a minimum pressure ratio of 1:1. Pump shall have aluminum housing with Buna-N trim. Recyclable oil transfer pump shall be Lincoln, Model 84852; Graco, Model D73-525; or equal.

**MISCELLANEOUS COMPONENTS.--****Recyclable oil storage tank.--**

Recyclable oil storage tank shall be upright and shall be constructed from cross linked polyethylene materials. Recyclable oil transfer tank shall be equipped with a translucent vessel and shall be sized as shown on the plans.

**Light reel assembly.--**

Light reel assembly shall be overhead type light reel with a positive reel latch cord lock mechanism, release mechanism, reel cord retractor, 9 m minimum length of 3-wire cord, 600 mm pigtail, ball stop, vapor-tight high impact phenolic plastic holder without switch or receptacle with heavy duty lamp guard and 100-watt incandescent bulb or 15-watt fluorescent tube. The incandescent light reel assembly shall be Alemite, 330005C; or equal. The fluorescent light reel assembly shall be Hi Reel, 3005-AFL; Woodhead, 945-3SW-1003-3S; or equal.

**Air compressor.--**

Air compressor shall be 2-stage, 1210 kPa design, 860 kPa output, mounted on an ASME code horizontal type receiver. The air compressor shall be complete with unloader, V-belt drive, belt guard, oil and air pressure gauges, automatic pressure controller, outlet valve, ASME relief valve, air intake filter, ball valve drain and an automatic tank drain operated by either the compressor unloader or a governor. Motor shall be high efficiency type, open dripproof with class B insulation. Air compressor shall be Champion, Ingersol Rand, Kellogg, or equal.

**Pressure regulator.--**

Pressure regulator shall be combination type with filter, bowl, pressure regulator and pressure gauge.

The filter bowl shall be the quick disconnect type, plastic with metal guard, manual drain, and 5 micron filter.

Pressure regulator shall be diaphragm controlled, balanced valve type, rated for 0 to 1100 kPa operation and shall be equipped with pressure gage, bottom clean-out plugs and internal strainers. Regulator shall be Wilkerson, Lincoln, Wabco, or equal.

**Flexible coupling.--**

Flexible coupling shall be brass flexible metal hose with threaded union ends and a minimum working pressure of 1380 kPa.

**Pressure gage.--**

Pressure gage shall be rotary type ANSI Standard: B40.1, Grade A, with 90 mm dial, liquid filled with cover, plain case, reset screw and bottom inlet. Pressure gage movement shall be phosphor bronze bushed. Gage shall read from 0 kPa to 1400 kPa. Each gage shall be equipped with a gage cock. Pressure gage shall be Marsh, Ashcroft, US Gage, or equal.

**Drum dolly.--**

Drum dolly shall have welded steel construction with a cross braced bottom and a 50 mm continuous perimeter lip, 4 ball bearing casters with steel or semi-steel wheels. Drum dolly shall be sized for 55 kg, drums or 205 liter drums as applicable.

**PART 3.- EXECUTION****INSTALLATION.--**

**General.--**The hose reels shall be installed rigidly and securely to the reel mounting bracket. The mounting bracket shall be attached to the overhead structure as shown on the plans.

The recyclable oil storage tank and transfer pump shall be installed as shown on the plans.

Pipelines shall be cleaned and flushed immediately prior to connecting the control valves.

Pressure relief kits shall be installed on the discharge side of the recyclable oil, gear lube, ATF and motor oil pumps as recommended by the pump manufacturer.

Air compressor shall be installed with drain piping, vibration isolation pads and expansion anchors.

Unions shall be installed before and after the pressure regulator/ball valve assembly.

Each pump assembly drum shall be supplied with a drum dolly.

### **FIELD QUALITY CONTROL.--**

**Testing.--**All tests, including general performance tests to demonstrate the proper operation of the lubrication systems and the air compressor, shall be performed by the Contractor in the presence of the Engineer.

The air compressor system shall be tested for the operational range, the cut-off pressure and the operation of air drops and system components.

The lubrication system, including piping and hoses, shall be tested for leaks and the rates of delivery specified herein. The lubrication connections shall show no visible signs of leaks when the system is filled with the specified lubricant and tested at 1040 kPa lubricant pump inlet air pressure.

The Contractor shall demonstrate that the completed lubrication system will deliver the given product at the flowrate and discharge pressure specified by the pump assembly manufacturer. If no specification is given the lubricants shall be delivered at the following rates at 1040 kPa lubricant pump inlet air pressure:

Lubricant Material	Delivery Rate
Chassis lubricant NLGI No. 2 grease	0.7 liters per minute
Motor oil (10W/40)	7 liters per minute
Gear oil (85W/140)	6 liters per minute
ATF (SAE 10)	8 liters per minute
Anti-freeze (50 % solution)	8 liters minute

The required delivery rate values may be adjusted, as determined by the Engineer, when testing for delivery rates with different materials or at temperatures other than 21°C.

The drums and lubricating material for testing the lubrication system will be State-furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions.

### **12-11.03 PORTABLE WELDING FILTRATION SYSTEM**

#### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing a portable welding filtration system in accordance with the details shown on the plans and these special provisions.

The performance rating and electric service shall be as shown on the plans.

#### **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data for a portable welding filtration system and accessories shall be submitted for approval.

Manufacturer's descriptive data shall include a complete description, performance data and installation instructions for the materials and equipment specified herein.

## **CLOSEOUT SUBMITTALS.--**

**Operation and maintenance manuals.--**Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

## **WARRANTY.--**

**Warranties and guarantees.--**Manufactures warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

## **PART 2.- PRODUCTS**

### **Portable welding filtration system.--**

Welding filtration system shall be portable type, equipped with electrostatic precipitator, welded steel cabinet, welding exhaust arm assembly, structural channel and angle welded iron base and cabinet mounted plug-in power pack with indicator lamps and 4500 mm minimum grounded extension cord. Precipitator shall be vertically mounted. self-contained, 2-stage type with mechanical prefilter, electronic ionizing section, removable collector cell and belt driven centrifugal blower.

Welding exhaust arm assembly shall have 3000 mm minimum reach and shall consist of a double ball bearing swivel with full 360° rotation, self-supporting arm with balancing springs, tubular hand grip, weldproof tubing and swivel mounted receptor. The base shall have two rubber wheels and two swiveling steel casters to provide ease of movement. The base shall be welded to the precipitator cabinet and shall be provided with heavy duty foot brake. The whole unit shall be assembled and pretuned at the factory.

## **PART 3.- EXECUTION**

### **INSTALLATION.--**

**General.--**The portable welding filtration system shall be installed in accordance with the manufacturer's recommendations.

### **FIELD QUALITY CONTROL.--**

**Testing.--**Testing of the portable welding filtration system shall be conducted by the Contractor in the presence of the Engineer.

The Contractor shall notify the Engineer in writing not less than 5 days prior to the time that testing is to be conducted.

## **12-11.04 WORKBENCH**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing a workbench in accordance with the details shown on the plans and these special provisions.

#### **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data and standard color palette shall be submitted for approval.

## **PART 2.- PRODUCTS**

### **Workbench.--**

Workbench shall be standard, factory fabricated and factory painted heavy duty workbench unit with plywood reinforced steel top, drawers, curb and shelves. Plywood top reinforcement shall consist of two layers of securely fastened 19 mm thick exterior type plywood. The drawers, shelves and curb shall be as shown on the plans. Paint shall be an industrial grade enamel.

### **Leg anchors.--**

Leg anchors shall be ICBO approved, integral stud type expansion anchors or internally threaded type anchors with independent stud.

## **PART 3.- EXECUTION**

**Installation.--**The workbench shall be installed with the top level and the legs rigidly and securely fastened to the floor. Anchors for the legs shall be installed in accordance with the manufacturer's instructions.

## **SECTION 12-12. FURNISHINGS**

### **12-12.01 HORIZONTAL BLINDS**

#### **PART 1.- GENERAL**

##### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing horizontal blinds in accordance with the details shown on the plans and these special provisions.

Horizontal blinds shall be standard, factory manufactured assemblies suitable for use on exterior wall windows.

##### **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data, color chips, and installation instructions shall be submitted for approval.

#### **PART 2.- PRODUCTS**

##### **Horizontal blinds.--**

Horizontal blinds shall be nominal 25 mm wide, spring tempered virgin aluminum alloy horizontal slats supported by braided polyester ladders. Braided ladders shall hold slats at equal spaces, parallel, straight, and shall provide tilt control and adequate overlap of slats. The distance between ladders shall not exceed 585 mm. Slat tilt shall be adjustable by a transparent wand. Blinds shall be adjustable to any height using lift cords.

Hardware shall be enclosed in a metal head and the opening hardware shall be clinched to the head. All metal parts shall have a corrosion resistant coating.

#### **PART 3.- EXECUTION**

**Installation.--**Horizontal blinds shall be installed in accordance with the manufacturer's instructions.

## SECTION 12-13. (BLANK)

## SECTION 12-14. CONVEYING SYSTEMS

### 12-14.01 BRIDGE CRANE AND HOIST

#### PART 1.- GENERAL

##### SUMMARY.--

**Scope.--**This work consists of designing, constructing, furnishing and installing a 2700-kilogram free standing electric bridge crane with an electric powered hoist on a motorized trolley, in accordance with the details shown on the plans, the requirements specified in these special provisions, and the recommendations and instructions of the hoist manufacturer.

The work shall also include the design, construction, furnishing and installation of the crane runway rails and the bridge girder for the trolley and hoist.

##### SYSTEM DESCRIPTION.--

**Runway and girder design requirements.--**The crane runway rails and the bridge girder shall be designed to support the crane and hoist loads, including the required safety factors, as recommended by the crane and hoist manufacturer for the crane capacity specified herein and as recommended by the Materials Handling Institute Standard No. 74, "Top Running and Underhung Single Girder Electric Overhead Traveling Cranes," and as required by Title 24 of the California Building Standards Code, Title 8 of the California Code of Regulations and the 1998 California Building Code.

The crane runway rails shall be located as shown on the plans and the crane system shall be complete with self-supported runway system consisting of bi-directional moment frames. The approximate spacing of the structural steel support frames is as shown on the plans. The minimum vertical clearance shall be as shown on the plans.

The bridge girder shall be designed for the span between the crane runways. The approximate length of span between the crane runways shall be as shown on the plans. Final span length shall be determined by the manufacturer. The length of travel of the trolley at each end shall be determined by the Contractor and shall be the maximum that can be attained while maintaining adequate operating clearances between the crane assembly and the building in which it is installed.

##### SUBMITTALS.--

**Product data.--**Manufacturer's descriptive data, performance data, parts list and installation instructions for bridge crane and hoisting equipment shall be submitted for approval.

**Working drawings.--**Working drawings and design calculations for the runways rails and bridge girder shall be submitted for approval.

Working drawings shall include control panel schematic and wiring diagram, and a listing of electrical equipment and devices to be furnished.

Working drawings and design calculations for the crane runways and bridge girder shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California.

##### CONTRACT CLOSEOUT SUBMITTALS.--

**Operation and maintenance manuals.--**Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

##### QUALITY ASSURANCE.--

**Certificate of Compliance.--**Certificates of Compliance shall be furnished for the crane runways and bridge girder in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the General Conditions.

**Codes and standards.**--All welding shall be in accordance with the requirements in American Welding Society (AWS) D14.1, "Specifications for Welding Industrial and Mill Crane and Other Material Handling Equipment."

## **PART 2.- PRODUCTS**

### **MANUFACTURERS.--**

**Acceptable manufacturers.**--Subject to project conditions, bridge crane shall be CraneVeyor Corp.; Detroit Hoist; Lift-Tech International, Inc.; or equal.

### **MANUFACTURED UNITS.--**

#### **Bridge crane.--**

**General.**--The electric bridge crane with a 2700-kilogram capacity shall include an electric powered hoist on a motorized trolley, power bar conductors, and pendant-type electrical controls.

The bridge crane shall be a 2700-kilogram capacity, motor driven, underhung, single girder type crane. Bridge crane shall include bridge girder, end trucks, wheels, crane drive shaft, motor drive head, and drive motor. Bridge crane speed shall be 15 meters per minute.

The hoist and trolley shall be a 2700-kilogram, close headroom, wire rope hoist mounted on a single-speed, electric motor driven trolley.

Crane control system shall consist of a bridge girder mounted control panel, festooned bridge conductor system, conductor bar system, travel limit switches, fully solid-state softstart for the bridge crane and trolley motors, and 7 button pendant station complete with strain relief hardware for full operation of hoist, trolley and bridge. Controls shall be actuated by the pendant station.

### **COMPONENTS.--**

#### **Bridge girder and trucks.--**

Bridge girder shall be fabricated from structural steel conforming to ASTM Designation: A 36, and shall have a maximum deflection of 1/600 of the span length under maximum loading conditions. The bridge girder shall be provided with travel stops.

The end trucks shall be designed to run on the lower flange of the runway rails and shall be constructed of welded structural steel shapes conforming to ASTM Designation: A 36. The end trucks shall be motorized and shall have not less than 4 forged steel wheels with sealed, tapered roller bearings.

The drive motor shall be a single gear driven motor with a common drive shaft or a dual drive motor system. The drive motor shall be rated for Class C Service, crane travel duty, and shall be reversible with motor brake. Horsepower, voltage and phase shall be as shown on the plans.

The crane drive shaft for single motor operation shall be supported on lubricated pillow blocks with precision ball bearings.

#### **Hoist and trolley.--**

The trolley shall be motorized and shall have not less than 4 hardened forged steel wheels with sealed, tapered roller bearings. The trolley frame shall be of rigid construction. The trolley operating speed shall be nominal 12 meter per minute. The trolley motor shall be continuous duty, reversible, with motor brake. Power requirements, voltage and phase shall be as shown on the plans.

The hoist shall be oil bath gear driven flanged drum with machined grooves, mechanical type disc brake, heavy duty ball bearings, have a high limit switch for the hook travel, and shall be equipped with a load limiting clutch to prevent damage from overloads. Hook shall be forged steel, with 360 degree swivel and spring latch. The hoist motor shall be continuous duty, reversible, with motor brake. Power requirements, voltage and phase shall be as shown on the plans.

#### **Runway rails.--**

Runway rails shall include all beams, rails, and stiffeners required to span between primary framing members of the building. Runway rails shall be fabricated from structural steel conforming to ASTM Designation: A 36. The rails shall have a maximum deflection of 1/600 of the span length under maximum loading conditions. The runway rails shall be provided with travel stops.

#### **Control panel.--**

Control panel shall be UL or FM listed for crane operation and shall include main disconnect, mainline contactor, hoist motor disconnect, bridge motor disconnect, trolley motor disconnect, hoist motor reversing starter, bridge motor reversing starter, trolley motor reversing starter, thermal overload relays, control transformer disconnect, control transformer, control relays, power terminal block and control terminal block. All contactors and starters shall be NEMA rated. Components shall be mounted on the interior mounting panel.

Control panel shall be a NEMA 12 enclosure, with interior mounting panel and hinged exterior dead front door. Control panel shall be factory prewired in conformance with Class-II Type 1C wiring. All wires entering or leaving the control panel shall terminate on terminal blocks. Control wires shall be 7 strand No. 14 Type MTW wires. Wiring shall be arranged such that any component may be removed without removing any wiring except that component's leads.

Control panel shall be a complete system, routinely advertised, furnished by the bridge crane and hoist manufacturer.

#### **Power and control cable.--**

Power and control cable shall be as recommended by the bridge crane and hoist manufacturer.

#### **Festooned bridge conductor system.--**

Festooned bridge conductor system shall consist of multiconductor cable, cable grip, messenger chain, tag-line wire, 50 mm (inside diameter) conductor cable rings, take up brackets, 10 mm eye-bolts and other necessary hardware. Conductor sizes shall be as recommended by the hoist and trolley manufacturer.

#### **Conductor bar system.--**

Conductor bar system shall consist of enclosed power conductors, collectors and related covers, hangers, couplings and appurtenances. Conductor bar system shall be rated for 600 volts, 90 amperes continuous duty and 135 amperes intermittent duty. Conductor bars shall be one piece, copper conductors with thermoplastic insulating covers. End covers shall be provided. Collectors shall be spring loaded, replaceable shoe type rated for 150 meters per minute (minimum) travel.

#### **FABRICATION.--**

**Shop finishing.--**Bridge crane and hoist shall be cleaned and receive 2 coats of the manufacturer's standard paint.

**Identification.--**An information plate, with the following information, shall be attached to the bridge crane hoist and trolley.

- Manufacturer's name and address
- Model number
- Serial number
- Crane capacity
- Hoist capacity
- Date of installation

## **PART 3.- EXECUTION**

### **INSTALLATION.--**

**General.--**The bridge crane and hoist shall be installed in accordance with the manufacturer's instructions and the approved working drawings.

Crane runway sections shall be installed with couplings at joints to provide flush and level connections with a maximum gap between adjacent ends at the load-carrying flange not exceeding 2 mm except at free ends.

The bottom flanges of all crane runways shall be parallel and level with one another within a tolerance of plus or minus 6 mm throughout their entire length.

Hanger system shall provide for vertical adjustment of the runway beams both so that the runways can be erected and maintained within level tolerance.

The crane control panel shall be mounted on the crane bridge and shall be actuated from a pendant station, suspended 1.2 meters above the floor. Main power and trolley power shall be by festooned bridge conductor system and shall be installed along the bridge crane from the control panel to the conductor bar system and trolley motor.

Each soft start unit for the bridge and trolley motors shall be enclosed in a NEMA 12 enclosure and may be installed near the bridge or trolley motor.

Power and control cables shall be fastened to the structural members with one-hole steel straps at a spacing of not to exceed 0.9 meter on center.

**Field painting.--**After installation, damaged and abraded areas of the shop paint shall be repainted using the same materials as applied in the shop.

### **FIELD QUALITY CONTROL.--**

**Tests.--**The bridge crane and hoist shall be tested in the presence of the Engineer. Any equipment failure or malfunction shall be corrected by the Contractor at his expense.

Tests shall be as described herein:

**NO LOAD TEST.--**The trolley and hoist shall be operated to throughout the full length of the crane runways and the limits of hook travel. Travel limit switches shall be engaged.

**LOAD TEST.--**The minimum test load shall be 125 percent of the rated load capacity. The trolley shall be operated for the full length of the crane runways under the test load. The test load shall be raised to the hook height limit and lowered until the cable is slack. After a 5-minute waiting period, the test load shall be raised one foot and held in that position, without slipping, for a minimum time period of ten minutes.

**LOSS OF POWER TEST.--**The main power switch shall be opened while the test load is being lowered. The test load shall stop completely and immediately when the power switch is opened.

**Manufacturer's field service.--**The Contractor shall arrange for the bridge crane manufacturer's representative to be present during testing.

## **SECTION 12-15. MECHANICAL**

### **12-15.01 MECHANICAL WORK**

#### **GENERAL.--**

**Scope.--**This work shall consist of performing mechanical work in accordance with the details shown on the plans and these special provisions.

Mechanical work shall include furnishing all labor, materials, equipment and services required for providing heating, ventilating, air conditioning, plumbing and liquefied petroleum gas (LPG) distribution systems.

Earthwork, foundations, sheet metal, painting, electrical, and such other work incidental and necessary to the proper installation and operation of the mechanical work shall be in accordance with the requirements specified for similar type work elsewhere in these special provisions.

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of pipes, ducts, etc., and location of equipment is to be governed by structural conditions and obstructions. Equipment requiring maintenance and inspection is to be readily accessible.

Roof penetrations shall be flashed and sealed watertight in accordance with the requirements specified under "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

### **SUBMITTALS.--**

**Product data.--**A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions for plumbing fixtures, and component layout shall be included where applicable.

Manufacturer's descriptive data shall be submitted for the following:

- Water hammer arrestor
- Access door
- Automatic trap seal primer valve
- Compression stop
- Hose faucet
- Pipe insulation
- Cleanouts
- Valve boxes
- Floor drain
- Water closet
- Urinal
- Lavatory
- Lavatory carrier
- Lavatory and sink faucets
- Mop sink
- Kitchen sink
- Water heaters
- Electric water cooler
- Emergency shower and eyewash
- Low intensity radiant heating system
- Gate valves
- Ball valves
- Balancing dampers
- Unit heater
- Electric wall heater
- Heat-vent-light combination
- Duct heater
- Supply fan
- Exhaust fans
- Evaporative coolers
- Air conditioning units
- Thermostats
- Time switches
- Diffusers
- Registers
- Air grilles
- Duct insulation
- Duct liner
- Flow indicator
- Alarm bell
- Fire department inlet connection
- Dry pipe valve

- Ductile iron pipe and fittings
- Backflow preventer
- Sprinkler heads
- Air maintenance system
- Wall hydrant
- Gas regulator
- Wye strainer
- Check valve
- Compressed air supply
- Combination heating/cooling unit

#### **CLOSEOUT SUBMITTALS.--**

**Operation and maintenance manuals.--**Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Operation and maintenance manuals shall be submitted for the following equipment:

- Air conditioning units
- Evaporative coolers
- Exhaust fans
- Radiant heating system components
- Electric water cooler
- Unit heaters
- Thermostats
- Duct heater
- Combination heating/cooling unit

#### **QUALITY ASSURANCE.--**

**Codes and standards.--**Mechanical work, including equipment, materials and installation, shall conform to the California Building Standards Code, Title 24, and to the California Code of Regulations, Title 8, Chapter 4, Division of Industrial Safety (DIS).

#### **WARRANTY.--**

**Warranties and guarantees.--**Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

#### **SYSTEM IDENTIFICATION.--**

**Piping, ducts, valves and equipment.--**Identification of piping, ducts, valves and equipment shall be as shown on the plans or these special provisions:

**Equipment.--**All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (for example, AC-4). Provide 15 mm high lettering, white on black background. Nameplates shall be permanently secured to the unit.

## 12-15.02 PIPE, FITTINGS AND VALVES

### PART 1.- GENERAL

#### SUMMARY.--

**Scope.--**This work shall consist of furnishing and installing pipes, fittings and valves in accordance with the details shown on the plans and these special provisions. Pipe, fittings and valves shall include such plumbing and piping accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the plumbing and piping systems.

All piping insulation and wrapping material shall be in accordance with the requirements specified under "Mechanical Insulation," in this Section 12-15.

The pipe sizes shown on the plans are nominal pipe size. No change in the pipe size shown on the plans shall be permitted without written permission from the Engineer.

The pipe and fitting classes and material descriptions shall be as specified herein. No change in class or description shall be permitted without written permission from the Engineer.

#### QUALITY ASSURANCE.--

**Codes and standards.--**Pipe, fittings and valves shall be installed in accordance with the requirements in the latest edition of the Uniform Plumbing Code, the manufacturer's recommendations and the requirements specified herein.

### PART 2.- PRODUCTS

#### MATERIALS.--

#### PIPE AND FITTINGS --

Class	Description
-------	-------------

##### A1.--

Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, with 1040 kPa galvanized malleable iron banded screwed fittings and galvanized steel couplings. The weight of the zinc coating shall be not less than 90 percent of that specified in ASTM Designation: A 53.

##### A2.--

Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, with black cast iron recessed drainage fittings. For rainwater leaders, neoprene-gasket compression couplings, Smith Blair, Dresser, or equal, may be used. The weight of the zinc coating shall be not less than 90 percent of that specified in ASTM Designation: A 53.

##### A3.--

Schedule 5 steel pipe conforming to ASTM Designation: A 135 with pressfit fittings and couplings for service as designated.

##### A4.--

Pipe and fittings shall be UL or FM listed, ferrous (Schedule 20 minimum) or copper (Type L minimum), suitable for the working pressure involved but not less than 1210 kPa. Pipe and fittings shall be in accordance with NFPA Code requirements.

##### B1.--

Schedule 40 black steel pipe conforming to ASTM Designation: A 53, with screwed fittings suitable for working pressure involved, but not less than 1210 kPa. Fittings shall be listed for fire protection.

**B2.--**

Schedule 40 black steel pipe conforming to ASTM Designation: A 53, with 1040 kPa black malleable iron banded screwed fittings and black steel couplings.

Steel pipe coating, where required, shall be factory applied plastic. Pipe coating shall be Standard Pipe Protection, X-Tru-Coat (0.50 mm thick); Pipe Line Service Corporation, Republic; 3M Company, Scotchkote 205 (0.30 mm thick); or equal.

**B3.--**

Schedule 80 black steel pipe conforming to ASTM Designation: A 53 grade B, 50 mm and smaller shall be 20 700 kPa WOG socket welding fittings and couplings or 13 800 kPa WOG threaded forged steel, ASTM Designation: A 105. 65 mm and larger shall be extra strong weight butt welding fittings and couplings.

**C1.--**

Hub and plain end cast iron soil pipe with neoprene gaskets conforming to Cast Iron Soil Pipe Institute's Standard 301. Pipe, fittings and gaskets shall be of one manufacturer.

**C2.--**

Hubless cast iron soil pipe with neoprene gaskets, corrugated stainless steel shields and stainless steel clamps conforming to Cast Iron Soil Pipe Institute's Standard 301. Joint materials shall be furnished by pipe manufacturer.

**D1.--**

Ductile iron push on joint pipe conforming to AWWA Designation: C151. Fittings shall be push on ductile iron conforming to AWWA Designation: C153. Joints shall be rubber gasketed and designed for a working pressure of 2420 kPa. Pipe and fittings shall be supplied with bituminous outer coating and cement lining. Pipe shall be listed for fire protection.

**H1.--**

Type DWV hard copper tubing conforming to ASTM Designation: B 306, with DWV drainage fittings, stop type couplings and threaded adapters.

**H2.--**

Type K hard copper tubing conforming to ASTM Designation: B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder shall be lead-free.

**H3.--**

Type L hard copper tubing conforming to ASTM Designation: B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder shall be lead-free.

**P2.--**

Polyvinyl chloride (PVC) plastic pipe and fittings conforming to ASTM Designation: D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 1380 kPa working pressure at 23°C, National Sanitation Foundation approved. Pipe shall have bell ends conforming to ASTM Designation: D 3139 with triple edge rubber sealing ring. For pipe sizes 50 mm diameter and smaller, plain end pipe with solvent welded fittings ASTM Designation: D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 1380 kPa may be used.

**P3.--**

Polyvinyl chloride (PVC) standard weight pipe and fittings, Schedule 40, conforming to ASTM Designation: D 1785. Pipe shall meet or exceed requirements of National Sanitation Foundation Standard No. 14. Pipe shall have bell ends conforming to ASTM Designation: D 2672. For pipe sizes 75 mm and smaller, plain end pipe with solvent welded fittings conforming to ASTM Designation: D 2241, may be used.

**P4.--**

Polyvinyl chloride (PVC) plastic pipe shall conform to AWWA Designation: C900, Class 150, Standard Dimension Ratio (SDR) 18. Pipe shall have bell end with a solid cross section elastomeric ring conforming to ASTM Designation: D 1869. Fitting shall be rubber gasketed, push on joint ductile iron and shall conform to ANSI/AWWA Designation: C110/A21.10. Joints shall be boltless and shall conform to ANSI/AWWA Designation: C111/A21.11. Pipe shall be listed for fire protection.

**Unions (for steel pipe).--**

Unions (for steel pipe) shall be 1730 kPa, threaded malleable iron, ground joint, brass to iron seat, galvanized or black to match piping.

**Unions (for copper or brass pipe).--**

Unions (for copper or brass pipe) shall be 1040 kPa cast bronze, ground joint, bronze to bronze seat with silver brazing threadless ends or 860 kPa cast brass, ground joint, brass to brass seat with threaded ends.

**Unions (for brass waste and flush pipes).--**

Unions (for brass waste and flush pipes) shall be slip or flange joint unions with soft rubber or leather gaskets. Unions shall be placed on the fixture side of the traps.

**Insulating union.--**

Insulating union or flange as applicable shall be suitable for the service on which used. Connections shall be constructed such that the 2 pipes being connected are completely insulated from each other with no metal to metal contact. Insulating couplings shall not be used. Insulating union shall be F. H. Maloney; Central Plastics; EPCO; or equal.

**Insulating connection (to hot water tanks).--**

Insulating connection (to hot water tanks) shall be 150 mm minimum, flexible copper tubing with dielectric union at each end and designed to withstand a pressure of 1040 kPa and a temperature of 93°C.

**VALVES.--****Gate valve (65 mm and smaller).--**

Gate valve (65 mm and smaller) shall be bronze body and trim, removable bonnet and non rising stem, Class 125 and same size as pipe in which installed. Gate valve shall be Crane, 438; Nibco Scott, T-113; Jenkins, 370; or equal.

Gate valve in nonferrous water piping systems may be solder joint type with bronze body and trim. Valve shall be Kitz, 59; Nibco Scott, S-113; Jenkins, 1240; or equal.

**Gate valve (75 mm and larger, above ground).--**

Gate valve (75 mm and larger, above ground) shall be iron body with bronze trim, removable bonnet and non-rising stem, class 125 and same size as pipe in which installed. Gate valve shall be Crane, 461; Nibco Scott, F-619; Jenkins, 326; or equal.

**Ball valve.--**

Ball valve shall be two piece, minimum 2760 kPa WOG, bronze body and chrome plated or brass ball with full size port. Valve shall be Nibco Scott, T-580; Watts, B-6000; Kitz, 56; or equal.

**LPG gas valve.--**

LPG gas valve shall be listed, 1730 kPa (minimum) WOG bronze ball valve. Valve shall be Jenkins, Model 30-A; Crane, Accesso; Watts; or equal.

**Automatic trap seal primer valve.--**

Automatic trap seal primer valve shall be bronze body with removable operating parts and integral vacuum breaker. Trap seal primer valve shall operate automatically on pressure fluctuation in the water supply. Valve shall be Josam, 88250; Zurn, Z-1022; Jonespec, 77250; or equal.

**FAUCET AND HYDRANTS.--****Hose faucet.--**

Hose faucet shall be compression type, angle pattern, wall flange at exterior locations, tee handle, 20 mm female thread with hose end, rough chrome or nickel plated finish for locations inside building, rough brass finish for others. Hose faucet shall be supplied with an integral or nonremovable threaded outlet vacuum breaker which meets the requirements of the American Society of Sanitary Engineering (ASSE) Standard: 1011. Hose faucet shall be Nibco, No. 63VB; Chicago, No. 15T; or equal.

**Wall hydrant.--**

Wall hydrant shall be 20 mm, non-freeze type, exposed, nickel bronze head with bronze casing, and integral vacuum breaker. Operating key shall be provided. Wall hydrant shall be J. R. Smith Model 5609 QT, Josam Model 71050, Zurn, Model 1310; or equal.

**CLEANOUTS.--****Cleanout through wall.--**

Cleanout through wall shall be cast iron cleanout tee type with polished stainless access plates. Plug shall be countersunk brass or bronze with tapered threads. Cleanout shall be Wade, No. W-8460; Smith, No. 4532; Zurn, No. 1445; or equal.

**Cleanout through floor.--**

Cleanout through floor shall have nonslip scoriated nickel bronze access plate and adjustable frame with square pattern top for ceramic tile and round pattern top for other finishes. Where floors are constructed with a membrane, access frame shall be provided with membrane clamping flange. Plug shall be countersunk brass or bronze with tapered threads. Cleanout shall be Wade, W-7000 Series; Smith, 4023 Series; Zurn, No. 1400; or equal.

Cleanout through floors in exterior locations shall be heavy duty, floating pipe type with cast iron cover. Cleanout shall be Wade, No. W-8300-HF; Smith, No. 4253; Zurn, No. 1474; or equal.

**MISCELLANEOUS ITEMS.--****Water hammer arrestor.--**

Water hammer arrestor shall be stainless steel body with bellows or piston. Arrestor compression chambers shall be pneumatically charged. Water hammer arrestors shall be tested and certified in accordance with the Plumbing and Drainage Institute Standard: PDI-WH201 and sized as shown on the plans.

**Access door.--**

Access door shall be 1.52 mm prime coated steel, face mounting square frame, minimum 300 mm x 300 mm door with concealed hinge and screwdriver latch.

**Compression stop (exposed).--**

Compression stop (exposed) shall be metal full free waterway, angle type, ground joint union, non-rising stem, molded rubber seat and wheel handle.

**Compression stop (concealed).--**

Compression stop (concealed) shall be long neck, built-in compression stops for required wall thickness, loose key and exposed parts polished chromium plated. Supplies shall be Chicago, 1771; California Brass, No. 172; or equal.

**Gas regulator.--**

Gas regulator shall be listed as suitable for LPG and equipped with full capacity relief valve, low pressure safety shut-off and weatherproof and insect proof vent for outside installation. Capacity shall be as shown on the plans. Gas regulator shall be Fisher; Reliance; Rockwell; or equal.

**Wye strainer.--**

Wye strainer shall be wye pattern, cast iron body and Type 304 stainless steel or monel strainer screen. The strainer screen shall have an open area equal to at least 3 times the cross sectional area of the pipe in which it is installed and shall be woven wire fabric with 20 mesh or perforated sheet with 850 micron maximum diameter holes.

**Backflow preventer.--**

Backflow preventer shall be double detector check valve assembly and shall include 2 check valves, 2 outside screw and yoke (OS&Y) valves, 2 test cocks and bypass line consisting of double check valve in series with water meter. Backflow preventer shall be factory assembled, FM approved for fire line service and listed by the County of Los Angeles Department of Health Services, Cross-Connection and Water Pollution Control Section, 2525 Corporate Place, Monterey Park, California 91754, Telephone (213) 881-4140.

**Pipe hanger (for piping supported from overhead).--**

Pipe hanger (for piping supported from overhead) shall be Grinnell, Model 269; Super Struct, C711; or equal.

**Pipe wrapping tape and primer.--**

Pipe wrapping tape shall be pressure sensitive polyvinyl chloride or pressure sensitive polyethylene tape having nominal thickness of 0.50 mm. Wrapping tape shall be Polyken, 922; Manville, Trantex VID-20; Scotchrap, 51; or equal.

Pipe wrapping primer shall be compatible with the pipe wrapping tape used.

**Floor, wall, and ceiling plates.--**

Floor, wall, and ceiling plates shall be chromium plated steel or plastic plates having screw or spring clamping devices and concealed hinges. Plates shall be sized to completely cover the hole.

**Valve box.--**

Valve box shall be traffic rated precast high density concrete with polyethylene face and cast iron traffic rated cover marked "WATER," "GAS" or "CO-SS" as applicable. Extension shall be provided as required. Valve box shall be Christy; Brooks Products Company; Frazer; or equal.

**Floor drain.--**

Floor drain shall be cast iron body and flashing collar, adjustable nickel bronze 150 mm strainer head with seepage openings and caulk or no-hub outlet. Floor drain shall be round or square as shown on the Architectural plans. Floor drain shall be J. R. Smith, 2005/2010; Wade, W-1100; Zurn, Z-415; or equal.

**PART 3.- EXECUTION****INSTALLATION.--****INSTALLATION OF PIPES AND FITTINGS.--**

**Pipe and fittings.--**Pipe and fittings shall be installed in accordance with the following designated uses:

Designated Use	Pipe and Fitting Class
Domestic water (CW and HW) in buildings	H3 or A1
Domestic water underground within 1.5 m of the building	A1 or H2
Domestic water underground 1.5 m beyond the building	P2, P3, P4, A1 or H2
Fire protection water, underground	B1,D1 or P4
Fire protection water riser	B1, D1 or H3
Fire protection sprinkler piping in building	A1, A3, A4 or B1
Sanitary drain piping above ground in building	H1, C1, or C2
Sanitary drain and vent piping underground within 1.5 m of the building	C1 or C2
Sanitary vent piping above ground in building	A2, H1, C1, or C2
Liquefied petroleum gas (LPG), 860 kPa or less, above ground	A1 or B2
LPG, 860 kPa or less, underground	B2 (plastic coated)
LPG, exceeding 860 kPa	B3
Compressed air	A1
Equipment drains and relief valve discharge	H3 or A1

**Installing piping.**--Water piping shall be installed generally level, free of traps and bends, and arranged to conform to the building requirements.

Piping installed underground shall be tested as specified elsewhere in these special provisions before backfilling.

Public use areas, offices, rest rooms, locker rooms, crew rooms, training rooms, storage rooms in office areas, hallway type rooms, and similar type use areas shall have concealed piping.

Warehouse rooms, equipment bays, and loft areas shall have exposed piping.

Piping shall not be run in floor fill, except as shown on the plans.

Piping shall be installed parallel to walls. All obstructions shall be cleared, headroom preserved and openings and passageways kept clear whether shown or not. Piping shall not interfere with other work.

Where pipes pass through exterior walls, a clear space around pipe shall be provided. Space shall be caulked water tight with silicone caulk.

Underground copper pipe shall have brazed joints. Underground plastic pipe shall be buried with No. 14 solid bare copper wire. Wire ends at pipe ends shall be brought up 200 mm and looped around pipe.

Exposed supply and drain piping in rest rooms shall be chrome finished.

Compressed air piping shall be pitched to low point. Ball valved drips shall be provided at all low points. Branches shall be taken off top of main.

Gas piping shall not be installed under building concrete slabs or structure. An insulating connection and valve shall be installed above ground at each building supply.

Gas piping shall be pitched to equipment or to low point and provided with a 200 mm minimum dirt leg.

Forty-five degree bends shall be used where offsets are required in venting. Vent pipe headers shall be sloped to eliminate any water or condensation.

Vent piping shall extend a minimum of 200 mm above the roof.

Horizontal sanitary sewer pipe inside buildings shall be installed on a uniform grade of not less than 2 percent unless shown otherwise on the plans.

Drainage pipe shall be run as straight as possible and shall have easy bends with long turns.

Wye fittings and 1/8 or 1/16 bends shall be used where possible. Long sweep bends and combination Wye and 1/8 bends may be used only for the connection of branch pipes to fixtures and on vertical runs of pipe.

**Water pipe near sewers.**--Water pipe shall not be installed below sewer pipe in the same trench or at any crossing, or below sewer pipe in parallel trenches less than 3 m apart.

When a water pipe crosses above a sewer pipe, a vertical separation of at least 300 mm between the top of the sewer and the bottom of the water pipe shall be maintained.

When water and sewer pipe is installed in the same trench, the water pipe shall be on a solid shelf at least 300 mm above the top of the sewer pipe and 300 mm to one side.

**Pipe sleeves.--**The Contractor shall provide sleeves, inserts and openings necessary for the installation of pipe, fittings and valves. Damage to surrounding surfaces shall be patched to match existing.

PVC pipe sleeves shall be provided where each pipe passes through concrete floors, footings, walls or ceilings. Inside diameter of sleeves shall be at least 20 mm larger than outside diameter of pipe. Sleeves shall be installed to provide at least 10 mm space all around pipe the full depth of concrete. Space between pipes and pipe sleeves shall be caulked watertight.

**Pipe penetrations in fire rated assemblies.--**Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping," in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

**Cutting pipe.--**All pipe shall be cut straight and true and the ends shall be reamed to the full inside diameter of the pipe after cutting.

**Damaged pipe.--**Pipe that is cracked, bent or otherwise damaged shall be removed from the work.

**Pipe joints and connections.--**Joints in threaded steel pipe shall be made with teflon tape or a pipe joint compound that is nonhardening and noncorrosive, placed on the pipe and not in the fittings.

The use of thread cement or caulking on threaded joints will not be permitted. Threaded joints shall be made tight. Long screw or other packed joints will not be permitted. Any leaky joints shall be remade with new material.

Exposed polished or enameled connections to fixtures or equipment shall be made with special care, showing no tool marks or threads.

**Cleaning and closing pipe.--**The interior of all pipe shall be cleaned before installation. All openings shall be capped or plugged as soon as the pipe is installed to prevent the entrance of any materials. The caps or plugs shall remain in place until their removal is necessary for completion of the installation.

**Securing pipe.--**Pipe in the buildings shall be held in place by iron hangers, supports, pipe rests, anchors, sway braces, guides or other special hangers. Material for hangers and supports shall be compatible with the piping or neoprene isolators shall be used. Allowances shall be made for expansion and contraction. Steel pipe shall have hangers or supports every 3 m. Copper pipe 25 mm or smaller shall have hangers or supports every 2 m and sizes larger than 25 mm shall have hangers or supports every 3 m. Plastic pipe shall have hangers or supports every 1 m. Cast iron soil pipe with neoprene gaskets shall be supported at each joint. Vertical pipes shall be supported with clamps or straps. Horizontal and vertical piping shall be securely supported and braced to prevent swaying, sagging or flexing of joints.

**Hangers and supports.--**Hangers and supports shall be selected to withstand all conditions of loading to which the piping and associated equipment may be subjected and within the manufacturer's load ratings. Hangers and supports shall be spaced and distributed so as to avoid load concentrations and to minimize the loading effect on the building structure.

Hangers and supports shall be sized to fit the outside diameter of pipe or pipe insulation. Hangers shall be removable from around pipe and shall have provisions for vertical adjustment after erection. Turnbuckles may be used.

Materials for holding pipe in place shall be compatible with piping material.

Hanger rods shall be provided with locknuts at all threaded connections. Hanger rods shall be sized as follows:

Pipe Size	Minimum Hanger Rod Diameter
15 mm to 50 mm	10 mm
65 mm to 87 mm	13 mm
100 mm to 125 mm	16 mm

**Wrapping and coating steel pipe.--**Steel pipe buried in the ground shall be wrapped or shall be plastic coated as specified herein:

1. Wrapped steel pipe shall be thoroughly cleaned and primed as recommended by the tape manufacturer.
2. Tapes shall be tightly applied with 1/2 uniform lap, free from wrinkles and voids with approved wrapping machines and experienced operators to provide not less than 1.00 mm thickness.

3. Plastic coating on steel pipe shall be factory applied. Coating imperfections and damage shall be repaired to the satisfaction of the Engineer.
4. Field joints, fittings and valves for wrapped and plastic coated steel pipe shall be covered to provide continuous protection by puttying and double wrapping with 0.50 mm thick tape. Wrapping at joints shall extend a minimum of 150 mm over the adjacent pipe covering. Width of tape for wrapping fittings shall not exceed 50 mm. Adequate tension shall be applied so tape will conform closely to contours of fittings. Putty tape insulation compounds approved by the Engineer shall be used to fill voids and provide a smooth even surface for the application of the tape wrap.

Wrapped or coated pipe, fittings, and filed joints shall be approved by the Engineer after assembly. Piping shall be placed on temporary blocks to allow for inspection. Deficiencies shall be repaired to the satisfaction of the Engineer before backfilling or closing in.

**Thrust blocks.--**Thrust blocks shall be formed by pouring concrete between pipe and trench wall. Thrust blocks shall be sized and so placed as to take all thrusts created by maximum internal water pressure.

Plastic pipe underground shall be provided with thrust blocks and clamps at changes in direction of piping, connections or branches from mains 50 mm and larger, and all capped connections.

**Union.--**Unions shall be installed where shown and at each threaded or soldered connection to equipment and tanks. Unions shall be located so piping can be easily disconnected for removal of equipment or tanks. Unions shall be omitted at compression stops.

**Insulating union and insulating connection.--**Insulating union and insulating connection shall be provided where shown and at the following locations:

1. In metallic water and gas service connections into each. Insulating connections shall be installed on the exterior of the building, above ground and after shut-off valve. When the shut-off valve is installed below ground, insulating connection shall be installed above ground and after shut-off valve.
2. In water, gas and air service connections in ground at point where new metallic pipes connect to existing metallic pipes. Install valve box above insulating connection.
3. At points of connections of copper or steel water pipes to steel domestic water heaters and tanks.

**Bonding at insulating connections.--**Interior water piping and other interior piping that may be electrically energized and are connected with insulating connections shall be bonded in accordance with the National Electrical Code. Bonding shall all be coordinated with electrical work.

**Compression stop.--**Each fixture, including hose faucets, shall be equipped with a compression stop installed on water supply pipes to permit repairs without shutting off water mains. Ball valves may be installed where shown on the plans or otherwise permitted by the Engineer.

#### **INSTALLATION OF VALVES.--**

**Exterior valves.--**Exterior valves located underground shall be installed in a valve box marked "Water." Extensions shall be provided as required.

#### **INSTALLATION OF FAUCETS AND HYDRANTS.--**

**Hose faucet and hydrants.--**Faucets and hydrants shall be installed with outlets 0.5 m above finished grade.

#### **INSTALLATION OF CLEANOUTS.--**

**Cleanouts.--**A concrete pad 0.5 m long and 100 mm thick shall be placed across the full width of trench under cleanout Wye or 1/8 bend. Cast iron soil pipe (C1 or C2) and fittings shall be used from Wye to surface. Required clearance around cleanouts shall be maintained.

Cleanout risers installed in tile and concrete floors, including building aprons and sidewalks, shall terminate in a cleanout through floor.

**INSTALLATION OF MISCELLANEOUS ITEMS.--**

**Water hammer arrestor.--**Water hammer arrestor shall be installed so that they are vertical and accessible for replacement. Water hammer arrestor shall be installed with access door when in walls or there is no access to ceiling crawl spaces. Access door location shall be where shown on the plans or as approved by the Engineer.

**Gas appliance connection.--**Gas valve and flexible connector shall be provided for gas piping at each appliance. Appropriately rated gas cocks may be used in 15 mm gas pipe. Cock or valve shall be within one meter of the appliance.

**Gas regulator.--**Gas regulator shall be installed complete with dirt leg, capped test tee, union, insulating union, gas valve and fittings.

**Backflow preventer.--**Backflow preventer assembly shall include a wye strainer, backflow preventer, fittings and pipe. Assembly components shall be installed a minimum of 300 mm above ground and shall be the same size as the pipe in which they are installed unless otherwise shown on the plans.

**Flushing completed systems.--**All completed systems shall be flushed and blown out.

**Chlorination.--**The Contractor shall flush and chlorinate all domestic water piping and fixtures.

Calcium hypochlorite granules or tablets, if used, shall not be applied in the dry form, but shall first be dissolved into a solution before application.

The Contractor shall take adequate precautions in handling chlorine so as not to endanger workmen or damage materials. All pipes and fittings shall be completely filled with water containing a minimum of 50 ppm available chlorine. Each outlet in the system shall be opened and water run to waste until a strong chlorine test is obtained. The line shall then be closed and the chlorine solution allowed to remain in the system for a minimum of 24 hours so that the line shall contain no less than 25 ppm chlorine throughout. After the retention period, the system shall be drained, flushed and refilled with fresh water.

**FIELD QUALITY CONTROL.--**

**Testing.--**The Contractor shall test piping at completion of roughing in, before backfilling, and at other times as directed by the Engineer.

The system shall be tested as a single unit, or in sections as approved by the Engineer. The Contractor shall furnish necessary materials, test pumps, instruments and labor and notify the Engineer at least 3 working days in advance of testing. After testing, the Contractor shall repair all leaks and retest to determine that leaks have been stopped. Surplus water shall be disposed of after testing as directed by the Engineer.

The Contractor shall take precautions to prevent joints from drawing while pipes and appurtenances are being tested. The Contractor shall repair damage to pipes and appurtenances or to other structures resulting from or caused by tests.

**General tests.--**All piping shall be tested after assembly and prior to backfill, pipe wrapping, connecting fixtures, wrapping joints and covering the pipe. Systems shall show no loss in pressure or visible leaks.

The Contractor shall test systems according to the following schedule for a period of not less than 4 hours:

Test Schedule		
Piping System	Test Pressure	Test Media
Sanitary sewer and vent	250 mm head	Water
Water	860 kPa	Water
Gas	690 kPa	Air
Air	860 kPa	Air

During testing of water systems, valves shall be closed and pipeline filled with water. Provisions shall be made for release of air.

Sanitary sewers shall be cleared of obstructions before testing for leakage. The pipe shall be proved clear of obstructions by pulling an appropriate size inflatable plug through the pipe. The plug shall be moved slowly through the pipe with a tag line. The Contractor shall remove or repair any obstructions or irregularities.

**Testing backflow preventers.--**Backflow preventers installed by the Contractor shall be tested at the completion of the supply system installation for proper operation by a certified Backflow Preventer Tester.

The tester shall hold a valid certificate as a Backflow Preventer Tester from the county in which the device to be tested is located or, if the county does not have a certification program for Backflow Preventer Testers, the tester shall have a certificate from one of the following:

1. The American Water Works Association.
2. A county which has a certification program for Backflow Preventer Testers. The certification under which the tester has been certified shall be acceptable to the water purveyor and the local agency having jurisdiction.

Testing for proper operation shall conform to the procedures of the county in which the testing is being performed, or, if such procedures are not available in the county, such tests shall conform to the provisions in the latest edition of the Guidance Manual For Cross Connection Control Program, which is available from the California Department of Health Services, Division of Drinking Water and Environmental Management, 601 N 7th Street, P.O. Box 942732, Sacramento, CA 94234.

The Contractor shall notify the Engineer at least 5 days prior to testing backflow preventers. Such tests shall be satisfactorily completed after installation of the backflow preventer assemblies and before operation of the systems.

One copy of all test results for each backflow preventer shall be furnished to the Engineer.

Full compensation for providing the certified Backflow Preventer Tester and for testing the backflow preventers shall be considered as included in the lump sum price paid for building work and no additional compensation will be allowed therefor.

## **12-15.03 MECHANICAL INSULATION**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing mechanical insulation in accordance with the details shown on the plans and these special provisions.

Piping insulation shall be installed on all domestic hot water piping, above grade, in non-conditioned spaces and on exterior exposed water piping above ground.

P-trap, hot water supply pipes and angle valves for lavatories and sinks, except in janitor closets or similar enclosed spaces, shall be insulated.

Duct insulation shall be installed on all rigid heating and cooling ductwork installed in concealed non-conditioned spaces.

Duct liner shall be installed in all rectangular heating and cooling ductwork installed in exposed non-conditioned spaces. Plenum liner shall be installed in all plenums in non-conditioned spaces .

#### **QUALITY ASSURANCE.--**

**Codes and standards.--**Mechanical insulation shall conform to California State Energy Commission regulations and, where applicable, shall meet American Society of Testing and Materials (ASTM) standards.

All materials shall bear the label of the Underwriters Laboratory (UL) or other approved testing laboratory indicating that the materials proposed for use conform to the required fire hazard ratings.

Pipe safety insulation shall conform to Section 1504(b) of Title 24, Part 5, California Plumbing Code.

## **PART 2.- PRODUCTS**

### **MATERIAL.--**

**General.--**All pipe insulation and wrapping material, including adhesives and jackets, located within buildings shall be certified to have a composite flame spread rating of not more than 25 and smoke development rating of not more than 450 when tested in accordance with ASTM Designation: E 84.

Duct insulation and wrapping material, including adhesives and jackets, located within buildings shall be certified to have a composite flame spread of not more than 25 and smoke development rating of not more than 50 when tested in accordance with ASTM Designation: E 84.

### **Domestic water piping insulation.--**

Piping insulation shall be glass fiber molded pipe insulation with factory applied jacket suitable for service temperatures up to 175°C. Covering jacket shall have pressure sealing lap adhesive joints. Pipe insulation shall have a minimum thermal resistance of  $R-0.5 \text{ K}\cdot\text{m}^2/\text{W}$ . Insulation and jackets shall be Owens-Corning, Fiberglass 25 with ASJ/SSL All Service Jacket; Manville, Micro-Lok 650ML with AP-T All Purpose Jacket; or equal.

### **Piping insulation cement.--**

Insulation cement shall be Fenco, All Purpose Cement; Manville, JM375; or equal.

### **Exterior piping insulation**

Piping insulation shall be polyurethane foam insulation with a service temperature range of 0°C to 120°C. A 0.15 mm vapor barrier shall be applied over the top off the insulation. The vapor barrier shall be installed with an adhesive as recommended by the manufacturer.

### **PVC jacket.--**

PCV jacket shall be rated for a service temperature of 80°C. PVC jacket shall include covers specifically designed to cover pipe fittings.

### **Alternative pipe insulation.--**

Alternative pipe insulation shall be closed cell, elastomeric material in a flexible tubular form. Insulation shall have a service temperature range between -40°C and 93°C, a minimum vapor transmission rating of 0.29 Perm-m, and a minimum thermal resistance of  $R-0.5 \text{ K}\cdot\text{m}^2/\text{W}$ .

### **Pipe safety insulation.--**

Pipe safety insulation for P-traps, hot water supply pipes and angle valves shall be molded closed cell vinyl or closed cell foam with exterior vinyl surface. Pipe safety insulation shall be configured to protect against contact. Pipe safety insulation shall be Truebro Inc., Handi Lav-guard; Plumberex Specialty Products, Handy Shield; or equal.

### **External duct insulation.--**

External duct insulation shall be 38 mm thick, 0.5 kg density glass-fiber blanket type. Material and coatings shall be fire resistive and shall be approved by the State Fire Marshal. External duct insulation shall be Fiberglas, Type PF-336; Ultralite, No. 100; Pittsburgh Plate Glass, Superfine; Johns-Manville, Microlite; Silvercote, Silvercel; or equal.

### **Plenum and duct liner.--**

Plenum and duct liner shall be 25 mm minimum thickness. Material and coatings shall be fire resistive and shall be approved by the State Fire Marshal. Liner shall be Gustin-Bacon, Ultra-Liner duct insulation; Owens-Corning Fiberglas, Type CE; Gustin-Bacon, coated insulation Board No. 90-A; Owens-Corning Fiberglas 0.7 kg density coated flexible duct liner; Johns-Manville, MicroBar, or 0.7 kg density coated Microlite; Pittsburgh Plate Glass, Superfine 0.7 kg density coated interior duct insulation; or equal.

**Adhesive.--**

Adhesive shall be non-flammable type: Benjamin Foster Company, No. 85-20 Spark Safe; Goodloe E. Moore Company, Tuff Bond No. 6; Permacel, No. PA-310; 3M, No. 38 Insulation Adhesive; Swift's, No. 7228 brush type or No. 7336 spray type; Chicago Mastic, 17-461; or equal.

**Studs.--**

Studs shall be cement-in-place type, pneumatic driven type or percussive welding type, and shall have 25 mm minimum diameter washers.

**PART 3.- EXECUTION****INSTALLATION.--**

**General.--**Insulation materials shall be neatly installed with smooth and even surfaces, jackets drawn tight and smoothly cemented down.

Insulation material shall not be installed until all pipes or surfaces to be covered are tested for leaks, cleaned and dried, and foreign materials, such as rust, have been removed.

**Piping insulation.--**Piping insulation shall be in accordance with the following, except that unions, unless integral with valves, and flexible connections shall not be insulated.

- a. Where insulation butts against flanges or is discontinued, insulation shall be tapered to pipe to allow for covering jacket to completely seal off end of insulation.

Insulation shall be extended on the valve bodies up to the valve bonnet.

Extend insulation continuous through pipe hangers and pipe sleeves. At hangers where pipe is supported, provide an insulated protection shield.

Insulating cement shall be applied to fittings, valves, and strainers and troweled smooth to thickness of adjacent covering. Strainer cleanout plugs shall remain accessible. Covers fabricated from molded pipe covering may be used in lieu of cement, provided covers are neat and well secured.

- b. Jacket flap shall be sealed down with factory applied self-sealing lap. Seams shall be lapped not less than 40 mm. Jacket shall be secured with aluminum bands installed at 300 mm centers.
- c. Exposed outdoor insulation shall have an additional 0.40 mm minimum thickness aluminum jacket applied over the completed insulation. The jacket shall have a factory applied moisture barrier and shall be Childers; Smith; or equal.

End joints shall be lapped with aluminum holding traps located directly over the lap. Additional aluminum holding straps shall be placed at 200 mm centers. Jacket at ells and tees shall be mitered, or premanufactured fitting jackets shall be provided, with additional aluminum holding bands, as required. All joints shall be sealed watertight using silicon type, heat resistant sealant.

- d. In-ground insulation shall have an additional PVC jacket applied over the completed insulation and vapor barrier. PVC jacket shall be made water with adhesive or sealant as recommended by the PVC jacket manufacturer.

Alternate pipe insulation, where used, shall be installed on hot water piping before connections are made or the insulation may be slit lengthwise, applied to pipe and sealed with adhesive.

**Pipe safety insulation.--**Pipe safety insulation shall be installed in accordance with the manufacturer's recommendations.

**Duct insulation.--**Ragged edges shall be repaired or taped. Coverings shall be neatly finished at joints and edges. Each joint shall have a 50 mm minimum lap.

Where transitions are made between externally covered ducts and lined ducts, the lined duct shall be overlapped 200 mm with external covering.

Insulation shall be flush with but not cover control devices, damper controls or access doors.

Before insulation is wrapped around concealed ducts, an adhesive shall be spot applied at a maximum of 100 mm centers on each side of the ducts to prevent sagging of the insulation. Insulation shall be wrapped entirely around the ducts and shall be wired securely in place with No. 16 copper clad wire, metal bands at least 10 mm wide or plastic ties. Supports shall be spaced a maximum of 300 mm on centers. Metal bands shall be installed with the use of a banding machine. Seams in the insulation shall be taped.

The finished insulation covering shall be even and level and shall not contain humps.

**Plenum and duct liner.**--Plenums and exposed ducts shall be lined with plenum and duct liner. Plenums and ducts shall be sized to provide the clear inside dimensions shown on plans after the liner is installed.

The insulation shall be applied with coated side exposed to air stream to prevent surface erosion.

The lining shall be fastened in place with adhesive and with studs with washers spaced a maximum of 500 mm on center each way.

**Applying adhesive.**--The adhesive shall be liberally applied over entire interior surfaces of ducts or plenums.

**Stud installation.**--Studs shall be installed as follows:

- a. Cement-In-Place Type Studs.--Cement-in-place type studs shall be cemented in place with adhesives manufactured for this purpose and shall be as recommended by the stud manufacturer. Cement-in-place type studs shall be used where concrete walls form part of plenum.
- b. Percussive Welding Type Studs.--Percussive welding type studs shall be carefully welded in place with current settings that will not appreciably burn galvanizing on opposite side of the sheet metal.
- c. Pneumatic Driven Type Studs.--At locations where pneumatic driven type studs are used, hardened steel backup plates or dollies shall be used under the sheet metal.

## 12-15.04 AUTOMATIC FIRE SPRINKLER SYSTEM (DRY)

### PART 1.- GENERAL

#### SUMMARY.--

**Scope.**--This work shall consist of designing, furnishing and installing an automatic dry pipe type fire sprinkler system, complete and ready for use, in accordance with the details shown on the plans and these special provisions.

The automatic fire sprinkling system shall include a UL listed outside screw and yoke (OS&Y) valve, dry pipe accelerator, air maintenance system, electric alarm bell, dry pipe valve sprinkler heads and related appurtenances, valves, piping and fittings.

**Rules and regulations.**--The design of the sprinkler system shall be in accordance with the code requirements for ordinary hazard occupancies, group 2, and shall provide coverage of the building area shown on the plans.

The water pressure and flow rate shall be verified with the local agency having jurisdiction.

#### SUBMITTALS.--

**Working drawings.**--Complete working drawings, including written verification of the water pressure and flow rate, shall be submitted for approval.

**State Fire Marshal approval.**--Prior to the submittal of the working drawings, the Contractor shall have said drawings reviewed and stamped "APPROVED" by the State Fire Marshal.

## **QUALITY ASSURANCE.--**

**Codes and standards.--**All work shall be in accordance with the requirements of the State Fire Marshal, the National Fire Protection Association (NFPA) Standard No. 13 1997 Edition, "Installation of Sprinkler Systems," and the requirements of other regulatory authorities having jurisdiction.

## **PART 2.- PRODUCTS**

### **Water flow indicator.--**

Water flow indicator shall be UL or FM listed for fire protection, vane type switch designed for wet pipe systems. Water flow indicator shall be designed for minimum flow rate of 40 liters per minute, and shall have an adjustable delay setting of from 0 to 90 seconds. Water flow indicator shall have double-pole double-throw contacts rated 5 amps at 120 V AC. Water flow indicator shall be Viking, Model VSR-D; Grinnell, Model F620; Reliable, Model A; or equal.

### **Check valve.--**

Check valve shall be UL or FM listed for use in fire protection service applications, swing type, self draining, iron body with brass trim and rubber clapper with removable cover plate. Check valve shall be Viking, Grinnell, Groeniger, or equal.

### **Alarm bell.--**

Alarm bell shall be UL or FM listed electric bell type, 120 volt AC. with a minimum sound rating of 95 decibels at 3 m. Alarm bell shall have a die cast aluminum housing with built-in rubber gasket for dust proof seal for bell striking mechanism. Alarm bell shall be Viking, Grinnell, Reliable, or equal.

### **Pipe and fittings.--**

Pipe and fittings shall be in accordance with the requirements specified under "Pipe, Fittings and Valves," elsewhere in this Section 12-15.

Pipe and fittings for dry pipe drain lines shall be as recommended by the valve manufacturer.

### **Pipe hangers.--**

Pipe hangers shall be of types listed as acceptable for specific applications in NFPA .

### **Valves.--**

Valves shall be UL or FM listed, outside screw and yoke (OS&Y) rising stem type.

Valves (OS&Y) 65 mm and larger in size shall be Crane, 467; Walworth, 8713F; Nibco Scott, F-607-0; or equal.

Valves (OS&Y) 50 mm and smaller in size shall be Crane, 459; Walworth, 873; Nibco Scott, T-104-D; or equal.

Optional; Valves 100 mm and larger may be butterfly type, UL or FM listed, working pressure 1210 kPa, gear operated, indicator flag, ductile iron body, bronze trim, with provisions for locking.

### **Compressed air supply connection.--**

Compressed air supply connection shall consist of 2 control valves, check valve, relief valve and accessories, in accordance with the NFPA.

### **Dry pipe valve.--**

Dry pipe valve shall be of the differential type with a differential ratio of 3 to 1. The dry pipe valve shall be protected against mechanical injury and shall be UL listed. The dry pipe valve shall be Grinnell; Viking; Reliable; or equal.

**Air maintenance system.--**

Air maintenance system shall include a pressure regulator, pressure relief valve, strainer, globe valve, angle valve, check valve, restriction and all other pipe, fittings and appurtenances necessary for the proper performance of the system. The air maintenance system shall be supplied as a pre-assembled package from the manufacturer or installed as individual components with all components supplied by a single manufacturer. The air maintenance system or all components of the system shall be UL listed. The air maintenance system shall be Grinnell; Viking; Reliable; or equal.

**Sprinkler head.--**

Sprinkler head shall be upright type above ceiling and pendant type below ceiling. Sprinkler head shall be brass body, chemical or solder fusing type, with proper temperature rating element. Sprinkler head shall be listed dry type and shall be Glove, Grinnell, Reliable, or equal.

**Spare sprinkler cabinet.--**

Spare sprinkler cabinet shall be metal cabinet as recommended by the sprinkler head manufacturer and conforming to NFPA requirements. The cabinet shall be painted red.

**Fire department connection.--**

Fire department connection shall be UL or FM listed, horizontal double Siamese with double clapper, as required, with nominal size 65 mm inlets, drain cock, caps, chain, and brass nameplate. Inlets shall have national standard hose threads. The fire department connection shall be Potter-Roemer, Grinnell, or equal.

**Accessories.--**

Drains, test connection, flush connections, pressure gauges, and other accessories shall be supplied as required.

**Sign.--**

Sign shall be sheet steel, not less than 0.76 mm thick, with red letters on a white background and a baked enamel coating.

**PART 3.- EXECUTION****INSTALLATION.--**

**General.--**Sprinkler piping and equipment shall be installed in accordance with the approved working drawings and shall be located to avoid interference with the lighting system, access openings, or other piping.

Reductions in pipe size shall be made with one piece reduction fittings. Bushings shall not be used. Reducers shall be installed to connect smaller piping to alarm valve.

**Piping.--**Dry pipe fire sprinkler system shall have branch lines pitched 0.4% and mains pitched 0.2%.

Connection to the shop air supply system shall be installed where shown on the plans.

Drain piping and test connections shall discharge into the nearest floor drain or to the outside of the building. Discharge piping shall not drain across walkways.

**Spare sprinkler cabinet.--**The spare sprinkler cabinet shall be installed where temperatures will not exceed 38°C at any time. Such location shall be approved by the Engineer. Six spare sprinklers and 2 sprinkler head wrenches shall be furnished and placed in the cabinet.

**Securing main shutoff valve.--**A galvanized chain, with a nominal material diameter of at least 5 mm, shall be provided to lock the main shutoff in the open position. The lock will be State-furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions.

**Signs.--**Signs and messages shall be as required by NFPA No. 13 and the regulatory authorities having jurisdiction. Lettering shall be standard-type of the following heights:

Item	Minimum Lettering Height
Nameplate date	6 mm
Drain signs	19 mm
Tamper sign	19 mm

**FIELD QUALITY CONTROL.--**

**Acceptance tests.--**The Contractor shall arrange for testing of the automatic fire sprinkler system in the presence of the Engineer and the State Fire Marshal. Three days written notice of said testing shall be provided by the Contractor.

The system shall be pressure tested for 2 hours at 1380 kPa. A successful test shall have no visible leaks or loss of pressure.

The Contractor shall perform such other tests as may be required by the State Fire Marshal.

In addition to the hydrostatic test, an air pressure leakage test at 280 kPa shall be conducted for 24 hours. Any leakage that results in a loss of pressure in excess of 10 kPa for the 24 hours shall be corrected.

**12-15.05 PLUMBING FIXTURES**

**PART 1.- GENERAL**

**SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing plumbing fixtures in accordance with the details shown on the plans and these special provisions.

**PART 2.- PRODUCTS**

**General.--**Plumbing fixtures shall be white in color and shall meet the following requirements:

**Water closet (disabled accessible, 6 liters per flush, floor mounted with tank)--**

Disabled accessible water closet shall be 6 liters per flush maximum, vitreous china, siphonable jet, 410 mm to 440 mm high elongated bowl, close coupled tank, floor mounted, with solid plastic open front elongated seat with check hinges. Water closet shall meet or exceed American Disabilities Act guidelines and ANSI Standards: A117.1 and A112.19.2. Closet and accessories shall be of the following types or equal:

	American Standard	Crane	Universal Rundle
Closet	"Cadet 17 EL1.6/PA" 2168.100 or 4086.800	"Hymont" 3-154E or 3-152 with3-655	"Atlas 1.5" UR 4078-341 or UR 4078-342
Seat	Church 5321.070	Olsonite 95	Benke 527

**Urinal (disabled accessible)--**

Urinal shall be vitreous china, wall hung, siphon jet or washout, top spud, integral shields, spreader and trap, with 380 mm maximum extension from wall. Urinal and valve shall meet American Disabilities Act guidelines and shall be of following types or equal:

	American Standard	Crane	Kohler
Urinal	"Allbrook" 6540.017	"Manhattan" 7-109	"Bardon" K-4960-T
Flush valve	Exposed, diaphragm type, chrome plated, with oscillating handle, integral control stop, adjustable tail piece and vacuum breaker suitable for use with top spud urinals.		

**Lavatory (wall-mounted).--**

Lavatory shall be vitreous china, with back, integral perforated grid drain, drilled for 102 mm centers, size 508 mm x 457 mm, with single extra long lever mixing faucet and chair carrier with concealed arms. Lavatory and accessories shall be of the following types or equal:

	Eljer	Crane	Kohler
Lavatory	"Lucerne" 0355.012	"Norwich" 1-194-V	"Greenwich" K-2032
Drain	--	C-1065-G or Moen 52659	K-7715
Supplies	Brass Craft FR1711C	C-1151 or Moen 52664	K-7605
Faucet	2385.130	Moen 8400	K-15592-5
Trap	32 mm chromium plated brass exposed bent tube adjustable 1.37 mm (17-gage) minimum thickness.		
Carrier	Concealed wall mounted carrier with leveling screws and locking devices; Zurn, J.R. Smith, Josam, Wade, Jonespec, or equal.		

**Mop sink.--**

Mop sink shall be acid resisting enameled cast iron, 711 mm x 711 mm outside dimensions, 75 mm trap, vinyl coated rim guard, vacuum breaker faucet with hose and wall hook. Sink and accessories shall be of the following types or equal:

	American Standard	Eljer	Kohler
Mop sink	"Florwell" 7740.020	"Custodial" 242-0050	"Whitby" K-6710
Strainer	7721.038	803-0630	K-9146
Faucet	8344.111	749-1450	K-8928

**Kitchen sink.--**

Kitchen sink shall be constructed of 18-gage minimum stainless steel with full undercoating. Sink shall be single compartment, self-rimmed with ledge for faucet. Normal bowl size shall be 533 mm x 381 mm with an outside depth of 178 mm or less. Sink shall be supplied with stainless steel strainer and chrome P-trap. Kitchen sink faucet shall be metal body, chrome plated, single lever mixing type with 200 mm long swing spout aerator and replaceable ceramic cartridge.

**Water heater (electric).--**

Water heater shall be minimum capacity as shown on plans, designed for minimum 860 kPa, interlocking (non-simultaneous) or single element, glass lined, and equipped with magnesium anodes, cold water drop tube, high temperature energy shut-off device, valved drain, high density R-1.4 K• m<sup>2</sup>/W minimum foam insulation and finished with a steel jacket with baked enamel finish. Water heater shall meet the requirements of the California Energy Commission.

Water heater shall be equipped with an ASME labeled, tank mounted, pressure and temperature relief valve sized for maximum input.

**Water heater (gas).--**

Water heater shall be minimum capacity as shown on plans, designed for minimum 860 kPa, glass lined, and equipped with gas pressure regulator, magnesium anodes, cold water drop tube, high temperature energy shut-off device, valved drain, high density R-1.4 minimum foam insulation and finished with a steel jacket with baked enamel finish. Water heater shall meet the requirements of the California Energy Commission.

Water heater shall be equipped with an ASME labeled, tank mounted, pressure and temperature relief valve sized for maximum input.

**Electric water cooler (disabled accessible, wall mounted).--**

Electric water cooler shall be wall mounted, wheelchair accessible, and shall produce a minimum of 28 liters of 10°C water per hour based upon an inlet water temperature of 27°C and an ambient room temperature of 32°C. Cooler shall have self closing, front and side mounted pushbar actuators, shielded bubbler, automatic stream regulator, loose key stop, adjustable thermostat and cast brass P-trap.

Compressor shall be hermetically sealed, positive start with fan cooled condenser and shall be mounted above the cooler top. Cooler shall be provided with 3-wire grounded plug and cord.

Electric water cooler shall be Haws, HWCA8D; Sunroc, HCWC-8S; Elkay, EHFS-8; or equal.

**Emergency eyewash and shower.--**

Emergency eyewash and shower shall be separate drench shower and eye bath, 32 mm minimum, galvanized steel pipe stand with 229 mm floor mounting flange and equipped with 216 mm x 279 mm pictorial and worded emergency identification sign.

Shower head shall have a 254 mm diameter ABS plastic head with a stay-open ball valve operated by a rigid pullrod with triangular handle.

Eyewash shall have a 254 mm diameter stainless steel bowl, anti-surge heads and circular chrome plated spray ring to bathe the entire face, dust cover assembly, and a stay-open ball valve operated by a flag handle. Eyewash unit shall be mounted on the shower pipe stand.

Emergency eyewash and shower shall be Haws, 8346; Speakman, SE-607; Western, 9231; or equal.

**PART 3.- EXECUTION**

**INSTALLATION.--**

**General.--**All finish for exposed metal on any fixture, including wall flanges, bolts, nuts and washer, shall be polished chrome plated.

Fixtures shall be sealed to wall or floor with silicone caulk bead.

All exposed metal surfaces on fixture supports shall be enameled to harmonize with fixtures.

Wall mounted fixtures shall be installed on concealed chair carriers designed to support weight of fixture from the floor, made for the specific fixture to be supported and for the particular installation conditions.

All fixtures, including showers, shall be provided with accessible metal stop valves.

Hot water supply, trap and tailpiece on lavatories shall be wrapped with insulating material.

Flush valves for fixtures designated on the plans as disabled accessible shall be installed so that the valve handle is on the widest side of the toilet space.

## **FIXTURE MOUNTING HEIGHTS.--**

**General.--**Unless otherwise noted, fixtures shall be mounted at the heights shown on the plans.

**Mop sink.--**Mop sink double faucet shall be mounted on wall above sink back with spout outlet face one meter above the floor.

**Water heater.--**Water heater shall be installed with seismic restraints, inlet ball valve and insulating connections, and 20 mm pressure and temperature relief drain pipe.

**Emergency eyewash and shower.--**Emergency eyewash and shower shall be installed with a rigid bracket located 1.2 m above the floor. Bracket shall be minimum 1.52 mm (16-gage) steel and shall be braced to the wall.

## **FIELD QUALITY CONTROL.--**

**Testing.--**The Contractor shall test piping in accordance with the requirements specified elsewhere in these special provisions.

All installed fixtures shall be tested for proper operation after all plumbing work has been completed.

## **12-15.06 WHEELCHAIR ACCESSIBLE SHOWER UNIT**

### **PART 1.- GENERAL**

#### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing a wheelchair accessible shower unit and fittings in accordance with the details shown on the plans and these special provisions.

#### **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive data, installation instructions and color palette shall be submitted for approval. The color will be selected from the manufacturer's standard product line by the Engineer after approval of the contract.

#### **QUALITY ASSURANCE.--**

**Codes and standards.--**Shower units shall conform to the requirements of the California State Accessibility Standards contained in the California Building Standards Code, Title 24.

### **PART 2.- PRODUCTS**

#### **Shower stall.--**

Shower stall shall be single unit, single piece construction with clear interior dimensions of 1065 mm wide, 1220 mm deep, with an entrance width of 915 mm, and no obstruction at the threshold. Shower stall shall be fabricated from gel-coated fiberglass or acrylic with a Class I Flame Spread. Shower unit shall be reinforced to accommodate the grab bars and seat.

Shower unit shall have a threshold or recessed drop, a maximum of 13 mm in height, sloped at an angle not exceeding 45 degrees from the horizontal. The floor shall be slip-resistant, sloping a maximum of 4% to a drain located near the rear wall.

Shower unit shall be provided with the following fittings and accessories: stainless steel corner grab bar and folding teak wheelchair transfer seat, each capable of resisting 1112 N of lateral, vertical and tensile load, stainless steel soap dish, chromium plated or stainless steel curtain rod, chromium plated steel hand-held shower head with ball

joint, chromium plated 1525 mm long flexible shower spray hose, chromium plated fixed shower head, chromium plated metal outlet drain with removable strainer, chromium plated single lever control thermostatic mixing valve with control cartridge with no metal to metal wearing surface, a lever operated shower head selector, and vinyl shower curtain with corrosion resistant hooks.

Shower stall units shall be Crane; Florestone; Maron and Associates; or equal.

### **PART 3.- EXECUTION**

#### **INSTALLATION.--**

**General.--**Shower shall be installed with the manufacturer's instructions. All joints shall be sealed and caulked watertight.

### **12-15.07 LIQUEFIED PETROLEUM GAS (LPG) SYSTEM**

#### **PART 1.- GENERAL**

##### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing a liquefied petroleum gas (LPG) distribution system in accordance with the details shown on the plans and these special provisions.

The LPG distribution system shall include a LPG storage tank, pipe, fittings, valves and such other system components necessary for the proper installation and operation of the LPG system.

**Permits.--**The Contractor shall obtain the required permits to operate pressure vessels in accordance with the requirements of the State Division of Industrial Safety (DIS), shall pay the costs for such permits and shall perform all required tests. Such permits shall be posted under glass at the site of the work.

##### **QUALITY ASSURANCE.--**

**Codes and standards.--**All work performed and materials installed shall conform to the California Building Standards Code, Title 24, Part 4 and Part 5; the California Code of Regulations, Title 8, Chapter 4, Subchapter 1, Article 5; and National Fire Protection Association Standard No. 58.

#### **PART 2.- PRODUCTS**

##### **LPG storage tank.--**

LPG storage tank shall be constructed and stamped for 1730 kPa working pressure in accordance with the ASME Code for "Unfired Pressure Vessels for Petroleum Liquids and Gases." Tank shall have certification of testing for 2590 kPa. Tank shall include a rainhood with top opening for relief valve and welded steel supports with provisions for bolting to the concrete foundation. Tank shall be shop prime painted with 2 coats of red oxide ferrous metal primer. Primer shall not contain lead pigments.

##### **Tank valves, fittings, regulators and accessories.--**

Tank valves, fittings, regulators and accessories shall be UL listed and labeled. Valves, fittings, regulators and accessories shall be as required by the California Codes listed above and shall be Rego, Fisher, Rockwell, or equal.

Pipe and fittings shall be as specified under "Pipe, Fittings and Valves" in Section 12-15, "Mechanical," of these special provisions. Piping below grade shall be factory coated.

##### **Warning signs.--**

Warning signs shall be sheet steel, not less than 1.2 mm thick (18-gage) with a baked enamel coating and shall have red letters on a white background.

## **PART 3.- EXECUTION**

### **INSTALLATION.--**

**General.--**The LPG storage tank and system components shall be installed in accordance with NFPA standards, the manufacturer's instructions and the approved installation drawings.

**Foundation.--**The tank shall be installed on a concrete foundation. The tank installation shall include seismic restraint and provisions for expansion and contraction. Neoprene or asphalt impregnated felt anti-corrosion pads shall be installed between the saddle and the concrete foundation.

The concrete foundation shall be constructed in accordance with the requirements specified for minor work under "Cast-In-Place Concrete" in Section 12-3, Concrete and Reinforcement," of these special provisions.

All openings shall be capped until ready for field connections. Piping shall be supported adequately, with allowance for swing joint movement.

**Piping installation.--**Piping shall be buried 900 mm minimum depth. Insulating unions shall be installed at least 150 mm above grade between the coated pipe and the above ground pipe lines.

Joints for underground piping shall be cleaned, primed and wrapped in accordance with the requirements specified under "Pipes, Fittings and Valves" in Section 12-15, "Mechanical," of these special provisions. The cleaning, priming and wrapping of pipe joints shall be completed after testing the piping system.

**Coated pipe inspection.--**The coating on all coated pipe shall be inspected for flaws prior to any testing, and shall be reinspected after testing and before the cleaning, priming and wrapping of the joints.

**Finish painting.--**After installation of the tank, all areas where the shop applied primer has been damaged or has deteriorated shall be thoroughly cleaned and spot painted with primer. Spot painted areas shall be approved by the Engineer prior to the application of the finish coats.

Two applications of the finish coating shall be applied to shop primed steel surfaces exposed to view after the erection of the tank has been completed. The finish coating shall be white gloss, exterior, alkyd enamel.

The word "FLAMMABLE" shall be painted on each side of the tank. Sign lettering shall be standard-type not less than 100 mm in height. The lettering color shall be red and shall be in sharp contrast to the color of the tank.

**Warning sign installation and application.--**Two warning signs with the words "NO SMOKING, OPEN FLAMES OR OTHER SOURCE OF IGNITION PERMITTED WITHIN 15.2 METERS (50 FEET)" shall be placed at the locations shown on the plans. Sign lettering shall be standard-type not less than 38 mm in height. The lettering color shall be in sharp contrast to the color of the sign.

### **FIELD QUALITY CONTROL.--**

**Testing.--**After construction, installation and pipe testing, the LPG system shall be pressure tested with air or nitrogen. The system shall be tested for a minimum time period of 30 minutes at 1380 kPa. If any leaks are detected during the test, the system shall be repaired and retested until no leaks are detected.

After the pressure tests have been completed, the LPG system shall be purged 5 times with methanol (methyl alcohol), using one-liter per 1000 liters water capacity, to remove moisture from the system.

After testing and purging the system, the tank shall be filled to 25 percent of the water capacity of the tank, measured in liters, with State-furnished LPG as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions.

An operational test shall be performed on the LPG system upon completion of the pressure tests, the purging of the system and the delivery of the State furnished LPG fuel. The operational test shall consist of operating all LPG equipment for a period of three 24-hour days.

## 12-15.08 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT AND SYSTEMS

### PART 1.- GENERAL

**Scope.--**This work shall consist of furnishing, installing and testing heating, ventilating and air conditioning (HVAC) equipment and systems in accordance with the details shown on the plans and these special provisions.

The performance rating and electric service of the HVAC equipment shall be as shown on the plans.

**Temperature controls.--**Thermostats, relays, timer switches, and other sensor type control devices required for this work shall be furnished and installed by the supplier of the heating, ventilating and air conditioning equipment. All temperature control wiring shall be furnished and installed in accordance with the requirements specified in Section 12-16, "Electrical," of these special provisions.

**Codes and standards.--**Equipment and systems shall conform to California State Energy Commission Regulations and, where applicable, shall be American Refrigeration Institute (ARI), American Gas Association (AGA), Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and Air Movement and Control Association (AMCA) approved for performance ratings and application shown on the plans.

Any appliance for which there is a California standard established in the Appliance Efficiency Standards may be installed only if the manufacturer has certified to the Commission, as specified in those regulations, that the appliance complies with the applicable standards for that appliance. Space conditioning equipment may be installed only if the manufacturer has certified that the equipment meets or exceeds all applicable efficiency requirements listed in the Energy Efficiency Standards.

### PART 2.- PRODUCTS

#### HEATING AND COOLING UNITS.--

##### Furnace.--

Furnace shall be gas fired, induced draft, high efficiency furnace. Furnace shall be AGA approved for LPG, shall be equipped with electronically controlled blower and hot surface ignition. Furnace cabinet shall have an enamel finish and the primary and secondary heat exchangers shall be corrosion resistant construction. Blower shall be vibration-isolated.

The fan and fan motor shall provide the specified air circulation, with filters, against external static pressure as shown on the plans.

Furnace shall have multi-speed fan motor with thermal overload protection and shall be factory wired for a single power connection, including provisions for optional air conditioning, and low voltage control circuit with a terminal board.

Split system furnace/air conditioner shall include a cased evaporator coil, a remote outdoor condensing unit and economizer. Indoor evaporator coil shall be a factory assembled unit by the forced air furnace equipment manufacturer. Furnace and cased coil unit shall be designed to mate with each other. Unit shall be provided with a refrigerant metering device and corrosion-resistant condensate drain pan with drain connections. The wetted coil air friction shall not exceed 75 Pa. The cased coil unit shall have the same finish as the furnace.

Refrigerant lines and condensate drain piping shall be as specified elsewhere in these special provisions.

Outdoor condensing unit shall be same manufacturer as indoor unit; air cooled, factory assembled, charged and tested, and wired for single point power and control connections. Unit shall be enclosed in a weatherproof acoustically lined cabinet with access panels and a baked-on enamel finish. The compressor shall be the hermetically sealed type and shall be provided with quick start components, pressure relief valve, high and low pressure switches, liquid-line filter-dryer, crankcase heater, short cycling protection, and service valves.

**Evaporative cooler.--**

Evaporative cooler shall be a factory assembled unit having removable side panels with filters and a bottom drain. The cabinet shall be fabricated from galvanized steel sheet metal with a baked-on enamel finish. Interior surfaces of the cabinet bottom shall be asphalt coated. The drain fitting shall be threaded for connection to drain piping.

All parts of the float valve and recirculating pump, which come into contact with water, shall be of stainless steel or other corrosion resistant material. Evaporative cooler shall be installed with cold weather damper.

The evaporative cooler shall be McGraw-Edison; Fan-Air; Arctic Circle; or equal.

**Unit heater.--**

Unit heater shall be gas-fired, propeller fan type, AGA approved for LPG and shall be equipped with aluminized steel heat exchanger, built in backdraft diverter, fan switch marked "SUMMER"- "WINTER," adjustable discharge louvers, gas pressure regulator, intermittent ignition device, gas main and pilot shutoff valves, automatic gas valve, high limit shutoff, 24-volt transformer, and fan motor local disconnect. All components shall be factory assembled. Unit heater shall be separated combustion high efficiency type with factory supplied horizontal concentric venting system. Unit heater shall be Reznor; Modine; Hastings; or equal.

Unit heater fan motor shall have integral thermal overload protection.

**Low intensity radiant heater.--**

Low intensity radiant heater shall be positive pressure, two stage, and shall include power burner, radiant tube, reflector, exhaust pipe, vent cap, controls, hangers, and appurtenances as necessary for proper installation and operation. System shall be AGA certified and rated for LPG.

Burner shall be two stage, equipped with direct spark ignition, flame safety control and combustion chamber inspection sight glass. All components of the system shall be supplied by the manufacturer of the burner.

Low intensity radiant heater controls shall consist of gas and burner controls. Thermostats and time switches shall be supplied by the radiant heater manufacturer.

Reflectors, hangers, supports and fasteners shall conform to the low intensity radiant heater manufacturer's recommendations.

**Combination heating/cooling unit (single package through-the-wall).--**

Combination heating/cooling unit shall be through-the-wall mounted combination sealed combustion gas heater and electric air conditioner. The unit shall be AGA certified and rated for LPG operation. The unit shall include slide-out chassis design, adjustable discharge grilles, intermittent ignition with 100 percent safety shut-off, multi-speed fan and be complete with plug. Capacity and electric service shall be as indicated on the plans. Fan motor shall have integral thermal overload protection. Unit shall have low voltage remote thermostat.

**Electric wall heater.--**

Electric wall heater shall be forced air, surface mounted type, and shall be equipped with a grille and integral thermostat.

**Duct heater.--**

Duct heater shall be electric, UL listed, slip-in type, all metal construction and shall have overtemperature protection. Heater shall be supplied with a 2-step control duct thermostat by heater manufacturer. Thermostat shall have a 3 deg. C differential and shall energize the first stage of heating at 12 deg. C and the second stage at 4 deg. C.

**FANS AND VENTILATORS.--****Exhaust fan (ceiling mounted).--**

Exhaust fan shall be ceiling mounted, AMCA certified and shall be equipped with grille, backdraft damper and metal housing. Exhaust fan motor shall have integral thermal overload protection. Ceiling exhaust fan shall be Broan; Penn; Greenheck; or equal.

**Exhaust fan (through-the-wall in restroom).--**

Exhaust fan shall be through-the-wall type, AMCA certified and shall be equipped with grille, metal housing, backdraft damper, and wall cap with bird screen. Fan motor shall have integral thermal overload protection. Wall exhaust fan shall be Broan Model 512; NuTone Model 8870; or equal.

**Exhaust fan (wall mounted).--**

Exhaust fan shall be wall mounted, AMCA certified and shall be equipped with grille, metal housing, backdraft damper, centrifugal fan wheel and bird screen. Fan motor and fan assembly shall be isolated from base with rubber vibration isolators. Fan shall be completely weatherproof and shall have a disconnect means under the hood and fan motor shall have integral thermal overload protection. Declassification fan shall be constructed in accordance with the requirements of the latest of AMCA Publication 99, "Standards Handbook."

Declassification fan motor shall be 3-phase, continuous duty and explosion proof. Wall exhaust fan shall be Greenheck; Carnes; Penn; or equal.

**Inline fan (supply).--**

Inline supply fan shall be AMCA certified with galvanized steel construction. Fan motor shall have integral thermal overload protection. Inline supply fan shall be Loren Cook "Gemmini"; Greenheck; or equal.

**Combination heat/vent/light.--**

Combination heat lamp/light/fan shall be ceiling mounted, recessed type unit consisting of fan forced heater, exhaust fan and light, with metal housing, grille and backdraft damper. Unit shall have a hinged glass lens, for relamping, and automatic reset thermal protection. Ducting size shall be as required by the manufacturer. Unit shall be supplied with a single gang, 3-switch control by the unit manufacturer. Combination heat/vent/light shall be Broan, No. 655; Nutone, No. 665; or equal.

**Inline fume exhaust fan.--**

Inline fume exhaust fan shall be AMCA certified, centrifugal duct fan, belt driven, with metal housing and a horsepower rated local disconnect, wall mounted next to the fan. Fan motor and fan assembly shall be isolated from base with rubber vibration isolators. Fan motor shall have integral thermal overload protection. Internal parts shall be accessible for repair without disturbing the ductwork. Roof fan shall be Penn; Greenheck; Carnes; or equal.

**Roof cap.--**

Roof cap shall be galvanized steel or aluminum construction, with 360 degree air opening and bird screen. Roof cap curb shall be supplied by the cap manufacturer.

**HVAC CONTROLS.--****Unit heater thermostat.--**

Unit heater thermostat shall be low voltage type, single set point range internally adjustable from 4°C to 27°C, and provided with a blank cover.

**Radiant heater thermostat.--**

Radiant heater thermostat shall be low voltage type, single set point range internally adjustable from 4°C to 27°C.

**Thermostat (office only).--**

Thermostat shall be 24-volt, 7-day programmable, electronic heating/cooling thermostat, with the ability to program the fan-on mode during normal working hours, and fan-off mode during unoccupied periods. Thermostat shall be provided with sub-base selector switches for "AUTO-HEAT-OFF-COOL" and fan "AUTO-ON". Thermostat shall be auto-changeover type, and have full temperature range setback capacity. Thermostat shall be Robertshaw, 7900; Honeywell, T7300; or equal.

**Time switch.--**

Time switch shall be double-pole, six-hour range, spring-wound, "OFF" type time switch without a "HOLD" feature. Time switch contacts shall be rated 20 amps at 120 volts. Time switch shall be Intermatic; Tork; or equal.

**AUXILIARY HVAC COMPONENTS.--**

Unless specified herein, all components shall be sized and have the characteristics as shown on the plans.

**Rigid ductwork.--**

Rigid ductwork shall be galvanized steel sheet metal conforming to the latest edition of the SMACNA "Low Velocity Duct Construction Standards." Galvanized steel shall be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.

**Spiral duct.--**

Spiral duct shall be prefabricated type.

**Duct supports.--**

Duct supports shall be hot-dip galvanized steel.

**Flexible ductwork.--**

Flexible ductwork shall be UL 181, Class 1 air duct rated and shall meet the requirements of NFPA 90-A. Duct shall have steel helix wire, flexible insulation, minimum thermal resistance of R-0.7 (m<sup>2</sup>\*K/W), and flame resistant vapor barrier. Inner and outer surfaces shall be non-metallic. Outer surface shall be Copolymer or Mylar, factory applied.

**Flexible connection.--**

Flexible connection shall be prefabricated type and shall be commercial quality flexible glass fabric coated on both sides with neoprene or hypalon.

**Ceiling diffuser (for gypsum board ceilings).--**

Ceiling diffuser for gypsum board ceilings shall be rectangular or square type. Diffuser shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum, equipped with a removable core and a standard flanged frame with sponge rubber or felt gasket. Diffuser shall have individually adjustable curved blades, counter-sunk screw holes, shall be surface mounted, with face velocity less than 3.05 m/s; Titus, 250; Air Mate, 400-O; Hart and Cooley, A40; or equal.

**Return register (for gypsum board ceilings).--**

Return register for gypsum board ceilings shall be rectangular or square, and shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum, fixed bar type, die formed louvers set at 45 degrees, 13 mm spacing maximum, surface mounted; Titus, 335; Air Mate, 280; or equal.

**Ceiling diffuser (for suspended ceilings).--**

Ceiling diffuser for suspended ceilings shall be 610 mm square. Diffuser shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum, perforated face hinged for easy access, and shall be fitted with fully adjustable air pattern controllers, a removable core, and a standard flanged frame; Titus, PAS; Air Mate, 700; or equal.

**Return register (for suspended ceilings).--**

Return register for suspended ceilings shall be 610 mm square, steel or extruded aluminum, perforated face hinged for easy access; Air Mate, 700RA; Titus, PAR; or equal.

**Wall supply grille.--**

Wall supply grille shall be double-deflecting adjustable type, with vertical face bars and horizontal rear louvers, steel with oven baked-on enamel bone white finish or extruded aluminum, flanged frame with sponge or felt gasket; Hart and Cooley T62; Air Mate 240-HO or equal.

**Duct inlet grille.--**

Duct inlet grille (for declassification fan) shall be heavy duty all steel construction, 18-gage minimum, 70 percent free area minimum, with one set of horizontal fixed bars, 15 mm spacing minimum, duct mounted. Duct inlet grille in overhead ductwork shall be steel or aluminum, egg crate type with one inch grid, duct mounted. Duct inlet shall be Titus; Hart and Coley; Krueger; or equal.

**Volume damper.--**

Volume damper shall be opposed blade type, operable from face with screw driver or Allen-head wrench, shall be same manufacturer as diffuser or may be furnished as part of the diffuser.

**Balance damper.--**

Balance damper shall be butterfly type, 1.52 mm (16-gage) minimum galvanized steel blade, end bearings with steel shaft and locking and indicator operator. Balance damper shall be Ventlock, Young, Anemostat, or equal.

**Vents and flues (for heaters).--**

Vents and flues for heaters shall be approved Type B or approved plastic vents for condensing furnaces.

**Refrigerant and condensate drain piping.--**

Refrigerant and condensate drain piping shall be rigid, Type L copper tubing with brazed solder fittings. The suction line shall be insulated, with vapor barrier and shall be weatherproofed for exterior installation. Factory sealed tubing shall not be used.

**PART 3.- EXECUTION****INSTALLATION.--**

**Heaters.--**Furnaces, unit heaters, radiant heaters and wall heaters shall be installed in such a manner as to insure adequate furnace clearance and separation of combustion air and circulating air. Appliances shall be connected to a rigidly mounted gas pipe supply system by an AGA approved flex connector and gas valve.

Radiant heaters shall be suspended by 7 mm minimum carbon steel chain and eye bolts. Heaters shall be angled to minimize heating of adjacent walls.

**Condensate drains.--**Air conditioning units shall be provided with condensate drain trap and piping. Outdoor piping shall extend to the nearest roof drain, gutter or as shown on the plans. Air gap shall be installed where required by code. Interior condensate drain piping shall be insulated with foam insulation.

**Evaporative cooler.--** Wall mounted evaporative cooler shall be provided with drain piping routed to within 150 mm of the ground.

**Temperature controls.--**Temperature control for each unit and radiant heater shall be provided by 2 thermostats and a time switch. One thermostat shall be set at 7°C. for low-limit temperature control and the second thermostat shall be set at 21°C. The first thermostat shall energize the heater whenever the temperature is below the setpoint. The second thermostat shall be wired in series with the time switch and shall de-energize the heater above the setpoint.

Each thermostat shall be insulated from the outside walls, and shall be provided with an aluminum radiation shield above the thermostat.

The time switch shall be installed beside the thermostat or where shown on the plans.

**Air outlets.--**Volume dampers shall be furnished and installed for all diffusers. Blocking shall be provided on all sides of air outlets between ceiling or wall joists. Collars shall be supplied for all outlets and shall be taped and sealed in place.

**Vents and flues.--**Vents and flues shall be securely fastened to the building construction, shall be provided with a collar at all ceiling penetrations and shall terminate with a weather cap fabricated of the same material.

**Access door.--**Access doors shall be provided in rigid ducts and plenums for access to volume dampers, fire dampers and control devices located within such ductwork; and shall be provided at such other locations as shown on the plans.

**Ducts and vents.**--Ductwork within the building shall be installed to clear lighting fixtures, doors, windows and other obstructions. Ductwork shall preserve head room and shall keep openings and passageways clear whether shown on plans or not.

Ductwork shall be installed and braced according to the latest edition of the SMACNA "HVAC Duct Construction Standards."

Slopes in sides at transitions shall be approximately one to five. The ductwork system shall not contain abrupt changes or offsets of any kind unless otherwise shown on the plans.

Where ducts pass through walls, galvanized sheet metal or steel angle collars shall be installed around the ducts.

Duct sections shall be connected by beaded sleeve-type couplings using joint sealer as recommended by the duct manufacturer. Duct sections shall be mechanically fastened with pop rivets or sheet metal screws and sealed with mastic or insulated, reinforced silver tape.

Flexible connections shall be provided at both inlet and outlet of fan coil and ventilating units.

Sheet metal plenums shall be adequately braced and supported from the floor or structure with structural steel angles to prevent sagging, flexing and vibration.

All standing seams and transverse joints of supply, return and exhaust ducts and seams around plenums, fan and coil housings shall be sealed with sealant and taped.

**Duct penetrations in fire rated assemblies.**--Where ductwork passes through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

**Ductwork identification.**--Ductwork shall be identified as follows:

Duct Description	Identification Symbol
Supply duct	S
Return duct	R
Exhaust duct	EXH
Outside air duct	OA

Identification symbol letters shall be stenciled at locations visible from the access routes to be used by maintenance workers. Such letters shall be painted with black colored paint and shall be a minimum of 50 mm high.

**FIELD QUALITY CONTROL.**--

**Pre-test requirements.**--Before starting or operating systems, equipment shall be cleaned and checked for proper installation, lubrication and servicing.

In each system, at least one air path, from fan to final outlet, shall have all balance dampers open. The final air quantities shall be achieved by adjusting the volume dampers or the fan RPM.

Final adjustments and balancing of the systems shall be performed in such a manner that the systems will operate as specified and as shown on the plans.

The Contractor shall replace or revise any equipment, systems or work found deficient during tests.

All automatic operating devices which are pertinent to the adjustment of the aforementioned air systems shall be set and adjusted to deliver the required quantities of air and at temperatures specified by the Engineer. All control work shall be done in collaboration with the control manufacturer's representative.

**Project completion tests.**--The Engineer shall be notified at least 3 working days in advance of starting project completion tests.

The project completion tests shall consist of the following:

- 1. Air Systems.**--All air systems shall be tested and balanced to the conditions set forth on the plans and in these special provisions. This work shall be performed by an Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) certified contractor. The air systems include, but are not necessarily limited to, the following:

- a. Supply air systems
- b. Return air systems
- c. Exhaust air systems

2. **Operational Data.**--The tests shall include operation of the heating, cooling, and ventilating systems for not less than two 8-hour days, each system shall operate at not less than 90 percent of their full specified capacities.

The required data shall be accurately measured. The data shall be measured during one operational cycle in the presence of the Engineer and shall be submitted for approval.

The following data shall be measured and tabulated:

- a. Ambient temperatures and conditions, °C
- b. Supply and return air quantities, m<sup>3</sup>/sec, each room
- c. Thermostat set point, °C
- d. Air temperatures at room center, °C
- e. Fan motor amperages and voltages
- f. System static pressures, Pa

## **SECTION 12-16. ELECTRICAL**

### **12-16.01 ELECTRICAL WORK**

#### **PART 1.- GENERAL**

##### **SUMMARY.--**

**Scope.**--This work shall consist of performing electrical work in accordance with the details shown on the plans and these special provisions.

Electrical work shall include furnishing all labor, materials, equipment and services required to construct and install the complete electrical system shown on the plans and the work of installing electrical connections for the thermostats, motors, and controls specified elsewhere in these special provisions.

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of conduits and other facilities and location of equipment is to be governed by structural conditions and other obstructions, and shall be coordinated with the work of other trades. Equipment requiring maintenance and inspection shall be located where it is readily accessible for the performance of such maintenance and inspection.

**Related work.**--Earthwork, foundations, sheet metal, painting, mechanical and such other work incidental to and necessary for the proper installation and operation of the electrical work shall be done in accordance with the requirements specified for similar work elsewhere in these special provisions.

##### **QUALITY ASSURANCE.--**

**Codes and standards.**--All work performed and materials installed shall be in accordance with the National Electrical Code; the California Building Standards Code, Title 24, Part 3, "California Electrical Code," and the California Code of Regulations, Title 8, Chapter 4, "Electrical Safety Orders," and all state ordinances.

**Warranties and guarantees.**--Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

##### **TESTING.--**

After the electrical system installation work has been completed, the electrical system shall be tested in the presence of the Engineer to demonstrate that the electrical system functions properly. The Contractor shall make necessary repairs, replacements, adjustments and retests at his expense.

## 12-16.02 BASIC MATERIALS AND METHODS

### PART 1.- GENERAL

#### SUMMARY.--

**Scope.--**This work shall consist of furnishing and installing conduits, conductors, fittings, and wiring devices in accordance with the details shown on the plans and these special provisions.

Conduits, conductors, fittings, and wiring devices shall include those accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the electrical system.

**Related work.--**Roof penetrations shall be flashed and sealed watertight conforming to the requirements specified under "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Where conduits pass through fire rated wall, floor or ceiling assemblies, the penetrations shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

#### SUBMITTALS.--

**Product data.--**A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions for recessed junction and pull boxes, and component layout shall be included where applicable. All control and power conductors on the shop drawings shall be identified with wire numbers.

### PART 2.- PRODUCTS

#### CONDUITS AND FITTINGS.--

##### Rigid steel conduit and fittings.--

Rigid steel conduit shall be threaded, full weight rigid steel, hot-dip galvanized inside and outside with steel or malleable iron fittings. Fittings shall be threaded unless otherwise specified or shown on the plans.

Split or three-piece couplings shall be electroplated, malleable cast iron couplings.

Insulated grounding bushings shall be threaded malleable cast iron body with plastic insulated throat and steel, lay-in ground lug with compression screw.

Insulated metallic bushings shall be threaded malleable cast iron body with plastic insulated throat.

##### Electrical metallic tubing (EMT) and fittings.--

Electrical metallic tubing shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam with zinc coating outside and enamel or lacquer coating inside.

Couplings shall be electroplated, rain and concrete tight, gland compression type, steel body couplings with malleable iron nuts.

Connectors shall be electroplated, rain and concrete tight, gland compression type, steel body connectors with male hub, malleable iron nut and insulated plastic throat.

**Flexible metallic conduit and fittings.--**

Flexible metallic conduit shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design.

Fittings shall be electroplated screw-in type with malleable cast iron body and threaded male hub with insulated throat.

**Liquid tight flexible metallic conduit and fittings.--**

Liquid tight flexible metallic conduit shall be fabricated in continuous length from galvanized sheet steel, spirally wound and formed to provide an interlocking design with an extruded polyvinyl chloride cover.

Fittings shall be electroplated, malleable cast iron body, with cap nut, grounding ferrule, and connector body with insulated throat.

**Rigid non-metallic conduit and fittings.--**

Rigid non-metallic conduit shall be Schedule 40, high impact, nonconducting, self-extinguishing polyvinyl chloride (PVC) rigid non-metallic conduit for direct underground burial.

Couplings shall be PVC, socket type or thread on one end and socket type on the other end as required for the particular application.

Terminal adapters for adapting PVC conduit to boxes, threaded fittings, or metallic conduit system shall be PVC adapters with threads on one end and socket type on the other end.

**CABLES AND CONDUCTORS.--****Radio Cables.--**

Radio cables shall have 25 twisted pairs of No. 24 AWG copper conductors. All conductors shall be color coded. Cable shall be suitable for direct burial and shall have a black, linear low density, high molecular, polyethylene jacket. Cable shall have a corrugated, copolymer coated, 0.2 mm or thicker aluminum tape applied longitudinally with overlapped edges and electrically continuous shielding. Cable shall have flexigel filling compound or approved equal. Radio cable shall be AT&T ALPETH cable, model No. PE89; or equal.

**Twisted Shielded Pair Cables.--**

Twisted shielded pair cables shall be comprised of one twisted shielded pair. Cable shall be stranded tinned copper conductors, minimum wire size AWG #22, polyethylene insulated, with a foil aluminum-polyester shield, drain wire and a PVC outer jacket. The cable insulation shall be rated 300 volts; Type TC; UL listed; suitable for use in wet and dry locations; suitable for installation in trays, duct, conduit; suitable for direct burial underground, exposure to sunlight; and suitable for remote control and telemetry applications. Cable shall have a minimum rating of 75°C in wet locations and 90°C in dry locations. Twisted shielded pair cables shall be as manufactured by Okonite; Houston Wire and Cable; or equal.

**Conductors.--**

Conductors shall be stranded copper wire.

Conductor insulation types unless otherwise shown or specified, shall be as follows:

1. Conductors across hinges of control panel enclosures shall be Type MTW.
2. Conductors shall be type XHHW-2 in wet and outdoor locations.
3. Conductors shall be type THHN in dry locations.

**Wire connections and devices.--**

Wire connections and devices shall be pressure or compression type, except that connectors for No. 10 AWG and smaller conductors in dry locations may be preinsulated spring-pressure type.

## **ELECTRICAL BOXES.--**

### **Outlet, device and junction boxes.--**

Unless otherwise shown or specified, boxes shall be galvanized steel boxes with knock-outs and shall be the size and configuration best suited to the application indicated on the plans. Minimum size of outlet, receptacle, switch or junction boxes shall be 100 mm square by 40 mm deep, except that switch boxes for the installation of single switches and outlet boxes for flush-mounted light fixtures shall be 50 mm by 75 mm by 40 mm deep.

Multiple switches shall be installed in standard gang boxes, unless otherwise specified or shown on the plans.

Cast metal boxes shall be cast iron boxes with threaded hubs and shall be of the size and configuration best suited to the application shown on the plans.

Flush-mounted boxes shall have stainless steel covers, one mm thick. Cover screws shall be metal with finish to match cover finish.

Unless otherwise shown or specified, surface-mounted boxes shall have galvanized steel covers with metal screws.

Weatherproof junction boxes shall have cast metal covers with gaskets.

Weatherproof switch and receptacle boxes shall have gasketed covers with gasketed hinged flaps to cover switches and receptacles. Weatherproof receptacle boxes shall maintain their weatherproof rating when a cord and plug are connected.

Sectional device plates will not be permitted.

### **Underground pull boxes.--**

Pull boxes shall be high density reinforced concrete box with ultraviolet inhibitor polyethylene etched face anchored in concrete and fiberglass cover with hold down bolts. The polyethylene and fiberglass material shall be fire resistant and show no appreciable change in physical properties with exposure to the weather. No. 3 1/2 pull box shall be Brooks Products, No. 3 1/2; Christy Concrete Products, N9; or equal. No. 6 pull box shall be Brooks Products No. 6; Christy Concrete Products, B1730; or equal.

Traffic rated pull boxes shall be high density reinforced concrete box with steel cover with hold down bolts and bonding strap. Pull box and cover shall be designed for H20 loading. No. 3 1/2 pull box shall have inside dimensions of 270 mm by 440 mm and No. 6 pull box shall have inside dimensions of 432 mm by 762 mm.

## **RECEPTACLES AND SWITCHES.--**

### **Duplex receptacles.--**

Duplex receptacles shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, safety grounding, ivory color, specification grade receptacle suitable for wiring with stranded conductors.

### **Management Information System (MIS) receptacles.--**

MIS receptacles shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, isolated grounding, orange color, specification grade receptacle suitable for wiring with stranded conductors.

### **A/C-1 receptacle.--**

A/C-1 receptacle shall be 250-volt, AC and shall match the plug of the air conditioning unit, A/C-1, provided.

### **Multi-outlet assemblies.--**

Multi-outlet assemblies shall be 3-wire, 15-ampere, 125-volt AC, 800 mm long strip, grounding type receptacles spaced 150 mm on center. The assembly shall be provided with the necessary entrance end fitting and blank end fitting.

**Welding receptacles.--**

Welding receptacles shall be surface-mounted, 600-volt, 100-ampere, 3-wire, 4-pole, circuit breaking, weather resistant, raintight receptacle with female interior assembly. The receptacle shall be complete with back box, angle adapter and spring door. The receptacle shall be grounded through extra pole and shell, and shall have crimp or solder type connections. A mating plug for the receptacle shall be provided.

**Mobile Vehicle Lift Receptacle.--**

Mobile vehicle lift receptacle shall be surface-mounted, 600-volt, 60-ampere, 3-wire, 4-pole, circuit breaking, weather resistant, raintight receptacle with female interior assembly. The receptacle shall be complete with back box, angle adapter and spring door. The receptacle shall be grounded through extra pole and shell, and shall have crimp or solder type connections. A mating plug for the receptacle shall be provided.

**Snap switches.--**

Snap switches shall be 20-ampere, 120/277-volt AC, quiet type, specification grade, ivory color switch with silver cadmium alloy contacts. Switch shall be suitable for wiring with stranded conductors.

**Three-way toggle switches.--**

Three-way toggle switches shall be 20-ampere, 120/277-volt AC, quiet type, specification grade, ivory color switch with silver cadmium alloy contacts. Switch shall be suitable for wiring with stranded conductors.

**Four-way toggle switches.--**

Four-way switches shall be 20-ampere, 120/277-volt AC, quiet type, specification grade, ivory color switch with silver cadmium alloy contacts. Switch shall be suitable for wiring with stranded conductors.

**MISCELLANEOUS MATERIALS.--****Warning Tape.--**

Warning tape shall be 100 mm wide and contain the printed warning "CAUTION ELECTRICAL CONDUIT" in bold 19 mm black letters at 760 mm intervals on bright orange or yellow background. The printed warning shall be non-erasable when submerged under water and resistant to insects, acids, alkali, and other corrosive elements in the soil. The tape shall have a tensile strength of not less than 70 kg per 100 mm wide strip and shall have a minimum elongation of 700 percent before breaking.

**Pull ropes.--**

Pull ropes shall be nylon or polypropylene with a minimum tensile strength of 225 kg.

**Watertight conduit plugs.--**

Watertight conduit plugs shall be a hollow or solid stem expansion plugs complete with inner and outer white polypropylene compression plates and red thermoplastic rubber seal. Seal material shall be non-stick type rubber resistant to oils, salt, and alkaline substances normally available at the construction sites.

**Anchorage devices.--**

Anchorage devices shall be corrosion resistant, toggle bolts, wood screws, bolts, machine screws, studs, expansion shields, and expansion anchors and inserts.

**Electrical supporting devices.--**

Electrical supporting devices shall be one hole conduit clamps with clamp backs, hot-dipped galvanized, malleable cast iron.

Construction channel shall be 41 mm x 41 mm, 2.66 mm (12-gage) galvanized steel channel with 13 mm diameter bolt holes, 40 mm on center in the base of the channel.

**Ground rod(s)--**

Ground rod(s) shall be a 19 mm (minimum) galvanized or copper clad steel rod, 3 meters long.

**Telephone outlet boxes.--**

Telephone outlet boxes shall be 102 mm square boxes and plates with modular type telephone outlets as shown on the plans. Boxes on stud walls shall have plaster ring.

Plates for flush mounting outlets in finished room shall be Type 430 stainless steel, 1 mm thick with satin finish.

**Radio outlet boxes.--**

Radio outlet boxes shall be 102 mm square boxes with blank cover plate. Boxes on stud walls shall have plaster rings.

Plates for flush mounting outlets in finished room shall be Type 430 stainless steel, 1 mm thick with satin finish.

**PART 3.- EXECUTION****INSTALLATION.--**

**Conduit, general.--**Rigid steel conduit shall be used unless otherwise shown on the plans or specified in these special provisions.

Electrical metallic tubing may be used in furred spaces and for exposed work indoors above the switch height.

Unless otherwise specified or shown on the plans, flexible metal conduit shall be used to connect suspended lighting fixtures, motors, HVAC equipment, and other equipment subject to vibration in dry locations.

Unless otherwise specified or shown on the plans, liquid-tight flexible metal conduit shall be used to connect motors, HVAC equipment, and other equipment subject to vibration in damp or wet locations.

Rigid non-metallic conduit shall be used at the locations shown on the plans for direct underground burial outside the building foundation.

**Conduit installation.--**Conduit trade sizes are shown on the plans. No deviation from the conduit size shown on the plans will be permitted without written permission from the Engineer.

Conduit shall be concealed unless otherwise shown on the plans.

Conduits shall be tightly covered and well protected during construction using metallic bushings and bushing "pennies" to seal open ends.

Rigid non-metallic conduit bends of 30 degrees or greater shall be factory-made long radius sweeps. Bends less than 30 degrees shall be made using an approved heat box.

A pull rope shall be installed in all empty conduits. At least one meter of pull rope shall be doubled back into the conduit at each termination.

Locations of conduit runs shall be planned in advance of the installation and coordinated with the ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

Where practical, conduits shall be installed in groups in parallel, vertical or horizontal runs and at elevations that avoid unnecessary offsets.

Exposed conduit shall be installed parallel and at right angles to the building lines.

Conduits shall not be placed closer than 300 mm from a parallel hot water or steam pipe or 75 mm from such lines crossing perpendicular to the runs.

All raceway systems shall be secured to the building structures using specified fasteners, clamps and hangers.

Single conduit runs shall be supported by using one hole pipe clamps. Where run horizontally on walls in damp or wet locations, conduit shall be installed with "clamp backs" to space conduit off the surface.

Multiple conduit runs shall be supported with construction channel secured to the building structure. Conduits shall be fastened to construction channel with channel compatible pipe clamps.

Raceways of different types shall be joined using approved couplings or transition fittings.

Expansion couplings shall be installed where conduit crosses a building separation or expansion joint.

All floor and wall penetrations shall be sealed water-tight.

Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel or cylindrical wire brush and blown out with compressed air.

**Conduit terminations.**--Rigid steel conduits shall be securely fastened to cabinets, boxes and gutters using 2 locknuts and specified insulating metallic bushing. Electrical metallic tubing shall be securely fastened to cabinets, boxes and gutters using specified connectors. Conduit terminations at exposed weatherproof enclosures and cast outlet boxes shall be made watertight using specified hubs.

Grounding bushings with bonding jumpers shall be installed on all type of conduits terminating at concentric knockouts and on all conduits containing service conductors, grounding electrode conductor, and conductors feeding separate buildings.

Rigid non-metallic conduits shall be terminated inside the underground pull boxes with an approved conduit bushings or fittings. All conduits shall enter the pull box at an angle of 45 degrees or more.

All future conduits terminated in underground pull boxes or exposed indoor and outdoor shall be provided with watertight conduit plugs.

**Warning Tape.**--Warning tape shall be placed over each conduit in a trench. Each warning tape shall be centered over the conduit and shall be placed over the 150 mm layer of sand covering the conduit as described elsewhere in these special provisions.

**Conductor installation.**--Conductors shall not be installed in conduit until all work of any nature that may cause injury is completed. Care shall be taken in pulling conductors that insulation is not damaged. An approved non-petroleum base and insulating type pulling compound shall be used as needed.

All conductors shall be installed and tested in accordance with manufacturer's recommendations.

Splices and joints shall be insulated with insulation equivalent to that of the conductor.

Provide 155 mm of slack at each outlet and device connection. If the outlet or device is not at the end of a run of wire, connection shall be made with correctly colored pigtails tapped to the runs with splices as specified herein.

Branch circuit conductors in panelboards and load centers shall be neatly trained along a path from the breaker terminals to their exit point. The conductors shall have ample length to transverse the path without strain, but shall not be so long as to require coiling, doubling back, or cramming. The path shall transverse the panelboard gutter spaces without entering a gutter containing service conductors and, unless otherwise shown on the plans, without entering the gutter space of any panelboard feeder.

All pressure type connectors and lugs shall be retightened after the initial set.

Splices in underground pull boxes and similar locations shall be made watertight.

Junction boxes in furred or accessible ceiling spaces shall be identified with felt-tip pen denoting the circuits contained in the box.

**Conductor identification.**--The neutral and equipment grounding conductors shall be identified as follows:

Neutral conductor shall have a white or natural gray insulation except that conductors No. 4 and larger may be identified by distinctive white marker such as paint or white tape at each termination.

Equipment grounding conductor shall be bare or insulated. If insulated, equipment grounding conductors shall have green or green with one or more yellow stripes insulation over its entire length except that conductors No. 4 and larger may be permanently identified by distinctive green markers such as paint or green tape over its entire exposed insulation.

Feeder and branch circuit ungrounded conductors shall be color coded by continuously colored insulation, except conductors No. 6 AWG or larger may be color coded by colored tape at each connection and where accessible. Ungrounded conductor color coding shall be as follows:

SYSTEM	COLOR CODE
120/208V-Three phase	Black, red, blue

All control conductors including control conductors of manufacturer supplied and field wired control devices shall be identified at each termination with the wire numbers shown on the plans, approved working drawings, and as directed by the Engineer where deemed necessary. Identification shall be made with one of the following:

1. Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.
2. Self-laminating wrap around type, printable, transparent, permanent heat bonding type thermoplastic film markers.
3. Pre-printed, white, heat-shrinkable tubing.

Each terminal block shall have a molded marking strip attached with screws. The identifying numbers of the terminating conductors, as shown on the plans or on the submittal drawings, shall be engraved in the marking strip.

**Outlet, device and junction box installation.--**Where one or more threaded steel conduits are required to connect to an outlet, device, or junction box, the box shall be a cast metal box with threaded hubs. Unless otherwise shown on the plans or specified in these special provisions, all other boxes shall be sheet steel boxes. Weatherproof outlet, device and junction boxes shall have cast metal covers with gaskets. Unless otherwise shown on the plans or specified in these special provisions, all other boxes shall have standard galvanized covers.

All boxes shall finish flush with building walls, ceiling and floors except where exposed work is called for.

Raised device covers (plaster rings) shall be installed on all boxes concealed in concrete, masonry or stud walls.

No unused openings shall be left in any box. Knockout seals shall be installed as required to close openings.

Outlet, device, and junction boxes shall be installed at the locations and elevations shown on the plans or specified herein. Adjustments to locations may be made as required by structural conditions and to suit coordination requirements of other trades.

Boxes in stud walls and partitions shall not be mounted back to back. Through-wall boxes shall not be used.

Boxes installed in metal stud walls shall be equipped with brackets designed for attaching directly to the studs or shall be mounted on heavy gauge galvanized steel, snap-in box supports.

Fixture outlet boxes installed in suspended ceilings of gypsum board or lath and plaster construction shall be mounted on 1.52 mm (16-gage) metal channel bars attached to main ceiling runners.

Fixture outlet boxes for pendant-mounted fixtures installed in suspended ceilings supporting acoustical tiles or panels shall be supported directly from the structures above.

**Underground pull box installation.--**Electrical pull box covers or lids shall be marked "ELECTRICAL." Telephone service pull box covers or lids shall have plain, unmarked covers.

The bottom of pull boxes shall be bedded in 155 mm of clean, crushed rock or gravel and shall be grouted with 40 mm thick grout prior to installation of conductors. Grout shall be sloped to a 25 mm PVC pipe drain hole. Conduit shall be sealed in place with grout.

Top of pull boxes shall be flush with surrounding grade or top of curb. In unpaved areas where pull box is not immediately adjacent to and protected by a concrete foundation, pole or other protective construction, the top of pull box shall be set at plus 30 mm above surrounding grade. Pull boxes shown on the plans in the vicinity of curbs shall be placed adjacent to the back of curb. Pull boxes shown on the plans adjacent to lighting standards shall be placed on the side of foundation facing away from traffic.

**Ground rod(s) installation.--**The ground rod(s) shall be driven vertically until the top is 155 mm above the surrounding surface. When vertical penetration of the ground rod cannot be obtained, an equivalent horizontal grounding system, approved by the Engineer, shall be installed.

**Anchorage.--**Hangers, brackets, conduit straps, supports, and electrical equipment shall be rigidly and securely fastened to surfaces by means of toggle bolts on hollow masonry; expansion shields and machine screws, or expansion anchors and studs or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood or lag screws on wood construction.

Anchorage devices shall be installed in accordance with the anchorage manufacturer's recommendations.

**Mounting heights.--**Electrical system components shall be mounted at the following mounting heights, unless otherwise shown on the plans. The mounting height dimensions shall be measured above the finished floor to the bottom of the device or component.

Thermostats	1.0 m maximum, office areas 1.25 m maximum, hallways
Wall switches	1.0 m maximum
Convenience outlets	510 mm minimum, office areas 1.25 m minimum, all other areas
Electric water cooler outlet	As recommended by the water cooler manufacturer.
Telephone and radio outlets	510 mm minimum

## 12-16.03 SERVICE AND DISTRIBUTION

### PART 1.- GENERAL

#### SUMMARY.--

**Scope.--**This work shall consist of furnishing and installing service and distribution equipment in accordance with the requirements of the serving utilities, the details shown on the plans and these special provisions.

**Related work.--**Concrete and reinforcement for service pedestal shall conform to the requirements specified for minor work under "Cast-in-Place Concrete," in Section 12-3, "Concrete and Reinforcement," of these special provisions.

#### SUBMITTALS.--

**Installation details.--**The Contractor shall submit complete service installation details to the serving utilities for approval. Prior to submitting installation details to the serving utility, the Contractor shall have said drawings reviewed and stamped "APPROVED" by the Engineer. Submittals shall be approved by the serving utility prior to commencing work.

**Product data.--**A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions, and component layout shall be included where applicable. All control and power conductors on the shop drawings shall be identified with wire numbers.

### PART 2.- PRODUCTS

#### Service equipment.--

Service equipment shall contain a pull section, metering compartment, remote meter, service disconnect switch, automatic transfer switch enclosure (for future ATS) and a distribution section for 120/208-volt, 800-ampere, 3-phase, 4-wire service.

#### Enclosures.--

Enclosures shall be rated NEMA 1. Exteriors shall be 2.66 mm (12-gage) and interiors shall be 1.90 mm (14-gage) sheet steel. All screws, latches, hinge pins and similar hardware shall be stainless steel. Enclosure finish shall be baked enamel or baked thermosetting polyester finish. Busbars shall be rated 1000 amperes.

#### Service disconnect switch.--

Service disconnect switch shall be 3-pole, 208-volt, 800-ampere frame, 800-ampere trip, molded case circuit breaker with AC magnetic trip. The interrupting capacity of the circuit breaker shall be 42,000 amperes (symmetrical) at 208 volts. Breaker shall be Westinghouse; Square D; General Electric; or equal.

#### Distribution circuit breakers.--

Distribution circuit breakers to be installed inside the service equipment shall be of the indicating type providing ON, Tripped and Off positions on the operating handle. Circuit breakers shall be quick-make, quick-break, with thermal magnetic action. An overload of one pole of all multiple-pole circuit breakers shall automatically cause all poles to open. Circuit breakers shall meet the requirements of UL and NEMA AB2. Unless otherwise noted, interrupting rating for circuit breakers used in service entrance equipment shall not be less than 42,000 amps rms symmetrical at 208 volts. Circuit breakers shall be sized as shown on the plans and shall be manufactured by Westinghouse; Square D; General Electric; or equal.

#### Lightning arrester and surge capacitor.--

Lightning arrester and surge capacitor shall be suitable for use at the service entrance of a 120/208 volt, three-phase, 4-wire, 60 Hz distribution system and shall be mounted on a bracket inside a NEMA 1 enclosure. Lightning arrester shall meet the design tests as required by ANSI/IEEE C62.11 for 10 kA, 4x10 microsec impulses. Lightning arrester and surge capacitor shall be as manufactured by General Electric; Delta; or equal.

### **Nameplates.--**

Nameplates shall be laminated phenolic plastic with white core and black front and back. Nameplate inscription shall be in capitals letters etched through the outer layer of the nameplate material.

**Equipment and component identification.--**Equipment and components shall be identified with nameplates fastened with self-tapping, cadmium-plated screws or nickel-plated bolts.

Nameplate inscriptions shall read as follows:

Item	Letter height, mm	Inscription
Service Entrance	6	SERVICE ENTRANCE 120/208 V, 800 A, 3PH, 4 WIRE
Distribution Section	6	DISTRIBUTION SECTION 120/208 V, 800 A, 3 PH, 4 WIRE
Main Breaker	3	MAIN BREAKER
Panelboard A Breaker	3	PANELBOARD A FEEDER
Panelboard B Breaker	3	PANELBOARD B FEEDER
Panelboard C Breaker	3	PANELBOARD C FEEDER
Panelboard D Breaker	3	PANELBOARD D FEEDER
Panelboard R Breaker	3	PANELBOARD R FEEDER
Lightning Arrester and Surge Capacitor	3	LIGHTNING ARRESTER AND SURGE CAPACITOR

### **PART 3.- EXECUTION**

Installation of service and distribution equipment shall be in accordance with the requirements of the serving utilities as shown on the approved installation details.

#### **12-16.04 ELECTRICAL EQUIPMENT**

##### **PART 1.- GENERAL**

##### **SUMMARY.--**

**Scope.--**This work shall consist of furnishing and installing panelboards, starters, disconnect switches, and related accessories in accordance with the details shown on the plans and these special provisions.

**Related work.--**Anchorage devices shall be as specified under "Basic Materials and Methods" elsewhere in this Section 12-16.

##### **SUBMITTALS.--**

**Product data.--**A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions, and component layout shall be included where applicable. All control and power conductors on the shop drawings shall be identified with wire numbers.

## **PART 2.- PRODUCTS**

### **PANELBOARDS.--**

#### **Panelboard A.--**

Panelboard A shall be indoor type, surface-mounted, factory assembled, 3-phase, 4-wire, 120/208-volt, AC panelboard at least 508 mm wide with 125-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panel shall be Square D Company; Westinghouse; General Electric; or equal.

#### **Panelboard B.--**

Panelboard B shall be indoor type, surface-mounted, factory assembled, 3-phase, 4-wire, 120/208-volt, AC panelboard at least 508 mm wide with 200-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panels shall be Square D Company; Westinghouse; General Electric; or equal.

#### **Panelboard C.--**

Panelboard C shall be indoor type, surface-mounted, factory assembled, 3-phase, 4-wire, 120/208-volt, AC panelboard at least 508 mm wide with 200-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panels shall be Square D Company; Westinghouse; General Electric; or equal.

#### **Panelboard R.--**

Panelboard R shall be indoor type, surface-mounted, factory assembled, 3-phase, 4-wire, 120/208-volt, AC panelboard at least 508 mm wide with 350-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panels shall be Square D Company; Westinghouse; General Electric; or equal.

#### **Panelboard S.--**

Panelboard S shall be indoor type, surface-mounted, factory assembled, 3-phase, 4-wire, 120/208-volt, AC panelboard at least 508 mm wide with 100-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Panels shall be Square D Company; Westinghouse; General Electric; or equal.

### **STARTERS.--**

#### **Air compressor starters.--**

Air compressor starters shall be combination 3-pole, 208-volt, NEMA Size 1, NEMA rated, line voltage starter and motor circuit protector in a NEMA-1 enclosure. Air compressor starters shall have two, 2-ampere, dual element, 250-volt fuses with 2-pole barrier type fuse base; 208-volt coil, double-break silver contacts and 3 manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Reset button shall be externally operable.

#### **Evaporative cooler motor controllers.--**

Evaporative cooler motor controllers shall be a combination motor starter, single-speed, 3-pole, 208-volt, NEMA Size 1, NEMA rated, line voltage starter and circuit breaker in a NEMA-1 enclosure. Circuit breaker shall be sized per manufacturer's recommendations. Evaporative cooler controller shall have one, dual element, 250-volt fuse with barrier type fuse base; 120-volt coil, double-break silver contacts and 3 manual reset, non-adjustable thermal overloads set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Reset button shall be externally operable. Controller shall be lockable on the OFF position.

**Declassification fan controller cabinet No.1.--**

Declassification fan controller cabinet No.1 shall be a NEMA 12, factory pre-wired, surface mounted enclosure with a hinged door and complete with 15 amp, 3-pole main circuit breaker; fan starter (ST1); start and stop pushbuttons; pilot light; and terminal blocks mounted inside the enclosure. The "Start-Stop" pushbutton shall be externally operable, and the pilot light shall be externally visible.

Declassification fan motor starter, ST1, shall be 3-pole, 208-volt, NEMA size 00, NEMA rated line voltage starter, 120-volt coil and one auxiliary contact complete with manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer.

**Declassification fan controller cabinet No.2.--**

Declassification fan controller cabinet No.2 shall be a NEMA 12, factory pre-wired, surface mounted enclosure with a hinged door and complete with 15 amp, 3-pole main circuit breaker; fan starters (ST2, ST3 and ST4); start and stop pushbuttons; pilot light; and terminal blocks mounted inside the enclosure. The "Start-Stop" pushbutton shall be externally operable, and the pilot light shall be externally visible.

Declassification fan motor starters, ST2, ST3 and ST4, shall be 3-pole, 208-volt, NEMA size 00, NEMA rated line voltage starters, 120-volt coil and one auxiliary contact complete with manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer.

**Declassification fan controller cabinet No.3.--**

Declassification fan controller cabinet No.3 shall be a NEMA 12, factory pre-wired, surface mounted enclosure with a hinged door and complete with 15 amp, 3-pole main circuit breaker; fan starters (ST5 and ST6); start and stop pushbuttons; pilot light; and terminal blocks mounted inside the enclosure. The "Start-Stop" pushbutton shall be externally operable, and the pilot light shall be externally visible.

Declassification fan motor starters, ST5 and ST6, shall be 3-pole, 208-volt, NEMA size 00, NEMA rated line voltage starters, 120-volt coil and one auxiliary contact complete with manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer.

**Fume exhaust fan controller cabinet No.1.--**

Fume exhaust fan controller cabinet No.1 shall be a NEMA 12, factory pre-wired surface mounted enclosure with a hinged door and complete with 15 amp, 3-pole main circuit breaker; fan starter (ST1); start and stop pushbuttons; pilot light; and terminal blocks mounted inside the enclosure. The "Start-Stop" pushbutton shall be externally operable, and the pilot light shall be externally visible.

Fume exhaust fan motor starter, ST1, shall be 3-pole, 208-volt, NEMA size 00, NEMA rated line voltage starter, 120-volt coil and one auxiliary contact complete with manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer.

**Fume exhaust fan controller cabinet No.2.--**

Fume exhaust fan controller cabinet No.2 shall be a NEMA 12, factory pre-wired surface mounted enclosure with a hinged door and complete with 15 amp, 3-pole main circuit breaker; fan starter (ST2); start and stop pushbuttons; pilot light; and terminal blocks mounted inside the enclosure. The "Start-Stop" pushbutton shall be externally operable, and the pilot light shall be externally visible.

Fume exhaust fan motor starter, ST2, shall be 3-pole, 208-volt, NEMA size 0, NEMA rated line voltage starter, 120-volt coil and one auxiliary contact complete with manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer.

**Fume exhaust fan controller cabinet No.3.--**

Fume exhaust fan controller cabinet No.3 shall be a NEMA 12, factory pre-wired surface mounted enclosure with a hinged door and complete with 15 amp, 3-pole main circuit breaker; fan starters (ST3 and ST4); start and stop pushbuttons; pilot light; and terminal blocks mounted inside the enclosure. The "Start-Stop" pushbutton shall be externally operable, and the pilot light shall be externally visible.

Fume exhaust fan motor starters, ST3 and ST4, shall be 3-pole, 208-volt, NEMA size 00, NEMA rated line voltage starters, 120-volt coil and one auxiliary contact complete with manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer.

#### **Pushbuttons, Selector switches, and pilot lights.--**

Pushbuttons, selector switches, and pilot lights shall be heavy-duty oil-tight, and manufactured to the requirements of NEMA ICS. Provide suitable NEMA rated enclosures or mount in panels as indicated.

Unless noted otherwise, provide extra-large, integral metal service legends (legend plates) indicating their specific functions, and laminated phenolic nameplates indicating the equipment they control.

Unless noted otherwise, pushbuttons shall be momentary contact and shall have the number and type of contacts as indicated or required.

Unless noted otherwise, selector switches shall be maintained contact, shall have the number of positions indicated, and shall have the number and type of contacts as indicated or required.

Pilot light shall be panel mounted, heavy duty, oil tight, indicating light with 120 volt, AC, LED lamp with domed cap.

Pushbutton, selector switches, and pilot lights shall be Allen-Bradley, Westinghouse, or equal.

#### **SWITCHES.--**

##### **Outdoor condensing unit disconnect switch (A/C-2).--**

Outdoor Condensing Unit disconnect switch shall be 3-pole, 600-volt, AC, 60-ampere, fused, heavy duty safety switch in a NEMA-3R enclosure. The fuses shall be sized to suit the outdoor condensing unit furnished.

##### **Furnace/cooling coil disconnect switch (A/C-2).--**

Furnace/cooling coil disconnect switch shall be single-pole, 120-volt, AC, 30-ampere, fused, general duty safety switch in a NEMA-1 enclosure. The fuses shall be sized to suit the furnace/cooling coil furnished.

##### **Overhead door operator disconnect switch.--**

Overhead door operator disconnect switch shall be 2-pole, 208-volt, AC, 30-ampere, non-fusible, general duty safety switch in a NEMA-1 enclosure with provision for padlocking in the "OFF" position.

#### **MISCELLANEOUS MATERIALS.--**

##### **Nameplates.--**

Nameplates shall be laminated phenolic plastic with white core and black front and back. Nameplate inscription shall be in capitals letters etched through the outer layer of the nameplate material.

##### **Warning plates.--**

Warning plates shall be laminated phenolic plastic with white core and red front and back. Warning plates inscription shall be in capitals letters etched through the outer layer of the nameplate material.

##### **Plywood backing panels.--**

Plywood backing panels for mounting electrical or telephone equipment shall be 19 mm, APA plywood panels, C-D PLUGGED and touch-sanded, Exposure 1.

##### **Paint.--**

Plywood backing panels shall receive the following paint system: one prime coat, alkyd, interior wood primer and 2 finish coats, acrylic, interior enamel, semi-gloss.

### PART 3.- EXECUTION

#### INSTALLATION.--

**Plywood backing board.--**Plywood backing board shall be securely fastened to walls or other vertical framing. Surface to be coated shall be cleaned of all dirt, excess materials, or filler by hand cleaning.

Coatings shall be applied in accordance with the manufacturer's instructions. Each coat shall be applied to a uniform finish, free of skips, brush marks, laps or other imperfections.

**Panelboard installation.--**Set cabinets plumb and symmetrical with building lines. Train interior wiring as specified under "Conductor and Cable Installation" in "Basic Materials and Methods" of these special provisions. Touch-up paint any marks, blemishes, or other finish damage suffered during installation. Replace cabinets, doors or trim exhibiting dents, bends, warps or poor fit which may impede ready access, security or integrity.

Mounting height shall be 1.4 meters to the highest circuit breaker handle, measured above the finished floor.

Where "Future" or "Space" is indicated on the plans, branch connectors, mounting brackets, and other hardware shall be furnished and installed for future breaker.

A typewritten directory under transparent protective cover shall be provided and set in metal frame inside each cabinet door. Directory panel designation for each circuit breaker shall include complete information concerning equipment controlled, including room number or area designated on the plans.

**Equipment identification.--**Equipment shall be identified with nameplates fastened with self-tapping, cadmium-plated screws or nickel-plated bolts.

Nameplate inscriptions shall read as follows:

Item	Letter height, mm	Inscription
Panelboard A	3	PANELBOARD A 120/208 V, 3 PH, 4 W
Panelboard B	3	PANELBOARD B 120/208 V, 3 PH, 4W
Panelboard C	3	PANELBOARD C 120/208 V, 3 PH, 4 W
Panelboard D	3	PANELBOARD D 120/208 V, 3 PH, 4 W
Panelboard R	3	PANELBOARD R 120/208 V, 3 PH, 4 W
Panelboard S	3	PANELBOARD S 120/208 V, 3 PH, 4 W
Panel M	3	PANEL M 120/208 V, 3 PH, 4 W
Declassification Fan Controller No.1	3	DECLASSIFICATION FAN CONTROLLER
Declassification Fan Controller No.2	3	DECLASSIFICATION FAN CONTROLLER
Declassification Fan Controller No.3	3	DECLASSIFICATION FAN CONTROLLER
Fume Exhaust Fan Controller No.1	3	FUME EXHAUST FAN CONTROLLER
Fume Exhaust Fan Controller No.2	3	FUME EXHAUST FAN CONTROLLER
Fume Exhaust Fan Controller No.3	3	FUME EXHAUST FAN CONTROLLER

Evaporative Cooler Controller	3	EVAPORATIVE COOLER CONTROLLER
Evaporative Cooler Controller	3	EVAPORATIVE COOLER CONTROLLER
Evaporative Cooler Controller	3	EVAPORATIVE COOLER CONTROLLER
Evaporative Cooler Controller	3	EVAPORATIVE COOLER CONTROLLER
Evaporative Cooler Controller	3	EVAPORATIVE COOLER CONTROLLER
Radiant Heater Controller	3	RADIANT HEATER CONTROLLER
Radiant Heater Controller	3	RADIANT HEATER CONTROLLER
Radiant Heater Controller	3	RADIANT HEATER CONTROLLER
Air Compressor Combination Starter	3	AIR COMPRESSOR STARTER
Air Compressor Combination Starter	3	AIR COMPRESSOR STARTER
Welding Outlet	3	WELDING OUTLET
Welding Outlet	3	WELDING OUTLET
Mobile Vehicle Lift Outlet	3	MOBILE VEHICLE LIFT OUTLET
LCP-1	3	LIGHTING CONTROL PANEL 1
LCP-2	3	LIGHTING CONTROL PANEL 2
LCP-3	3	LIGHTING CONTROL PANEL 3
LCP-4	3	LIGHTING CONTROL PANEL 4

**Warning plates.--**Warning plates shall be attached to designated equipment with self-tapping cadmium-plated screws or nickel-plated bolts.

Warning plate inscriptions shall read as shown on the plans.

## 12-16.05 LIGHTING

**GENERAL.--**This work shall consist of furnishing, installing and connecting all lighting equipment in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.--**Manufacturer's descriptive information, photometric curves, catalog cuts, and installation instructions shall be submitted for approval.

### PRODUCTS.--

#### Lighting fixture lamps.--

Lighting fixture lamps shall be type and size as shown on the plans. Lamps shall be General Electric, Phillips, Sylvania, or equal. Fluorescent lamps, unless otherwise noted, shall be 4100K tri-phosphor with a CRI of 70 or greater.

#### Ballasts.--

All fixtures shall be equipped with high power factor ballasts suitable for the line voltage and for the type, size and number of lamps required by the fixture. Fluorescent ballasts shall be UL Listed, Class P and ETL Certified ballasts with sound rating A. Fluorescent ballasts shall be high-frequency electronic ballasts with power factor greater than 0.95, nominal ballast factor of 0.88 unless specified otherwise, total harmonic distortion less than 20 percent, crest factor less than or equal to 1.7, complying with ANSI C 62.41 Category A for surge protection, and FCC Part 18 for interference.

**Lighting fixtures.--**

Lighting fixtures shall be as shown on the plans and as specified herein. Outdoor luminaires shall be listed and labeled "Fixture Suitable For Wet Locations."

**F1.--**

Lay-in 300 mm x 1200 mm lensed troffer fluorescent fixture with one 32-watt T8 lamp, white baked enamel reflector and electronic ballast. The fixture shall be Columbia; Day-Brite; Lithonia; or equal.

**F2.--**

Lay-in 600 mm x 1200 mm lensed troffer fluorescent fixture with two 32-watt T8 lamps, white baked enamel reflector and electronic ballast. The fixture shall be Columbia; Day-Brite; Lithonia; or equal.

**F3.--**

Ceiling-mounted fluorescent fixture with \_two 32-watt T8 lamps, electronic ballast, white baked enamel reflector and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be Columbia; Day Brite; Lithonia; or equal.

**F4.--**

Stem mounted fluorescent fixture with two 32-watt T8 lamps, electronic ballast, white baked enamel reflector and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be Columbia; Lithonia; Day Brite; or equal.

**F5.--**

Lay-in 600 mm x 1200 mm lensed troffer fluorescent fixture with three 32-watt T8 lamps, white baked enamel reflector and electronic ballast. The fixture shall be Columbia; Day-Brite; Lithonia; or equal.

**F6.--**

Stem mounted fluorescent fixture with three 32-watt T8 lamps, electronic ballast, white baked enamel reflector and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be Columbia; Lithonia; Day Brite; or equal.

**F7.--**

Stem mounted fluorescent fixture with two 110-watt, T12 lamps, 800 MA ballast and white baked enamel ribbed reflector, complete with end plates and wire guard. The fixture shall be Columbia; Lithonia; Day Brite; or equal.

**F8.--**

Stem mounted fluorescent fixture with three 110-watt, T12 lamps, 800 MA ballast and white baked enamel ribbed reflector, complete with end plates and wire guard. The fixture shall be Columbia; Lithonia; Day Brite; or equal.

**F9.--**

Ceiling-mounted fluorescent fixture with \_two 32-watt T8 lamps, electronic ballast, white baked enamel reflector and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be suitable for installation in wet locations. The fixture shall be Columbia; Day Brite; Lithonia; or equal.

**F10.--**

Ceiling-mounted fluorescent fixture with \_three 32-watt T8 lamps, electronic ballast, white baked enamel reflector and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be Columbia; Day Brite; Lithonia; or equal.

**H1.--**

Outdoor, canopy mounted, 50-watt, 120-volt high pressure sodium luminaire with integral ballast. The luminaire shall be Holophane; ITT; or equal.

**H2.--**

Outdoor, wall mounted, 50-watt, 120-volt high pressure sodium luminaire with integral ballast. The luminaire shall be Holophane; ITT; or equal.

**H3.--**

Outdoor, ceiling mounted, 150-watt, 120-volt high pressure sodium luminaire with integral ballast. The luminaire shall be Holophane; ITT; or equal.

**H4.--**

Pole mounted, 250-watt, 208-volt, high pressure sodium, cut-off luminaire with integral photoelectric unit and ballast. The luminaire shall be General Electric; ITT; or equal.

Pole for luminaire shall be round tapered galvanized steel, have 331 MPa minimum yield strength. Height and mast arm length shall be as shown on the plans. The pole shall be able to withstand stresses produced by steady state wind with velocity of 145 km/h. Pole shall have hand hole with cover plate, base plate and all necessary hardware.

**Fused splices.--**

Fused splices shall be Buss; Elastimold; or equal; with standard midget, ferrule, 5-ampere, 208-volt, slow blowing fuses.

**Photoelectric unit, PEC.--**

Photoelectric unit shall be cadmium sulfide photoelectric control with capacity of 600-watt inductive or fluorescent load, mounting adapter, and EEI-NEMA twist lock receptacle; Fisher-Pierce, Ripley, or equal.

**Lighting control panel, LCP-1 and LCP-4.--**

Lighting control panel shall consist of a lighting contactor, selector switch and pilot light in a surface mounted NEMA-12 enclosure with a hinged door.

**Lighting control panel, LCP-2 and LCP-3.--**

Lighting control panel shall consist of a lighting contactor in a surface mounted NEMA-12 enclosure with a hinged door.

**Lighting contactor, LC.--**

Lighting contactor shall be electrically held, combination lighting contactor with 120-volt AC coil and 20-ampere, double-break, silver alloy contacts. The number of poles shall be as shown on the drawings. Lighting contactor shall be as manufactured by Square D Company, I.T.E., Westinghouse, or equal.

**Selector switch, SS.--**

Selector switch shall be rotary action, double-pole, 3-position, 10-ampere, 120-volt switch. Switch contacts shall have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break) and 10 amperes (continuous) at 120 volts and 35 percent power factor. Selector switch shall have legend plate marked MANUAL-OFF-AUTO.

**Pilot light, PL.--**

Pilot light shall be panel mounted, heavy duty, oil tight indicating light with 120-volt, AC, direct incandescent replacement LED lamp with red domed cap.

**Concrete.--**

Concrete shall be as specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions. The concrete shall be commercial quality portland cement concrete containing not less than 337 kilograms of cement per cubic meter.

**EXECUTION.--**

**LIGHTING FIXTURES.--**Lighting fixtures shall be mounted securely in accordance with the manufacturer's recommendations. Mounting methods shall be suitable for the particular type of ceiling or support at each location.

The Contractor shall provide all supports, hangers, spacers, channels, fasteners and other hardware necessary to support the fixtures.

Fixtures shall be set at the mounting heights shown on the plans, except heights shown shall be adjusted to meet conditions.

**BALLASTS.**--All fluorescent fixtures shall be equipped with high power factor ballasts suitable for the line voltage and for the type, size and number of lamps required by fixture.

All ballasts used outside or in unheated areas inside the building shall be -20°C ballasts or less.

**POLE MOUNTED LUMINAIRES.**--In the pull box adjacent to each pole for luminaire, H4, a fused splice connector shall be installed in each ungrounded conductor between the line and the ballast. The connector shall be readily accessible in the pull box and shall be insulated and made waterproof in accordance with the splice connector manufacturer's recommendations.

Concrete foundations shall be as shown on the plans. Anchor bolts or devices shall be accurately located and positioned to match the holes in the pole base plates. Pole and luminaire orientation shall be as indicated on the plans.

The poles for pole mounted type fixtures shall be mounted rigidly and securely on the foundations as recommended by the fixture and pole manufacturer.

## **12-16.06 ANTENNA POLE**

**GENERAL.**--This work shall consist of furnishing and installing an antenna pole and foundation in accordance with the details shown on the plans and these special provisions.

**SUBMITTALS.**--Manufacturer's descriptive information, wind velocity calculations, catalog cuts, and installation instructions shall be submitted for approval.

### **PRODUCTS.**--

#### **Antenna pole.**--

Antenna pole shall be a round, tapered, gray fiberglass pole with a smooth finish. The pole shall be able to withstand stresses produced by a steady state wind with a velocity of 145 km/h. Pole height shall be as shown on the plans. Pole shall have a hand hole cover plate, base plate, pipe nipples, removable cap, and all necessary hardware.

#### **Concrete.**--

Concrete shall be as specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions. The concrete shall be commercial quality portland cement concrete containing not less than 337 kilograms of cement per cubic meter.

### **EXECUTION.**--

**ANTENNA POLE.**--Concrete foundations shall be as shown on the plans. Anchor bolts or devices shall be accurately located and positioned to match the holes in the pole base plates.

The antenna pole shall be mounted rigidly and securely on the foundation as recommended by the pole manufacturer.

## **12-16.07 INTRUSION ALARM SYSTEM**

### **PART 1.- GENERAL**

#### **SUMMARY.**--

**Scope.**--This work shall consist of furnishing and installing a complete and operational intrusion alarm system in accordance with the details shown on the plans and these special provisions.

The system shall include all materials, whether mentioned or not, that are necessary for a complete and operational intrusion alarm system.

## **SYSTEM DESCRIPTION.--**

**Design requirements.--**The intrusion alarm system shall be a low voltage, direct current, zoned alarm system, and shall consist of a master reporting control panel in the Office/Equipment Building Communication Room, magnetic contact switches, glass break discriminators and keypad stations for the buildings. Each zone shall be a "supervised, Class B circuit." The end of line resistor shall be installed in the identified control panel.

The alarm system shall self-test and report status of individual zones every 24 hours.

The alarm system shall provide an automatically rechargeable back-up power supply system, 24 hour minimum, in case of building power interruption.

The alarm system components shall be UL Listed for commercial usage or F.M. Listed. The system proposed shall be approved by the Federal Communication Commission (FCC).

## **SUBMITTALS.--**

**Product data.--**Manufacturer's descriptive information and installation instructions shall be submitted for approval.

Installation instructions shall include manufacturer and catalog reference, and model number of equipment to be furnished, conduit and conductor sizes, wiring diagram, and floor plan showing locations of devices.

## **QUALITY ASSURANCE.--**

**Installer qualification.--**The installer of the security alarm system shall be licensed by the State Department of Consumer Affairs, Bureau of Security and Investigative Services. License numbers and expiration dates shall be included on all correspondence.

## **PART 2.- PRODUCTS**

### **Control panel.--**

The master control panel (Radionics 9412B or equal) shall be a surface-mounted, locking cabinet, completely self-contained control panel suitable for 120-volt, AC, input power with separate terminals for all external wires.

The control panel shall meet the following requirements:

Control panel will be UL Listed for commercial fire and burglar reporting;

Minimum 8 zones (capable of zone expansion);

Digital dialer communicator;

12-volt auxiliary power supply (minimum 24 hours);

Rechargeable battery ( 24 hour minimum);

Battery charger;

Low battery reporting;

Silent alarm signaling;

System connected to RJ31X or RJ38X telephone jack or equivalent;

Line test every twenty-four (24) hours;

120-volt, AC, input;

Front accessible control and indication digital keypad;

UL Listed for commercial use;

Remote control identification.

### **Magnetic contact switch.--**

Magnetic door switch for pedestrian door shall be a 2-section, self-lock mounting type switch, and shall be compatible with the material of the door on which it is installed. The switch shall be epoxied in the switch housing. Magnetic contact switches shall be the type capable of being concealed on the top of the door frame.

Magnetic contact switches for the overhead vehicle doors shall be 2-section, extra heavy-duty, floor mounting type switch with stainless steel armored cable.

Switch shall be housed in a non-magnetic case.

### **Glass break discriminator.--**

Glass break discriminator shall be an acoustic glass break detector with advanced technology for sensing and reporting simultaneous sound and shock wave activity. Detector shall respond to energy of breaking windows using piezo-electric crystal microphone. Sensor coverage pattern shall be directional, detecting breakage of uncovered glass in a 10.5 meters wide area at a distance of 3.5 meters minimum. The sensor shall be housed in a fire retardant ABS housing.

### **Digital keypad.--**

Keypad shall be weatherproof 12 button keypad with 16 user codes capable of expansion to 120, surface-mounted low-voltage (12 VDC/24 VDC), vandal-resistant device with programmable ability for user codes 1-6 digits. Keypad shall have an EEPROM memory for backup of all codes, have a relock time delay adjustable from 1-90 seconds or on/off and have a tamper switch to detect unauthorized access to the keypad working system. The keypad will have incorporated four on-board relays for electric door locks, alarm shunting, forced door monitoring and door ajar monitoring.

## **PART 3. EXECUTION.--**

### **INSTALLATION.--**

**General.--**The intrusion alarm system shall be installed in accordance with the manufacturer's recommendations and at the locations shown on the plans.

The switch section without wires shall be recessed flush into the top edge of the door at the approximate center of the door, and the switch section with wires shall be recessed flush in the top section of the door frame. The two sections of the switch shall be mounted directly opposite each other to provide maximum sensitivity. The wiring from each magnetic switch shall be run to the control panel in the zone dedicated for the intrusion alarm circuit.

Magnetic contact switches for overhead doors shall be mounted as follows. The switch section mounted on the bottom edge of the overhead door shall be without wires. The switch section with wire shall be mounted on the floor directly below the switch part without wires. The wiring from each magnetic switch shall be run to the control panel in the zone dedicated for the intrusion alarm circuit. The glass break discriminator shall be mounted on the ceiling at locations shown on the plans.

At pedestrian access doors the following devices are to be installed per manufacturer instructions and work as an integrated system to control employee access and egress into the designated areas. The digital keypads are to be mounted internal to the buildings. Other components of the entry system will include a magnetic contact switch.

### **Intrusion alarm zoning.--**Intrusion alarm panel zoning shall be as follows:

Office/Equipment Building-Communications room (Control Panel item #11)

Zone 1: Office/Equipment Building-Pedestrian access door into welding area to include: one digital keypad (30 second delay) (item #5) and one magnetic contact switch-pedestrian (item #4).

Zone 2: Office/Equipment Building-Pedestrian and vehicle access doors into the welding area to include: two magnetic contact switches-pedestrian into equipment storage room (items #1 and #2); two magnetic contact switch-pedestrian on pedestrian doors into the welding area (items #3 and #8); and two magnetic contact switches-vehicle (items #6 and #7).

Zone 3: Office/Equipment Building-Vehicle access doors into the equipment bay area to include: six magnetic contact switches-vehicle (items #11, #12, #13, #14, #15 and #16).

Zone 4: Office/Equipment Building-Pedestrian access doors into the equipment bay area to include: two magnetic contact switches-pedestrian (items #9 and #10).

Zone 5: Office/Equipment Building-Pedestrian access door into north hallway of the office area to include: one magnetic contact switch-pedestrian (item #18).

Zone 6: Office/Equipment Building-Glass break discriminator in the communications room (item #17).

Zone 7: Office/Equipment Building-Glass break discriminators in both men's and women's restrooms (items #19 and #20).

Zone 8: Office/Equipment Building-Glass break discriminators in office areas (items #23 and #24).

Zone 9: Office/Equipment Building-Pedestrian access door into the vestibule area to include: one digital keypad (30 second delay) (item #26) and one magnetic contact switch-pedestrian (item #25).

- Zone 10: Resident Mechanics Building-Pedestrian access door into service bay area to include: one digital keypad (30 second delay) (item #28) and one magnetic contact switch-pedestrian (item # 27).
- Zone 11: Resident Mechanics Building-Pedestrian access door (perimeter) into parts area to include: one magnetic contact switch-pedestrian (item # 29).
- Zone 12: Resident Mechanics Building-Pedestrian access door (west) into service bay area to include: one magnetic contact switch-pedestrian (item # 30).
- Zone 13: Resident Mechanics Building-Vehicle access doors into service bay area to include: three magnetic contact switches-vehicle (items #31, #32 and #33).

**Conduit and conductors.**--All intrusion alarm system wiring shall be installed in conduit system conforming to the requirements under "Basic Materials and Methods" elsewhere in these special provisions. Conduit size shall be as recommended by the intrusion alarm manufacturer, except that conduits shall be not less than 16 mm diameter. Within the office areas, conduits shall be concealed in ceiling or walls. All other conduit shall be exposed unless shown otherwise on the plans.

All conductors and cables for the intrusion alarm system wiring shall be as recommended by the intrusion alarm system manufacturer.

All points of protection must be specifically identified by zone when reporting to the intrusion alarm panel. All points of protection will be transmitted to the UL Listed monitoring company.

#### **FIELD QUALITY CONTROL.--**

**Testing.**--The operational test for the intrusion alarm system shall be performed by the Contractor in the presence of the Engineer and a representative from the Caltrans Operation Security Branch. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer and Caltrans Operations Security Branch in writing not less than 10 days in advance of performing the operational tests.

**Monitoring.**--The contractor shall provide UL Listed monitoring services for the facility for one year after the acceptance of the contract. The services shall include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station shall contact designated site representative in the event of alarm and dispatch an immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

#### **DEMONSTRATION.--**

**Training.**--The Contractor shall provide one hour of on-site training on the use, operation, and maintenance of the system for designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.