Addendum 001

San Ramon Public Safety Building

Issued: March 03, 2021

This Addendum is issued before the award of contract to inform the bidders of revisions to the bidding documents. It shall be the responsibility of the general contractor to inform any affected sub-bidder of the content of this Addendum.

All requirements contained in the bidding documents shall apply to this Addendum, and the general character of the work called for in this addendum shall be the same as originally set forth in the applicable portions of the bidding documents for similar work, unless otherwise specified under this addendum, and all incidental work necessitated by this Addendum as required to complete the work shall be included in the bids, even though not particularly mentioned in this addendum.

This addendum is hereby made a part of the bidding documents and shall be signed and dated, submitted with bidder's proposal, and acknowledged as received on the General Contractor's 00 4000 Bid Form. Failure to do so may subject the Bidder to disqualification.

MEP subcontractor site visit is scheduled for 9:00 am Tuesday, March 9. RSVP required to jeff@jeffkatzarchitecture.com. The site visit will only access the building equipment room - general building tours will not be provided.

I. CHANGES TO THE SPECIFICATIONS

a. Revise Table of Contents
   i. Add Section 31 25 00 Erosion and Sedimentation Controls to Table of Contents. Refer to new section 31 25 00 Erosion and Sedimentation Controls.
   ii. Add 27 41 00 Audio Visual Systems to Table of Contents.

b. Revise Specification 27 41 00 Audio Visual Systems
   i. Add Section 27 41 00 Appendix F.

c. Add the following Specification sections that were omitted in the 02/19/21 For Bid, but included in the Table of Contents:
   i. TABLE OF CONTENTS
   ii. 03 01 00 CONCRETE SPALL REPAIR AND CRACK INJECTION
   iii. 03 10 00 CONCRETE FORMING AND ACCESSORIES
   iv. 03 20 00 CONCRETE REINFORCING
   v. 03 30 00 CAST-IN-PLACE CONCRETE
   vi. 03 38 50 FIBER REINFORCED EPOXY COMPOSITE MATERIAL
   vii. 05 12 00 STRUCTURAL STEEL FRAMING
   viii. 05 30 00 METAL DECKING
   ix. 05 40 00 COLD-FORMED METAL FRAMING
   x. 23 00 00 MECHANICAL GENERAL PROVISIONS
   xi. 31 10 00 SITE CLEARING
   xii. 31 20 00 EARTH MOVING
   xiii. 31 21 00 UTILITY TRENCHING AND BACKFILL

xiv. 31 25 00 EROSION AND SEDIMENTATION CONTROLS
xv. 32 11 00 PAVEMENT BASE COURSE
xvi. 32 13 13 CONCRETE PAVEMENT
xvii. 32 13 18 CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS
xviii. 32 13 75 CONCRETE CURBS AND GUTTERS
xix. 32 17 23 PAVEMENT MARKINGS
xx. 33 10 00 WATER SYSTEMS
xxi. 33 30 00 SANITARY SEWER SYSTEMS
xxii. 33 41 00 STORM UTILITY DRAINAGE PIPING

II. CHANGES TO THE DRAWINGS

a. Revise Drawing Sheet C-5.0
   i. Change to storm drain line size. Refer to revised sheet C-6.0 Delta 1 dated 03/03/21. Change storm drain pipe size along Eastern side of EOC building from 24" to 30" diameter. Adjust invert elevations as noted.

b. Revise Drawing Sheet C-6.0
   i. Change to storm drain line size. Refer to revised sheet C-6.0 Delta 1 dated 03/03/21. Change storm drain pipe size along Eastern side of EOC building from 24" to 30" diameter. Adjust invert elevations as noted.

c. Revise Drawing Sheet C-8.0
   i. Add roadway sign.

d. Revise Drawing Sheet C-10.1
   i. Clarify dimensions at overflow riser.

III. CLARIFICATION TO QUESTIONS

a. **Question:**
Audio Video Specification Section 27 41 00, Part 2, 2.6, A. indicates an Appendix F to reference for specific product to be used with no exceptions. 27 41 00, Part 2, 2.6, B. indicates the product list and quantities are in an Appendix C.

These documents are not on Bay Area Builders Exchange (where I am finding all the Bid Set Documents).

Please provide/advise.

Response:
Specification 27 41 00 Audio Visual Systems Appendix F provided in Addendum 001. Section 27 21 00 Par 2.6.B should be changed to read "Product list and quantities (See Appendix F)".

b. **Question:**
What is the existing Fire Alarm System in the existing San Ramon building permit center and police department?

Response:
See attached images.

c. **Question:**
Please see sheet E0.1, regarding the Comm/Data/Security Legend; The conduit size for rough in is given followed by C.O. This is conduit only for all the designated symbols. In the project manual it includes Division 27 for Communications and Division 28 for Electronic Safety and Security.

Is the owner responsible for the Low Voltage Systems cabling infrastructure? Rough-in as shown by the electrical contractor?

Response:
The General Contractor and associated Sub-Contractors are responsible for providing the Low Voltage pathways, cabling, and all infrastructure for the project.

d. **Question:**
Please see sheet AV-101, regarding the Responsibility Schedule and Abbreviations;

There is no Specification/Division for the AV system.

Is the owner responsible for the Low Voltage Systems cabling infrastructure? Rough-in as shown by the electrical contractor? Miscellaneous boxes, switches, and power for required A/V devices per the matrix?

Response:
Specification section 27 41 00 Audio Visual Systems is included in the Bid Set Specifications, it was missing from the Table of Contents.

The General Contractor and associated Sub-Contractors are responsible for providing the Low Voltage pathways, cabling, and all infrastructure for the project.

e. **Question:**
A 2100 lbs. capacity elevator is specified. However, a 3500 lbs. capacity elevator with a side opening door is needed IF the elevator needs to accommodate an emergency gurney. Can you advise if it needs to accommodate an emergency gurney?

Response:
Gurney not required.

f. **Question:**
The specification calls for the elevator to interface with a card reader. Elsewhere, it says that it should have security keyswitches. Should it have card reader provisions, security keyswitches, or neither?

Response:
The elevator shall have card reader provisions. Addendum 001 for Specification section 14 24 00 Hydraulic Elevators, deletes paragraph 2.05.C.2 (this would retain the Card Reader and delete the Keyswitch operation).

g. **Question:**
The warranty period is blank. Should a one year warranty be assumed since this is typical of elevator scopes?

Response:
12-month warranty.

h. **Question:**
Specification Table of Contents lists the following divisions but these sections are missing from the specifications. Will they be provided under separate cover? 02 50 50, 03 01 00, 03 10 00, 03 20 00, 03 30 00, 03 38 50, 05 12 00, 05 30 00, 05 40 00, 31 10 00, 31 20 00, 31 21 00, 32 11 00, 32 13 13, 32 13 18, 32 13 75, 32 17 23, 33 10 00, 33 30 00, 33 41 00.

Response:
Specifications have been provided in Addendum 001. Note that 02 50 50 Erosion Control has been changed to 31 25 00 Erosion and Sedimentation Controls.

i. **Question:**
Will BIM be required? There is only one reference in specification section "08 31 13 Access Doors and Frames".

Response:
BIM is not required for Access Doors and Frames. Specification section 23 00 00 Mechanical General Provisions had the incorrect footer (08 31 13 Access Doors and Frames), which requires BIM per Part 1.12 D.

IV. ATTACHMENTS

a. Pre-bid Meeting Sign-In Sheet.
b. Specification sections 27 41 00 Audio Visual Systems, Appendix F, TOC, 03 01 00, 03 10 00, 03 20 00, 03 30 00, 03 38 50, 05 12 00, 05 30 00, 05 40 00, 23 00 00, 31 10 00, 31 20 00, 31 21 00, 31 25 00, 32 11 00, 32 13 13, 32 13 18, 32 13 75, 32 17 23, 33 10 00, 33 30 00, 33 41 00.
c. Drawing sheets C-5.0, C-6.0, C-8.0. C-10.1.
d. Response images to Question III b.

END OF ADDENDUM 001

RECEIPT ACKNOWLEDGED BY:

NAME OF CONTRACTOR'S REPRESENTATIVE	NAME OF BIDDER
SIGNATURE OF CONTRACTOR'S REPRESENTATIVE	DATE

SAN RAMON PUBLIC SAFETY CENTER
MANDATORY PRE BID
MARCH 2, 2021

COMPANY NAME	MAILING ADDRESS	ATTENDEE NAME	EMAIL ADDRESS	PHONE NUMBER	GENERAL CONTRACTOR (Y/N)	MEETING TIME
BHM Construction Inc	221 Gateway Rd #405, Napa, CA	April Karsemeyer	bids@bhmconstruction.com	707-643-4580	Y	10:00 AM
EF Brett & Company	10 Paul Dr. San Rafael, CA	Bill Walls	adamc@efbrett.com	415-302-7035	Y	10:00 AM
Bishop Ranch	2600 Camino Ramon, San Ramon, CA	Samual Ponce	sponce@bishopranch.com	925-499-6067	Y	10:00 AM
Alten Construction	1141 Marina Way, Richmond, CA	Bobby Alten	bids@altenconstrcution.com	510-234-4200	Y	10:00 AM
Bobo Construction	9722 Kent St, Elk Grove, CA	Killian Obrien	bestimating@boboconstructioninc.com	916-383-7777	Y	10:00 AM
Cal Pacific Construction	1009 Terra Nova Blvd, Pacifica, CA	Truman Chan	gl@pacific888.com	650-557-1238	Y	10:00 AM
Roebbelen Contracting, Inc	1241 Hawks Flight Court, El Dorado Hills, CA	Mike Garant	estimating@roebbelen.com	916-939-1110	Y	1:00 PM
Hensel Phelps	4750 Willow, Pleasanton, CA	Aamir Imam	AImam@henselphelps.com	925-494-9700	y	1:00 PM
Arntz Builders	431 Payran St. Petaluma, CA	Sam Arntz	bids@arntzbuilders.com	707-836-2900	y	1:00 PM
Sausal Corporation	3550 Willow Pass Road, Concord, CA	Teena Singley	bids@sausal.net	925-568-2200	y	1:00 PM
Lathrop Construction Associates, Inc.	4001 Park Road, Benicia, CA	Anthoony Reed	asr@lathropconstruction.com	707-746-8000	y	1:00 PM
DL Falk	3526 investment Blvd, Hayward, CA	Dave Falk	htruong@dlfalk.com	415-278-1051	y	1:00 PM

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END OF SECTION

SECTION 03 01 00

CONCRETE SPALL REPAIR AND CRACK INJECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide all labor, materials, formwork, equipment and services to complete removal of damaged concrete and repair/patching of concrete to be reconstructed.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19 Concrete.

B. American Concrete Institute (ACI) 224.1 “Cause, Evaluation, and Repair of Cracks in Concrete Structures”.

C. ACI RAP Bulletin 1 “Field Guide to Concrete Repair Application Procedures – Structural Crack Repair by Epoxy Injection”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve submittals prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review. Submit for review prior to installation.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturers' data on manufactured products and other concrete related materials. Demonstrate compliance with specified characteristics. Provide samples of items upon request.

D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.

1.4 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI RAP Bulletin 1.

B. Perform tests specified below in article FIELD QUALITY CONTROL.

C. Contractor shall bear the entire cost of remediation, removal, and/or replacement of concrete repairs determined defective or non-conforming, including Architect/Engineer fees for redesign.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials specified by brand name shall be delivered in undamaged packages bearing manufacturer's label and shall be brand specified or a previously submitted and approved equal.

B. Delivery, handling and storage of other materials shall conform to the applicable sections of the current editions of the various reference standards listed in this Section.

C. Protect materials from weather, temperature variations, or other damage. Sort to prevent inclusion of foreign materials.

1.6 MOCK-UP

A. Perform spall repair and/or crack injection on an inconspicuous location for review prior to commencing work

B. Provide 2 inch diameter concrete core at injected location to ensure adequate penetration and bond of epoxy. Notify Engineer for location of core. Patch core with repair mortar.

C. If determined to be acceptable mock-up may remain as part of the Work.

1.7 SCHEDULING AND SEQUENCING

A. Perform Work in existing facilities during such hours and by methods as are approved by Owner. Owner reserves the right to modify proposed schedules to eliminate conflicts and ensure use of existing facilities during the Work. Follow exactly the schedule as finally approved by Owner.

B. Organize the work and employ shop and field crew(s) of sufficient size to minimize impact on the Owner/Tenant.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Bonding Agent: Sika “Sikadur 32 Hi-Mod”, Simpson Strong-Tie “FX-752”.

B. Steel Corrosion Inhibitor: Sika “Armatec 110 EpoCem”, Simpson Strong-Tie “FX-406”.

C. Crack Injection:

1. Epoxy Surface Seal Compound: When required furnish Sika “Sikadur 31 High Mod Gel”, Simpson Strong-Tie “CIP-F” paste-over. The surface seal material shall have adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection.

2. Injection ports: per epoxy manufacturer’s recommendations.

3. Pressure Injected Epoxy:

a. For installations above 60 degrees Fahrenheit: Sika “Sikadur 35 Hi-Mod LV” adhesive, Simpson Strong-Tie “CI-LV”. The epoxy resin adhesive shall conform to ASTM C881, Type I and IV, Grade 1, Class C, with a minimum 14-day bond strength per ASTM C882 of 2,750 psi.

b. For cold weather installations (40 to 60 degrees Fahrenheit): Sika “Sikadur 35 Hi-Mod LV” adhesive, Simpson Strong-Tie “CI-LV FS”. The epoxy resin adhesive shall conform to ASTM C881, Type I and IV, Grade 1, Class B, with a minimum 14-day bond strength per ASTM C882 of 2,750 psi.

D. Spall Repairs:

1. Horizontal or formed surfaces: Sika “Sikacrete 211 SCC”, Simpson Strong-Tie “FX-Rapid Setting Mortar”.

2. Vertical or overhead surfaces: Sika “SikaQuick VOH”, Simpson Strong-Tie “FX-263”.

PART 3 - EXECUTION

3.1 GENERAL CONCRETE WORK

A. Work must be performed by a contractor having not less than 5 years successful experience with comparable concrete repair projects employing personnel skilled in the restoration process and operations indicated

B. Protect finished surfaces not to be repaired from work to be done in this section.

C. Provide formwork, shoring, and bracing as required to complete work.

3.2 CRACK INJECTION WITH EPOXY

A. Equipment for Injection: Provide the type of equipment necessary to meter and mix the two injection adhesive components and inject the mixed adhesive into the crack. Follow manufacturer’s recommendations.

B. Surface Preparation: The cracks and surface adjacent to cracks or other areas of application shall be cleaned of dirt, dust, grease, oil, efflorescence or other foreign matter detrimental to bond of epoxy injection surface seal system. Use wire brushing, sandblasting, high pressure water blasting, etc per manufacturer’s instructions. Acid and other corrosives shall not be permitted. Repair area must be dry prior to product application. Manufacturer’s recommended minimum application and minimum/maximum curing temperature for substrate shall be verified.

C. Epoxy Application or Injection: In accordance with accepted procedures overseen by an experienced contractor, inject or apply epoxy compounds in strict accordance with the manufacturer's specifications and recommendations for each intended type of use. Entry ports shall be provided along the crack at intervals no greater than the thickness of the concrete (8 inch maximum spacing). Do not proceed until injected or pasted over material has gained adequate strength to continue with injection process. Perform epoxy adhesive injection continuously until all pressure-injected cracks are completely filled. The epoxy injection process should not, under any circumstances, result in any damage to the steel in the concrete.

D. Finishing and Cleaning: Excess materials, gel sealants and pastes, and plastic ports shall be removed after epoxy resin has cured. Exposed surfaces to be restored to original condition.

3.3 SPALL REPAIR OF CONCRETE

A. Remove loose/damaged concrete, sawcut straight edges with a minimum of 1/4" depth, chip and/or sand blast to assure competent concrete surfaces, expose clean aggregate surface to 1/4" minimum amplitude (ICRI CSP 9 or higher), and clean/remove rust from existing reinforcing. Remove concrete to minimum ¾ inch clear all around exposed reinforcing bars.

B. Notify Engineer for review of cleaned reinforcing.

C. If existing reinforcing steel is deemed acceptable by Engineer, coat prepared reinforcing steel with corrosion inhibitor per manufacturer's requirements. Coat prepared concrete surfaces with bonding agent per manufacturer's requirements.

D. Set formwork as required.

E. Mix and place grout per manufacturer's recommendations. Surfaces to be saturated surface dry (SSD) with no standing water unless noted otherwise. Scrub mortar into substrate, filling all pores and voids. Force grout against edge of repair, working toward the center.

F. Finishes: All finishes to match original finishes. Float, hand trowel, and edge (as for slab on grade). Remove formed edges if used (when grout has achieved sufficient set), float and hand trowel. Provide light broom, hand trowel, or other finish as required to match existing surfaces.

G. Apply curing compound or cover with water retaining materials and keep wet for 4 days minimum. Use of curing compound is limited to locations and/or conditions for which discoloration due to cure is acceptable and locations where other finishes will not be affected.

3.4 FIELD QUALITY CONTROL

A. A 2 inch diameter concrete core shall be taken for every 50 feet of injected crack (minimum 2 cores total) to verify adequate penetration and bond. Notify Engineer for location of cores. Patch core holes with repair mortar.

3.5 CLEANING

A. Remove all debris created by the work of this section.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials and equipment and all operations required to complete all formwork as indicated on the drawings; to produce shapes and configurations as shown, as required; and as specified herein, including:

1. Forms, shores, bracing, removal and other operations as necessary for all cast-in-place concrete and masonry placed.
2. Setting and securing anchor bolts and other metal items embedded in concrete into formwork, using materials and layouts furnished and delivered to jobsite as specified under other sections.

B. Related Sections:

1. Pertinent Sections of Division 03 specifying concrete construction.
2. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete foundations and formwork.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19 Concrete.

B. American Concrete Institute (ACI) 347 "Recommended Practice for Concrete Formwork".

C. American Plywood Association (APA) “Concrete Forming Guide”.

D. West Coast Lumberman Inspection Bureau (WCLIB) “Standard Grading Rules for West Coast Lumber”.

E. ACI SP-066 “ACI Detailing Manual”.

F. ACI 301 “Specifications for Structural Concrete”.

G. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice”.

1.3 DESIGN REQUIREMENTS

A. Design, engineer, and construct formwork, shoring and bracing to conform to design and code requirements, resist imposed loads; resultant concrete to conform to required shape, line and dimension.

1.4 SUBMITTALS

A. Limitation of review: Structural Engineer's review will be required only where specifically requested for general architectural applications and features only. Contractor is responsible for structural stability, load-resisting characteristics and sufficiency of form work design.

1.5 QUALITY ASSURANCE

A. General: All form materials shall be new at start of work. Produce high quality concrete construction. Minimize defects due to joints, deflection of forms, roughness of forms, nonconforming materials, concrete or workmanship.

B. Reuse of Forms: Plywood forms may be reused, if thoroughly cleaned of all dirt, mortar, and foreign materials, and undamaged at edges and contact face. Reuse shall be subject to permission from the Architect without exception, and issued in writing. Reuse of any panel which will produce a blemish on exposed concrete, will not be permitted.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Form Materials:

1. Non-Exposed Surface Formwork Facing: Forms for concrete which is not exposed to view, may be of plywood as specified for exposed surfaces, or square edge 1x nominal Douglas Fir, Construction Grade, S4S.
2. Exposed Surface Formwork Facing:
   a. Forms for all exterior and interior concrete flat surfaces unless otherwise specified as board formed shall be new Douglas Fir Plywood (APA) ply, 5/8-inch, B-B Plyform, Class 1, Exterior Type, oiled and edged and edge-sealed conforming to U.S. Product Standard PS 1 in large sheet sizes to achieve joint patterns shown.
   b. All exposed concrete edges shall be chamfered 3/4" minimum or as noted on the drawings.
3. Exposed Surface Formwork - Special Pattern Form Liner:
   a. Forms for all exterior and interior concrete flat surfaces indicated shall be as designated by Architect.

B. Earth Forms: Allowed, subject to soil standing in excavations without ravel or caving.

C. Form Release Agent: Spray-on compound, not affecting color, bond or subsequent treatment of concrete surfaces. Maximum VOC content shall comply with local requirements and California Green Building Code.

D. Accessories: Types recommended by manufacturers or referenced standards to suit conditions indicated;

1. Anchors, spacers, void in-fill materials: sized to resist imposed loads.
2. Form Ties: Prefabricated rod, flat band, or wire snap ties with 1" break-back or threaded internal disconnecting type with external holding devices of adequate bearing area. Ties shall permit tightening and spreading of forms and leave no metal closer than 1" to surface.

E. Corner Chamfers and Rustications: Filleted, wood strip or foam type; sizes and shapes as detailed, or 3/4 x 3/4 inch size minimum if not detailed; maximum possible lengths.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect the substrate and the conditions under which concrete formwork is to be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates and conditions.

B. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. If natural soil or compacted fill can be accurately cut and maintained, foundations and grade beams may be poured against earth without forming. Provide positive protection of trench top corners.

B. Maintain earth forms free of water and foreign materials.

3.3 ERECTION – FORMWORK

A. General: Construct formwork in accordance with calculations, and recommendations of Chapter 3 of ACI 347. Construct forms to the sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in finished structure. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.

1. Construct cambers specified in concrete members and slabs in the formwork.
2. Schedule the work and notify other trades in ample time so that provisions for their work in the formwork can be made without delaying progress of the project. Install all sleeves, pipes, etc. for building services systems, or other work. Secure information about and provide for all openings, offsets, recessed nailing blocks, channel chases, anchors, ties, inserts, etc. in the formwork before concrete placement.
3. Deflection: Formwork and concrete with excessive deflection after concrete placement will be rejected. Excessive deflection is that which will produce visible and noticeable waves in the finished concrete.
4. Measure formwork for elevated structural slabs, columns, wall elevations points of maximum camber and submit in writing to the Architect/Engineer prior to placing concrete.

B. Formwork Construction: Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301. Uniform, substantial and sufficiently tight to prevent leakage of concrete paste, readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Tie, brace, shore, and support to insure stability against pressures from any source, without failure of any component part and without excessive deflection. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

C. Provide all openings, offsets, inserts, anchorages, blocking, and other features of the work as shown or required. See INSERTS, EMBEDDED PARTS, AND OPENINGS for detailed requirements.

D. Warped, checked, or scuffed forms will be rejected.

E. Maintain membranes, reinforcing and other work free of damage; protect with plywood runway boards or other positive, durable means.

F. Align joints and make watertight. Keep form joints to a minimum.

G. Provide fillet and chamfer strips on external corners of exposed locations and as indicated to form patterns in finished work. Extend patterns around corners and into alcoves, on backs of columns and similar locations not otherwise shown.

1. Produce beveled, smooth, solid, unbroken lines, except as otherwise indicated to conform to patterns.
2. Form corners and chamfers with 3/4 inch x 3/4 inch strips, unless otherwise indicated, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer at changes in direction.

H. Unexposed corners may be formed either square or chamfered.

I. Ties and Spreaders: Arrange in a pattern acceptable to the Architect when exposed. Snap-ties may be used except at joints between pours where threaded internal disconnecting type shall be used.

J. Coordinate this section with other sections of work that require attachment of components to formwork.

K. Reglets and Rebates: Accurately locate, size, and form all reglets and rebates required to receive work of other trades, including flashing, frames, and equipment.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not allow excess form coating material to accumulate in the forms or to come into contact with reinforcement or surfaces which will be bonded to fresh concrete.

D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork will be rejected.

E. Leave no residue or stain on the face of the concrete, nor affect bonding of subsequent finishes or work specified in other sections.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

1. Provide openings in concrete formwork to accommodate work of other sections including those under separate contracts (if any). Size and location of openings, recesses and chases shall be in accordance with the section requiring such items. Accurately place and securely support items to be built into forms.

B. Construction Joints: Construct and locate generally as indicated on Drawings and only at locations approved by Structural Engineer, so as not to impair the strength of the structure. Form keys in all cold joints shown or required.

C. Locate and set in place items that will be cast directly into concrete.

D. Rough Hardware and Miscellaneous Metal: Set inserts, sleeves, bolts, anchors, angles, and other items to be embedded in concrete. Set embedded bolts and sleeves for equipment to template and approved shop drawings prepared by trades supplying equipment.

E. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

F. Wood Inserts and Nailers: Provide approved preservative-treated lumber. Set all required nailing blocks, grounds, and other inserts as required to produce results shown. Wood plugs shall not be used.

G. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

H. Piping: Do not embed piping in structural concrete unless locations specifically approved by Structural Engineer.

I. Conduit: Place conduit below slabs-on-grade and only as specifically detailed on structural drawings. Minimum clear distance between conduits shall be 3 diameters. Location shall be subject to Engineer's written approval and shall not impair the strength of the structure.

J. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

1. Provide openings for the introduction of vibrators at intervals necessary for proper placement.
2. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

K. Install Form Liner inserts in accordance with manufacturer's recommendations, to produce patterns and textures indicated.

L. Install waterstops in accordance with manufacturer's recommendations to provide continuous waterproof barrier.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Remove all dirt, chips, sawdust, rubbish, water and foreign materials detrimental to concrete.
2. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.7 FOOTINGS

A. Verify elevations and provide final excavation required for footings prior to placing of concrete.

3.8 EQUIPMENT BASES

A. Form concrete bases for all mechanical and electrical equipment in accordance with approved shop details furnished by other sections.

B. Sizes and locations as indicated and as required to produce results shown.

C. Provide coved base for all equipment bases placed on concrete slabs.

3.9 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.10 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

C. Clean and repair surfaces to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

D. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.11 FORM REMOVAL

A. Do not loosen or remove forms before minimum curing period has elapsed without employment of appropriate alternate curing methods, approved by the Architect in writing.

B. Remove forms without damage to the concrete using means to insure complete safety of the structure and without damage to exposed beams, columns, wall edges, chamfers and inserts. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Do not remove forms until the concrete has hardened sufficiently to permit safe removal and the concrete has attained sufficient strength to safely support imposed loads. The minimum elapsed time for removal of forms after concrete has been placed shall be as follows:

1. Columns and Walls: 7 days, provided members are not subjected to overhead loads.
2. Retaining Walls: 21 days minimum.
3. Footings: 7 days minimum. If backfilled immediately, side forms may be removed 24 hours after concrete is placed.
4. Beams, elevated slab, and similar overhead conditions: 28 days unless adequate shoring is provided.

D. Durations listed above are minimums and are subject to extension at the sole judgment of the Architect/Engineer.

E. Reshoring: Reshore members where and if required by Formwork Design Engineer.

F. Do not subject concrete to superimposed loads (structure or construction) until it has attained full specified design strength, nor for a period of at least 14 days after placing.

G. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.12 CLEANING

A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing steel work for all concrete and masonry work as indicated on the drawings and specified herein.
2. Coordinate this work with other work affected by these operations, such as forms, electrical work, mechanical work, structural steel, masonry and concrete.

B. Related Sections:

1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
2. Pertinent Sections of Divisions 03 specifying concrete construction.
3. Pertinent Sections of Divisions 04 specifying masonry construction.
4. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete work.

1.2 REFERENCE STANDARDS

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19 Concrete.

B. American Concrete Institute (ACI) 301 “Specifications for Structural Concrete for Buildings”.

C. ACI 318 “Building Code Requirements for Reinforced Concrete and Commentary”.

D. ACI SP-066 “ACI Detailing Manual”.

E. American Society for Testing and Materials (ASTM) A1064 “Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete”.

F. ASTM A615 “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”.

G. ASTM A706 “Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement”.

H. American Welding Society (AWS) D1.4 – “Structural Welding Code for Reinforcing Steel”.

I. Concrete Reinforcing Steel Institute (CRSI) - “Manual of Standard Practice”.

J. CRSI - “Placing Reinforcing Bars”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer.

C. Shop Drawings: Show complete fabrication and placing details of all reinforcing steel. Comply with requirements of ACI SP-66. Include:

1. Bar sizes and schedules;
2. Shapes of bent bars, layout and spacing of bars, location of splices.
3. Stirrup spacing, arrangements and assemblies,
4. References to Contract Document detail numbers and designations.
5. Wall elevations corresponding to elevations shown in Contract Documents.

D. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.

E. Certificates: Submit all certifications of physical and chemical properties of steel for each heat number as manufactured, including location of material in structure as specified below in Article titled QUALITY ASSURANCE. All materials supplied shall be tagged with heat numbers matching submitted Mill Test Report analyses.

F. Samples: Provide to the Owner's Testing laboratory as specified in Article SOURCE QUALITY CONTROL.

1.4 QUALITY ASSURANCE

A. Perform work of this Section in accordance with the CRSI “Manual of Standard Practice”, CRSI “Placing Reinforcing Bars”, ACI 301, and ACI 318.

B. Requirements of Regulatory Agencies, refer to pertinent Sections of Division 01 and CBC.

C. Certification and Identification of Materials and Uses: Provide Owner's Testing Agency with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.

1. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.
2. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each grade of reinforcing and/or heat number in the project (i.e. foundations, walls, etc.).
3. Unidentified Material Tests: Where identification of materials by heat number to mill tests cannot be made, Owner's Testing Agency shall test unidentified materials as described below.

D. Testing and Inspection: Tests and Inspections required by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent Sections of Division 01.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with pertinent requirements of Division 01.

B. Deliver reinforcement to project site in bundles marked with durable tags indicating heat number, mill, bar size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.

C. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel: Deformed billet steel bars, ASTM A706 Grade 60 or ASTM A615 Grade 60.

1. Welded reinforcement shall be ASTM A706, or A615 meeting carbon requirements of AWS D1.4. Welding shall conform with AWS D1.4.
2. All reinforcement to be unfinished.
3. ASTM A615 reinforcement at special structural concrete walls, concrete coupling beams, and special concrete moment frames shall have maximum yield stress of 78,000 psi and the tensile strength shall be greater than 125% of the actual yield strength. Test ASTM A615 reinforcement for conformance to these criteria prior to fabrication and/or installation.

B. Welded Wire Reinforcement: ASTM A1064.

C. Tie Wire: No. 16 AWG or heavier, black annealed.

D. Concrete Blocks: On-grade conditions only, as required to support reinforcing bars in position.

E. Reinforcing Supports: Plastic or galvanized steel chairs, bolsters, bar supports, or spacers sized and shaped for adequate support of reinforcement and construction loads imposed during concrete placement, meeting ACI and CRSI standards.

1. For use over formwork: Galvanized wire bar type supports complying with CRSI recommendations. Provide plastic tips where exposed to view or weather after removal of formwork. Do not use wood, brick, or other unacceptable materials.

F. Reinforcement Splice Couplers: For use only where specified on drawings. Submit other locations proposed for use to Engineer for review. "L-Series Bar Lock" Coupler Systems for Splicing Reinforcement Bars, UES ER-0319, by Dayton-Superior Corporation.

2.2 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4), unless specifically shown otherwise. Details not specifically shown or indicated shall conform to SP-066 and specified codes and standards.

1. Accurately shop-fabricate to shapes, bends, sizes, gauges and lengths indicated or otherwise required.

2. Bend bars once only. Discard bars improperly bent due to fabricating or other errors and provide new material; do not re-bend or straighten unless specifically indicated. Rebending of reinforcement in the field is not allowed.
3. Do not bend reinforcement in a manner that will injure or weaken the material or the embedding concrete.
4. Do not heat reinforcement for bending. Heat-bent materials will be rejected.

B. Unacceptable materials: Reinforcement with any of the following defects will not be permitted in the work.

1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
2. Bends or kinks not indicated on Drawings or final shop drawings.
3. Bars with reduced cross-section due to rusting or other cause.

C. Tag reinforcement with durable identification to facilitate sorting and placing.

D. Shop Fusion Welded Stirrup/Tie/Spiral Cages

1. Shop fusion welding of stirrup/tie/spiral cages is permitted to aid in fabrication and handling. The following requirements shall be met.
2. All reinforcing bars receiving weld shall be ASTM A706.
3. Longitudinal holding wires shall be ASTM A1064.
4. Shop welding shall be performed by machines under a continuous, controlled process.
5. Quality control tests shall be performed on shop-welded specimens and the test results shall be available, upon request, to the Architect/Engineer.
6. Tack welding of reinforcing steel is not permitted.
7. Welding of any type shall not occur at 90°, 135°, or 180° bends. Circular ties and spirals may be shop fusion welded outside of areas with 90°, 135°, or 180° hook bends.
8. Longitudinal bars shall not be welded to stirrups/ties/spirals.

2.3 SOURCE QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform the following:

1. Material Testing:
   a. Identified Steel: When samples are taken from bundled steel identified by heat number, matched with accompanying mill analyses as delivered from the mill, supplemental testing of reinforcing steel is not required.
   b. Unidentified Steel: When identification of materials by heat number matched to accompanying mill analyses cannot be made, perform one tensile test and one bend test per each two and one-half tons or fraction thereof for each required size of reinforcing steel. Tests of unidentified steel shall be performed by the Owner's Testing Agency and costs for these tests shall be paid by the Contractor by deductive change order.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect the conditions under which concrete reinforcement is to be placed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Coordinate with work of other sections to avoid conflicts or interference. Bring conflicts between reinforcement and other elements to Architect's attention. Resolve conflicts before concrete is placed.

C. Notify Architect, Structural Engineer, and Authority Having Jurisdiction for review of steel placement not less than 48 hours before placing concrete.

3.2 PLACEMENT

A. General: Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean bars free of substances which are detrimental to bonding. Maintain reinforcement clean until embedded in concrete.

C. Place reinforcement to obtain the minimum coverages for concrete protection. Do not deviate from required position. Maintain required distance, spacing and clearance between bars, forms, and ground.

D. Location and Support: Provide metal chairs, runners, bolsters, spacers and hangers, as required.

E. Provide additional steel reinforcement as necessary or as directed, to act as spreaders or separators to maintain proper positioning.

F. Tying and Attachment: Securely tie at all intersections and supports with wire. Prevent dislocation or movement during placement of concrete. Direct twisted ends of wire ties away from exposed concrete surfaces.

G. Separate reinforcing from pipes or conduits with approved non-metallic separators. Do not use wood or steel form stakes or reinforcement used as stakes as support for reinforcement.

H. Accommodate placement of formed openings required by other sections.

I. Obstructions:

1. Where obstructions, block-outs, or penetrations (conduits, raceways, ductwork) prevent continuous placement of reinforcement as indicated, provide additional reinforcing as detailed and as directed by the Structural Engineer to supplement the indicated reinforcement around the obstruction.
2. Place additional trim bars, ties, stirrups, or other elements as detailed and as directed at all opening, sleeves, pipes or other penetrations through structural elements.

J. Welded Wire Reinforcement: Reinforce slabs with 6"x 6"-W1.4 x W1.4 welded wire reinforcement reinforcing, unless otherwise noted on drawings.

1. Provide flat sheets only, no rolls. Straighten, cut to required size, and lay out flat in place.
2. Securely wire-tie reinforcement to other reinforcement at frequent intervals.
3. Extend reinforcement over supporting beams and walls, and to within 1 inch of edge of slabs, construction joints, and expansion joints.
4. Support reinforcement in mid-depth of slab.

5. Lift reinforcement at intervals as slab concrete is placed, ensure proper embedment.

3.3 REINFORCING SPACING AND COVERAGE

A. Spacing: Do not space bars closer than four (4) diameters of the largest of two adjacent bars, except at bar laps, which shall be placed such that a minimum of 2 bar diameters is clear between bars.

B. Where reinforcing in members is placed in two layers, the distance between layers shall not be less than four bar diameters of the largest bar and the bars in the upper layers shall be placed directly above those in the bottom layer, unless otherwise detailed or dimensioned.

C. Coverage of bars (including stirrups and columns ties) shall be as follows, unless otherwise shown:

1. Footings and Mat Foundation: 3 inches to any soil face, 2 inches to top.
2. Slabs (on grade): 2 inches to grade face, 1-1/2 inches to top face.
3. Slabs (elevated): 1-1/2 inches top and bottom.
4. Beam & Column: 1-1/2inches to form.
5. Walls: 1-1/2 inches clear to form and 2 inches clear to form at soil face.

3.4 DOWELS, SPLICES, OFFSETS AND BENDS

A. Provide standard reinforcement splices at splices, corners, and intersections by lapping ends, placing bars in contact, and tightly tying with wire at each end. Comply with details shown on structural drawings and requirements of ACI 318.

B. Provide minimum 1-1/2 inch clearance between sets of splices. Stagger splices in horizontal bars so that adjacent splices will be 4 feet apart.

C. Laps of welded wire reinforcement shall be at least two times the spacing of the members in the direction lapped but not less than twelve inches.

D. Splices of reinforcement shall not be made at points of maximum stress. Provide splice lengths as noted on the structural drawings, with sufficient lap to transfer the stress between bars by bond and shear.

E. Spacing:

1. Space bars minimum distance specified and all lapped bars 2 bar diameters (minimum) clear of the next bar.
2. Stagger splices of adjacent bars where possible and where required to maintain bar clearance.
3. Beam or slab top bars shall be spliced mid-span of column support and bottom bars spliced at column supports.
4. Request Architect/Engineer review prior to placement for all splices not shown on the drawings.

F. Reinforcement Couplers: Install at all locations indicated. Install couplers in accordance with manufacturer's recommendations.

3.5 WELDING

A. No reinforcing shall be welded unless specifically indicated. No reinforcing shall be welded without prior approval of the Structural Engineer and the Authority Having Jurisdiction.

B. Only when so approved for use as noted above, all welding shall conform to AWS D1.4, ACI 318 Section 26.6.4, and the following;

1. All welding performed by certified welders.
2. All reinforcement requires preheat prior to welding. All preheat and welding shall be continuously inspected by the Testing Agency.

3.6 MISPLACED REINFORCEMENT

A. Notify Architect/Engineer immediately if reinforcing bars are known to be misplaced after concrete has been placed.

B. Perform no correction or cutting without specific direction. Do not bend or kink misplaced bars.

C. Correct misplaced reinforcing only as directed in writing by the Architect/Engineer. Bear all costs of redesign, new, or additional reinforcing required because of misplaced bars at Contractor's expense.

3.7 FIELD QUALITY CONTROL

A. The Testing Agency as specified in the Article QUALITY ASSURANCE, will inspect the work for conformance to contract documents before concrete placement.

1. Inspection: Provide inspection and verification of installed reinforcement. Confirm that the surface of the rebar is free of form release oil or other coatings.
2. Inspect all preheat and welding activities for steel reinforcement, when these occur.
3. Exception: Shallow foundations & non-structural slabs-on-grade supporting buildings of no greater than three stories and either of concrete design strength 2500psi (or greater) or supporting light-frame construction do not require special inspection. Non-structural patios, driveways, and sidewalks do not require special inspection.

3.8 CLEANING

A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Provide all labor, materials, equipment and services to complete all concrete work required, including, but not limited to, the following:

1. Foundations, beams, columns, elevated slabs, slabs-on-grade, walls, and retaining walls.
2. Installation of all bolts, inserts, sleeves, connections, etc. in the concrete.
3. Joint devices associated with concrete work.
4. Miscellaneous concrete elements, including, but not limited to: equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.
5. Concrete curing.
6. Coordination with other sections:
   a. Make all preparations and do all work necessary to receive or adjoin other work. Install all bolts and anchors, including those furnished by other sections, into formwork and provide all required blocking.
   b. Install all accessories embedded in the concrete and provide all holes, blockouts and similar provisions necessary for the work of other sections. Provide all patching or cutting made necessary by failure or delay in complying with this requirement at the Contractor's expense.
   c. Coordinate with other sections for the accurate location of embedded accessories.

B. Related Sections:

1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
2. Pertinent Sections of Division 03 specifying concrete construction.
3. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete.
4. Pertinent sections of other Divisions specifying floor finishes and sealants applied to concrete substrates.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19 Concrete.

B. American Concrete Institute (ACI) 211.1 “Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete”; ACI 211.2 “Standard Practice for Selecting Proportions for Lightweight Concrete”.

C. ACI 301 “Specifications for Structural Concrete”.

D. ACI 302.1R “Guide for Concrete Floor and Slab Construction”.

E. ACI 304R “Guide for Measuring, Mixing, Transporting, and Placing Concrete”.

F. ACI 305R “Hot Weather Concreting”.

G. ACI 306R “Cold Weather Concreting”.

H. ACI 308 “Standard Practice for Curing Concrete”.

I. ACI 318 “Building Code Requirements for Reinforced Concrete and Commentary”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturers' data on manufactured products and other concrete related materials such as bond breakers, cure/sealer, admixtures, etc. Demonstrate compliance with specified characteristics. Provide samples of items upon request.

D. Mix Designs: Submit Mix Designs for each structural concrete type required for work per requirements of articles CONCRETE MIXES and QUALITY ASSURANCE. Resubmit revised designs for review if original designs are adjusted or changed for any reason. Non-Structural mixes need not be submitted for review by Structural Engineer.

E. Shop Drawings: Proposed location of construction and cold joints. Proposed location of all slab construction/dowel joints, control joints, and blockouts.

F. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.

G. Batch Plant Certificates: Include with delivery of each load of concrete. Provide Certificates to the Testing Agency and the Architect/Engineer as separate submittals. Concrete delivered to the site without such certificate shall be rejected and returned to the plant. Each certificate shall include all information specified in Article SOURCE QUALITY CONTROL below.

H. Engineering Analysis: Prepared by a California-licensed Civil or Structural Engineer, justifying construction-imposed loads on slabs, beams, and walls which exceed those allowed by CBC for the specified use.

1. 2000 lbs maximum allowable construction load without analysis.
2. 10,000 lbs maximum allowable construction load with analysis.

I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.4 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Concrete construction verification and inspection to conform to CBC 1705.3.

C. Common Sourcing: Provide each of the following materials from a single source for entire project.

1. Cement.
2. Fly ash.
3. Aggregate.

D. Follow recommendations of ACI 305R when concreting during hot weather. Follow recommendations of ACI 306R when concreting during cold weather.

E. Services by the Independent Testing Agency (includes "Special" Inspections) as specified in this Section and as follows:

1. Perform tests and inspections specified below in articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and reports to be in conformance with pertinent Sections of Division 01.

F. Contractor shall bear the entire cost of remediation, removal, and/or replacement of concrete determined defective or non-conforming, including Architect/Engineer fees for redesign.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials specified by brand name shall be delivered in unbroken packages bearing manufacturer's label and shall be brand specified or an approved equal.

B. Delivery, Handling and Storage of other materials shall conform to the applicable sections of the current editions of the various reference standards listed in this Section.

C. Protect materials from weather or other damage. Sort to prevent inclusion of foreign materials.

D. Specific Requirements:

1. Cement: Protect against dampness, contamination, and warehouse set. Store in weather tight enclosures.
2. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregates. Use only one supply source for each aggregate stock pile.
3. Admixtures:
   a. Store to prevent contamination, evaporation, or damage.
   b. Protect liquid admixtures from freezing and extreme temperature ranges.
   c. Agitate emulsions prior to use.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather (Freezing or near-freezing temperatures) per ACI 306R:

1. Heat concrete materials before mixing, as necessary to deposit concrete at a temperature of at least 50°F but not more than 90°F.
2. Do not place concrete during freezing, near-freezing weather, snow, rain or sleet unless protection from moisture and/or cold is provided.

3. Protect from freezing and maintain at a temperature of at least 50°F for not less than seven days after placing. Take special precautions to protect transit-mixed concrete.
4. No salts, chemical protection or admixture are permitted without written approval of Architect/Engineer.
5. Contractor shall maintain an air temperature log for the first 7 days after placement with entry intervals not to exceed 8 hours.

B. Hot Weather per ACI 305R:

1. Cool concrete materials before mixing, or add ice in lieu of mix water as necessary to deposit concrete at a temperature below 85°F.
2. Do not place concrete in hot/windy weather without Architect/ Engineer review of procedures.
3. Provide sunshades and/or wind breakers to protect concrete during finishing and immediate curing operations. Do not place slab concrete at air temperature exceeding 90°F.
4. Provide modified mix designs, adding retarders to improve initial set times and applying evaporation reducers during hot/windy weather for review by Independent Testing Agency prior to use.

1.7 MOCK-UP

A. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish, as result of formwork.

1. Panel Size: Sufficient to illustrate full range of treatment.
2. Number of Panels: 2.
3. Locate as indicated on drawings.

B. If requested by Architect / Engineer, cast concrete against mock-up panel. Obtain acceptance of resulting surface finish prior to erecting formwork.

C. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.

D. Mock-up may remain as part of the Work.

1.8 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 – PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 03 1000.

2.2 REINFORCEMENT

A. Comply with requirements of Section 03 2000.

2.3 MATERIALS

A. General Requirements: All materials shall be new and best of their class or kind. All materials found defective, unsuitable, or not as specified, will be condemned and promptly removed from the premises.

B. Cementitious Materials:

1. Portland Cement: ASTM C150, Type II, low alkali conforming to CBC 1903.1.
2. Fly Ash (Pozzolan): ASTM C618, Class F.

C. Concrete Aggregates:

1. Coarse and Fine Aggregates: ASTM C33; Stone aggregate and sand. Specific source aggregate and/or sand or shrinkage characteristics as required for class of concrete specified.
2. Lightweight aggregate: ASTM C330 and C332.
3. Source shall remain constant throughout the duration of the job. The exact portions of the fine aggregates and coarse aggregates to be used in the mix shall be determined by the mix design.

D. Water: Potable, clean, from domestic source.

E. Admixtures: All admixtures shall be used in strict accordance with the manufacturer's recommendations. Admixtures containing calcium chlorides or other accelerators shall not be used without the approval of the Architect/Engineer and the Owner's Testing Laboratory.

1. Mid Range Water Reducing Admixtures: ASTM C494 Type A, "MasterPolyHeed" (formerly “PolyHeed”) series by BASF, "WRDA" series by W.R. Grace, or equal.
2. High Range Water-Reducing Admixtures: ASTM C494 Type F, "MasterRheoBuild 1000" (formerly “RheoBuild 1000”) or “MasterGlenium” (formerly “Glenium”) series by BASF or equal.
3. Water Reducing Admixture and Retarder: ASTM C494 Type B or D, "MasterPozzolith" (formerly “Pozzolith”) series or “MasterSet DELVO” (formerly “DELVO”) series by BASF, "Plastiflow-R" by Nox-crete, or equal.
4. Air Entraining Admixtures: ASTM C260, product suit condition by BASF or equal.
5. Viscocity Modifiers: ASTM C494 Type S.

F. Slurry: Same proportion of cement to fine aggregates used in the regular concrete mix (i.e. only coarse aggregate omitted); well mixed with water to produce a thick consistency.

G. High Strength Grout: See section 05 1200 or 05 1100 for requirements.

H. Dry Pack: Dry pack (used only for cosmetic concrete repairs) shall consist of:

1. One part cement to 2-1/2 parts fine aggregate (screen out all materials retained on No.4 sieve), mixed with a minimum amount of water, added in small amounts.
2. Mix to consistency such that a ball of the mixture compressed in the hand will retain its shape, showing finger marks, but without showing any surface water.

2.4 ACCESSORIES

A. Bonding Agent: ASTM C881, Type II Grade 2 Class B or C. Do not allow epoxy to set before placing fresh concrete.

1. "MasterEmaco ADH 326" (formerly "Concresive Liquid LPL") by BASF;
2. "Rezi-Weld 1000" by W.R. Meadows.

B. Chemical Hardener: Fluorosilicate solution designed for densification of cured concrete slabs. "MasterKure HD 300 WB" (formerly "Lapidolith") by BASF, "LIQUI-HARD" W.R. Meadows Co, or equal.

C. Moisture-Retaining Cover: ASTM C171, type 1, one of the following;

1. Regular Curing Paper, Type I, reinforced waterproof: Fortifiber Corporation "Orange Label Sisalkraft", "Pabcotite" paper, or equal.
2. Polyethylene Film: ASTM D 2103, 4 mil thick, clear or white color.
3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd.

D. Liquid Curing Compound: ASTM C 309, Type 1, Class B, clear or translucent, 25% minimum solids, water base acrylic cure/sealer which will not discolor concrete and compatible with bonding of finishes specified in related sections. W.R. Meadows Co. "Vocomp 25" or equal. Maximum VOC content shall comply with local requirements and California Green Building Code.

E. Under Slab Water Vapor Retarder: Vapor retarder sheet to be ASTM E1745 Class A; 15 mil, single ply extruded polyolefin; permeance no greater than 0.01 U.S. Perms per ASTM E154, ASTM E96 procedure B or ASTM F1249.

1. "Stego Wrap Vapor Barrier (15mil)" by Stego Industries LLC.
2. "Vaporguard" by Reef Industries.
3. Approved Equal.

F. Evaporation Reducer: "MasterKure ER 50" (formerly Confilm), by BASF.

G. Permeability Reducer: Use only where specifically referred to.

1. Admixture Type: Xypex Chemical Corporation "XYPEX Admix C-500". Dosage: 2-3% of cement content by weight; 15 lb/cu. yd. max. or BASF "MasterLife 300D" (formerly "Rheomac 300D"). Dosage: 2% of cement by mass.
2. Surface-Applied Type: Xypex Chemical Corporation "XYPEX Concentrate. Brush application: 1.25-1.50lb/sq. yd., 5 parts powder to 2 parts water. BASF "MasterSeal 500" (formerly Tegraproof"). Slurry coat: one part water to 2.25-2.5 parts powder by volume.
3. Approved equal.

2.5 JOINT DEVICES AND MATERIALS

A. Waterstops: Resilient type, meeting Corps of Engineers CRD-C 572. Consult manufacturer for appropriate product for specific use. Submit for review. Install per manufacturers recommendation. Provide W. R. Meadows "Seal Tight" PVC waterstop, Sika "Greenstreak" PVC waterstop, or approved equal.

B. Expansion Joint Filler: ASTM D1751, Nonextruding, resilient asphalt impregnated fiberboard or felt, 3/8 inch thick and 4 inches deep; tongue and groove profile.

1. Products: "Servicised Products", W.R. Meadows, Inc., "National Expansion Joint Company", "Celotex Corporation", or equal.

C. Joint Filler: ASTM D944, Compressible asphalt mastic with felt facers, 1/4 inch thick and 4 inches deep.

D. Sealant and Primer: As specified in Section 07 9000.

E. Slab Joint Sealant: Compatible with floor finishes specified in related sections.

2.6 CONCRETE MIXES

A. General requirements for mix design and submittal of structural class concrete:

1. Provide Contractor submittals to Architect/Engineer not less than 15 days before placing concrete.
2. Contractor shall review mix designs and proposed placing requirements prior to submittal for compatibility to ensure that the concrete as designed can be placed in accordance with the drawings and specifications.
3. Changes or revisions require re-submittal: All variations to approved mix designs, including changing type and/or quantity of admixtures shall be resubmitted to the Architect/Engineer for review prior to use.
4. Mix design(s) for all structural classes of concrete to be prepared by qualified person experienced in mix design. Allow for time necessary to do trial batch testing when required.
5. Preparer to provide backup data and certify in writing that mix design meets:
   a. Requirements of the specifications for concrete durability and quality;
   b. Requirements of the California Building Code and ACI 318 Section 26.4, including break histories, trial batching test results, and/or a mix designed by a California Registered Civil Engineer per ACI 318 Section 26.4.3.1(b) and bearing the Engineer's seal & signature.
6. Clearly note on mix designs with specified maximum WCR if design permits addition of water on site, or clearly identify in the mix design that no water is to be added on site.
7. Deviations: Clearly indicate proposed deviations, and provide written explanation explaining how the deviating mix design(s) will provide equivalent or better concrete product(s) than those specified.
8. Include adjustments to reviewed mix designs to account for weather conditions and similar factors.

B. Proportioning - General: The following provisions apply to all mix designs:

1. Proportion concrete mixes to produce concrete of required average strength (as defined by ACI 318 Section 19.2.1). Select slump, aggregate sizes, shrinkage, and consistency that will allow thorough compaction without excessive puddling, spading, or vibration, and without permitting the materials to segregate, or allow free water to collect on the surface.
2. Select aggregate size and type to produce dense, uniform concrete with low to moderate shrinkage, free from rock pockets, honeycomb and other irregularities.
3. Mix designs may include water reducing and retarding admixtures to meet or exceed minimum set times (time required to place and finish) and to minimize Water Cement Ratios (WCR). Minimum and maximum criteria presented in this section are guidelines and do not represent a specific mix design.

4. Cement Content: Minimum cement content indicates minimum sacks of cementitious material. Increasing cement content to increase early strengths or to achieve specified WCR while maintaining water content is discouraged in order to minimize effects of shrinkage.
    a. Substitution of fly ash for Portland cement on an equivalent weight basis up to 25% replacement is permitted, except at high early strength concrete. Replacement in excess of 25% is not permitted unless part of a specified mix design that has been submitted for review.
    b. Such substitution requests may be denied by the Engineer.
5. Water Content: Mix designs with a specified maximum Water Cement Ratio (WCR) may be designed with a lower WCR than specified in order to allow addition of water at the site.
6. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301 and this section.
    a. For trial mixtures method, employ independent testing agency acceptable to Architect/Engineer for preparing and reporting proposed mix designs.
7. Placement Options: Mix designs may, at the Contractor's option, be designed for either pump or conventional placement with aggregate size, slumps, etc. to be maintained as specified in this section.

C. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations and this section.

D. Proportioning Structural Light Weight Concrete: Comply with ACI 211.2 recommendations and this section. Maximum cured weight of light weight concrete shall be 120 pounds per cubic feet. General Contractor is responsible for coordinating and providing light weight concrete density to meet the required fire assembly rating of the Construction Documents at the concrete depths provided in the structural drawings. General Contractor to notify the Structural Engineer for review if light weight concrete of the required density for the specified fire assembly rating cannot be sourced.

E. Special mix design requirements for interior concrete floor slabs on grade:

1. Proportion concrete mixes per this specification, ACI 211.1, and the requirements below:
2. Fly Ash Type F, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a minimum replacement of 25% and a maximum of 35%.
3. 200 lbs. of 3/8(-) aggregate shall be added to reduce total sand.
4. Reduce total sand to minimum practical.
5. Admixture dosage shall be per manufacturer’s recommendations. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.

F. Mix Design Minimum Requirements:

Concrete Class	Coarse Aggregate Size (Inches) & Fine Aggregate[3]	Maximum WCR or Maximum Nominal Slump & Tolerance (Inches)[1,2]	Minimum 28-Day Design Strength	Minimum Cement Sacks/per yd[4]
NON-STRUCTURAL				
1) Lean Concrete (use only where specified)	---	---	---	3.0
2) Slab on Grade Exterior (Walks & Patios)	1" x #4	4" ± 1"	2,500	4.5
STRUCTURAL				
3) Interior Slab on Grade[5]	1" x #4	WCR = .45	3,000	6.1
4) Foundation (including stem walls)	1" x #4	WCR = .53	3,000	5.0
5) Cast Slab Above Grade on Metal Deck	3/4" x #4	WCR = .53	3,000	5.0
6) Columns, Walls, Retaining Walls & Beams	1" x #4	WCR = .46	4,000	6.0
7) Light Weight Concrete	3/4" x #4 Expanded Shale	3" ± 1/2"	3,000	5.5

1. The tolerance is the maximum deviation allowable without rejection. The mix design shall be based on the nominal value specified and is without water reducing mixtures. Slump to be measured at the end of the hose.
2. The maximum water cement ratio (WCR) is limited at time of placement as noted. No water is to be added on site such that the specified WCR or maximum slump is exceeded without approval of the testing laboratory and the Architect/Engineer. Workability is to be achieved utilizing an acceptable mid range to high range water reducing admixture.
3. Gradation of aggregate is per ACI 318 section 26.4.1.2 and ASTM C33.
4. Minimum cement content includes all cementitious materials.
5. See Article 2.6E for additional requirements at interior slabs on grade.

2.7 MIXING CONCRETE

A. Batch final proportions in accordance with approved mix designs. All adjustments to approved proportions, for whatever reason, shall be reviewed by the Architect/Engineer prior to use.

B. Batch and mix concrete in accordance with ASTM C94, at an established plant. Site mixed concrete will be rejected.

C. Provide batch and transit equipment adequate for the work. Operate as necessary to provide concrete complying with specified requirements.

D. Place mixed concrete in forms within 1-1/2 hours from the time of introduction of cement and water into mixer or 300 revolutions of the drum whichever comes first. Use of, re-mixing, and/or tempering mixed concrete older than 1 hour will not be permitted.

E. Do not add water at the site to concrete mixes with a maximum specified WCR unless the water content at batch time provides for a WCR less than specified and this provision,

including the quantity of water which may be added at the site, is specifically noted on the mix design and certification by the mix preparer. See ASTM C94 for additional requirements.

2.8 SOURCE QUALITY CONTROL

A. Services by independent Testing Agency:

1. Batch Plant Certificates: Obtain the weighmaster's Batch Plant Certificate at arrival of truck at the site. If no batch plant certificate is provided, recommend to the General Contractor that the truckload of concrete be rejected. So note in daily log, along with the location of the load of concrete in the structure if the load is not rejected.
   a. Laboratory's inspector shall obtain for each transit mixer Batch Plant Certificates to verify mix design quantities and condition upon delivery to the site.
   b. Certificates to include: Date, time, ingredient quantities, water added at plant and on job, total mixer revolutions at time of placement, and time of departure.
   c. Concrete with specified water cement ratio: Add no water on site unless mix design and batch records each show additional water may be added. See ASTM C94 for additional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

B. Verify work of other sections is complete and tested as required before proceeding.

3.2 PREPARATION

A. Observation, Inspection and Testing:

1. Architect/Engineer: Notify not less than 2 working days before each concrete placement, for observation and review of reinforcing, forms, and other work prior to placement of concrete.
2. Testing Agency: Notify not less than 24 hours before each placement for inspection and testing.

B. Placement Records: Contractor shall maintain records of time, temperature and date of concrete placement including mix design and location in the structure. Retain records until completion of the contract. Make available for review by Testing Agency and Architect/Engineer.

C. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

D. Verify location, position and inclusion of all embedded and concealed items.

E. Verify installation of vapor retarder under interior slabs on grade, as specified in related section, is complete.

F. Cleaning and Preparation:

1. Remove loose dirt, mud, standing water, and foreign matter from excavations and cavities.
2. Close cleanout and inspection ports securely.
3. Thoroughly clean reinforcement and other embedded items free from loose rust and foreign matter. Maintain reinforcing securely in place. Do not place concrete on hot reinforcing.
4. Dampen form materials and substrates on which concrete is to be placed at least 1 hour in advance of placing concrete; repeat wetting as necessary to keep surfaces damp. Do not saturate. Do not place concrete on saturated material.
   a. Thoroughly wet wood forms (except coated plywood), bottom and sides of trenches, adjacent concrete or masonry and reinforcement.
   b. Concrete slabs on base rock, dampen rock.
   c. Concrete slabs on vapor retarder, do not wet vapor retarder.
5. Verify that metal forms are clean and free of rust before applying release agent.
6. Thoroughly clean metal decking. Do not place concrete on wet deck surface.
7. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

G. Drill holes in existing concrete at locations where new concrete is doweled to existing work. Insert steel dowels and prepare connections as detailed.

H. Do not overcut at existing concrete work to remain. Contractor is responsible for repair/replacement of overcut concrete to the Owner’s satisfaction.

3.3 PIPES AND CONDUITS IN CONCRETE

A. Slabs-on-Grade:

1. No pipe or conduit exceeding 1 inch outside diameter shall be embedded within the specified slab thickness except as specifically detailed.
2. Do not stack or abut pipes, maintain 3 inches minimum clearance.

B. Sleeving and Wrapping:

1. Foundations: Sleeve or wrap all individual pipe penetrations, minimum 1-1/2 inches clear to reinforcing all around.
   a. Sleeves: PVC. Provide 1 inch minimum clear all around O.D. pipe to I.D sleeve, UNO at ends, fill void space with mastic or plastic bituminous cement.
   b. Wrapped Vertical Pipes: Provide 1/8 inch nominal sheet foam with three wraps minimum, UNO.
   c. Wrapped Horizontal Pipes: Provide 1/8 inch nominal sheet foam with eight wraps minimum, UNO.
   d. Underground Fire Lines 4” and Larger: At sleeves provide 2 inch minimum clear all around O.D. pipe to I.D sleeve. At wrapped pipes, provide 1/8 inch nominal sheet foam with sixteen wraps minimum.
2. Slabs or Curbs: Wrap pipes as described above.

C. Space groups of pipes/conduits at least 3 sleeve diameters apart, do not interrupt specified concrete and reinforcement.

1. Provide block-outs as detailed when grouping of pipes/conduits in foundation or other structural member prevents spacing as described. Notify Architect/Engineer for review of any conditions not conforming to details.
2. Center pipe/conduit penetrations in the depth and/or thickness of foundations.

3. Maximum size of pipe/conduit penetrations shall not exceed the least dimension of concrete divided by 3.

D. Do not embed pipes/conduits in concrete slabs on metal deck.

E. Provide the following at pipes/conduits detailed to be embedded in a concrete beam, wall or column:

1. Place as near as possible to center of member with reinforcing as specified on each side.
2. Where reinforcing is located near or at center of member, place pipe or conduit 1 inch minimum clear from reinforcing and provide #3 at 12 inches on center perpendicular to the pipe/conduit. Reinforcing to extend 12 inches minimum past pipe/conduit each side.
3. Maintain ¾ inch clear minimum from added reinforcing to face of concrete where not exposed to weather and 1-1/2 inches clear where exposed to weather.
4. Space embedded items (groups of pipe/conduit, junction boxes or other elements) minimum 3 inches apart.
5. Provide reinforcing in walls, beams, columns as detailed for groups of pipe/conduit. Provide minimum replacement reinforcement of same size and number for interrupted or displaced reinforcement for the full height, length, width of the wall, beam, and/or column on each side of the “effective opening.”

3.4 CONCRETE PLACEMENT

A. Transporting:

1. Provide clean, well-maintained equipment of sufficient quantity and capacity to execute the work and produce concrete of quality specified.
2. Handle and transport concrete from mixer to final deposit location as rapidly as practicable. Prevent separation or loss of ingredients.

B. Perform concrete placement by methods which will not puncture, damage or disturb vapor retarder membrane. Repair all damage to vapor retarder membrane before covering.

C. Placement - General: Placement, once started, shall be carried on as a continuous operation until section of approved size and shape is completed. Provide construction joints as detailed on the drawings. Engineer's written approval required for all deviations.

1. Deposition:
   a. Deposit concrete to maintain an approximately horizontal plastic surface until the completion of the unit placement.
   b. Deposit as neatly as practicable in final position, minimize re-handling or flow.
   c. Do not drop concrete freely where reinforcing bars, embeds, or obstructions occur that may cause segregation. Provide spouts, elephant trunks, or other means to prevent segregation during placement.
2. Depth: Layered placement in columns and walls shall not exceed ten feet vertical depth.
   a. Place concrete in minimum 32 inch horizontal lifts.
   b. Schedule placement to ensure that concrete will not take initial set before placement of next lift.
   c. No horizontal cold joints are allowed in columns or walls.

3. Progress Cleaning: Remove all concrete spilled on forms or reinforcing steel in portions of structure not immediately concreted. Remove completely before concrete sets.
4. Interruptions: Shut down placement operations and dispose of all remaining mixed concrete and concrete in hoppers or mixers following all interruption in placement longer than 60 minutes.
    a. If such interruption occurs, provide new or relocate existing construction joints as directed by Engineer.
    b. Cut concrete back to the designated line, cleaning forms and reinforcing as herein specified.
    c. Prepare for resumption of placement as for new unit when reason for interruption is resolved.

D. Placement - Elevated Structural Systems: Place as noted for "General" above and as follows:

1. Metal Decking and Structural Steel Beam Systems that are not to be shored: Locate screed lines on primary structural members. Review proposed screed line locations and expected structural deflections with the Architect/Engineer prior to placement of concrete.
2. Place screed lines to match camber of primary girders made of material other than concrete. Locate screeds to provide the minimum specified thickness of concrete at all locations.
3. Compensate for deflection of intermediate structural members and decking by placement of additional concrete.
4. Adjust embedded items to compensate for camber and deflection. Maintain locations within specified tolerances.

E. Consolidation:

1. Consolidate all concrete thoroughly during placement with high-speed mechanical vibrators and other suitable tools. Perform manual spading and tamping to work around reinforcement, embedded fixtures, and into corners of formwork as required to obtain thorough compaction.
    a. Provide vibrators with sufficient amplitude for adequate consolidation.
    b. Use mechanical vibrators at each point of concrete placement.
    c. Keep additional spare vibrators, in addition to those required for use, at the site for standby service in case of equipment failure.
2. Consolidate each layer of concrete as placed.
    a. Insert vibrators vertically at points 18 to 30 inches apart; work into top area of previously placed layer to reconsolidate, slowly withdraw vibrator to surface.
    b. Avoid contact of vibrator heads with formwork surfaces.
    c. Systematically double back and reconsolidate wherever possible. Consolidate as required to provide concrete of maximum density with minimized honeycomb.

F. Unacceptable Materials:

1. Do not place concrete that has started to set or stiffen. Dispose of these materials.
2. Do not add water on site to concrete except as specified in the approved mix design, see PART 2 above.

G. Protection of installed work:

1. Do not introduce any foreign material into any specified drainage, piping or duct systems.
2. Contractor shall bear all costs of work required to repair or clean affected work as a result of failure to comply with this requirement.

3.5 CONCRETE JOINTS

A. Structural Joints (Construction/Cold Joints):

1. Locate joints only where shown, or as approved.
2. Review Required: Joints not indicated on the plans shall be located to meet the minimum requirements below, shall not impair the strength of the structure and shall be submitted to Architect/Engineer for review prior to placement of concrete.
   a. Indicate proposed location(s) of construction/cold/expansion joints on shop drawing submittals for review prior to placing concrete.
3. Clean and roughen all surfaces of previously placed concrete at construction joints by washing and sandblasting to expose aggregate to 1/4 inch amplitude.
4. Slabs-On-Grade: Maximum Length of continuous placement shall not exceed 60 feet without special review by the Architect/Engineer. Alternate or stagger placement sections.
5. Foundations, Beams, Elevated Slabs and Joists: Maximum Length of continuous placement shall not exceed 200 foot increments. Provide “keyed” shut-off locations made up with form boards. Extend reinforcing one lap length or more through shut-off.
   a. All reinforcement shall be continuous through construction/cold joint, lapping to adjacent reinforcing in future placement.
   b. Construction Joints in Elevated Slabs: Review all proposed locations with Architect/Engineer.
   c. Construction Joints in Slabs on Metal Decking: Review all proposed locations with Architect/Engineer. Do not locate closer than 24 inches to faces of girder or beam.
6. Retaining and Basement Walls: Maximum Length of continuous placement shall not exceed 100 foot increments. Provide “keyed” shut-off locations made up with form boards to limit the length of continuous placement and at abrupt changes in wall thickness. Extend reinforcing one lap length or more through shut-off.
   a. Review all proposed locations with Architect/Engineer
   b. Horizontal construction joints are not allowed unless approved by the Engineer
7. Horizontal Construction Joints: Place 2 inch slurry (specified concrete mix less coarse aggregate) at beginning of pour at the bottom of walls unless a prior review of a mock-up section demonstrates that segregation of aggregate will not occur.

B. Expansion/Construction Joints (Dowel Joints and Control Joints):

1. Interior and Exterior Slabs-on-Grade:
   a. Expansion/Construction Joints: Provide dowel joints or control joints at a maximum dimension (in feet) of three times the slab thickness (in inches) in each direction unless noted otherwise (15’-0” maximum). Install joints to match slab level and in straight lines. Locate joints at all reentrant corners including blockouts.
   b. Proportions: Install joints to divide slab into rectangular areas with long dimensions less than 1.5 times short dimension.

2. Exterior Concrete Slabs-on-Grade (walkways, patios):
   a. Expansion/ construction joints: Provide a 2 inch deep troweled groove or asphalt impregnated joint material embedded 50 percent of the slab depth at 12 feet on center, maximum.
   b. Proportions: Place no section with a length larger than two times width. Additionally, place joints at all inside corners and at all intersections with other work.
3. Elevated Structural Slabs: Locate construction joints as specifically indicated on the drawings. All additional proposed locations shall be reviewed by the Architect/Engineer prior to placement.
4. Retaining and Basement Walls:
   a. Contraction Joints: Provide ¾ inch wide beveled wood strips attached to inside face of formwork on each side of the wall. Wood strips shall extend 1/8 times the wall thickness into the wall. Cut 50% of the horizontal reinforcing bars at contraction joint locations
   b. Proportions: Place joints at 2 times the height of the wall on center max, but not less than 10'-0". Joints shall not exceed 25'-0" on center.
   c. Review all proposed locations with Architect/Engineer

C. Joint Types:

1. Dowel Joint: A keyed joint with smooth dowels passing through to allow unrestricted movement due to contraction and expansion. Joints are as specified on the drawings.
2. Control Joint(s): Shrinkage crack control joints may be of the following types when shown on the drawings. Install joints in a straight line between end points with edges finished appropriate to type. Depth shall be 25% of the slab thickness, unless noted otherwise. Fill joints with sealant as shown on the drawings or as required by related sections.
   a. 1/4 inch wide troweled joint.
   b. Keyed joint: Only at locations where concealed by other finishes.
   c. Masonite Strip, 1/8 inch: Only at locations where concealed by other finishes.
   d. Saw Cut, 1/8 inch: Must be performed within eight hours of completion of finishing. Do not make saw cuts if aggregate separates from cement paste during cutting operation. Prevent marring of surface finish. Fill with flexible sealant.

3.6 VAPOR RETARDER

A. Vapor Retarder Installation: Install as specified in PART 2, ASTM E1643, and per manufacturer's recommendations including taping and lapping of seams, sealing of penetrations, and repair of damage. Do not extend vapor retarder below footings.

3.7 FLATWORK

A. General Requirements for All Concrete Formed & Finished Flat:

1. Edge Forms and Screeds: Set accurately to produce indicated design elevations and contours in the finished surface, edge forms sufficiently strong to support screed type proposed.
2. Jointing: Located and detailed as indicated.
3. Consolidation: Concrete in slabs shall be thoroughly consolidated.

B. Flatwork Schedule:

1. Exterior Slabs-On-Grade: Place concrete directly over sub-base as indicated.
   a. Sub-Base: Clean free-draining, crushed base rock, 4 inch minimum thickness, thoroughly compacted.
2. Interior Concrete Slabs-On-Grade:
   a. Sub-Base: Clean free-draining, crushed base rock, 4 inch minimum thickness, thoroughly compacted.
   b. Vapor Retarder: Install over sub-base.

3.8 FORMED SURFACES

A. Form all concrete members level and plumb, except as specifically indicated. Comply with tolerances specified in ACI 318 Section 26.11, ACI 301 Section 2, and this specification, except that maximum permissible deviation is 1/4 inch end-to-end for any single member.

B. Cambers: Provide all cambers indicated in the formwork construction. Set screeds to produce specified cambers in the finished concrete.

3.9 CONCRETE FINISHES

A. Flatwork Finishing:

1. Perform with experienced operators.
2. Finish surfaces monolithically. Establish uniform slopes or level grades as indicated. Maintain full design thickness.
3. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains as indicated on drawings.
4. Flatwork Finish Types:
   a. Wood Float Finish: Surfaces to receive quarry tile, ceramic tile, or cementitious terrazzo with full bed setting system, or wood frame for raised finished floors.
   b. Steel Trowel Finish: Surfaces to receive carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set tile or similar finishes specified in related sections. Trowel twice, minimum.
   c. Broom Texture Finish: Exterior surfaces as indicated or for which no other finish is indicated. Finish as for steel trowel finish, except immediately following first troweling, (depending on conditions of concrete and nature of finish required) provide uniform surfaces texture using a medium or coarse fiber broom.

B. Other Concrete: Provide as required to achieve appearance indicated on structural and architectural drawings and related sections.

1. Repair surface defects, including tie holes, immediately after removing formwork.
2. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
3. Exposed Form Finish: Finish concrete to match forms. Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   a. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
   b. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.

c. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.

4. Intermediate joint and score marks and edges: Tool smooth and flush unless otherwise indicated or as directed by the Architect.
5. Use steel tools of standard patterns and as required to achieve details shown or specified. All exposed corners not specified to be chamfered shall have radiused edges.

3.10 TOLERANCES

A. Minimum Flatwork Tolerances: Measure flatness of slabs with in 48 hours after slab installation in accordance with ACI 302.1R and ASTM E1155 and to achieve the following FF and FL tolerances:

1. Exterior surfaces: 1/8 inch minimum per foot where sloped to drain. Level otherwise. FF20 and FL15.
2. Interior surfaces not otherwise shown or required: Level throughout. FF25 and FL20
3. Interior surfaces required to be sloped for drainage: 1/8 inch in 10 ft.
4. Finish concrete to achieve the following tolerances:
   a. Under Glazed Tile on Setting Bed: FF30 and FL20.
   b. Under Resilient Finishes: FF35 and FL25.
   c. Flooring manufactureer and pertainent section of Division 9.

B. Formed Surface Tolerances:

1. Permanently Exposed Joints and Surfaces: Provide maximum differential height within two feet of, and across construction joints of 1/16 inch.
2. Vertical Elevations: Elevation of surfaces shall be as shown or approved.

3.11 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.

E. Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels not to exceed 20 feet in either direction.

F. Screed toppings level, maintaining surface tolerances per above.

3.12 CONCRETE CURING

A. Curing - General: Cure in accordance with ACI 308. Maintain concrete water content for proper hydration and minimize temperature variations. Begin curing immediately following finishing.

B. Protection During Curing: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. The General Contractor is responsible for the protection of the finished slab from damage.

1. Avoid foot traffic on concrete for minimum of 24-hours after placement.
2. Protect concrete from sun and rain.
3. Maintain concrete temperature at or above 50 degrees F. during the first 7 days after placement. See Article ENVIRONMENTAL REQUIREMENTS.
4. Do not subject concrete to design loads until concrete is completely cured, and until concrete has attained its full specified 28-day compressive strength or until 21 days after placement, whichever is longer.
5. Protect concrete during and after curing from damage during subsequent building construction operations. See Article PROTECTION.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than 7 days.
2. High early strength concrete: Not less than 4 days.

D. Begin curing immediately following finishing.

E. Surfaces Not in Contact with Forms:

1. Start initial curing as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than 3 days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
2. Begin final curing after initial curing but before surface is dry.
   a. Moisture-retaining cover: Seal in place with waterproof tape or adhesive.
   b. Curing compound: Apply in two coats at right angles, using application rate recommended by manufacturer.
3. In addition, see specific conditions noted below.

F. Slabs on Grade: Cure by one of the following methods:

1. Water Cure (Ponding): Maintain 100 percent coverage of water over floor slab areas, continuously for minimum 7 calendar days.
2. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
3. Moisture-Retaining Film or Paper: Lap strips not less than 6 inches and seal with waterproof tape or adhesive; extend beyond slab or paving perimeters minimum 6 inches and secure at edges; maintain in place for minimum 7 days.
4. Absorptive Moisture-Retaining Covering: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides and extend beyond slab or paving perimeters 6 inches minimum; maintain in place for minimum 7 days.
5. Liquid Membrane-forming Curing Compound: Provide only when subsequent concrete treatments or finish flooring specified in related sections will not be affected by cure/sealer. Apply curing compound in accordance with manufacturer's instructions at the maximum recommended application rate in two coats, with second coat applied at right angles to first.

G. Elevated Slabs: Cure by one of the following methods.

1. Moisture-Retaining Sheet: As specified for Slab on Grade above.
2. Water Cure: As specified above for minimum 14 days.

3. Apply Membrane Curing Compound as specified above after initial curing period.

H. Concrete on Metal Decking: Moisture-Retaining Sheet method as specified above.

I. Formed Concrete Members: Cure by moist curing with forms in place for full curing period.

1. Protect free-standing elements from temperature extremes.
2. Maintain forms tight for minimum 7 days. Maintain exposed surfaces continuously damp and completely covered by sheet materials thereafter.
3. Maintain all shoring in place. Refer to related sections specifying formwork.
4. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

J. Foundations: Apply curing compound immediately after floating.

3.13 CONCRETE HARDENER

A. Apply hardener to all floor slabs not receiving other finishes after 30 days minimum curing. Clean slabs of non-compatible cure/sealers or other foreign material(s) and apply in strict accordance with the manufacturer's directions.

3.14 GROUTING AND DRY PACK

A. Set steel plates on concrete or masonry with high strength grout bed, completely fill all voids; thoroughly compact in place. See Section 05 1200 or 05 1100.

B. Bolts or inserts dry packed or grouted in place shall cure for minimum 7 days before tensioning.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspections by Independent Testing Agency: Provided verification and inspection of concrete per CBC Table 1705.3. Provide written reports for to Engineer, Architect, Contractor and Building Official for the following tests and inspections:

B. Testing & Inspection: Provide periodic inspection of reinforcing steel. Provide continuous inspection during placement of structural class concrete, 3000 psi or more. Non-structural class concrete with a design strength of 2500 psi or less to have periodic inspection on a 150 cubic yard basis as required to assure conformance.

1. Provide periodic inspection of bolts in concrete prior to and during placement where so noted on the construction documents.
2. Structural Concrete Cylinder Tests: Perform in accordance with ASTM C31.
   a. Take four standard 6 inch x 12 inch (or five 4 inch x 8 inch) cylinder specimens on the site, of each class of concrete as specified in PART 2, not less than once a day or for each 150 cubic yards or 5000 sq ft or fraction thereof placed each day.
   b. Record the location of each concrete batch in the building in a log and also note on each specimen.
   c. Perform standard compression test of cylinders in accordance with ASTM C39, one at 7 days and two (three for 4x8 cylinders) at 28 days.
   d. Hold fourth (fifth) cylinder untested until specified concrete strengths are attained.

3. Structural Concrete Slump Test and Air Tests: Perform in accordance with ASTM D143 and C231 or C173 at the time of taking test cylinders, and/or at one-hour intervals during concrete placing.
4. Measure and record concrete temperature upon arrival of transit mixers and when taking specimens. Note weather conditions and temperature.
5. Propose adjustments to reviewed mix designs for Architect / Engineer review to account for variations in site or weather conditions, or other factors as appropriate.
6. Water Vapor Transmission Tests: Floors receiving floor finishes specified in related sections will be tested prior to installation of flooring systems. Refer to sections specifying floor finishes for related requirements.

C. Services by Contractor:

1. Rejection of Concrete Materials: Do not use the following without prior written approval of the Architect/Engineer;
   a. Materials without batch plant certificates.
   b. Materials not conforming to the requirements of these specifications.

3.16 ADJUSTING

A. Inspect all concrete surfaces immediately upon formwork removal. Notify Architect/Engineer of identified minor defects. Repair all minor defects as directed.

B. Surface and Finish Defects: Repair as directed by the Architect/Engineer, at no added expense to the Owner. Repairs include all necessary materials; reinforcement grouts, dry pack, admixtures, epoxy and aggregates to perform required repair.

1. Repair minor defective surface defects by use of drypack and surface grinding. Specific written approval of Architect/Engineer is required. Submit proposed patching mixture and methods for approval prior to commencing work.
2. Slabs-on-Grade, Elevated Slabs and on Slabs on Metal Deck: Review for "curled" slab edges and shrinkage cracks prior to installation of other floor finishes. Grind curled edges flush, fill cracks of 1/16 inch and greater with cementitious grout.
3. Grind high spots, fins or protrusions caused by formwork; Fill-in pour joints, voids, rock pockets, tie holes and other void not impairing structural strength. Provide surfaces flush with surrounding concrete.

3.17 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required compressive strength, lines, details, dimensions, tolerances, finishes or specified requirements; as determined by the Architect/Engineer.

B. Repair or replacement of defective concrete will be determined by the Architect/Engineer who may order additional testing and inspection at his option. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Specific Defects:

1. "Low-Strength"; Concrete Not Meeting Specified Compressive Strength after 28 days:

a. Concrete with less than 25% Fly Ash as cementitious material: Test remaining cylinder(s) at 56 days. If strength requirements are met, concrete strength is acceptable.
b. Concrete with 25% or more Fly Ash as cementitious material: Test remaining cylinder(s) at 70 days. If strength requirements are met, concrete strength is acceptable.

2. Excessive Shrinkage, Cracking, Crazing or Curling; Defective Finish: Remove and replace if repair to acceptable condition is not feasible.
3. Lines, Details, Dimensions, Tolerances: Remove and replace if repair to acceptable condition is not feasible.
4. Slab sections not meeting specified tolerances for trueness/flatness or lines/levels: Remove and replace unless otherwise directed by the Architect/Engineer. Minimum area for removal: Fifteen square feet area unless directed otherwise by the Architect/Engineer.
5. Defective work affecting the strength of the structure or the appearance: Complete removal and replacement of defective concrete, as directed by the Architect/Engineer.

3.18 CLEANING

A. Maintain site free of debris and rubbish. Remove all materials and apparatus from the premises and streets at completion of work. Remove all drippings; leave the entire work clean and free of debris.

B. Slabs to Receive Floor Finishes Specified in other sections: Remove non-compatible cure/sealers or other foreign material(s) which may affect bonding of subsequent finishes. Leave in condition to receive work of related sections.

3.19 PROTECTION

A. Protect completed work from damage until project is complete and accepted by Owner.

B. Construction Loads: Submit engineering analysis for equipment loads (including all carried loads) specified in article submittals.

C. Keep finished areas free from all equipment traffic for a minimum of 4 additional days following attainment of design strength and completion of curing.

D. Protection of Drainage Systems:

1. Care shall be taken not to introduce any foreign material into any specified drainage, piping or duct system.
2. Cost of work to repair or clean drainage system as a result of failure to comply with this requirement will be back charged to the contractor.

E. Cover traffic areas with plywood sheets or other protective devices; maintain protection in place and in good repair for as long as necessary to protect against damage by subsequent construction operations.

END OF SECTION

SECTION 03 38 50

FIBER REINFORCED EPOXY COMPOSITE MATERIAL

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Provide all labor, materials, equipment and services required to complete all work required for the proper application of the composite system.

B. Related Sections:
1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
2. Pertinent Sections of other Divisions specifying site concrete: Formwork for site concrete.
3. Section 03 10 00 - Concrete Formwork.
5. Pertinent Sections of Division 03 specifying concrete construction.
6. Pertinent Sections of other Divisions specifying work to be embedded in concrete.
7. Pertinent Sections of other Divisions specifying work penetrating concrete.
8. Pertinent sections of other Divisions specifying roofing finishes and sealants applied to concrete substrates.

1.2 REFERENCES

A. ACI 440.2R-17 “Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures”.

B. ICC-ESR 3403 “Simpson Strong-Tie Composite Strengthening Systems (CSSs)”.

C. ACI Repair Application Procedures (RAP) No. 1 through No. 7

D. ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

E. ASTM D4541, Standard Test Method for Pull-Off Strength for Coatings Using Portable Adhesion Testers

F. ASTM D7522, Standard Test Method for Pull-Off Strength for FRP Bonded to Concrete Substrate

G. ICRI Technical Guideline No. 310.1R, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion

H. ICRI Technical Guideline No. 310.2R, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

I. ICRI Technical Guideline No. 210.3R, Guide for Using In-Situ Tensile Pulloff Tests to Evaluate Bond of Concrete Surface Materials

J. ICRI Technical Guideline No. 210.1R, Guideline for Verifying Field Performance of Epoxy Injection of Concrete Cracks

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturers' product data, specifications and recommended application procedures showing compliance with the project requirements, including:
   1. 10,000 hour system environmental durability testing (such as that performed by The Aerospace Corporation)
   2. Large scale structural test results of the proposed composite material on representative test specimens, conducted and reported by an independent testing facility
   3. Certification from the system manufacturer of the material and section properties for the supplied material
   4. An approved ICC Evaluation Report number in the name of the proposed system and the system's manufacturer.
   5. Written verification from the system manufacturer that the applicators have received the manufacturer's certifications and training.

D. Shop Drawings: Complete shop drawings shall be submitted for each installation of the composite system. The shop drawings shall contain details of the number and thickness of layers, fiber orientation, surface preparation, and finish requirements, joint and end details and locations to be applied as per part 3 of this specification.

E. System manufacturer's Quality Control Manual in compliance with ICC AC10, "Acceptance Criteria for Quality Control Manuals."

F. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

G. A list of a minimum of twenty (20) completed composite strengthening projects performed by the certified applicator within the past three (3) years. The list should include at a minimum, the dates of work, type, description and amount of work performed, and the name and telephone number of a contact person at the agency or company for which the work was completed. In addition, provide the names of the applicator's key personnel (superintendent and assistant) who will perform the actual work. The superintendent and assistant shall have a minimum experience of 1 year involved in directing projects such as this.

H. The engineer of record shall have the right to approve or reject the personnel qualifications as submitted. The engineer may suspend the work if the contractor substitutes unauthorized personnel for authorized personnel during construction.

I. Project Record Documents: Accurately record actual locations of components that will be concealed from view upon completion of concrete work.

J. Applicator Qualification: Written documentation from the composite system manufacturer that the contractor has completed the manufacturer's training program and has been trained to install the proposed system.

1.4 QUALITY ASSURANCE

A. Perform work of this section in accordance with Manufacturer's Published Installation Instructions, ACI440.2R, and the ICC ESR code approval report .

B. Concrete construction verification and inspection to conform to CBC 1704A.4.

C. Composite system shall be installed by a contractor certified by the manufacturer by means of written verification. Certified applicator shall have a minimum of two years' experience in performing composite retrofits with wet lay-up systems.

D. Services by the Independent Testing Agency (includes "Special" Inspections) as specified in this Section and as follows:
   1. Perform tests and inspections specified below in articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and reports to be in conformance with pertinent Sections of Division 01.

E. Contractor shall bear the entire cost of remediation, removal, and/or replacement of composite determined defective or non-conforming, including Architect/Engineer fees for redesign.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver epoxy materials in factory-sealed containers with the manufacturer's labels intact and legible with verification of date of manufacture and shelf life.

B. Store materials in a protected area free of moisture and UV exposure at a temperature between 45^{o}F and 95^{o}F.

C. Products shall be stored according to the manufacturer's requirements and shall avoid contact with moisture or exposure to UV light.

1.6 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Simpson Strong-Tie Company, Inc., 5956 West Las Positas Boulevard, Pleasanton, CA 94588.Tel: (800) 925-5099, email: info@strongtie.com

B. Engineer-of-record approved equal that satisfies all of the requirements of Section 1.04. The proposed alternate composite system must be approved in an addendum to these specifications by the engineer of record two-weeks prior to the project bid date.

2.2 MATERIALS

A. Approved FRP Composite Strengthening Systems® to be supplied by Simpson Strong-Tie Company, Inc., 5956 West Las Positas Boulevard, Pleasanton, CA 94588. See structural drawings for specific products to be used including fabric, adhesive, and paste.

B. Provide other materials as needed for the proper installation of the complete composite system as selected by the contractor in conformance with these specifications.

C. Concrete surface preparation & repair products:
   1. Crack repair products. Cracked substrates with cracks wider than 0.01 inch must be pressure injected with epoxy prior to FRP installation. For concrete substrates, refer to ACI 224.1R. Smaller cracks exposed to aggressive environments may require resin injection or sealing to prevent corrosion of existing steel reinforcement. Crack-width criteria for various exposure conditions are given in ACI 224.1R. The crack repair system shall be epoxy based two-component high-solids formulation, meeting the mechanical strength requirements of ASTM C-881 type IV epoxy bonding systems. The crack repair system shall be suitable for the condition at which it will be placed: dry, damp, wet, high or low temperature, horizontal or vertical. The crack repair system shall not be installed in an active leaking crack or an active moving crack. The crack repair system shall be able to be installed by crack injection or gravity fed as needed for the application. Pre-approved systems include:
      a. For hairline cracks up to 1/4” in width use: Simpson Strong-Tie ETI-SLV: meets the requirements of ASTM C-881 type I, and IV, grade 1
      b. For fine cracks (greater than 1/64”) up to 1/4” in width use: Simpson Strong-Tie ETI-LV: meets the requirements of ASTM C-881 type I, and IV, grade 1. Approved under NSF/ANSI standard 61 (22 in2/1000 gal)
      c. For medium size cracks (greater than 3/32”) up to 1/4” in width use: Simpson Strong-Tie ETI-GV: meets the requirements of ASTM C-881 type I, and IV, grade 3
   2. Reinforcement steel primer. Primer shall be used to protect steel reinforcing from corrosion and promote positive bond from existing steel reinforcing to new repair material. Pre-approved systems include: Simpson Strong-Tie FX-406 Zinc-Rich Primer
   3. Bonding agent for bonding new repair material to existing concrete. Pre-approved systems include:
      a. For applications 40°F (4.4°C) and above. Bonding agent shall meet the requirements of ASTM C881, type II, grade 2, class B: Simpson Strong-Tie FX-752 Epoxy Bonding Agent
      b. For applications 60°F (15.5°C) and above or when extended working time is required, bonding agent shall meet the requirements of ASTM C881, type II, grade 2, class C: Simpson Strong-Tie FX-792 LPL Long Pot Life Epoxy Bonding Agent
   4. High performance repair mortars. Repair material shall be used to repair areas of damaged concrete. Note: any repairs made using cementitious repair mortars must be fully cured prior to applying FRP. Allow 3-7 days for full cure or verify moisture content is less than 5% prior to applying FRP. Pre-approved systems include:
      a. Simpson Strong-Tie FX-263 Rapid-Hardening Vertical/Overhead Repair Mortar
      b. Simpson Strong-Tie FX-261S Form and Pour Repair Mortar
      c. Simpson Strong-Tie FX-32GMF Repair Mortar with Fibers
   5. Protective coatings for the FRP System. Pre-approved systems include:
      a. Simpson Strong-Tie FX-505 Water-Based Acrylic Coating
      b. Simpson Strong-Tie FX-207 Slurry Seal
      c. Simpson Strong-Tie FX-70-9 Epoxy Coating

PART 3 - EXECUTION

3.1 APPLICATOR EXPERIENCE

A. The work described under this specification shall be performed by an applicator with proven past experience utilizing the manufacturer’s system. The applicator company shall be certified by the manufacturer through written verification and shall provide a quality control procedure in compliance with the manufacturer’s installation requirements.

3.2 SURFACE PREPARATION

A. The surface to receive composite shall be free from fins, sharp edges and protrusions that will cause voids behind the installed fabric or that, in the opinion of the Engineer, will damage the fibers. Small voids less than 2 square inches are acceptable so long as the area is less than 5% of the total laminate and there are no more than 10 such voids. Existing uneven surfaces to receive composite between 2 to 25 square inches shall be filled with epoxy filler or other material approved by the Engineer. Large voids greater than 25 square inches shall be locally cut away and a new material shall be applied. Filling of large voids in surfaces to receive composite shall be paid for as an extra to the contract work of installing the composite system (small pinholes or micro-bubbles in the concrete surface or resin, do not require special detailing). Cracked substrates with cracks wider than 0.01 inches must be pressure injected with epoxy prior to FRP installation. The contact surfaces shall have no surface water on them at the time of application but may be damp (less than 5% surface moisture as measured by a moisture meter). If surface water cannot be avoided, use the manufacturer suggested wet prime epoxy.

B. Round off sharp and chamfered corners to a minimum radius of 3/4-inch by means of grinding or forming with the system's thickened epoxy.

C. Concrete surfaces shall be prepared for bonding by means of abrasive blasting or grinding to achieve an International Concrete Repair Institute profile 3 (ICRI CSP-3). All contact surfaces shall then be cleaned. One prime coat of the manufacturer's epoxy shall be applied. Prior to the application of the saturated composite fabric, fill any uneven surfaces/grout lines with the manufacturer's thickened epoxy.

D. If reinforcing steel is exposed, contractor shall remove all concrete behind the reinforcing steel following ICRI Technical Guideline 310.1R.

E. Existing concave and convex surfaces must be filled/transitioned with epoxy paste. To repair voids, CSS-EP or CSS-ES thickened with fumed silica may be extended with FX-702 at no more than a 1:1 ratio by volume.

3.4 PROCEDURES FOR APPLICATION

A. Preparation work for project: Visit site to insure that all patch work is complete and cured. Review project specifications in detail.

B. Verify ambient and concrete temperatures. No work shall proceed if the temperature of the concrete surface being repaired is less than 45 degrees Fahrenheit or greater than 95 degrees Fahrenheit. The temperature of the epoxy components shall be between 45 and 95°F at the time of mixing or as specified on the component labels. When air temperature is outside the prescribed range, other measures must be employed to ensure components' temperature is maintained within this range.

C. Prepare the epoxy matrix by combining components at a weight ratio specified on the manufacturer's labeled units. The components of epoxy resin shall be mixed with a mechanical mixer until uniformly mixed, typically 5 minutes at 400-600 rpm. Components that have exceeded their shelf life (as designated on the material label) shall not be used.

D. Saturation of the fabric shall be performed and monitored according to manufacturer's specified fiber-resin ratio. Fabric shall be saturated by hand or mechanical rollers, as the material is

being installed. Saturation shall be supervised and checked by the properly trained representative of the installer.

E. Both the epoxy resin and fabric shall be measured accurately, combined, and deposited uniformly at the rates shown on the approved working drawings and per manufacturer's recommendations. The composite system shall be comprised of fibers saturated with epoxy resin per proper ratio.

F. Quality control procedures: Record batch numbers for fabric and epoxy used each day, and note locations of installation. Measure square footage of fabric and volume of epoxy used each day. Label test specimens from each day's production and submit ASTM 3039 test results, as they are made available. Complete report and submit to authority having jurisdiction and system manufacturer.

G. Fabric sampling procedure (12" x 12" or as required): From a standard epoxy mix saturate fabric according to specified fiber-resin ratio. On a smooth, flat, level surface covered with polyethylene sheeting, or 16 mil plastic film, prime with epoxy resin, then prepare sample by placing two layers of saturated fabric oriented in the same direction. Apply additional topping of epoxy. Cover with plastic film and squeegee out all bubbles. Samples shall be stored in a sample box and not moved for a minimum 48 hours after casting. The prepared, identified samples shall be given to a pre-approved testing laboratory. Laboratory shall precondition samples for 48 hours at 140 degree F before testing (see section 3.06B for testing requirements).

H. Installation Procedures:
1. Prepare surface as required, including all concrete repair work.
2. Remove dust and debris as per specifications.
3. Clean up and protect area adjacent to element.
4. Using a roller or trowel, apply one prime coat of epoxy resin to the concrete surface (2 mil. min.). Allow primer to become tacky to the touch.
5. Apply thickened epoxy to concrete surface.
6. Apply saturated fabric to concrete surface by hand lay-up, using methods that produce a uniform, constant tensile force that is distributed across the entire width of fabric. The system may be placed entirely by hand methods assuring a uniform, even final appearance. A lap length as specified on the approved drawings is required at all necessary over-laps in the reinforcing fabric. The fabric shall be installed with the fibers oriented within 5° of that specified on the construction drawings.
7. Apply epoxy saturant with rollers to ensure full saturation of fabric as needed.
8. Before previous layer has fully cured, apply subsequent layers, continuously or spliced, until designed number of layers is achieved, per project drawings.
9. Using a roller or hand pressure, insure proper orientation of fibers, release or roll out entrapped air, and ensure that each individual layer is firmly bedded and adhered to the preceding layer or substrate.
10. Apply a final coat of thickened epoxy. Detail all fabric edges, including butt splice, termination points, and jacket edges, with epoxy. Provide an even, light-broadcast of course (#16 to #30 sieve), dry sand to the surface of wet epoxy.
11. Finish: Refer to architectural specification for final finish. Use system as directed by manufacturer. Apply finish as specified between 24 and 72 hours after final application of epoxy. If after 72 hours the epoxy is cured, the surface must be roughened by sanding or brush blasting in areas that did not receive coarse sand.
12. System may incorporate structural fasteners but limitations and detailing must be verified with composite system manufacturer.

I. Curing of composite system: Epoxy curing temperatures shall be maintained in the temperature range designated for the formulation used, 45°F to 95°F for 72 hours. The composite system

shall be protected from contact by moisture for a period of a minimum of 72 hours. The use of tenting, plastic sheeting, etc to provide protection shall be considered means and methods to be designed by the contractor.

J. All FRP on floors, roofs, and walls shall be protected from inadvertent damage during its service life. FRP on the roof will be covered by insulation and roofing and is therefore considered protected. FRP on floors will be covered by flooring and is therefore considered protected. FRP on walls will be covered by a furring wall up to about 10 feet and is considered protected. FRP on walls at an elevation above 10 feet and FRP on ceilings is not accessible without intentional effort and is therefore considered protected.

3.5 PROCEDURE MODIFICATIONS

A. Installation procedures may be modified to achieve maximum results, subject to approval by the engineer of record, and DSA. Procedure modifications shall be approved prior to implementing the modifications.

3.6 FIELD QUALITY CONTROL

A. Installation Contractor:
1. Record batch numbers for fabric and epoxy used each day, and note locations of installation. Measure square footage of fabric and volume of epoxy used each day. Complete report and submit to City/County and system manufacturer.
2. Monitor the mixing of all epoxy components for proper ratio and adherence to manufacturer's recommendations.

B. Testing and Inspections by Independent Testing Agency: Inspector(s) shall be a licensed design professional or qualified inspector. Inspector(s) shall be knowledgeable of FRP systems and trained in the installation of FRP systems. Provide verification and inspection of concrete per CBC Table 1704A.4. Provide written reports to Engineer, Architect, Contractor and Building Official for the following tests and inspections:
1. Observe all aspects of preparation, mixing, and application of materials, including the following:
   a. Ambient temperature, relative humidity, and general weather observations
   b. Surface temperature of concrete
   c. Surface moisture
   d. Surface preparation methods and resulting profile using ICRI surface profile chips.
   e. Qualitative description of surface cleanliness
   f. Type of auxiliary heat source, if applicable
   g. Width of cracks not injected with epoxy
   h. Fiber laminate batch number(s) and approximate location in structure
   i. Bath numbers; mixture ratios, ; mixing time; and qualitative descriptions of the appearance of all mixed resins including primers, putties, saturants, adhesives, and coatings mixed for the day
   j. Observation of progress of cure of resins
   k. Conformance with installation procedures
   l. Pull-off test results: bond strength, failure mode, and location
   m. FRP properties from tests of field sample panels or witness panels
   n. Location and size of any delaminations or air voids
   o. General progress of work
   p. Material container labels

2. Continuously inspect the composite casing during and immediately following application of the composite.

3. Continuously monitor the mixing of all epoxy components for proper ratio and adherence to manufacturer's recommendations.
4. SAMPLING AND TESTING--Record lot number of fabric and resin used, and location of installation. A "sample batch" shall consist of two 12 inches by 12 inch "samples" of cured composite. A minimum of three "sample batches" shall be made daily per floor and per fabric type. The two "sample batches" will be taken at appropriate times during the day so as to ensure the maximum material deviance in the components of the composite. Testing laboratory shall pre-condition samples at 140 degrees Fahrenheit for 48 hours before testing. "Samples" shall be tested, at random, at owner's discretion and cost.
5. Tested samples shall be tested per ASTM D3039. The 12" x 12" sample shall have 5 coupons, ¾" x 9", removed and tested for their material properties in the longitudinal (primary fiber) direction. In the case of bi-directional fabric, cut the coupons parallel to either of the 45° fiber directions, such that a tension test may be performed. Test laboratories shall confirm with the manufacturer that they are testing in the correct direction. Tests shall conform to ASTM procedures and manufacturer's published testing methods. Only pre-qualified testing laboratories shall be used.
6. Testing results shall be made available within 3 weeks of sample submission. Results shall meet or exceed the below values. The testing shall provide average values of the following:
    a. Ultimate tensile strength
        i. CSS-CBGF = 40ksi
        ii. CSS-CUCF11 = 128ksi
        iii. CSS-CUCF44 = 128ksi
    b. Tensile modulus
        i. CSS-CBGF = 2,900ksi
        ii. CSS-CUCF11 = 14,200ksi
        iii. CSS-CUCF44 = 14,200ksi
    c. Percent elongation
        i. CSS-CBGF = 1.4%
        ii. CSS-CUCF11 = 0.9%
        iii. CSS-CUCF44 = 0.9%
7. All "sample batches" shall be tested.
8. Adhesion Tests shall be conducted in accordance with ASTM D7522 and/or ASTM D4541 and performed on flat surfaces. 3 tests shall be executed on each type of substrate or surface preparation method used, with a minimum of 3 tests per 1000 square feet of surface area covered. Testing shall be done on an area adjacent to strengthening locations with substrate, surface preparation, and orientation (i.e. overhead, vertical, etc.) that are representative of that being strengthened. Before pull-off tests are performed, the composite system shall be allowed to reach full cure. Adhesion tests shall exhibit minimum 200 psi, notify the SEOR otherwise.

3.7 DEFECTIVE WORK

A. All defects (including bubbles, delamination's, and fabric tears) as specified by the manufacturer, SEOR, or DSA shall be repaired. Two types of repairs shall be performed;
    1. Isolated small defects 2" diameter maximum shall be injected or back filled with epoxy, unless their combined area exceeds 5% of the total laminate area of a given stip in which case repairs shall be as required by the SEOR and approved by DSA.
    2. Large defects shall be repaired as required by the SEOR and approved by DSA.

B. Remedial Measures:
    1. In the event that material testing, per section 3.06-B, determines a "sample batch" to possess insufficient material properties, remedial measures shall be taken.
    2. At any structural member where the installed composite system has material properties determined to be below the minimum specified values, a retrofit solution will be designed by the Engineer and reviewed for approval by DSA.

3.8 PERIODIC INSPECTION OF STRENGTHENIGN SYSTEM AFTER COMPLETION OF CONSTRUCTION

A. FRP shall be inspected every 2 years in accordance with ACI 440.2R-17 for changes in color, debonding, peeling, blistering, cracking, crazing, indications of reinforcing bar corrosion, and other anomalies.

B. The inspection shall be performed by a Testing Agency qualified to inspect the installation of FRP.

C. Any anomalies cited in the report produced by the Testing Agency shall be reviewed by a Structural Engineer and repairs provided as required.

END OF SECTION

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SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials, equipment and operations required to complete structural and miscellaneous metals in shapes and configurations indicated; including:

1. Structural steel columns, beams, bracing, base plates, bolts, joist hangers, and stud bolts welded to structural steel.
2. Miscellaneous structural steel and connections; fabricated connectors and hangers installed by related sections.
3. Anchor bolts and steel inserts embedded in concrete or masonry, installed by related sections.
4. Fabricated steel items embedded in concrete or masonry installed by related sections.
5. Supervision of anchor bolt setting, leveling and elevations to insure required fit of steel work.
6. Shop priming and field touch-up, galvanizing.
7. Bracing, Shoring, Fabrication and Erection.

B. Related Sections:

1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.
2. Pertinent Sections of other Divisions specifying concrete reinforcement, formwork, concrete, structural and miscellaneous metal fabrications, steel joists, metal decking, cold-formed metal framing, rough carpentry.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 22 Steel.

B. American Institute of Steel Construction (AISC) 303 “Code of Standard Practice for Steel Buildings and Bridges”.

C. AISC 341 “Seismic Provisions for Structural Steel Buildings”.

D. AISC 358 “Prequalified Connection for Special and Intermediate Steel Moment Frames for Seismic Applications”.

E. AISC 360 “Specification for Structural Steel Buildings”.

F. American Welding Society (AWS) D1.1 “Structural Welding Code - Steel”.

G. AWS D1.8 “Structural Welding Code - Seismic Supplement”.

H. Research Council on Structural Connections (RCSC) “Specification for Structural Joints Using High-Strength Bolts”.

I. Underwriters Laboratories (UL) FRD “Fire Resistance Directory”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.

D. Shop drawings: Submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following;

1. Profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Fabrication tolerances for all steel.
3. Connections: All, including type and location of shop and field connections.
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths, type, size, and sequence. Designate demand critical welds.
5. Designation of Seismic Force Resisting System (SFRS) members and connections. Locate and dimension protected zones. Braced frame gusset plates shall be drawn to scale.
6. Cross-reference all shop drawing detail references to contract document detail references.
7. Secure all field measurements as necessary to complete this work prior to submitting shop drawings for review.
8. Provide holes, welded studs, etc. as necessary to secure work of other sections.
9. Provide the following as separate submittals for each building or unit of work:
   a. Bolt and anchor setting plans.
   b. Layout, fabrication and erection drawings.

E. Certifications:

1. Steel Materials: Submit the following for identified materials.
   a. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
   b. Mill Test Reports: Indicate structural strength, destructive test analysis, and non-destructive test analysis.
   c. Contractor's affidavit certifying that all identified steel materials provided are of the grades specified and match the certificates supplied.
2. High-Strength Bolting: Certify all materials provided are the grades specified.
3. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification per AWS D1.1.

F. Samples: Provide samples to the Testing Agency as specified in Article SOURCE QUALITY CONTROL, at no additional costs.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies, refer to pertinent sections of Division 01 and CBC Chapter 17.

B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.

C. Certification and Identification of Materials and Uses: Provide Testing Agency with access to fabrication plant to facilitate inspection of steel. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.

1. Test all steel as required by ASTM A6.
2. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.
3. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each material type and/or heat number in the project (i.e. walls, braced frames etc.).
4. Unidentified Material Tests: Where identification of materials by heat number or mill tests cannot be made, Owner's Testing Agency shall test unidentified materials.
5. Provide all certification, verifications, and other test data required to substantiate specified material properties at no additional cost to the Owner.

D. Testing and Inspection: Tests and Inspections performed by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent sections of Division 01.

E. The following standards are the minimum level of quality required. Provide higher quality work as specifically indicated in the Contract Documents.

1. Workmanship and details of structural steel work shall conform to the CBC and AISC 360.
2. The quality of materials and the fabrication of all welded connections shall conform to AWS D1.1 and D1.8.
3. Comply with Section 10 of AISC 303 for architecturally exposed structural steel.

F. The Testing Agency will review all submittals and testing of materials.

G. All re-inspections made necessary by non-conforming work shall be at the Contractor's expense.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in bundles marked with durable tags indicating heat number, mill, member size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.

B. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

1.6 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize

inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel W Shapes: ASTM A992 Gr. 50 or ASTM A572 Gr. 50.

B. Structural Steel Plates: ASTM A36 or ASTM A572 Gr. 50 or ASTM 529 Gr. 50

C. Structural Steel Channels, Angles: ASTM A36 or ASTM A572 Gr. 50.

D. HSS (Hollow Structural Sections):

1. Round: ASTM A500, Gr. C.
2. Rectangular or Square: ASTM A500, Gr. C.

E. Pipe: ASTM A53, Grade B.

F. Bolts and Washers: See FINISHES section for galvanization, where required.

1. Machine Bolts, Nuts, and Washers: Bearing and shear connections (denoted as "MB"); ASTM A307 Grade A machine bolts with ASTM A563 Grade A nuts and ASTM F844 washers to match.
2. High Strength Bolts, Nuts, and Washers: Bearing and shear connections (denoted as "HSB"); ASTM F3125 Grade A325 or A490 with ASTM A563 Grade C nuts (Grade DH at A490) and ASTM F436 Type 1 washers.
   a. HSB-N: For use in snug tight (ST), pretensioned (PT), and slip critical (SC) joints. Conform to the RCSC Specifications.
   b. HSB-X: For use where specified on the drawings.
   c. Use of ASTM F3125 Grade F1852 (twist off assemblies) is permitted conforming to requirements of RCSC Specifications.
   d. Use of ASTM F959 Load Indicator Washers is permitted conforming to the requirements of RCSC Specifications.
   e. Slip critical (SC) bolt faying surfaces shall be prepared per RCSC as Class A, unless noted to be Class B per the drawings. Galvanized surfaces at SC bolts shall be hand wire brushed.

G. Headed Stud Type Shear Connectors: ASTM A108 and AWS D1.1 Section 7.

H. Deformed Bar Anchors: ASTM A496.

I. Anchor Bolts/Rods:

1. ASTM F1554 Grade 36 or 55 with ASTM A563 Grade A nuts and ASTM F436 Type 1 washers.
2. ASTM F1554 Grade 105 where indicated on plans with ASTM A563 Grade DH nuts and ASTM F436 Type 1 washers.
3. No upset thread allowed.

J. Arc-Welding Electrodes: AWS Standards E70 or equivalent, except no E70T-4 allowed.

Additionally, welding electrodes to be used in the welding of seismic force resisting system to conform to AISC 341 and AWS D1.8.

K. Other Welding Materials: AWS D1.1; type required for materials being welded.

2.2 ACCESSORIES

A. High Strength Grout: ASTM C1107, non-shrink, premixed compound consisting of aggregate, cement, and water reducing plasticizing agents.

1. Minimum Compressive Strength at 3 days: 3000 psi.
2. Minimum Compressive Strength at 28 days: 7000 psi, placed in a “fluid” state.
3. Provide only non-metallic grout at exposed work.
4. Meet or exceed properties of BASF "Master Flow 928" mixed to fluid consistency. Other acceptable manufacturers: The Burke Company and W.R. Meadows, Inc.

B. Building Structural Steel Primers: Comply with local VOC limitations of authorities having jurisdiction and the California Green Building Code. Verify compatibility with finish coats specified in other sections. Follow manufacturers printed instructions. Apply one coat unless otherwise directed.

1. Type A: Self-Crosslinking Hydrophobic Acrylic passing 2000 hours ASTM D4585 and 7000 hours ASTM D5894. “Series 115 Uni-Bond DF” by Tnemec (2.0 to 4.0 mils DFT).
2. Type B: Organic Zinc-Rich Urethane passing 50,000 hours ASTM B117 and 15000 hours ASTM G85. “Series 90-97 Tneme-Zinc” by Tnemec (2.5 to 3.5 mils DFT) or “Series 94-H20 Hydro-Zinc” by Tnemec (2.5 to 3.5 mils DFT).
3. Type C: MIO-Zinc Filled Urethane passing 10,000 hours ASTM B117 and 5000 hours ASTM D4585. “Series 394 PerimePrime” by Tnemec (2.5 to 3.5 mils DFT).

C. Galvanizing: ASTM A153 and A123.

D. Touch-Up Primer for Galvanized Surfaces: Type B primer.

2.3 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal built up members by continuous welds where exposed to weather.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Protect all materials, before and after fabrication, from rust, corrosion, dirt, grease, and other foreign matter.

E. Fabricate framing members free from twists or bends. Form holes, cut and sheared edges neatly without kinks, burrs, or warped edges.

F. Exposed Steel: Straight, smooth, free of nicks, scars or dents.

G. Gas Cutting: Gas cutting of holes in a member shall not be permitted.

H. Splicing of members: Members requiring splicing due to length requirements may be spliced using full penetration butt welds when such welds and procedures are inspected

and certified by the Testing Agency, in conformance with AWS and AISC standards. The location of splices shall be approved by the Architect/Engineer in writing prior to fabrication.

I. Welding: Welding of structural steel connections shall be performed by qualified welders in accordance with AWS Standards. All weld sizes shall match those shown on the drawings.

1. Preparation: Clean all surfaces free of rust, paint and all foreign matter. Remove paint or scale by brushing, chipping or hammering as required. Chip clean and wire brush burned or flame cut edges before welding. Space and alternate welds, clamping as necessary to prevent warp or misalignment.
2. Sequence Welding: When welds enclose, or partially enclose, the perimeter or portion of the surface of a member, make weld bead in sequence, or staggered. Minimize internal stresses. Weld groups of members occurring in a single line in staggered sequence to minimize distortion of the structural frame.
3. Faulty and Defective Welding: Welds failing to meet AWS standards and the Contract Documents shall be rejected and remade at Contractor expense. All welds showing cracks, slag inclusion, lack of fusion, bad undercut or other defects, ascertained by visual or other means of inspection shall be removed and replaced with conforming work.
4. Minimum Weld Strengths: All welds shall match the minimum weld sizes recommended by AISC. Details of fabrication not specifically shown shall match similar details which are specifically shown. All bevel and groove welds shall be full penetration unless size is noted otherwise.
5. Threaded studs, headed studs, and deformed bar anchors shall be full-fusion welded conforming to ASW D1.1.

J. Camber: Fabricate all beams cambered as indicated on the drawings.

1. Fabricate beams without camber for installation with any "natural" crown up.
2. Exception: Fabricate cantilever beams with "crown" down.

K. Grinding: Grind smooth the following structural steel and connections;

1. Exposed cut ends of structural and fabricated shapes.
2. All welds exposed to view.
3. Mitered and fit-up corners and intersections.

L. Back-Up Bars: Required for all complete penetration welds. See requirements of AISC 358.

M. Bolt Holes: Edge, end distances and spacing shall conform to dimensions shown on the drawings, and as follows;

1. Round: Size indicated and 1/16 inch maximum oversize, except 1 inch and larger bolts may have 1/8 inch maximum oversize.
2. Slotted: At locations specifically noted on the drawings, provide size indicated and 1/16 inch by 1/4 inch oversize slotted in direction perpendicular to applied loads.
3. Holes in base plates for anchor bolts may be 1/8 inch oversize.

2.4 FINISHES

A. Steel exposed to inclement atmospheric conditions or weather (such as coastal moisture

or seasonal rain) shall be sufficiently primed or otherwise protected against corrosion. If condition of steel is suspect due to weathering/corrosion, Contractor shall bear cost of inspection to determine if excessive corrosion is present and if steel member(s) requires repair or replacement. Contractor shall bear cost of repair or replacement.

B. Prepare and finish structural and miscellaneous steel component surfaces as follows, unless a higher standard-of-care is determined necessary per item A:

1. Unpainted, interior, dry exposure surfaces need not be primed.
2. Finished painted, interior, dry exposure surfaces:
   a. Surface Preparation: SSPC-SP2 Hand-Tool and/or SP3 Power-Tool Cleaning. Apply Primer Type A. Field touchup with same primer.
   b. Where jobsite exposure is expected to exceed 6 months, SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning is required. Apply Primer Type B or C. Field touchup with same primer.
3. Finish painted surfaces with exterior exposure, interior exposure subject to wet conditions or fumes, or surfaces to receive high performance finish coatings (for example epoxy or urethane coatings.
   a. Surface Preparation: SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning to create a dense, uniform angular surface profile of 2.0 mils minimum. For severe (immersion) exposure, SSPC-SP10 / NACE No. 2 Near-White Blast-Cleaning is required.
   b. Apply Primer Type B. Field touchup with same primer.
4. Surfaces to be fire proofed need not be primed unless required by the fireproofing manufacturer or if jobsite exposure is expected to be inclement per item A. Where unprimed steel is to receive fireproofing, prepare steel surface as required by fireproofing manufacturer. If fireproofed surfaces are to be primed, provide primer as follows:
   a. Surface Preparation: SSPC-SP3 Power-Tool Cleaning.
   b. Apply Primer Type C. Field touchup with same primer.
5. Exterior exposed (unpainted) surfaces and as otherwise indicated to receive galvanizing:
   a. Galvanize per ASTM A123 Class 55 minimum. Passivation agents are not permitted on galvanized metal that is to be painted. Provide vent holes per ASTM A385 at closed sections (such as HSS). Submit proposed location of vent holes for review by Engineer.
   b. Connection hardware shall be hot-dip galvanized per ASTM A153 or F2329. Grade A325 high-strength bolt assemblies may be mechanically galvanized per ASTM B695 class 55 or hot-dip galvanized per ASTM F2329. Mating bolts and nuts shall receive the same zinc-coating process.
   c. Repair all uncoated, damaged, or altered galvanized surfaces per ASTM A780.

C. Do not prime the following surfaces unless otherwise indicated:

1. Connections to be field welded.
2. Steel in contact with concrete.
3. Surfaces to receive welded metal decking.

D. Slip critical bolted connection surfaces shall either be unfinished & prepared per the RCSC or primed per item B3 or B4.

E. Do not cover up work with finish materials until inspection is complete and work is approved by the Testing Agency.

2.5 SOURCE QUALITY CONTROL

A. An independent Testing Agency will perform source quality control tests and submit reports, as specified in pertinent sections of Division 01.

B. Steel Materials Testing:

1. No testing is required for materials identified in accordance with CBC Section 2202.1 (heat number, grade stencil, etc.).
2. Unidentified steel- General: Test all structural shapes. In addition, test to verify Fy and Fu values when engineering requirements exceed Fy = 25 ksi for design.
3. Charpy V-Notch (CVN) testing requirements are per AISC 341. Heavy sections requiring CVN testing are indicated on the documents.

C. Shop Welding Inspection:

1. Testing Agency shall inspect and certify all structural welds, unless the fabricating shop has been accredited in conformance with CBC requirements. Submit certification to the Architect/Engineer for review and the Building Official for approval.
2. Welder Qualifications: Welding inspector shall verify that all the welders are properly qualified prior to steel fabrication and state the qualifications of each welder in the welding inspection report.
3. Welding Inspection: Continuous inspection required unless otherwise noted below. Comply with requirements of AWS D1.1, AWS D1.8 and AISC 341.
   a. Welding Inspector shall check all welds, materials, equipment and procedures.
   b. Welding Inspector shall provide reports certifying the welding is as required and has been done in conformity with the plans, specifications and codes.
   c. Welding Inspector shall use radiographic, ultrasonic, magnetic particle, or any other necessary aid to visual inspection to assure adequacy of welds.
4. Periodic Inspection Acceptable:
   a. Single pass fillet welds not exceeding 5/16 inch.
   b. Welding of studs to beams.

D. Bolts, Nuts and Washers: Provide samples to Testing Agency for required testing, at no additional cost.

E. High Strength Bolted Connections: Provide testing and verification of shop-bolted connections in accordance with RCSC specifications. Test all bolts at each connection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Framing:

1. Erect all structural steel true and plumb.
2. Verify proper final alignment prior to making final connections.

C. Field Connections:

1. Workmanship of field bolted and welded connections shall conform in all respects to methods and tolerances specified for fabrication.
2. Field weld components indicated on shop drawings. Sequence field welds to minimize built-up stress and distortion of the structural frame. Verify sequence with Engineer. Coordinate field welding schedule with Testing Laboratory.
3. Welded Studs: Install in accordance with manufacturer's instructions and structural welding code AWS D1.1 and AWS D1.8.

D. Templates: Provide bolt setting templates for all anchor bolts. Provide instructions for the setting of anchors and bearing plates, verify these items are set correctly as work progresses.

E. Column base plates: Set level to correct elevations, support temporarily on steel wedges, shims, or leveling nuts where shown, until the supported members are plumbed and base plate is grouted.

1. Grout solid the full bearing area under base plates prior to installation of floor and/or roof decks.
2. Comply with manufacturer's instructions for high strength grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

F. Bolting - General:

1. Inspect mating surfaces to insure that bolt head and nut will have full bearing and that metal plies will mate flush between bolts.
2. Install bolts in matching holes. Do not distort metal or enlarge holes by drifting during assembly. Remake mismatched components to achieve tolerances indicated.
3. Holes mismatched in excess of 1/8 inch will be rejected.
4. Holes mismatched less than 1/8 inch may be reamed to the next larger size bolt.
5. Do not enlarge holes by flame cutting or air/arc (“plasma“) cutting.
6. Provide flat washer(s) at over-size holes.
7. Provide washers for all conditions per RCSC Section 6 and under nuts to connected parts less than ¼ inch thick.
8. Provide ASTM F436 beveled washers when the slope of the surfaces of parts in contact with the bolt head or nut is greater than 1:20.
9. Do not install bolts with damaged threads.
10. Threads shall commence outside of the shear plane where noted as HSB-X on drawings.

G. Bolting - Specific:

1. Machine Bolts (MB): Install and tighten to a snug condition (ST) such that laminated surfaces bear fully on one another, using an impact wrench or “full effort” of an installer using a standard spud wrench.
2. High Strength Bolts in Bearing/Shear or Static Tension joints snug tight (ST):
   a. Provide a hardened washer at the head/nut at slotted holes
   b. Install and tighten as per Machine Bolts (MB) snug tight (ST) and other

requirements of RCSC specification Section 8.

c. Use ASTM F436 washer only in snug tight connections with static tension loads.

3. High Strength Bolts in Pretensioned joints (PT):
   a. Provide ASTM F436 washer per requirements of RCSC Section 6.
   b. Install and tighten in accordance with the requirements of RCSC Section 8.
   c. Install bolts in all holes of the joint and compact the joint until the connected plies are in firm contact prior to pretensioning.
   d. The following tightening methods and bolt type are acceptable for PT joints:
      (a) Turn-of-the-nut pretensioning method
      (b) Calibrated wrench pretensioning method
      (c) Twist-off-type tension-control bolts
      (d) Direct-tension-indicator washer pretensioning method.
4. High Strength Bolts in Slip Critical (SC) joints:
   a. Provide tensioning for High Strength Bolts (PT) per above.
   b. Faying surfaces to be prepared per RCSC Section 3 and PART 2.

H. Supports, Shoring and Bracing: Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing. Conform to requirements of all applicable laws and governing safety regulations. Resist imposed loads, including those of stored materials and equipment.

1. Provide all temporary supports, shoring and bracing necessary to achieve work of tolerances indicated.
2. Provide all necessary temporary flooring, planking and scaffolding required for erection of steel, and support of erection machinery.
3. Construction Loading: Do not overload the structure or temporary supports with stored materials, equipment or other loads.
4. Maintain temporary bracing and shoring until work is complete, and longer as required to ensure stability and safety of structure.

I. Do not make final connections until structure is aligned to meet specified tolerances.

3.3 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. The independent Testing Agency will perform field quality control tests, as specified in pertinent sections of Division 01.

B. Field Welding Inspection: Conform to all requirements of section SOURCE QUALITY CONTROL.

C. High Strength Bolting: Provide testing and verification of field-bolted connections in accordance with RCSC Section 9.

1. Inspect mating surfaces.
2. Test all materials prior to use. Use only materials meeting specified

requirements.

3. Inspector shall review installation and verify “full effort” with installers for ST joints and shall randomly manually verify “full effort” on 10 percent of installed bolts.
4. Inspector shall verify installation for 100% of SC and PT joints.
5. Review installation procedures for all types of HSB joints and verify installation of “Twist-off” and load-indicator type bolts.
6. If any bolt fails testing, all bolts at the joint shall be loosened and re-tightened. Exception: Galvanized bolts shall be replaced prior to re-testing.

D. Welded Studs: Test headed studs electro-magnetically welded through metal deck to directly to steel members as follows:

1. Install minimum of two trial studs.
2. Testing Agency shall bend studs with a hammer to minimum 30 degrees out of axis.
3. Any failure shall require new studs be welded for another test and welding apparatus adjusted.

3.5 ADJUSTING

A. Touch-up damaged finishes with compatible specified primer.

B. Replace defective or damaged work with conforming work. Replace all defective work at Contractor's expense.

C. Straighten materials by means that will not injure the materials.

D. Replace defective or damaged work which cannot be corrected in the field with new work, or return defective items to the shop for repair.

E. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.

F. Pay expenses incurred by Owner for Architect/Engineer's costs for (re-)design and obtaining approvals of Authorities Having Jurisdiction (AHJ) necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

G. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

3.6 CLEANING AND PROTECTION

A. Clean all surfaces upon completion of erection; leave free of grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave surfaces broomed clean.

B. Protect work from damage by subsequent operations.

END OF SECTION

SECTION 05 30 00

METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: All material, labor, equipment and services necessary for the fabrication, erection, and completion of all metal decking as noted on drawings, including all supports for erection. The work shall include, but not necessarily be limited to the following:

1. Furnish metal decking, supports at structural steel, closures, flashing, weld plates, and necessary accessories, complete and ready to receive concrete or roofing.
2. Install metal decking including cutting, fitting, and welding.
3. All cutting and reinforcing of openings as required, and as laid out by other trades.

B. Related Sections:

1. Pertinent Sections of Division 01 Specifying Quality Control and Testing Agency Services
2. Pertinent Sections of Division 03 Specifying Concrete Construction
3. Pertinent Sections of Division 05 Specifying Structural Steel

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19 Concrete, Chapter 22 Steel.

B. American Iron and Steel Institute (AISI) S100 "North American Specification for the Design of Cold-Formed Steel Structural Members".

C. Steel Deck Institute (SDI) “Design Manual for Composite Decks, Form Decks and Roof Decks”.

D. International Code Council (ICC) “Acceptance Criteria (AC) 43 – Steel Deck Roof and Floor Systems”.

E. American Society for Testing and Materials (ASTM):

1. ASTM A653 “Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process”.
2. ASTM A780 “Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings”.
3. ASTM A1003 “Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members”.
4. ASTM A1008 “Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable”.

5. ASTM C1513 “Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections”.

F. American Welding Society (AWS) “D1.3 Structural Welding Code – Sheet Steel”.

1.3 SUBMITTALS

A. Shop drawings shall indicate all details of layout, fabrication and installation, location and dimension of openings, reinforcing and accessories, metal closures and flashing and type, size and location of all welds, and electromagnetically welded studs. Submit shop drawings before the start of fabrication. All details must reference detail callouts on the construction documents. Submittals that do not meet these requirements will be returned for correction without review.

B. Current ICC reports indicating design values.

C. Obtain reviewed structural steel shop drawings and verify all conditions before preparing shop drawings for metal decking; show all members required for support of metal decking on shop drawings for metal decking.

D. The Contractor shall review and approve shop drawings prior to submittal. The Architect's review is of a general nature only and all responsibility for conformance with drawings and specifications and for dimensions shall remain with the Contractor.

1.4 QUALITY ASSURANCE

A. All work under this section shall be fabricated and installed in strict accordance with the incorporated documents. Refer to pertinent sections of Division 05, Structural Steel.

B. Decking shall be installed in the field by an approved steel deck applicator with at least five years demonstrated successful experience in this type work.

C. All installation and welding shall be done by qualified, experienced workers skilled in their trade, in conformance with established standards of good practice and the manufacturer's recommendations. All welders shall be AWS certified.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection: Steel decking sheets shall be covered and protected from weather during transit and during storage at the job site. Sheets shall not be in contact with the ground and are to have a waterproof covering.

1.6 JOB CONDITIONS

A. Coordination: The Contractor shall secure all field measurements necessary for the completion of this work. The Contractor shall be responsible for all errors of detailing and fabrication and for the correct fitting of all metal decking to each other and to their supports. Provide holes and reinforcement for mechanical and electrical penetrations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Deck shall be of type and by manufacturer as specified on the drawings or approved equal. All equals must meet or exceed ICC approved design values of specified decking.

B. Steel decking and flashing shall be formed from steel sheets conforming to ASTM A653, A1003, or A1008 with a minimum yield strength of 40,000 psi. Before forming, the steel shall receive a protective metal coating of zinc conforming to ASTM A653 G60 wiped coating.

C. Deck Sections

1. Deck units shall be supplied in lengths to span over at least 3 supports where layout permits. All single span units shall have temporary mid-span shoring.
2. All deck units shall be provided with either an interlocking side lap or a lapping type side lap.
3. Venting Devices: Unless noted otherwise, all deck sections to receive cementitious fill shall be vented using individual separating clips of type, style and spacing recommended by deck manufacturer (space no more than 48" o.c. or a two per deck span) or built-in venting-slot formed as an integral part of deck profile. Venting slots are required only in non-cellular deck. Tabs shall be turned up into deck so that they cannot be used for hangers. Provide three rows of slots at 2'-0" on centers in three foot wide deck sections.
4. Flashing and Closure Plates: Provide 16 gauge zinc coated continuous flashing for deck units as detailed, or as required, at ends and sides, at openings and at deck perimeter to contain fill. Flashing shall be detailed and installed to prevent concrete leakage.
5. Reinforcing at openings and penetrations: Provide reinforcing at all openings and penetrations per PART 3.
6. Galvanization Coating Repair: Zinc dust-zinc oxide primer, ASTM A780.

D. Headed welded studs and deformed bar anchors: See section 05 1200 or 05 1100.

E. Painted Finish: Where painted finish is specified it shall be Manufacturer’s standard; baked on, rust inhibitive, applied to chemically cleaned surface.

F. Welding Electrodes: AWS Standard E60 or equivalent or E70 or equivalent, or as specified by AWS D1.3 and Manufacturer’s recommendation.

2.2 FABRICATION

A. All fabrication bevel cuts, etc. shall be done in the shop, and shall be equal to a high standard of workmanship. All deck units shall be shipped to the field in standard widths and in precut lengths so that end joints occur over supporting members.

B. Deck section shall be cut to fit all openings, which are required. Dimensions of openings and holes required for the work of other trades will be provided by respective trades for cutting of deck.

C. Misalignment of deck sections and cuts, short lengths, and poor workmanship shall be cause for rejection. All rejected work shall be replaced at the Contractor's expense.

2.3 SOURCE QUALITY CONTROL

A. An independent testing agency will perform source quality control tests and submit reports as specified in pertinent sections of Division 01.

B. Steel Materials Testing:

1. No Testing Required for Materials as follows:
   a. Materials identified in accordance with CBC 2202.1 and ASTM A6. (heat number, grade stencil, etc.)
   b. Materials accompanied by certified mill test reports for all members, and Contractor's affidavit confirming that all materials used in the fabrication and shipped to the job are from the grades specified and match the certificates supplied.
2. Unidentified steel: Where identification of materials by heat number or mill reports cannot be made, testing agency shall test unidentified deck.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The steel deck units shall be placed on the supporting framework, aligned, and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting beams. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of the steel units, the Contractor shall notify the Architect prior to taking corrective action to insure properly aligned work.

B. Deck units shall be placed in straight alignment for the entire length of run with close registration of the cells of one unit with those of abutting and adjoining units. Provide a minimum of 2 inch end bearing at abutting deck units. Continuous deck units shall be provided with a minimum of 3" bearing, all butt joints shall be "tight" (no gap).

C. Deck units shall not be placed on supporting members until all structural steel is completely installed, plumbed, and connections are completed.

D. Welding:

1. Steel deck units shall be fastened to the steel framework by the arc welding process. Welds shall be free of sharp points or edges.
2. All welding shall be done by competent experienced welders, thoroughly familiar with the metal to be welded, and certified for welding of light gauge metal.
3. Deck sheets shall be welded to the supporting member and to each other with welds as listed below unless otherwise noted on the drawings.
   a. End and intermediate support perpendicular to deck flutes: 3/4" diameter spot weld at each flute.
   b. Side joints between individual deck units with side interlock joint: 1-1/2" top or side seam weld at 12" on center. Button punch at 36" on center before welding to draw units together.
   c. Side joints between individual deck units where concrete is placed on the metal deck is to be button punched at 36" on center.
   d. Boundary deck units to parallel supports and interior deck units to parallel framing supports 3/4" diameter spot weld or 3/8" x 1-1/4" arc seam weld at 12" on center.
4. Weld all closure angles and plates with 3/4" diameter spot weld or 3/8"x 1-1/4" arc seam welds at 18" apart.

5. Headed welded studs and deformed bar anchors: See section 05 1200 or 05 1100.

E. Screw Attachment: When called for on the drawings, painted roof deck is to be attached with galvanized #12 hex head metal screws with neoprene washers at flutes and at 24" on center at side laps and at 12" on center at perimeter side laps. Screws and metal washers shall be painted to match deck color where decking is a painted finish surface.

F. Decking shall be installed in a continuous operation to avoid delays in the construction.

G. Opening reinforcement shall be as detailed on the drawings. Cutting of holes other than those detailed on the drawings shall be done only as specifically approved by the Architect. Holes not shown on structural drawings shall be cut and reinforced in accordance with details on drawings. In general, reinforcing is not required for holes less that 4" in diameter. Holes at column penetrations shall be reinforced as any other hole. See details on drawings for other requirements.

H. Leave slag in place at welds to be covered by concrete. Elsewhere, remove slag to bright metal and touch up all welds and field cut edges with galvanization repair primer.

I. Field Finishing:

1. Permanently exposed galvanized surfaces requiring welding shall be thoroughly cleaned by wire brushing after welding and then touched up with galvanization repair primer.
2. After erection all damaged surfaces shall be primed.
3. Painted deck shall be touched up with primer and matching paint.

3.2 FIELD QUALITY CONTROL

A. Welding Inspection:

1. Testing Agency shall inspect and certify all structural welds. Submit certification to the Architect/Engineer for review and the Building Official for approval.
2. Welder Qualifications: Welding inspector shall verify that all the welders are properly qualified prior to steel fabrication and state the qualifications of each welder in the welding inspection report.
3. Welding Inspection:
   a. Welding Inspector shall check all welds, materials, equipment and procedures.
   b. Welding Inspector shall provide reports certifying the welding is as required and has been done in conformity with the plans, specifications and codes.
   c. Periodic inspection per CBC is acceptable.

3.3 DEFECTIVE WORK

A. All work not in conformance with these specifications and/or generally accepted standards of the trade, will be deemed defective by the Architect and will be rejected. All work that is defective shall be corrected or replaced as directed by the Architect. Corrections redesign, and replacement of defective work shall be at Contractor's expense.

3.4 CLEANING

A. After erection, all surfaces shall be cleaned and left free of all grime and dirt. Decking shall be cleaned with solvents, if necessary to provide a surface, which will readily bond with concrete fill and direct-to-steel fireproofing. Remove unused materials, tools, scaffolding and debris from the premises and leave the area broom clean.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. All design and other services, material, labor and equipment as necessary for the fabrication, erection and completion of all cold formed metal framing including all bracing and shoring required for erection, miscellaneous metal, and related work.

B. Related Sections:
1. Pertinent Sections of Division 01 Specifying Quality Control and Testing Agency Sections
2. Pertinent Sections of Division 05 Specifying Structural Steel.

1.2 REFERENCE STANDARDS

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 22 Steel.

B. American Iron and Steel Institute (AISI) S100 “North American Specification for the Design of Cold-Formed Steel Structural Members”.

C. AISI S200 “North American Standard for Cold-Formed Steel Framing – General Provisions”.

D. AISI D100 “Cold-Formed Steel Design Manual.

E. American Welding Society (AWS) D1.3 “Structural Welding Code – Sheet Steel”

F. American Society for Testing and Materials (ASTM):
1. ASTM A307 “Stand Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength”.
2. ASTM A606 “Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance”.
3. ASTM A653 “Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process”.
4. ASTM A780 “Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings”.
5. ASTM A1003 “Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members”.
6. ASTM A1008 “Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable”.
7. ASTM A1011 “Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength”.
8. ASTM C645 “Standard Specification for Nonstructural Steel Framing Members”.
9. ASTM C754 “Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products”.
10. ASTM C955 “Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases”.

11. ASTM C1007 “Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories”.
12. ASTM C1513 “Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections”.

G. The Society for Protective Coatings (SSPC) SSPC-Paint20 “Zinc-Rich Coating (Inorganic or Organic)”.

1.3 SUBMITTALS

A. Shop Drawings
1. Show size and locations of all framing members in conformance to the criteria shown on the drawings.
2. Shop and field assembly details, including cuts and connections. All details must reference detail callouts on the construction documents.
3. Type and location of shop and field welds, screws, bolts, and fastening devices.
4. General Contractor shall review and approve shop drawings prior to submittal.
5. Shop drawing submittals that do not meet these requirements will be returned for correction without review.

B. Manufacturer's Literature:
1. Descriptive data illustrating cold-formed framing system components including framing members, fasteners, and accessories, including ICC-ES reports.
2. Erection instructions containing sequence of operations.

C. Samples: Provide adequate samples of unidentified material to the Owner's Testing Laboratory for testing purposes.

1.4 QUALITY ASSURANCE

A. Erector Qualifications:
1. Minimum of three years successful experience on comparable cold-formed metal framing projects.
2. Welders qualified in accordance AWS D1.3.

B. Cold form carbon and low alloy steel used for structural purposes shall be identified per CBC Section 2202.1.

C. Welding inspections shall conform to AWS D1.3 and CBC 1705.2.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Members of the "Steel Stud Manufacturers Association (SSMA)" with products meeting ICC-ES ESR-3064P. Members of the "Certified Steel Stud Association (CSSA)" with products meeting ICC-ES ESR-3016.

2.2 MATERIALS

A. Steel Framing System:
1. All stud and/or joist framing members shall be of the type & size as shown on the plans and reviewed shop drawings.
2. All runner and end tracks, bridging, and non-load bearing studs shall be of the type & size shown on the plans.

3. All studs, joists, and tracks 54 mils or greater in thickness shall be formed from steel that corresponds to the requirements of ASTM A1003 (Grade ST50H or ST50L) with a minimum yield of 50,000 psi.
4. All studs, joists, track, bridging, U-channel, (hat) furring (F) channels, and accessories 43 mils or thinner in thickness shall be formed from steel that corresponds to the requirements of ASTM A1003 (Grade ST33H or ST33L) with a minimum yield of 33,000 psi.
5. All stud and joist components shall be formed from steel having a minimum G-60 galvanized coating (equivalent coatings such as “G60e” are not acceptable), unless noted otherwise, or shall be primed with paint meeting the performance requirements SSPC-Paint20, where noted.
6. Welding Electrodes: Shall conform to AWS D1.3. E60 or E70. Touch up all welds with zinc-rich paint in compliance with ASTM A780.
7. Primer: SSPC-Paint20.

B. Screws shall be per ASTM C1513.

C. Machine bolts shall be per ASTM A307.

D. Powder Driven Pins (PDP): Hilti X-U, ICC ESR-2269. For use only where specified by the drawings.

E. Accessories: Cold-formed metal framing manufacturer's standard.

2.3 FABRICATION

A. Form members to manufacturer's standard shapes meeting design criteria.

B. Cut right angle connections of framing components to fit squarely against abutting members.

C. Prime un-galvanized steel to 1.5 mil (0.038) minimum dry film thickness.

PART 3 - EXECUTION

3.1 ERECTION

A. Clean surfaces that will be in contact after assembly.

B. Position members plumb, square and true to line.

C. Seat studs squarely in track with stud web and flange abutting track web with maximum 1/8 inch gap.

D. Connect members together by welding and/or fasteners in accordance with the drawings.

E. Do not splice studs. Provide "headers" and "trim studs" at openings as required. Studs shall be securely attached to tracks at all exterior walls except as noted below.

F. Provide for expansion and contraction between floors at solid wall sections of two stories or more by providing a slip joint between stud and track at one end. This connection shall be capable of transmitting lateral loads to the structure.

G. Provide and install bridging, fire blocking, etc. per manufacturer's recommendations, the plans, and code requirements.

H. Perform welding in accordance with AWS D1.3

I. Remove erection bolts and screws used in welded construction.

J. Do not use gas cutting for field correction of fabrication without concurrence of Architect/Engineer.

K. Touch-up field connections and breaks in shop coating with same primer used for shop priming.

3.2 DEFECTIVE WORK AND MATERIALS

A. Work found to be defective, missing or damaged shall be immediately replaced with proper work. Such replaced work and the inspection for same shall be at the expense of the Contractor.

B. Straightening of any materials, if necessary, shall be done by a process and in a manner that will not injure the materials, and which is approved by the Architect. Sharp kinks or bends shall be cause for rejection. Heating will not be allowed.

C. If defects or damaged work cannot be corrected in the field, the material shall be returned to the shop or new parts furnished, as the Architect directs; the Contractor shall replace all work at his own expense.

3.3 CLEANING

A. After erection, all surfaces shall be cleaned and left free of all grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave broom clean.

END OF SECTION

SECTION 23 00 00

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL REQUIREMENTS

1.1 GENERAL CONDITIONS:

The general conditions and Division 1 are a part of this section and the contract for this work and apply to this section as fully as if repeated herein. This section, 230000, applies to all Division 23 categories, including but not limited to:

Section	22 04 00	Plumbing
	23 08 00	Heating, Ventilating and Air Conditioning

A. Reference to Other Sections: The applicable requirements from the above sections shall form a part of the mechanical work and each section shall consult the other sections in detail for general and specific requirements.

1.2 SCOPE:

These Division 23 specifications and the accompanying drawings are intended to comprise the furnishing of all labor, and the furnishing and installing of all materials, equipment and supplies as specified herein and required for the satisfactory completion by the Contractor of all work pertaining to mechanical trades.

1.3 EXPLANATION OF DRAWINGS AND REFERENCE TO SCHEDULES:

B. The drawings and these specifications are complementary to each other in that all apparatus, materials and equipment outlined in the drawings and/or specified herein shall be considered essential to the contract.

C. The specifications are intended to describe the quality and character of the materials and equipment and methods of installation. All miscellaneous items of work and materials necessary for the completion of the installation shall be provided, whether or not mentioned in the specifications or shown on the drawings.

D. Space allotted, clearances, access, electrical data, structural supports, etc., on drawings, is for equipment models and sizes as listed in schedules on plans. The Contractor shall assume the responsibility for the coordination with other trades required in the use of equal or substitute equipment or materials and pay all difference in cost arising from such substitutions, regardless of approval.

E. Separate Sections cover the Site Work, Architectural Work and the Electrical Work. The Contractor shall familiarize themselves with the entire specification.

F. Should there be any question as to the scope of the work for which the Contractor is responsible, they shall ask the Architect for an interpretation before submitting their bid. In the event that the Contractor finds discrepancies or omissions or is in doubt as to the exact meaning of the plans and/or specifications, they shall, before submitting bid, contact the Mechanical Engineer for clarification.

G. For purposes of clearness and legibility, drawings are diagrammatic and, although size and location of equipment are drawn to scale wherever possible, the Contractor shall make use of all data in all the contract documents and shall verify this information at building site.

H. The drawings indicate required size and points of termination of pipes, and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets and beam cans, and it shall be the work of the Contractor to make the installation in such a manner as to conform to structure, avoid obstruction, preserve headroom and keep openings and passageways clear.

I. It is intended that all apparatus be located symmetrical with architectural elements. Refer to architectural details in completing the correlating work.

J. The Contractor shall fully inform themselves regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under the contract. They shall exercise due and particular caution to determine that all parts of their work are made quickly and easily accessible.

K. The Contractor shall study all drawings and specifications to determine any conflict with ordinances and statutes. Any errors or omissions shall be reported, and any changes shall be shown in the as-built drawings and the additional work performed at no cost to the Owner.

L. The submittal of bid shall indicate that the Contractor has examined the site and the drawings and has included all required allowances in their bid. They shall also determine in advance and make allowances for the methods of installing and connecting the equipment, the means of getting equipment in to place and they shall make themselves familiar with all the requirements of the contract. No allowance will be made for any error resulting from the Contractor's failure to visit job site and to review drawings, and bid shall include costs for all required drawings and changes as outlined above.

M. The Contract Drawings indicate the extent, the general location and arrangement of equipment, piping, ductwork, etc. Equipment, piping and ductwork shall be located to avoid interference with electrical, plumbing and structural features. All locations for mechanical work shall be checked and coordinated with the building, structural, electrical work.

N. If any conflicts occur necessitating departures from the Contract Drawings, details of departures and reasons therefore shall be submitted as soon as practical for written approval, and the piping, ductwork, fixtures or equipment affected shall not be installed until approval is received.

O. Reference to Drawing Schedules:

1. Refer to equipment schedule for unit identification number and corresponding capacity and design requirements.

2. Wherever schedules or notes appear on the Drawings or in the specifications in which sizes and capacities of equipment are indicated, the equipment furnished and installed under this contract shall meet the following requirements under operating conditions.

1.4 DEFINITIONS:

A. "Provide" shall mean "provide complete in place," that is, "furnish and install."

B. "Piping" shall mean pipes, fittings, valves and all like pipe accessories connected thereto.

C. Pressure ratings specified, such as for valves and the like, is the design working pressure and is for and with reference to the fluid which the device will serve.

D. "Ductwork" shall mean ducts, plenums, compartments, casings or any like devices, including the building structure, which is used to convey or contain air.

E. "Building Boundary" shall mean exterior building walls.

F. "Mechanical Work" shall mean all work specified and shown in the Division 23, "Mechanical," categories. Mechanical Work generally includes: Plumbing, and Heating, Ventilating, Air Conditioning.

1.5 CODES AND STANDARDS:

A. All work, material or equipment shall comply with the requirements of codes, ordinances and regulations of the local Government having jurisdiction at the location of the work, including the regulations of serving utilities, and any participating Government agencies having jurisdiction.

B. The latest editions of the following Specifications, Codes and Standards shall form a part of these specifications, the same as if herein written out in full, and all materials and installations include but not be limited to:

1. CMC (California Mechanical Code)
2. ASHRAE (American Society of Heating, Refrigeration and Air Conditioning)
3. UL (Underwriters' Laboratories, Inc.)
4. AMCA (Air Moving and Conditioning Associates)
5. California State Division of Industrial Safety
6. SMACNA HVAC Duct Construction Standards
7. CBC (California Building Code)
8. NFPA (National Fire Protection Association)
9. San Diego County Codes
10. California Administrative Code, Title 24
11. Requirements of the State Fire Marshall
12. National Electrical Code
13. ASTM (American Society for Testing and Materials)
14. AGA (American Gas Association)
15. OSHA
16. CPC (California Plumbing Code)
17. CEC (California Energy Code)

C. No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. No apparatus, equipment, device or construction shall be installed which will provide a cross connection permitting any backflow or siphonage from any source into the domestic water supply system.

1.6 PERMITS AND FEES:

Obtain all permits, patent rights, and licenses that are required for the performing of the work by all laws, ordinances, rules and regulations, or orders of any officer and/or body, give all notices necessary in connection therewith, and pay all fees relating thereto and all costs and expenses incurred on account thereof. No work shall be covered before inspection by the jurisdictional authority and the Architect.

1.7 SUPERVISION AND COOPERATION:

A. The Contractor shall include the services of experienced superintendents for each sub- section who shall be constantly in charge of the work, together with the qualified journeymen, helpers, and laborers, required to properly unload, install, connect, adjust, start, operate and test the work involved, including equipment and materials furnished by others.

B. The work under this section shall be in cooperation with the work of other trades to prevent conflict or interference and to aid rapid completion of the overall project.

1.8 PROJECT SITE VISIT:

Periodic visits to the project site by the Engineer are for the expressed purpose of verifying compliance with the contract documents. Such site visits shall not be construed as inspections, construction supervision, i.e., the Engineer assumes no responsibility for providing a safe place for the performance of the work by the Contractor or the Contractor's employees or the safety of the supplies of the Contractor. Neither shall such site visits relieve the Contractor of the responsibility for the discovery of their own errors and the correction of them, nor of the responsibility of properly performing the work.

1.9 COORDINATION:

A. The Contractor shall be responsible for providing all information, drawings or layouts of equipment or work under this section which affect the work of the other trades.

B. In case changes in the indicated locations or arrangements are necessary due to developed conditions in the construction, or rearrangement of furnishings, or equipment, these changes shall be made without extra cost to the Owner, provided the change is ordered before work directly connected is installed, and no extra materials are required.

1.10 EXISTING UTILITIES:

A. The location of utilities shown on the plans is the best-known information available at time of design. The Contractor shall contact the appropriate agencies and confirm the information and make arrangements for connection thereto, prior to excavation and installation of any piping or systems.

B. Prior to installation of any waste and soil lines the Contractor shall physically verify whether the building sewer can be installed and properly connected to the sewer main. Any work requiring added expense which is caused by the Contractor to make such physical verification shall be borne by the Contractor.

1.11 UTILITY SERVICES DURING CONSTRUCTION:

All water and electric power used for construction shall be paid for by the Contractor.

1.12 SUBMITTALS AND SHOP DRAWINGS:

A. Equipment and materials shall be submitted to the Architect for approval within 30 days after award of Contract and prior to fabrication or purchase of equipment and materials.

B. Installation of materials or ordering of equipment prior to approval of submittals is done entirely at the risk of the Contractor.

C. Unless otherwise specifically directed in the following specifications, the submittals by the Contractor to the Architect shall be as follows:

1. Submit all items at one time in a neat and orderly manner as individual electronic, Portable Document Format (PDF) indexed files. A partial submittal will not be acceptable.
2. Reference catalog cuts and brochures of products to proper paragraph in specifications. Furnish numerical index by specification article number, listing product name, catalog number and reference to page number of submittal brochure.
3. Cross reference individual catalog numbers of substitute products to number of specified materials.
4. Submit manufacturers' certification that equipment meets or exceeds the minimum requirements as specified.
5. Where materials, equipment and installations are specified to conform with societies or agencies such as ANSI, ASHRAE, SMACNA, etc., submit certification of such compliance.
6. The submittal shall be complete and with manufacturer’s selection data and information properly tagged to match equipment schedules and marked to show, among other things, material capacity and performance to meet capacities or performance as specified or indicated.
7. The Contractor is responsible for confirmation of code approval of material and equipment. Certification of code conformance by the manufacturer shall be submitted for:
    a. Water heaters.
    b. Backflow preventors.
8. If the Contractor submits a product that is specified, a complete set of brochures, rating tables, etc., is still required for future reference.
9. Review of the submittal is only for general conformance with design concept of project and general compliance with information given in the contract documents. The Contractor is responsible for confirmation and correlation of the dimensions, quantities and sizes, for information that pertains to fabrication methods or construction techniques, and for coordination of work of all trades. Deviations from drawings and specifications shall be clearly and completely indicated (by a separate letter) in the submittal.

10. For items, which are not manufactured, and which have to be specifically fabricated, including drawings and typical duct construction and complicated portions of ductwork as electronic, Portable Document Format (PDF) files and detail description shall be submitted. Shop drawings shall be submitted with such promptness as to allow ample time for examination and any re-submittal.

D. For duct and piping shop drawing development, the contractor shall obtain the most current architectural, structural and electrical CAD/Revit files. Files shall be overlaid on to mechanical duct and piping shop drawings files using Navisworks by Autodesk for clash detection by the contractor's BIM Coordinator.

1.13 SUBSTITUTIONS:

A. Substitution of an article, device, product, material, fixture, form or type of construction, other than those specified by name, make or catalog number is not permitted before the bid date. The contractor awarded the project, may propose substitutions as part of the submittal package as value engineering items. Written approval cannot be finalized until submittals are examined and credit to the owner is established.

B. It is the responsibility of the contractor to coordinate substituted materials and equipment with all trades. If the use of substituted equipment results in an increase in the cost, including the work of other trades, the Contractor shall be solely responsible for payment of said increase in cost.

1.14 GUARANTEE:

A. In addition to the guarantees required elsewhere, all work, materials and equipment provided under the mechanical sections shall be guaranteed for a period of one year from the date of acceptance of the work by the Owner. Should any trouble develop during this period due to defective materials or faulty workmanship, the Contractor shall immediately furnish all necessary labor and materials to correct the trouble without cost to the Owner. The Contractor, under this guarantee, shall be responsible for all damages to any part of the premises caused by equipment furnished under this section.

B. Furnish written certified guarantee, in acceptable form, to the Owner, against defective workmanship, materials and operating equipment. Further guarantee to rebalance and adjust entire system, or any part thereof as required for perfect operation for a period of at least one year after acceptance. Compressors shall have five-year warranty. Repair, replace and make satisfactorily operative any and all defective items and work, holding the Owner free from any cost and liability in connection therewith, for the term of the guarantee.

1.15 INTERRUPTION OF SERVICES:

A. Existing services required to stay in operation in areas not remodeled shall be maintained rerouted or otherwise provided with temporary connection to prevent interruptions.

B. If impossible to prevent interruptions, they shall be performed during "off-hours" and coordinated with the Owner's Representative.

C. Provide a minimum of seven (7) days written notice of interruption. Do not interrupt services without written consent of the Owner.

1.16 DAMAGE BY LEAKS:

The Contractor shall be responsible for damage to the grounds, walks, roads, buildings, furnishings, piping systems, electrical systems and their equipment and contents, caused by leaks in the piping systems being installed or having been installed herein. They shall repair at their expense all damage so caused.

1.17 EMERGENCY REPAIRS:

The Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding the Contractor's guarantee bond nor relieving the Contractor of his responsibilities.

1.18 DEMOLITION:

A. Demolition, capping and rerouting shall be performed as shown and as required to accommodate new construction.

PART 2 – PRODUCTS

The specification of the mechanical products is detailed in the individual specification sections of Division 23.

PART 3 – EXECUTION

3.1 INSTALLATION INSTRUCTIONS:

A. The requirements of "mechanical" installation is detailed in the individual specification sections of Division 23. In addition, the following general requirements shall apply:

1. Obtain Manufacturer's printed installation instruction to aid in properly executing work of installing equipment whenever such instructions are available. Submit three copies of such instructions to the Architect prior to time of installation for use of supervising the work.

2. Erect equipment in a neat and workmanlike manner. Align, level and adjust for satisfactory operation. Install so that connecting and disconnecting of piping and accessories can be made readily, and so that all parts are easily accessible for inspection, operation, maintenance and repair. Minor deviation from arrangements shown on drawings may be made, as approved by the Architect.

3.2 PROTECTION OF PIPING SYSTEMS:

A. It shall be the responsibility of the Contractor to install and maintain pipe and equipment which is reasonably clean and free from rust, dirt, scale, etc. Where necessary, the Contractor shall provide temporary airtight covers at all pipe and equipment openings.

B. Before turning the systems over to the Owner, all piping systems shall be thoroughly flushed of all scale and dirt. Drains shall be installed at the low points to facilitate flushing of the piping systems.

3.3 PROTECTION OF AIR HANDLING SYSTEMS:

A. The Contractor shall continuously maintain adequate protection to keep dirt and foreign matter from getting into the air handling system.

B. Ductwork and equipment shall not be left open for any extended period of time. Open section and open fittings shall be capped wherever they occur until such time as final connections are made to equipment, grilles, register, etc. as required by SMACNA IAQ Guidelines.

3.4 PROTECTION OF ELECTRICAL SYSTEMS:

Do not route liquid filled pressure and drain piping over electrical equipment, switchboards motor control centers and the like. When unavoidable, install galvanized drain pans to prevent liquid from dripping or squirting onto such equipment.

3.5 EXCAVATION AND BACKFILL:

A. See "Earthwork" section of the specifications for requirements. In addition, the following shall apply:

1. Execute all excavation to grades to accommodate elevations indicated and where invert elevations are not indicated, provide minimum coverage (above top of pipes) as follows:

a. Any piping under building slab (top of pipe to underside of slab) 18-inches.
b. Steel, cast iron, and copper in other locations 30-in.
c. Clay and Plastic piping in other locations - 36-in.

2. Excavation for pipes shall be cut a minimum of six-inches below the required grade. A six-inch bed of sand or other approved material shall be then placed and properly compacted to provide an accurate grade and uniform bearing throughout the length of the pipe, except for plastic piping for which sand shall be used.

3. Sand used shall be washed river sand normally used for backfill purposes, free of clods or lumps of clay, rock, debris and rubbish.

4. Backfilling shall not be placed until the work has been inspected, tested and approved.

5. PVC piping excepted, backfill to point 12-inches above top of piping with fine earth (excavated material may be used) free of excessive amounts of clay, debris, rubbish, rocks, or clods, as approved by the Architect. Backfill above 12-inches from top of piping may be with excavated material. Apply backfill by hand in 6-inch deep layers the full width of the trench. Moisten each layer (do not flood or puddle), and hand tamp to a minimum 90 percent compaction before proceeding with the next layer of backfill. Note: PVC piping shall be backfilled with sand to a point 12-inches above top of piping, remainder of trench may be backfilled with fine earth as specified above.

6. Clods or lumps one-inch in size or larger will not be permitted in the backfill. If the excavated material is not suitable adequate material shall be provided by hauling from other locations.

7. Surplus earth or material remaining after backfilling shall be removed from the site as indicated in Section entitled "Earthwork."

8. Do not excavate under or near foundations or footings except in manner permitted and approved by the Architect. Do not backfill until installed piping has been successfully tested and approved for backfill by the jurisdictional inspector and the Architect.

3.6 RECORD DRAWINGS:

A. The Contractor shall keep an accurate dimensional record of the as-built locations of all work under this Contract. This record shall be kept up-to-date at all times on blue line prints or an electronic set of plans as the job progresses and shall be available for inspection at all times.

B. Upon completion of the work, the contractor shall obtain from the Architect CAD/Revit files of the applicable contract documents. All changes and information contained on the Record Drawings shall be transferred to the new CAD/Revit files.

C. The Contractor shall submit one electronic, Portable Document Format (PDF) files and one CAD/Revit set of files, of the completed reproducible Record Set for approval. Make such changes and correction as may be required for final approval.

D. When final approval is received, sign the reproducible Record Set and stamp or note "As-Built" and submit to the Architect.

E. Final observation will not be made until these approved as-built drawing files have been received by the Architect.

3.7 CUTTING AND PATCHING:

A. Perform all cutting and fitting required for work of this Section in rough construction of the building.

B. All patching of finished construction of building shall be performed under the section of specification covering these materials.

C. All cutting of concrete work by this Contractor shall be by core drilling or concrete sawing. No cutting or coring shall be done without first obtaining the permission of the Architect.

D. Information regarding requirements for openings, recesses, chases in the walls, partitions, framing or openings shall be provided for work under the appropriate sections of the specifications in advance of the work. Should this be neglected, delayed or incorrect and additional cutting is found to be required, this work shall be accomplished at no additional cost to the Owner.

E. All access panels shall be approved by the Architect as to location, appearance, and finish.

3.8 VIBRATION ELIMINATION AND CONNECTORS:

Rotating or reciprocating mechanical equipment shall be mounted on or suspended from vibration isolators to prevent vibration and structural borne noise transmission to the building. Refer to each mechanical trade section of these specifications for specific details. Flexible duct connection shall be used between all fan openings and sheet metal work. Flexible connectors shall be used in piping connections to rotating or reciprocating equipment. See individual mechanical sections for specifications.

3.9 REQUIREMENTS FOR FINAL INSPECTION:

A. All of the following items must be completed prior to final inspections. No exception and no final payment will be made until all items are completed and approved. For specific requirements see the individual section in the Division 23 Category.

1. Cleaning equipment and premises
2. Test and balance of systems
3. Test and balance reports are reviewed by the Engineer
4. Service manual
5. Pipe and valve identification
6. Pipe and valve identification schedule
7. Operation tests
8. Operating instructions
9. As-built drawings
10. Certification of water sterilization
11. CALGreen and Title-24 Acceptance forms

3.10 EARTHQUAKE RESTRAINT:

A. General:

B. All earthquake resistant designs for mechanical equipment, such as air handling units, water heaters, blowers, motors, ductwork, mechanical and plumbing piping, shall conform to the regulations of the California Building Code.

C. The restraints which are used to prevent disruption of the function of the piece of equipment because of the application of the horizontal force shall be such that the forces are carried to the frame of the structure in such a way that the frame will not be deflected when the apparatus is attached to a mounting base and equipment pad, or to the structure in the normal way, utilizing the attachments provided. Equipment, piping, ductwork, etc. shall be secured to withstand a force in any direction equal to the value stated in the CBC for Commercial Buildings and the CAC for Healthcare Facilities, Schools, and Public Buildings.

D. Piping:

1. All HVAC and Plumbing piping shall be secured by bracing at every fourth hanger transversely and every eighth hanger longitudinally. Bracing shall be done in accordance with the NFPA Code, and as described in paragraph "Sway Bracing for Protection against Earthquakes," of that code.

2. As approved by code authority, the SMACNA "Guidelines for Seismic Restraints of Mechanical Systems" may be used as a guide.

E. No sway bracing is required for pipes that are installed on very short hangers (12-inches or less).

F. As approved by the code authority a bracing system as manufactured by "Superstrut" or "Pipe Shields Inc." may be used.

3.11 ADJUSTMENTS OF SYSTEMS AND OPERATION TESTS:

A. When the work included in these specifications is complete, and at such time as directed by the Architect, the Contractor shall adjust all parts of the systems, advising the Architect when this has been done and the work is ready for their final tests. Refer to "Balancing and Testing Procedures" in Section 23 00 00.

B. The Owner may require operation of parts or all of the systems prior to final acceptance. If it becomes necessary for temporary use of the systems before all parts are complete, the Contractor shall adjust all parts as far as possible in order to make such temporary use as effective as possible. After temporary use and before acceptance tests, all systems shall be readjusted to meet permanent operational requirements. This occupancy shall not be construed as final acceptance cost of utilities for such operation will be paid by the Owner.

C. Operation Test and Instruction:

1. After final acceptance, the Contractor shall operate all mechanical systems and provide operational instructions for a period of at least one eight-hour day to demonstrate fulfillment of the requirements of the contract. During this time, all adjustments shall be made to the equipment until the entire system is in satisfactory operating condition acceptable to the Architect.

2. Final Operation Instructions: Contractor shall place a competent person at the building who shall operate the systems instructing the Owner's Representatives in all details of operation and maintenance.

3. Any required instructions from manufacturer's representatives shall be given during this period.

4. All arrangements for operation and instruction periods shall be made through the Architect.

D. For specific requirements see individual Mechanical Sections.

3.12 RUBBISH REMOVAL AND CLEANING:

Upon completion of the work under this section, the Contractor shall remove all surplus materials, equipment and debris incidental to their work, and leave the premises clean and orderly.

3.13 SERVICE:

Ninety (90) days free service shall be provided after completion of the job including changing of filters. Replacement filters shall be provided by the Owner and shall be on the job site.

3.14 PAINTING:

A. Excepting piping identification specified in the specific section all painting is specified in the Painting Section of the Specifications.

B. Surfaces to be painted shall be cleaned of cement, plaster and other spills.

C. Factory finishes shall be repaired to original condition when scratched or dented.

END OF SECTION

ITEM	QTY	MFG	MODEL	DESCRIPTION
		Standard Conference Room		
1				**DISPLAY EQUIPMENT**
2	1	SAMSUNG	SAMQB98T	LCD, 98" 4K/UHD 350NIT 183LB 4000:1 CONT MAGICINFO S6 24/7
3	5	SAMSUNG	SAMQB85R	LCD, 85" 4K/UHD 350NIT 108LB 4000:1 CONT 16/7 (2) 10W SPKR
4	6	CHIEF	CHIXTM1U	MOUNT, FUSION MICRO-ADJ TILT WALL MOUNT, EXTRA LARGE
5	3	SAMSUNG	SAMQB75R	LCD, 75" 4K/UHD 350NIT 94LB 4000:1 CONT COO VIETNAM NON-TAA
6	1	SAMSUNG	SAMQB65R	LCD, 65" 4K/UHD 350NIT 56LB 6000:1 CONT - (NON-TAA)
7	4	CHIEF	CHILTM1U	MOUNT, MICRO ADJUST TILT WALL MOUNT, LARGE
8	1	SAMSUNG	SAMQB43R	LCD, 43" 4K/UHD 350NIT 30LB 5000:1 CONT - (NON-TAA)
9	1	CHIEF	CHIMTM1U	MOUNT, MEDIUM FUSION MICRO-ADJ TILT WALL MOUNT
10	11	CHIEF	CHIPAC526FC	ENCLOSURE, WALL, 16 X 16, MTI-D, PRE/PST INST, CVR
11				**TEAMS UC EQUIPMENT**
12	9	LOGITECH	LOGTAPMSTLARGE	VIDEO CONFERENCING PACKAGE, LARGE ROOM BUNDLE, TAP-MICROSOFT
13	9	LOGITECH	LOG939001644	RALLY MOUNTING KIT
14	22	LOGITECH	LOG952000002	MOUNT, RALLY MIC POD TABLE
15	9	LOGITECH	LOG939001647	RALLY MIC POD HUB
16	5	LOGITECH	LOG989000430	MICROPHONE POD, ADD ON MIC, OMNI DIRECTIONAL
		Standard Command Private Office		
1				**DISPLAY EQUIPMENT**
2	12	SAMSUNG	SAMQB55R	LCD, 55" 4K/UHD 350NIT 39LB 4000:1 CONT - (NON-TAA)
3	12	CHIEF	CHIMTM1U	MOUNT, MEDIUM FUSION MICRO-ADJ TILT WALL MOUNT
4	12	CHIEF	CHIPAC526FC	ENCLOSURE, WALL, 16 X 16, MTI-D, PRE/PST INST, CVR
5				**BYOD UC EQUIPMENT**
6	12	LOGITECH	LOG960001101	WEBCAM, VTC MEETUP, 30 FPS, USB 2.0, 3840X2160, MICROPHONE
7	12	LOGITECH	LOG939001498	MOUNTING BRACKET FOR VTC CAMERA, BLACK
8	12	CABLES TO GO	CAB39702	PLATE, HDMI/USB DONGLE F/F - WHITE
		Fire Dept. Boardroom		
1				**LCD DISPLAY EQUIPMENT**
2	3	SAMSUNG	SAMQB98T	LCD, 98" 4K/UHD 350NIT 183LB 4000:1 CONT MAGICINFO S6 24/7
3	2	SAMSUNG	SAMQB75R	LCD, 75" 4K/UHD 350NIT 94LB 4000:1 CONT COO VIETNAM NON-TAA
4	3	CHIEF	CHIXTM1U	MOUNT, FUSION MICRO-ADJ TILT WALL MOUNT, EXTRA LARGE
5	2	CHIEF	CHIPDRUB	MOUNT, UNIVERSAL DUAL SWING ARM WALL MOUNT - BLACK
6	5	CHIEF	CHIPAC526FC	ENCLOSURE, WALL, 16 X 16, MTI-D, PRE/PST INST, CVR
7	5	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
8				**CEILING DIAS LCD MONITORS**
9	4	SAMSUNG	SAMQB55R	LCD, 55" 4K/UHD 350NIT 39LB 4000:1 CONT - (NON-TAA)
10	4	CHIEF	CHILCM1U	MOUNT, SINGLE CEILING, LARGE - BLACK
11	4	CHIEF	CHICMA100	CEILING PLATE WITH ADJUSTABLE EXTENSION COLUMN, BLACK
12	4	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
13				**DIAS MONITOR EQUIPMENT**
14	4	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
15	3	CRESTRON	CREHDDA84KZE	DISTRIBUTION AMP 1 TO 8 HDMI W/4K60 4:4:4 & HDR SUPPORT
16	13	CRESTRON	CRECBLHD20	CABLE, 20 FT HDMI INTERFACE CABLE
17	13	DELL COMPUTERS	DEL210ADOF	LCD, 27" MONITOR 3840x2160 350NIT 16:9 WS 1000:1 4K (P2715Q)
18				**DIAS DIGITAL DISCUSSION SYSTEM**
19	1	TAIDEN INDUSTRIAL CO., LT	TAIHCS4100MC52	FULLY DIGITAL CONGRESS SYSTEM MAIN UNIT, DISCUSSION VOTING
20	1	TAIDEN INDUSTRIAL CO., LT	TAIHCS4890CVSB50	FULLY DIGITAL CONGRESS SYSTEM CHAIRMAN KIT, TABLETOP - BLK
21	12	TAIDEN INDUSTRIAL CO., LT	TAIHCS4890DVSB50	FULLY DIGITAL CONGRESS SYSTEM DELEGATE KIT, TABLETOP - BLK
22	2	TAIDEN INDUSTRIAL CO., LT	TAICBL6PS20	CABLE, 20M 6-PIN EXTENSION PLENUM
23	13	TAIDEN INDUSTRIAL CO., LT	TAIMS47EGF1S	STEM MICROPHONE, 18.5" 5-PIN CONNECTOR, TWO-COLOR
24	1	TAIDEN INDUSTRIAL CO., LT	TAIHCS421450	VOTING MANGEMENT MODULE
25	1	TAIDEN INDUSTRIAL CO., LT	TAIHCS421350	MICROPHONE MANGEMENT MODULE
26	1	TAIDEN INDUSTRIAL CO., LT	TAIHCS421052	SOFTWARE, BASIC SYSTEM SETUP MANAGMENT MODULE
27	2	TAIDEN INDUSTRIAL CO., LT	TAIMVPROJREV	ONLINE PROJECT REVIEW
28	2	TAIDEN INDUSTRIAL CO., LT	TAIMVCOMMWEB	SERVICE, REMOTE COMMISSIONING/TRAINING (QUOTE REQUIRED)
29	3	TAIDEN INDUSTRIAL CO., LT	TAIMVSLAGOLD	MAINTENANCE/SUPPORT, 1 YEAR, PREMIUM (QUOTE REQUIRED)
30				**PRESENTER PODIUM EQUIPMENT**
31	1	TBD	OFE	OWNER FURNISHED PRESENTER PODIUM
32	1	TBD	OFE	PODIUM TOP HDMI CONNECTION
33	1	SHURE	SHUMX415C	MICROPHONE, 15" SHOCK-MOUNTED GOOESNECK, CARDIOID
34	1	CRESTRON	CREDMTX4KZ100C1GBT	TRANSMITTER, 4K DigitalMedia 8G+ 4K60 HDR WALLPLATE (BLACK)
35	1	CRESTRON	CREDMNVXE760C	ENCODER CARD, DM 4K60 4:4:4 HDR NETWORK AV W/DM INPUT
36	1	CRESTRON	CRETSW770BS	TOUCH SCREEN, 7" WALL MOUNT, BLACK SMOOTH
37				**CONTROLLER STATION EQUIPMENT**
38	3	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
39	2	DELL COMPUTERS	DEL210ADOF	LCD, 27" MONITOR 3840x2160 350NIT 16:9 WS 1000:1 4K (P2715Q)
40	2	QSC	QSCADC6TLP	SPEAKER, 6.5" CEILING LOW PROFILE, 70/100V (ORDER IN PAIRS)
41	1	TBD	OFE	OWNER FURNISHED PC FOR VOTING & AGENDA
42				**TEAMS ROOM EQUIPMENT**
43	1	TBD	OFE	OWNER FURSNISHED PC FOR TEAMS
44	2	QSC	QSCPTZ12X72	CAMERA, PTZ 12X OPTICAL ZOOM 72 DEGREE HORIZONTAL, 12V, GY
45	2	QSC	QSCPTZCMB1	BRACKET, CEILING MOUNT FOR PTZ CAMERA
46	1	QSC	QSCIOUSBBRIDGE	Q-SYS POE BRIDGING ENDPOINT FOR AV TO USB BRIDGING
47	3	CRESTRON	CREDMNVX360C	ENCODER/DECODER CARD, DM NVX 4K60 4:4:4 HDR NETWORK AV

		Fire Dept. Boardroom (Cont.)		
48				**VIDEO ROUTING EQUIPMENT**
49	1	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
50	2	CRESTRON	CREDMFCI8	CARD CHASSIS, DM FOR DM-NVX-C & DMCF, 8 SLOTS
51	1	GRANICUS	OFE	OWNER FURNISHED GRANICUS CAPTURING PC
52	3	CRESTRON	CREDMNVX360C	ENCODER/DECODER CARD, DM NVX 4K60 4:4:4 HDR NETWORK AV
53	1	CRESTRON	CREDMXIODIR160	SWITCH, DIGITALMEDIA XiO DIRECTOR - FOR 160 ENDPOINTS
54				**AUDIO EQUIPMENT**
55	1	QSC	QSCCORE510IKIT	SYSTEM, INTEGRATED CORE W/8 I/O CARD SLOTS, 256 NETWORKED CH
56	3	QSC	QSCCIML4	CARD, 4CH MICROPHONE / LINELEVEL ANALOG AUDIO INPUT
57	2	QSC	QSCCOL4	4 CHANNELS OF BALANCED LINE LEVEL AUDIO ANALOG OUTPUT
58	1	QSC	QSCCDN64	CARD, Q-SYS DANTE BRDIGE CARD, 64X64
59	1	QSC	QSCUNDX2IO+	WALL PLATE, 4x2 DUAL GANG DANTE/AES67 2 LINE I/O (XLR) PHO
60	1	QSC	QSCCXQ2K4	AMPLIFIER, 4 CHANNEL 500W Q-SYS NETWORKED, LO-Z, 100V
61	8	QSC	QSCADC6TLP	SPEAKER, 6.5" CEILING LOW PROFILE, 70/100V (ORDER IN PAIRS)
62				**ASSISTIVE LISTENING SYSTEM**
63	1	LISTEN TECHNOLOGIES CORPC	LISLT8401	IR TRANSMITTER/RADIATOR COMBO
64	4	LISTEN TECHNOLOGIES CORPC	LISLR4200IR	RECEIVER, INTELLIGENT DSP IR
65	4	LISTEN TECHNOLOGIES CORPC	LISLA401	UNIVERSAL EAR SPEAKER
66	2	LISTEN TECHNOLOGIES CORPC	LISLA430	INTELLIGENT EARPHONE/NECK LOOP LANYARD
67	1	LISTEN TECHNOLOGIES CORPC	LISLA42301	4 PORT USB CHARGER
68	4	LISTEN TECHNOLOGIES CORPC	LISLA422	CABLE, USB TO MICRO USB
69				**CONTROL SYSTEM EQUIPMENT**
70	1	CRESTRON	CRECP3N	CONTROL PROCESSOR, 3 SERIES
71	1	TBD	OFE	LIGHTING CONTROL INTERFACE IN AV RACK ROOM
72	2	CRESTRON	CRETS1070BS	TOUCH SCREEN, 10.1" TABLETOP, BLACK SMOOTH
73	1	NETGEAR	NETXSM4348CS100NES	SWITCH, M4300-48X MANAGED SWITCH
74				**RACK STORAGE EQUIPMENT**
75	1	MIDDLE ATLANTIC	MIDBGR4527AV	RACK, 45 SPACE 27" DEEP CONFIG AV
76	1	MIDDLE ATLANTIC	MIDU2V4	RACKSHELF, 2 SPACE VENTED - 4 PACK

		Emergency Operations Center		
1				**LCD DISPLAY EQUIPMENT**
2	10	BARCO ELECTRONICS, INC.	BARR98495000B	LCD, 55" 1080P 500NIT 31LBS LED 4000:1 W/PS,VID MODULE,MOUNT
3	1	BARCO ELECTRONICS, INC.	BARR98494000B	MOUNT, UNI-4000 UNISEE CONNECT KIT
4	10	BARCO ELECTRONICS, INC.	BAR12363	WARRANTY, 5YR ESSENTIALCARE, UNISEE
5	1	BARCO ELECTRONICS, INC.	BAR13102	SERVICE, GUIDED INSTAL BETWEEN 5-10 UNISEE PANELS(QUOTE REQ)
6	1	DRAPER	TBD	UNISEE TRIM KIT FOR 5X2 DISPLAY WALL LAYOUT
7	10	CHIEF	CHIPAC526FC	ENCLOSURE, WALL, 16 X 16, MTI-D, PRE/PST INST, CVR
8	10	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
9				**PRESENTER PODIUM EQUIPMENT**
10	1	TBD	OFE	PODIUM TOP HDMI CONNECTION
11	1	SHURE	SHUMX415C	MICROPHONE, 15" SHOCK-MOUNTED GOOESNECK, CARDIOID
12	1	CRESTRON	CREDMNVXE760C	ENCODER CARD, DM 4K60 4:4:4 HDR NETWORK AV W/DM INPUT
13	1	CRESTRON	CREDMTX4KZ100C1GBT	TRANSMITTER, 4K DigitalMedia 8G+ 4K60 HDR WALLPLATE (BLACK)
14	1	CRESTRON	CRETSW770BS	TOUCH SCREEN, 7" WALL MOUNT, BLACK SMOOTH
15				**TEAMS ROOM EQUIPMENT**
16	1	TBD	OFE	OWNER FURSNISHED PC FOR TEAMS
17	1	QSC	QSCPTZ12X72	CAMERA, PTZ 12X OPTICAL ZOOM 72 DEGREE HORIZONTAL, 12V, GY
18	1	QSC	QSCPTZCMB1	BRACKET, CEILING MOUNT FOR PTZ CAMERA
19	1	QSC	QSCIOUSBBRIDGE	Q-SYS POE BRIDGING ENDPOINT FOR AV TO USB BRIDGING
20	3	CRESTRON	CREDMNVX360C	ENCODER/DECODER CARD, DM NVX 4K60 4:4:4 HDR NETWORK AV
21				**VIDEO ROUTING & SOURCE EQUIPMENT**
22	4	TBD	OFE	OWNER FUNRISHED RACK MOUNT CATV TUNER
23	4	TBD	OFE	OWNER FUNRISHED RACK MOUNT PC
24	2	CRESTRON	CREDMFCI8	CARD CHASSIS, DM FOR DM-NVX-C & DMCF, 8 SLOTS
25	9	CRESTRON	CREDMNVX360C	ENCODER/DECODER CARD, DM NVX 4K60 4:4:4 HDR NETWORK AV
26	1	CRESTRON	CREDMXIODIR160	SWITCH, DIGITALMEDIA XiO DIRECTOR - FOR 160 ENDPOINTS
27				**AUDIO EQUIPMENT**
28	1	QSC	QSCCORE510IKIT	SYSTEM, INTEGRATED CORE W/8 I/O CARD SLOTS, 256 NETWORKED CH
29	3	QSC	QSCCIML4	CARD, 4CH MICROPHONE / LINELEVEL ANALOG AUDIO INPUT
30	2	QSC	QSCCOL4	4 CHANNELS OF BALANCED LINE LEVEL AUDIO ANALOG OUTPUT
31	1	QSC	QSCCDN64	CARD, Q-SYS DANTE BRDIGE CARD, 64X64
32	1	QSC	QSCUNDX2IO+	WALL PLATE, 4x2 DUAL GANG DANTE/AES67 2 LINE I/O (XLR) PHO
33	2	SHURE	SHUMXA710W4FT	MICROPHONE, 4' LINEAR ARRAY, WHITE
34	1	QSC	QSCCXQ2K4	AMPLIFIER, 4 CHANNEL 500W Q-SYS NETWORKED, LO-Z, 100V
35	8	QSC	QSCADC6TLP	SPEAKER, 6.5" CEILING LOW PROFILE, 70/100V (ORDER IN PAIRS)
36				**ASSISTIVE LISTENING SYSTEM**
37	1	LISTEN TECHNOLOGIES CORPC	LISLT8401	IR TRANSMITTER/RADIATOR COMBO
38	4	LISTEN TECHNOLOGIES CORPC	LISLR4200IR	RECEIVER, INTELLIGENT DSP IR
39	4	LISTEN TECHNOLOGIES CORPC	LISLA401	UNIVERSAL EAR SPEAKER
40	2	LISTEN TECHNOLOGIES CORPC	LISLA430	INTELLIGENT EARPHONE/NECK LOOP LANYARD
41	1	LISTEN TECHNOLOGIES CORPC	LISLA42301	4 PORT USB CHARGER
42	4	LISTEN TECHNOLOGIES CORPC	LISLA422	CABLE, USB TO MICRO USB
43				**CONTROL SYSTEM EQUIPMENT**
44	1	CRESTRON	CRECP3N	CONTROL PROCESSOR, 3 SERIES
45	1	CRESTRON	CRETS1070BS	TOUCH SCREEN, 10.1" TABLETOP, BLACK SMOOTH
46	1	NETGEAR	NETXSM4348CS100NES	SWITCH, M4300-48X MANAGED SWITCH
47				**RACK STORAGE EQUIPMENT**
48	1			EQUIPMENT RACK INCLUDED WITH DISPATCH CENTER BOM
49	1	MIDDLE ATLANTIC	MIDU2V4	RACKSHELF, 2 SPACE VENTED - 4 PACK

		Dispatch Center		
1				**LCD DISPLAY EQUIPMENT**
2	8	BARCO ELECTRONICS, INC.	BARR98495000B	LCD, 55" 1080P 500NIT 31LBS LED 4000:1 W/PS,VID MODULE,MOUNT
3	1	BARCO ELECTRONICS, INC.	BARR98494000B	MOUNT, UNI-4000 UNISEE CONNECT KIT
4	8	BARCO ELECTRONICS, INC.	BAR12363	WARRANTY, 5YR ESSENTIALCARE, UNISEE
5	1	BARCO ELECTRONICS, INC.	BAR13102	SERVICE, GUIDED INSTAL BETWEEN 5-10 UNISEE PANELS(QUOTE REQ)
6	1	DRAPER	TBD	UNISEE TRIM KIT FOR 5X2 DISPLAY WALL LAYOUT
7	8	CHIEF	CHIPAC526FC	ENCLOSURE, WALL, 16 X 16, MTI-D, PRE/PST INST, CVR
8	8	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
9				**VIDEO SOURCE & ROUTING EQUIPMENT**
10	8	TBD	OFE	OWNER FURNISHED WORKSTATION PC'S
11	8	TBD	OFE	OWNER FURNISHED RACK MOUNT SOURCES WITH HDMI
12	2	CRESTRON	CREDMFCI8	CARD CHASSIS, DM FOR DM-NVX-C & DMCF, 8 SLOTS
13	16	CRESTRON	CREDMNVX360C	ENCODER/DECODER CARD, DM NVX 4K60 4:4:4 HDR NETWORK AV
14	1	CRESTRON	CREDMXIODIR160	SWITCH, DIGITALMEDIA XiO DIRECTOR - FOR 160 ENDPOINTS
15				**AUDIO EQUIPMENT**
16	1	QSC	QSCCORE110F	SYSTEM, UNIFIED SERIES CORE W/ 24 LOCAL I/O CHANNELS, 1RU
17	4	QSC	QSCADC6TLP	SPEAKER, 6.5" CEILING LOW PROFILE, 70/100V (ORDER IN PAIRS)
18	1	QSC	QSCSPA2200	AMPLIFIER, 2 CHANNEL 1/2 RU, ENERGY STAR
19				**CONTROL SYSTEM EQUIPMENT**
20	1	CRESTRON	CRECP3N	CONTROL PROCESSOR, 3 SERIES
21	1	CRESTRON	CRETS1070BS	TOUCH SCREEN, 10.1" TABLETOP, BLACK SMOOTH
22	1	NETGEAR	NETXSM4348CS100NES	SWITCH, M4300-48X MANAGED SWITCH
23				**RACK STORAGE EQUIPMENT**
24	1	MIDDLE ATLANTIC	MIDBGR4527AV	RACK, 45 SPACE 27" DEEP CONFIG AV
25	1	MIDDLE ATLANTIC	MIDU2V4	RACKSHELF, 2 SPACE VENTED - 4 PACK

		Fire Dept. Classroom		
1				**PROJECTION DISPLAY EQUIPMENT**
2	1	NEC TECHNOLOGIES	NECNPPA653U41ZL	PROJECTOR, WUXGA 6500 LUMEN 23LB LCD 8000:1 W/NP41ZL LENS
3	1	CHIEF	CHIKITES006	MOUNT KIT, RPMAU, CMS440, CMS006
4	1	DA-LITE SCREEN COMPANY	DAL20848LS	SCREEN, ADVANTAGE, TNSD 123D DM
5	1	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
6				**SIDE DISPLAY EQUIPMENT**
7	2	SAMSUNG	SAMQB65R	LCD, 65" 4K/UHD 350NIT 56LB 6000:1 CONT - (NON-TAA)
8	2	CHIEF	CHILTM1U	MOUNT, MICRO ADJUST TILT WALL MOUNT, LARGE
9	2	CHIEF	CHIPAC526FC	ENCLOSURE, WALL, 16 X 16, MTI-D, PRE/PST INST, CVR
10	2	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
11				**PRESENTER PODIUM EQUIPMENT**
12	1	TBD	OFE	PODIUM TOP HDMI CONNECTION
13	1	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
14				**TEAMS ROOM EQUIPMENT**
15	1	TBD	OFE	OWNER FURSNISHED PC FOR TEAMS
16	2	QSC	QSCPTZ12X72	CAMERA, PTZ 12X OPTICAL ZOOM 72 DEGREE HORIZONTAL, 12V, GY
17	2	QSC	QSCPTZCMB1	BRACKET, CEILING MOUNT FOR PTZ CAMERA
18	1	QSC	QSCIOUSBBRIDGE	Q-SYS POE BRIDGING ENDPOINT FOR AV TO USB BRIDGING
19	3	CRESTRON	CREDMNVX360C	ENCODER/DECODER CARD, DM NVX 4K60 4:4:4 HDR NETWORK AV
20				**VIDEO ROUTING EQUIPMENT**
21	1	CRESTRON	CREDMFCI8	CARD CHASSIS, DM FOR DM-NVX-C & DMCF, 8 SLOTS
22	1	CRESTRON	CREDMNVX360C	ENCODER/DECODER CARD, DM NVX 4K60 4:4:4 HDR NETWORK AV
23	1	TBD	OFE	RACK MOUNTED CATV TUNER
24				**WIRELESS MICROPHONE EQUIPMENT**
25	1	SHURE	SHUMXWAPT4Z10	TRANSCEIVER, 4-CH ACCESS POINT
26	1	SHURE	SHUMXWNCS4	CHARGING STATION, 4CH NETWORKED
27	2	SHURE	SHUMXW1OZ10	TRANSMITTER, BODYPACK W/INTERGRATED OMNIDIRECTIONAL MICROPHO
28	2	SHURE	SHUWL185	MICROFLEX CARDIOID LAVALIER MICROPHONE
29	2	SHURE	SHUMXW2SM58Z10	TRANSMITTER, HANDHELD W/ SM58 MICROPHONE
30	4	SHURE	SHUSB900A	BATTERY, LITHIUM-ION RECHARGABLE
31				**AUDIO EQUIPMENT**
32	1	QSC	QSCCORE510IKIT	SYSTEM, INTEGRATED CORE W/8 I/O CARD SLOTS, 256 NETWORKED CH
33	2	QSC	QSCCIML4	CARD, 4CH MICROPHONE / LINELEVEL ANALOG AUDIO INPUT
34	2	QSC	QSCCOL4	4 CHANNELS OF BALANCED LINE LEVEL AUDIO ANALOG OUTPUT
35	1	QSC	QSCCDN64	CARD, Q-SYS DANTE BRDIGE CARD, 64X64
36	1	QSC	QSCUNDX2IO+	WALL PLATE, 4x2 DUAL GANG DANTE/AES67 2 LINE I/O (XLR) PHO
37	1	QSC	QSCCXQ2K4	AMPLIFIER, 4 CHANNEL 500W Q-SYS NETWORKED, LO-Z, 100V
38	2	QSC	QSCADC6TLP	SPEAKER, 6.5" CEILING LOW PROFILE, 70/100V (ORDER IN PAIRS)
39				**ASSISTIVE LISTENING SYSTEM**
40	1	LISTEN TECHNOLOGIES CORPC	LISLT8401	IR TRANSMITTER/RADIATOR COMBO
41	4	LISTEN TECHNOLOGIES CORPC	LISLR4200IR	RECEIVER, INTELLIGENT DSP IR
42	4	LISTEN TECHNOLOGIES CORPC	LISLA401	UNIVERSAL EAR SPEAKER
43	2	LISTEN TECHNOLOGIES CORPC	LISLA430	INTELLIGENT EARPHONE/NECK LOOP LANYARD
44	1	LISTEN TECHNOLOGIES CORPC	LISLA42301	4 PORT USB CHARGER
45	4	LISTEN TECHNOLOGIES CORPC	LISLA422	CABLE, USB TO MICRO USB

	Fire Dept. Classroom (Cont.)			
46				**CONTROL SYSTEM EQUIPMENT**
47	1	CRESTRON	CRECP3N	CONTROL PROCESSOR, 3 SERIES
48	1	CRESTRON	CRETS1070BS	TOUCH SCREEN, 10.1" TABLETOP, BLACK SMOOTH
49	1	NETGEAR	NETXSM4348CS100NES	SWITCH, M4300-48X MANAGED SWITCH
50				**RACK STORAGE EQUIPMENT**
51	1	MIDDLE ATLANTIC	MIDBGR4527AV	RACK, 45 SPACE 27" DEEP CONFIG AV
52	1	MIDDLE ATLANTIC	MIDU2V4	RACKSHELF, 2 SPACE VENTED - 4 PACK

	Police Dept. Briefing & Training Rooms			
1				**DISPLAY EQUIPMENT**
2	2	SAMSUNG	SAMQB98T	LCD, 98" 4K/UHD 350NIT 183LB 4000:1 CONT MAGICINFO S6 24/7
3	1	SAMSUNG	SAMQB85R	LCD, 85" 4K/UHD 350NIT 108LB 4000:1 CONT 16/7 (2) 10W SPKR
4	2	SAMSUNG	SAMQB75R	LCD, 75" 4K/UHD 350NIT 94LB 4000:1 CONT COO VIETNAM NON-TAA
5	5	CHIEF	CHIXTM1U	MOUNT, FUSION MICRO-ADJ TILT WALL MOUNT, EXTRA LARGE
6	5	CHIEF	CHIPAC526FC	ENCLOSURE, WALL, 16 X 16, MTI-D, PRE/PST INST, CVR
7	5	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
8				**PRESENTER PODIUM EQUIPMENT**
9	2	TBD	OFE	PODIUM TOP HDMI CONNECTION
10	2	CRESTRON	CREDMNVX360	ENCODER/DECODER, DM NVX 4K60 4:4:4 HDR NETWORK AV
11				**TEAMS ROOM EQUIPMENT**
12	2	TBD	OFE	OWNER FURSNISHED PC FOR TEAMS
13	4	QSC	QSCPTZ12X72	CAMERA, PTZ 12X OPTICAL ZOOM 72 DEGREE HORIZONTAL, 12V, GY
14	4	QSC	QSCPTZCMB1	BRACKET, CEILING MOUNT FOR PTZ CAMERA
15	2	QSC	QSCIOUSBBRIDGE	Q-SYS POE BRIDGING ENDPOINT FOR AV TO USB BRIDGING
16	6	CRESTRON	CREDMNVX360C	ENCODER/DECODER CARD, DM NVX 4K60 4:4:4 HDR NETWORK AV
17				**VIDEO ROUTING EQUIPMENT**
18	1	CRESTRON	CREDMFCI8	CARD CHASSIS, DM FOR DM-NVX-C & DMCF, 8 SLOTS
19	2	CRESTRON	CREDMNVX360C	ENCODER/DECODER CARD, DM NVX 4K60 4:4:4 HDR NETWORK AV
20	2	TBD	OFE	RACK MOUNTED CATV TUNER
21				**WIRELESS MICROPHONE EQUIPMENT**
22	2	SHURE	SHUMXWAPT4Z10	TRANSCEIVER, 4-CH ACCESS POINT
23	2	SHURE	SHUMXWNCS4	CHARGING STATION, 4CH NETWORKED
24	4	SHURE	SHUMXW1OZ10	TRANSMITTER, BODYPACK W/INTERGRATED OMNIDIRECTIONAL MICROPHO
25	4	SHURE	SHUWL185	MICROFLEX CARDIOID LAVALIER MICROPHONE
26	4	SHURE	SHUMXW2SM58Z10	TRANSMITTER, HANDHELD W/ SM58 MICROPHONE
27	8	SHURE	SHUSB900A	BATTERY, LITHIUM-ION RECHARGABLE
28				**AUDIO EQUIPMENT**
29	1	QSC	QSCCORE510IKIT	SYSTEM, INTEGRATED CORE W/8 I/O CARD SLOTS, 256 NETWORKED CH
30	4	QSC	QSCCIML4	CARD, 4CH MICROPHONE / LINELEVEL ANALOG AUDIO INPUT
31	3	QSC	QSCCOL4	4 CHANNELS OF BALANCED LINE LEVEL AUDIO ANALOG OUTPUT
32	1	QSC	QSCCDN64	CARD, Q-SYS DANTE BRDIGE CARD, 64X64
33	2	QSC	QSCUNDX2IO+	WALL PLATE, 4x2 DUAL GANG DANTE/AES67 2 LINE I/O (XLR) PHO
34	1	QSC	QSCCXQ2K4	AMPLIFIER, 4 CHANNEL 500W Q-SYS NETWORKED, LO-Z, 100V
35	8	QSC	QSCADC6TLP	SPEAKER, 6.5" CEILING LOW PROFILE, 70/100V (ORDER IN PAIRS)
36				**ASSISTIVE LISTENING SYSTEM**
37	2	LISTEN TECHNOLOGIES CORPC	LISLT8401	IR TRANSMITTER/RADIATOR COMBO
38	8	LISTEN TECHNOLOGIES CORPC	LISLR4200IR	RECEIVER, INTELLIGENT DSP IR
39	8	LISTEN TECHNOLOGIES CORPC	LISLA401	UNIVERSAL EAR SPEAKER
40	4	LISTEN TECHNOLOGIES CORPC	LISLA430	INTELLIGENT EARPHONE/NECK LOOP LANYARD
41	2	LISTEN TECHNOLOGIES CORPC	LISLA42301	4 PORT USB CHARGER
42	8	LISTEN TECHNOLOGIES CORPC	LISLA422	CABLE, USB TO MICRO USB
43				**CONTROL SYSTEM EQUIPMENT**
44	1	CRESTRON	CRECP3N	CONTROL PROCESSOR, 3 SERIES
45	2	CRESTRON	CRETS1070BS	TOUCH SCREEN, 10.1" TABLETOP, BLACK SMOOTH
46	1	NETGEAR	NETXSM4348CS100NES	SWITCH, M4300-48X MANAGED SWITCH
47				**RACK STORAGE EQUIPMENT**
48	1	MIDDLE ATLANTIC	MIDBGR4527AV	RACK, 45 SPACE 27" DEEP CONFIG AV
49	1	MIDDLE ATLANTIC	MIDU2V4	RACKSHELF, 2 SPACE VENTED - 4 PACK

	Common Areas			
1				**DISPLAY EQUIPMENT**
2	1	SAMSUNG	SAMQB75R	LCD, 75" 4K/UHD 350NIT 94LB 4000:1 CONT
3	2	SAMSUNG	SAMQB65R	LCD, 65" 4K/UHD 350NIT 56LB 6000:1 CONT
4	3	CHIEF	CHILTM1U	MOUNT, MICRO ADJUST TILT WALL MOUNT, LARGE
5	3	CHIEF	CHIPAC526FC	ENCLOSURE, WALL, 16 X 16, MTI-D, PRE/PST INST, CVR
6				**VIDEO SOURCE EQUIPMENT**
7	3	TBD	OFE	OWNER FURNISHED CATV SERVICE BEHIND THE DISPLAY

	Lobby Digital Signage			
1				**DISPLAY EQUIPMENT**
2	1	SAMSUNG	SAMQM65R	LCD, 65" 4K/UHD 500NIT 25LB 4000:1 CONT 24/7
3	1	PERLESS	PERKIPC2565	FLOOR STANDING PORTRAIT KIOSK FOR 65" MONITOR
4	1	CHIEF	CHILTM1U	MOUNT, MICRO ADJUST TILT WALL MOUNT, LARGE
5	1	CHIEF	CHIPAC526FC	ENCLOSURE, WALL, 16 X 16, MTI-D, PRE/PST INST, CVR
6				**VIDEO SOURCE EQUIPMENT**
7	1	TBD	OFE	OWNER FURNISHED FORM FACTOR PC BEHIND THE DISPLAY

	Paging System			
1				**FIRE DEPT. 1ST FLOOR EQUIPMENT**
2	31	QSC	QSCACC6T	SPEAKER, 6" 2-WAY CEILING 70/100V (ORDER IN PAIRS)
3	1	QSC	QSCMPA20V	AMPLIFIER, 400W, FLEXAMP 2 X 200W
4	1	VALCOM, INC.	VALVIP801AIC	GATEWAY, INFORMACAST 1 AUDIO PORT, NETWORKED
5	1			EQUIPMENT RACK SHARED WITH FD TRAINING ROOM
6				**FIRE DEPT. 2ND FLOOR EQUIPMENT**
7	31	QSC	QSCACC6T	SPEAKER, 6" 2-WAY CEILING 70/100V (ORDER IN PAIRS)
8	1	QSC	QSCMPA20V	AMPLIFIER, 400W, FLEXAMP 2 X 200W
9	1	VALCOM, INC.	VALVIP801AIC	GATEWAY, INFORMACAST 1 AUDIO PORT, NETWORKED
10	1			EQUIPMENT RACK SHARED WITH FD BOARDROOM
11				**POLICE DEPT EQUIPMENT**
12	18	QSC	QSCACC6T	SPEAKER, 6" 2-WAY CEILING 70/100V (ORDER IN PAIRS)
13	62	QSC	QSCACC6T	SPEAKER, 6" 2-WAY CEILING 70/100V (ORDER IN PAIRS)
14	1	QSC	QSCMPA40V	AMPLIFIER, 800W, 4-CHANNEL
15	1	VALCOM, INC.	VALVIP801AIC	GATEWAY, INFORMACAST 1 AUDIO PORT, NETWORKED
16	1			EQUIPMENT RACK SHARED WITH FD BRIEFING & TRAINING

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 Section Includes

A. Removal of existing trees and vegetation

B. Clearing vegetation, debris, trash and other materials within limits indicated

C. Grubbing of vegetation within limits indicated

D. Stripping of topsoil within limits indicated

E. Removing above-grade site improvements within limits indicated

F. Disconnecting, capping or sealing, and abandoning site utilities in place

G. Disconnecting, capping or sealing, and removing site utilities

H. Disposing of objectionable material

1.2 related sections

A. Section 31 20 00, Earth Moving

B. Section 32 12 16, Asphalt Paving

C. Section 32 13 13, Concrete Pavement

1.3 Related Documents

A. Geotechnical Report: Geotechnical Investigation- San Ramon Emergency Operations Center, by Geocon Consultants, Inc., in August 2020.

B. ANSI A300: Industry Standards for Tree Care Practices

C. Applicable Publications
1. “Trees and Building Sites,” official publication of the International Society of Arboriculture.
2. “Arboriculture,” the care of trees and shrubs by Dr. Richard Harris.

1.4 Definitions

A. ANSI: American National Standards Institute

B. CAL-OSHA: California Occupational Safety and Health Administration

C. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.5 Submittals

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.6 quality assurance

A. Do not remove or prune trees without first securing a permit from the appropriate agency.

B. Prune to the standards of the International Society of Arborists and to ANSI A300.

1.7 PROJECT CONDITIONS

A. Except for materials indicated to be stockpiled or to remain the Owner's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the Owner's Representative. Avoid damaging materials designated for salvage.

C. Unidentified Materials;
1. If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the Owner's Representative.
2. If necessary, the Owner's Representative will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

PART 2 - PRODUCTS

2.1 Soil materials

A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to engineered fill defined in Section 31 20 00, Earth Moving.

PART 3 - EXECUTION

3.1 preparation

A. Protect and maintain benchmarks and survey control points during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain during construction.

3.2 TREE REMOVAL

A. Remove trees designated for removal prior to the construction of new improvements in the vicinity:

1. When demolishing trees indicated to be removed within areas for new pavement or hardscape, remove tree, stump to a depth of two (2) feet below finish grade, and all roots located in the top twelve (12) inches of soil. Remove wood chips created from grinding process down to remaining stump then refill void and re-compact to 80% relative compaction. Use import soil as indicated in specifications for this purpose. Import soil and compaction in future paved areas shall be in accordance with Section 32 12 16, Asphalt Paving and Section 32 13 13, Concrete Pavement.

2. When demolishing trees indicated to be removed within new landscaped areas, removal shall be done in one of the following ways:
   a. For trees located in accessible areas, remove tree and grind stump to four (4) inches below finish grade. Backfill the void and re-compact to 80% relative compaction. Use import soil as indicated in specifications for this purpose. Do not remove existing roots.
   b. For trees located in inaccessible areas, cut stump flush with finish grade, and cover with 3 inches of bark mulch. Do not grind the stump and do not remove existing roots.

B. Perform tree removal work in a safe and proper manner, adhering to CAL-OSHA tree work protection standards and ANSI A300 Standards.

C. All trees to be demolished shall be removed in such a way as to not damage branches, trunks, or root systems of adjacent trees.

3.3 RESTORATION

A. Restore damaged improvements to their original condition, as acceptable to the Owner's Representative.

B. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, as directed by the Owner's Representative.
   1. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
   2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the Owner's Representative.

3.4 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.

B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner's Representative or others unless authorized in writing by the Owner's representative, and then only after arranging to provide temporary utility services according to requirements indicated.

D. Coordinate utility interruptions with utility company affected.

E. Do not proceed with utility interruptions without the permission of the Owner's Representative and utility company affected. Notify Owner's Representative and utility company affected two working days prior to utility interruptions.

F. Excavate and remove underground utilities that are indicated to be removed.

G. Fill abandoned piping with cement slurry.

H. Securely close ends of abandoned piping with tight fitting plug or cement slurry minimum 6 inches thick.

3.5 CLEARING AND GRUBBING

A. Areas to be graded shall be cleared of existing vegetation, rubbish, existing structures, and debris.

B. Remove obstructions, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

D. Use only hand methods for grubbing within drip line of remaining trees.

3.6 SITE STRIPPING

A. Strippings and spoils shall be disposed at an off-site location, per geotechnical recommendations.

B. Remove vegetation before stripping soil.

C. Surface soils that contain organic matter should be stripped. In general, the depth of required stripping will be relatively shallow (i.e. less than 2 inches); deeper stripping and grubbing may be required to remove isolated concentrations of organic matter or roots.

D. Remove trash, debris, weeds, roots, and other waste materials.

E. Stockpile soil materials designated to remain on site at a location approved by the Owner's Representative at a location away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

F. Do not stockpile soil within drip line of remaining trees.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

3.8 Backfill

A. Place and compact material in excavations and depressions remaining after site clearing in accordance with Section 31 20 00, Earth Moving.

3.9 DISPOSAL

A. Remove surplus soil material, unsuitable soil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner's property.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for roadways, driveways, parking areas, building pads, walks, paths, or trails and any other site improvements called for on the Plans.

1.2 SECTION EXCLUDES

A. Earthwork related to underground utility installation shall be performed in accordance with Sections 31 21 00, Utility Trenching and Backfill.

1.3 RELATED SECTIONS

A. Section 01 10 00, Supplemental General Requirements

B. Section 01 50 50, Erosion Control

C. Section 31 10 00, Site Clearing

D. Section 31 23 19, Dewatering

E. Section 33 46 00, Subdrainage

1.4 RELATED DOCUMENTS

A. Geotechnical Report Geotechnical Investigation- San Ramon Emergency Operations Center, by Geocon Consultants, Inc,, in August 2020.

B. ASTM
1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
2. D1586, Method for Penetration Tests and Split-Barrel Sampling of Soils
3. D2487, Classification of Soils for Engineering Purposes
4. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
5. D4318. Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
6. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
7. E548, Guide for General Criteria Used for Evaluating Laboratory Competence

C. California Building Code, California Code of Regulations, Title 24, Part 2, Chapter 18, Soils and Foundations, and Chapter 33, Safeguards During Construction

D. Caltrans Standard Specifications, 2015
1. Section 17, General
2. Section 19, Earthwork

E. CAL/OSHA, Title 8.

1.5 DEFINITIONS

A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.

B. Excavation: Removal of material encountered above subgrade elevations.
   1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans or authorized by the Geotechnical Engineer.
   2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.

C. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.

D. Structural Backfill: Soil materials approved by the Geotechnical Engineer and used to fill excavations resulting from removal of existing below grade facilities, including trees.

E. Structural Fill: Soil materials approved by the Geotechnical Engineer and used to raise existing grades.

F. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material ¾ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.

H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.

I. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

J. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project. The Geotechnical Engineer will determine if a soil material is unsuitable.

K. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.

L. Utilities: onsite underground pipes, conduits, ducts and cables.

1.6 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Samples:
   1. If required by the Geotechnical Engineer, provide 20 pound samples, sealed in airtight containers, tagged with source locations and suppliers of each proposed soil material from

on-site or borrow sources, 72 hours prior to use. Do not import materials to the Project without written approval of the Geotechnical Engineer.

2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer.

C. Classification according to ASTM D2487 of each onsite or borrow soil material proposed for fill and backfill.

1. Laboratory compaction curve in conformance with ASTM D1557 for each onsite or borrow soil material proposed for fill and backfill.

1.7 QUALITY ASSURANCE

A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.

B. Conform all work in accordance with Caltrans Standard Specification Section 17, General and Section 19, Earthwork.

C. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.

D. Perform excavation, filling, compaction and related earthwork under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of the Geotechnical Engineer, shall be removed and replaced at no cost to the Owner. Notify the Geotechnical Engineer at least 24 hours prior to commencement of earthwork and at least 48 hours prior to testing.

E. The Geotechnical Engineer will perform observations and tests required to enable him to form an opinion of the acceptability of the Project earthwork. Correct earthwork that, in the opinion of the Geotechnical Engineer, does not meet the requirements of these Technical Specifications and the Geotechnical Report.

F. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications and the Geotechnical Report. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces and shall replace portions that in the opinion of the Geotechnical Engineer have been displaced or are otherwise unsatisfactory due to the Contractor's operations.

G. Finish subgrade tolerance at completion of grading:

1. Building and paved areas: ±0.05 feet
2. Other areas: ±0.10 feet

1.8 PROJECT CONDITIONS

A. Promptly notify the Owner's Representative of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Owner's Representative verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless the Contractor has notified the Owner's Representative in writing of differing conditions prior to the Contractor starting work on affected items.

B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Prevent erosion of freshly-graded areas during construction and until such time as permanent drainage and erosion control measures have been installed in accordance with Section 01 50 50, Erosion Control.

D. Temporarily stock-pile fill material in an orderly and safe manner and in a location approved by the Owner's Representative.

E. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: On-site soils are considered suitable for use as fill provided the materials are placed in accordance with Geotechnical Recommendations. Highly expansive soils shall not be used as select structural fill, or used as backfill for trenches located within hardscape areas.

B. Imported fill soils, if required, should be predominantly granular in nature, and should be free of organics, debris, or rocks over 3 inches in size, and shall be approved by the Geotechnical Engineer before importing to the site. Imported non-expansive soils shall have a Plasticity Index less than 15 as determined by ASTM D4318, an R-value of at least 20, and fines content between 15 and 65 percent. Import fill shall be considered non-hazardous per Department of Toxic Substances Control guidelines (DTSC, 2017) and non-corrosive per Caltrans Corrosion Guidelines (Caltrans, 2015).

2.2 SOIL STERILANT

A. Commercial chemical for weed control, registered by EPA. Provide granular, liquid or wet-able powder form.

PART 3 - EXECUTION

3.1 GENERAL

A. Perform work in accordance with Caltrans Standard Specification Section 19, Earthwork, as modified by the Contract Documents.

B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

C. The use of explosives will not be permitted.

D. Grading and earthwork operations shall be observed and tested by a representative of the Geotechnical Engineer for conformance with the project plans/specifications and the geotechnical recommendations. This work includes site preparation, selection of satisfactory materials, and placement and compaction of the subgrades and fills. Sufficient notification prior to commencement of earthwork is essential to make certain that the work will be properly observed.

3.2 CONTROL OF WATER AND DEWATERING

A. Comply with Section 31 23 19, Dewatering, if dewatering is necessary.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.

C. Dewater during backfilling operation so that groundwater is maintained a least 1 foot below level of compaction effort.

D. Obtain the Geotechnical Engineer's approval for proposed control of water and dewatering methods.

E. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.

F. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.

G. Maintain dewatering system in place until dewatering is no longer required.

3.3 WET WEATHER CONDITIONS

A. Do not prepare subgrade, place or compact soil materials if subgrade or materials are above optimum moisture content.

B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.4 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Geotechnical Engineer, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.5 TOPSOIL STRIPPING

A. Remove topsoil in accordance with Section 31 10 00, Site Clearing.

3.6 EXCAVATION

A. Excavate earth and rock to lines and grades shown on plans and to the neat dimensions indicated on the plans, required herein or as required to satisfactorily compact backfill.

B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.

C. Excavation through buried concrete and other unknown obstructions will require specialized techniques for demolition and removal.

D. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.

E. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

3.7 GRADING

A. Uniformly grade the Project to the elevations shown on plans

B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.

C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.8 SUBGRADE PREPARATION

A. Subgrade Preparation: Prior to backfilling depressions created by the removal of old foundations and utility lines, scarify the bottom of the excavation to an approximate depth of 8 inches and uniformly moisture condition the scarified surfaces to a moisture content that is at least 2 percent over optimum. Compact the scarified surfaces to a minimum of 90 percent relative compaction at above optimum moisture content.

B. Over-excavate any remaining soft (pumping) areas down to firm soil and backfill the area.

C. Subgrade shall be maintained in a moist, but not wet, condition by periodically sprinkling water prior to the placement of additional fill or installation of roads. Subgrade that has been permitted to dry out and loosen or develop desiccation cracking should be scarified, moisture conditioned, and re-compacted as recommended above.

D. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.

E. Prepare subgrades under the structural section of paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.

F. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.

G. Obtain the Geotechnical Engineer’s approval of subgrades prior to placing pavement structural section.

3.9 KEYWAYS AND BENCHES

A. Provide keyways as indicated for fill slopes steeper than 6 horizontal to 1 vertical. Extend keyway 5 feet minimum into competent, undisturbed soil or 3 feet minimum into competent, undisturbed rock as directed by the Geotechnical Engineer.

B. Place subsurface drains in bottom of keyway in accordance with Section 33 46 00, Subdrainage.

C. Bench subgrade as indicated above toe of fill.

D. Place subsurface drains at benches every 20 vertical feet or as directed by the Geotechnical Engineer.

3.10 LOT FINISH GRADING

A. Blade finish lots to lines and grades indicated.

3.11 FILL PLACEMENT AND COMPACTION

A. Place fill in uniformly moisture conditioned and compacted lifts not exceeding 8 inches in loose thickness. Each lift should be thoroughly moisture conditioned and compacted to 90 percent before successive fill layers are placed.

B. In order to achieve satisfactory compaction in the subgrade and fill soils, it may be necessary to adjust the soil moisture content at the time of soil compaction per geotechnical recommendations. This may require that water be added and thoroughly mixed into any soils which are too dry or that scarification and aeration be performed in any soils which are too wet.

C. Obtain the Geotechnical Engineer's approval of surface to receive structural fill prior to placement of structural fill material.

D. Place structural fill on prepared subgrade.

E. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.

F. Do not compact by ponding, flooding or jetting.

G. Perform compaction using rollers, pneumatic or vibratory compactors or other equipment and mechanical methods approved by the Geotechnical Engineer.

H. Compaction requirements (unless specified otherwise by the Geotechnical Engineer):
   1. Compact structural fills less than 5 feet thick to 90 percent compaction.
   2. Compact structural fill 5 feet thick or greater to 95 percent compaction.
   3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 5 feet beyond pavement edges unless specified otherwise by the Geotechnical Engineer.
   4. Compact the upper 6 inches of subgrade soils under walks, structures and areas to receive structural fill to 90 percent compaction.

3.12 SOIL STERILIZATION

A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concrete pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.

B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.

C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

3.13 DISPOSAL

A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

SECTION 31 21 00

UTILITY TRENCHING AND BACKFILL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping, underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc., and associated structures.

B. Provide labor, material, equipment, and services necessary to complete the backfilling and compacting as necessary for this project. Section includes, but is not limited to:
1. Select Backfill Material
2. Aggregate Base
3. Detectable Tape
4. Trench Excavation
5. Pipe Bedding
6. Trench Backfill
7. Trench Surfacing

C. This section excludes drainage fill material and placement around subdrains. See Section 33 46 00 – Subdrainage.

1.2 RELATED SECTIONS

A. Section 31 10 00 – Site Clearing

B. Section 31 20 00 – Earthwork Moving

C. Section 31 23 19 - Dewatering

D. Section 33 10 00 – Water System

E. Section 33 30 00 – Sanitary Sewer System

F. Section 33 41 00 – Storm Utility Drainage Piping

G. Section 33 46 00 – Subdrainage

1.3 RELATED DOCUMENTS

A. Geotechnical Report: Geotechnical Investigation- San Ramon Emergency Operations Center, by Geocon Consultants, Inc,, in August 2020.

B. ASTM
1. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
2. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Applications.

C. California Administrative Code, Title 24, Part 2 - Basic Building Regulations, Chapter 24, Excavations, Foundations, and Retaining Walls.

D. Caltrans Standard Specifications, 2015
   1. Section 19, Earthwork
   2. Section 26, Aggregate Bases
   3. Section 68, Subsurface Drains
   4. Section 96, Geosynthetics

E. CAL/OSHA, Title 8

1.4 DEFINITIONS

A. AC: Asphalt Concrete

B. ASTM: American Society for Testing and Materials

C. Base: The layer placed between the subgrade and surface pavement in a paving system.

D. Bedding: Material from bottom of trench to bottom of pipe

E. CDF: Controlled Density Fill

F. DIP: Ductile Iron Pipe

G. Engineered Fill:
   1. Soil or soil-rock material approved by the Owner and transported to the site by the Contractor in order to raise grades or to backfill excavations.
   2. Contractor shall provide sufficient tests, and a written statement that all materials brought onto the project site comply with specification requirements.

H. Excavation: Consists of the removal of material encountered to subgrade elevations

I. Initial Backfill: Material from bottom of pipe to 12 inches above top of pipe

J. PCC: Portland Cement Concrete

K. RCP: Reinforced Concrete Pipe

L. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.

M. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of ½ the outside diameter measured from the top or bottom of the pipe.

N. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base.

O. Subsequent Backfill: Material from 12 inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.

P. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
   1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans or authorized by the Geotechnical Engineer.

2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.

Q. Utility Structures:
1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
2. Sanitary sewer manholes, vaults, etc.
3. Water vaults, etc.

1.5 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 10 00 – Supplemental General Requirements.

B. Test Reports: Submit the following report for import material directly to the Owner from the Contractor's testing services:
1. Compaction test reports for aggregate base.

C. Samples:
1. If required by the Geotechnical Engineer, provide 20-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material. Do not import materials to Project without written approval of the Geotechnical Engineer and the Owner.
2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer and the Owner.

1.6 QUALITY ASSURANCE

A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.

B. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19, Earthwork.

C. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

D. The Geotechnical Engineer will perform observations and tests required to enable him to form an opinion of the acceptability of the trench backfill. Correct the trench backfill that, in the opinion of the Geotechnical Engineer, does not meet the requirements of these Technical Specifications and the Geotechnical Report.

1.7 PROJECT CONDITIONS

A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless Contractor has notified the Owner in writing of differing conditions prior to contractor starting work on affected items.

B. Barricade open excavations and post with warning lights.
1. Operate warning lights and barricades as required.

2. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout, and other hazards.
3. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.

D. Provide dust and noise control in conformance with Section 01 10 00 Supplemental General Requirements.

E. Environmental Requirements:
1. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.
2. Protect existing streams, ditches and storm drain inlets during work on this project.

F. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.

G. Transport all excess soils materials by legally approved methods to disposal areas.
1. Coordinate with the Engineer.
2. Any additional fill requirements shall be the responsibility of the Contractor.

1.8 EXISTING UTILITIES

A. Locate existing underground utilities in the areas of work. For utilities that are to remain in place, provide adequate means of protection during excavation operations.
1. Locating of existing underground utilities shall include but not be limited to pot-holing prior to the start of construction.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Owner and/or utility agency immediately for directions.
1. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation.
2. Repair damaged utilities to the satisfaction of the agency with jurisdiction.

C. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

PART 2 - PRODUCTS

2.1 GENERAL

A. Import materials will be subject to approval of the Geotechnical Engineer.

B. For approval of imported fill material, notify the Owner at least 7 days in advance of intention to import material.

2.2 PIPE BEDDING AND INITIAL BACKFILL

A. ASTM D2321, Class IA, IB or II.
1. Clean and free of clay, silt or organic matter.

B. Permeable Material: In accordance with Section 68-2.02F of Caltrans Standard Specifications, Class 1, Type A or Class 2.

C. Class 2 Aggregate Base: In accordance with Section 26 of Caltrans Standard Specifications, ¾ inch maximum.

D. Sand: In accordance with Section 19-3.02F of Caltrans Standard Specifications.

2.3 SELECT BACKFILL

A. Select backfill material shall be gravel, free of clay or organic matter and shall conform to the following gradation:

Sieve Size	Percentage Passing
1 inch	100
¾ inch	90 – 100
No. 4	35 – 60
No. 200	2 - 9

B. For gas pipe and fuel piping select backfill shall be clean, graded building sand conforming to the following gradation:

Sieve Size	Percentage Passing
No. 4	100
No. 200	0 -5

2.4 WARNING TAPE

A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.
   1. Warning Tape Color Codes
      a. Red: Electric
      b. Yellow: Gas, Oil; Dangerous Materials
      c. Orange: Telephone and Other Communications
      d. Blue: Water Systems
      e. Green: Sewer Systems
      f. White: Steam Systems
      g. Gray: Compressed Air
   2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.
   3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.5 DETECTION WIRE FOR NON-METALLIC PIPING

A. Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

2.6 SUBSEQUENT BACKFILL

A. Conform to on-site or imported structural backfill in Section 31 20 00, Earth Moving.

2.7 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)

A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8 inch top size. The 3/8 inch aggregate shall not comprise more than 30% of the total aggregate content.

B. Cement: Conform to the standards as set forth in ASTM C150, Type II Cement.

C. Fly Ash: Conform to the standards as set forth in ASTM C618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.

D. Air Entraining Agent: Conform to the standards as set forth in ASTM C260.

E. Aggregates need not meet the standards as set forth in ASTM C33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.

F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.

G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.

H. Mix design shall meet the Geotechnical Engineer’s approval.

2.8 CONCRETE STRUCTURE BEDDING AND BACKFILL

A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill, or other material approved by the Geotechnical Engineer.

B. Poured-in-Place Structures:
   1. Bedding: Bedding shall meet the approval of the Geotechnical Engineer. In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
   2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 20 00, Earth Moving.

2.9 GEOSYNTHETICS

A. Filter Fabric:
   1. Filter Fabric: Section 96-1.02 of Caltrans Standard Specifications.

2. Mirafi 140N, Mirafi Inc., or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with the recommendations of the Geotechnical Engineer.

B. Protect existing trees to remain. No grading is permitted under the drip line of protected trees.

C. Excavations for appurtenant structures, such as, but not limited to, manholes, transition structures, junction structure, vaults, valve boxes, catch basins, thrust blocks, and boring pits, shall be deemed to be in the category of trench excavation.

D. Unless otherwise indicated in the Plans, all excavation for pipelines shall be open cut.

E. Prior to commencement of work, become thoroughly familiar with site conditions.

F. In the event discrepancies are found, immediately notify the Owner in writing, indicating the nature and extent of differing conditions.

G. Backfill excavations as promptly as work permits.

H. Do not place engineered fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the Owner.

I. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

J. In excavations, use satisfactory excavated or borrow material.

K. Under grassed areas, use satisfactory excavated or borrow material.

3.2 SITE PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, which are to remain, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the Owner.

3.3 EXISTING UTILITIES

A. Identity the location of existing utilities.
   1. Prior to trenching, the Contractor shall excavate at locations specifically indicated on the Plans, if any, and where new lines cross other utilities of uncertain depth and determine the elevation of the utility in question to ensure that the new line will clear the potential obstruction.
   2. The Contractor shall contact Underground Service Alert (USA) at 1-800-227-2600 for assistance in locating existing utilities.
   3. If, after the excavation, a crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the Owner to clear the utility.

B. Protect all existing utilities to remain in operation.

C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at Contractor's risk.

D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
   1. Use hand or light equipment for excavating immediately adjacent to known utilities or for excavations exposing a utility or buried structure.
   2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
   3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
   4. Report damage of utility line or subsurface structures immediately to the Owner.

E. Backfill trenches resulting from utility removal in lifts of 8 inches maximum.

3.4 TRENCH EXCAVATION

A. General
   1. Excavation shall include removal of all water and materials that interfere with construction. The Contractor shall remove any water which may be encountered in the trench by pumping or other methods during the pipe laying, bedding and backfill operations. Material shall be sufficiently dry to permit approved jointing.
   2. Excavation shall include the construction and maintenance of bridges required for vehicular and pedestrian traffic, support for adjoining utilities.
   3. The Contractor shall be responsible to safely direct vehicular and pedestrian traffic through or around his/her work area at all times.
   4. The Contractor shall relocate, reconstruct, replace or repair, at his/her own expense, all improvements which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor.

B. Existing Paving and Concrete:
   1. Existing pavement over trench shall be sawcut, removed, and hauled away from the job. Existing pavement shall be neatly sawcut along the limits of excavations.
   2. Existing concrete over the trench shall be sawcut to a full depth in straight lines, at a minimum distance of 12 inches beyond the edge of the trench, either parallel to the curb or a right angles to the alignment of the sidewalk.
   3. Boards or other suitable material shall be placed under equipment outrigging to prevent damage to paved surfaces.

C. Trench Width:
   1. The maximum allowable trench widths at the top of the all pipe materials outside diameter of barrel pipe plus 18 inches. shall be as follows:
      a. The maximum trench width shall be inclusive of all shoring.
      b. If the maximum trench width is exceeded, the State's representative may direct the Contractor to encase or cradle the pipe in concrete at no additional charge.
   2. For pipes 3 inch diameter and larger, the free working space on each side of the pipe barrel shall not be less than 6 inches.

D. Excavation Width at Springline of Pipe:
   1. Up to a nominal pipe diameter of 24 inches: Minimum of twice the outside pipe diameter, or as otherwise allowed or required by the Geotechnical Engineer.
   2. Nominal pipe diameter of 30 inches through 36 inches: Minimum of the outside pipe diameter plus 2 feet, or as otherwise allowed or required by the Geotechnical Engineer.

3. Nominal pipe diameter of 42 inches through 60 inches: Minimum of the outside pipe diameter plus 3 feet, or as otherwise allowed or required by the Geotechnical Engineer.

E. Open Trench:
1. The maximum length of open trench shall be 300 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench shall be left open at the end of the day.
2. Provisions for trench crossings and free access shall be made at all street crossings, driveways, water gate valves, and fire hydrants.
3. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.
4. Excavation Depth for Bedding: Minimum of 6 inches below bottom of pipe or as otherwise allowed or required by the Geotechnical Engineer, except that bedding is not required for nominal pipe diameters of 2 inches or less.
5. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.
6. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
7. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

F. Excavated Material:
1. All excavated material not required for backfill shall be immediately removed and properly disposed of in a legal manner by the Contractor.
2. Material excavated in streets and roadways shall be laid alongside the trench no closer than 2 feet from the trench edge and kept trimmed to minimize inconvenience to public traffic.
3. Provisions shall be made whereby all storm and wastewater can flow uninterrupted in gutters or drainage channels.

3.5 CONTROL OF WATER AND DEWATERING

A. Contractor attention is directed to Section 31 23 19, Dewatering.

B. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage to the satisfaction of the Geotechnical Engineer and the Owner until backfilling is completed.

C. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.

D. Obtain the Geotechnical Engineer’s approval for proposed control of water and dewatering methods.

E. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.

F. Maintain dewatering system in place until dewatering is no longer required.

3.6 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Geotechnical Engineer, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.7 PIPE BEDDING

A. Obtain approval of bedding material from the Geotechnical Engineer.

B. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of bedding material will not be permitted.

C. Stabilization of Trench Bottom: When the trench bottom is unstable due to wet or spongy foundation, trench bottom shall be stabilized with gravel or crushed rock. The State’s inspector will determine the suitability of the trench bottom and the amount of gravel or crushed rock needed to stabilize a soft foundation. Soft material shall be removed and replaced with gravel or crushed rock as necessary.

D. Placement of Bedding Material: The trench bottom shall be cleaned to remove all loose native material prior to placing select backfill material. Sufficient select backfill material shall be placed in trench and tamped to bring trench bottom up to grade of the bottom of pipe. The relative compaction of tamped material shall be not less than 90 percent. It is the intention of these requirements to provide uniform bearing under the full length of pipe to a minimum width of 60 percent of the external diameter.

3.8 BACKFILLING

A. Initial Backfill:
   1. Obtain approval of backfill material from Geotechnical Engineer.
   2. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12 inches above the top of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of initial backfill material will not be permitted.

B. Pipe Detection: In trenches containing pressurized plastic pipes, tracer wire shall be placed directly above the pipe and shall be connected to all valves, existing exposed tracer wires, and other appurtenances as appropriate.

C. Installation of Tracer Wire:
   1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
   2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
   3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.
   4. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

D. Installation of Warning Tape
   1. Install tape approximately 1 foot above and along the centerline of the pipe.
   2. Where tape is not continuous lap tape ends a minimum of 2 feet.

E. Subsequent Backfill:
   1. Above the level of initial backfill, the trench shall be backfilled with non-expansive native material from trench excavation or with imported select backfill material (Contractor's option). Subsequent backfill shall be free of vegetable matter, stones or lumps exceeding 3 inches in greatest dimension, and other unsatisfactory material.
   2. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, except that the upper 36 inches in areas subject to vehicular traffic shall be compacted to at least 95% relative compaction, unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of subsequent backfill material will not be permitted.

F. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe. Jetting of trench backfill is not permitted.

G. Utility backfill shall be inspected and tested by the Geotechnical Engineer during placement. Cooperate with the Geotechnical Engineer and provide working space for such tests in operations. Backfill not compacted in accordance with these specifications shall be re-compacted or removed as necessary and replaced to meet the specified requirements, to the satisfaction of the Geotechnical Engineer and the Owner prior to proceeding with the Project.

H. Compaction testing shall be in accordance with California Test Method ASTM D1556 or D1557.

3.9 CLEANUP

A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all materials, labor and equipment necessary to complete all work as specified herein, including but not limited to the following:
   1. Apply specified treatments to all cuts and fill slopes, soil stockpiles, and all disturbed areas.
   2. Install all temporary erosion control devices per Plans and Specifications.

B. All other labor and materials reasonably incidental to the satisfactory completion of the work, including cleanup of the site.

1.2 RELATED SECTIONS

A. Section 01 10 00, Supplemental General Requirements

1.3 RELATED DOCUMENTS

A. Caltrans Standard Specifications, 2015
   1. Section 21, Erosion Control

B. Association of Official Seed Analysts Procedures

C. California State Seed Law of the Department of Food and Agriculture

1.4 CONTRACTOR SUBMITTALS

A. The Contractor shall submit, in accordance with Section 01 10 00, Supplemental General Requirements, manufacturer's letters of compliance and manufacturer's literature for the following items:
   1. Seed Mixes (or individual items)
   2. Mulches
   3. Binders/Tackifiers
   4. Fertilizer
   5. Humate
   6. Soil inoculates
   7. Straw (Weight receipts from scales shall be required)
   8. Erosion Control Blanket

1.5 SITE CONDITION

A. It is the responsibility of the Contractor to visit the site to determine existing conditions including access to the site, the nature and extent of existing improvements upon adjacent public and private property, the nature of materials to be encountered, and other factors that may affect the work of this section.

B. It is the responsibility of the Contractor to have finished the grading of the slopes, including track walking the areas to be treated with erosion control treatments.

1.6 WORK SCHEDULE

A. The Contractor shall proceed with work during a period of August 15 through October 15, 2**XXX** or between January 15 and February 15, 2**XXX** ***[enter work period]***. The work shall progress as soon as the site becomes available consistent with normal seasonal limitations.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All products shall be delivered to the site in manufacturer's unopened standard containers bearing original labels showing quantity, analysis and name of manufacturer.

B. All materials shall be stored in designated areas and in such a manner as to protect them from weather or other conditions that might damage or impair the effectiveness of the product.

1.8 ANALYSIS OF SAMPLES AND TESTS

A. Samples: The Owner reserves the right to take and analyze samples of materials for conformity to the Specifications at any time. On request, seed shall delivered to Owner' Representative 30 days prior to seeding so seed can be tested. Seed samples shall be drawn in accordance with procedures outlined in Association of Official Seed Analysts.

B. Rejected material: Rejected materials shall be removed immediately from the site at Contractor's expense. Contractor shall pay the cost of testing replacement materials.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products shall be in conformance with the Specifications listed below. Any changes to products to be used shall be approved, in writing, by the Owner or Owner's representative prior to job site delivery.

2.2 SEED MIX [SEED MIX NEEDS TO BE PROVIDED BY LANDSCAPE CONSULTANT OR SEED COMPANY FOR THE PROJECT AREA]

A. Seed shall conform to the provisions in Section 21-2.02F, "Seed," of the Standard Specifications. Individual seed species shall be measured and mixed in the presence of the Owner's Representative.

B. 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.

C. Composition:

Species	**Common Name**	**PLS lbs. /acre**
Gazania	*Trailing Gazania*	*4 lbs. /acre* ***[revise per project area]***

OR [verify the need for and the seed mix with landscape architect or seed company]

NON-LEGUME SEED

Botanical Name (Common Name)	Percent Germination (Minimum)	Kilograms Pure Live Seed Per Hectare (Slope Measurement)
Baccharis pilularis var. pilularis (Coyote Bush)	20	0.05
Artemisia californica (California Sagebrush)	25	0.5
Mimulus aurantiacus. (Sticky Monkeyflower)	25	.1
Elymus glaucus, (Blue Wildrye,)	40	9
Festuca idahoensis (Idaho Festuca)	35	4
Hordium brachyantherum californicum (Meadow Barley)	40	8
Regreen	60	45.0

D. Quality
   1. All seed shall be in conformance with the California State Seed Law of the Department of Food and Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. In addition, the container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained.
   2. Prior to seeding at the request of the Owner, the Contractor shall provide a letter of certification, original Association of Official Seed Analysts (AOSA) seed test results, and calculations of PLS.
   3. All legume seed shall be pellet-inoculated. Inoculant sources shall be species specific and shall be applied at a rate of 2 pounds of inoculant per one hundred pounds of seed.

2.3 MULCH

A. Mulch shall be 100% wood hydroseed and shall be composed of wood fiber derived from whole wood chips with no growth or germination inhibiting substances, and shall be manufactured in such a manner that when thoroughly mixed with seed, fertilizer, organic stabilizer, and water, in the proportions specified, will form a homogeneous slurry which is capable of being sprayed to form a porous mat.

B. The fibrous mulch in its air-dry state shall contain no more than 15% by weight of water. The fiber shall have a temporary green dye and shall be accompanied by a certificate of compliance stating that the fiber conforms to these Specifications.

2.4 ORGANIC STABILIZER/TACKIFIER

A. Stabilizer and tackifier shall be an organic substance supplied in powder form and shall be psyllium-based and packed in clearly marked bags stating the contents of each package. The California Department of Food and Agriculture shall certify the material as an Auxiliary Soil Chemical.

2.5 FERTILIZER

A. Fertilizer shall be of commercial quality, conform to the requirements of the California Department of Food and Agriculture Code, shall have a guaranteed analysis for nitrogen, phosphorus and potassium of 7-2-3. Products specified as slow-release shall have been tested and demonstrate a nearly linear release curve.

2.6 HUMATE

A. Humate shall be OMRI listed and contain at least 40 % Humic acid. It shall be a natural granual humic acid based material that functions as an organic chelator and microbial stimulator. Humate shall not burn plant material and shall be non-toxic and non-staining.

B. Humate Soil Conditioner

Humic Acids (from Leonardite)	40 .00 %
Organic matter	40 .00 % - 50.00%
Carbon	50.00 % - 60.00%
Nitrogen	0.05 % - 1%
Phosphoric Acid	0.07 %
Potash	0.13 %
Sulfur	0.21 %
Magnesium	0.18 %
Calcium	0.32 %
pH	4.0
Soluble Salts	1.8

2.7 MYCORRHIZAL INOCULUM

A. Endo (arbuscular) mycorrhizal inoculum shall be registered by the California Department of Food and Agriculture and consist of spores, mycelium and mycorrhizal root fragments in a solid carrier suitable for handling by hydro-seeding. The carrier shall be the material in which the inoculum was originally produced, and may include organic materials, vermiculite, perlite, calcined clay, or other approved materials consistent with mechanical application and with good plant growth.

B. Each endomycorrhizal inoculum shall carry a supplier's guarantee of 80,000 propagules minimum per kilogram. The minimum propagule count shall be shown on each label provided. If more than one fungal species is claimed by the supplier, the label shall include a guarantee for each species of mycorrhizal fungus claimed.

C. Endomycorrhizal fungal species shall be suitable for the pH of the soil at the planting site. If the inoculum consists of a mixture of species, no more than 20% of the claimed propagule count shall consist of fungal species known to be unsuitable for the pH of the soil at the planting site.

D. A sample of approximately 28 grams (one ounce) of inoculum will be taken from each inoculum container by the Owner’s Representative. The number of propagules will be determined by laboratory testing. Propagules shall include live spores, mycelial fragments and viable mycorrhizal root fragments.

E. Endomycorrhizal inoculum shall be stored, transported and applied at temperatures of less than 32° C (90° F).

2.8 STRAW

A. Shall be derived from irrigated rice or clean cereal grain straw.

B. The Contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw from outside the County in which it is to be used is delivered to the site of the work.

C. Straw that has been used for bedding is prohibited.

2.9 EQUIPMENT

A. Equipment used for application of slurry shall be a commercial-type Hydro-Seeder and have a built-in agitation system with an operation capacity sufficient to agitate, suspend and homogeneously mix slurry.

B. Tank capacity shall be a minimum of 1,500 gallons and shall be mounted on a truck to allow access to the site.

C. Pump shall be able to generate 150 psi at the nozzle.

D. Straw blowers: Equipment shall be specifically designed and manufactured for the application of straw and shall be of sufficient horsepower to break up and distribute straw at the specified application rate.

2.10 WATER

A. Water shall be furnished by Owner ***(verify if that is true or not and if there are any associated fees)*** and shall be made readily available at the sites indicated on the project map. Water shall be of potable quality.

B. Contractor shall add 4-6 lbs. of Vulpia Microstachys or 20 lbs. of Regreen per acre if hydroseeding occurs in the fall or winter months.

C. Hydroseed mix can be obtained from Pacific Coast Seed, Inc., (925) 373-4417. ***[Enter local seed company]***

1.11 EROSION CONTROL BLANKETS

A. Erosion control must be Erosion Control Technology Council (ECTC) Type 2D and made of processed natural fibers that are mechanically, structurally, or chemically bound together to form a continuous matrix that is surrounded by 2 natural nets. Erosion control blanket must comply with the requirements shown in the following table:

Erosion Control Blanket

Quality characteristic	Test method	Requirement		
		Type A	Type B	Type C
Roll width (min, inches)	--	72		
Matrix (%) Straw/coconut Woven coir (coconut fiber) Wood excelsior (6 inches or longer)	--	 70/30 -- --	 -- 100 --	 -- -- 80
USLE C-Factor for a 1:1 (H:V) unvegetated slope	--	≤ 0.20		

Shear stress (max, psf)	ASTM D6460	1.75
Tensile strength (min, psf)	ASTM D5035	75
Functional longevity (months)	--	12

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. No soil amendments shall be required except as noted on the Plans.

B. Verification: Contractor shall verify:
1. That all areas to receive erosion control treatments are free of vegetation and other objectionable material.
2. That grades are final for permanently treated areas and within reasonable standard for temporary treatments.
3. That all sloped areas are uniformly compacted: wherever possible, the surface compaction of the top 1 foot shall be 85% or less.

3.2 EROSION CONTROL BLANKET INSTALLATION

A. Before placing the erosion control blankets, Contractor shall ensure the subgrade has been graded smooth and has no depressed voids. The subgrade must be free from obstructions, such as tree roots, projecting stones, or foreign matter greater than 1 inch in diameter. Overlap the end of the erosion control blanket by 24 inches. Use 18 inch staples staked at maximum of 4 feet on center in staggered pattern. Do not drive vehicles on the erosion control blanket.

3.3 HYDROSEEDED AREA

A. Areas to receive erosion control treatments include all graded areas as shown on the site plan and other areas as determined by the Owner.

B. Perform erosion control treatments on a section by section basis. On approval of the Owner, and as soon as possible after grading, complete treatments in the following order of priority: stream zones, graded slopes, non-trafficked road and parking areas, building pads and other flat areas.

C. Contractor shall be available to re-treat areas disturbed by on-going activities.

D. Preparation: All slurry preparation to be conducted at the job site.
1. Water, mulch, fertilizer, compost, binder and other ingredients shall be added to the tank simultaneously so that the finished load is a homogenous mix of the specified ingredients.
2. Seed shall be added last and shall be discharged within 2 hours. Loads held over 2 hours will be recharged with ½ the seed rate before application.
3. Once fully loaded, the complete slurry shall be agitated for 3-5 minutes to allow for uniform mixing.

E. Application: Apply specified slurry in a sweeping motion to form a uniform application.
1. Step One - with hydroseeder apply:
   a. Seed Mix Total — 4 lbs./acre
   b. 100% Cellulose Fiber Mulch — 500 lbs./acre
   c. Biosol 7-2-3 (Organic Fertilizer) — 1,600 lbs./acre
   d. AM120 (Mycorrhizal Inoculant) — 60 lbs./acre
2. Step Two - with straw blower apply:
   a. Rice or Clean Cereal Grain Straw — 4,000 lbs./acre

3. Step Three - with hydroseeder apply:
   a. 100% Cellulose Fiber Mulch 500 lbs./acre
   b. M-Binder 100 lbs./acre
4. Under suitable conditions straw shall be uniformly spread at the specified rates. The straw may be pneumatically applied as long as the resulting straw in predominately 3 to 6 inches in length. The straw shall be treated with mulch and tackifier before it can blow off the site but in no case shall straw be left untreated for more than 24 hours. The Contractor will clean up areas of straw which are blown from the site, and the areas shall be retreated at no additional expense to the Owner.

F. Protection: Contractor is to stay off treated areas.

G. Unused Loads: If mixture remains in tank for more than 8 hours it shall be removed from the job site at Contractor's expense.

H. Preliminary Inspection: Notify the Owner's Representative 48 hours in advance of all seeding. Inspection and favorable review of completed work shall begin the plant establishment period.

3.4 PLANT ESTABLISHMENT MAINTENANCE

A. General plant maintenance shall immediately follow seeding and continue for **90 days**. ***[Enter plant maintenance period]***

B. Protect areas against all damage, including erosion and trespass, and provide proper safeguards. Maintain and keep in good repair all temporary barriers erected to prevent trespassing. Check all barrier and temporary fencing daily, and make immediate repairs or replacements

C. Repair all damage to seeded areas.

D. Maintain constant moisture depth in soil to insure vigorous growth.

3.5 FINAL INSPECTION AND ACCEPTANCE:

A. Final inspection will be conducted upon completion of maintenance, replacements and corrective work. Five (5) days' notice shall be given. If project improvements, corrective work, and maintenance have not been performed as specified and to the satisfaction of the Owner's Representative, maintenance shall continue at Contractor's expense until such time as work has been successfully completed.

3.6 GUARANTEE AND REPLACEMENT

A. Guarantee all planting to be in a healthy, thriving condition until the end of the maintenance period or beyond that time until active growth is evident and for one year from date of acceptance. ***[These terms are to be determined by the Owner]***

B. Replace all seeded areas not in vigorous condition as soon as directed by Owner's Representative. Seed mixture used for replacement must be of the same kind and quantity as specified in this section.

3.7 CLEAN-UP

A. Erosion control work areas shall be maintained in a neat and orderly condition. Keep paved area free of erosion treatment, soil, and other debris.

B. Overspray: Installing Contractor is responsible for washing or otherwise cleaning excess material off all areas not intended to receive treatment.

C. Debris: Clean up and remove erosion control associated materials and debris from project site before Final Acceptance.

END OF SECTION

SECTION 32 11 00

PAVEMENT BASE COURSE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate subbase

B. Aggregate base

C. Cement treated base

D. Lime stabilization

1.2 RELATED SECTIONS

A. Section 01 10 00, Supplemental General Requirements

B. Section 01 50 50, Erosion Control

C. Section 31 20 00, Earth Moving

1.3 RELATED DOCUMENTS

A. Geotechnical Report: Geotechnical Investigation- San Ramon Emergency Operations Center, by Geocon Consultants, Inc., in August 2020.

B. ASTM:
1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
2. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
3. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
4. E548, Guide for General Criteria Used for Evaluating Laboratory Competence

C. Caltrans Standard Specifications, 2015
1. Section 24, Stabilized Soils
2. Section 25, Aggregate Subbases
3. Section 26, Aggregate Bases
4. Section 27, Cement Treated Bases

1.4 DEFINITIONS

A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.

B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material ¾ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.

C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.

D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials. Perform work in accordance with Section 31 20 00, Earth Moving.

1.5 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.6 QUALITY ASSURANCE

A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.

B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.

C. Perform installation of base materials under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of the Geotechnical Engineer, shall be removed and replaced at no cost to the Owner. Notify the Geotechnical Engineer at least 24 hours prior to commencement of base material installation and at least 48 hours prior to testing.

D. Do not mix or place cement treated base when the temperature is below is below 36 degrees F or when the ground is frozen.

E. Finish surface of material to be stabilized prior to lime treatment shall be in accordance with Caltrans Standard Specification Section 24, Stabilized Soils.

F. Finish surface of the stabilized material after lime treatment shall be in accordance with Caltrans Standard Specifications Section 24, Stabilized Soils.

G. Finish surface of cement treated base shall be in accordance with Caltrans Standard Specification Section 27, Cement Treated Bases.

H. Do not project the finish surface of aggregate subbase above the design subgrade.

I. Finish grade tolerance at completion of base installation: +0.05 feet

1.7 PROJECT CONDITIONS

A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the Owner.

C. Provide dust and noise control in accordance with Section 01 10 00, Supplemental General Requirements.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE

A. Material: Class 2 or 3, 1 ½ inch maximum or ¾ inch maximum in accordance with Caltrans Standard Specification Section 26, Aggregate Bases.

2.2 LIME STABILIZED SOILS

A. Material: In accordance with Caltrans Standard Specification Section 24-2, Lime Stabilized Soil.

PART 3 - EXECUTION

3.1 GENERAL

A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

3.2 WET WEATHER CONDITIONS

A. Do not place or compact subgrade if above optimum moisture content.

B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.3 AGGREGATE SUBBASE

A. Spreading and Compacting: In accordance with Caltrans Standard Specification Section 25-1.03D, Spreading and 25-1.03E, Compacting.

3.4 AGGREGATE BASE

A. Watering, Spreading and Compacting: In accordance with Caltrans Standard Specification Section 26-1.03D, Spreading and 26-1.03E, Compacting.

3.5 CEMENT TREATED BASE

A. Proportioning and Mixing Plant-Mixed: In accordance with Caltrans Standard Specification Section 27-1.03D.

3.6 LIME STABILIZATION

A. Lime stabilization shall conform to Caltrans Standard Specification Section 24, Stabilized Soils, and the following:
   1. Add lime in the amount specified by the Geotechnical Engineer.
   2. Lime treat subgrade soils from back of curb to back of curb to a depth specified by the Geotechnical Engineer.
   3. Mix in two mixing periods, both with the tines lowered to the same depth. Both mixing periods shall be monitored and verified by the Geotechnical Engineer. The second mixing shall occur at about 24 hours after the initial mixing.
   4. Compact and grade the lime mixed subgrade immediately after the second mixing.
   5. Compact the lime treated subgrade to 93 percent as determined by ASTM D1557.

6. After application of the curing seal, do not allow traffic on the lime treated material for a period of 7 days in lieu of the 3 days specified in Caltrans Standard Specifications, Section 24.
7. Proof-roll the stabilized subgrade after compacting to confirm that a non-yielding surface has been achieved. Yielding areas, if any, shall be mitigated. Mitigation could consist of over-excavation, utilization of stabilization fabric, or chemical treatment. Each case shall be addressed individually in the field by the Geotechnical Engineer.

3.7 DISPOSAL

A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.

B. Form construction and use in placing portland cement concrete pavement.

C. Joints for portland cement concrete pavement.

D. Finishing portland cement concrete pavement.

E. Curing and protecting portland cement concrete pavement.

1.2 RELATED SECTIONS

A. 01 10 00, Supplemental General Requirements

B. 31 20 00, Earth Moving

C. 32 11 00, Pavement Base Course

D. 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. Geotechnical Report: Geotechnical Investigation- San Ramon Emergency Operations Center, by Geocon Consultants, Inc., in August 2020.

B. AASHTO Standard Specifications
1. T132: Standard Method of Test for Tensile Strength of Hydraulic Cement Mortars

C. ASTM Standards
1. D36: Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
2. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. A706: Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
4. A775: Standard Specification for Epoxy Coated Steel Reinforcing Bars.
5. A934: Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
6. A996: Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
7. C94: Standard Specification for Ready-Mixed Concrete
8. C603: Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants
9. C639: Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
10. C661: Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
11. C679: ASTM C679-15 Standard Test Method for Tack-Free Time of Elastomeric Sealants

12. C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
13. C793: Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
14. C881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
15. D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
16. D1640: Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
17. D2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
18. D2835: Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
19. D3963: Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
20. D6690: Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

D. Caltrans Standard Specifications, 2015
   1. Section 10, General
   2. Section 40, Concrete Pavement
   3. Section 52, Reinforcement
   4. Section 95, Epoxy

E. Caltrans Standard Plans:
   1. Plan P1: Jointed Plan Concrete Pavement – New Construction
   2. Plan P10: Concrete Pavement Dowel Bar Details

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing and Materials

C. Caltrans: State of California, Department of Transportation

1.5 QUALITY ASSURANCE

A. Testing Agency: Geotechnical Engineer will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

D. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer’s plant and each aggregate from one source.

1.6 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.

C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
1. Cementitious materials and aggregates
2. Steel reinforcement and reinforcement accessories
3. Admixtures
4. Curing compound
5. Applied finish material
6. Bonding agent of adhesive
7. Joint filler
8. Joint Sealant
9. Tie Bars
10. Epoxy
11. Backer Rods

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

A. In accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.2 BASE MATERIAL

A. In accordance with Section 32 11 00, Pavement Base Course.

2.3 TIE BARS

A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A615, Grade 40 or 60

B. Epoxy-coat in accordance with Caltrans Standard Specification Section 52-2.02, Epoxy-Coated Reinforcement, except bars must comply with ASTM A706; ASTM A996; or ASTM A615, Grade 40 or 60.

C. Do not bend tie bars.

2.4 EPOXY

A. Bond tie bars to existing concrete with epoxy resin in accordance with Caltrans Standard Specification Section 95-1.02D, Epoxy Adhesive for Bonding Freshly Mixed Concrete to Hardened Concrete.

2.5 SILICONE JOINT SEALANT

A. Furnish low modulus silicone joint sealant in a one-part silicone formulation. Do not use acid cure sealants. Compound to be compatible with the surface to which it is applied and conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 77°± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	45 psi max.
Flow at 77° ± 1°F	ASTM C639[a]	Shall not flow from channel
Extrusion Rate at 77° ± 1°F	ASTM C603[b]	75-250 g per min.
Specific Gravity	ASTM D792 Method A	1.01 to 1.51
Durometer Hardness, at 0°F, Shore A, cured 7 days at 77° ± 1°F	ASTM C661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C793	No chalking, cracking or bond loss
Tack free at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM C679	Less than 75 minutes
Elongation, 7 day cure at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	500 percent min.
Set to Touch, at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 77° ± 1°F	AASHTO T132[c]	50 psi min.
Movement Capability and Adhesion, 100% extension at 0°F after air cured 7 days at 77° ± 1°F, and followed by 7 days in water at 77° ± 1°F	ASTM C719[d]	No adhesive or cohesive failure after 5 cycles

Notes:

a. ASTM Designation: C639 Modified (15 percent slope channel A).
b. ASTM Designation: C603, through $^1/_8$ inches opening at 50 psi.
c. Mold briquets in conformance with the requirements in AASHTO Designation: T132, sawed in half and bonded with a $^1/_{16}$ inches maximum thickness of sealant and tested in conformance with the requirements in AASHTO Designation: T132. Briquets shall be dried to constant mass at 212 ± 10°F.
d. Movement Capability and Adhesion: Prepare 12 inch x 1 inch x 3 inch concrete blocks in conformance with the requirements in ASTM Designation: C719. A sawed face shall be used for bond surface. Seal 2 inch of block leaving ½ inches on each end of specimen unsealed. The depth of sealant shall be $^3/_8$ inches and the width ½ inches.

B. Formulate the silicon joint sealant to cure rapidly enough to prevent flow after application on grades of up to 15 percent.

C. Furnish to the Owner's Representative a Certificate of Compliance. Accompany certificate with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. Provide the certificate and accompanying test report for each lot of silicone joint sealant prior to use on the project.

2.6 ASPHALT RUBBER JOINT SEALANT

A. Conform to the requirements of ASTM Designation: D6690 as modified herein or to the following:
   1. Provide a mixture of paving asphalt and ground rubber. Ground rubber to be vulcanized or a combination of vulcanized and de-vulcanized materials ground so that 100 percent will pass a No. 08 sieve and contain not less than 22 percent ground rubber, by mass. Modifiers may be used to facilitate blending.
   2. The Ring and Ball softening point shall be 135°F minimum, when tested in conformance with the requirements in ASTM D36.
   3. Provide asphalt rubber sealant material capable of being melted and applied to cracks and joints at temperatures below 400°F.

B. The penetration requirements of Section 4.2 of ASTM Designation: D6690 do not apply. The required penetration at 77˚F, 5 oz, 5s, shall not exceed 120.

C. The resilience requirements of Section 4.5 of ASTM Designation: D6690 do not apply. The required resilience, when tested at 77°F, shall have a minimum of 50 percent recovery.

D. Accompany each lot of asphalt rubber joint sealant shipped to the job site, whether as specified herein or conforming to the requirements of ASTM Designation D6690, as modified herein, by a Certificate of Compliance, storage and heating instructions and precautionary instructions for use.

E. Heat and place in conformance with the manufacturer's written instructions and the details shown on the Plans. Provide manufacturer's instructions to the Owner's Representative. Do not place when the pavement surface temperature is below 50 ˚F.

2.7 PREFORMED COMPRESSION JOINT SEALANT

A. Material: ASTM Designation: D2628.
   1. Number of cells: 5 or 6.
   2. Lubricant Adhesive: ASTM Designation D2835.
   3. Install compression seals along with lubricant adhesive according to the manufacturer's recommendations. Submit manufacturer's recommendations to the Owner's Representative`.

B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of Compliance, storage instructions and precautionary instructions for use. Also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the Plans. Show evidence that the selected seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the Plans.

2.8 BACKER RODS

A. Provide backer rods that have a diameter prior to placement at least 25 percent greater than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond, adverse reaction occurs between the rod and sealant. In no case use a hot pour sealant that will melt the backer rod. Submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

2.9 SLIP RESISTIVE AGGREGATE FINISH

A. Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

PART 3 - EXECUTION

3.1 WATER SUPPLY

A. Provide water supply in accordance with Caltrans Standard Specification Section 10-6, Watering.

3.2 SUBGRADE

A. Prepare subgrade in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

3.3 SOIL STERILANT

A. Furnish and apply to areas indicated in accordance with Section 31 20 00, Earth Moving.

3.4 PLACING

A. Prepare concrete in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

3.5 SPREADING COMPACTING AND SHAPING

A. Conform to the following:
   1. Stationary Side Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Stationary Side-Form Construction.
   2. Slip Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Slip Form Construction.

3.6 INSTALLING TIE BARS

A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the Plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 50 feet. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.

B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:
   1. Drilling and bonding in conformance with the details shown on the Plans. Provide a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C881, Type V. Grade 3 (Non-Sagging), Class shall be as follows:

Temperature of Concrete	Required Class of Epoxy Resin
Lower than 40° F	A
40˚ F through 60˚ F	B
Above 60˚ F	C

   2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be cleaned in accordance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Owner's Representative, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Owner's Representative, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.
   3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
   4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of

threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

3.7 JOINTS

A. Construct joints in accordance with Caltrans Standard Specification Section 40-1.03B, Joints, except that tie bars shall be as specified under Part 1, Materials.
   1. Construction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B(2), Construction Joints.
      a. Construct a construction joint at the end of each day's work, or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.
      b. If sufficient concrete has not been mixed to form a slab to match the next contraction joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall be become the property of the Contractor and shall be properly disposed of.
      c. A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of tie bars.
   2. Contraction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B (3), Contraction Joints, except that the insert method of forming joints in pavement shall not be used.

3.8 FINISHING

A. Finish concrete in accordance with Caltrans Standard Specification Section 40-1.03H, Finishing.

B. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:
   1. Uniformly spread ***[25 lb per 100 sq. ft.] [40 lb per 100 sq. ft.] [60 lb per 100 sq. ft.] <Insert rate of application>*** of dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
   2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.

3.9 CURING

A. Cure concrete in accordance with Caltrans Standard Specification Section 40-1.03I, Curing.

3.10 SEALING JOINTS

A. Liquid Joint Sealant Installation.
   1. The joint sealant detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the Plans.
   2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.

3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 2 inch on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of 1/4 $\pm$ 1/32 inches and a minimum pressure of 90-psi.
4. Install backer rod as shown on the Plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 40°F or above. Install backer rod when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.
5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the Plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the Plans.
6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the Plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the Plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.
7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

B. Preformed Compression Joint Seal Installation
1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the Plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of 1/4 $\pm$ 1/32 inches and a minimum pressure of 90 psi.

3.11 PROTECTING CONCRETE PAVEMENT

A. Protect pavement in accordance with Caltrans Standard Specification Section 40-1.03J Protecting Concrete Pavement.

END OF SECTION

SECTION 32 13 18

CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Materials for portland cement concrete

B. Aggregate and aggregate grading for portland cement concrete

C. Water for portland cement concrete

D. Admixtures for portland cement concrete

E. Proportioning for portland cement concrete

F. Mixing and transporting portland cement concrete

G. Formwork for cast in place portland cement concrete

H. Embedded materials for portland cement concrete

I. Steel reinforcement for portland cement concrete

J. Placing and finishing portland cement concrete

K. Curing portland cement concrete

L. Protecting portland cement concrete

1.2 RELATED SECTIONS

A. Section 32 12 16, Asphalt Paving

B. Section 32 13 13, Concrete Pavement

1.3 RELATED DOCUMENTS

A. ASTM Standards
   1. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   2. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   3. C94, Standard Specification for Ready-mixed Concrete
   4. C150, Standard Specification for Portland Cement
   5. C260, Standard Specification for Air-Entraining Admixtures for Concrete
   6. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
   7. C494, Standard Specification for Chemical Admixtures for Concrete.
   8. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Portland Cement

9. C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
10. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
11. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

B. Caltrans Standard Specifications, 2018
1. Section 51: Concrete Structures
2. Section 73: Concrete Curbs and Sidewalks
3. Section 90: Concrete

1.4 DEFINITIONS

A. ASTM: American Society for Testing and Materials

1.5 SUBMITTALS

A. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the Plans. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

B. Reinforcing Steel Shop-Drawings

1.6 QUALITY ASSURANCE

A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.
1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slabs on grade and other work.

B. Certifications:
1. Provide Owner's Representative at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
a. Materials contained comply with the requirements of the Contract Documents in all respects.
b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
c. Statement of type and amount of any admixtures.
2. Provide Owner's Representative, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

1.7 DESIGNATION

A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the

concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.

B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT

A. General: Type II or Type V cement conforming to the requirements of ASTM C150. Contractor may substitute pozzolan for portland cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F Fly Ash meeting the requirements of ASTM C618.

2.2 AGGREGATE AND AGGREGATE GRADATION

A. General: Fine and coarse aggregates shall be ¾ inch maximum size; clean and crushed aggregate free of materials which may cause staining. Aggregates shall conform to the requirements of section 90-1.02C of the Caltrans Standard Specifications.

B. Aggregate Size and Gradation: Conform to the requirements of section 90-1.02C(4)(d) of the Caltrans Standard Specifications for 1 inch maximum combined aggregate.

2.3 WATER

A. General: Water shall be clean, free from injurious amounts of oil, alkali, organic matter, or other deleterious material, and not detrimental to concrete per ASTM C94. Water shall conform to the requirements of section 90-1.02D of the Caltrans Standard Specifications, for mixing and curing portland cement concrete and for washing aggregates.

2.4 CHEMICAL ADMIXTURES

A. Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material. Admixtures shall conform to the requirements of section 90-1.02E of the Caltrans Standard Specifications and as noted herein or on the Plans.
   1. Air-Entraining Admixture: ASTM C260/C260M
   2. Water-Reducing Admixture: ASTM C494/C494M, Type A
   3. Retarding Admixture: ASTM C494/C494M, Type B
   4. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D
   5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F
   6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G
   7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II

2.5 CLASSIFICATION OF PORTLAND CEMENT CONCRETE

A. Unless specified otherwise herein or on the Plans, portland cement concrete for the following items shall be designated as follows:
   1. Curbs, Gutters, and Sidewalks: Minor concrete.
   2. Cast in Place Concrete Pipe: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.
   3. Thrust Blocks: The concrete shall have a minimum compressive strength of 3,000 psi.

4. Sign and Fence Footings: The concrete shall consist of a minimum of 376 pounds of portland cement per cubic yard of concrete.
5. Water, Storm, and Sanitary Structures: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.

2.6 EXPANSION JOINT MATERIAL

A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless specified otherwise herein or on the Plans, expansion joint thickness shall be as follows:
1. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½ inch
2. Structures: As indicated

2.7 REINFORCEMENT AND DOWELS

A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM A615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.

B. Slip dowels, where noted or called for on the Plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM A615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.

C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM A1064. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.

D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM A1064.

E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.8 CURING AND SEALING MATERIALS

2.9 FORMS

A. Conform to the requirements of Section 73-1.03C and Section 90-1.03B(5) of the Caltrans Standard Specifications.

B. Tolerance: Not to deviate more than ¼ inch in 10 feet in grade and alignment.

2.10 PRECAST CONCRETE STRUCTURES

A. Conform to the following Sections of Caltrans Standard Specifications:
1. 51-7, Minor Structures
2. 70-5.02, Flared End Sections

2.11 CONCRETE VEHICULAR PAVEMENT

A. General: See Section 32 13 13, Concrete Pavement.

PART 3 - EXECUTION

3.1 STRUCTURAL EXCAVATION

A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.

B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density as determined by ASTM D1557.

C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site.

3.2 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Consulting Engineer for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.3 PLACING CONCRETE FORMS

A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.

B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.

C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.

D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the

Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.4 PLACING STEEL REINFORCEMENT

A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
   1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
   2. Splice locations shall be made as indicated on the plans.

B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing 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. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.

C. Place reinforcing to provide the following minimum concrete cover:
   1. Surfaces exposed to water: 4 inches.
   2. Surfaces poured against earth: 3 inches.
   3. Formed surfaces exposed to earth or weather: 2 inches.
   4. Slabs, walls, not exposed to weather or earth: 1 inch.

D. Minimum spacing, center of parallel bars shall be two and one half (2 ½) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.5 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

A. Transit mix concrete in accordance with the requirements of ASTM Designation C94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by the Owner's Representative.

B. Do not hand mix concrete for use in concrete structures.

3.6 PLACING PORTLAND CEMENT CONCRETE

A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.

B. Do not place concrete until the subgrade and the forms have been approved.

C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.

D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner's Representative. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.

E. Concrete in certain locations may be pumped into place upon prior approval by the Owner's Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 PLACING ACCESSORY MATERIALS

A. Place water stops and other items required to be embedded in of portland cement concrete structures at locations shown or required in accordance with Section 51-2.04 of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans.

B. Curing Compounds:
1. Regular Portland Cement Concrete: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 FORM REMOVAL

A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.

B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.

C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.

D. Leave edge forms in place at least 24 hours after pouring.

E. Decorative surfacing concrete walks, concrete median islands or other installations shall be formed and placed as a concrete slab conforming to the details shown or noted on the Plans.

3.9 FIELD QUALITY CONTROL

A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.

B. No concrete shall be placed prior to approval of forms.

C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.

D. Conform the finish grade and cross section of concrete improvements to the design grades and cross sections.

E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances ACI 117 and as follows:
1. Elevation: ¼ inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10 foot long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.

8. Joint Spacing: 3 inches, unless otherwise indicated.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 RESTORATION OF EXISTING IMPROVEMENTS

A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.

B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

SECTION 32 13 75

CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Portland cement concrete curbs and gutters, sidewalk, curb ramps and driveways.

1.2 RELATED SECTIONS

A. Section 31 20 00, Earth Moving

B. Section 32 11 00, Pavement Base Course

C. Section 32 13 13, Concrete Pavement

D. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. Geotechnical Report: Geotechnical Investigation- San Ramon Emergency Operations Center, by Geocon Consultants, Inc., in August 2020.

B. American society for Testing and Materials (ASTM)
   1. A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   2. D1751 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

C. Caltrans Standard Specifications, 2015
   1. Section 51: Concrete Structures
   2. Section 72: Slope Protection
   3. Section 73: Concrete Curbs and Sidewalks
   4. Section 90: Concrete

1.4 DEFINITIONS

A. ASTM: American Society for Testing Materials

B. ACI: American Concrete Institute

1.5 SUBMITTALS

A. Submittal procedures shall be as outlined in Section 01 10 00 – Supplemental General Requirements.

B. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Owner. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

1.6 QUALITY ASSURANCE

A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.

B. Certifications:
   1. Provide Owner at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
      a. Materials contained comply with the requirements of the Contract Documents in all respects.
      b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
   2. Settlement of type and amount of any admixtures.
   3. Provide Owner, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

C. Conform to the applicable provisions of Sections 51, 73 and 90 of the Caltrans Standard Specification and these Technical Specifications.
   1. Conform construction of portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks) to the requirements of Section 73 of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
   2. Construct "V" ditches in accordance with Section 72-5 of the Caltrans Standard Specifications; except that finishing shall be in accordance with Standard Specification Section 73, or as otherwise required in these Technical Specifications or shown on the Plans.

1.7 DESIGNATION

A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.

B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.2 PORTLAND CEMENT CONCRETE

A. Unless specified otherwise herein or on the Plans, portland cement concrete for items in this section shall be Minor Concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:
   1. Compressive Strength:
      a. Typical: 3000 psi, minimum at 28 days, unless otherwise indicated.
      b. Curbs & Gutters: 3500 psi, minimum at 28 days.
   2. Slump Limit: 8 inches minimum for concrete containing high-range water-reducing admixture (superplasticizer, limited to flatwork only); 4 inches for other concrete.
   3. Water/Cement Ratio: 0.5

2.3 CURBS AND GUTTERS FORMS

A. Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.

2.4 EXPANSION JOINT MATERIAL

A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM Designation D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

B. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
   1. Curbs, Curb Ramps, Island Paving, Driveways and Gutter Depressions: ¼ inch

2.5 REINFORCEMENT AND DOWELS

A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

B. Form, place and finish concrete curbs, gutters, walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.

C. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12 inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6 inch deep lift of asphalt concrete after gutter form is removed.

3.2 SUBGRADE

A. Conform to Section 73-1.03B of Caltrans Standard Specifications.

3.3 SOIL STERILANT

A. Furnish and apply an oxidation granular preemergent soil sterilant to prepared subgrade or after installation of rock or aggregate base uniformly at the rate recommended by the manufacturer.

3.4 PLACING CONCRETE FORMS

A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.

B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.

C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.

D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.5 PLACING PORTLAND CEMENT CONCRETE

A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.

B. Do not place concrete until the subgrade and the forms have been approved.

C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.

D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.

E. Concrete in certain locations may be pumped into place upon prior approval by the Owner. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.6 EXPANSION JOINTS

A. Construct expansion joints incorporating premolded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, median/island paving, valley gutters, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch smooth slip dowels in the positions shown or noted on the detail drawings.

B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

3.7 WEAKENED PLANE JOINTS

A. Construct weakened plane joints in concrete curbs, gutters, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.

B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

C. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

3.8 FINISHING CONCRETE

A. Finish curb and gutter in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.

B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.

C. Provide a broom finish to all horizontal surfaces perpendicular to the path of travel on surfaces used by pedestrians:
   1. Sloped Less than 6%: Provide a medium salt (medium broom) finish by drawing a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.
   2. Surfaces Sloped Greater than 6%: Provide a slip resistant (heavy broom finish) by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.9 FORM REMOVAL

A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.

B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.

C. Leave edge forms in place at least 24 hours after pouring.

3.10 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

A. New curb or gutter is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert ½ inch diameter by 12 inch long dowels at 24 inches on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.

B. A cold joint to the existing curb is not acceptable.

3.11 FIELD QUALITY CONTROL

A. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.

B. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in Section 73 of the Caltrans Standard Specifications.

3.12 RESTORATION OF EXISTING IMPROVEMENTS

A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.

B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of existing traffic stripes and pavement markers

B. Removal of existing signs

C. Cleaning and sweeping of streets before application of traffic stripes and pavement markings

D. Materials and application for traffic stripes and pavement markings

E. Materials and application for pavement markers

F. Traffic control signs and street name signs

G. Object markers

H. Survey monuments

1.2 RELATED SECTIONS

A. Section 01 10 00, Supplemental General Requirements

B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. Caltrans Standard Specifications, 2015
   1. Section 78, Incidental Construction
   2. Section 81, Miscellaneous Traffic Control Devices
   3. Section 82, Signs and Markers
   4. Section 84, Markings

B. Caltrans Standard Plans, 2015
   1. Plan A20A through A20D: Pavement Markers and Traffic Lines, Typical Details
   2. Plan A24A and A24B: Pavement Markings Arrows
   3. Plan A24C: Pavement Markings, Symbols and Numerals
   4. Plan A24D: Pavement Markings, Words
   5. Plan A24E: Pavement Markings, Words, Limit and Yield Lines
   6. Plan A24F: Pavement Markings, Crosswalks
   7. Plan A73A: Object Markers
   8. Plan A73B: Markers
   9. Plan A73C: Delineators, Channelizers and Barricades
   10. Plan A74: Survey Monuments
   11. Plan RS1: Roadside Sign, Typical Installation Details No. 1
   12. Plan RS2: Roadside Sign, Wood Post - Typical Installation Details No. 2
   13. Plan RS3: Roadside Sign, Laminated Wood Box Post - Typical Installation Details No. 3
   14. Plan RS4: Roadside Sign, Typical Installation Details No. 4

C. The State of California Traffic Manual, 2014

D. The regulations, standards, and tests of the State of California Department of Transportation Materials and Research Division, edition in effect at time of date on Plans.

E. Professional Land Surveyor's Act, Business and Professions Code §§ 8700 – 8805

1.4 SUBMITTALS

A. Submit product data for each of the following in accordance with Section 01 10 00, Supplemental General Requirements:
   1. Traffic paint
   2. Pavement markers and adhesives
   3. Reflectorized markers and posts

1.5 QUALITY ASSURANCE

A. Deliver certificates showing conformance with this specification to the Owners Representative with each shipment of materials and equipment to the Project site.

B. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

1.6 PROJECT CONDITIONS

A. Do not apply traffic striping or pavement markings to the pavement until after approval to proceed has been given by the Owners Representative.

B. Thoroughly cure new asphalt concrete and portland cement concrete before application of stripes, markings or markers.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC STRIPES AND MARKING

A. Thermoplastic striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02B, unless noted otherwise herein or on the Plans.

B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.

C. Thermoplastic stripes and markings shall have a minimum skid friction value of BPN 35.

2.2 PAINTED STRIPES AND MARKINGS

A. Painted striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02C, unless noted otherwise herein or on the Plans.

B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.

2.3 PAVEMENT MARKERS

A. Pavement Markers shall be in accordance with Caltrans Standard Specification Section 81-3, Pavement Markers, and as indicated on the Plans.

B. Material

1. Non-reflective Material shall be in accordance with Caltrans Standard Specification Section 81-3.02B, Non-Reflective Pavement Markers. ***[Specify type A or AY and select ceramic or plastic or indicate otherwise.]***

2. Retroreflective Material shall be in accordance with Caltrans Standard Specification Section 81-3.02C, Retroreflective Pavement Markers. ***[Specify type A or AY or indicate otherwise.]***

C. Adhesive:

1. Adhesive Material shall be in accordance with Caltrans Standard Specification Section 81-3.02D, Hot Melt Bituminous Adhesive.

[Specify standard or flexible.]

[Specify rapid or standard set.]

2.4 TRAFFIC CONTROL SIGNS

A. General: Traffic control signs shall be in accordance with Caltrans Standard Specification Section 82-1, Signs and Markers.

B. Sign Panels shall be in accordance with Caltrans Standard Specification Section 82-2, Sign Panels. Conform type (regulatory or warning), size, shape and pattern to the State of California, Department of Transportation, Traffic Manual, edition in effect at the date of the Plans.

C. Posts:

1. Metal Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02B, Metal Posts.
2. Wood Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02C, Wood Posts.

D. Mounting Hardware shall be in accordance with Caltrans Standard Specification 82-3.02E, Sign Panel Fastening and Mounting Hardware, unless otherwise specified.

E. Post Foundations: Conform to Caltrans Standard Plans.

2.5 REFLECTORIZED OBJECT MARKERS

A. Reflectorized Metal Object Markers: In accordance with Caltrans Standard Specification Section 82-5, Markers, for target plates and reflectors, and Caltrans Standard Plans A73A through A73C. Marker type shall be as shown on Plans.

B. Posts: Metal posts shall be in accordance with Caltrans Standard Specification Section 82-5.02C, Metal Posts, and Caltrans Standard Plan A73B.

C. Mounting Hardware: In accordance with Caltrans Standard Specification Section 82-5.02G, Hardware.

2.6 STREET SURVEY MONUMENTS

A. General: In accordance with Caltrans Standard Specification Section 78-2, Survey Monuments, except that the marker disk will not be furnished. Marker disk shall be 2 inch diameter solid brass with a 2 ¾ inch shaft, “Lietz No. 525” or approved equal.

1. Portland Cement Concrete: In accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION

3.1 REMOVAL OF TRAFFIC STRIPES, PAVEMENT MARKINGS AND PAVEMENT MARKERS

A. Where blast cleaning is used for the removal of painted traffic stripes and pavement markings, or for removal of objectionable material, remove the residue, including dust and water, immediately after contact with the surface being treated. Remove by a vacuum attachment operating concurrently with the blast cleaning operation.

B. Where grinding is used for the removal of thermoplastic traffic stripes and pavement markings; remove the residue by means of a vacuum attachment to the grinding machine. Do not allow the residue to flow across or be left on, the pavement.

C. Where markings are to be removed by blast cleaning or by grinding, the removed area shall be approximately rectangular so that no imprint of the removed marking remains on the pavement.

D. Waste from removal of yellow painted traffic stripe may contain lead chromate. Residue produced when yellow paint is removed may contain heavy metals in concentrations that exceed thresholds established by the California Health and Safety Code and may produce toxic fumes when heated. As such, when grinding or other methods approved by the Owner's Representative are used to remove yellow painted traffic stripes, the removed residue, including dust, shall be collected and contained immediately. The Contractor shall submit a written work plan for the removal, storage, and disposal of yellow painted traffic stripe to the Owner's Representative for approval not less than fifteen (15) days prior to the start of the removal operations. Removal operations shall not be started until the Owner's Representative has approved the work plan.

E. Contractor will be responsible for repairing any damage to the pavement during removal of pavement markers. Damage to the pavement, resulting from removal of pavement markers, shall be considered as any depression more than 1/4-inch deep.

3.2 TEMPORARY PAVEMENT MARKERS

A. If permanent pavement markers cannot be installed immediately, and the street or road is to be placed in service, install short term, temporary pavement markers on the new pavement prior to opening the street or road to traffic.

B. Place markers, at a minimum, of 24 feet on centers, or as required by the governmental agency having jurisdiction, in the appropriate colors to delineate centerlines and travel lanes on multi-lane roadways.

3.3 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Apply in conformance with the manufacturer's instructions and the applicable requirements Caltrans Standard Specification Section 84-2.03, Construction, and Caltrans Standard Plans A20A through A20D, and A24A through A24E.

3.4 PAINTED TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Apply in conformance with the manufacturer's instructions and the applicable requirements of Caltrans Standard Specification Section 84-3.03, 3.04 and 3.05 and Caltrans Standard Plans A20A through A20D, and A24A through A24F.

3.5 PAVEMENT MARKERS

A. Place in accordance with Caltrans Standard Specification Section 81-3.03, Construction.

B. Pavement recesses are not required. Markers shall be installed accurately to the line established by the Owner's Representative. No markers shall be installed until the surface has been approved by the Owner's Representative.

3.6 TRAFFIC CONTROL SIGNS

A. Install in accordance with Caltrans Standard Specification Sections 82-2.03 and 82-3.03, Caltrans Standard Plan RS1, the applicable requirements of the State of California Department of Transportation Maintenance Manual and the details shown on the Plans. The horizontal locations shown on Caltrans Standard Plan RS1 shall not be applicable, the horizontal location shall be as shown on the Plans.

B. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

C. After erection, damage to traffic sign faces shall be touched up or the sign replaced.

3.7 STREET NAME SIGNS

A. Install in accordance with the manufacturer's instructions and as shown on the Plans.

B. Horizontal location shall be as shown on the Plans.

C. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

3.8 REFLECTORIZED OBJECT MARKERS.

A. Install in accordance with Caltrans Standard Specification Section 82-5.03, Construction, except that the metal marker posts shall not be driven in place without prior approval of the Owner's Representative.

B. Install at locations shown on the Plans.

3.9 STREET SURVEY MONUMENTS

A. Install Survey Monuments in accordance with Caltrans Standard Specification Section 78-2.03, Construction and Caltrans Standard Plan A74, except that the marker disk will not be furnished. Exact point in marker to be determined by an accurate survey and placed by a California Licensed Land Surveyors in accordance with the Professional Land Surveyors' Act.

3.10 PROTECTION

A. Protect the newly installed traffic stripes and pavement markings from damage until the material has cured.

B. Replace any traffic stripes or pavement markings or markers broken, misaligned or otherwise disturbed prior to opening roadway to traffic.

3.11 RESTORATION OF EXISTING IMPROVEMENTS

A. Existing signs striping or other markings removed or damaged due to the installation of new facilities shall be replaced in kind.

B. Existing landscaping or planting removed, damaged or disturbed due to the installation of traffic control signs or street name signs shall be replaced in kind.

END OF SECTION

SECTION 33 10 00

WATER SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Site water distribution system for domestic and fire protection services up to 5 feet of any on-site building being served.

B. Domestic water and fire protection water transmission or distribution system within a roadway or street right-of-way.

1.2 RELATED SECTIONS

A. Section 31 21 00, Utility Trenching and Backfill

1.3 RELATED DOCUMENTS

A. ASME
1. ASME A112.1.2: Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water Connect Receptors
2. ASME B1.20.1: Pipe Threads, General Purpose, Inch
3. ASME B16.1: Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
4. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings
5. ASME B16.22: Wrought Copper and Copper Alloy Solder – Joint Pressure fittings
6. ASME B16.26: Cast Copper Alloy Fittings for Flared Copper Tubes

B. ASTM
1. ASTM A536: Standard Specification for Ductile Iron Castings
2. ASTM A674: Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
3. ASTM B61: Standard Specification for Steam or Valve Bronze Castings
4. ASTM B62: Standard Specification for Composition Bronze or Ounce Metal Castings
5. ASTM B88: Standard Specification for Seamless Copper Water Tube
6. ASTM C94: Standard Specification for Ready-Mixed Concrete
7. ASTM D1785: Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
8. ASTM D2564: Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems
9. ASTM F1056: Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings

C. AWWA
1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
3. C110: Ductile-Iron and Gray-Iron Fittings
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
6. C116: Protective Fusion-Bonded Epoxy Coatings for the Interior & Exterior Surfaces for Ductile-Iron and Gray-Iron Fittings
7. C150: Thickness Design of Ductile-Iron Pipe
8. C151: Ductile-Iron Pipe, Centrifugally Cast
9. C153: Ductile-Iron Compact Fittings

10. C200: Steel Water Pipe 6 inch and larger
11. C203: Coal-Tar Protective Coatings and Linings for Steel Water Pipe
12. C205: Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 inch and Larger-Shop Applied
13. C207: Steel Pipe Flanges for Waterworks Service-Sizes 4 inch through 144 inch
14. C208: Dimensions for Fabricated Steel Water Pipe Fittings
15. C209: Cold Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings
16. C210: Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings
17. C213: Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
18. C214: Tape Coatings for Steel Water Pipelines
19. C218: Liquid Coatings for Aboveground Steel Water Pipe and Fittings
20. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
21. C500: Metal-Seated Gate Valves for Water Supply Service
22. C502: Dry-Barrel Fire Hydrants
23. C503: Wet Barrel Fire Hydrants
24. C504: Rubber Seated Butterfly Valves.
25. C507: Ball Valves, 6 inch through 60 inch.
26. C508: Swing-check Valves for Waterworks Service, 2 inch through 48 inch NPS.
27. C509: Resilient-Seated Gate Valves for Water Supply Service
28. C510: Double Check Valve Backflow Prevention Assembly
29. C511: Reduced-Pressure Principle Backflow Prevention Assembly
30. C512: Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
31. C550: Protective Interior Coatings for Valves and Hydrants
32. C600: Installation of Ductile-Iron Water Mains and Their Appurtenances
33. C606: Grooved and Shouldered Joints
34. C651: Disinfecting Water Mains
35. C800: Underground Service Line Valves and Fittings
36. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 60 inch for Water Transmission and Distribution
37. C901: Polyethylene (PE) Pressure Pipe and Tubing, ½ inch through 3 inch for Water Service
38. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch through 48 inch for Water Transmission and Distribution
39. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 65 inch, for Waterworks
40. M11: Steel Pipe - A Guide for Design and Installation
41. M23: PVC Pipe – Design and Installation
42. M41: Ductile-Iron Pipe and Fittings

D. Factory Mutual Insurance Company (FM)
1. FM 1530: Fire Department Connections

E. National Fire Protection Association (NFPA)
1. NFPA 24: Installation of Private Fire Service Mains and Their Appurtenances
2. NFPA 70: National Electric Code
3. NFPA 1963: Fire Hose Connection

F. National Sanitation Foundation (NSF)
1. NSF 61: Drinking Water System Components-Health Effects

G. Underwriters Laboratory(UL)
1. UL 262: Safety Gate Valves for Fire-Protection Service
2. UL 405: Safety Fire Department Connection Devices

3. UL 789: Indicator Posts for Fire-Protection Service

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing Materials

C. AWWA: American Waterworks Association

D. DI: Ductile iron

E. DIP: Ductile iron pipe

F. FM: Factory Mutual

G. NFPA: National Fire Protection Association

H. NSF: National Sanitation Foundation

I. PCC: Portland cement concrete

J. PE: Polyethylene

K. PVC: Polyvinyl Chloride

L. UL: Underwriters Laboratory

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Working Internal Pressures: As indicated on Plans. ***[Check if it is indicated on the plans, if not state it here.]***

B. External Load: Earth load indicated by depth of cover plus AASHTO H20 live load unless indicated otherwise.

1.6 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Product Data: Manufacturer's literature and data, including, where applicable, sizes, pressure rating, rated capacity, listing/approval stamps, labels, or other marking on equipment made to the specified standards for materials, and settings of selected models, for the following: ***[delete items not included in project]***

1. Piping materials and fittings
2. Gaskets, couplings, sleeves, and assembly bolts and nuts
3. Flexible pipe fittings
4. Restrained pipe fittings
5. Flexible Connectors
6. Expansion joints
7. Flexible expansion joints
8. High deflection fittings/ball joints
9. Gate valves
10. Butterfly valves

11. Check valves
12. Ball valves
13. Air release, air/ vacuum and combination air valves
14. Blow-off valves
15. Pressure reducing valves
16. Flow Regulating valves
17. Service connections and water meters
18. Valve boxes, meter boxes, frames and covers
19. Backflow preventers
20. Fire hydrants
21. Post indicator valves
22. Fire department connections
23. Thrust block concrete mix
24. Tapping sleeves and tapping valves
25. Service saddles and corporation stops
26. Identification materials and devices

C. Shop Plans and Calculations: Where an on-site fire water system is required, Contractor shall provide shop plans for Engineer and agency approval prior to construction. Coordinate with the Plans and identify any proposed modifications or deviations. Shop Plans and Calculations shall be stamped and signed by a registered Fire Protection Engineer licensed by the State of California as required.
1. Include the following information:
   a. Design assumptions
   b. Thrust block sizing and calculations
   c. Materials to be used
   d. Available water pressure
   e. Required water pressure
2. The review of fire system components constitutes only a portion of the review and approval required. A copy of the fire system component submittal package shall be forwarded to the local fire marshal for further review and approval.

D. Water Pressure Report ***[check if needed]***: At the conclusion of work, the Contractor shall engage a qualified testing service to conduct a flow test of the existing system (providing flow test data for all mains and at least six (6) hydrants). Provide date and location of test, type and method of test performed, static pressure and residual pressure in psig, observed flow in gpm, and orifice size.

E. Shop drawings: Include plans, elevations, details and attachments.
1. Precast and cast in-place vaults and covers
2. Wiring diagrams for alarm devices

F. Field test reports: Indicate and interpret test results for compliance with the Project requirements.

1.7 QUALITY ASSURANCE

A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.

B. Comply with the following requirements and standards:
1. NSF 61: “Drinking Water System Components-Health Effects” for materials for potable water.
2. NFPA 24: “Installation of Private Fire Service Mains and Their Appurtenances” for materials, installations, tests, flushing, and valve and hydrant supervision.

3. NFPA 70: “National Electric Code” for electrical connections between wiring and electrically operated devices.

C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

1.8 MATERIAL DELIVERY, STORAGE AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.

C. Handling: Use slings to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. During Storage: Use precautions for valves, including fire hydrants according to the following.
1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
2. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

E. Do not store plastic pipe and fittings in direct sunlight.

F. Protect pipe, fittings, flanges, seals and specialties from moisture, dirt and damage.

G. Protect linings and coatings from damage.

H. Handle precast boxes, vaults and other precast structures according to manufacturer’s written instructions.

I. Protect imported bedding and backfill material from contamination by other materials.

1.9 COORDINATION

A. Coordinate connection to existing water mains with water utility supplying water.

B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution piping and fire protection piping.

PART 2 - PRODUCTS

SMALL-SIZE SERVICE PIPES *[This section is for pipes/tubes between ¾ and 3 inches. Choose the pipe materials that you are using on your job, delete others]*

2.1 COPPER PIPE: SIZES ¾ INCH THROUGH 2 INCH

A. Pipe and Fittings: Provide Type K soft or hard copper pipe, seamless water tube, annealed conforming to ASTM B88.

B. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18.

C. Wrought copper solder-joint pressure fittings or wrought copper alloy unions shall conform to ASME B16.22

D. Cast copper alloy flare fittings shall conform to ASME B16.26.

E. Wrought copper alloy body, hexagonal stock, metal-to-metal seating surfaces, and solder-joint threaded ends shall conform to ASME B1.20.1.

F. Compression connections shall be Mueller 110, Ford or approved equal.

G. Joints: Restrain by couplings.

2.2 PE PLASTIC PIPE: SIZES ½ INCH THROUGH 3 INCH

A. Pipe and Fittings: Provide PE3408, Pressure Class ***[modify pipe class and DR per pipe design pressure and depth]*** 200, DR 9 conforming to AWWA C901. PWPIPE, or approved equal.

B. Cast Copper Fittings shall conform to ASME B16.18.

C. Cast Copper Compression Fittings and connections shall be Mueller 110, Ford or approved equal.

D. Joints: Restrain with clamps or heat-fusion.

2.3 PVC PIPE: SIZES 1/8 INCH THROUGH 3 INCH

A. Pipe and Fittings: ASTM D1785, Schedule 40. ***[Schedule 80 and 120 are also available. Pressure ratings up to 260 psi are achievable with schedule 40]***

B. Joints: Restrain with solvent cement. Do not use threaded pipe.

C. Solvent Cement: ASTM D2564.
1. EBAA Iron, or approved equal.

2.4 PE PIPE: SIZES 4 INCH THROUGH 64 INCH

A. Pipe and Fittings: AWWA C906

B. Joints:
1. Thermal Butt Fusion: AWWA C906 and pipe manufacturer's recommendations
2. Flanged joints: AWWA C906 and pipe manufacturer's recommendations

2.5 PVC PIPE: SIZES 4 INCH THROUGH 48 INCH

A. Pipe: Pressure ***[modify pipe class and DR per pipe design pressure and depth]*** Class 200, DR 14, spigot and gasket bell end, conforming to AWWA C900 (4 inch through 12 inch and AWWA C905 (14 inch through 48 inch)

B. Fittings: Ductile iron fittings
1. Standard: AWWA C110, sizes 4 inch through 48 inch
2. Compact: AWWA C153, sizes 4 inch through 24 inch
3. All fittings shall be fusion epoxy coated per AWWA C116

C. Unrestrained Joints: Push-On Bell and Spigot Joint: AWWA C900

D. Restrained Joints:
1. Push-On Bell and Spigot Joint: Harness assembly as manufactured by EBAA Iron, or approved equal. ***[Check with the manufacturer for sizes, pressure ratings and corrosion protection coatings that are available.]***
2. Plain End PVC to Ductile Iron Mechanical Joint: EBAA Iron, or approved equal.

E. Steel or Ductile Iron Couplings: ***[check with manufacturer for sizes and pressure rating available]***
1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. ***[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]*** Smith-Blair, Inc., Dresser, or approved equal. ***[Specify anchor studs or locking pins at locations where joints must be restrained.]***
2. Plain End Pipe to Ductile Iron or Steel Flanged Pipe: Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. ***[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]*** Smith-Blair, Inc, Dresser or approved equal. ***[Specify anchor studs or locking pins at locations where joints must be restrained.]***

F. PVC Couplings: ***[check with manufacturer for sizes and pressure rating available]***
1. Unrestrained Plain End to Plain End Pipe: AWWA C900, as manufactured by North American Piper approved equal. ***[Couplings for joint deflections up to 5 degrees are available.]***
2. Restrained Plain End to Plain End Pipe: AWWA C900, "Fluid-Tite" as manufactured by North American Pipe, or approved equal.

2.6 CEMENT MORTAR LINED AND COATED STEEL PIPE: 6 INCH AND LARGER

A. Pipe: AWWA C200 and AWWA M11

B. Special Sections and Fittings: AWWA C200, C207, C208 and AWWA M11 for all bends, tees, nozzles, closures, etc.

C. Flanges: AWWA C207. Includes blind flanges.

D. Linings and Coatings for Pipe, Special Sections and Fittings: Cement Mortar Lining and Coating: AWWA C205. ***[Other linings and coatings are available. Consult the following AWWA Standards and pipe manufacturers such, as Ameron, for details.***
1. ***Liquid Epoxy Lining and Coating: AWWA C210***
2. ***Fusion Bonded Epoxy Lining and Coating: AWWA C213***
3. ***Coal-Tar Lining and Coating: AWWA C203***
4. ***Cold-Applied Tape Coatings, Piping: AWWA C214***
5. ***Cold-Applied Tape Coatings, Specials, Connection and Fittings: AWWA C209***
6. ***Cold Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Buried or Submerged Steel Water Pipelines***
7. ***Aboveground Pipe Coatings: AWWA C218]***

E. Non-Restrained Joints: AWWA M11 - Rubber Gasket: Carnegie-shape rubber gasket as indicated

F. Restrained Joints: AWWA M11. Where a flanged joint, butt strap or coupling are not indicated, either restrained joint a, or b, as follows, is acceptable, but the selected joint shall be used throughout the project.
   1. Rubber Gasket: Carnegie-shape rubber gasket with field welded restraint bar as indicated
   2. Field Lap Welded Slip Joint: As indicated
   3. Field Welded Butt Strap: As indicated
   4. Flanged Joint: AWWA C207 with Type 316L stainless steel bolts and nuts as indicated

G. Joint Coating for Cement Mortar Lined and Coated Steel Pipe:
   1. Field Joint Encasement: Cement mortar contained in fabric lined with closed cell polyethylene foam as indicated. Attach fabric to pipe with Type 316L stainless steel straps as indicated. Closed cell polyethylene foam encasement shall be by Industrial Specialties or approved equal.

H. Non-Restrained Flexible Couplings: AWWA C219, Smith Blair, Inc., Number 411 or approved equal, with factory applied fusion-bond epoxy coating and Type 316L stainless steel bolts and nuts.

I. Restrained Flexible Couplings: Non-restrained flexible coupling supplemented with a restraining harness as indicated and as follows:
   1. Restraining harness design by Contractor's pipe manufacturer using criteria presented in AWWA M11.
   2. Space harness-lugs and tie bolts equally around the pipe.
   3. Type 316L stainless steel harness tie bolts and nuts.
   4. Design and dimensions of harness lugs to be modified from that shown in AWWA M11, as necessary, to provide additional height to clear the coupling.

J. Field Coating of Coupling Assemblies: Apply either of the following flexible tape and mastic or putty coating systems to the all non-restrained or restrained flexible steel couplings.
   1. Denso Coating System – Denso North American, Inc.
   2. Trenton Coating System – Trenton Corporation

2.7 FLEXIBLE CONNECTORS *[CHECK WITH THE MANUFACTURER TO DETERMINE THE PIPE MATERIALS TO WHICH THE FOLLOWING FITTINGS MAY BE JOINED.]*

A. Flanged Coupling Adapters for plain end pipe at fittings, valves and equipment shall be Dresser Style 127 or 128, similar models by ITT; Baker Coupling Company or approved equal. Nuts, bolts and other hardware shall be Type 304 stainless steel.

B. Mechanical Couplings shall be rated for a minimum working pressure of 150 psi. The barrel shall be a minimum 10 inches long. Couplings shall be cleaned and shop primed with manufacturer's standard rust inhibitive primer. Mechanical couplings shall be Smith-Blair, Romac, JCM, Apac or approved equal, with stainless steel nuts, bolts, and threaded rods.

C. Flexible Coupling for Steel Pipe shall be Dresser Coupling Style 38 with EPDM gaskets, or approved equal.

2.8 EXPANSION JOINT *[CHECK WITH THE MANUFACTURER TO DETERMINE THE PIPE MATERIALS TO WHICH THE FOLLOWING FITTINGS MAY BE JOINED.]*

A. An expansion joint shall be installed at location indicated on the Plans and shall be manufactured of ductile iron conforming to the material properties of AWWA C153.

B. Separation beyond the maximum extension of the expansion joint shall be prevented without the use of external tie rods.

C. The expansion joint shall be pressure tested against its own restraint to a minimum of 250 psi.

D. All pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy, conforming to the applicable requirements of AWWA C213, and shall be tested with a 1500 volt spark test conforming to stated specification.

E. Mechanical or Flanged Joint: The expansion joint shall be Model Ex-Tend 200, 4 inch through 36 inch, as manufactured by EBAA Iron, Inc., or approved equal. ***[WARNING DO NOT USE THE EX-TEND EXPANSION JOINT WITH A FORCE BALANCED FLEXTEND. THE FORCE IMBALANCE WILL CAUSE THE EXTEND TO MOVE. USE A STANDARD FLEXTEND INSTEAD].***

F. TR Flex Joints: TR Flex Telescoping Sleeve, 4 inch through 64 inch, U. S. Pipe.

2.9 FLEXIBLE EXPANSION JOINTS *[CHECK WITH THE MANUFACTURER TO DETERMINE THE PIPE MATERIALS TO WHICH THE FOLLOWING FITTINGS MAY BE JOINED.]*

A. Flexible expansion joints shall be installed at locations indicated on the Plans and shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and AWWA C153.

B. Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum of 250 psi. A minimum 2:1 safety factor, determined from the published pressure rating, shall apply.

C. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of 15º, and 6 inches minimum expansion. The flexible expansion fitting shall not expand or exert an axial imparting thrust under internal water pressure. The flexible expansion fitting shall not increase or decrease the internal water volume as the unit expands or contracts.

D. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61.

E. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C116

F. Polyethylene sleeves, meeting AWWA C105, shall be included for direct buried applications.

G. Flanged or mechanical Joint: Flexible expansion joint shall be Force Balanced FLEX-TEND, sizes 3 inch through 48 inch, as manufactured by EBAA Iron, or approved equal. ***[WARNING DO NOT USE THE EX-TEND EXPANSION JOINT WITH A FORCE BALANCED FLEXTEND. THE FORCE IMBALANCE WILL CAUSE THE EXTEND TO MOVE. USE A STANDARD FLEXTEND INSTEAD].***

H. Flanged Joint: Starflex, Series 5000, Star Pipe Products, or approved equal.

I. Plain End to Plain End Pipe: “Xtra Flex,” sizes 4 inch through 24 inch, U. S. Pipe, or approved equal.

2.10 HIGH DEFLECTION FITTINGS/BALL JOINTS

A. Plain End Pipe: Xtra Flex Restrained Joint High Deflection Fittings, 4 inch through 24 inch, U. S. Pipe, or approved equal.

B. Mechanical or Flanged Joint: Flex 900, 4 inch through 12 inch, EBAA Iron, or approved equal.

2.11 GATE VALVES *[PROVIDE ON PIPES 12 INCH AND SMALLER]*

A. Provide valves conforming to AWWA C500 or AWWA C509

B. Valves shall be resilient-seated, with non-rising stem, gray or ductile-iron body and bonnet, with bronze or gray or ductile-iron gate, bronze stem and square stem operating nut unless noted otherwise.

C. ***[Metal seated, AWWA C500, and rubber seated, AWWA C504, are also available.]***

D. All bolts, nuts and washers, except operating nut, shall be stainless steel.

E. Stem operating nut to be 2 inches square and open counter-clockwise.

F. Stem extensions shall be installed to bring the stem operating nut to within 2 feet of finish grade where the depth from finish grade to the stem operating nut exceeds 4 feet.

G. Equip valves in pump stations and other interior or vault installations with hand-wheels. ***[Verify this with the system owner]***.

H. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.

I. For the domestic water system, valves shall also conform to NSF 61.

J. Service vine Valves and fittings, 2 inch and smaller shall be in accordance with AWWA C800

K. Where a post indicator is shown, provide valve with an indicator post flange.

L. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
1. Mueller Company
2. M&H Valve Company
3. Crane Company, or approved equal

2.12 BUTTERFLY VALVES *[PROVIDE ON PIPES LARGER THAN 12 INCH]*

A. AWWA C504, rubber seated, Class 150B cast iron body, cast or ductile iron discs, stainless steel shafts, adjustable field replaceable rubber seats mating against stainless steel seat rings and field-replaceable seals.

B. Flanged or mechanical joint end connections.

C. No wafer type valves allowed.

D. Traveling nut type valve actuators designed for buried service unless noted otherwise. ***[Check if valve is automated or not. If not delete this paragraph]***

E. All bolts, nuts and washers, except wrench nut, shall be stainless steel.

F. Wrench nut to be 2 inches square and open counter-clockwise.

G. Stem extensions shall be installed to bring the wrench nut to within 2 feet of finish grade where the depth from finish grade to the wrench nut exceeds 4 feet.

H. Equip valves in pump stations and other interior or vault installations with hand-wheels. ***[Verify this with the system owner]***

I. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.

J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Mueller Company
2. M&H Valve Company
3. Crane Company, or approved equal

2.13 SWING CHECK VALVES

A. Provide swing-check type valves conforming to AWWA C508.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Mueller Company
2. M&H Valve Company
3. DeZurik/APCO
4. Watts, or approved equal

2.14 BALL VALVES

A. Provide ball valves (6 inch through 48 inch) per AWWA C507 as manufactured by Crane Company, or approved equal.

B. Provide ball valves (2 inches and smaller) conforming to AWWA C800 as manufactured by Mueller 300 Series, Ford, or approved equal.

C. Valves shall open by counterclockwise rotation of the valve stem.

D. Provide valves with ends as appropriate for the adjoining pipe.

E. Provide valve with lockable operating nut or handle as shown on the Plans.

2.15 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES

A. Air release and vacuum valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve body, and shall conform to AWWA C512. A compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve. Provide universal air-vacuum type valves, Crispin, DeZurik/APCO or approved equal.

B. Combination air valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve or double valve body, and shall conform to AWWA C512. A simple or

compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
   1. Crispin
   2. DeZurik/APCO, or approved equal

2.16 BLOW-OFF VALVES

A. Provide valve and service size as shown in the Plans. Provide 2 inch valves at low points of the piping system, and 4 inch valves at dead-ends of the piping system, unless otherwise directed by the Engineer.

B. 2 inch blow-off shall have a 2 inch vertical female iron pipe (FIP) inlet and a 2 inch normal pressure and temperature (NPT) nozzle outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16 inch square operating nut. All working parts shall be serviceable without excavation. Kupferle/Truflo Model TF550, or approved equal.

C. 4 inch blow-off shall have all brass principal working parts, 4 inch inlet and outlet and is self-draining and non-freezing. Valve shall open by counterclockwise rotation of a top-mounted 2 inch square operating nut. All working parts shall be serviceable without excavation.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:

E. Kupferle/ MainGuard #7600, or approved equal

2.17 PRESSURE-REDUCING VALVES

A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250 psi working-pressure ***[check working pressure for system]***, bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment.

B. Valves shall have flanged ends. Valves sized 3 inches or smaller may have screwed ends.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Cla-Val Company
   2. Bermad
   3. Ames Company, or approved equal

2.18 FLOW-REGULATING VALVES

A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250 psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment. Details as indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Cla-Val Company
   2. Bermad
   3. Ames Company, or approved equal

2.19 SERVICE CONNECTIONS AND WATER METERS

A. Service connections and water meter details and boxes as indicated. ***[Check with the owner of the system for details.]***

2.20 VALVE BOXES, METER BOXES, FRAMES AND COVERS

A. Water Valve Box: Provide pre-cast concrete valve box for each buried valve. Provide box with steel or cast iron traffic cover marked “WATER”. Christy Model G5 with G5C cover or approved equal.

B. Valve or Meter Boxes: Contractor shall verify box size required for water system appurtenances as shown in the Construction Documents. Provide a precast concrete utility box for each buried appurtenance. Provide a traffic-rated lid for H20 loading. A non-traffic rated lid may be used for boxes located in landscape areas. Christy, or approved equal.

2.21 BACKFLOW PREVENTER - REDUCED PRESSURE PRINCIPLE ASSEMBLIES (RPPA) *[LOCAL HEALTH DEPARTMENT OR OWNER OF SYSTEM MAY HAVE LIST OF ACCEPTABLE REDUCED-PRESSURE-PRINCIPLE BACKFLOW PREVENTER MANUFACTURERS AND MODELS THAT ARE ACCEPTABLE. THE STATE OF CALIFORNIA DEPARTMENT OF HEALTH SERVICES ISSUES A LIST OF APPROVED BACKFLOW PREVENTION ASSEMBLIES. ALSO A REDUCED-PRESSURE-PRINCIPLE DETECTOR BACKFLOW PREVENTER IS ALSO AVAILABLE.]*

A. Provide RPPA consisting of two independently operating check valves with a pressure differential relief valve located between the two check valves, two shut-off valves and four test cocks. RPPA shall be tamper-proof and conform to AWWA C511. Valve shall have an outside screw (OS) gate valve on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves for continuous-pressure application.

B. Body:
1. 2 inch and Smaller: Bronze with threaded ends
2. 2 ½ inch and Larger: Bronze, cast iron steel, or stainless steel with flanged ends

C. Interior Lining: AWWA C550, epoxy coating for cast iron or steel bodies

D. Interior Components: Corrosion-resistant materials

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Cla-Val Company
2. Ames Company
3. Febco, CMB Industries, Inc.
4. Hersey Products, Inc.
5. Watts
6. Zurn/Wilkins, or approved equal

2.22 BACKFLOW PREVENTER - DOUBLE CHECK DETECTOR ASSEMBLY (DCDA) *[REVIEW DOUBLE CHECK DETECTOR ASSEMBLY WITH LOCAL AGENCY HAVING JURISDICTION. LOCAL FIRE DEPARTMENT OR OWNER OF SYSTEM MAY HAVE LIST OF DOUBLE CHECK DETECTOR ASSEMBLY MANUFACTURERS AND MODELS THAT ARE ACCEPTABLE. THE STATE OF CALIFORNIA DEPARTMENT OF HEALTH SERVICES ISSUES A LIST OF*

APPROVED DOUBLE CHECK DETECTOR ASSEMBLIES. ALSO A SINGLE CHECK DETECTOR ASSEMBLY IS ALSO AVAILABLE.]

A. Provide a cast-iron body DCDA consisting of mainline double check assemblies in parallel with a bypass double check and meter assembly, two shut-off valves and four test cocks. DCDA shall be tamper-proof and conform to AWWA C510. FM approved or UL listed, with outside screw and yoke (OS&Y) gate valve on inlet and outlet, and strainer on inlet. Include two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer, for continuous pressure application.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Cla-Val Company
2. Ames Company
3. Febco, CMB Industries, Inc.
4. Hersey Products, Inc.
5. Zurn/Wilkins, or approved equal

2.23 POST INDICATOR VALVE *[REVIEW REQUIREMENTS FOR POST INDICATOR VALVE WITH AGENCY HAVING JURISDICTION.]*

A. General: UL 789, FM approved, vertical-type, cast-iron body with operating wrench extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve. ***[Review fire department connection with agency having jurisdiction. Check hose threads and all sizes with fire department.]***

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Mueller Company
2. Clow Corporation
3. American Cast Iron Company

2.24 FIRE DEPARTMENT CONNECTION *[REVIEW FIRE DEPARTMENT CONNECTION WITH AGENCY HAVING JURISDICTION. CHECK HOSE THREADS AND SIZES WITH LOCAL FIRE DEPARTMENT.]*

A. Exposed, sidewalk or Freestanding Type Fire Department Connection: UL 405, cast brass body with threaded inlets according to NFPA 1963 and matching local fire department hose threads and threaded bottom outlet. Include lugged caps, gaskets and chains; lugged swivel connections and drop clapper for each hose-connection inlet; 18 inch high brass sleeve; and round escutcheon plate. Number of inlets shall be as shown on the Plans. Clapper and spring check inlets shall each have a minimum capacity of 250 gpm ***[check capacity required]***, and be furnished with a cap and chain. Outlet shall be sized for simultaneous use of all inlets. Connection shall be branded “Building XX”.
1. 2-Way FDC: Connection shall conform to UL 405 or FM 1530. Elkhart, Croker, or approved equal.
2. 3-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Elkhart, Croker, Potter-Roemer or approved equal.
3. 4-Way FDC: Connection shall conform to UL 405. Potter-Roemer, Croker, or approved equal.
4. 6-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Croker, Potter-Roemer or approved equal.

2.25 FIRE HYDRANTS *[CHECK WITH LOCAL AGENCY HAVING JURISDICTION FOR ACCEPTABLE HYDRANT MANUFACTURER(S) AND MODEL(S)]*.

A. Provide two 2 ½ inch and one 4 ½ inch outlets, with a 6 inch nominal inside diameter inlet and break-away type bolts. Hydrant shall have a working pressure of 250 psi and shall conform to AWWA C502 ***[dry barrel to be used in areas where freezing temperatures encountered]*** or C503 ***[wet barrel to be used in areas ere freezing temperatures not encountered]***, and be UL listed and FM approved. Provide hydrants of one manufacturer. Clow model 960 series or approved equivalent, subject to approval of the Owner and fire marshal.

2.26 THRUST BLOCKS

A. Use concrete conforming to ASTM C94 having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 ½ parts sand, and 5 parts gravel, having the same minimum compressive strength.

B. Provide thrust blocks or mechanical pipe restraints at all fittings and changes in angle, alignment or elevation.

C. Where depth or location of existing structures prohibit the use of standard thrust blocks, gravity blocks may be used.

2.27 TAPPING SLEEVES AND TAPPING VALVES

A. Tapping sleeves shall be epoxy coated and furnished with stainless steel washers, nuts and bolts. Mueller H-615 and H-619, Ford, or approved equal.

B. Tapping valves shall have flanged inlet, Class 125 ***[check class required based on design pressure]*****,** conforming to ASME B16.1 and furnished with stainless steel washers, nuts and bolts. Tapping valves shall be constructed with a mechanical joint outlet. Mueller T-687, T-642, T-681, or approved equal.

2.28 SERVICE SADDLES AND CORPORATION STOPS

A. Service Saddles: Saddles shall conform to AWWA C800 and NSF 61.
1. For DIP: Provide bronze or stainless steel body, double strap type with a 200 psi ***[check pressure required based on design pressure]*****,** maximum working pressure. Mueller BR2 Series, Ford, or approved equal.
2. For PVC: Provide bronze body, wide strap type. Mueller H-13000 Series, Ford, or approved equal.
3. For PE: Per manufacturer's recommendations.

B. Corporation Stops: Provide ground key type; bronze conforming to ASTM B61 or ASTM B62, for a working pressure of 100 psi and suitable for the working pressure of the system.
1. Ends shall be suitable for adjoining pipe and connections, solder-joint, or flared tube compression type joint.
2. Threaded ends shall conform to AWWA C800.
3. Coupling nut for connection to flared copper tubing shall conform to ASME B16.26.
4. Mueller H-15000 Series with "CC" threads and a copper flare straight connection outlet, Ford, or approved equal.

2.29 IDENTIFICATION MATERIALS AND DEVICES

A. Warning Tape: Provide warning tape consisting of metallic foil bonded to solid blue plastic film not less than 3 inches wide. Film shall be inert polyethylene plastic. Film and foil shall each not be less than 1 mil thick. The tape continuously shall have printed black-letter, not less than ¾ inch high, message reading “CAUTION: WATER MAIN BELOW”.

B. Tracer Wire for Nonmetallic Piping: Provide 12 guage, coated copper or aluminum wire not less than 0.10 inch in diameter, with blue THW, THWN, or THHN rated insulation, in sufficient length to be continuous over each separate run of nonmetallic pipe. Wire shall be tied in at all valves.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) shown on the Plans.

B. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00 – Utility Trenching and Backfill.

C. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer’s recommendations.

D. Pipe laying and jointing:
1. Provide proper facilities for lowering sections of pipe into trenches.
2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.
3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
5. Grade the pipeline in straight lines; avoid the formation of dips and low points.
6. Support pipe at proper elevation and grade.
7. Provide secure firm, uniform support. Wood support blocking will not be permitted.
8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
9. Provide anchors and supports where indicated and where necessary for fastening work into place.
10. Make proper provision for expansion and contraction of pipelines.
11. Keep trenches free of water until joints have been properly made.
12. Do not lay pipe when conditions of trench or weather prevent proper installation.
13. All fittings shall be blocked with appropriately sized thrust blocks as shown on the Plans.

E. Installation of Tracer Wire:
1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.

4. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

F. Installation of Warning Tape
   1. Install tape approximately 1 foot above and along the centerline of the pipe.
   2. Where tape is not continuous, lap tape ends a minimum of 2 feet.

G. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

H. Connections to Existing Lines:
   1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
   2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.

I. Closure: Close open ends of pipes and appurtenance openings at the end of each day's work or when work is not in progress.

3.2 INSTALLATION OF DUCTILE-IRON PIPING

A. Install pipe and fittings in accordance with requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

B. Jointing:
   1. Provide push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
   2. Provide mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of AWWA C111.
   3. Provide flanged joints with the gaskets, bolts, and nuts specified for this type joint.
   4. Install flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories.
   5. Align bolt holes for each flanged joint.
   6. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
   7. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without over straining the flange.
   8. Where flanged pipe and fitting have dimensions that do not allow the installation of a proper flanged joint as specified, replace it by one of proper dimensions.
   9. Use setscrewed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe. Assemble in accordance with the recommendations of the setscrewed flange manufacturer.
   10. Provide insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints. Bolts for insulating sleeves shall be full size for the bolt holes.
   11. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

C. Exterior Protection: Completely encase buried ductile iron pipelines and underground appurtenances with polyethylene wrap. Install 8 mil linear low-density polyethylene (LLD) film or

4 mil high-density cross-laminated (HDCL) film per manufacturer's recommendations and in accordance with AWWA/ANSI C105/A21.5 and ASTM A674.

D. Pipe Anchorage: Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.3 INSTALLATION OF POLYVINYL CHLORIDE PIPING

A. Comply with the recommendations for pipe installation, joint assembly and appurtenance installation in AWWA Manual M23.

B. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.

C. Jointing:
1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the applicable requirements of AWWA C600 for joint assembly.
6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

D. Pipe Anchorage:
1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.4 INSTALLATION OF POLYETHYLENE PIPING

A. Install pipe, fittings, and appurtenances in accordance with manufacturer's recommendations.

B. Jointing:
1. Provide mechanical joints, compression fittings, or flanges as recommended by the manufacturer.
2. Jointing shall be performed using proper equipment and machinery by trained and certified personnel.
3. Joints, fittings and tools shall be clean and free of burrs, oil, and dirt.
4. Butt fusion:
   a. Pipe ends shall be faced to establish clean, parallel mating surfaces.
   b. Align and securely fasten the components to be joined squarely between the jaws of the joining machine.
   c. Heat the ends of the pipe to the pipe manufacturer's recommended temperature interface pressure and time duration. A pyrometer or other surface temperature measuring device should be used to insure proper temperature of the heating tool. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.

d. Prevent molten plastic from sticking to the heater faces. Molten plastic on the heater faces shall be removed immediately according to the tool manufacturer's instructions.
e. Bring the molten ends together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. Hold the molten joint under pressure until cooled adequately to develop strength. Refer to the manufacturer's recommendations for temperature, pressure, holding, and cooling times.
f. Remove the inside bead from the fusion process using Manufacturer's recommended procedure.

5. Socket fusion:
   a. Mixing manufacturers' heating tools and depth gauges will not be allowed unless the tools conform to ASTM F1056.
   b. Pipe ends shall be faced square to establish clean, parallel mating surfaces.
   c. Clamp the cold ring on the pipe at the proper position using a depth gauge.
   d. Heat the tool to the pipe manufacturer's recommended temperature. A pyrometer or other surface temperature measuring device should be used to insure proper temperature. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
   e. Follow manufacturer's recommendations for bringing the hot tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket fitting.
   f. Simultaneously remove the pipe and fitting from the tool.
   g. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion.
   h. Hold or block the pipe in place during cooling.
6. Electrofusion:
   a. Unless the operation is for a saddle-type electrofusion joint, pipe ends shall be faced square to establish clean, parallel mating surfaces.
   b. Clamp the pipe and fitting at the proper position in the fixture.
   c. Connect the electrofusion control box to the fitting and to the power source. Apply the electric current using manufacturer's instructions.
   d. Allow the joint to cool before removing the clamping fixtures.

3.5 INSTALLATION OF VALVES

A. Gate Valves
1. Install gate valves conforming to AWWA C500 and UL 262 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, operation, and Maintenance of Gate Valves) to AWWA C509.
2. Install gate valves conforming to AWWA C509 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C509.
3. Install gate valves on PVC water mains in addition in accordance with the recommendations for appurtenance installation in AWWA Manual M23.

B. Butterfly Valves: Install butterfly valves in accordance with the applicable requirements of Appendix A of AWWA C504.

C. Check Valves: Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated.

D. Joints:

1. Valves on DI, PE and PVC Pipe: Mechanical joint valves for buried locations. Flanged-end valves for installation in vaults/pits.
2. Valves on Steel Pipe: As indicated for buried locations. Flanged-end valves for installation in vaults/pits.

3.6 INSTALLATION OF VALVE AND METER BOXES

A. Boxes shall be centered over the appurtenance so as not to transmit shock or stress. Covers shall be set flush with the surface of the finished pavement, or as shown on the Plans. Backfill shall be placed around the boxes and compacted to the specified level in a manner that will not damage or displace the box from proper alignment or grade. Misaligned boxed shall be excavated, plumbed, and backfilled at no additional cost to the Owner.

3.7 INSTALLATION OF FIRE HYDRANTS

A. Install fire hydrants, except for metal harness, plumbed vertical, in accordance with AWWA C600 for hydrant installation and as indicated.

B. Provide and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Hydrants shall be set so that mounting bolts clear the top of finished grade by three inches so bolts may be easily replace if needed.

C. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached.

3.8 SERVICE LINE CONNECTIONS TO WATER MAINS

A. Connect service lines of size shown on plans to the main with a rigid connection or a corporation stop and gooseneck. Install a gate valve on the service line.

B. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.

C. Connect service lines to PVC plastic water mains in accordance with the recommendations of AWWA Manual M23.

3.9 INSTALLATION OF BACKFLOW PREVENTERS

A. Backflow devices shall be installed horizontal and level, with three feet minimum clearances from obstructions.

3.10 ANCHORAGE INSTALLATION

A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer's instructions.

B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24 hours curing time before introducing water into the pipeline and allow a minimum of 7 days curing time before pressure testing.

3.11 CONNECTION TO EXISTING

A. Contractor shall submit a work plan delineating the work sequence and duration of each task.

B. The Contractor to submit a contingency plan in case work extends beyond the allowable shutdown duration

C. The total allowed duration of shutdown shall not exceed ***xxx [enter duration]***. Any day exceeding this period will accrue liquidated damages of ***$XXX [enter amount]*** per day.

D. Contractor to notify Owner 48 hours prior to shutdown.

E. Prior to shutdown the Contractor shall have the following:
1. Approved submittals for the work to be done
2. Approved work plan
3. Approved contingency plan
4. The material, tools and equipment necessary to do the work, including pumps, generator, lighting, etc.

F. No work shall be done within two weeks from a wet weather event.

G. Contractor to check the weather (NOAA website) and plan work during dry weather period.

3.12 HYDROSTATIC PRESSURE AND LEAKAGE TEST

A. General:
1. Provide all necessary materials and equipment, including water.
2. Backfill all trenches sufficient to hold pipe firmly in position.
3. Allow time for thrust blocks to cure prior to testing.
4. Flush all pipes prior to testing to remove all foreign material.
5. Perform pressure and leakage test concurrently.
6. Apply test pressure by means of a pump connected to the pipe.
7. Base test pressure on the elevation of the lowest point in the line.
8. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
9. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.
10. The pressure test on mortar-lined pipe shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption in the cement mortar lining.
11. Allow the system to stabilize at the test pressure before conducting the leakage test.
12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
13. Maintain test pressure as specified for type of pipe being tested.
14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.

B. Preparation for Test
1. Vents shall be provided at the high points of the system and drains provided where means of venting or draining do not exist.
2. Remove or block off, all relief valves, rupture discs, alarms, control instruments, etc. that shall not be subjected to the test pressure.
3. All discs, balls, or pistons from check valves shall be removed if they interfere with filling of the system. Open all valves between inlet and outlet of the section to be tested.

4. Connect pump and provide temporary closures for all of the external openings in the system. Use caution to insure that the closures are properly designed and strong enough to withstand the test pressure.
5. A joint previously tested in accordance with this specification may be covered or insulated.
6. Expansion joints shall be provided with temporary restraint for additional pressure under test or shall be isolated from the test.
7. Flanged joints, where blanks are inserted to isolate equipment during the test, need not be tested.

C. DIP Leakage Test: Perform in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated as follows:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
3. No piping will be accepted if the leakage is greater than that determined by the following formula:

L = (S x D x P1/2)/133,200

L = Allowable leakage, gallons per hour.
S = Length of pipe tested, feet.
D = Nominal diameter of pipe, inches.
P = Average test pressure during the leakage test, pounds per square inch (gauge).

D. PE Pipe Leakage Test:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Apply the test pressure and allow the pipe to stand, without makeup pressure, for sufficient time to allow for diametric expansion or pipe stretching to stabilize, approximately two to three hours.
3. After the above stabilization has occurred, return the section being tested to the test pressure. Hold the test pressure for four hours. If the pressure in the test section drops, and it is determined the drop may be the result of expansion resulting from increasing temperature, a limited amount of additional water may be added to bring the pressure back to the test pressure. Allowable amounts of make-up water, to compensate for expansion due to increasing temperature, are as shown in the following table. Make-up water is only allowed during this final test period and not during the initial stabilization described in the previous paragraph. If the additional water added is less than the allowable shown in the table and there are no visual leaks or significant pressure drops, the tested section passes the test.

Nominal Pipe Size (in.)	Allowance for Expansion (U.S. Gals./100 Feet of Pipe) 1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.50
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4

14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

E. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:
   1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
   2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
   3. No piping will be accepted if the leakage is greater than that determined by the following formula:

      L = (N x D x P1/2)/7,400

      L = Allowable leakage, gallons per hour.
      N = Number of joints in the length of the pipeline tested.
      D = Nominal diameter of pipe, inches.
      P = Average test pressure during the leakage test, pounds per square inch (gauge).

F. Cement Mortar Lined and Coated Steel Pipe Leakage Test: Perform in accordance with AWWA M11. Selected requirements of AWWA M11 are repeated as follows:
   1. All pipelines shall be tested by subjecting each section to a pressure, measured at the lowest end of the section, of at least 150 percent of the class rating or design pressure of the pipe under test. In no case shall the pipe be tested at less than 150 psi, nor shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
   2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
   3. There shall be no significant leakage for pipe with welded joints or mechanical couplings.
   4. For pipe joined with O-ring rubber gaskets, a leakage of 25 gallons per inch of diameter per mile per 24 hours is allowed.

3.13 CLEANING

A. At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Owner will examine the pipes for leaks. If any further defective pipes or joints are discovered, the Contractor shall repair them. Finished paving shall not be installed prior to completion of all cleaning and testing.

3.14 DISINFECTION OF PIPELINES

A. After completion of the hydrostatic test, the mains shall be thoroughly flushed with a minimum pipe velocity of 2.5 fps and chlorinated in accordance with the latest revision of AWWA 651, Standards of Disinfecting Water Mains. Any one of the methods therein described may be used, with the additional requirement of 50 ppm chlorination minimum initial application. At the end of the contact period, the mains shall again be flushed, and bacteriological samples taken.

B. If necessary, the Contractor shall provide, at his expense, outlets from which to take the samples. The location of the chlorination and sampling points will be determined by the Owner in the field. Taps for chlorination and sampling shall be installed. The Contractor shall uncover and backfill the taps as required.

C. Disinfection of tie-ins shall be performed by the Contractor by swabbing with chlorine or by other approved methods. Following a tie-in, the area affected by the tie-in shall be thoroughly flushed and bacteriological samples will be taken as deemed necessary.

D. All treated water flushed from the lines shall be dechlorinated and disposed of by discharging to the locations identified in the Plans, or by other approved means. No discharge of chlorinated water to any storm sewer or natural water course will be allowed, unless properly dechlorinated.

E. The Contractor shall rechlorinate and retest any lines that do not meet the requirements of the above testing. The line shall not be placed in service until the requirements of the State Public Health Department are met.

3.15 BACTERIOLOGICAL TESTING

A. Samples shall be gathered and tests conducted at the expense of the Contractor by a laboratory approved by the Owner.

B. Water samples are to be taken at representative points no less than one test per 500 feet of pipe, plus one test at each end of the pipe; or as required by the Owner.

C. After the samples have passed the bacteriological testing, the Contractor will be notified and arrangements can be made to make tie-ins and connections to house services.

D. Each water sample will have passed the bacteria tests if they show zero total coliform per 100 ml and not more than 50 non-sheen bacteria per 100 ml, and when the turbidity is no greater than the source water.

E. Samples shall be taken no sooner than 24 hours after final flushing.

F. Jumpers and/or plates shall be pulled within 14 days of the notification of a successful test, or new bacteria samples will have to be taken.

G. Follow-up bacteriological testing shall take place after tie-ins have been made, and shall meet the same passing requirements as the initial tests.

END OF SECTION

SECTION 33 30 00

SANITARY SEWER SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary gravity sewers and force mains up to five feet from any on-site building

1.2 RELATED SECTIONS

A. Section 31 21 00, Utility Trenching and Backfill

B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. AASHTO
1. M199: Standard Specification for Precast Reinforced Concrete Manhole Sections
2. M252: Standard Specification for Corrugated Polyethylene Drainage Pipe
3. M294: Standard Specification for Corrugated Polyethylene Pipe, 12 to 60 inch Diameter

B. ASTM
1. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
2. ASTM A674: Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
3. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete
4. C443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
5. C478: Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
6. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
7. C1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems
8. C1244: Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
9. D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
10. D3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
11. D4101: Standard Specification for Propylene Injection and Extrusion Materials
12. F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
13. F679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
14. ASTM F1056: Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings
15. F1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings

C. AWWA
1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
3. C110: Ductile-Iron and Gray-Iron Fittings
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

5. C115: Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
6. C116: Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
7. C150: Thickness design of Ductile Iron Pipe
8. C151: Ductile-Iron Pipe, Centrifugally Cast
9. C153: Ductile-Iron Compact Fittings
10. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
11. C512: Air Release , Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
12. C600: Installation of Ductile-Iron Water Mains and Their Appurtenances.
13. C606: Grooved and Shouldered Joints
14. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. for Water Transmission and Distribution
15. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. for Water Transmission and Distribution
16. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. for Waterworks
17. M23: PVC Pipe – Design and Installation
18. M41: Ductile Iron Pipe and Fittings

D. Caltrans Standard Specifications, 2015
1. Section 51, Concrete Structures
2. Section 65, Concrete Pipe
3. Section 75 Miscellaneous Metal
4. Section 90, Concrete

E. Federal Specification
1. SS-S-00210 (GSA-FSS)

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing Materials

C. AWWA: American Water Works Association

D. HDPE: High-density polyethylene

E. PE: Polyethylene

F. DIP: Ductile iron pipe

G. PVC: Polyvinyl Chloride

H. RCP: Reinforced concrete pipe

I. NPS: Nominal pipe size

1.5 SUBMITTALS *[EDIT SUBMITTAL LIST PER MATERIAL ON THE JOB]*

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Product data for the following:
1. Piping materials and fittings

2. Special pipe couplings
3. Joint sealants
4. Cleanout plugs or caps
5. Sewage air relief valves

C. Shop drawings: Include plans, elevations, details and attachments for the following:
1. Precast concrete manholes, frames and covers
2. Precast concrete clean out boxes and box covers
3. Force main piping access openings

D. Design Mix Reports and Calculations: For each class of cast in place concrete

E. Field Test Reports: Indicate test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage
1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

B. Handling
1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.
2. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.
3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 DIP PIPE AND FITTINGS: SIZES 4 INCH THROUGH 48 INCH

A. Pipe: Pressure Class ***[insert class required based on design pressure]*** pipe conforming to AWWA C151 and standard thickness per AWWA C150. U.S. Pipe, American Cast Iron Pipe Company, or approved equivalent

B. Fittings: Provide fittings with pressure rating greater than or equal to that of the adjoining pipe.

C. Pipe and Fitting Lining: Cement Mortar, AWWA C104. Use Type II or V cement for mortar lining.

D. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115

E. Fittings
1. Standard: AWWA C110, sizes 4 inch through 48 inch
2. Compact: AWWA C153, sizes 4 inch through 24 inch
3. All fittings shall be fusion epoxy coated per AWWA C116

F. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105. ***[Use only if soil conditions warrant, i.e. corrosive soils. Check geotechnical report]***

G. Unrestrained Joints (Rubber Gasket Joints):
1. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111.
2. Mechanical Joint: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111.

H. Insulating Joints:
1. Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
2. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.
3. Provide gasket of the dielectric type, full face, as recommended in AWWA C115.
4. Provide bolts and nuts as recommended in AWWA C115.

I. Couplings: ***[check with manufacturer for sizes and pressure rating available]***
1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. ***[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]*** Smith-Blair, Inc., Dresser, or approved equal. ***[Specify anchor studs or locking pins at locations where joints must be restrained.]***
2. Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. ***[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]*** Smith-Blair, Inc., Dresser, or approved equal. ***[Specify anchor studs or locking pins at locations where joints must be restrained.]***; or 2) restrained flange adapter, "Megaflange," sizes 3 inch through 36 inch, EBAA Iron, or approved equal.

2.2 HDPE PIPE AND FITTINGS: 4 INCH THROUGH 10 INCH

A. Pipe shall be in accordance with AASHTO M252 Type S, smooth interior and corrugated exterior.

B. Bell and spigot joints

C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477

D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.3 HDPE PIPE AND FITTINGS: 12 INCH THROUGH 48 INCH

A. Pipe shall be in accordance to AASHTO M294 Type S, smooth interior and corrugated exterior.

B. Bell and spigot joints

C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477

D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint.

2.4 PVC PIPE

A. Pipe:
1. 4 inch through 15 inch: ASTM D3034, SDR 26 ***[Check external load and laying condition, SDR 23.5 is also available if a stronger pipe is required]***
2. 18 inch through 36 inch: ASTM F679, T-1 wall

B. Bell and spigot joints

C. Fittings:
1. 4 inch through 27 inch: ASTM F1336
2. 30 inch through 36 inch: ASTM D3034, SDR 26

D. Joint Gasket: Elastomeric seal, ASTM F477

E. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.5 REINFORCED CONCRETE PIPE

A. Designated by Class, rubber gasketed joints, Type II or V cement
1. Circular Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-2.02C(2), Class III. ***[Check external load and laying condition, Class IV and V are available if stronger pipe is required.]***
2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-2.02D. Class HE-III and VE-III. ***[Check external load and laying condition, Classes HE-IV, and VE-IV, V and VI are available if stronger pipe is required.]***

B. Rubber Gasketed Joints: Caltrans Standard Specification Section 65-2.02F

2.6 DIP: SIZES 4 INCH THROUGH 48 INCH

A. Pipe: Pressure Class ***[insert class required based on design pressure]*** pipe conforming to AWWA C151 and standard thickness per AWWA C150. U.S. Pipe, American Cast Iron Pipe Company, or approved equivalent

B. Fittings: Provide fittings with pressure rating greater than or equal to that of the adjoining pipe.

C. Pipe and Fitting Lining: Cement Mortar, AWWA C104. Use Type II or V cement for mortar lining.

D. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115

E. Fittings
1. Standard: AWWA C110, sizes 4 inch through 48 inch
2. Compact: AWWA C153, sizes 4 inch through 24 inch
3. All fittings shall be fusion epoxy coated per AWWA C116

F. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105. ***[Use only if soil conditions warrant, i.e. corrosive soils. Check geotechnical report]***

G. Restrained Joints:
1. Flanged Joint: ***[In general, use only in non-buried conditions, i.e. above grade or in a vault]*** Provide bolts, nuts, and gaskets in conformance with AWWA C115. Gaskets shall conform to the requirements specified in AWWA C111. Unless otherwise required, above

ground flange assembly bolts shall be standard hex-head, cadmium plated machine bolts with American Standard Heavy, hot –pressed, cadmium plated hexagonal nuts. Buried flange nuts and bolts s shall be as above except they shall be of Type 304 stainless steel.

2. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111 with “Field Lok Gasket,” sizes 4 inch through 24 inch, “TR Flex,” sizes 4 inch through 64 inch; both by U. S. Pipe, or approved equal. “Megalug” restraint harness, EBAA Iron, or approved equal.
3. Mechanical Joint: ***[Pressure rating of 350 psi for sizes 3 inch through 16 inch, and 250 psi for sizes 18 inch through 48 inch]*** Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111 with “Mega Lug,” sizes 3 inch through 48 inch, EBAA Iron, or approved equal.
4. Grooved and Shouldered Joints: AWWA C150, AWWA C151 and AWWA C606. 24 inch maximum size. ***[Use only for above grade piping]***

H. Insulating Joints:
1. Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
2. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.
3. Provide gasket of the dielectric type, full face, as recommended in AWWA C115.
4. Provide bolts and nuts as recommended in AWWA C115.

I. Couplings: ***[check with manufacturer for sizes and pressure rating available]***
1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer’s shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. ***[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]*** Smith-Blair, Inc., Dresser, or approved equal. ***[Specify anchor studs or locking pins at locations where joints must be restrained.]***
2. Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer’s shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. ***[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]*** Smith-Blair, Inc., Dresser, or approved equal. ***[Specify anchor studs or locking pins at locations where joints must be restrained.];*** or 2) restrained flange adapter, “Megaflange,” sizes 3 inch through 36 inch, EBAA Iron, or approved equal.

2.7 PE PIPE: SIZES 4 INCH THROUGH 65 INCH.

A. Pipe and Fittings: AWWA C906.

B. Joints:
1. Thermal Butt Fusion: AWWA C906 and pipe manufacturer’s recommendations
2. Flanged Joints: AWWA C906 and pipe manufacturer’s recommendations

2.8 PVC PIPE: SIZES 4 INCH THROUGH 48 INCH.

A. Pipe: Pressure ***[modify pipe class and DR per pipe design pressure and depth]*** Class 200, DR 14, spigot and gasket bell end, conforming to AWWA C900 (4 inch through 12 inch and AWWA C905 (14 inch through 48 inch).

B. Fittings: Ductile iron fittings
1. Standard: AWWA C110, sizes 4 inch through 48 inch
2. Compact: AWWA C153, sizes 4 inch through 24 inch
3. All fittings shall be fusion epoxy coated per AWWA C116

C. Unrestrained Joints: Push-On Bell and Spigot Joint: AWWA C900

D. Restrained Joints:
1. Push-On Bell and Spigot Joint: Harness assembly as manufactured by EBAA Iron, or approved equal. ***[Check with the manufacturer for sizes, pressure ratings and corrosion protection coatings that are available.]***
2. Plain End PVC to Ductile Iron Mechanical Joint: EBAA Iron, or approved equal

E. Steel or Ductile Iron Couplings: ***[check with manufacturer for sizes and pressure rating available]***
1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. ***[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]*** Smith-Blair, Inc., Dresser, or approved equal. ***[Specify anchor studs or locking pins at locations where joints must be restrained.]***
2. Plain End Pipe to Ductile Iron or Steel Flanged Pipe: Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. ***[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]*** Smith-Blair, Inc, Dresser or approved equal. ***[Specify anchor studs or locking pins at locations where joints must be restrained.]***

F. PVC Couplings: ***[check with manufacturer for sizes and pressure rating available]***
1. Unrestrained Plain End to Plain End Pipe: AWWA C900, as manufactured by CertainTeed or approved equal. ***[Couplings for joint deflections up to 5-degrees are available.]***
2. Restrained Plain End to Plain End Pipe: AWWA C900, "Fluid-Tite" as manufactured by North American Pipe, or approved equal.

2.9 GRAVITY PIPE CLEANOUTS

A. Piping: Same as sanitary sewer line if possible

B. Top Cap: Threaded and of same material as piping if possible

C. Box Size: As required to provide access and allow easy removal and reinstallation of cap

D. Box Types:
1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty
2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading

E. Box Cover Markings: "SANITARY SEWER" unless otherwise specified

F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
1. Associated Concrete Products, Inc.
2. Brooks Products Inc.
3. Christy Concrete Products, Inc., or approved equal

2.10 MANHOLES

A. Manholes shall be pre-cast concrete of the size and shape shown on the Plans and shall conform to ASTM C478. Equivalent poured-in-place structures may be used at the Contractor's option. Concrete shall consist of Caltrans Type I/II cement. Rate for AASHTO H20 loading in traffic areas.

B. All interior concrete surfaces shall be coated with “Xypex Crystalline” or approved equivalent. Use of a water-resistant admix is acceptable, at Contractor option.

C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-2.02B. Manhole covers shall have the words “SANITARY SEWER” in letters not less than 2 inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.

D. Frames and lids for manholes shall be match-marked in pairs before delivery to the job site. The lids shall fit into their frames without rocking.

E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Plans. Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.

F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of Caltrans Standard Specifications Section 90 and as specified herein. The concrete shall be Class “A” containing six (6) sacks of portland cement per cubic yard of concrete. The grading of the combined aggregate shall be in accordance with the Caltrans requirements of the three-quarter inch maximum. The consistency of the concrete shall be such that the slump does not exceed four inches, as determined by ASTM C143. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.

2.11 JOINT SEALANT FOR STRUCTURES AND MANHOLES

A. Mortar: Caltrans Standard Specification Section 51-1.02F
   1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.

B. Gaskets: Preformed flexible rubber or plastic gasket
   1. Rubber Gaskets: ASTM C443
   2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is “Ram-Nek,” as manufactured by the Henry Company, or equal

2.12 SERVICE LATERAL RECONNECTIONS

A. Service lateral reconnections shall be made using a PVC SDR 26 45 degree Wye; sized to fit the sewer main and the diameter of the sewer lateral.

2.13 PIPE TO STRUCTURE CONNECTOR/SEAL

A. A flexible pipe to manhole connector shall be used for all pipe penetrations to pre-cast and/or cast-in-place concrete structures.
   1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.
   2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C923. The connector

and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C923.

3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.
4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

2.14 SEWAGE AIR RELIEF VALVE ASSEMBLY FOR FORCE MAINS

A. Air release and vacuum valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve body, and shall conform to AWWA C512. A compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve. Provide universal air-vacuum type valves, Crispin, DeZurik/APCO or approved equal.

2.15 THRUST BLOCKS FOR FORCE MAINS

A. General: Location and configuration as indicated

B. Portland Cement Concrete: Section 32 13 18, Cement and Concrete for Exterior Improvements

PART 3 - EXECUTION

3.1 GRAVITY PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03 for reinforced concrete pipe and chapter 11.3.3 of AWWA M41 for ductile iron pipe.

B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated. ***[Check section shown on the Plans with that described in Section 31 21 00]***

C. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill.

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified.

Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance at the end of each day's work or when work is not in progress.

3.2 FORCE MAIN PIPE INSTALLATION

A. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) shown on the Plans.

B. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill

C. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.

D. Pipe laying and jointing:
1. Provide proper facilities for lowering sections of pipe into trenches.
2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.
3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
5. Grade the pipeline in straight lines; avoid the formation of dips and low points.
6. Support pipe at proper elevation and grade.
7. Provide secure firm, uniform support. Wood support blocking will not be permitted.
8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
9. Provide anchors and supports where indicated and where necessary for fastening work into place.
10. Make proper provision for expansion and contraction of pipelines.
11. Keep trenches free of water until joints have been properly made.
12. Do not lay pipe when conditions of trench or weather prevent proper installation.
13. All fittings shall be blocked with appropriately sized thrust blocks as shown on the Plans.
14. Installation of Tracer Wire:
15. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
16. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
17. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.
18. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

E. Installation of Warning Tape
1. Install tape approximately 1 foot above and along the centerline of the pipe.
2. Where tape is not continuous, lap tape ends a minimum of 2 feet.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel.

If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Connections to Existing Lines:
   1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
   2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.

H. Closure: Close open ends of pipes and appurtenance openings at the end of each day's work or when work is not in progress.

3.3 INSTALLATION OF DUCTILE-IRON PIPING

A. Install pipe and fittings in accordance with requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

B. Jointing:
   1. Provide push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
   2. Provide mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of AWWA C111.
   3. Provide flanged joints with the gaskets, bolts, and nuts specified for this type joint.
      a. Install flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories.
      b. Align bolt holes for each flanged joint.
      c. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
      d. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without over straining the flange.
      e. Where flanged pipe and fitting have dimensions that do not allow the installation of a proper flanged joint as specified, replace it by one of proper dimensions.
      f. Use setscrewed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe. Assemble in accordance with the recommendations of the setscrewed flange manufacturer.
   4. Provide insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints. Bolts for insulating sleeves shall be full size for the bolt holes.
   5. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

C. Exterior Protection: Completely encase buried ductile iron pipelines and underground appurtenances with polyethylene wrap. Install 8-mil linear low-density polyethylene (LLD) film or 4-mil high-density cross-laminated (HDCL) film per manufacturer's recommendations and in accordance with AWWA C105 and ASTM A674.

D. Pipe Anchorage: Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.4 INSTALLATION OF POLYVINYL CHLORIDE PIPING

A. Comply with the recommendations for pipe installation, joint assembly and appurtenance installation in AWWA M23.

B. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.

C. Jointing:
   1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
   2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
   3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
   4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
   5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the applicable requirements of AWWA C600 for joint assembly.
   6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
   7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

D. Pipe Anchorage:
   1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.5 INSTALLATION OF POLYETHYLENE PIPING

A. Install pipe, fittings, and appurtenances in accordance with manufacturer's recommendations.

B. Jointing:
   1. Provide mechanical joints, compression fittings, or flanges as recommended by the manufacturer.
   2. Jointing shall be performed using proper equipment and machinery by trained and certified personnel.
   3. Joints, fittings and tools shall be clean and free of burrs, oil, and dirt.
   4. Butt fusion:
      a. Pipe ends shall be faced to establish clean, parallel mating surfaces.
      b. Align and securely fasten the components to be joined squarely between the jaws of the joining machine.
      c. Heat the ends of the pipe to the pipe manufacturer's recommended temperature interface pressure and time duration. A pyrometer or other surface temperature measuring device should be used to insure proper temperature of the heating tool. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
      d. Prevent molten plastic from sticking to the heater faces. Molten plastic on the heater faces shall be removed immediately according to the tool manufacturer's instructions.
      e. Bring the molten ends together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. Hold the molten joint under pressure until cooled adequately to develop strength. Refer to the manufacturer's recommendations for temperature, pressure, holding, and cooling times.
      f. Remove the inside bead from the fusion process using Manufacturer's recommended procedure.
   5. Socket fusion:

a. Mixing manufacturers' heating tools and depth gages will not be allowed unless the tools conform to ASTM F1056.
b. Pipe ends shall be faced square to establish clean, parallel mating surfaces.
c. Clamp the cold ring on the pipe at the proper position using a depth gauge.
d. Heat the tool to the pipe manufacturer's recommended temperature. A pyrometer or other surface temperature measuring device should be used to insure proper temperature. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
e. Follow manufacturer's recommendations for bringing the hot tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket fitting.
f. Simultaneously remove the pipe and fitting from the tool.
g. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion.
h. Hold or block the pipe in place during cooling.

6. Electrofusion:
a. Unless the operation is for a saddle-type electrofusion joint, pipe ends shall be faced square to establish clean, parallel mating surfaces.
b. Clamp the pipe and fitting at the proper position in the fixture.
c. Connect the electrofusion control box to the fitting and to the power source. Apply the electric current using manufacturer's instructions.
d. Allow the joint to cool before removing the clamping fixtures.

3.6 SPECIAL PIPE COUPLINGS

A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

B. Installation: Manufacturers' instructions

3.7 POURED-IN-PLACE CONCRETE

A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of Caltrans Standard Specifications.

B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the Caltrans Standards Specifications. Unless otherwise noted herein or in the Plans, exposed surfaces of structures shall be Class 1 surface finish.

C. Curing shall conform to applicable portions in Section 90 of Caltrans Standard Specifications. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.

D. Concrete shall not be cropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.8 GRAVITY PIPELINE AIR TESTING AND FLUSHING

A. All new sections of sanitary sewer shall be tested using the following procedures:
1. Test is conducted between two consecutive manholes, or as directed by the Project Manager.

2. The test section of the sewer shall be plugged at each end. One of the plugs used at the manhole shall be tapped and equipped for the air inlet connection for filling the line from an air compressor.
3. All service laterals, stubs, and fittings into the sewer test section shall be properly capped or plugged and carefully braced against the internal pressure to prevent air leakage by slippage and blowout.
4. Connect air hose to tapped plug selected for the air inlet. Connect the other end of the air hose to the portable air control equipment, which consists of valves and pressure gauges used to control the air entry rate into the sewer test section, and to monitor the air pressure in the pipeline. More specifically, the air control equipment includes a shut-off valve, pressure regulating valve, pressure reduction valve, and a monitoring pressure gauge having a pressure range from 0-5 psi. The gauge shall have minimum divisions of 0.10 psi and an accuracy of 0.40 psi.
5. Connect another air hose between the air compressor (or other source of compressed air) and the air control equipment. This completes the test equipment set-up. Test operations may commence.
6. Supply air to the test section slowly, filling the pipeline until a constant pressure of 3.5 psig is maintained. The air pressure must be regulated to prevent the pressure inside the pipe from exceeding 5.0 psig.
7. When constant pressure of 3.5 psig is reached, throttle the air supply to maintain the internal pressure above 3.0 psig for at least 5 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall. During this stabilization period, it is advisable to check all capped and plugged fittings with a soap solution to detect any leakage at these connections. If leakage is detected at any cap plug, release the pressure in the line and tighten all leaky caps and plugs. Start the test operation again by supplying air. When it is necessary to bleed off the air to tighten or repair a faulty plug, a new 5-minute interval must be allowed after the pipeline has been refilled.
8. After the stabilization period, adjust the air pressure to 3.5 psig and shut-off or disconnect the air supply. Observe the gauge until the air pressure reached 3.0 psig. At 3.0 psig, commence timing with a stopwatch until the pressure drops to 2.5 psig, at which time the stop watch is stopped. The time required, as shown on the stopwatch, for a pressure loss of 0.5 psig is used to compute the air loss.
9. If the time, in minutes and seconds, for the air pressure drop from 3.0 to 2.5 psi is greater than that shown in the following table for the designated pipe size, the section undergoing test shall have passed and shall be presumed to be free of defects. The test may be discontinued at any time.
10. If the time, in minutes and seconds, for the 0.5 psig drop is less than that shown in the following table for the designated pipe size, the section of the pipe shall not have passed the test; therefore, adequate repairs must be made and the line retested.

Requirements for Air Testing

Pipe Size	Time	
(in inches)	Minutes	Seconds
4	2	32
6	3	50
8	5	6
10	6	22
12	7	39
14	8	56
15	9	35
16	10	12
18	11	34
20	12	30

[For larger diameter pipe use the following: Minimum time in seconds = 462 X pipe diameter in feet]

11. For 8 inch and smaller pipe, only: if, during the 5 minute saturation period, pressure drops less than 0.5 psig after the initial pressurization and air is not added, the pipe section undergoing test shall have passed.
12. Multi-pipe sizes: when the sewer line undergoing test is 8 inch or larger diameter pipe and includes 4 inch or 6 inch laterals, the figures in the table for uniform sewer main sizes will not give reliable or accurate criteria for the test. Where multi-pipe sizes are to undergo the air test, the Project Manager can compute the "average" size in inches which is then multiplied by 38.2 seconds. The results will give the minimum time in seconds acceptable for a pressure drop of 0.5 psig for the "averaged" diameter pipe.
13. Adjustment Required for Groundwater:
    a. An air pressure correction is required when the ground water table is above the sewer line being tested. Under this condition, the air test pressure must be increased .433 psi for each foot the ground water level is above the invert of the pipe.
    b. Where ground water is encountered or is anticipated to be above the sewer pipe before the air testing will be conducted, the following procedure shall be implemented at the time the sewer main and manholes are constructed.
        1) Install a ½ inch diameter pipe nipple (threaded one or both ends, approximately 10 inch long) through the manhole wall directly on top of one of the sewer pipes entering the manhole with threaded end of nipple extending inside the manhole.
        2) Seal pipe nipple with a threaded ½ inch cap.
        3) Immediately before air testing, determine the ground water level by removing the threaded cap from the nipple, blowing air through the pipe nipple to remove any obstruction, and then connecting a clear plastic tube to the pipe nipple.
        4) Hold plastic tube vertically permitting water to rise in it to the groundwater level.
        5) After water level has stabilized in plastic tube, measure vertical height of water, in feet, above invert of sewer pipe.
        6) Determine air pressure correction, which must be added to the 3.0 psig normal starting pressure of test, by dividing the vertical height in feet by 2.31. The result gives the air pressure correction in pounds per square inch to be added.

[Example: if the vertical height of water from the sewer invert to the top of the water column measures 11.55 feet, the additional air pressure required would be:

11.55/2.31 = 5.0 psig

Therefore, the starting pressure of the test would be 3.0 plus 5 or 8.0 psig, and the ½ pound drop becomes 7.5 psig. There is no change in the allowable drop (0.5 psig) or in the time requirements established for the basic air test.]

B. After the line has passed the air test, it shall be balled and flushed with water to clean. A metal screen shall be used downstream at the point of connection to the existing system to collect and remove any rock or other debris that is flushed out during cleaning.

3.9 TESTING OF MANHOLES ON GRAVITY LINES

A. At the option of the Contractor, either the following hydrostatic or vacuum test shall be performed.
    1. Hydrostatic Test: In general, the following hydrostatic test is in conformance with that presented in ***[enter the agency's name that has jurisdiction over sewers]*** Standard Specifications.
    2. Insert inflatable plugs in all sewer inlets and outlets.

3. Fill the manhole with water to a point six inches below the base of the manhole frame.
4. Maintain the water at this point for one hour to allow time for absorption.
5. Begin one-hour test period. Measure the amount of water added in one-hour period to maintain the water level at six inches below the base of the manhole frame. Do not allow water level to drop more than 25% of the manhole depth.
6. Determine the allowable leakage by the following formula.

   L = 0.0002 x D x H1/2

   L = Allowable leakage, gallons per minute.
   D = Depth of manhole from top to bottom, feet.
   H = Head of water in feet as measured from the surface of the water in the manhole to the sewer line invert or to the prevailing ground water surface outside the manhole. The lesser height governs.

7. If the leakage exceeds the allowable, determine the cause, take remedial action and retest the manhole. If the leakage is less than the allowable and leaks are observed, repair the leaks.

B. Vacuum Test:
1. General: Test in accordance with ASTM C1244.
2. Test prior to backfilling around the manhole.
3. Test Preparation: Plug all lift holes and pipes entering or exiting the manhole.
4. Place test head inside the top section of the manhole's cone section and inflate in accordance with the manufacturer's instructions.
5. Draw a vacuum of 10 inches of mercury and shut the pump off.
6. With the valve closed, the time for the vacuum to drop 9 inches shall be measured.
7. The manhole shall pass the test if the time is greater than 60 seconds for a 48 inch diameter manhole, 75 seconds for a 60 inch diameter manhole and 90 seconds for a 72 inch diameter manhole.
8. If the manhole fails the initial test, make necessary repairs with a non-shrink grout. Once the repair material has cured according to the manufacturer's recommendations the vacuum test shall be repeated. This process shall continue until a satisfactory test is obtained.
9. All temporary plugs and braces shall be removed after each test.

3.10 HYDROSTATIC AND LEAKAGE TESTING OF FORCE MAINS

A. General:
1. Provide all necessary materials and equipment, including water.
2. Backfill all trenches sufficient to hold pipe firmly in position.
3. Allow time for thrust blocks to cure prior to testing.
4. Flush all pipes prior to testing to remove all foreign material.
5. Perform pressure and leakage test concurrently.
6. Apply test pressure by means of a pump connected to the pipe.
7. Base test pressure on the elevation of the lowest point in the line.
8. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
9. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.
10. The pressure test on mortar-lined pipe shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption in the cement mortar lining.
11. Allow the system to stabilize at the test pressure before conducting the leakage test.

12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
13. Maintain test pressure as specified for type of pipe being tested.
14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.
16. Preparation for Test
17. Vents shall be provided at the high points of the system and drains provided where means of venting or draining do not exist.
18. Remove or block off, all relief valves, rupture discs, alarms, control instruments, etc. that shall not be subjected to the test pressure.
19. All discs, balls, or pistons from check valves shall be removed if they interfere with filling of the system. Open all valves between inlet and outlet of the section to be tested.
20. Connect pump and provide temporary closures for all of the external openings in the system. Use caution to insure that the closures are properly designed and strong enough to withstand the test pressure.
21. A joint previously tested in accordance with this specification may be covered or insulated.
22. Expansion joints shall be provided with temporary restraint for additional pressure under test or shall be isolated from the test.
23. Flanged joints, where blanks are inserted to isolate equipment during the test, need not be tested.

B. DIP Leakage Test: Perform in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated as follows:
   1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
   2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
   3. No piping will be accepted if the leakage is greater than that determined by the following formula:

      L = (S x D x P1/2)/133,200

      L = Allowable leakage, gallons per hour.
      S = Length of pipe tested, feet.
      D = Nominal diameter of pipe, inches.
      P = Average test pressure during the leakage test, pounds per square inch (gauge).

C. PE Pipe Leakage Test:
   1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
   2. Apply the test pressure and allow the pipe to stand, without makeup pressure, for sufficient time to allow for diametric expansion or pipe stretching to stabilize, approximately two to three hours.
   3. After the above stabilization has occurred, return the section being tested to the test pressure. Hold the test pressure for four hours. If the pressure in the test section drops, and it is determined the drop may be the result of expansion resulting from increasing temperature, a limited amount of additional water may be added to bring the pressure back to the test pressure. Allowable amounts of make-up water, to compensate for expansion due to increasing temperature, are as shown in the following table. Make-up water is only allowed during this final test period and not during the initial stabilization described in the

previous paragraph. If the additional water added is less than the allowable shown in the table and there are no visual leaks or significant pressure drops, the tested section passes the test.

Nominal Pipe Size (in.)	Allowance for Expansion (U.S. Gals./100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.50
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

D. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:

1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
3. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (N \times D \times P1/2)/7,400$$

L = Allowable leakage, gallons per hour.
N = Number of joints in the length of the pipeline tested.
D = Nominal diameter of pipe, inches.
P = Average test pressure during the leakage test, pounds per square inch (gauge).

3.11 DEFLECTION TESTING

A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.

B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.

C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.

D. Pull-Through Device:
   1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
      a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.
      b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
   2. Ball, cylinder, or circular sections shall conform to the following:
      a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
      b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
      c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
      d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

E. Pull-Through Device:
   1. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
   2. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.

F. Deflection measuring Device:
   1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
   2. Obtain approval of deflection measuring device prior to use.

G. Deflection Measuring Device Procedure:
   1. Measure deflections through each run of installed pipe.
   2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
   3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.

H. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.12 CLEANING

A. Thoroughly clean sewer lines and manholes of sediments, dirt, debris, and obstructions of any kind.

3.13 TELEVISION INSPECTION

A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the sewer line shall be televised with a color closed-circuit television with

tilt-head camera recorded in DVD format. The original disc and log sheets shall be provided to the Owner for review.

B. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
   1. Low spot (1 inch or greater - mainlines only)
   2. Joint separations (3/4 inch or greater opening between pipe sections)
   3. Cocked joints present in straight runs or on the wrong side of pipe curves
   4. Chips in pipe ends
   5. Cracked or damaged pipe
   6. Dropped joints
   7. Infiltration
   8. Debris or other foreign objects
   9. Other obvious deficiencies
   10. Irregular condition without logical explanation

END OF SECTION

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roadway and/or site storm drainage system up to five feet of any on-site building

1.2 RELATED SECTIONS

A. Section 31 21 00, Utility Trenching and Backfill

B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. AASHTO
1. M199: Precast Reinforced Concrete Manhole Sections
2. M252: Corrugated Polyethylene Drainage Pipe
3. M294: Corrugated Polyethylene Pipe, 12 to 604 inch Diameter

B. ASTM
1. A74: Cast Iron Soil Pipe and Fittings
2. A615: Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
3. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete
4. C443: Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
5. C478: Circular Precast Reinforced Concrete Manhole Sections
6. C564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings
7. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
8. C1173: Flexible Transition Couplings for Underground Piping Systems
9. D1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
10. D2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
11. D2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
12. D3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
13. D4101: Propylene Injection and Extrusion Materials
14. F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe
15. F656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
16. F679: Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
17. F1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings

C. AWWA
1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. for Water
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. C115: Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
6. C116: Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
7. C150: Thickness design of Ductile Iron Pipe
8. C151: Ductile-Iron Pipe, Centrifugally Cast

9. C153: Ductile-Iron Compact Fittings
10. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
11. M41: Ductile Iron Pipe and Fittings

D. Caltrans Standard Specifications, 2015
1. Section 51, Concrete Structures
2. Section 52, Reinforcement
3. Section 65, Concrete Pipe
4. Section 66, Corrugated Metal Pipe
5. Section 70, Miscellaneous Drainage Facilities
6. Section 72, Slope Protection
7. Section 75, Miscellaneous Metal
8. Section 90, Concrete

E. Caltrans Standard Plans, 2015
1. Plan D94A: Metal and Plastic Flared End Sections
2. Plan D94B: Concrete Flared End Sections
3. Plan D97A: Corrugated Metal Pipe Coupling Details No. 1, Annular Coupling Band Bar and Strap and Angle Connection
4. Plan D97C: Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers
5. Plan D97D: Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands
6. Plan D97E: Corrugated Metal Pipe Coupling Details No. 5, Standard Joint
7. Plan D97F: Corrugated Metal Pipe Coupling Details No. 6, Positive Joint
8. Plan D97G: Corrugated Metal Pipe Coupling Details No. 7, Downdrain
9. Plan D98A: Slotted Corrugated Steel Pipe Drain Details
10. Plan D98B: Slotted Corrugated Steel Pipe Drain Details

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing Materials

C. AWWA: American Water Works Association

D. CMP: Corrugated metal pipe

E. DIP: Ductile iron pipe

F. HDPE: High-density polyethylene

G. NPS: Nominal pipe size

H. PE: Polyethylene

I. PVC: Polyvinyl Chloride

J. RCP: Reinforced concrete pipe

1.5 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Product data for the following:

1. Piping materials and fittings
2. Special pipe couplings
3. Polymer-concrete, channel drainage systems (trench drains)
4. Joint sealants
5. Plastic area drains
6. Cleanout plugs or caps
7. Precast concrete catch basins, inlets, curb inlets, junction structures and area drains, including frames and grates
8. Precast clean out boxes and box covers
9. Concrete, metal and plastic flared end sections

C. Shop drawings: Include plans, elevations, details and attachments for the following:
1. Precast concrete manholes, frames and covers

D. Design Mix Reports and Calculations: For each class of cast in place concrete

E. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage
1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

B. Handling
1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.
2. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.
3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS (HDPE): 4 INCH THROUGH 10 INCH

A. Pipe shall be in accordance with AASHTO M252 Type S, smooth interior and corrugated exterior

B. Bell and spigot joints

C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477

D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.2 PE PIPE AND FITTINGS (HDPE): 12 INCH THROUGH 48 INCH

A. Pipe shall be in accordance to AASHTO M294. Type S, smooth interior and corrugated exterior.

B. Bell and spigot joints

C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477

D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.3 PVC PIPE AND FITTINGS-SMALLER THAN 4 INCH

A. Pipe shall be in accordance to ASTM D1785, Schedule 40.

B. Joints: Solvent Cement, ASTM D2564

C. Include primer according to ASTM F656

D. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.4 PVC PIPE, 4 INCH AND LARGER

A. Pipe
1. 4 inch through 15 inch: ASTM D3034, SDR 35.
2. 18 inch through 36 inch: ASTM F679, T-1 wall

B. Bell and spigot joints

C. Fittings:
1. 4 inch through 27 inch: ASTM F1336
2. 30 inch through 36 inch: ASTM D3034, SDR 35

D. Joint Gasket: Elastomeric seal, ASTM F477

E. Special Pipe Coupling: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined

2.5 REINFORCED CONCRETE PIPE

A. Designated by Class, rubber gasketed joints, Type II or V cement
1. Circular Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-2.02C(2). Class III
2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-2.02D. Class HE-III and VE-III

B. Rubber Gasketed Joints: Caltrans Standard Specification Section 65-2.02F

C. Special Pipe Couplings: Portland cement collar as indicated

2.6 PIPE ANCHORS

A. General: Location, configuration bearing area, etc. as indicated

B. Portland Cement Concrete: Section 32 13 18, Cement and Concrete for Exterior Improvements

2.7 PIPE CLEANOUTS

A. Piping: Same as storm drain line if possible

B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.

C. Box Size: As required to provide access and allow easy removal and reinstallation of cap

D. Box Types
   1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty
   2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading

E. Box Cover Markings: “S.D.,” unless otherwise specified

F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
   1. Associated Concrete Products, Inc.
   2. Brooks Products Inc.
   3. OldCastle Precast/Christy Concrete Products, Inc.

2.8 AREA DRAINS

A. Grate and Riser: Area drain shall be as manufactured by Nyloplast or approved equal. Riser shall be constructed of 6 inch PVC SDR 35 piping per paragraph 2.1(A) of this section and connected to area drain by a gasket joint. Riser shall be vertical except as otherwise noted in the plans. Riser may include a reducer if necessary to make connection to the storm drain line.

B. Elevation and Grading: Area Drain rim elevation shall be set and area around area drain shall be graded to drain away from any adjacent structures, walks, or roadways and towards area drain.

2.9 CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC.

A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.

B. Portland Cement Concrete and Reinforcing: Section 32 13 18, Cement and Concrete for Exterior Improvements.

C. Precast Structure: Rate for AASHTO H20 loading in traffic areas.

D. Steps: ASTM C 478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091).

E. Frames, Grates and Covers: Caltrans Standard Specification Section 75-1.02, 75-1.02.B and 75-2
   1. Galvanize steel frames, grates and covers
   2. Grates and covers shall be non-rocking
   3. Rate for AASHTO H20 loading in traffic areas

2.10 JOINT SEALANT FOR PRECAST STRUCTURES AND MANHOLES

A. Mortar: Caltrans Standard Specification Section 51-1.02F
   1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.

B. Gaskets: Preformed flexible rubber or plastic gasket
   1. Rubber Gaskets: ASTM C443
   2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is “Ram-Nek,” as manufactured by Henry Company, or approved equal.

2.11 PIPE TO STRUCTURE CONNECTOR/SEAL

A. A flexible pipe to manhole connector shall be used for all pipe penetrations to pre-cast and/or cast-in-place concrete structures.
   1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.
   2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C923.
   3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.
   4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer’s instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03 for reinforced concrete pipe, Caltrans Standard Specification Section 66-1.03 for corrugated metal pipe, and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.

B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated. ***[Check section shown on the Plans with that described in Section 312100]***

C. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer’s recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe

with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance at the end of each day's work or when work is not in progress.

3.2 SPECIAL PIPE COUPLINGS

A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

B. Installation: Manufacturers' instructions

3.3 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC. AND MANHOLES

A. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill

B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
   1. Shape bottoms to convey flows as indicated.

C. Precast Structures: Install as indicated.
   1. Seal all joints and pipe entrances and exits.
   2. Place concrete in bottom and shape to convey flows as indicated.

3.4 POURED-IN-PLACE CONCRETE

A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of Caltrans Standard Specifications.

B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the Caltrans Standards Specifications. Unless otherwise noted herein or in the Plans, exposed surfaces of structures shall be Class 1 surface finish.

C. Curing shall conform to applicable portions in Section 90 of Caltrans Standard Specifications. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.

D. Concrete shall not be cropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.5 PIPELINE FLUSHING

A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning.

3.6 DEFLECTION TESTING

A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.

B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.

C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.

D. Pull-Through Device:

1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
    a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.
    b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
2. Ball, cylinder, or circular sections shall conform to the following:
    a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
    b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
    c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
    d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
3. Pull-Through Device:
    a. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
    b. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.

E. Deflection measuring Device:

1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
2. Obtain approval of deflection measuring device prior to use.

F. Deflection Measuring Device Procedure:

1. Measure deflections through each run of installed pipe.

2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.

G. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.7 CLEANING

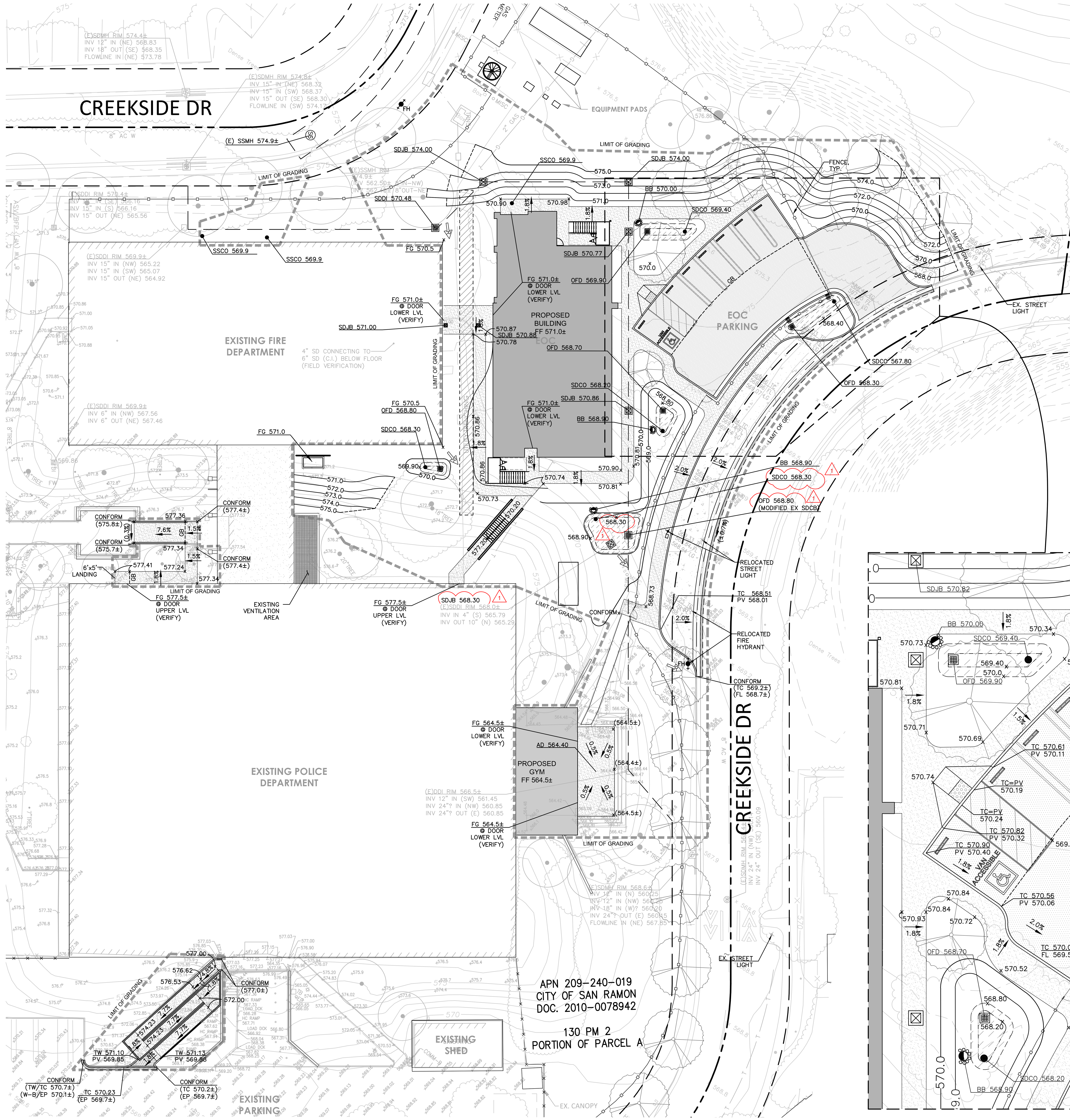
A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

3.8 TELEVISION INSPECTION

A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the drain line shall be televised with a color closed-circuit television with tilt-head camera recorded in DVD format. The original disc and log sheets shall be provided to the Owner for review.

B. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
1. Low spot (1 inch or greater - mainlines only)
2. Joint separations (3/4 inch or greater opening between pipe sections)
3. Cocked joints present in straight runs or on the wrong side of pipe curves.
4. Chips in pipe ends
5. Cracked or damaged pipe
6. Dropped joints
7. Infiltration
8. Debris or other foreign objects
9. Other obvious deficiencies
10. Irregular condition without logical explanation

END OF SECTION

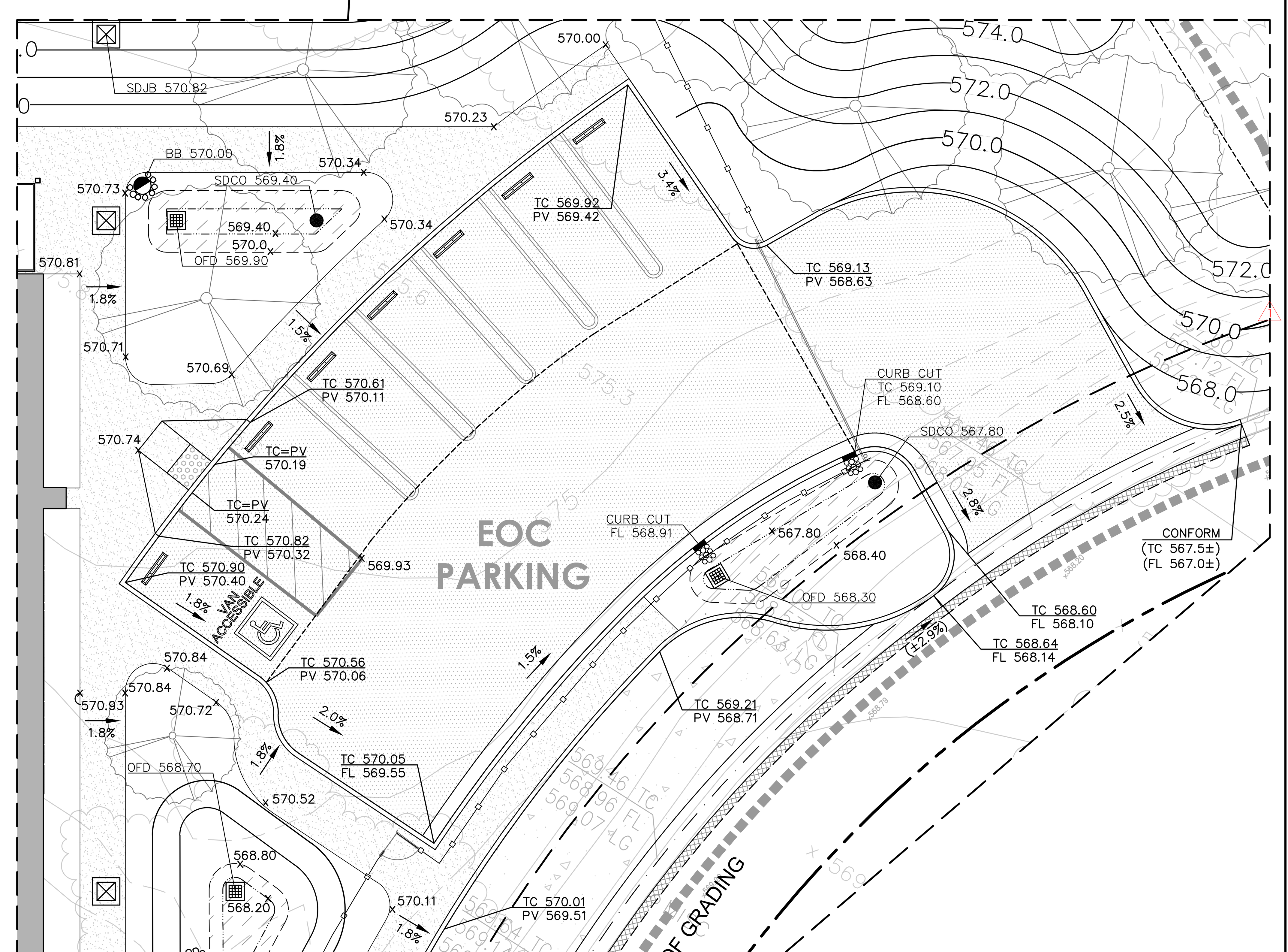


IMPERVIOUS AND PERVIOUS SURFACES SUMMARY		
	PRE-PROJECT (SQ. FT.)	POST-PROJECT (SQ. FT.)
PERVIOUS SURFACE	23,900	8,977
IMPERVIOUS SURFACE INCLUDING: 1. EOC + GYM BLDG 2. CONCRETE PVMT 3. AC PVMT	2,258	17,181 5,822 7,250 4,109
TOTAL (SQ. FT.)	26,158	26,158

APPROXIMATE AREA OF SOIL DISTURBED = 42,600 SQ. FT.

LEGEND

BOUNDARY LINE	
LOT LINE	
EASEMENT LINE	
LIMIT OF GRADING LINE	
BIORETENTION BASIN PER DETAIL 2, SHEET C10.1	
AC PAVEMENT PER CSR CITY STD DTL C-7, SHEET C10.2.	
PCC CONCRETE (PEDESTRIAN) PER CSR CITY STD DTL C-5, SHEET C10.2.	
PCC CONCRETE (VEHICULAR) PER CSR CITY STD DTL C-6, SHEET C10.2.	
UTILITY TRENCHING AREA	
ELEVATION (PROPOSED)	TC XXX.XX FL XXX.XX
ELEVATION (EXISTING)	(TC XXX.XX±) (FL XXX.XX±)
FINISHED FLOOR ELEVATION	FF XX.XX
SPOT ELEVATION (PROPOSED)	100.00
SPOT ELEVATION (EXISTING)	(100.0±)
GRADE BREAK	
RETAINING WALL (S.S.D.)	
OVERLAND RELEASE	
SLOPE TO GRADE (LANDSCAPE)	
SLOPE TO GRADE (HARDSCAPE)	X.X%
6" RISER	
STORM DRAIN INLET (EXISTING)	
STORM DRAIN JUNCTION BOX	
STORM DRAIN AREA DRAIN	AD
STORM DRAIN DRAIN INLET	
SANITARY SEWER MANHOLE	
SANITARY SEWER CLEANOUT	
WATER VALVE	



PARKING LOT - ENLARGED VIEW

SCALE: 1"=10'

REGISTERED PROFESSIONAL ENGINEER · CIVIL · STATE OF CALIFORNIA

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San Ramon CALIFORNIA

SAN RAMON POLICE

Project:

SAN RAMON PUBLIC SAFETY BUILDING

2401 CROW CANYON RD
SAN RAMON, CA 94583

SAN RAMON VALLEY FIRE Est. 1913

Description:	Date:
BLDG. DEPT. SUBMITTAL	12/21/20
FOR BID	02/19/21
ADDENDUM 001	03/03/21

ISSUED FOR CONSTRUCTION

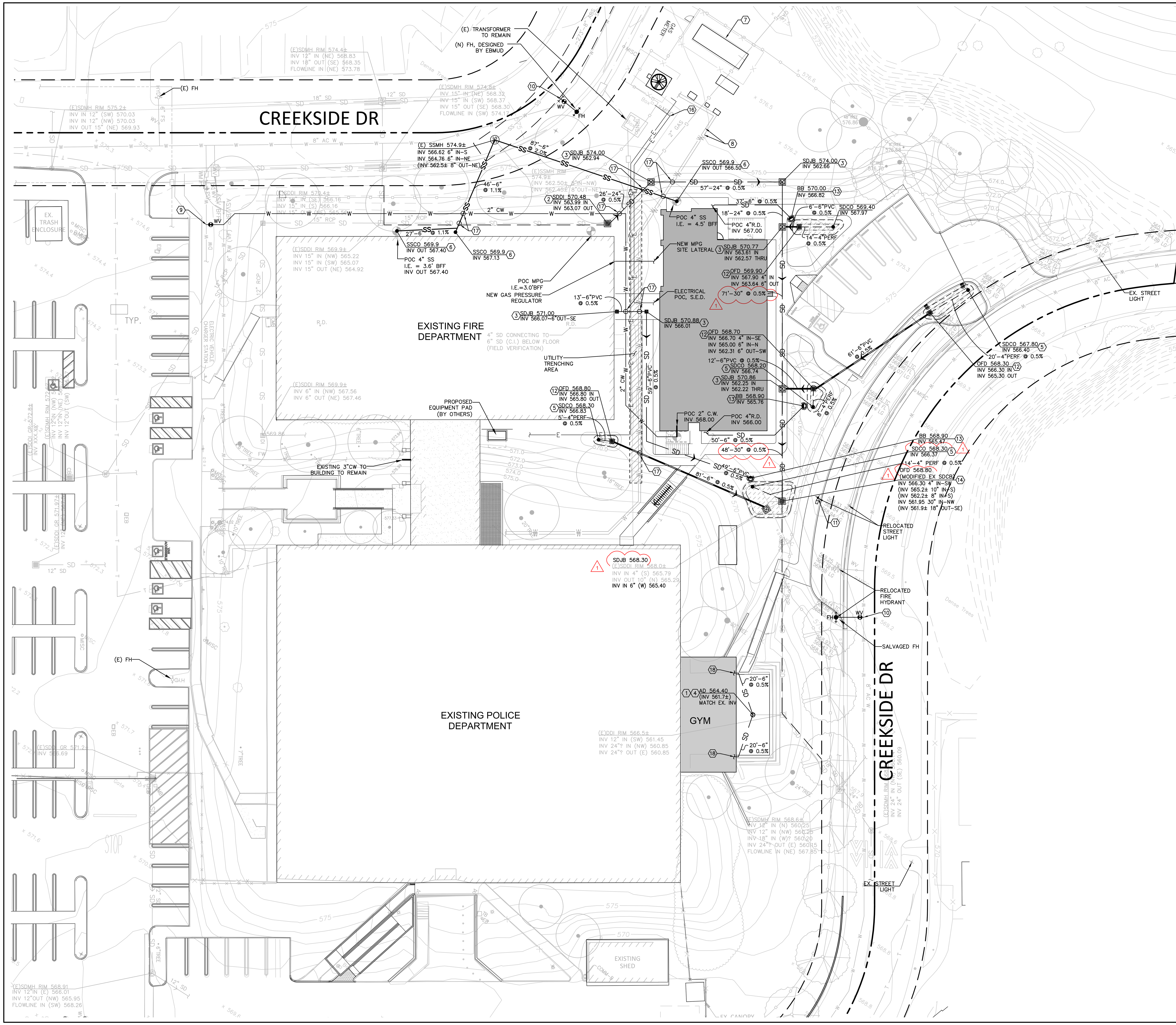
Project Number:	180801
Approved By:	PK
Checked By:	TN
Drawn By:	JH

Sheet Title:

GRADING AND DRAINAGE PLAN

Sheet Number:

C-5.0



LEGEND

BOUNDARY LINE	
EASEMENT LINE	
ROADWAY CENTER LINE	
CURB CUT (18" WIDE WITH SPLASH ROCK)	
BIORETENTION BASIN (SEE DETAIL 2, SHEET 10.1)	
ELEVATION	RIM XXX.XX / INV XXX.XX
COMMUNICATION LINE	COMM
DOMESTIC WATER LINE	W
ELECTRIC LINE	E
FIRE WATER LINE	FW
GAS LINE	G
JOINT TRENCH LINE	JT
SANITARY SEWER LINE	XX'–X" @X.X% SS
STORM DRAIN (DIRECTION)	SD
STORM DRAIN (PERFORATED)	
STORM DRAIN (TREATED)	XX'–X" @X.X%
STORM DRAIN (UNTREATED)	XX'–X" @X.X% SD
STORM DRAIN AREA DRAIN	
STORM DRAIN CLEANOUT	
STORM DRAIN OVERFLOW DRAIN	
STORM DRAIN BUBBLER BOX	
STORM DRAIN CATCH BASIN	
STORM DRAIN DROP INLET	
STORM DRAIN JUNCTION BOX	
STORM DRAIN MANHOLE	SDMH
SANITARY SEWER CLEANOUT	SSCO
SANITARY SEWER MANHOLE	SSMH
BACKFLOW PREVENTER	
FIRE HYDRANT	
WATER METER	
WATER VALVE	WV

KEYNOTES

1. INSTALL AREA DRAIN PER DETAIL 4, SHEET C9.0.
2. INSTALL STORM DRAIN DROP INLET PER CITY STD DTL SD–4.
3. INSTALL STORM DRAIN JUNCTION BOX PER DETAIL 1, SHEET C9.1.
4. CONNECT TO EXISTING SD LINE.
5. INSTALL STORM DRAIN CLEANOUT PER DETAIL 6, SHEET C9.0.
6. INSTALL SS CLEANOUT PER DETAIL 2, SHEET C9.0.
7. PROTECT IN PLACE EXISTING GENERATOR.
8. NEW 8" CONDENSER WATER. SEE MEP PLANS. PROVIDE 12" MIN. VERTICAL CLEARANCE BETWEEN CROSSING UTILITIES.
9. HOT TAP (N) 2" CW SERVICE TO (E) WATER LATERAL. VIF.
10. (N) FH SERVICE DESIGNED BY EBMUD.
11. RELOCATE STREET LIGHT PER CITY STD DETAILS AND SPECS. 1
12. INSTALL OVERFLOW DRAIN PER DETAIL 4, SHEET C10.1.
13. INSTALL BUBBLER PER DETAIL 1, SHEET C10.0.
14. REPLACE EX. SDCB WITH THE OVERFLOW DRAIN 24"X24", SEE OVERFLOW DRAIN DETAIL 4, SHEET C10.1.
15. INSTALL 18" CURB CUT PER DETAIL 3, SHEET C10.1.
16. ELECTRICAL LINES SHOWN FOR REFERENCE ONLY. FOR COMMUNICATION/TELECOM, S.E.D. PROVIDE 12" MIN. VERTICAL CLEARANCE BETWEEN CROSSING UTILITIES.
17. PROVIDE 12" MIN. VERTICAL CLEARANCE BETWEEN CROSSING UTILITIES. CONTRACTOR TO VIF.
18. ROOF DRAIN CONNECTION. SEE PLUMBING DRAWINGS FOR CONTINUATION.

NOTE: THE EOC BUILDING FOOTING EDGE SHALL BE DEEPENED WHERE NECESSARY TO KEEP ADJACENT UTILITY LINES TO STAY ABOVE THE FOOTING ZONE OF INFLUENCE.

GRAPHIC SCALE
20 0 20 40

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100+ YEARS
ENGINEERS SURVEYORS PLANNERS

Project:

SAN RAMON PUBLIC SAFETY BUILDING

2401 CROW CANYON RD
SAN RAMON, CA 94583

Description:	Date:
BLDG. DEPT. SUBMITTAL	12/21/20
FOR BID	02/19/21
ADDENDUM 001	03/03/21

ISSUED FOR CONSTRUCTION

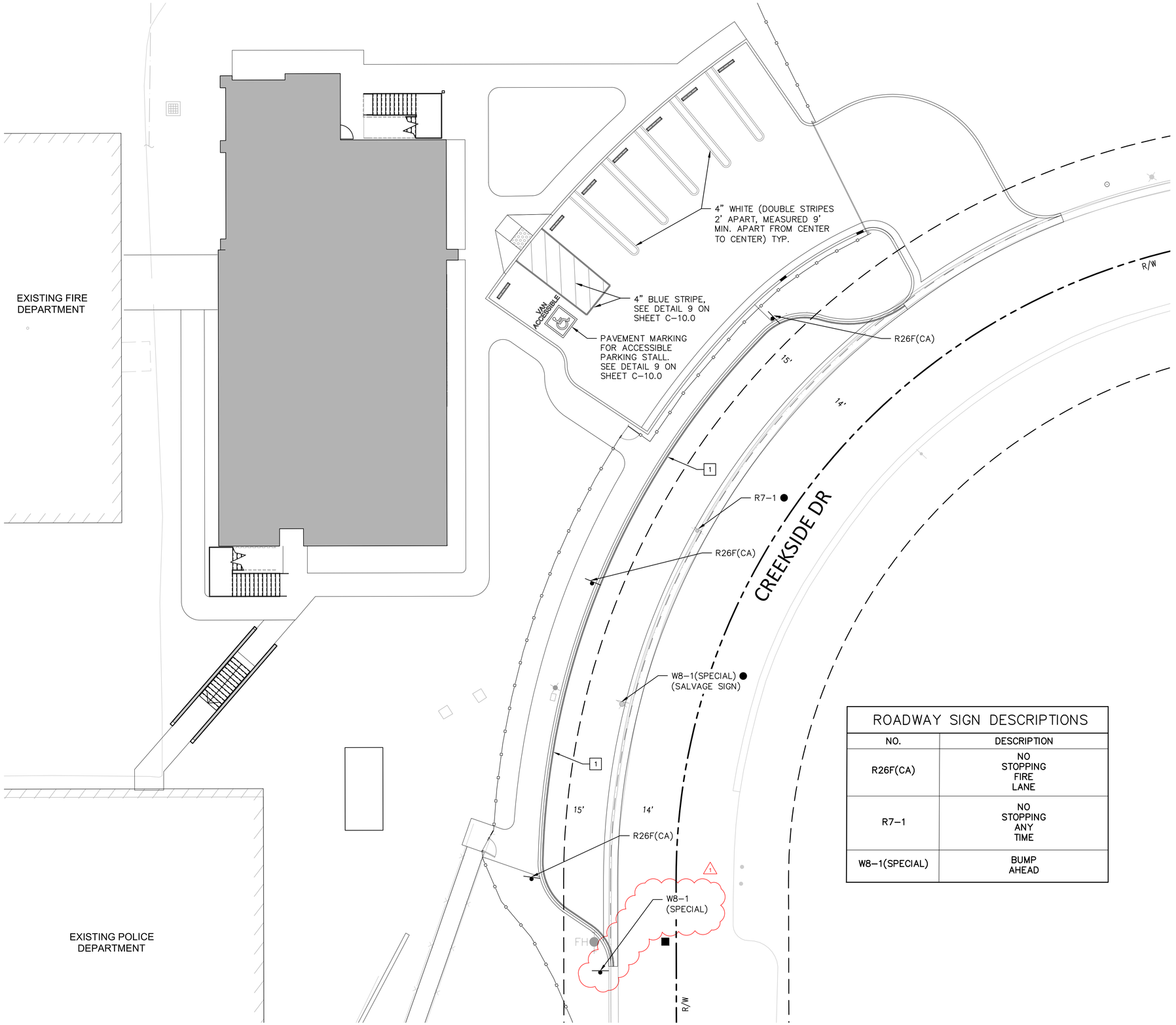
Project Number:	180801
Approved By:	PK
Checked By:	TN
Drawn By:	JH

Sheet Title:

COMPOSITE UTILITY PLAN

Sheet Number:

C-6.0



ROADWAY SIGN DESCRIPTIONS

NO.	DESCRIPTION
R26F(CA)	NO STOPPING FIRE LANE
R7-1	NO STOPPING ANY TIME
W8-1(SPECIAL)	BUMP AHEAD

LEGEND

- NEW ROADSIDE SIGN TO BE INSTALLED ON NEW POLES
- EXISTING ROADSIDE SIGN ON EXISTING POLE
- NEW ROADSIDE SIGN TO BE INSTALLED ON NEW STREET LIGHT POLE
- INSTALL BLUE FIRE HYDRANT REFLECTIVE MARKER
- REMOVE EXISTING SIGN
- PAINTED CURB

CONSTRUCTION NOTES

1. RED CURB:
DARK LINE DENOTES RED CURB PAINTED WITH WHITE STENCILING LABELED "FIRE LANE – NO PARKING" AT MAXIMUM 75' SPACING

GENERAL NOTES

1. SEE CITY STANDARD DETAILS R-3 THRU R-6 FOR SIGNAGE AND STRIPING DETAILS.

GRAPHIC SCALE
20 0 20 40

REGISTERED PROFESSIONAL ENGINEER PAUL KOCH CIVIL STATE OF CALIFORNIA

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San Ramon CALIFORNIA
SAN RAMON POLICE

Project:

SAN RAMON PUBLIC SAFETY BUILDING

2401 CROW CANYON RD
SAN RAMON, CA 94583

SAN RAMON VALLEY FIRE PROTECTION DISTRICT ESTD. 1019

Description:	Date:
BLDG. DEPT. SUBMITTAL	12/21/20
FOR BID	02/19/21
ADDENDUM 001	03/03/21

ISSUED FOR CONSTRUCTION

Project Number:	180801
Approved By:	PK
Checked By:	TN
Drawn By:	JH

Sheet Title:

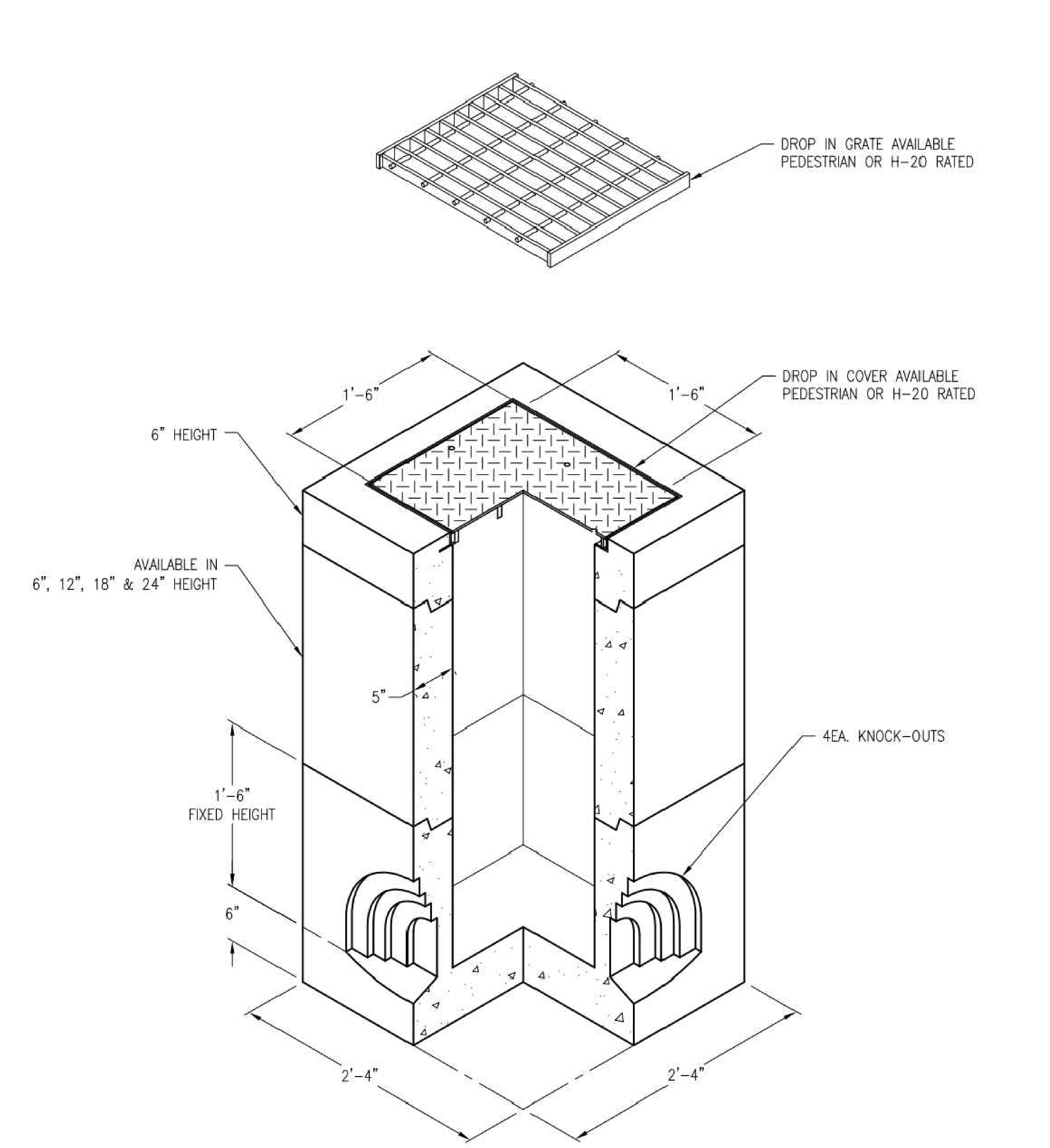
SIGNING AND STRIPING PLAN

Sheet Number:

C-8.0

VERTICAL AVAILABLE TO MEET REQUIRED DEPTH

SD-18

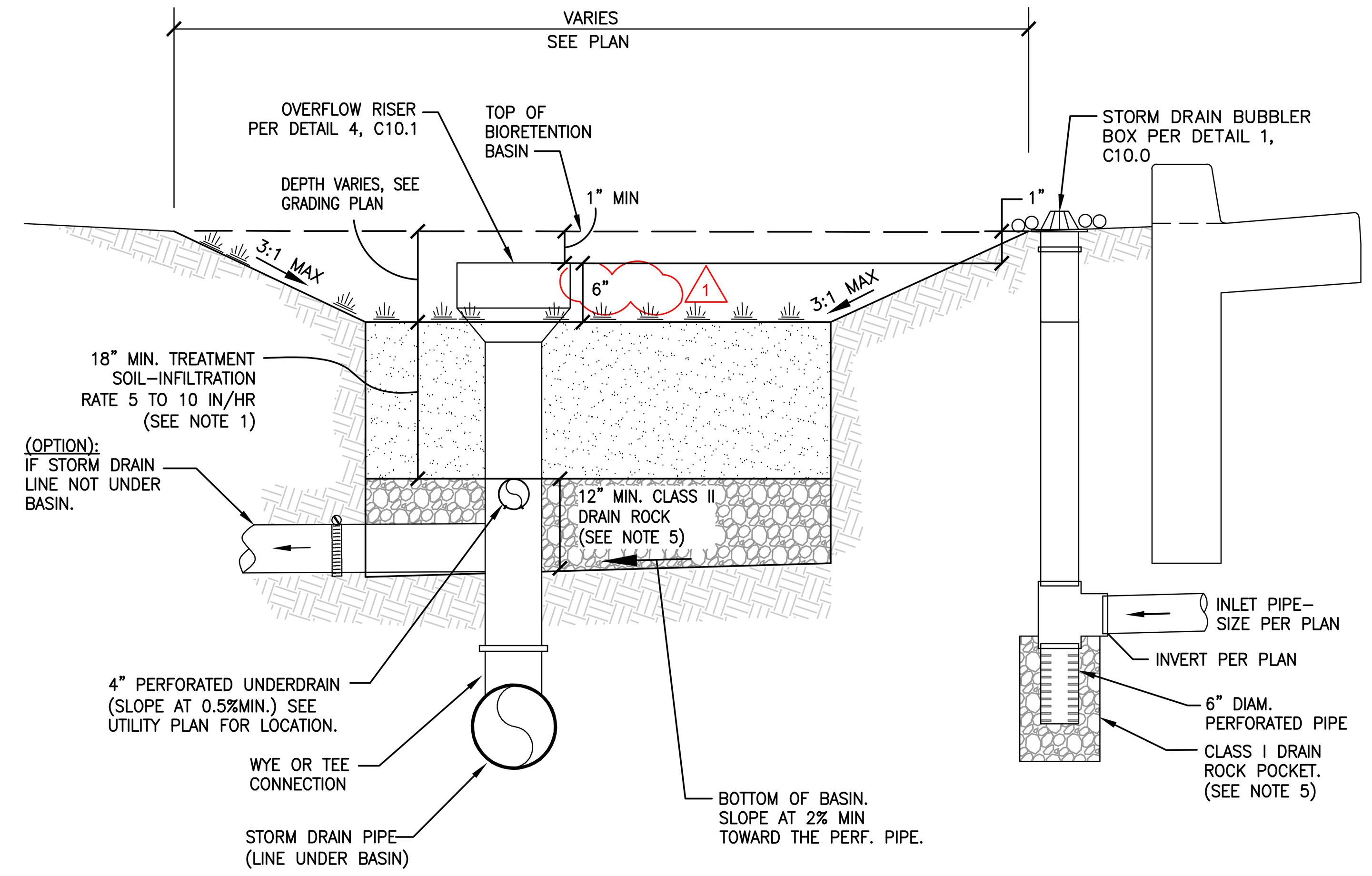


VERTICAL WEIGHT PER FOOT: 490 LBS.
FLOOR WEIGHT: 420 LBS.

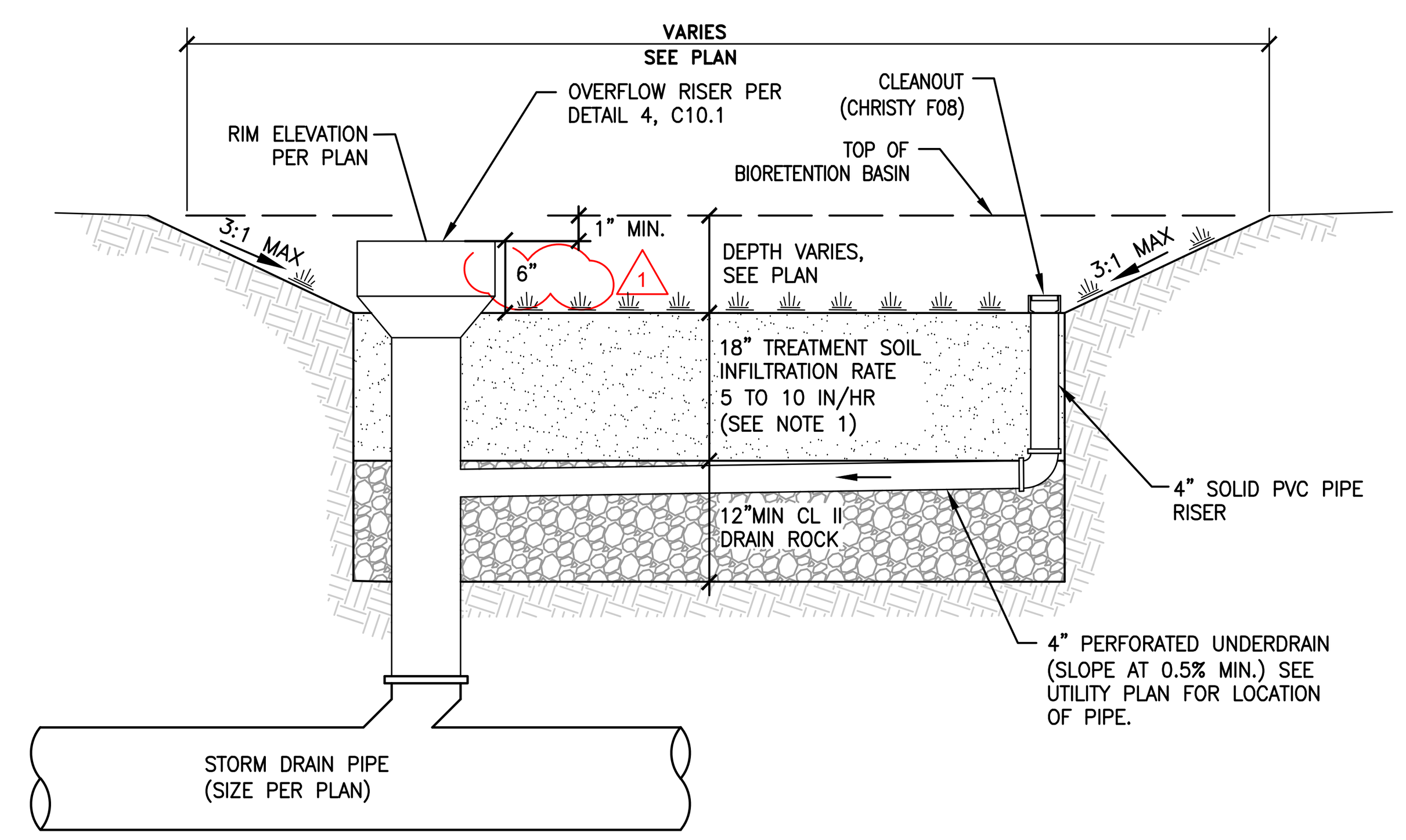
DRAWING MAY NOT CONFORM TO THE MOST CURRENT SPECIFICATION

Oldcastle Precast® Northern California Madera • Morgan Hill • Pleasanton • Santa Rosa • Stockton • Tulare Phone: 925-750-6650 Fax: 925-750-6660	KOB-1818	1'-6" X 1'-6" X VARIES (I.D.) KNOCK-OUT BASES STORM DRAIN
	FILE NAME: SD-18.DWG	
	REVISED: MARCH 2016	
	www.oldcastleprecast.com	Copyright © 2016 Oldcastle Precast, Inc.

1 DROP INLET / STORM DRAIN JUNCTION BOX



TRANSVERSE SECTION



LONGITUDINAL SECTION

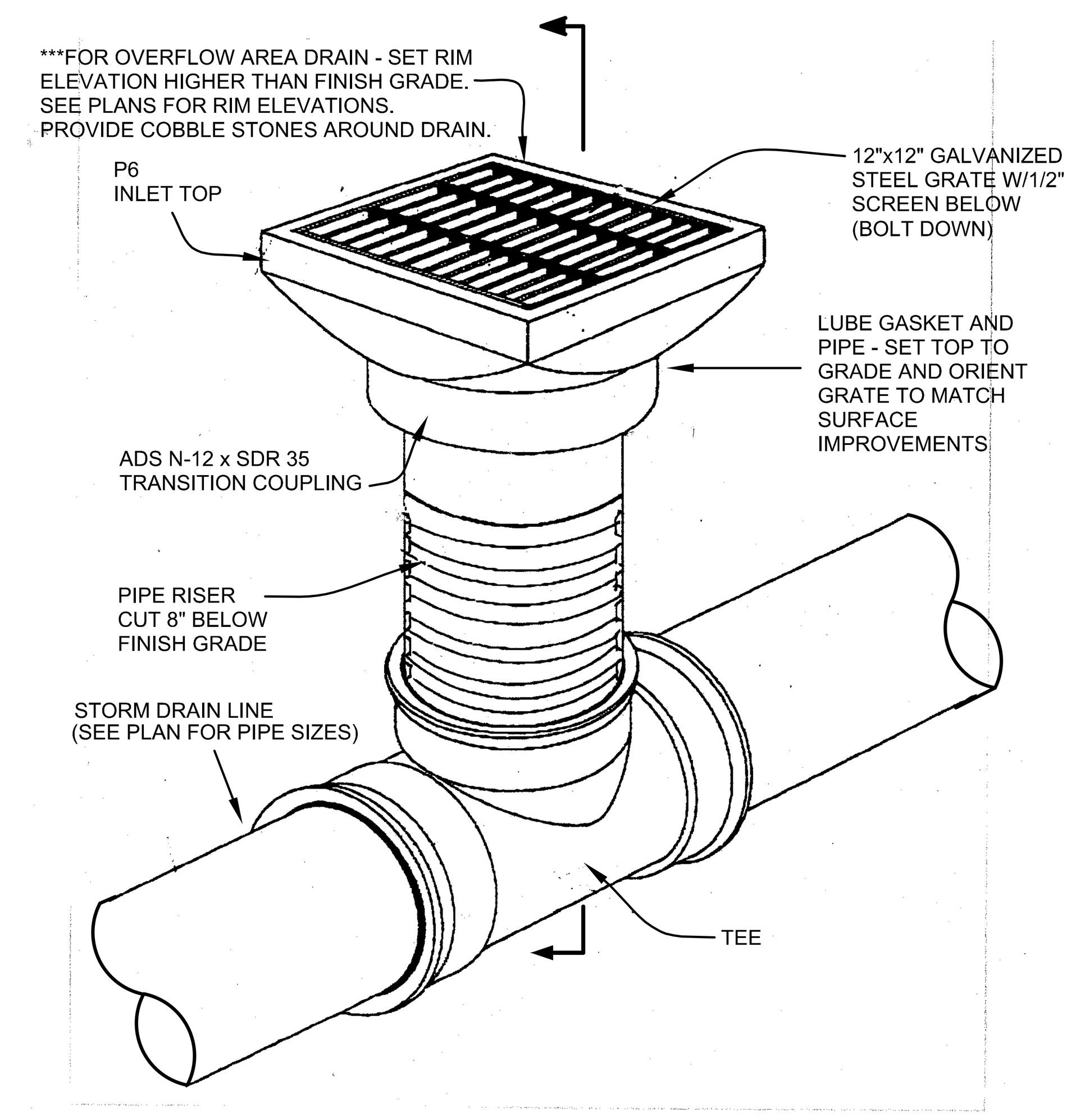
N.T.S.

NOTE:

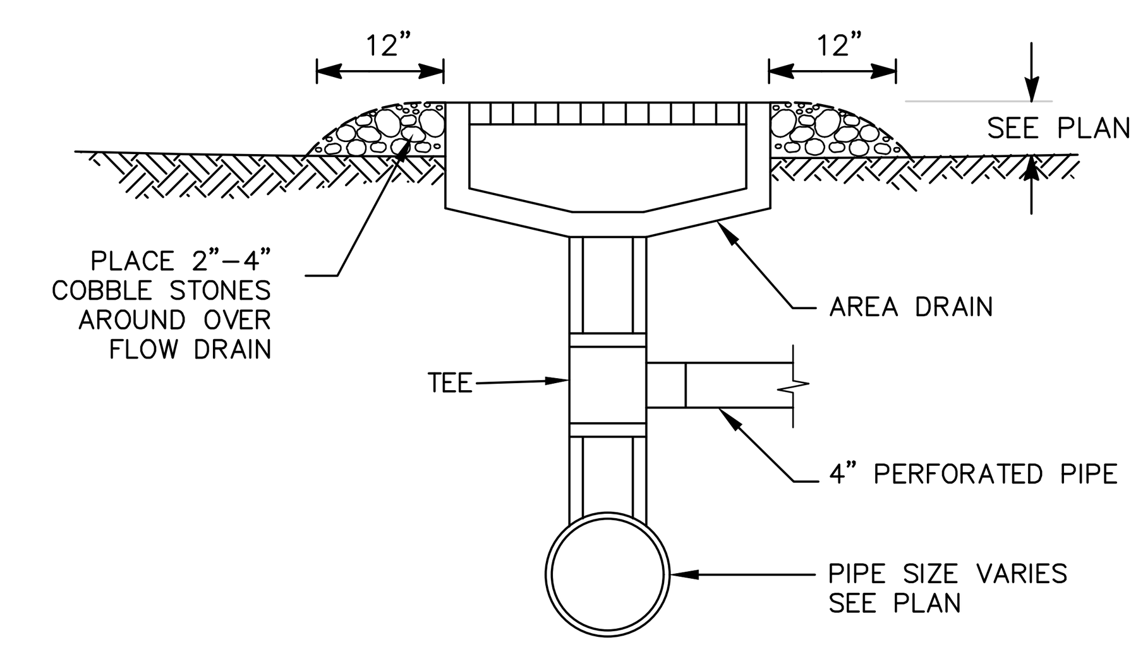
1. TREATMENT SOIL MIX SHALL MEET REQUIREMENTS AS SPECIFIED IN THE CONTRA COSTA CLEAN WATER PROGRAM (CCCWP) STORMWATER C.3 GUIDEBOOK DATED 2017 IN APPENDIX B.
2. BACKFILL BIORETENTION ONLY WITH PERMEABLE PLANTING MATERIAL AND DRAIN ROCK AS SPECIFIED IN THIS DETAIL. ABSOLUTELY NO NATIVE MATERIAL SHALL BE USED FOR BACKFILL. CONTRACTOR MUST COORDINATE WITH CIVIL ENGINEER PRIOR TO CONSTRUCTION.
3. CONTACT THE CITY'S URBAN RUNOFF COORDINATOR FOR INSPECTION DURING INSTALLATION OF BIORETREATMENT SOIL, OF THE TREE POD SYSTEM, AND FINAL LANDSCAPING. RESULT FROM A PERCOLATION RATE SHALL BE GREATER THAN 5.0 IN/HR AND LESS THAN 10.0 IN/HR.
4. A MINIMUM 2-FOOT LEVEL CLEARANCE (MAX 2%) SHALL BE PROVIDE BETWEEN THE TOP OF BASIN AND WALKWAYS/PUBLIC SIDEWALKS.
5. DRAIN ROCK TO BE CLASS 2 PERMEABLE MATERIAL PER CALTRANS STANDARD SPECIFICATIONS, SECTION 68-1.025. THE MATERIAL SHALL BE WASHED AND FREE FROM CLAY OR ORGANIC MATERIAL.
6. PERFORATED PIPE SHALL BE SOLVENT WELD PVC SDR 35 (OR APPROVED EQUAL) WITH PERFORATIONS FACED DOWN. LOCATION OF THE PIPE VARIES, SEE PLAN.
7. FOR ANY HORIZONTAL LINER PENETRATIONS, RADIAL-CUT THE LINER FOR PIPE. MASTIC AND SEAL WITH PIPE CLAMP TO INSURE WATER-TIGHT SEAL.

N.T.S.

2 BIORETENTION BASIN

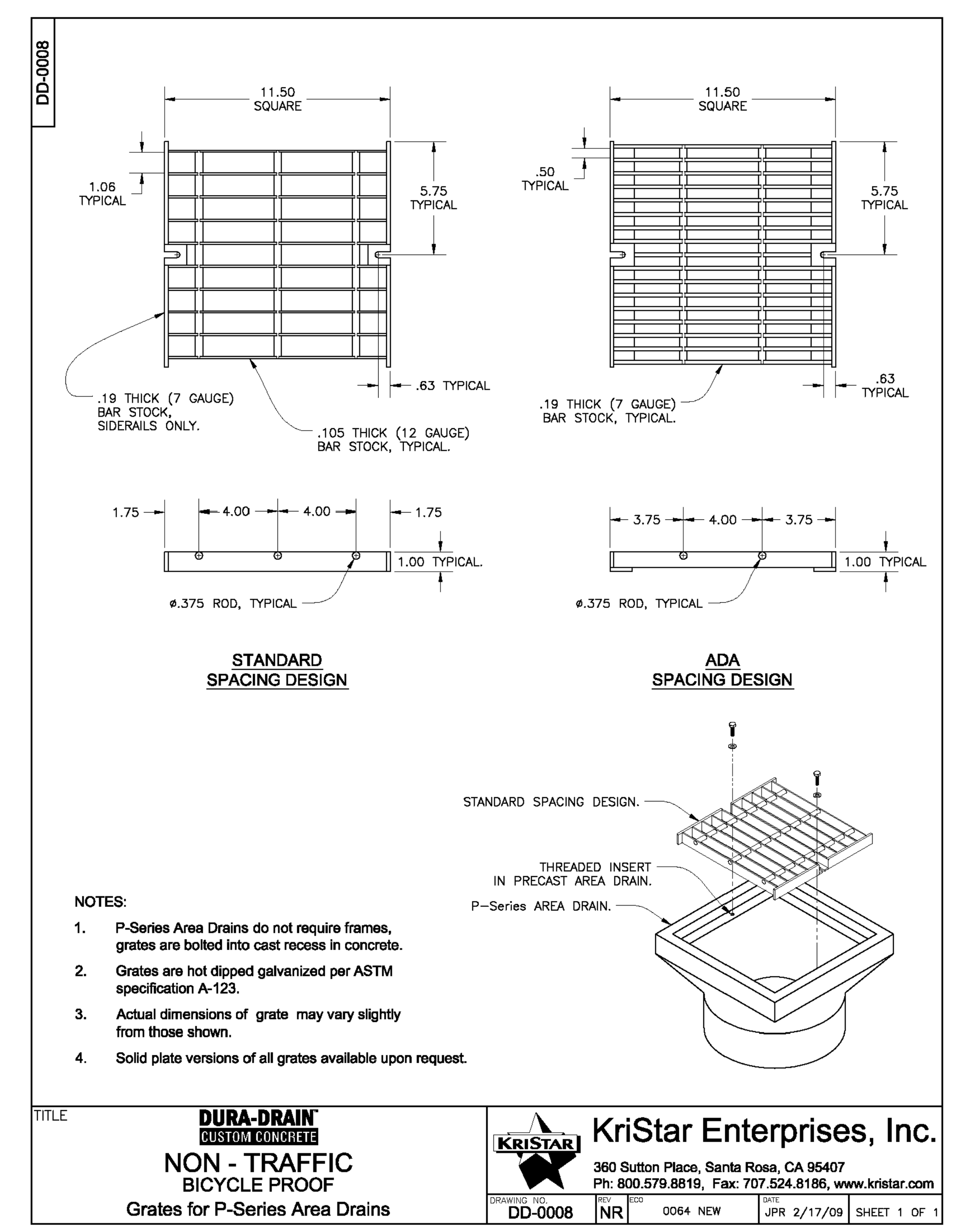


NOTE: INSTALL TRASH CAPTURE DEVICE AT ALL OFD.



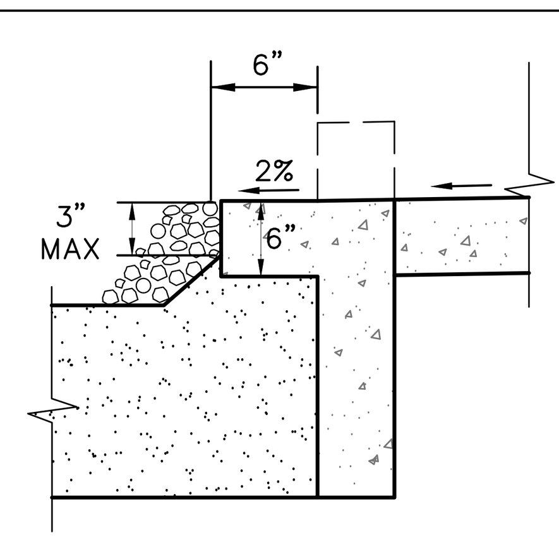
SECTION A-A

NTS

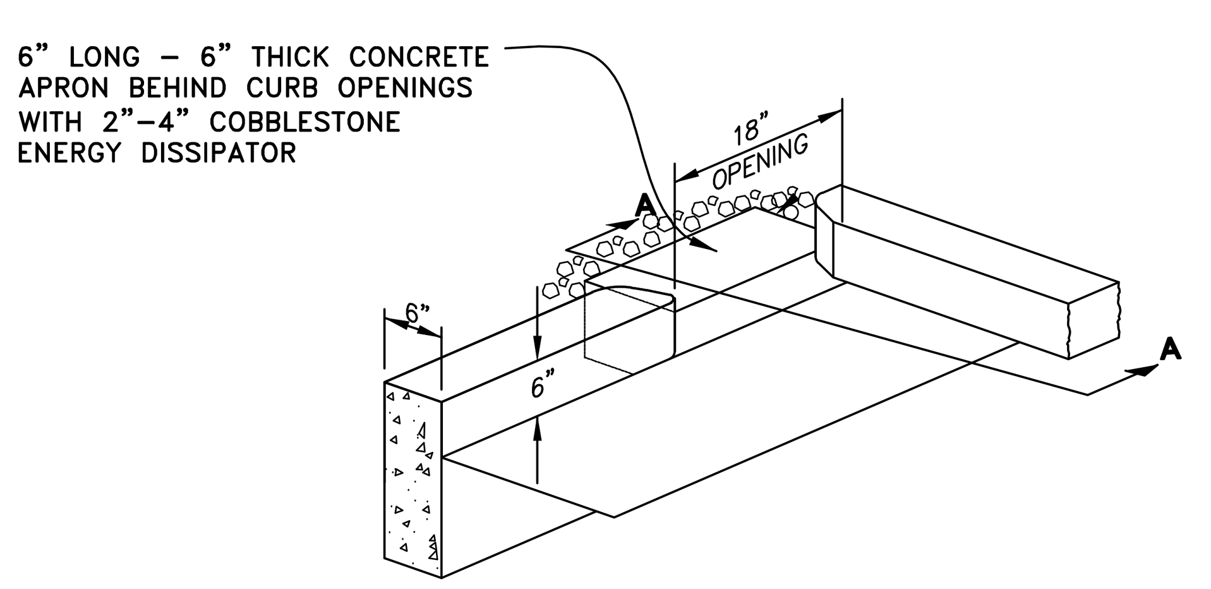


N.T.S.

4 OVERFLOW DRAIN RISER AT BIORETENTION BASIN



SECTION A-A



N.T.S.

3 18" CURB CUT / OPENING

JKA jeff katz ARCHITECTURE
200 E STREET, SANTA ROSA, CA 95404
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BKF 100+ YEARS ENGINEERS SURVEYORS PLANNERS

Project:

SAN RAMON PUBLIC SAFETY BUILDING

2401 CROW CANYON RD
SAN RAMON, CA 94583

Description:	Date:
BLDG. DEPT. SUBMITTAL	12/21/20
FOR BID	02/19/21
ADDENDUM 001	03/03/21

ISSUED FOR CONSTRUCTION

Project Number:	180801
Approved By:	PK
Checked By:	TN
Drawn By:	JH

Sheet Title:

CONSTRUCTION DETAILS

Sheet Number:

C-10.1

QUESTION III b
Response Images

[ ] CH.4 PROPRIETARY
[x] CH.4 CENTRAL STATION
[ ] CH.4 REMOTE STATION

POWER SUPPLY:

PRIMARY 120 VOLTS LOCATION _____ SECONDARY BATTERY TYPE LEAD ACID

INSPECTED BY: DIVERSIFIED FIRE PRODUCTS, INC DATE: 4-24-03

FOR SERVICE CONTACT: *Diversified Fire Products, Inc.* *(408) 370-3770*

PASS code HHHH

System Normal

SAN RAMON P. D.

Alarm History: 0000

PRESS ZONE FOR INFORMATION →

ALARM
Supervisory
Disable / Test
Monitor
Trouble
Ground Fault
CPU Fault
Power

Help
Status
Panel Silence / Acknowledge
Panel Silenced
MENU
Del
Enter
Off
On
Enable Controls
System Reset
Alarm Silence
Drill

1 2 3 4 5 6 7 8 9 0

1 6 11 16 21 26
2 7 12 17 22 27
3 8 13 18 23 28
4 9 14 19 24 29
5 10 15 20 25 30

FIRE ALARM EQUIPMENT
UL LISTED S4446
ALSO SUITABLE AS A CONTROL UNIT FOR RELEASING DEVICE SERVICE

EST

2401 CROW CANYON ROAD

Before test PASS code L.P.C.

LICENSE #:C10 - 713099

RED HAWK
Fire & Security
the power of experience™

FOR SERVICE
Call: 510-438-1342

FOR SALES
Call: 510-438-1300

FOR CENTRAL MONITORING
Call: See Panel Account Sticker

AFTER HOURS SERVICE
Call: 510-438-1300

RED HAWK
Fire & Security

A Central Station monitors this system
Before working on the system you must call:

(800) 341-9292

Systems Account # 02-868

PASSCODE - 2844

RED HAWK
Fire & Security

24 HOUR EMERGENCY SERVICE
(510) 438-1300
www.redhawkus.com

Last Inspection Date 01/14/19

QuickStart

1- Test
2 -
3 -

Underwriters Laboratories Inc.®

Northbrook, IL San Jose, CA Melville, NY

A not-for-profit organization dedicated to public safety and committed to quality service

File No: S6340 CCN: UUFX
Service Center No: 2
Expires: 03/18/2013
Issued: 03/19/2008
Entry No: 2054654 Version: 7

CENTRAL STATION - FIRE
FIRE ALARM SYSTEM CERTIFICATE DESCRIPTION
For Certificate Serial No: FC87053491

Protected Property:

CROW CANYON BUSINESS PARK
2401 CROW CANYON RD
SAN RAMON, CA 94583
Request Signed on 03/20/2008 by:
WENDY K. OSBORNE

Alarm Service Company:

DIVERSIFIED FIRE PRODUCTS
SUITE 1545
180 GRAND AVE
OAKLAND CA 94612
Request Signed on 03/20/2008 by:
ARNOLD BARRIENTOS JR.

Comments and Clarifications:
AS SPECIFIED BY THE AHJ

System Description
This system is installed and operated in accordance with standard NFPA 72,1999 edition.
Area Covered: BUILDING
Authority Having Jurisdiction: SAN RAMON VALLEY FIRE DEPT
Responding Fire Department: SAN RAMON VALLEY FIRE DEPT
Testing and Maintenance Contract date: 07/01/2006

SYSTEM DEVIATIONS FROM REFERENCED NFPA STANDARDS
No deviations from standards.

Automatic Fire Detection and Alarm Service
Coverage is Selected Area
24 - Smoke Detectors : 0 - Ionization 24 - Photoelectric
3 - Duct Smoke Detectors : 0 - Ionization 3 - Photoelectric

Sprinkler System Waterflow Alarm and Supervisory Service
Sprinkler System Type: Wet Pipe
1 - Waterflow Switch
1 - Sprinkler Valve Supervisory Service

Manual Fire Alarm and Guard's Tour Supervisory Service
10 - Manual Fire Alarm Boxes

Alarm Notification and Annunciation Devices
28 - Visual Signals : Type - Strobe
3 - Bells
56 - Audible/Visual Signals : Type - Strobe

Control and Transmitter Unit
EST QUICK START W/DLD DIALER

This form is to accompany the Certificate