SECTION 033050 - UTILITY CAST-IN-PLACE CONCRETE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to furnish and place ready-mix cast-in-place concrete, and shall form, mix, place, consolidate, finish, cure, repair and perform all appurtenant work necessary to produce finished concrete complete in place as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 331102	PVC Pressure Pipe
	Section 331104	Steel Pipe - Mortar-Lined and Mortar-Coated
	Section 331219	Fire Hydrants
	Section 333900	Precast Concrete Maintenance Holes
	Section 328000	Irrigation Systems
	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Water Field Drop Inlets
	Section 321300	Concrete Surface Improvements.
B.	Section 036000	Grout.
	Section 055900	Ductile Iron Pipe
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Federal Specifications and Standards:**

PS 1	U.S. Product Standard for Concrete Forms, Class I.
PS 20	U.S. Product Standard for American Softwood Lumber.
UU-B-790A (Int. Amd.)	Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant).

B. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 51	Concrete Structures.
Section 52	Reinforcement.
Section 73	Concrete Curbs and Sidewalks.

C. **Commercial Standards:**

ACI 301	Specifications for Structural Concrete for Buildings.
ACI 315	Details and Detailing of Concrete Reinforcement.
ACI 318	Building Code Requirements for Reinforced Concrete.

ACI 347	Recommended Practice for Concrete Formwork.
ASTM A 185	Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM C 31	Practice for Making and Curing Concrete Test Specimens in the Field.
ASTM C 33	Specification for Concrete Aggregates.
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 94	Specification for Ready-Mixed Concrete.
ASTM C 143	Test Method for Slump of Hydraulic Cement Concrete.
ASTM C 150	Specification for Portland Cement.
ASTM C 309	Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM C 494	Specification for Chemical Admixtures for Concrete.
ASTM C 1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
ASTM D 1751	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
AWS D1.4	Structural Welding Code - Reinforcing Steel.
CRSI MSP-1	Concrete Reinforcing Steel Institute Manual of Standard Practice.
UBC	Uniform Building Code.

1.4 CONTRACTOR SUBMITTALS

A. **Certificate of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. **Mix Designs:** A list of pre-approved ready-mix designs are on file in the ENGINEER'S office. If the CONTRACTOR does not use one of the pre-approved designs prior to beginning the concrete work, the CONTRACTOR shall submit to the ENGINEER, for review, preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete specified herein. Each mix design shall be accompanied by a Certificate of Compliance to these specifications.

C. **Delivery Tickets:** The CONTRACTOR shall provide delivery tickets at the time of delivery of each load of concrete. Each delivery ticket shall be accompanied by batch tickets automatically produced by the batching equipment, indicating quantities of each ingredient. Each delivery ticket shall, in addition, state the mix number, total yield in cubic yards, date and the time of day, to the nearest

minute, corresponding to when the batch was loaded, when it was dispatched, when it arrived at the job, and the time that unloading began.

1.5 CONSTRUCTION TOLERANCES

A. The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed WORK is within the tolerances shown on the Drawing and as specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Permissible deviations for cast-in-place concrete structures shall not exceed ± 1/4-inch.

PART 2 -- PRODUCTS

2.1 FORM AND FALSEWORK MATERIALS

A. Except as otherwise expressly accepted by the ENGINEER, all lumber brought on the job site for use as forms, shoring, or bracing shall be new material.

B. Materials for concrete forms, formwork and falsework shall conform to the following requirements:

1. Lumber shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS 20.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class I, and shall be edge sealed.

3. Form materials shall be metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line and grade shown. Metal forms shall be an approved type that will accomplish such results.

2.2 FORM TIES

A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming. Form Ties shall be **Burke Penta-Tie System, Richmond Snap-Tys, or equal.**

2.3 REINFORCEMENT STEEL

A. **General:** All reinforcement steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to ASTM A 615 for Grade 60 Billet Steel Reinforcement with supplementary requirement S-1, or as otherwise shown.

2. Welded wire fabric reinforcement shall conform to ASTM A 185 and the details shown.

B. **Accessories:**

1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers and other devices to position reinforcement during concrete placement. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8 inch minimum thickness of plastic coating which extends at least 1/2 inch from the concrete surface. Plastic shall be gray in color.

2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.

2.4 CONCRETE MATERIALS

A. Ready-mix concrete shall conform to the requirements of ASTM C 94.

B. **Admixtures:** Admixtures shall be used in accordance with manufacturer's printed recommendations.

1. **Calcium Chloride:** Calcium chloride will not be permitted to be used in concrete, unless specifically approved by the ENGINEER.

2.5 CURING MATERIALS

A. Materials for curing concrete shall be in conformance with Section 321300, "Concrete Surface Improvements."

2.6 DESIGN

A. **Concrete Design Requirements:**

1. **General:** A list of pre-approved ready-mix designs are on file in the ENGINEER'S office. Any other mix design must be approved by the ENGINEER. Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities specified. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the CITY. All changes shall be subject to review by the ENGINEER.

2. **Compressive Strength and Cement Content:** The minimum compressive strength and cement content of concrete shall be not less than that specified in the following tabulation.

Class of Concrete Min. 28-Day Compressive Strength (psi)	Caltrans Class	Aggregate Size	Minimum Cement per cu yard (pounds)
3000	A	1 inch x No. 4	564
3000	B	1 inch x No. 4	470
2000	C	1 inch x No. 4	376
3500	D	1 inch x No. 4	658

The CONTRACTOR is cautioned that the limiting parameters specified above are NOT a mix design. Additional cement or water reducing agent may be required to achieve workability demanded by the CONTRACTOR'S construction methods and aggregates. The CONTRACTOR is responsible for any costs associated with furnishing concrete with the required workability.

3. **Cement:** Type II cement is acceptable for all cast-in-place concrete.

2.7 CONSISTENCY

A. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. Unless otherwise specified the slump for all concrete shall be in accordance with the City's Standard Detail G-6.

B. Retempering of concrete will not be permitted.

2.8 MIXING AND TRANSPORTING

A. Mixing and transporting shall be in conformance with Section 321300 "Concrete Surface Improvements" City Standard Specifications. All concrete shall be mixed in mechanically operated mixers.

B. Ready-mixed concrete shall meet the requirements as to materials, batching, mixing, transporting and placing as specified herein and in accordance with ASTM C 94, including the supplementary requirements specified herein.

C. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within one and one-half hours after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first.

D. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

E. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a delivery ticket furnished to the ENGINEER.

G. The use of non-agitating equipment for transporting ready-mixed concrete will be allowed only with written approval of the ENGINEER.

PART 3 -- EXECUTION

3.1 GENERAL

A. All cast-in-place concrete shall be constructed in accordance with the Drawings.

3.2 GENERAL FORMWORK REQUIREMENTS

A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The CONTRACTOR shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the WORK and replaced at the CONTRACTOR'S expense. All design, construction, maintenance, preparation and removal of forms shall be in conformance with Section 51-1.05, "Forms," of the Caltrans Standard Specifications; ACI 347; and the requirements specified herein.

B. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete.

3.3 REINFORCEMENT

A. **General:** All reinforcement steel, welded wire fabric and other appurtenances shall be fabricated and placed in accordance with the requirements of the Uniform Building Code, the Drawings and the supplementary requirements specified herein.

B. **Fabrication:**

1. General: Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings.

2. Bending or Straightening: Reinforcement shall not be straightened or rebent in a manner which will injure the material.

C. **Placing:**

1. Reinforcement steel shall be accurately positioned as shown, and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections.

2. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

3. Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the Uniform Building Code.

4. The minimum spacing requirements of ACI 318 shall be followed for all reinforcing steel.

5. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete will not be allowed.

D. **Splicing:**

1. General: Reinforcement bar splices shall be of the character acceptable to the ENGINEER.

2. Splices of Reinforcement:

a. The length of lap for reinforcement bars, unless otherwise shown, shall be in accordance with ACI 318.

b. Laps of welded wire fabric shall be in accordance with the ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

E. **Cleaning and Protection:**

1. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign

substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcing shall be reinspected and, if necessary, recleaned.

3.4 PREPARATION OF SURFACES FOR PLACING CONCRETE

A. **General:** Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud and debris at the time of placing concrete.

B. **Joints in Concrete:** Hardened concrete surfaces upon or against which concrete is to be placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface to a minimum 1/4-inch amplitude for good bond. Before new concrete is placed, the joint surfaces shall be cleaned of all laitance, loose or defective concrete and foreign material. Any water shall be removed from the surface of construction joints before the new concrete is placed.

C. **Placing Interruptions:** Interruptions in placing concrete will not be allowed without the written approval of the ENGINEER. The CONTRACTOR shall submit its purposed method of joint construction to the ENGINEER for review. When interruption of concrete placement operations has been approved the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work.

D. **Embedded Items:** All reinforcement, anchor bolts, sleeves, inserts and similar items shall be set and secured in the forms where shown on the Drawings or by shop drawings and shall be acceptable to the ENGINEER before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

E. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, shall be the responsibility of CONTRACTOR.

F. Anchor bolts shall be accurately set and shall be maintained in position by templates while being embedded in concrete.

3.5 PLACING

A. **General:** Placing of concrete shall conform to the applicable requirements of Section 51-1.09, “Placing Concrete,” of the Caltrans Standard Specifications and the requirements of this Section.

B. **Non-Conforming Work or Materials:** All concrete which does not to conform to the requirements of this Section shall be removed from the work.

C. **Placement in Wall Forms:**

1. Concrete shall not be dropped through reinforcement steel into any deep form. In such cases, hoppers and, if necessary, vertical ducts of canvas, rubber or metal shall be used for placing concrete. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes or buggies. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet and care shall be taken to avoid inclined layers. Each layer shall be placed while the previous layer is still soft.

2. The surface of the concrete shall be level whenever a run of concrete is stopped.

D. **Temperature of Concrete:** The temperature of concrete when it is being placed shall be in conformance with Section 321300 “Concrete Surface Improvements” City Standard Specifications.

3.6 PUMPING OF CONCRETE

A. **General:** If the pumped concrete does not produce satisfactory end results as determined by the ENGINEER, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

3.7 CONSOLIDATION

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted in general conformance with Section 51-1.09, “Placing Concrete,” of the Caltrans Standard Specifications.

3.8 FINISHING CONCRETE SURFACES

A. **General:** Exposed surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface.

B. **Formed Surfaces:** No treatment is required after form removal except for curing, repair of defective concrete and treatment of surface defects.

C. **Unformed Surfaces:** After proper and adequate vibration and tamping, all exposed un-formed surfaces of pads, slabs and floors, shall be brought to a uniform surface with suitable tools. The finish for all unformed concrete surfaces shall be a soft broom finish.

3.9 CURING

A. **General:** All exposed concrete top surfaces of pads, shall be cured in conformance with Section 321300, "Concrete Surface Improvements."

3.10 PROTECTION

A. The CONTRACTOR shall protect all concrete against injury until final acceptance by the CITY.

B. Holes left by form-tying and other minor imperfections as defined herein shall be repaired in an approved manner with cement grout in conformance with Section 036000, "Grout."

- END OF SECTION -

SECTION 033055 - CAST-IN-PLACE CONCRETE PIPE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to furnish and install all cast-in-place concrete pipe and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

B. The minimum internal diameter for cast-in-place concrete pipe shall be 36 inches.

C. Cast-in-place concrete pipe will not be allowed in areas with less than 3 feet of cover from finished grade to top of pipe.

D. Cast-in-place concrete pipe will not be allowed in the existing or future public road right-of-way.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain Leakage Testing.
C.	Section 333900	Precast Concrete Maintenance Holes.
D.	Section 321300	Concrete Surface Improvements
E.	Section 033050	Utility Cast-in-Place Concrete.
F.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Water Field Drop Inlets.
G.	Section 331100	Piping, General.
H.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 63	Cast-In-Place Concrete Pipe.

B. **Commercial Standards:**

ACI 301	Specifications for Structural Concrete for Buildings.
ACI 347	Recommended Practice for Concrete Formwork.
ASTM C 31	Practice for Making and Curing Concrete Test Specimens in the Field.
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens.

ASTM C 94	Specification for Ready-Mixed Concrete.
ASTM C 143	Test Method for Slump of Hydraulic Cement Concrete.
ASTM C 150	Specification for Portland Cement.
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C 309	Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM C 494	Specification for Chemical Admixtures for Concrete.
ASTM C 1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
UBC	Uniform Building Code.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used in this Section.

B. The CONTRACTOR shall submit to the ENGINEER for review the mix design for the portland cement concrete. Cast-in-place concrete pipe shall not be placed until this mix design has been reviewed and accepted by the ENGINEER.

C. **Delivery Tickets:** The CONTRACTOR shall provide delivery tickets at the time of delivery of each load of concrete. Each delivery ticket shall be accompanied by batch tickets automatically produced by the batching equipment, indicating quantities of each ingredient. Each delivery ticket shall, in addition, state the mix number, total yield in cubic yards, date and the time of day, to the nearest minute, corresponding to when the batch was loaded, when it was dispatched, when it arrived at the job and the time that unloading began.

1.5 QUALITY ASSURANCE

A. When required, the CITY will employ a testing laboratory to take core samples from the cast-in-place pipe to check for obvious segregation of aggregate, rock pockets, blisters, voids, honeycomb or inadequate wall thickness.

B. After core samples and measurements for wall thickness have been taken by the CITY, the CONTRACTOR shall patch all holes.

C. Cast-in-place concrete pipe may be rejected based on the conditions outlined in Section 63-1.05 "Construction" of the Caltrans Standard Specifications.

PART 2 -- PRODUCTS

2.1 CAST-IN-PLACE CONCRETE

A. Cast-in-place concrete shall be constructed of Class D Portland cement concrete conforming to the provisions in Section 321300 “Concrete Surface Improvements” of the City Standard Specifications. Cement shall conform to ASTM C150, Type II.

B. Ready-mix concrete shall conform to the requirements of ASTM C 94.

2.2 AGGREGATE

A. The combined aggregates for concrete used shall conform to the grading limits for a one inch maximum size specified in Section 321300 “Concrete Surface Improvements” of the City Standard Specifications.

2.3 ADMIXTURES

A. Admixtures shall be used in accordance with manufacturer's printed recommendations.

1. **Calcium Chloride:** Calcium chloride will not be permitted to be used in concrete, unless specifically approved by the ENGINEER.

2. **Mineral:** Mineral admixtures will NOT be allowed.

2.4 CONSTRUCTION JOINTS

A. The rebar for use in construction joints shall be in conformance with Section 63-1.05, "Construction" of the Caltrans Standard Specifications.

2.5 CURING COMPOUND/WATERPROOF MEMBRANE

A. Curing compound and waterproof membrane shall be in conformance with Section 321300 “Concrete Surface Improvements” of the City Standard Specifications.

2.6 CONSISTENCY

A. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slump shall be 2 inches +/- one inch.

B. Retempering of concrete will not be permitted.

2.7 MIXING AND TRANSPORTING

A. Mixing and transporting shall be in conformance with Section 321300 “Concrete Surface Improvements” of the City Standard Specifications. All concrete shall be mixed in mechanically operated mixers.

B. Ready-mixed concrete shall meet the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94, including the supplementary requirements specified herein.

C. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within one and one-half hours after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first.

D. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

E. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any,

shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a delivery ticket furnished to the ENGINEER.

G. The use of non-agitating equipment for transporting ready-mixed concrete will be allowed only with written approval of the ENGINEER.

PART 3 -- EXECUTION

3.1 GENERAL

A. Cast-in-place concrete pipe shall be in conformance with Section 63, "Cast-in-place Concrete Pipe," of the Caltrans Standard Specifications and as specified herein.

3.2 EARTHWORK

A. Earthwork shall be in conformance with Section 63-1.04, "Earthwork" of the Caltrans Standard Specifications and as modified by this Section.

B. When rock is encountered in the trench, it shall be removed to a minimum depth of 6 inches below the bottom of the pipe and backfilled and compacted with suitable bedding material in conformance with Section 312300, "Utility Earthwork."

C. The trench shall be excavated and backfilled in conformance with Section 312300, "Utility Earthwork."

3.3 CAST-IN-PLACE CONCRETE

A. The concrete shall be placed in conformance with Section 63-1.05, "Construction" of the Caltrans Standard Specifications and as specified herein.

B. The minimum wall thickness for the pipe shall be as specified in Section 63-1.02, "Materials" of the Caltrans Standard Specifications.

C. If construction of the pipe stops short of a manhole, the resulting construction joint must be reinforced with a concrete collar. The end of the pipe shall be left rough with a slope of approximately 45 degrees. The concrete collar shall be monolithically poured and must extend a minimum of one foot beyond each side of the joint and must be of a minimum thickness not less than 1-1/2 times the wall thickness. The concrete collar must completely encircle the pipe.

D. Variations from the nominal internal diameter shall not exceed 1/32 inch per diameter inch.

E. Concrete shall not be placed when the air temperature in the vicinity of the WORK exceeds 90 degrees Fahrenheit.

3.4 CURING

A. Curing and protecting cast-in-place concrete pipe shall be in conformance with Section 63-1.06, "Curing and Protecting Concrete" of the Caltrans Standard Specifications.

3.5 TESTING

A. Testing shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 033500 - TEXTURED CONCRETE PAVING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and place all textured concrete paving which may include but is not necessarily limited to, preparation of subgrade, aggregate base, reinforcement, concrete, colored hardener, colored curing compound, acrylic sealer, special imprinting tools and all other appurtenant work, complete in place as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 310000	Earthwork.
B.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
C.	Section 321300	Concrete Surface Improvements.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 19	Earthwork.
Section 26	Aggregate Bases.

B. **Commercial Standards:**

ASTM C 33	Specifications for Concrete Aggregates.
ASTM C 150	Specifications for Portland Cement.
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C 309	Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM C 494	Specification for Chemical Admixtures for Concrete.
ASTM D 1751	Specifications for Preformed Expansion Joint Filter for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

1.4 CONTRACTOR SUBMITALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. If requested, the CONTRACTOR shall provide a 2-foot by 2-foot square shop sample to be approved by the Engineer prior to start of construction.

1.5 QUALITY ASSURANCE

A. Textured concrete paving shall be installed by a licensed specialty CONTRACTOR.

B. All work shall comply with the current specifications and quality standards issued by the manufacturer.

PART 2 -- PRODUCTS

2.1 AGGREGATE BASE

A. Aggregate base shall be class 2, 19 millimeter maximum size grading, aggregate base in conformance with Section 26, "Aggregate Bases," of the Caltrans Standard Specifications.

2.2 REINFORCEMENT AND DOWELS

A. Steel bar for textured concrete paving reinforcement and dowels shall be deformed billet-steel bars of the size or sizes as specified on the Drawings and shall be in conformance with PART 2 - PRODUCTS of Section 321300, "Concrete Surface Improvements."

2.3 PORTLAND CEMENT CONCRETE

A. Portland cement concrete for textured concrete paving shall have a minimum 28 day compressive strength at 3000 psi.

B. Portland cement shall be Type II cement conforming to ASTM C 150.

C. Aggregate shall be minus 3/8-inch to 1 inch conforming to ASTM C 33.

D. When textured concrete paving is installed in the travelway, aggregate shall be minus 1-inch conforming to ASTM C33.

E. An air-entraining agent conforming with ASTM C 260 and/or a normal set or retarded set water reducing admixture conforming with ASTM C 494 may be used.

F. Calcium chloride shall not be permitted in the mix.

2.4 EXPANSION JOINT MATERIAL

A. Expansion joint material shall be premolded expansion joint filler 1/2-inch thick in conformance with ASTM D 1751. Expansion joint material shall be shaped to fit the cross section of the concrete improvements prior to being placed.

2.5 COLOR HARDENER

A. Color hardener shall be a ready to use, regular grade, dry-shake color hardener and shall be streak-free integregations of pigments, surface conditioning and dispersing agents, and portland cement blended with hard, graded aggregate.

2.6 COLORED CURING COMPOUND

A. Colored curing compound shall be in conformance with ASTM C 309 and shall conform with all applicable air pollution regulations.

2.7 ACRYLIC SEALER

A. A colored acrylic sealer may be used in lieu of a colored curing compound in accordance with the manufacturer's recommendations. A clear acrylic sealer may be used if textured concrete paving is multicolored.

PART 3 -- EXECUTION

3.1 SUBGRADE PREPARATION

A. Preparation of subgrade shall be in conformance with Section 310000 "Earthwork" and Section 321000 "Asphalt Pavement, Base and Surface Treatment."

B. Finish subgrade shall be within the tolerances established in Section 19-1, "General," of the Caltrans Standard Specifications.

3.2 AGGREGATE BASE

A. Aggregate base shall be spread and compacted in conformance with PART 3-Execution of Section 321000 "Asphalt Pavement, Base and Surface Treatments." The aggregate base shall be placed to the depth as shown on the Drawings.

3.3 CONCRETE REINFORCEMENT

A. Concrete reinforcement and dowels shall be placed at the location as shown on the Drawings. Installation of concrete reinforcement and dowels shall be in conformance with Section 033050 "Utility Cast-in Place Concrete."

3.4 INSTALLATION OF TEXTURED CONCRETE PAVING

A. Textured concrete paving shall be installed to the dimensions as shown on the Drawings.

B. The concrete shall be placed and screeded to the finished grade and floated to a uniform surface in accordance with the manufacturer's recommendations.

C. The Contractor shall use manufacturer approved imprinting tools to make the desired impression to the surface of the concrete while the concrete is still in the plastic stage of set.

3.5 COLOR HARDENER

A. Color hardener shall be applied evenly to the concrete surface by the dry-shake method using a minimum of 60 pounds per 100 square feet in accordance with the manufacturer’s recommendations.

B. Color hardener shall be applied in two or more shakes, floated after each and troweled only after the final floating.

3.6 EXPANSION JOINTS/DEEP JOINTS

A. Expansion joints shall be placed continuously between all textured concrete paving surfaces and concrete surfaces.

B. Deep joints shall be placed to a depth of 1/4 of the thickness of the textured concrete paving at a minimum spacing equal to 1.5 times the width of the textured concrete paving unless otherwise recommended by the manufacturer.

- END OF SECTION -

SECTION 034800 - PRECAST CONCRETE VAULTS, UTILITY BOXES, AND STORM WATER FIELD DROP INLETS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all precast items as required, including all appurtenances necessary to make a complete installation as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 033050	Utility Cast-In-Place Concrete.
B.	Section 033500	Grout.
C.	Section 055000	Miscellaneous Metalwork.
D.	Section 330526	Piping Identification Systems.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ACI 318 Building Code Requirements for Reinforced Concrete.

1.4 CONTRACTOR SUBMITTALS

A. **Shop Drawings:**

1. The CONTRACTOR shall submit Shop Drawings for all specialty precast concrete items. Submitted drawings shall show design criteria, all dimensions, location and type of lifting inserts, and details of reinforcement and joints.

2. For all precast items which are manufactured, the CONTRACTOR shall also submit a list of the design criteria and product data sheets used by the manufacturer.

B. **Certification of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 DEFINITIONS

A. In these Specifications, where the terms "Precast Concrete," "Prefabricated Concrete" and "Precast Concrete Specialties" are used, they shall have equivalent meaning.

PART 2 -- PRODUCTS

2.1 MANUFACTURED ITEMS

A. **Miscellaneous Precast Vaults:**

1. Vault dimensions shall be as required by the specific installations and shall meet all required clearances.

2. Vaults shall be **Christy, Utility Vault Co. or equal.**

3. The vault frames shall be provided by the vault manufacturer. Vault covers shall be steel checker plate or vault access doors as specified and shall conform to Section 055000, "Miscellaneous Metalwork." When leveling bolts are used to set the vault top sections, the CONTRACTOR shall ensure that the load on the vault will be transferred through the mortar to the vault, and will not be carried by the leveling bolts.

4. Where vaults are in areas which may be subjected to vehicular traffic vault, frame and cover shall be designed for HS-20 traffic loading.

5. Vaults larger than 24 inches by 36 inches shall have vault access doors, with hinged meter reading lids when specified, and shall be located as specified or as shown on the Drawings.

B. **Utility Boxes:**

1. Utility boxes shall be sized as shown on the Drawings or shall meet the minimum clearance requirements as specified or as required for the intended use.

2. Utility boxes shall have covers that are designed by the manufacturer for HS-20 traffic loading in streets and driveways subject to vehicular traffic. The covers shall be embossed "Water," "Sanitary Sewer," or "Recycled" as appropriate. All water meter utility box covers shall have touch read recess holes in the lid.

3. Utility boxes larger than 22 inches by 36 inches shall have two piece steel checker plate lids and shall be located as specified or as shown on the Drawings.

4. Utility boxes shall be as manufactured by **Christy or equal.** The following table lists standard model numbers for Christy:

Service	**Christy Box/lid***
a. Water Meters:	
Piston Meter Boxes	
5/8"	B-9/B-9P*
3/4"	B-12/B12P*
1"	B-16/B16P*
1-1/2"	B-36/B36P*
2"	B-36/B-36-61P*
Turbine Meter Boxes	
1-1/2"	B-36/B-36P*
2"	B-36/B-36P*
3"	Special design as approved by the City
b. Valve Boxes, Water Line Angle Marker Boxes	G-5/G5C
c. Sampling Station, Blow-Off and Angle Meter Stop Boxes	B-9/B-9*
d. Air Release Valves (1" and 2")*	B-24/B24-D (1" and 2" valves)
e. Sanitary Sewer:	
Clean Out Boxes	F8/F8*

* Utility boxes located in streets or driveways shall have cast-iron covers. Water meter boxes located in driveways shall have steel checker plate covers with a reading lid. All other utility boxes shall have reinforced concrete covers or polymer concrete covers.

5. Utility boxes in landscape areas, unimproved areas, and field installations shall have bolt or screw down lids or covers.

6. Utility boxes for blow-off valves on pipelines greater than 12" shall be Christy Box/lid B-30/B-30D* or equal and as shown on the DRAWINGS.

C. **Storm Water Field Drop Inlets:**

1. Frame and grate or cover plate shall be of the same manufacturer as the pre-cast inlet and shall be hot-dip galvanized after fabrication.

2. Precast storm water field drop inlets frame and grate shall be in conformance with Section 055000, "Miscellaneous Metalwork."

3. **Storm water field drop side-opening inlet:** Precast storm water field drop side-opening inlets shall be **Santa Rosa, Type C, or equal.** Frame and grate or cover plate shall be in conformance with Section 055000, "Miscellaneous Metalwork."

2.2 PREFORMED JOINT SEALANT

A. On vaults the joint sealing compound shall be a preformed, cold- applied, ready to use plastic joint sealing compound **Quick-Seal**, **Ram-Nek; or equal.**

2.3 NON-SHRINK GROUT

A. Non-shrink grout shall be as specified in the Section 033500, "Grout."

PART 3 -- EXECUTION

3.1 MANUFACTURED ITEMS

A. Precast Concrete Vaults, Utility Boxes and Field Storm Water Inlets shall be installed in accordance with the manufacturer's printed recommendations, and as shown on the Drawings.

B. Connections to precast vaults, utility boxes, and field storm water inlets shall be made by installing pipe sections into the structure wall using non-shrink grout as specified in Section 033500, “Grout.” A water stop shall also be installed on all plastic pipes.

C. All utilities shall be identified as specified in Section 330526, "Piping Identification Systems."

D. Construction grade redwood shims and one-piece boards shall be installed as shown on the Drawings.

- END OF SECTION -

SECTION 036000 - GROUT

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and place grout and shall form, mix, place, cure, repair, finish, and do all other work as necessary to produce finished grout as shown on the Drawings and as specified herein.

B. The following types of grout shall be covered in this Section:

1. Non-Shrink Grout: Non-Shrink grout is to be used unless another type is specifically referenced or as shown on the Drawings.

2. Epoxy Grout

3. Cement Grout

C. Cement grout for pressure grouting around steel casing pipes shall be in conformance with Section 330523, “Steel Casing Boring and Jacking.”

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 330523	Steel Casing Boring and Jacking.
B.	Section 033050	Utility Cast-in-Place Concrete.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Specifications, codes, and standards shall be as specified in Section 033050, "Utility Cast-in-Place Concrete," and as referred to herein.

B. **Commercial Standards:**

ASTM C 109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-In. or 50-mm Cube Specimens).
ASTM C 531	Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings.
ASTM C 579	Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings.
ASTM C 827	Test Method for Change in Height of Early Ages of Cylindrical Specimens from Cementitious Mixtures.
ASTM D 696	Test Method for Coefficient of Linear Thermal Expansion of Plastics.
CRD-C 621	Corps of Engineers Specification for Non-shrink Grout.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance**: Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 PREPACKAGED GROUTS

A. Non-Shrink Grout:

1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.

2. Class A non-shrink grouts shall have a minimum 28-day compressive strength of 5000 psi; shall have no shrinkage (zero percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C 827; and shall have no shrinkage (zero percent) and a maximum of 0.2-percent expansion in the hardened state when tested in accordance with CRD C 621.

3. Class B non-shrink grouts shall have a minimum 28-day compressive strength of 5000 psi and shall meet the requirements of CRD C 621.

4. Application:

   a. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified; except, for those applications for Class B non-shrink grout and epoxy grout specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

   b. Class B non-shrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material.

B. **Epoxy Grout:**

1. Epoxy grout shall be a pourable, non-shrink, 100-percent solids system. The epoxy grout system shall have 3 components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.

3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.

4. The epoxy grout shall develop a compressive strength of 5000 psi in 24 hours and 10,000 psi in 7 days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (zero percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.

5. Application: Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other specified applications.

2.2 CEMENT GROUT

A. **Cement Grout:** Cement grout shall be composed of one part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi.

B. Cement shall be as specified in Section 033050, "Utility Cast-in-Place Concrete."

2.3 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is specified, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

2.4 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using appropriate containers. Shovel measurement will not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 -- EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 033050, "Utility Cast-in-Place Concrete." The finish of the grout surface shall match that of the adjacent concrete.

B. The manufacturer of Class A non-shrink grout and epoxy grout shall provide on-site technical assistance upon request.

C. All mixing, surface preparation, handling, placing, consolidation and other means of execution for prepackaged grouts shall be done according to the printed instructions and recommendations of the manufacturer.

3.2 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

- END OF SECTION -