

**SECTION 31 00 00 - EARTHWORK**

## 1.00 GENERAL

## 1.01 DESCRIPTION

## A. Principal work in this Section:

1. All excavating, filling, backfilling, compacting and grading required for the Project.
2. Adjusting manhole rims, grates, valve boxes, etc. to finished grade indicated.
3. Pumping, draining, shoring, cribbing and other protective measures.
4. Importing fill materials.
5. Shoring and cribbing.
6. Removing excess and unsatisfactory excavated materials from the site.

## B. Related work in other Sections:

1. Selective Demolition: Section 02 41 13.
2. Site Clearing: Section 31 10 00.
2. Trenching, backfilling and compacting for utilities: Section 31 23 33.
3. Disconnecting utilities: Section 02 41 13.
4. Re-routing utilities: Sections 33 00 00, 33 10 00, 33 30 00 and 33 40 00.
5. Aggregate base under asphalt paving: Section 32 12 16.
6. Finish grading for landscaping and asphalt paving: Section 32 12 16.

## 1.02 QUALITY ASSURANCE

A. Lines and levels: All construction staking shall be provided by Contractor.

B. Inspections and tests: The Owner will employ a Geotechnical Consultant to inspect and test the work of this Section. At completion of this work, the Geotechnical Consultant will be required to submit written report certifying that the site was developed with acceptable materials in accordance with these Specifications and the recommendations of the Soil Investigation Report.

1. The Geotechnical Consultant will:

- a. Make the tests and inspections of the structural subgrades required by the nature of the subsurface conditions discovered during the progress of the earthwork operations.
- b. Approve for use of imported fill material.
- c. Inspect all filling, backfilling, and compacting of the soils.

### 1.03 SUBMITTALS

- A. Imported fill materials: Submit samples of proposed imported materials, minimum 40 lbs., tagged with source location and manufacturer to the Owner's Representative at least 15 days prior to import. Material shall not be imported to job site without written approval by the Owner's Representative.

### 1.04 GEOTECHNICAL INVESTIGATION

- A. A geotechnical investigation report has not been prepared for the site.

## 2.00 PRODUCTS

### 2.01 FILL MATERIALS

- A. Select (porous) fill under building slab-on-grade and behind retaining and basement walls: Clean gravel or crushed rock complying with CalTrans Standard Specifications, Section 68, Class 2.
- B. Imported fill materials and on-site select materials shall be granular in nature, non-expansive, free of organic materials, with a plasticity index of less than 12, and an expansion index of less than 20 and graded as follows:

Sieve Size	Percentage Passing Sieve
3"	100
No. 4	60 - 100
No. 200	Less than 20

- C. On-site materials, less debris and organic matter, shall be approved by the Geotechnical Engineer.
- D. Import shall be approved by the Geotechnical Engineer.

## 3.00 EXECUTION

### 3.01 PROTECTIVE MEASURES

- A. Underground utilities: Report any lines encountered that are not indicated, or are in location other than indicated, on the Drawings to the Engineer's attention who will issue instruction for proceeding with the work.
- B. Moisture control: Remove water and debris, which would interfere with construction, from excavated areas and keep working areas dry when work is in progress. Grade perimeter of excavations so that water run-off drains away from the excavations.
  - 1. Keep excavations free from loose material and water while fill is placed and compacted.
  - 2. Dispose of water resulting from dewatering operations in a manner that will not cause damage to public or private property, or constitute a nuisance or menace to the public.
  - 3. Make sure that debris and dirt generated by this work does not block existing storm drain system. Keep adjacent paving (outside Contract area) broom clean and free of debris and dirt. Clean any existing facilities that become plugged.
- C. Shoring, cribbing and bracing: Provide and install shoring, cribbing and bracing of the excavations as necessary to prevent cave-ins and to support and protect adjacent construction in accordance with Federal, State and local laws. Contractor shall be completely responsible for adequacy and safety of shoring design, construction, and removal.
- D. Benchmarks and monuments: Protect benchmarks, monuments and other reference points against displacement and damage. Repair or replace benchmarks, monuments and other permanent survey data that becomes displaced or damaged due to the performance of the work of this Section.
- E. Dust palliation: Keep down dust at the site by intermittent watering and sprinkling while the work of this Section is being performed. Earthwork operations shall be conducted so as to prevent windblown dust and dirt. Assume liability for all claims related to windblown dust and dirt. Apply water in accordance with applicable provisions of Section 17 of California Transportation Standard Specifications and with Section 1590 (e) of CAL/OSHA, Title 8.
- F. Protection of existing facilities and landscape: Protect all trees, plants, utilities and existing improvements to remain from injury and damage resulting from the work of this Section. Replace all damaged landscaping, improvements or utilities in kind. Refer to Section 31 10 00 for additional requirements on tree protection. Clean staging and other use areas of debris and dust upon completion of project. Re-stripe portions of parking lot where, in the opinion of the Owner's Representative, the striping was damaged or destroyed by Contractor's operations.
- G. Protection of completed work:
  - 1. Protect finished areas from weather damage to prevent erosion of graded areas.

2. Hauling and other activities on prepared grades which will deform them from required cross sections will not be permitted. Repair and re-compact damage to prepared grades caused by such operations at no additional cost to the Owner.

### 3.02 EXCAVATING AND FILLING

- A. Site clearing is specified in Section 31 10 00 and/or soils report. Verify that existing paving, curbs, light posts and other improvements, and all debris are removed from the site.
- B. After site has been properly cleared, stripped, and excavations to rough grade have been made, exposed surface soils in those areas to receive engineered fills, concrete slabs-on-grade, or pavements should be scarified to a depth of 12 inches, moisture conditioned, and compacted (see D). In building areas to receive concrete slabs-on-grade, sub-grade preparation shall extend at least 5 feet beyond the limits of the proposed structures and any adjoining flat work. In pavement areas and for exterior flatwork not connected to buildings, sub-grade preparation shall extend at least 2 feet beyond the back of the curbs or outside limits of flatwork.
- C. Any portions of the site which are disturbed or softened by standing water shall be re-graded and re-compacted to 90% of maximum density (ASTM D-1557) as recommended by the Owner's Representative. Portions of the site which show evidence of "pumping" or movement under load shall be excavated, dried out, or filled with bridging rock or other material determined to be suitable by the Owner's Representative, then recompacted to the above standards. All this work shall be done at no additional cost to the Owner.
- D. Place fill materials in loose lifts no more than 8" in uncompacted thicknesses. Compaction of fill should be accomplished by mechanical means only. Compact engineering fills consisting of expansive clay soil between 88% to 93% relative compaction at soil moisture content of between 3 and 5 percent above the laboratory optimum moisture content. Compact on-site or imported soils with low expansion potential to at least 90% relative compaction at soil moisture content of between 1 and 3 percent above the laboratory optimum moisture content. In pavement areas, the upper 12 inches of sub-grade shall be compacted to at least 95% percent relative compaction at soil moisture content 1 to 3 percent above optimum value. Aggregate base material in pavement areas shall be compacted slightly above the optimum moisture content to at least 95% relative compaction. Behind retaining walls, care should be taken to avoid over-compaction of the backfill materials. Avoid excessive wall movements and lateral pressures use lightweight hand-operated equipment to compact backfill within 3 feet behind retaining walls.
- E. Do not place fill during unfavorable weather conditions. If work is interrupted by heavy rain, do not resume operations until the proper moisture content and density of the materials have been achieved.
- F. Earth and rock, regardless of character and subsurface conditions, shall be excavated to depths shown on Drawings and to the neat dimensions of the footings wherever practicable, to permit pouring of footings and grade beams without use of side forms, except at slab perimeters.

## 3.04 BACKFILLING

- A. Place backfill in loose layers not exceeding 8" thick, as construction operations permit, but not before work to be covered has been inspected and approved, and loose soils and debris have been removed from the excavations.
- B. Do not place backfill during unfavorable weather conditions as specified for fill above.
- C. Compact backfill to 95% of maximum density (ASTM D1557).
- D. Where backfill is required on both sides of a structure, place it simultaneously so that the height of fill remains approximately equal on both sides at all times.
- E. Brace construction which has not been designed to withstand eccentric loading during backfilling.
- F. Backfill only after the structure to be backfilled against has attained its design strength or has been properly braced, to resist the load of the backfill. No compacting by jetting permitted.
- G. Keep rollers and other heavy equipment at least 4 feet from footings, foundations, piers and walls of building and appurtenances.

## 3.05 GRADING

- A. The locations and elevations of all construction are indicated on the Drawings and, unless inconsistencies are brought to the Owner's Representatives attention prior to commencement of work, the Contractor will be held responsible for the proper location and elevations of the completed work.
- B. Grade all areas to the lines and levels required. Keep grades straight between changes in elevations. Finish grading tolerance shall not exceed plus or minus one half inch ( $\frac{1}{2}$ " ) of required elevations, if evenly distributed.
- C. The required subgrade elevation shall be such that when subbase and indicated construction are added, the final elevations will be those shown on the Drawings.

## 3.07 FRAMES, COVERS, GRATES AND VALVE BOXES

- A. Adjust frames, grates, valve boxes, and covers of existing manholes, inlets, or other facilities to grade in conformance with Sections 15 of the CDT Standard Specifications.
- B. A structure located in a paved area shall not be constructed to final grade until the adjacent pavement or surfacing has been compacted.

## 3.08 DISPOSAL OF SURPLUS AND UNSUITABLE EXCAVATED MATERIALS

- A. Remove these materials from the Owner's site and dispose of them in a legal manner; this includes materials resulting from all excavations including elevator cylinder, concrete piles and utility excavations. Burning and burying materials on-site is prohibited.

3.09 FIELD QUALITY CONTROL

- A. Field density tests: To check the degree of compaction of native soils and fill will be taken by the Owner's Representative. The location and frequency of the tests will be at the Owner's Representative discretion.
- B. Verification of elevations: Owner will provide the services of a licensed Civil Engineer or Land Surveyor upon completion of earthwork operations to verify that grades are within the tolerances specified. Should the grades be found to be out of tolerance, the site shall be reworked and resurveyed by the Owner at the Contractor's expense.

**END OF SECTION 31 00 00**

**SECTION 31 23 33 - TRENCHING, BACKFILLING & COMPACTING**

## 1.00 GENERAL

## 1.01 DESCRIPTION

## A. Principal work in this Section:

1. Trenching, backfilling and compacting.
2. Surface restoration.

## B. Related work in other Sections:

1. Selective demolition: Section 02 41 13 .
2. Earthwork: Section 31 00 00.
3. Storm Drainage Utilities: Section 33 40 00.
4. Piped Utilities: Section 33 00 00.
5. Sanitary Sewerage Utilities: Section 33 30 00.
6. Water Utilities: Section 33 10 00.

## 1.02 QUALITY ASSURANCE

## A. Reference standards: The applicable provisions of the following govern the work of this Section.

1. American Society for Testing and Materials (ASTM).
  - a. D1556: Density of Soil in Place by Sand Cone Method.
  - b. D1557: Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using a 10 lb (4.5 kg) Rammer and 18" (457mm) drop.
2. California Department of Transportation (CDT).
  - a. Standard Specifications.
  - b. Standard Test Methods: No. 202, 216, and 231.
3. CAL/OSHA Regulation for Construction: Section 29 CFR.

- B. The degree of compaction specified herein shall be determined by California Test Method No. 216 or No. 231. Unless otherwise noted, the percentage specified shall be the minimum allowable.

### 1.03 SUBMITTALS

- A. Submit Product Data under 2.01 Materials, certifying that each material item complies with specified requirements.

### 1.04 SITE CONDITIONS

- A. Comply with OSHA Construction Safety Orders, and specifically with those provisions dealing with trenching and underground construction.

### 1.05 SYSTEM DESCRIPTION

- A. Definitions:

1. A trench is defined as an excavation in which the depth is greater than the width of the bottom of the excavation.
2. Excavations for appurtenant structures, such as but not limited to manholes, transition structures, junction structures, vaults, valve boxes, catch basins, thrust blocks, and boring pits shall be deemed to be in the category of trench excavation.

- B. Unless otherwise indicated on the Drawings, excavation for pipelines shall be open cut.

### 2.00 PRODUCTS

### 2.01 MATERIALS

- A. Select backfill material:

1. Sand or granular materials, free from organic matter, of the quality herein specified. Select backfill material shall have a size and gradation falling within the following limits when determined by California Test No. 202:

Sieve Size	Percentage Passing Sieve
1"	100
No. 4	50-100
No. 200	5 max.

2. The minus 200 portion of the material expressed as a percentage multiplied by the Plasticity Index shall not exceed 100.

- B. Detectable tape: Detectable tape shall be 5.0 mil composition film containing metalized foil laminated between layers of inert plastic film, such as Detectable Terra Tape or approved equal. The tape shall be highly resistant to alkalis and acids found in the soil.



The tape, when buried 4' deep, shall be detectable by buried pipe or cable locating equipment. The tape shall be 3" wide and bear a continuous printed message warning of the type of utility buried beneath.

### 3.00 EXECUTION

#### 3.01 PREPARATION

##### A. General:

1. Prior to trenching excavate at locations 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. If, after excavation, the crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the Engineer to clear the utility.

#### 3.02 TRENCHING

##### A. General:

1. Trenching shall include removal of all water and materials that interfere with construction. Remove 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 structures and where necessary, the rearrangement and repair of adjoining utilities.
3. It shall be the Contractor's responsibility to direct vehicular and pedestrian traffic through or around his work area at all times.
4. Except as specified in other Sections, the Contractor shall relocate, reconstruct, replace or repair, at his own expense, existing utilities, walls, fences, services, other structures or improvements of what ever nature, which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor whether specifically identified on the Drawings or not. The Contractor shall connect such utilities to existing systems and leave all in a workable and operating condition.
5. Tree roots over 2" in diameter and crossing pipelines shall be protected by using hand excavation; refer to Section 31 10 00. Hand excavation shall mean excavation using the smallest piece of motorized equipment available in combination with manual use of hand equipment, with the intent to minimize the damage to low hanging tree limbs, tree roots and utilities.

- B. Existing paving and concrete: The following supplements the requirements of Section 31 10 00.

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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. If a longitudinal pavement joint or edge of pavement is located within 3' of the limit of excavation, all intervening pavement shall be removed and replaced after completion of backfilling.
2. Existing concrete over the trench shall be sawcut to a minimum depth of 1½" in straight lines either parallel to the curb or at right angles to the alignment of sidewalk. No section to be replaced shall be smaller than 30" in either length or width. If the sawcut would fall within 30" of a construction joint, expansion joint, or edge, or within 12" of a score mark, the concrete shall be removed to the joint, edge or mark.
3. Place boards or other suitable material under backhoe outrigging to prevent damage to paved surfaces.

## C. Trench Width:

1. The maximum allowable trench widths at the top of the pipe shall be the following:

Pipe Type	Trench Width (Max.)
Cast-iron	Outside diameter of barrel plus 18"
Ductile-iron	Outside diameter of barrel plus 18"
PVC	Outside diameter of barrel plus 18"
VCP	Outside diameter of barrel plus 18"
Concrete cylinder	Outside diameter of barrel plus 18"
Welded steel	Outside diameter of barrel plus 18"
Corrugated metal	Outside diameter of barrel plus 18"
RCP	Outside diameter of barrel plus 18"

- a. The maximum trench width shall be inclusive of all shoring.
  - b. If the maximum trench width is exceeded, the Architect may direct the Contractor to embed or cradle the pipe in concrete at no additional charge to the Owner.
2. In no case shall the free working space on each side of the pipe barrel be less than 6".

## D. Open trench:

1. The maximum length of open trench shall be 300' 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.

- E. Excavation bracing:
1. The excavation shall be supported and excavation operations conducted in accordance with the California Industrial Accident Commission, State of California, Division of Industrial Safety requirements, and OSHA.
  2. The Contractor shall, at his own expense, furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of all excavations (whether above or below the pipe grade), and to prevent any movement which could in any way diminish the required trench section or otherwise injure or delay the work. The sheeting and bracing shall be withdrawn to prevent any earth movement that might overload the pipe.
- F. Excavated material:
1. Material excavated and not required for backfill shall be immediately removed and properly disposed of off the Owner's site.
  2. Material excavated in streets and roadways shall be laid alongside the trench 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.
  4. Excavated material shall not be stored on landscaping.

### 3.03 PIPE BEDDING

- A. Bedding excavation: Excavate the trench below the grade of the pipe bottom to the following minimum depths:

Pipe Type	Depth
Cast-iron	6"
Ductile-iron	6"
PVC	6"
VCP	6"
Concrete cylinder	4"
Welded steel	4"
Corrugated metal	3"
RCP	3"

- B. 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 Engineer 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 when ordered by the Soils Consultant.

- C. Placement of bedding material: Sufficient select backfill material as specified in Paragraph 2.01 A (above) 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% as determined by ASTM D1556 or California Test 216. It is the intent of these Specifications to provide uniform bearing under the full length of pipe to a minimum width of 60% of the external diameter.

### 3.04 TRENCH BACKFILL

A. Initial backfill:

1. Prior to trench backfill, the Owner's Representative will inspect the condition of the trench and laying of pipe.
2. Select backfill material as specified in Paragraph 2.01 A (above) shall be used for initial backfill. After the pipe has been properly laid and inspected, select backfill material shall be placed on both sides of the pipe and compacted to final depth as follows:

Pipe Type	Depth
Cast-iron	12" above top of pipe
Ductile-iron	12" above top of pipe
PVC	12" above top of pipe
VCP	12" above top of pipe
Concrete cylinder	12" above top of pipe
Welded steel	12" above top of pipe
Corrugated metal	½ outside diameter of pipe
RCP	(Pipe spring line)

3. Compaction:

- a. Initial backfill compaction shall be by mechanical means. The initial backfill material shall be hand tamped in layers not exceeding 4" in uncompacted depth and shall be brought up uniformly on both sides of the pipe to avoid bending or distortion stress. After hand tamping, the relative compaction of the initial backfill material shall be not less than 90%.
- b. Compaction testing will be in accordance with one or more of the following methods: California Test No. 216, California Test No. 231, ASTM 1556, or ASTM 1557.

- B. Detectable Tape: In trenching continuing non-metallic pipes, detectable tape shall be placed on top of the initial backfill, except with reinforced concrete pipe where the tape shall be placed 12" above top of pipe.

C. Subsequent Backfill:

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1. Above the level of initial backfill, the trench shall be backfilled with native material from trench excavation or with select imported material. Subsequent backfill shall be free of vegetable matter, stones, or lumps exceeding 3" in greatest dimension, and other unsatisfactory material. The Soil Engineer shall approve the backfill material prior to replacement.
  2. Subsequent backfill compaction shall be by mechanical means. The backfill material shall be placed in layers not exceeding 6" in loose depth, and each layer shall be thoroughly compacted before succeeding layers are placed. The use of machine tampers, except manually held types, shall not be permitted.
  3. Relative compaction shall be at least 90%.
- D. Backfill Cap: trench backfill shall be capped with 12 inches of backfill compacted to 95% of relative compaction. Lift shall be no more than 6".

## 3.05 TRENCH SURFACING

- A. General: In areas to be improved under separate contract, the trench shall be backfilled and graded to the level of adjacent surfaces. No mounds of earth shall be left along the trench.
- B. Temporary surfacing in areas to remain in use by the public:
1. Temporary surfacing shall be 2½" of cut back asphalt on 12" of Class 2 aggregate base.
  2. Temporary surfacing shall be laid within one day after backfilling.
  3. Before the trenching area is opened to traffic, excess dirt, rock and debris shall be removed and the street surface shall be swept clean.
  4. Temporary surfacing shall be maintained to prevent the occurrence of mudholes and prevent the surface from settling below 1" or rising more than 1" from the existing pavement grade.

## 3.06 INSPECTION

- A. Pipes shall be inspected/tested prior to backfilling and compaction, tests as required shall be performed to ensure compliance with these Specifications. The test(s) shall be conducted at no cost to the Owner.
- B. A final inspection upon completion of the paving operation shall be made to ensure conformity with the existing pavement surface.

**END OF SECTION 31 23 33**

**SECTION 32 12 16 - ASPHALT CONCRETE PAVING**

## 1.00 GENERAL

## 1.01 DESCRIPTION

## A. Principal work in this Section:

1. Aggregate base material.
2. Prime coating.
3. Paint binder as required herein.
4. Asphalt concrete.
5. Seal coat.

## B. Related work in other Sections:

- 1 Earthwork: Section 31 00 00.
- 2 Curbs and gutters: Section 32 16 00.
- 3 Pavement marking and accessories: Section 32 17 23.

## 1.02 QUALITY ASSURANCE

## A. Reference standards: Applicable provisions of the following govern the work of this Section.

1. American Association of State Highway and Transportation Officials (AASHTO), M 288-96 or Latest Version Thereof.
2. California Department of Transportation (CDT).
  - a. Standard Specifications: Sections 26, 37, 39, 92, 93, and 94.
  - b. Standard Test Method No. 399A.

## B. All work in this Section shall conform to Sections 26, 37, 92, 93, and 94 of the Standard Specifications (CDT).

## 1.03 SUBMITTALS

## A. Certificates: Submit the following:

1. Two copies of material certificates signed by the material producer and the Contractor, certifying that each material item complies with, or exceeds specified requirements.

2. Certified weight or load slip to the Owner's representative for each load of material used in the construction of the asphalt concrete pavement.

#### 1.04 SITE CONDITIONS

- A. Prime coat, seal coat and paint binder.
  1. Apply only when the ambient temperature is above 50°F and when temperature has not been below 30°F for 12 hours immediately prior to application.
  2. Do not apply when base or surfaces are wet or contain an excess of moisture.
- B. Construct asphalt concrete surface course only when atmospheric temperature is above 40°F and when base is dry.

#### 2.00 PRODUCTS

##### 2.01 AGGREGATE BASE

- A. Class 2 aggregate base, three quarter inch ( $\frac{3}{4}$ " ) maximum size, as specified in Section 26 of the CDT Standard Specifications.
- B. Mineral aggregate shall be Type B mineral aggregate as specified in Section 39 of the CDT Standard Specifications.
- C. Grading of combined aggregates for new pavement shall be  $\frac{1}{2}$ " maximum size, medium grading, except asphaltic concrete for overlaying existing paved surfaces shall be  $\frac{3}{8}$ " maximum size.
- D. Liquid asphalt for prime coat: Grade SC-70 in conformance with Section 93 of the CDT Standard Specifications.
- E. Asphaltic emulsion for paint binder and fog seal coat: Emulsified asphalt, Type SS-1h, conforming to Section 94 of the CDT Standard Specifications.

#### 3.00 EXECUTION

##### 3.01 PREPARATION

- A. Subgrade: The upper 12" of subgrade shall be compacted to 95% per Section 31 00 00 of these Specifications.
- B. Crack sealing:
  1. Before sealing, cracks shall be cleared of dirt, dust, soil vegetation debris, and other deleterious materials by means of air blowing to a depth of  $\frac{1}{4}$ " to  $\frac{1}{2}$ ".

2. Cracks 1/8" in width and greater in existing AC paving to be overlaid and shall be sealed.
3. Applications of crack sealer shall be in accordance with the manufacturer's recommendations or as directed by the Owner's representative.

### 3.02 AGGREGATE BASE

- A. Place, spread and compact in conformance with Section 26 of the CDT Standard Specifications.

### 3.03 ASPHALT CONCRETE PAVING

- A. Proportion, mix, place, spread and compact in conformance with Section 39 of the CDT Standard Specifications.
- B. Before placing asphalt concrete on untreated base, apply liquid asphalt prime coat to base course in conformance with Section 39 of the CalTrans Standard Specifications. Apply prime coat at the rate of 0.25 gallons per square yard.
- C. Before placing asphalt concrete, apply an asphalt emulsion tack coat (paint binder) to vertical surfaces of existing pavement, curbs, gutters, construction joints and existing pavement to be surfaced, in conformance with Section 39 of the CDT Standard Specifications.
- D. Spread and compact asphalt concrete in accordance with Section 39 of CDT Standard Specifications.
- E. Apply seal coat to all finished surfaces of asphalt concrete pavement in accordance with Section 37 of the CDT Standard Specifications.
- F. After seal coat has been applied, allow ample time for drying before traffic is allowed on the pavement or paint striping is applied.

### 3.04 FIELD QUALITY CONTROL

- A. Aggregate Base: The surface of finished aggregate base shall vary no more than 0.05' above or below the grade indicated.
- B. Asphalt Concrete Paving:
  1. The finished asphalt pavement, where not controlled by adjacent structures or features, shall not vary more than 0.05 feet above or below the planned grade, providing it is uniform and free of sharp breaks and does not pond water.
  2. The cross section of the finished pavement shall be free of ridges and valleys and shall not vary more than 0.03' above or below the theoretical section at any point on the cross section.
  3. The specified thickness of the finished pavement shall be the minimum acceptable.



4. Conforms shall form a smooth, pond free, transition between existing and new pavement.

**END OF SECTION 32 12 16**

**SECTION 32 13 12 - SITE CONCRETE REINFORCING**

## 1.00 GENERAL

## 1.01 DESCRIPTION

## A. Principal work in this Section:

1. Reinforcing steel for site cast in place concrete.
2. Accessories such as chairs and tie wires.

## B. Related work in other Sections:

1. Curb and Gutters: Section 32 16 00.
2. Site Cast-in-Place Concrete: Section 32 13 13.

## 1.02 QUALITY ASSURANCE

## A. Source quality control:

1. The Contractor shall ensure that the material delivered for use is that represented by the mill reports and obtain copies of mill reports, examine them, certify whether the material represented complies with Specifications requirements, and make distribution of reports as required. Report chemical composition of each heat, as determined by ladle analysis.
2. Where materials proposed for use cannot be identified, the Contractor shall pay for an approved testing laboratory to make one series of tests (tensile and bend) from each 2.5 tons, or fraction thereof, of each size and kind of reinforcing steel.

## B. Standards: The applicable provisions of the following govern the work of this Section:

1. ACI 301 Specifications for Structural Concrete for Buildings.
2. ACI 318 Building Code Requirements For Reinforced Concrete.
3. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.
3. ACI SP 66 American Concrete Institute Detailing Manual.
4. ANSI/ASTM A497 Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

## 1.03 SUBMITTALS

- A. Submit bar drawings, schedules and placing diagrams for reinforcing steel. Submit bar drawings and schedules with the corresponding placing diagrams. Drawings shall be complete for any specific area of Project at the time they are submitted.

#### 1.04 HANDLING

- A. Comply with the requirements of Specification.
- B. Marking and shipping reinforcement: Bundle and tag with suitable identification. Transport to and store at the site to avoid damage to material. Maintain tags after bundles are broken.

#### 2.00 PRODUCTS

##### 2.01 MATERIALS

- A. Reinforcement Steel - Bar Reinforcement - ASTM A 615 Grade 60 (ASTM A 615M Grade 400), deformed.
- B. Reinforcement Steel - Reinforcing Fabric - Welded wire fabric - ASTM A 185, welded steel wire fabric.
- C. Stirrup steel: ANSI/ASTM A1064.
- D. Tie wire: 16 gauge (min.) annealed steel wire.
- E. Chairs and similar support items:
  - 1. Standard manufactured products conforming to CRSI Manual of Standard Practice, MSP-2.
  - 2. Use dense precast concrete bar support with embedded wire ties for reinforcement placed on grade; elsewhere reinforcement shall be supported by wire bar supports.

##### 2.02 FABRICATION

- A. General: Except as modified by the Drawings and the Specifications, comply with CRSI and WCRSI Manual of Standard Practice for Reinforced Concrete Construction, for fabrication of reinforcing steel.
- B. Bending and forming:
  - 1. Fabricated steel bars, wire and fabric of indicated sizes, lengths, and gauges and accurately form to shapes indicated by methods that will not injure the materials.
  - 2. Do not heat reinforcement for bending. Do not install bars with unscheduled kinks or bends.

## 3.00 EXECUTION

## 3.01 PLACING

- A. Cleaning: Clean reinforcement of oil or other coating that might destroy or reduce its bond with concrete before placing it.
- B. Placing: Conform to the Manual of Standard Practice for Reinforced Concrete Construction by CRSI and WCRSI, and the following:
  - 1. Accurately place reinforcement and securely tie in position with steel wire at points where bars cross to hold them against displacement.
  - 2. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- C. Spacing of reinforcement:
  - 1. Space reinforcement to maintain the proper distance and clearance between parallel bars and between bars and forms. Provide metal spreaders and spacers to hold horizontal steel in position.
  - 2. Support steel at proper height by using galvanized "S" chairs, or "Support Bars" and galvanized "S" chairs, with hangers, or in other manner, as necessary.
  - 3. Where "Support Bars" are used to hold the slab reinforcement in place, space chairs under the support bars not to exceed the distances specified previously.
- D. Splicing:
  - 1. Stagger all lap splices. Bars shall be in contact, unless noted otherwise on the Drawings, at lapped splices and shall be firmly wired together before placing concrete. Lap bars as indicated.
  - 2. Extend stubs and dowels required to receive and engage subsequent work a sufficient length to develop the strength of the bar. Place dowel and stub bars in the forms and secure against displacement during placing of concrete.
- E. Maintain clear distances between reinforced steel and face of concrete indicated on the Drawings.
- F. Dowels in existing concrete:
  - 1. When drilling for dowels in existing concrete, use sharp bits, drill hole full depth and slightly oversize, fill with a 6000 psi epoxy and hammer dowel to refusal

**END OF SECTION 32 13 12**

**SECTION 32 13 13 - SITE CAST-IN-PLACE CONCRETE**

## 1.00 GENERAL

## 1.01 DESCRIPTION

## A. Principal work in this Section:

1. Site Cast-in-place concrete.
2. Shotcrete.
3. Replacement concrete (patios, walks, steps, etc.).

## B. Related work in other Sections:

1. Site Reinforcing steel: Section 32 13 12.
2. Earthwork: Section 31 00 00.

## 1.02 QUALITY ASSURANCE

## A. Reference standards: Applicable provisions of the following govern the work of this Section.

1. ACI 301, Specifications for Structural Concrete for Buildings.
2. ACI302, Recommended Practice for Concrete Floor and Slab Construction.
3. ACI 304, Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 305, Recommended Practice for Hot Weather Concreting.
5. ACI 306, Recommended Practice for Cold Weather Concreting.

## B. Source quality control:

1. Employ a testing laboratory, acceptable to the Owner, and Engineer, to test the materials for conformance with these Specifications before concrete mixes are established, and when source is changed, unless recent test results of materials to be used on the Project, performed by an acceptable testing laboratory, are accepted by the Engineer.
2. Testing coarse aggregates:
  - a. Test aggregate before and after concrete mix is established and whenever the character source of material is changed, but not less than one test for each 50 cubic yards.

- b. Perform a sieve analysis to determine conformity with limits of gradation. Perform sampling and testing according to ASTM C33, and as follows:
- 1) Sampling of aggregates: ASTM D75. Take samples of aggregates at source of supply, or if source of supply has been approved, from storage bunkers at ready-mixed concrete plant.
  - 2) Testing of aggregates shall include:
    - a) Sieve analysis: ASTM C136.
    - b) Organic impurities: ASTM C40. Fine aggregate shall develop a color not darker than the referenced standard color.
    - c) Soundness: ASTM C88. Loss after 5 cycles not over 8% for coarse aggregate, nor 10% for fine aggregate.
    - d) Abrasion of concrete aggregate: ASTM C131. Weight loss not over 10-1/2% after 100 revolutions, nor 42% after 500 revolutions.
    - e) Deleterious materials: ASTM C33.
    - f) Materials passing No. 200 sieve: ASTM C117, not over 1% for gravel, 1.5% for crushed aggregate per ASTM C33.
    - g) Reactive materials: ASTM C289. aggregates shall indicate no potential deleterious reactivity.
    - h) Definitions: ASTM C125.

3. Cement test:

- a. The cement mill laboratory will be acceptable as testing laboratory for this purpose when approved by the Building Department. Submit evidence to show that the cement mill laboratory is qualified to perform tests. The laboratory shall make tests for every 500 barrels or fraction thereof for of cement used in accordance with ASTM C150.
- b. Make tensile strength test at 7 days. Tag the cement for identification at the location of sampling. A representative of the Testing Laboratory shall certify that materials being used are taken from the lots sampled and tested for this report.

## 2.01 MATERIALS

- A. Portland cement: ASTM C150, Type I or II low alkali with air entrainment as required. Do not change brand or type of cement without Engineer's written approval.
- B. Aggregates:
  - 1. Hardrock aggregates: ASTM C33 graded so that coarse aggregates nominal size is not larger than 1/5 the narrowest dimensions between form faces; nor 3/4 of the minimum clear spacing between individual reinforcing bars or bundles of bars, but never greater than 3/4" in any dimension for slabs 4" thick or less; 1-1/2" at all other locations.
- C. Admixtures: ASTM C494, Type A, admixtures shall contain no chlorides and may be used only with the Engineers approval, except as specified. Submit manufacturer's data for products proposed for use to the Engineer.
- D. Pozzolanic Fly Ash: ASTM C618, Class F.
- E. Water: Fresh, clean, and free of oil and other materials injurious to concrete.
- F. Concrete curing compound:
  - 1. Liquid membrane-curing compound containing a fugitive dye, conforming to ASTM C309, Type I, guaranteed not to affect the bond, adhesion, or effectiveness of finishes and surface treatment specified herein to be applied to concrete.
- G. Expansion joint materials:
  - 1. Joint filler: Homex Expansion Joint by Homasote Co. or equal non-bituminous product compatible with sealant specified in Section 07 90 00 per ASTM D 1751.
  - 2. Joint sealant and back-up rod: As specified in Section 07 90 00.
- H. Dry pack and grout: One of the following or equal.
  - 1. Masterflow 713 by Master Builders.
  - 2. Five Star Grout by U.S. Grout Corporation.
  - 3. Fondag Nonshrink Grout by Specrete Products, Ltd.
- I. Aggregate Base: Class 2 aggregate base, three quarter inch (3/4") maximum size, as specified in Section 26 of the CalTrans Standard Specifications.

## 2.02 MIXES

- A. Mix design:



1. Employ a testing laboratory, acceptable to the Owner's Representative, to design all structural concrete mixes required for the Project to provide:
    - a. Normal weight concrete with 3000 psi 28-day compressive strength, unless noted otherwise on the Drawings.
    - b. Adequate workability and proper consistency to permit concrete to be worked readily into the forms and around reinforcement without segregation and excessive bleeding.
    - c. Other requirements of these Specifications.
  2. Proper proportions for design mixes shall be in accordance with ACI 211 or ACI 318.
  3. Proper water-cement ratio shall be determined by the preliminary test made in accordance with ASTM C192.
  4. Slump limits: Proportion and design mixes to result in the following concrete slump at point of placement.
    - a. Tieback anchors: Not more than 7".
    - b. Piers: Not less than 4" and not more than 6".
    - c. All other concrete: Not less than 1" and not more than 4".
  5. Use air-entering admixture in all concrete, unless otherwise shown or specified. Add air-entering admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within 3% to 6%.
  6. Tests shall be conducted in accordance with ASTM C39.
- B. Submit report showing results of sieve analysis, mix design and results of compression tests. Make test specimens from not less than 3 batches of each design specimens from not less than 3 batches of each design mix. The trial batch strength for each mix shall exceed indicated  $f'_c$  by 25% or a lesser amount based on standard deviations of strength test records according to ACI 318. Do not start concrete production until mixes have been reviewed and are acceptable to the Engineer.
- C. For each batch, weigh the fine and coarse aggregate separately, measure cement and water separately and introduce separately into the mix so that proportions can be accurately controlled and easily checked.
- D. Do not change proportions established by the accepted mix design without the Engineer's written approval.
1. Cement: If concrete develops less than required minimum strength, adjust mix proportions and increase the amount of cement, as necessary.

2. Water: Do not exceed predetermined amount of water because of slowness of discharge from mixer necessary to produce concrete that will work readily into corners and angles of forms and around reinforcements, without segregation of materials and without free water collecting on the surface.
3. Aggregates: Reasonable variations in grading will be allowed by the Engineer because of characteristics of available materials and the need for workability and strength.

E. Concrete mixing:

1. Mixing and delivery shall comply with ASTM C94, these Specifications, and applicable Building Code requirements. If the referenced specifications, these Specifications or the Building Code conflict, comply with the most restrictive requirement.
2. The Owner's Testing Agency will perform check sieve analysis of the aggregates being used, check compliance with mix design and the cement being used against mix design; check that water has been removed from the drum before adding mix ingredients for the following load and shall witness the loading of mixing trucks. The Owner's Testing Agency will send a written report of each inspection to Engineer indicating compliance with these Specifications.
3. Provide a ticket signed by an authorized representative of the batching plant with each mixer truck of concrete delivered to the site indicating:

Name of Project.  
Date of Delivery  
Supplier of Concrete.  
Brand of Cement.  
Truck Identity and  
Cement Content.  
Ticket Serial Number.  
Strength Classification.  
Batching Time.  
Admixture Content.  
Point of Deposit.  
Name of Contractor.  
Total Amount of Water.  
Water Added at Jobsite.  
Name of Driver.  
Weight of Aggregate.  
Time loaded and First  
Daily Temperature  
Mixing Concrete.  
Number of Cubic Yards  
Reading of Revolution in Load.

4. Store batch tickets at time concrete is delivered in job file for reference at the site.
5. Remove all materials, including water, remaining in the ready-mix truck drum completely before ingredients for the following loads are introduced into the drum.
6. Retempered concrete: Do not use concrete which has not been placed 30 minutes after leaving the mixer, or concrete that is not placed within 60 minutes after water is introduced into the mix.

### 3.00 EXECUTION

#### 3.01 PREPARATION

- A. Inspect excavations, subgrades and formwork, as applicable for each placing operation, for accuracy of lines, levels, elevations and dimensions. Make necessary corrections to obtain concrete within the tolerances specified.
- B. Inspect placement of reinforcement and accessories for proper positions, sizes, clearances, fastenings, laps and splices.
- C. Moisten, do not saturate, earth subgrade and bearing surfaces. Moisten the sand base under slabs-on-grade the day before concrete is to be cast thereon.
- D. Wet wood forms thoroughly when they are not treated with form release agent. Wet other materials sufficiently to reduce suction and maintain concrete workability.
- E. Recompact disturbed gravel fill and install vapor barrier under building slabs on grade. Lap joints 4". Lap on walls 2". Cut patches at penetrations for a tight fit. Tape all joints to make moisture tight. Cover vapor barrier with a minimum of 2" of damp concrete sand.
- F. Embedded items including, but not limited to, conduits, anchors and rough hardware, built into concrete as indicated or required.
  1. Do not embed piping and conduits, other than electrical conduits, in structural concrete. Locate conduits so as to reduce strength of the structure the least amount, as approved by the Engineer, and as indicated on the Drawings.
  2. Embed bolts, inserts and other items in the concrete, accurately secured so that they are not displaced during concrete placing and compacting operations.
  3. Set embedded bolts for materials and equipment attached to concrete to template, layouts and shop drawings. Verify size, length and location of electric conduit with respect to equipment supports.
- G. Do not proceed with placement of concrete until all conditions are satisfactory.

## 3.02 CONVEYING

- A. Rapid handling: Transport concrete from the mixer to location of placing as rapidly as practical to avoid separation or loss of ingredients.
- B. Transporting methods: Use cranes, carts, buggies or other approved means to deliver concrete to final locations. Do not use delivery systems (pipe, chutes, etc.) formed of aluminum for transporting concrete. If pumping of concrete is contemplated, first obtain Engineer's approval for the design mix and the placement method before placing concrete.
- C. Free fall: Not more than 4 ft. in concrete which will remain exposed in the Work; no more than 6 ft. elsewhere. Avoid large concentration of concrete in one location which would produce unacceptable deflection in supporting formwork or on one side of steel soldier beam.
- D. Lifts: No more than 2 ft. high.
- E. Concrete flow: Carry concrete up uniformly for the length of walls being placed to reduce lateral flow of concrete to 5 ft. maximum.
- F. Runways: Construct substantial runways and scaffolding to avoid movement and vibration in the forms and reinforcing steel as a result of transporting and placing concrete.

## 3.03 PLACING

- A. General: Comply with ACI 304. Do not place concrete in or under water.
- B. Consolidation: Thoroughly consolidate concrete and work it around reinforcement and embedded items and into corners and angles of forms, by spading, rodding and tamping to exclude rock pockets, air bubbles and "honeycombs" and to obtain required density and strength.
- C. Internal vibration:
  - 1. Use mechanical vibrators to consolidate each layer with that previously placed, to completely consolidate the concrete in forms. Take care to avoid over-vibration, causing separation of ingredients. Keep extra standby vibrator at the site.
  - 2. Vibration of pier concrete below grade is not required.
- D. Flow of concrete: Keep surface of concrete level during placing, with a minimum of concrete allowed to flow from one position to another. Place concrete in a continuous operation until each section or panel has been completed.
- E. Record: Keep records showing location, date and time of placement of all concrete batches.

- F. Temperature: Do not place concrete when the ambient temperature is above +85°F or below +40°F. at the time of placing, or if it is likely to go above +85°F or below +40°F before the concrete has taken its initial set, unless special precautions recommended by ACI 305 and 306 are provided.
- G. Construction joints:
1. Location:
    - a. Locate construction joints where indicated. When not shown, submit layout showing location of construction joints and placing procedure, for the Engineer's approval, before placing concrete.
    - b. Locate construction joints to least impair the strength and appearance of structure.
    - c. Off-set construction joints not less than 5 ft. with a minimum of 2 offsets.
  2. Joints in channels: Locate as detailed on the Drawings.
  3. Contact surfaces: Keep exposed face of construction joints continuously moist from time of initial set until subsequent placing of concrete against them, but not to exceed the curing period.
    - a. Clean contact surfaces thoroughly by chipping entire surface not earlier than 5 days after initial placing.
    - b. As an option, jet wash or sandblast the surface to expose clean aggregate solidly embedded in the mortar matrix; remove wash water entirely from surface.
    - c. If a contact surface becomes coated with foreign materials of any nature, after being cleaned, chip or rechip the surface completely, to suitable condition.
- H. Tolerances: In compliance with ACI 117 as follows.
1. Paragraph 2.1, except for reference to slip-forming.
  2. Paragraph 2.2, Class AX.
  3. Paragraph 3.6.

### 3.04 FINISHING

- A. Formed concrete surfaces:
1. General:

- a. Remove fins, laitance and loose material from concrete surfaces when forms are removed.
  - b. Repair concrete honeycombs, rock pockets, sand runs, spalls, or otherwise damaged surfaces by removing the damaged or unsatisfactory area to sound concrete, with slightly undercut edges, and filling-in with the same mix as the adjacent concrete minus the coarse aggregate.
  - c. Tamp and float the patch flush with adjacent surface.
2. Shotcrete walls: Provide a "rubbed finish" as defined in ACI 301 to produce a uniform surface by float trowel or rub board immediately after shotcrete is applied.
  3. Clean surface of pier cast below grade by sandblasting. Apply a sand-cement mortar, trowel and rub to match shotcrete finish.
- B. Top of grade beams, footings and pier caps: Screed to elevations indicated.
- C. Channels:
1. Protection: Protect exposed flatwork as necessary to prevent damage resulting from impact or from subsequent work.
    - a. Protect work of other trades from damage by covering it with heavy kraft paper securely taped in place. Leave protection in place as long as its need exists.
    - b. Control the use of water and other contaminants within the area so that no damage to previously installed work or existing structure and finish occurs.
  2. Compacting and floating:
    - a. Bring channels to proper elevations and strike off with a straightedge. Remove excess water and laitance.
      - 1) Compact by rolling with weighted rollers or by tamping with grid tampers. Thoroughly hand-tamp areas not accessible to rollers.
      - 2) Float and test surfaces with a 10 ft. straightedge and eliminate high and low spots to comply with tolerances specified.
      - 3) From this point, use the methods and tools necessary to produce surface tolerances and finishes specified.
    - b. Use screeds to type and spacing required to produce specified channel tolerance.

3. Moisture control: In addition to other finishing requirements, use a water fog spray to reduce plastic shrinkage cracks during flatwork finishing operations when conditions of low humidity and/or high temperature exist.
  - a. Immediately after concrete has been brought to a flat surface and the shiny film of moisture disappears, restore it and maintain until final troweling by applying a light film of moisture with an atomizing type fog sprayer.
  - b. Use frequent light applications of moisture rather than excessive amounts at any one time. Adjust the amount and refrequency of fog spray as required by variable conditions of weather, wind, temperature and humidity.
4. General requirements:
  - a. Finish surfaces to produce a uniform appearance throughout area involved and throughout adjacent areas with the same treatment.
  - b. Where concrete finishing occurs adjacent to finished metal or other surfaces, particularly where serrated or indented surfaces before allowing to harden.
  - c. Use no troweling machines within 12" of electrical junction and outlet boxes which are set to finish flush with concrete floors. Float and trowel such areas by hand with wood floats and steel trowels, taking care to see that concrete is finished flush with box cover and matches adjacent surfaces.
5. Schedule of finishes:
  - a. Float surfaces to produce a uniform broom sweep texture and finish throughout.
  - b. Provide an equivalent of a medium salted finish along concrete surfaces at slopes of less than 6%.
  - c. Provide an equivalent of a heavy broom slip resistant finish along concrete surfaces at slopes of 6% and greater.

D. Curbs: Immediately after removing forms, finish faces and top with a steel trowel.

### 3.05 CURING

A. Formed concrete:

1. Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.

2. If forms are removed before 14 days after concrete is cast, coat concrete with curing compound as specified for flatwork below.
- B. Concrete flatwork:
1. After finishing, spray the specified curing compound uniformly in 2 coats at 90° to each other not exceeding coverage rates recommended by the manufacturer.
  2. Inspect treated surfaces daily for 14 days for evidence of drying. Re-wet the surfaces and apply a new application of curing compound if premature drying occurs, as soon as can be done after finishing without marring the surfaces.
- C. Pits, trenches and curbs: Construct pits for transformers, sumps, valves, trenches, curbs, gutters, and other miscellaneous concrete work.
- D. Grouting and drypacking: Install as indicated and required, except for items grouted by other trades.
1. Mix material, in accordance with its manufacturer's instructions, with sufficient water so it flows under its own weight for grout, and to just moisten and bind the materials together for drypack.
  2. Place drypack by forcing and rodding to fill all voids and provide complete bearing under plates. Place fluid grout from one side only and puddle to completely fill voids; do not remove dams or forms until grout attains initial set. Finish exposed surfaces smooth, and damp cure at least 3 days.
- E. Splash block: Precast in tight molds, to the dimensions and profiles indicated. Use a mix with coarse aggregates passing 3/8" sieve to obtain a compressive strength of 3,500 psi minimum at 28 days. Steel trowel unformed surface.

### 3.06 PROTECTING AND CLEARING

- A. Protect finished surfaces from stains or abrasions. Do not allow fire in direct contact with concrete. Provide adequate protection against injurious action by sun or wind. Protect fresh concrete from heavy rain and mechanical injury.
- B. Upon completion, wash and clean exposed concrete and leave free of oil, paint, plaster and foreign substances, ready to receive applied finishes or to be left exposed.

### 3.07 DEFECTIVE CONCRETE

- A. Concrete finishes which are not within the specified tolerances nor finished as specified which do not connect properly to adjoining work, do not slope to drains or are not



properly cured, or do not meet other provisions of the Specifications, will be deemed defective.

- B. Remove defective concrete as directed by Engineer and replace with concrete of specified strength.

### 3.08 FIELD QUALITY CONTROL

- A. Concrete quality control (refer also to Section 01 40 00): The following will be performed by the Owner's Testing Agency.
  - 1. Samples will be taken during progress of the work for determination of slump, compression strength, aggregate sieve analysis, and grout-mix tests, with assistance furnished by the Contractor.
  - 2. 3 cylinders will be made for each day's pour or for each 100 cubic yards or less, or once for each 5,000 square feet of surface area, whichever is less, for each type of concrete being cast.
  - 3. 1 cylinder will be tested at 7 days, and 1 cylinder at 28 days. The remaining cylinder will be kept in reserve in case tests are unsatisfactory.
  - 4. Samples will be made in accordance with ASTM C172.
  - 5. Specimens will be made and laboratory cured in accordance with ASTM C31.
  - 6. The 28-day values will be the criteria for acceptance of concrete regarding strength only.
    - a. 7-day tests may be regarded as indicative of compliance or non-compliance with the 28-day strength requirements, and the Contractor should be guided accordingly in matter of adjusting proportions, if necessary, and notify the Engineer.
    - b. 7-day tests shall also be a guide to the Contractor regarding time for form removal.
  - 7. Slump tests will be made for each set of tests cylinders in accordance with ASTM C142.
- B. Tests evaluation:
  - 1. Concrete cylinder test will be evaluated in accordance with ACI 214 and 318.
  - 2. If 28-day test results indicate the concrete strength is not as specified, core concrete as directed by the Engineer in accordance with ASTM C42.
    - a. Plug core hole solid as specified in Article 3.04 of this Section.
    - b. The cost of cores, tests and patching shall be borne by the Contractor.

3. In the event that additional core tests do not show strength required, or as determined by load tests made in accordance with ACI 318, the defective concrete shall be removed and replaced or shall be reinforced as directed by the Engineer at the Contractor's expense.
4. If core tests results fall below design strength specified, adjust the concrete mix or water content for future batches, at not additional cost to the Owner.

**END OF SECTION 32 13 13**

**SECTION 33 00 00 - PIPED UTILITIES**

## 1.00 GENERAL

## 1.01 DESCRIPTION

## A. Principal work in this Section:

1. Connection to existing systems.
2. Pipe installation and connection to building stubouts.

## B. Related work in other Sections:

1. Trenching, backfilling and compacting: Section 31 23 33.
2. Storm Drainage Utilities: Section 33 40 00.
3. Sanitary Sewerage Utilities: Section 33 30 00.
4. Water Utilities: Section 33 10 00.

## 1.02 QUALITY ASSURANCE

## A. Refer to specific utility Sections as noted above.

## 1.03 HANDLING

- A. Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, insulation, joint materials, fittings, valves and rubber gaskets under cover out of direct sunlight. Do not store materials directly on ground. Keep interiors of pipes and fittings free of dirt and debris.
- B. Handle pipe, fittings, valves and other accessories in such a manner as to ensure deliver to the trench in sound and undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry pipe to the trench; do not drag it.
- C. The pipe will be inspected at destination to assure compliance with specified requirements. Any pipe or couplings that are found to be defective or that do not meet the requirements of the Specifications shall be replaced. Rejection of 10% of any shipment shall be cause of, and will be considered sufficient reason for, rejection of the entire shipment.

## 2.00 PRODUCTS

- A. Refer to specific utility Sections as noted above.

## 3.00 EXECUTION

- A. Any connections to public improvements require notification of, and inspection by the City or Public Utility Company.

## 3.01 CONNECTION TO EXISTING SYSTEM(S)

- A. Make connections to existing lines at a time which will cause a minimum of disruption to the existing system. Any service interruption(s) shall be coordinated with and approved by the Engineer. Overtime costs shall be paid for by the Contractor.
- B. Contractor shall coordinate with and arrange for "hot" tap connections to existing mains by forces of the Water Service Agency. Owner will pay separately for work to be done by the Water Service Agency.

## 3.02 PIPE INSTALLATION

- A. Laying and jointing of pipe and fitting shall be in accordance with the manufacturer's recommendations. Joint deflections shall not exceed the maximum recommended by the manufacturer. There shall be no shoulder or unevenness along the interior of the pipe at the shoulder joints.
- B. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, valves, fittings or other appurtenances into trenches. Do not drag pipe with preformed rubber joint seals against trench walls and damage the seals.
- C. Cut pipe accurately to measurements established at the site and work into place without springing or forcing. Do not use pipe or fitting that does not allow sufficient space for proper installation of jointing material.
- D. Pipe fittings, valves and accessories shall be carefully inspected before and after installation and those found defective shall be replaced. Remove fins and burrs from pipe and fittings. Before the pipe is laid, the interior of the joint of the preceding pipe and fitting shall be carefully cleaned. After each section of the pipe has been laid to line and grade and jointed to the preceding section, and after jointing procedure has commenced, there shall be no movement of the pipe in subsequent operations.
- E. Take care to place sand under the haunches on either side of the pipe. Lay bell and spigot pipe with the bell end pointing in the direction of laying. Drainage and sewerage pipe shall be laid uphill commencing at the lowest invert elevation. Grade the pipeline in straight lines, taking care to avoid the formation of any dips or low points. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints and couplings.

- F. Before the Contractor leaves the work at any time, the pipe shall be securely closed at its open end. After the work is completed, the pipe shall be carefully and thoroughly cleaned of all refuse, earth or any objectionable material.

### 3.03 STRUCTURES AND APPURTENANCES

- A. Structures and appurtenances shall be installed at the locations and to the lines and dimensions and/or as herein specified.
- B. Valves shall be set plumb and valve boxes shall be centered over valve stems.
- C. Connections in manholes shall be constructed with concrete channels directed toward the outlet pipe or as indicated on the plans.
- D. Penetrations into manholes, vaults and building walls shall be by preformed breakout or coredrill holes. Breakout or coredrill holes in concrete structures shall be grouted all around to prevent groundwater infiltration.

**END OF SECTION 33 00 00**

**SECTION 33 30 00 - SANITARY SEWERAGE UTILITIES**

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Sanitary sewer pipelines.
2. Pipeline testing.

B. Related work in other Sections:

1. Trenching, backfilling and compacting: Section 31 23 33.
2. Piped Utilities: Section 33 00 00.

1.02 QUALITY ASSURANCE

- A. Reference Standards: Applicable provisions of the Sanitation Agency Design and Construction Standards govern the work of this Section.

1.03 SUBMITTALS

A. Submit the following:

1. Product data for sanitary sewer piping specialties.
2. Shop Drawings for pre-cast concrete sewer manholes, cleanout boxes, including frames and covers.

2.00 PRODUCTS

2.01 SANITARY SEWER PIPES

A. One of the following:

1. Vitrified clay pipe (VCP) conforming to ASTM C700. Pipe shall be extra strength, unglazed, with bell and spigot joints conforming to ASTM C425 per Sanitation Agency Standards.
2. Polyvinyl chloride (PVC) pipe per ASTM D3034, SDR 26.

2.02 MANHOLES

## SANITARY SEWERAGE UTILITIES

- A. Manholes: Precast concrete of the size and shape shown on the Drawings and conforming to ASTM C478. Equivalent cast-in-place structures may be used at the Contractor's option per Sanitation Agency Standards.
- B. Frames and covers: Cast iron conforming to Section 55-2.03 and 75-1.02 of the CDT Standard Specifications. Manhole covers shall have the words SANITARY SEWER in letters not less than 2" high cast into the cover. The clear opening for manhole covers shall be 24"; Phoenix Iron Works P-1090 or equal per Sanitation Agency Standards.

## 3.00 EXECUTION

## 3.01 PIPELINE TESTING

- A. New sections of sanitary sewer shall be air tested in accordance with the Sanitation Agency Standards or using the following procedures:
  - 1. Test is conducted between two consecutive manholes, or as directed by the Owner's Representative.
  - 2. The test section of the sewer line is plugged at each end. One of the plugs used at the manhole must be tapped and equipped for the air inlet connection for filling the line from the air compressor.
  - 3. 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 leakage by slippage and blow outs.
  - 4. Connect air hose to tapped plug selected for the air inlet. Then 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 to the sewer test section and to monitor the air pressure in the pipe line. 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 .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 pipe line 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 or plug, release pressure in the line and tighten leaky caps

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and plugs. Then start the test operation again by supplying air. When it is necessary to bleed of the air to tighten or repair a faulty plug, a new five minute interval must be allowed after the pipe line 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 reaches 3.0 psig. At 3.0 psig commence timing with a stop watch which is allowed to run until the line pressure drops to 2.5 psig at which time the stop watch is stopped. The timer required, as shown on the stop watch, 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 to drop from 3.0 to 2.5 psig 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 the 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.

## Time Requirements for Air Testing

Pipe Size (In Inches)	Time	
	Min.	Sec.
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	45
21	13	30

(For larger diameter pipe, use the following: Minimum time in seconds = 462 x pipe diameter in feet)

11. For 8" and smaller pipe, only: If, during the five 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" or larger diameter pipe and includes 4" or 6" 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 Owner's designated representative 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 ground water.
  - 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 0.433 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 ½" diameter pipe nipple (threaded one or both ends, approx. 10" long) through the manhole wall directly on top of one of the sewer pipes entering the manhole with threaded end of nipple entering inside the manhole.
    - 2) Seal pipe nipple with a threaded ½" 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 obstructions, and then connecting a clear plastic tube to the pipe nipple.
    - 4) Hold plastic tube vertically permitting water to rise in it to the ground water 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' the additional air pressure required would be:

$$\frac{(11.55)}{(2.31)} = 5.0 \text{ psig}$$

Therefore, the starting pressure of the test would be 3.0 plus 5 or 8.0 psig, and then 1/2 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.

**END OF SECTION 33 30 00**