

the centerline of each run of items such as are described in subparagraph 3.01-E-1 above.

- a. Clearly identify the item by accurate note such as "cast iron drain", "galvanized water", and the like.
 - b. Show, by symbol or note, the vertical location of the item ("under slab", "in ceiling plenum", "exposed", and the like).
 - c. Make all identification sufficiently descriptive that it may be related reliably to the Specifications.
3. The Architect may waive the requirements for conversion of schematic layouts where, in the Architect's judgment, conversion serves no useful purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Architect.

3.02 FINAL PROJECT RECORD DOCUMENTS

- A. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.
- B. Acceptance of recorded data prior to transfer:
 1. Following receipt of the transparencies described in Paragraph 2.01-b above, and prior to start of transfer of recorded data thereto, obtain the Architect's acceptance of all recorded data.
 2. Make required revisions.
- C. Transfer of data to Drawings:
 1. Carefully transfer change data shown on the job set of Record Drawings to the corresponding transparencies, coordinating the changes as required.
 2. Clearly indicate at each affected detail and other Drawing a full description of changes made during construction, and the actual location of items described in subparagraph 3.01-E-1 above.
 3. Call attention to each entry by drawing a "cloud" around the area or areas affected.
 4. Make changes neatly, consistently, and with the proper media to assure longevity and clear reproduction.
- D. Transfer of data to other Documents:
 1. If the Documents other than Drawings have been kept clean during progress of the Work, and if entries thereon have been orderly to the acceptance of the Architect, the job set of those Documents other than Drawings will be accepted as final Record Documents.
 2. If any such Document is not so accepted by the Architect, secure a new copy of that Document from the Architect at the Architect's cost for reproduction and handling, and carefully transfer the change data to the new copy to the acceptance of the Architect.
- E. Review and Submittal:
 1. Submit the completed set of Project Record Documents to the Architect as described in Paragraph 1.03-C above.
 2. Participate in review meetings as required.
 3. Make required changes and promptly deliver the final Project Record Documents to the Architect.

3.03 CHANGES SUBSEQUENT TO ACCEPTANCE

The Contractor has no responsibility for recording changes in the Work subsequent to Final Completion, except for changes resulting from work performed under Warranty.

***** END OF SECTION *****

SECTION 01730
OPERATION AND MAINTENANCE ITEMS

PART 1 -- GENERAL

1.01 SUMMARY

- A. Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.
- B. Work Included: To aid the continued instruction of operating and maintenance personnel, and to provide a positive source of information regarding the products incorporated into the Work, furnish and deliver the data described in this Section and in pertinent other Sections of these Specifications.

1.02 QUALITY ASSURANCE

In preparing data required by this Section, use only personnel who are thoroughly trained and experienced in operation and maintenance of the described items, completely familiar with the requirements of this Section, and skilled in technical writing to the extent needed for communicating the essential data.

1.03 SUBSTITUTIONS

Substitutions will be considered per Article 3.11 of the General Conditions, Project Manual Section 00600.

1.04 SUBMITTALS

- A. In accordance with Article 3 of the General Conditions, Project Manual Section 00600.
- B. Submit two copies of a preliminary draft of the proposed Manual or Manuals to the Architect for review and comments.
- C. Unless otherwise directed in other Sections, or in writing by the Architect, submit (3) three copies of the final Manual to the Architect prior to indoctrination of operation and maintenance personnel.

PART 2 -- PRODUCTS

2.01 OPERATION MANUALS

- A. Where instruction Manuals are required to be submitted under other Sections of these Specifications, prepare in accordance with the provisions of this Section.
- B. Reference Chart: See Section 01900 – List of Project Close-Out Items for summary of Sections that require submittal of Operation Manuals.
- C. Format:
 - 1. Size: 8-1/2" x 11"
 - 2. Paper: White bond, at least 20 lb. weight
 - 3. Text: Neatly written or printed
 - 4. Drawings: 11" in height preferable; bind in with text; fold-out acceptable; larger drawings acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.
 - 5. Flysheets: Separate each portion of the Manual with neatly prepared flysheets briefly describing contents of the ensuing portion; flysheets may be in color.
 - 6. Binding: Use heavy-duty plastic or fiberboard covers with binding mechanism

concealed inside the Manual; 3-ring binders will be acceptable; all binding is subject to the Architect's acceptance.

7. Measurements: Provide all measurements in U.S. standard units such as feet-and-inches, lbs., and cfm.
- D. Provide front and back covers for each Manual, using durable material accepted by the Architect, and clearly identified on or through the cover with at least the following information:

OPERATING AND MAINTENANCE INSTRUCTIONS:

Name and Address of Work

Name of Contractor

General Subject of this Manual

Space for Signature of the Architect and Date

- E. Contents: Include at least the following:
1. Neatly typewritten index near the front of the Manual, giving immediate information as to location within the Manual of all emergency information regarding the installation.
 2. Complete instructions regarding operation and maintenance of all equipment involved including lubrication, disassembly, and reassembly.
 3. Complete nomenclature of all parts of all equipment.
 4. Complete nomenclature and part number of all replacement parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.
 5. Copy of all guarantees and warranties issued.
 6. Manufacturer's bulletins, cuts, and descriptive data, where pertinent, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturer's data with which this installation is not concerned.
 7. Such other data as required in pertinent Sections of these Specifications.

2.02 INSTRUCTION MANUALS

A. Preliminary:

1. Prepare a preliminary draft of each proposed Manual.
2. Show general arrangement, nature of contents in each portion, probable number of drawings and their size, and proposed method of binding and covering.
3. Secure the Architect's acceptance prior to proceeding.

B. Final: Complete the Manuals in strict accordance with the accepted preliminary drafts and the Architect's review comments.

C. Revisions: Following the indoctrination and instruction of operation and maintenance personnel, review all proposed revisions of the Manual with the Architect.

*** END OF SECTION***

SECTION 02050
DEMOLITION & SALVAGE

PART 1 - GENERAL

1.01 **GENERAL REQUIREMENTS**

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 **SECTION INCLUDES**

- A. The Contractor shall provide demolition and removal of existing structural materials, piping, fencing, electrical gear, equipment and structures in accordance with the requirements of the Contract Documents. The Contractor shall conduct demolition operations so that the existing facilities to remain and new work to be completed will not be damaged or disturbed.
- B. It is vital that the existing utility system remains in operation at all times. Any proposed shut-down of any one of the systems facilities shall be coordinated and approved by the Construction Manager.
- C. The Contractor shall repair or replace, without cost to the Owner and to the satisfaction of the Construction Manager, existing facilities disturbed or damaged during demolition and removal operations.
- D. Immediately upon removal of demolition items, the Contractor shall legally dispose of demolished items not to be salvaged. Demolished items not to be salvaged shall be removed from the Site within two (2) calendar days of the commencement of demolition activities. Unless noted in the Plans, the Owner reserves the right to salvage any of the existing material or equipment. The Contractor, upon being notified by the Construction Manager, shall salvage and relocate to an Owner-designated, on-site storage area any materials or equipment the Owner desires to keep. The cost of the removal and relocation of the items shall be included in the contract price. No demolished items shall be sold while on the Owner's property.
- E. The Contractor shall patch and seal abandoned openings and holes left as a result of removal and demolition to match the existing surrounding structure. Openings in concrete shall be patched with a non-shrink grout and if necessary grouted openings in floors shall be supported in a manner approved by the Construction Manager. Large openings shall be supported by ¾-inch minimum treated plywood bolted to the structure underneath the opening prior to the placement of the non-shrink grout.
- F. Existing concrete structures exhibiting spalls or holes not related to previously installed mechanical equipment shall be patched with a non-shrink grout.

1.03 **SUBMITTALS**

Provide in accordance with Article 5 of the General Conditions.

1.04 **PRODUCT HANDLING**

Comply with the requirements of Section 01620.

1.05 **WARRANTY:**

Comply with the requirements of General Conditions Article 5.

*****END OF SECTION*****

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SECTION 02200

EARTHWORK

PART 1 – GENERAL

1.01 **GENERAL REQUIREMENTS**

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 **SECTION INCLUDES**

The Work of this Section includes all earthwork required for construction of the Work. Earthwork shall include, but not be limited to the loosening, removing, loading, transporting, depositing and compacting in its final location of all materials wet and dry, as required for the purposes of completing the work specified in the Contract Documents which shall include, but not be limited to: the sawcutting and removal of A.C. pavement, P.C.C. concrete and underlying material to a subbase design grade indicated on the Plans, the installation of subbase material to a subbase grade beneath A.C. pavement and concrete infrastructure, the excavation of pipeline trenches, the installation of backfill material within pipeline trenches, excavations for above-grade and below-grade structures, backfill requirements for material to be placed beneath above-grade and below-grade structures, backfill requirements for the areas surrounding above-grade and below-grade structures, backfilling of manholes and catch basins, construction of earth embankments, backfilling of depressed areas, abandoned ponds or depressed areas resultant from demolition, the disposal of excess excavated materials, borrow of materials to make up deficiencies for fills; and all other incidental earthwork, all in accordance with the requirements of the Contract Documents.

Principal work items included in this Section are:

- A. Site preparation, clearing and grubbing.
- B. Preparation of fill areas.
- C. Excavation and controlled fill construction.
- D. Structural excavation and backfills.
- E. Disposal of surplus and/or unsuitable materials.
- F. Dust control and drainage control.
- G. Grading
- H. Clean-up.

1.03 **REFERENCE STANDARDS**

ASTM C 131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D 75	Practice for Sampling Aggregates
ASTM D 422	Method for Particle-Size Analysis of Soils
ASTM D 698	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Rammer and 12-in (304.8-mm) Drop
ASTM D 1556	Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	Test Method for Moisture-Density Relations of Soils Using Rammer and Drop
ASTM D 1682	Test method for Breaking Load and Elongation of Textile Fabrics

ASTM D 2419	Test method for Sand Equivalent Values of Soil and Fine Aggregate
ASTM D 2487	Classification of Soils for Engineering Purposes
ASTM D 2922	Test Method for Density of Soil in Places by Nuclear Methods (Shallow Depth)
ASTM D 3017	Test method for Water Content of Soil and Rock in Place by Nuclear Methods
ASTM D 3776	Test Method for Mass Per Unit Area (Weight) of Woven Fabric
ASTM D 4253	Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Plate
ASTM D 4254	Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D 4751	Test Method for Determining the Apparent Opening Size of a Geotextile
CAL-OSHA	Title 8 General Industry Safety Orders

1.04 DEFINITIONS

- A. Site: The property owned by the County of Riverside.
- B. Controlled Fill: Compacted suitable fill material in all areas of the site requiring filling to grade as shown on the Plans.
- C. Structural Fill: Compacted suitable fill material which will support a structure or some part of a structure. This includes support material for P.C.C. structures and pads
- D. Structural Backfill: Compacted suitable material placed between the wall of a structure and construction excavation slope up to finished grade.
- E. Suitable Material: As specified herein shall be any material imported or excavated from the cut areas that is, in the opinion of the Engineer, suitable for use in constructing fills.
- F. Waste Excavation: Also Surplus Material. Material from project excavations which is not suitable for use in backfill or compacted fills or is in excess of that required to be used for backfill or to construct fills.
- G. Pipe Zone Backfill: Material suitable for placement below or surrounding the pipe to a given vertical distance above the pipe as required by the pipe section.
- H. Pipe Trench Backfill: Material suitable for placement from the pipe zone to finish grade or to pavement subbase material.

1.05 SITE INVESTIGATION

- A. Soil Investigation Report: A Geotechnical Report has been prepared for this project and is available for review at the Construction Manager's office. The Soils Report is not a part of the Contract Documents and is for information only.
- B. Contractor's Responsibility: The Contractor shall carefully examine the site and make all inspections necessary in order to determine the full extent of the work required to make the completed Work conform to the Plans and Specifications. The Contractor shall satisfy himself/herself as to the nature and location of the Work, conditions, the conditions of the existing ground surface, and the character of equipment and facilities needed prior to and during prosecution of the Work. The Contractor shall satisfy himself/herself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered. The Contractor shall review water table conditions. Any inaccuracies or discrepancies between the actual field conditions and the Plans, or between the Plans and Specifications must be brought to the Engineer's attention in order to clarify the exact nature of the Work to be performed.

- C. Existing Elevations: All existing elevations illustrated on the Plans are approximate. The Contractor shall recognize and acknowledge the condition that the bid lump sum price shall include all earthwork activities irrespective of the possible localized difference in contour elevations and actual ground; and that there will be no additional compensation from the Owner for earthwork changes, engineering, or field staking in this regard.

1.06 SAFETY

The Contractor shall familiarize himself/herself with, and shall at all times conform to, the regulations of the "OSHA General Industry Occupational Safety and Health Standards", and "OSHA Safety and Health Regulations for Construction Safety Orders" and "Trench Construction Safety Orders" of the State of California, Department of Industrial Relations, Division of Occupational Health and Safety. A copy of these documents shall be kept on the job site.

1.07 ENVIRONMENTAL SAFEGUARDS AND REGULATIONS

The Contractor shall comply with regulations in force at all times to prevent pollution of air and water. The Contractor shall be responsible for the construction of Project Environmental Control facilities in accordance with Section 01560 of Division 1, as applicable.

1.08 GEOTECHNICAL TESTING

The County of Riverside shall provide the services of a qualified Geotechnical Consultant to perform the required earthwork geotechnical testing specified within the contents of the Plans and Specifications. The cost for the Geotechnical Testing shall be borne by the County of Riverside. A copy of all tests shall be forwarded to the Engineer within four (4) days after the testing is complete. Geotechnical Earthwork Testing shall include in-situ native soil compaction testing, moisture-density soils testing, compaction testing, gradation testing, sand equivalent testing and similar testing. The Contractor shall bear the cost of retest and re-inspection of re-worked material due to faulty work.

1.09 STANDARDS FOR SOIL CLASSIFICATION, PROPERTIES AND TESTS

A. Earthwork and Embankment:

1. Classification - ASTM D 2487.
2. Physical Properties - ASTM D 854, D 2216.
3. Compaction - Modified Proctor ASTM D 1557-91.

B. Backfill for Trench:

1. Classification - ASTM D 2487.
2. Compaction - Modified Proctor ASTM D 1557-91.
3. Field Density Test - ASTM 1556-82; D 2937-83, D 2922-81 (as approved by Engineer).

C. Structural Fill and Backfill:

1. Classification - ASTM D 2487.
2. Attenberg Limits - PlastiOwner Index and Liquid Limit ASTM D 4318.
3. Compaction - Modified Proctor ASTM D 1557-91.
4. Physical Properties - ASTM D 854, D 2216.
5. Field Density Test - ASTM D 1556-82, D 2937-83, D 2922-81 (as approved by Engineer).

D. Controlled Fills:

1. Classification - ASTM D 2487.

2. Physical Properties - ASTM D 854, D 2216.
3. Compaction - Modified Proctor ASTM D 1557-91.
4. CBR - ASTM D 1883 (R-Value - ASTM 2844).
5. Field Density Test - ASTM D 1556-82, D 2937-83, D 2922-81 (as approved by Engineer).

E. Earth Embankments and Berms:

1. Classification - ASTM D 2487.
2. Physical Properties - ASTM D 854, D 2216.
3. Compaction - Modified Proctor ASTM D 1557-91
4. CBR - ASTM D 1883.
5. Field Density Test - ASTM D 1556-82, D 2937-83, D 2922-81 (as approved by Engineer).

F. Borrow:

1. Classification - ASTM D 2487.
2. Other properties - as determined by requirements at point of use.

G. Pipe Trenches:

1. Classification - ASTM D 2487.
2. Physical Properties - ASTM D 854, D 2216.
3. Compaction - Modified Proctor ASTM D 1557-91.
4. CBR - ASTM D 1883.
5. Field Density Test - ASTM D 1556-82, D 2937-83, D 2922-81 (as approved by Engineer).

1.10 COMPACTION

The maximum dry density, optimum moisture content and field density of each soil type used in the controlled compacted fill shall be determined as stated in Section 1.09 above.

1.11 INSPECTION

Observation and compaction tests shall be obtained by the Geotechnical Consultant engaged by the City of Yucaipa during the filling and compacting operations.

The Geotechnical Consultant shall be required to be present at the site on a full-time basis for several work activities and conduct intermittent testing for other work activities. The following chart indicates the earthwork items which will require full time or intermittent geotechnical testing.

ITEM NO.	ITEM	GEOTECHNICAL TESTING
1.	Excavation and scarification process	Full-time Inspection

ITEM NO.	ITEM	GEOTECHNICAL TESTING
2.	Backfill for Water Pipe, Storm Drainage Pipe, Sanitary Sewer Pipe and Irrigation Pipe Trenches. The Specification requires that the backfill be compacted in lifts. Additional lifts shall not be allowed to be placed until previous lifts have been satisfactorily tested for compaction.	Intermittent Testing
3.	Backfill for Electrical Conduit Trenches. The specification requires that the backfill be compacted in lifts. Additional lifts shall not be allowed to be placed until previous lifts have been satisfactorily tested for compaction. This requirement shall be strictly enforced and the Contractor shall be required to remove all backfill from the electrical conduit trench if this specification is violation.	Intermittent Testing
4.	Over excavation and recompaction of subgrade material	Intermittent Testing
5.	Installation of Class 2 Base for Site Grading.	Intermittent Testing
6.	Installation of Granular Sand for P.C.C. Infrastructure Subbase Material	Intermittent Testing
7.	Installation of Granular Sand for Water Pipelines, Stormwater Drainage Pipelines and Sanitary Sewer pipelines.	Intermittent Testing
8.	Existing Retention Basin Preparation	Intermittent Testing
9.	Building Pad Preparation	Intermittent Testing

1.12 WARRANTY

Comply with the requirements of General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Engineered Fill Material: Materials for engineered fill shall consist of any material imported or excavated from the *cut areas* that, in the opinion of the Engineer, is appropriate for use in

constructing fills. The on-site soils are suitable for use as compacted fill. Native and imported materials should be placed in lifts no greater than 8 inches in loose thickness, uniformly moisture conditioned to between optimum moisture and 4% over optimum moisture, and re-compacted to at least 90% of ASTM D1557 maximum density, except in the building pad when it shall be at least 95%.

Imported fill soils should consist of non-expansive (Expansion Index less than 10) granular soils that meet the USCS classifications of SM, SP-SM, with a maximum rock size of 3 inches, and 5 to 35% passing the No. 200 sieve. The geotechnical engineer should approve the fill soils prior to importing.

In areas other than the building pad which are to receive concrete slabs and asphalt concrete pavement, the ground surface should be over-excavated to a depth of 12 inches, uniformly moisture conditioned to $\pm 2\%$ over optimum moisture, and re-compacted to at least 90% of ASTM D1557 maximum density.

Trench Backfill: On-site soil free of debris, vegetation, and other deleterious matter may be suitable for use as utility trench backfill. Backfill within roadways should be placed in layers not more than 6 inches in thickness, uniformly moisture conditioned to between optimum moisture and 4% over optimum moisture, and mechanically compacted to a minimum of 90% of the ASTM D1557 maximum dry density except for the top 12 inches of the trench which shall be compacted to at least 95%. Trench backfill should only be placed and compacted after encapsulating buried pipes with suitable bedding and pipe envelope material.

Representative samples of material to be used for fill shall be tested in the laboratory by the Geotechnical Engineer in order to determine the maximum density, optimum moisture content, sand equivalent and classification of the soil. In addition, the Geotechnical Engineer shall determine the approximate bearing value of a recompacted saturated sample by direct shear tests or other tests applicable to the particular soil.

During grading operations, soil types other than those analyzed in the report of the soil investigation may be encountered by the Contractor. The Geotechnical Engineer shall be consulted to determine the suitability of these soils. The Contractor shall bear the expenses of the Geotechnical investigation.

- B. Structural Fill Material: Materials shall consist of crushed rocks, Class 2 Base, granular sand, decomposed granite (crusher fines) or fine gravel either imported or manufactured from excavated onsite rocky material.

The crushed aggregate, granular sand, decomposed granite (crusher fines) or fine gravel shall be uniformly graded. The following gradations shall apply:

1. Granular Sand:

Clean granular sand free of clay, shale and deleterious material. Sand shall be compacted to 95 percent of maximum density at optimum water content per ASTM D 1557 unless otherwise noted on the Plans. The material shall conform to a sand equivalent of 30 or greater. The maximum amount of material passing the Number 200 sieve shall be 5 percent. The sand shall conform to the following gradation percentages:

<u>SIEVE SIZE</u>	<u>GRANULAR SAND</u> <u>% PASSING</u>
3/8"	100
No. 4	98-90

No. 8	90-75
No. 10	75-60
No. 16	60-50
No. 30	50-38
No. 40	38-29
No. 50	29-19
No. 100	19-7
No. 200	5-0

The Contractor shall supply a 5-gallon sample of sand material to the material testing laboratory within five (5) days after the Notice to Proceed is issued. The gradation, sand equivalent and maximum density of the sand material shall be determined. The test results shall be forwarded to the Engineer. The cost of testing shall be incurred by the Contractor. The gradation of the granular sand shall be determined and the test results forwarded to the Engineer prior to the delivery of the granular sand material to the Site. Prior to the placement of sand the native subbase grade shall be checked and approved by the Engineer.

Crusher fines shall be allowed to be utilized in lieu of sand if approved by the Engineer.

2. Crusher Fines:

Crusher fines shall consist of decomposed granite indigenous to the Imperial Valley. Crusher fines utilized for this project shall conform to the following gradation requirements:

<u>SIEVE SIZE</u>	<u>PERCENT PASSING</u>
5/8"	100
No. 4	80-100
No. 8	50-85
No. 30	30-50
No. 200	4-15

The sand equivalent shall be 20 or greater.

The Contractor shall supply a five-gallon sample of crusher fines material to the material testing laboratory within five (5) days after the Notice to Proceed is issued. The Gradation and Maximum Density of the crusher fines material shall be determined. The test results shall be forwarded to the Engineer for approval prior to the delivery of the material to the Site. The cost of the testing shall be incurred by the Contractor.

3. Fine Gravel:

Clean fine gravel free of clay, shale and deleterious material. Fine gravel shall be compacted with a plate compactor with one pass in maximum 1 foot lifts. Additional lifts shall not be added until previous lifts shall have been passed over by the plate

compactor. The maximum amount of material passing the 1/4" Sieve shall be 2 percent. The fine gravel shall conform to the following gradation percentages:

<u>SIEVE SIZE</u>	<u>PERCENT PASSING</u>
3/8"	100
1/4"	0-2

The Contractor shall supply a five-gallon sample of fine gravel material to the material testing laboratory within five (5) days after the Notice to Proceed is issued. The Gradation and Maximum Density of the fine gravel material shall be determined. The test results shall be forwarded to the Engineer for approval prior to the delivery of the material to the Site. The cost of the testing shall be incurred by the Contractor.

4. Class 2 Base:

The Class 2 Base material shall conform to Caltrans Section 26, Latest Edition, for 25mm maximum base material. The gradation requirements are as follows:

<u>SIEVE SIZE</u>	<u>CLASS 2 BASE</u> <u>% PASSING</u>
1"	100
3/4"	87-100
No. 4	30-65
No. 30	5-35
No. 200	0-12

The sand equivalent shall be 25 or greater. An angular aggregate is to be used. Class 2 Base material shall be compacted to 95 percent of maximum density according to ASTM D 1557, unless otherwise noted on the Plans or Details. The tolerance for the Class 2 Base between design subgrade elevation and actual subgrade elevation as constructed in the field shall be plus or minus 0.02 feet as referenced from the design subgrade. Prior to the placement of Class 2 Base, the native subbase grade shall be checked and approved by the Engineer. The native subbase grade shall be within plus or minus 0.05 feet of native subbase design grade prior to the placement of Class 2 Base.

The Contractor shall supply a 5-gallon sample of the Class 2 Base to the material testing laboratory within four (4) days of the Notice to Proceed. The material shall be delivered to the testing laboratory to determine the maximum density, gradation, R-value, sand equivalent and durability index of the Class 2 Base. A copy of the test results shall be forwarded to the Engineer by the Geotechnical Consultant for review. The gradation of the Class 2 Base shall be determined and the test results forwarded to the Engineer for approval prior to the delivery of the Class 2 Base material to the Site. *Class 2 Base utilizing recycled materials shall not be allowed.*

- C. Structural Backfill Material: Structural Backfill Material shall consist of the same material listed with the Structural Fill Material item above.

PART 3 – EXECUTION

3.01 GENERAL

The Work performed under this Specification shall be constructed to the lines, grades, elevations, slopes and cross-sections indicated on the Plans, specified herein, and/or directed by the Owner. Slopes, graded surfaces, and drainage features shall present a neat uniform appearance upon completion of the Work.

It shall be the Contractor's responsibility (1) to maintain adequate safety measures and working conditions; and (2) to take all measures necessary during the performance of the Work to protect the entire project area and adjacent properties which would be affected by this Work from storm damage, flood hazard, caving of trenches and embankments, and sloughing of material, until final acceptance by the Owner. It shall be the Contractor's responsibility to maintain completed areas until the entire project area is in satisfactory compliance with the job specification.

Utility lines and structures indicated on the Plans which are to remain in service shall be protected by the Contractor from any damage as a result of his/her operation. Where utility lines or structures not shown on the Plans are encountered, the Contractor shall report them to the Owner before proceeding with the Work. The Contractor shall bear the cost of repair or replacement of any utility lines or structures which are broken or damaged by his/her operations.

3.02 REMOVALS, CLEARING AND GRUBBING

- A. Clearing: Clearing consists of the complete removal of objectionable materials and obstructions above and below the ground surface including tree stumps, brush, grass, vegetative matter and other objectionable materials within the project limits. All brush and organic material shall be removed before placing any earth fills. It shall be the Contractor's responsibility to save and protect all trees that lie outside the construction area.
- B. Grubbing: Grubbing consists of the complete removal of stumps, including tap roots or lateral roots 1-1/2 inches or more in diameter, and the removal of brush, grass or weeds to depths below the natural ground as specified herein. Stumps shall be grubbed to a depth of 3 feet and grass or weeds shall be grubbed to a depth of 6 inches below the natural ground surface, or to the depths as determined in the field by the Engineer at the time of construction.
- C. Protection: Existing items not designated to be demolished or removed shall be protected from damage. Any such item damaged by the Contractor shall be restored or replaced immediately at the Contractor's expense.
- D. Debris and Waste Material: All debris and waste material resulting from demolition, clearing and grubbing shall be removed from the site and disposed of by the Contractor.

3.03 DUST CONTROL

The Contractor shall take all steps possible to prevent and reduce dust arising from the construction activity. Section 01560 Project Environmental Controls elaborates on dust control requirements.

3.04 CARE OF DRAINAGE WATER

Contractor shall take care of drainage water from the construction operations, and of stormwater and/or wastewater reaching the construction area from any source, so that damage is not incurred to the excavation, pipe or structures. The Contractor shall be responsible for any damages to persons or property on or off the Site due to such drainage water or to the interruption or diversion of such stormwater or wastewater on account of his/her operation.

Such grading shall be accomplished as may be necessary to prevent surface water from flowing into excavations, and any water accumulating therein shall be removed by pumping or by other reviewed methods.

Protection of the site during construction shall be the responsibility of the Contractor. Completion of a portion of the project shall not preclude that portion or adjacent areas from the requirements for site protection until such time as the entire project is complete.

3.05 EXCAVATION

- A. General: The Contractor shall perform all excavation necessary or required as illustrated on the Plans. The excavation shall include the removal and disposal of all earth materials of whatever nature encountered, which shall include both rock excavation and common excavation when both are present, and shall include the furnishing, placing and maintaining of shoring and bracing necessary to safely support the sides of the excavations. The Work shall also include all pumping, ditching and other required methods for the removal or exclusion of water. See Division 2 Section 02150 Sheeting, Shoring and Bracing;
- B. Excavation for Structures: Structure excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the Work. The removal of such materials shall conform to the lines and grades shown on the Plans and/or herein specified. Temporary structure excavations shall at all times conform to the Requirements of the State of California, Division of Occupational Health and Safety, and pertinent requirements contained in referenced Geotechnical Investigation Report and Specification Section 02150 - Sheeting, Shoring and Bracing.

All trench excavations should conform to Cal/OSHA requirements for Type C soil. The contractor is solely responsible for the safety of workers entering trenches. Temporary excavations with depths of 4 feet or less may be cut nearly vertical for short duration. Temporary slopes should be no steeper than 1.5H:1V. Sandy soil slopes should be kept moist, but not saturated, to reduce the potential of raveling or sloughing.

Trench excavations deeper than 4 feet will require shoring or slope inclinations in conformance to Cal/OSHA regulations for Type C soil. Surcharge loads of stockpiled soil or construction materials should be set back from the top of the slope a minimum distance equal to the height of the slope. All permanent slopes should not be steeper than 3:1 to reduce wind and rain erosion. Protected slopes with ground cover may be as steep as 2:1. However, maintenance with motorized equipment may not be possible at this inclination.

Existing Retention Basin Preparation: Loose soils at the bottom of the retention basin should be removed. The exposed natural sub-grade should be scarified to a depth of 8 inches, uniformly moisture conditioned to $\pm 2\%$ over optimum moisture, and re-compacted to at least 90% of ASTM D1557 maximum density. Fill should be placed and compacted on benches cut into the side slopes of the basin.

Building Pad Preparation: The existing surface soils within the building pad area, outside the top of the basin side slopes, should be removed to 4 feet below the lowest foundation grade or 5 feet below the existing grade (whichever is deeper), extending five feet beyond all exterior wall/column lines. The exposed sub-grade should be scarified to a depth of 8 inches, uniformly moisture conditioned to $\pm 2\%$ over optimum moisture, and re-compacted to at least 90% of ASTM D1557 maximum density.

Loose soils existing below depths of 5 feet, such as those found to a depth of 10 feet within the south-east corner of the proposed building pad area (refer to soil boring B-4 location of the Geotechnical Investigation Report), will require removal and replacement with compacted fill. After the over-excavation of the loose soils, a minimum related compaction of 85% of the exposed soils in the building limits and five feet laterally beyond, should be present prior to placement of engineered fill. If 85% relative compaction is not encountered, then additional removals will be required until 85% relative compaction is attained. After verification of 85%

relative compaction of the exposed sub-grade soils, the engineered building pad should be constructed in accordance with above paragraph.

Moisture Control and Drainage: The moisture condition of the building pad should be maintained during trenching and utility installation until concrete is placed or should be rewetted before initiating delayed construction. If soil drying is noted, a 2 to 3 inch depth of water may be used in the bottom of footings to restore footing subgrade moisture and reduce potential edge left.

Auxiliary Structures Foundation Preparation: Auxiliary structures such as free standing or retaining walls should have the existing soil beneath the structure foundation prepared in the manner recommended for the building pad except the preparation needed only to extend 3 feet below and beyond the footing.

Contingent upon locations, all surfaces to receive compacted fill shall be scarified, brought to near optimum moisture content and compacted to required percentage of relative compaction as specified herein unless otherwise indicated on the Plans.

Rough grade excavations for structures and footings will be inspected by the Geotechnical Engineer to verify that the excavations extend into satisfactory soils and are free of loose and disturbed materials.

3.06 CONTROLLED FILL

- A. General: Controlled fill shall consist of native material, granular sand, Class 2 Base, crusher fines or other material as indicated on the Plans. The subbase grade shall be excavated to within plus or minus 0.05 feet of design grade prior to the placement of controlled fill. The design subbase grade shall be field verified and approved by the Engineer prior to the placement of the controlled fill material. The Engineer shall determine the number and location of points to check for the subbase grade elevation compliance. Prior to the Engineer's inspection of the subbase grade, the Contractor shall establish bluetop stakes on a 20-foot by 20-foot grid across the area controlled fill is to be placed.

If the controlled fill consists of native material it shall be placed in maximum 8-inch lifts and compacted to 90 percent of maximum density (except in the building pad when it shall be at least 95%) at optimum water content per ASTM D 1557 unless otherwise required by the Geotechnical Report. Additional native soil lifts shall not be placed until previous lifts have attained the specified compaction requirement and are approved by both the on-site geotechnical representative and the Engineer.

Granular sand, Class 2 Base and crusher fine controlled fill material shall be placed in maximum 8-inch lifts and compacted to 95 percent of maximum density at optimum water content per ASTM D 1557. Additional granular sand, Class 2 Base or crusher fine lifts shall not be placed until previous lifts have attained the specified compaction requirement and are approved by both the on-site geotechnical representative and the Engineer.

- B. Preparing Areas To Be Filled: All vegetation and objectionable material shall be removed by the Contractor from the surface upon which the fill is to be placed and any loose and porous soils shall be removed or compacted to a depth specified by the Geotechnical Engineer. The surface shall then be plowed or scarified to a minimum depth of 6 inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

When placing fill in horizontal lifts adjacent to areas sloping steeper than 5:1 (horizontal:vertical), horizontal keys and vertical benches shall be excavated into the adjacent slope area. Keying and benching shall be sufficient to provide at least 6-foot wide benches and a minimum of 4 feet vertical bench height within the firm natural ground, firm bedrock or engineered compacted fill. No compacted fill shall be placed in an area subsequent to keying and benching until the area has been reviewed by the Geotechnical Engineer. Material generated by the benching operation shall be moved sufficiently away from the bench area to allow for the review of the horizontal bench prior to placement of fill.

After the foundation for the fill has been cleared, plowed or scarified, it shall be disced or bladed by the Contractor until it is uniform and free from large clods, brought to the proper moisture content and compacted as specified.

- C. Placing, Spreading and Compacting Fill Material: The fill material shall be placed by the Contractor in thin layers that when compacted shall not exceed 8 inches for granular sand, Class 2 Base, crusher fines and native material. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material in each layer.

When the moisture content of the fill material is below that required by the Geotechnical Engineer, water shall be added by the Contractor until the moisture content is increased or decreased as required for the specified compaction.

When the moisture content of the fill material is above that required by the Geotechnical Engineer, the fill material shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the moisture content is as required for the specified compaction.

After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted by the Contractor to the specified density. Compaction shall be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers or other types of acceptable compacting equipment. Equipment shall be of such design that it shall be able to compact the fill to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes over the material to ensure that the desired density has been obtained.

Compacted fill slopes shall be overbuilt and cut back to grade, exposing the firm, compacted inner core. The slopes shall be overbuilt a minimum of five feet (5'). If the desired compaction is not achieved, the existing slope shall be overexcavated and reconstructed. The amount of overbuilding shall be increased until the desired compaction is achieved on the slope. The Contractor shall provide thorough mechanical compaction to the outer edge of the overbuilt slope surface. There shall be no excessive loose soil on the slopes.

The Contractor shall provide and maintain adequate erosion control facilities during the construction of the fill areas. The erosion control facilities shall be maintained in optimum condition until the permanent drainage system and vegetation is complete. The facilities shall be inspected following significant rainfall, repairs made and excess sediment removed. It shall be the Contractor's responsibility to prevent the discharge of sediment off-site or to adjacent watercourses.

3.07. STRUCTURE FILL AND STRUCTURE BACKFILL MATERIAL

- A. Placement of Structure Backfill: Before beginning backfilling, all foreign material, including water, shall be removed from the space to be backfilled and the area to be backfilled shall be inspected and approved by the Geotechnical Engineer. Sloping sides of the excavated space shall be stepped to prevent wedging action of the backfill against the structure. No backfill shall be placed around or upon any structure until it is proven that the concrete has attained satisfactory strength in accordance with the Division 3 of Technical Specifications and that the structure as a whole is adequate to receive backfill. The compressive strength shall be determined by tests on representative cylinders cured under conditions similar to those prevailing at the site.
- B. General: Structure fill and structure backfill shall consist of granular sand, Class 2 Base, crusher fines or other material as indicated on the Plans. The subbase grade shall be excavated to within plus or minus 0.05 feet of design grade prior to the placement of structure fill and structure backfill. The design subbase grade shall be field verified and approved by the Engineer prior to the placement of the structure fill or structure backfill material. The Engineer shall determine the number and location of points to check for the subbase grade elevation compliance. Prior to the Engineer's inspection of the subbase grade the Contractor shall establish bluetop stakes on a 20-foot by 20-foot grid across the area which structure backfill is to be placed.

Granular sand, Class 2 Base and crusher fine structure fill and structure backfill material shall be placed in maximum 8-inch lifts and compacted to 95 percent of maximum density at optimum water content per ASTM D 1557. Additional granular sand, Class 2 Base or crusher fine lifts shall not be placed until previous lifts have attained the specified compaction requirement and are approved by both the on-site geotechnical representative and the Engineer.

- C. Placing, Spreading and Compacting Fill Material: The structural fill and structural backfill material shall be placed by the Contractor in thin layers that when compacted shall not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material in each layer.

When the moisture content of the fill material is below that required by the Geotechnical Engineer, water shall be added by the Contractor until the moisture content is as required for the specified compaction.

When the moisture content of the fill material is above that required by the Geotechnical Engineer, the fill material shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the moisture content is as required for the specified compaction.

After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted by the Contractor to the specified density. Compaction shall be accomplished by sheepfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers or other types of acceptable compacting equipment. Equipment shall be of such design that it shall be able to compact the fill to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes over the material to ensure that the desired density has been obtained.

Compacted fill slopes shall be overbuilt and cut back to grade, exposing the firm, compacted inner core. The slopes shall be overbuilt a minimum of five feet (5'). If the desired compaction is not achieved, the existing slope shall be overexcavated and reconstructed. The amount of overbuilding shall be increased until the desired compaction is achieved on the slope. The Contractor shall provide thorough mechanical compaction to the outer edge of the overbuilt slope surface. There shall be no excessive loose soil on the slopes.

The Contractor shall provide and maintain adequate erosion control facilities during the construction of the fill areas. The erosion control facilities shall be maintained in optimum condition until the permanent drainage system and vegetation is complete. The facilities shall be inspected following significant rainfall, repairs made and excess sediment removed. It shall be the Contractor's responsibility to prevent the discharge of sediment off-site or to adjacent watercourses.

3.08 ESTABLISHMENT OF SUBBASE GRADE, SUBGRADE OR FINISH GRADE

Finish Grade is defined as the finish surface grade. For instance, the top of an A.C. or P.C.C. paved surface is referred to as finish grade.

Subgrade is defined as the grade of the material beneath the finish surface. For instance, the top of Class 2 Base grade beneath an A.C. or P.C.C. paved surface is referred to as subgrade.

Subbase is defined as the grade of the material beneath the base material. For instance, the top of native material beneath the Class 2 Base subgrade material of an A.C. or P.C.C. paved roadway is the subbase grade.

Finish grade surfaces are to be graded to within plus or minus 0.02 feet from design grade as illustrated on the Grading Plans. The Contractor shall place bluetop stakes on a 20-foot x 20-foot grid across the top of the finish grade surface during final grading. A bluetop stake is defined as a stake placed at the finish grade elevation within the tolerance of plus or minus 0.02 feet of finish grade. The Engineer shall obtain elevations across finish grade surfaces at locations determined by the Engineer prior to accepting and approving the finish grade surfaces. The Contractor shall rework areas not conforming to the finish surface grade tolerance as required. Work items to

occur after the establishment of finish grade shall not occur until the Engineer has approved the finish grade.

Subgrade surfaces are to be graded to within plus or minus 0.02 feet from design grade as illustrated on the Grading Plans. Bluetop stakes shall be placed on a 20-foot x 20-foot grid pattern across rectangular or square facilities such as parking lots and access roads. The Engineer shall obtain elevations across the subgrade surfaces at locations determined by the Engineer prior to accepting and approving the subgrade surfaces. The Contractor shall rework areas not conforming to the subgrade tolerance as required. Work items to occur after the establishment of subgrade shall not occur until the Engineer has approved the finish subgrade.

Subbase surfaces are to be graded to within plus or minus 0.05 feet of subbase design grade as illustrated on the Grading Plans. Bluetop stakes shall be placed on a 20-foot x 20-foot grid pattern across rectangular or square facilities such as parking lots, access roads, sludge beds, structures, building pads, etc. The Engineer shall obtain elevations across the subbase surfaces at locations determined by the Engineer prior to accepting and approving the subbase surfaces. The Contractor shall rework areas not conforming to the subbase design grade tolerance as required. Work items to occur after the establishment of subbase grade shall not occur until the Engineer has approved the subbase grade.

3.09 COMPACTION TEST SCHEDULE

The following **compaction test(s)** shall apply to this project:

<u>ITEM</u>	
<u>NO.</u>	<u>ITEM</u>
1.	Excavation and scarification process
2.	Backfill for Water Pipe, Storm Drainage Pipe, Sanitary Sewer Pipe and Irrigation Pipe Trenches. The Specification requires that the backfill be compacted in lifts. Additional lifts shall not be allowed to be placed until previous lifts have been satisfactorily tested for compaction.
3.	Backfill for Electrical Conduit Trenches. The specification requires that the backfill be compacted in lifts. Additional lifts shall not be allowed to be placed until previous lifts have been satisfactorily tested for compaction. This requirement shall be strictly enforced and the Contractor shall be required to remove all backfill from the electrical conduit trench if this specification is violation.
4.	Over excavation and Recompanction of Subgrade Material
5.	Installation of Class 2 Base for Site Grading.
6.	Installation of Granular Sand for P.C.C. Infrastructure Subbase Material

7. Installation of Granular Sand for Water Pipelines, and Stormwater Drainage Pipelines and Sanitary Sewer pipelines.
8. Existing Retention Basin Preparation
9. Building Pad Preparation

3.10 CLEAN-UP

Upon completion of Work in this Section, all rubbish and debris shall be removed from the site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a clean, neat and acceptable condition.

*****END OF SECTION*****

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SECTION 02221

TRENCHING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 DESCRIPTION

Requirements specified in the Technical and Special Conditions form a part of this Section. The Work of this Section includes all labor, machinery, construction equipment and appliances to perform in a professional manner all trench excavation and backfill work illustrated on the Plans and herein specified. Principal items included: Trench excavation, backfill and compaction.

1.02 SAFETY

The Contractor shall be familiarized with, and shall at all times conform to all applicable regulations of "Excavations, Trenching, and Shoring" of OSHA Safety and Health Regulations for Construction, "General Construction Safety Orders" and "Trench Construction Safety Orders" of the State of California, Department of Industrial Relations, Division of Occupational Health and Safety.

1.03 INSPECTION AND CONTROL

The County of Riverside shall provide inspection and testing by a Geotechnical Engineer approved by the County of Riverside engaged and paid for by the County of Riverside. In this regard, a Geotechnical Engineer shall be engaged by the Owner, who shall act as the direct representative of the Owner in geotechnical work, to perform inspection of the removal and replacement of unsuitable materials, all excavations, and the placement and compaction of all fills and backfills within the limits of earthwork on this Project. Costs for all such inspections and tests will be paid by the County of Riverside, and Contractor shall bear the cost of retest and re-inspection of reworked fills and backfills due to compaction test failure.

1.04 REQUIREMENTS

A. General:

1. The Work performed under this Specification shall be constructed to the lines, grades, elevations, slopes and cross-sections indicated on the Plans, specified herein, and/or directed by the Engineer in writing. Slopes, graded surfaces, and drainage features shall present a neat, uniform appearance upon completion of the Work.
2. It shall be the Contractor's responsibility (1) to maintain adequate safety measures and working conditions; and (2) to take all measures necessary during the performance of the Work to protect the entire project area and adjacent properties which would be affected by this Work from storm damage, flood hazard, caving of trenches, cavings of excavations, and embankments, and sloughing of material, until final acceptance by the Owner. It shall be the Contractor's responsibility to maintain completed areas in good condition until the entire project area is in satisfactory compliance with the Project Specifications.
3. Contractor shall be responsible for the excavation and disposition of unsuitable or surplus material by approved means of conveyance away from the working area.

B. Protection of Existing Utilities:

1. Utilities: Unless otherwise illustrated on the Plans or stated in the Specifications, all utilities, both underground or overhead, shall be maintained in continuous service

throughout the entire contract period. The Contractor shall be responsible and liable for any damages to or interruption of service caused by the construction.

If the Contractor desires to simplify his operation by temporarily or permanently relocating or shutting down any utility or appurtenance, he shall make the necessary arrangements, agreements and approvals with the utility purveyor, Owner and Engineer and shall be completely responsible for all costs concerned with the relocation or shutdown and reconstruction. All property shall be reconstructed in its original or new location as soon as possible and to a condition at least as good as its previous condition. This cycle of relocation or shutdown and reconstruction shall be subject to inspection and approval by the Engineer, Owner and the utility purveyor.

The Contractor shall be entirely responsible for safeguarding and maintaining all conflicting utilities that are illustrated on the Plans. This includes overhead wires and cables and their supporting poles whether they are inside or outside of the open trench. If, in the course of work, a conflicting utility line that was not illustrated on the Plans is discovered, it shall be brought to the immediate attention of the Engineer for a determination regarding alternatives to the conflict.

2. Building, Foundations and Structures: Where trenches are located adjacent to buildings, foundations and structures, the Contractor shall take all necessary precaution against damage to them. The Contractor shall be liable for any damage caused by the construction except where authorized in the Special Conditions or in writing by the Engineer. Water settling of backfill material in trenches adjacent to structures will not be permitted.
3. Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines: These underground facilities shall be adequately supported by the Contractor. Support for plastic pipe shall be continuous along the bottom of the pipe. Support for metal pipe and electrical conduit may be continuous or nylon webbing may be used for suspension at no greater than ten foot (10') intervals. The Contractor shall avoid damaging the plastic pipe, pipe ways or conduits during trench backfilling and during foundation and bedding placement.

1.05 WARRANTY

Comply with the requirements of General Condition Article 5.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Granular Sand Material: Granular sand material shall consist of imported granular sand complying with Section 02200, of the specifications.
- B. Crusher Fines: Crusher fines material shall consist of imported decomposed granite complying with Section 02200, of the specifications.
- C. Class 2 Base Material: Class 2 Base material shall consist of imported virgin (not recycled) Class 2 Base complying with Section 02200, of the Specifications.
- D. Concrete: 4000 PSI compressive strength, minimum, as specified in Division 3, Concrete, of the Specifications.
- E. Pipelines: Use materials shown on the Plans and as specified in other pertinent Sections of the Specifications.

PART 3 - EXECUTION

3.01 TRENCH EXCAVATION

- A. Excavation for Trenches: Shall include the removal of all material of any nature for the installation of the pipe or facility and shall include the construction of trench shoring and stabilization measures, timbering and all necessary installations for dewatering.
- B. Minimum Width of Trench: The minimum width of pipe trenches, measured at the crown of the pipe, shall not be less than 12 inches greater than the exterior diameter of the pipe, exclusive of bells and the minimum base width of such trench shall be not less than 12 inches greater than the exterior diameter of the pipe, exclusive of special structures or connections, and such minimum width shall be exclusive of all trench supports.
- C. Maximum Width of Trench: The maximum allowable width of trench for all pipelines measured at the top of the pipe shall be the outside diameter of the pipe (exclusive of bells or collars) plus 16 inches, and such maximum shall be inclusive of all timbers. A trench wider than the outside diameter plus 16 inches may be used without special bedding if the Contractor, at his expense, furnishes pipe of the required strength to carry the additional trench load. Such modifications shall be submitted for the Engineer's review. Whenever such maximum allowable width of trench is exceeded for any reason, except as provided for on the Plans or in the Specifications, or by the written direction of the Engineer, the Engineer may, at its discretion, require that the Contractor, at his own expense for all labor and materials, cradle the pipe in 4000 PSI compressive strength concrete, or other approved pipe bedding.
- D. Maximum Length of Open Trench: Except by special permission by the Engineer only that amount of open trench shall be permitted, which shall allow for that amount of pipeline construction, including excavation, construction of pipeline, and backfill in any one location, which can be completed in one day; however, maximum length of open trench shall never exceed 600 feet. This length includes open excavation, pipe laying and appurtenant construction and backfill which has not been temporarily resurfaced.
- E. Trench Side Slopes:
 - 1. Temporary trench excavations shall at all times conform to the safety requirements hereinbefore specified in Section entitled "Safety".
 - 2. Loose cobbles or boulders shall be removed from the sides of the trenches before allowing workmen into the excavation, or the trench slopes must be protected with screening or other methods. Trench side slopes shall be kept moist during construction to prevent local sloughing and raveling. Surcharge loads due to construction equipment shall not be permitted within 10 feet of the top of any excavated slope.
 - 3. If the Contractor elects to shore or otherwise stabilize the trench sides, he shall file with the Engineer copies of drawings for same prepared, signed and stamped by a Civil Engineer duly registered in the State of California before commencing excavation.
- F. Excess Trench Excavation: If any trench, through the neglect of the Contractor, is excavated below the bottom grade required, it shall be refilled to the bottom grade, at the Contractor's expense for all labor and material, with granular sand material compacted to a firm stable foundation.

3.02 BRACING TRENCHES

The sides of the trenches shall be supported with plank sheeting and bracing in such a manner as to prevent caving of the sides of the trench. Space left by withdrawal of sheeting or shoring shall be filled completely with dry granular material blown or rammed in place. Trench shoring shall be completed per the recommendations of the Geotechnical Report and OSHA Standards.

3.03 PIPING BEDDING

The Contractor shall excavate to four inches (4") below the bells or couplings for the full width of the trench and shall place four inches (4") of granular material upon which the pipe is to be laid, unless indicated otherwise on the Plans. Construct pipe bedding as indicated on the Plans.

At pipe subgrade, if foundation soil in trench is soft, wet, spongy, unstable or does not afford solid foundation for pipe, the Contractor shall excavate as directed by the Engineer and provide stable base by excavating any unsuitable material 18" minimum below the subgrade base or as the Engineer determines is necessary for placement of pipe bedding. A filter fabric shall be placed in the trench bottom and along the trench sidewalls in the pipe zone to the top of the pipe zone material. A crushed rock material shall be placed at the bottom of the trench and sidewalls of the pipe to a point 1 foot above the pipe. The crushed rock material shall be hand tamped in 16-inch lifts along the sidewalls. The crushed rock shall be compacted with a plate compactor in minimum 6 inch lifts beneath the pipe and over the top of the pipe.

Where rock is encountered in the trench, the Contractor shall excavate to a minimum 18 inch depth below subgrade or as the Engineer determines is necessary, and shall construct a base by placing crushed rock bedding upon which a subgrade can be prepared.

Before any pipe is lowered in place, the trench bottom shall be prepared so that each pipe shall be supported for the full length of the barrel with full bearing on the bottom segment of the pipe equal to a minimum of one-half (1/2) of the pipe OD, and a width equal to the trench width. All adjustments in line and grade shall be made by scraping away or filling and tamping in under the barrel of the pipe. Wedging or blocking is not permitted.

The pipe bedding shall be compacted to a minimum of 90 or 95 percent relative compaction as hereinafter specified or as required by the Plans.

3.04 BACKFILLING PIPE TRENCHES

A. Backfilling Pipe Zone: Backfill material for the pipe zone shall consist of imported granular material or two sack cement/sand slurry as required by the Plans. Place material in the trench simultaneously on each side of the pipe for the full width of the trench and the depth of the pipe zone in layers 6 inches in depth. Each layer shall be thoroughly compacted by tamping. In all cases, backfilling of the pipe zone must be accomplished by hand. Particular attention shall be given to underside of the pipe and fittings to provide a firm support along the full length of the pipe. The pipe zone shall be considered to extend 12 inches above the top of the pipe unless otherwise illustrated on the Plans, and shall be compacted in the trench to a relative compaction of not less than 90 or 95 percent of maximum density per ASTM D 1557 as illustrated on the Plans. Care shall be taken not to damage pipe and fittings or special coatings on the pipe and fittings.

1. Use of material other than those specified shall be reviewed by the Engineer prior to use. The Contractor shall bear all cost of removal of rejected material, its hauling to an authorized disposal site, and cost of providing required material to complete the bedding and backfilling.

B. Backfilling Pipe Trench: After the pipe has been laid in the trench and has been inspected and approved, and backfilling in the pipe zone is complete and compacted, the remainder of the trench may be backfilled. The backfill material shall be granular sand or Class 2 Base as specified in Paragraph 2.01 and illustrated on the Plans. Care shall be taken to ensure that no voids remain under, around or near the pipe.

1. The Contractor shall incur the expense to remove and dispose of the excess trench excavation material displaced by the trench import material and include the costs in the bid.

C. Compaction: The maximum dry density and optimum moisture content of each soil type used in the controlled compacted fill shall be determined by ASTM D 1557-91. Field density tests

shall be determined in accordance with ASTM D 1556-82, ASTM D 2937-83 and ASTM D 2922-81.

D. Placement and Compaction of Trench Backfill: The placement and compaction of all trench backfill shall be as follows:

1. Mechanically Compacted Backfill: With approval of the Engineer, backfill shall be mechanically compacted by means of tamping rollers, sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers to 90 or 95 percent relative compaction as illustrated by the Plans. Impact-type pavement breakers (stompers or hydro-hammers) shall not be permitted over any pipe. Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements or improvements installed under the Contract. The Contractor shall make his own determination in this regard. Backfill shall be placed in horizontal layers not exceeding eight inches (8"). Each layer shall be evenly spread, the moisture content brought to near optimum condition and then tamped or rolled until the specific relative compaction has been attained. Additional backfill lifts shall not be placed until previous lifts have been satisfactorily compacted and tested and approved by the Engineer.

3.05 CENTRAL PIPELINE INSTALLATION REQUIREMENTS

A. Depth of Pipe: Unless otherwise illustrated on the Plans, all pipelines shall have coverage of at least 36 inches between the top of the pipe and the finished surface. All gravity line invert elevations and locations illustrated on the Plans are intended to be exact and any change in alignment and grade shall be reviewed in accordance with the Contract Documents to the satisfaction of the geotechnical testing representative and Engineer. All force and gravity mains shall have 1 foot vertical clearance between themselves and all other utilities. At all water main, sewer and stormwater crossings, both gravity and force mains shall have 20 linear feet of concrete encasement centered at the crossing as required by the State of California Department of Health.

B. Changes in Line and Grade: In the event obstructions not shown on the Plans, are encountered during the progress of the Work, which will require alterations to the Plans, the Engineer shall issue the necessary revisions to the Plans and order the necessary deviation from the line or grade. The Contractor shall not make any deviation from the specified line and grade without prior review and approval by the Engineer. Should any deviations in line and grade be permitted by the Engineer in order to reduce the amount of rock excavation or for other similar convenience to the Contractor, any additional costs for thrust blocks, valves, air and vacuum valve assemblies, blow-off assemblies, extra pipe footage, concrete, sewer structures, or other additional costs shall be borne by the Contractor.

1. Contractor shall include in his Bid provisions to cover any deviation from the invert grade shown on the Plans to facilitate the extra depth required to avoid possible conflicts between existing or new gravity pipelines and other utilities with new water, stormwater or sewer forcemains.

C. Pipe Installation:

All pipe and fittings, and accessories furnished by the Contractor shall be new material free from rust or corrosion. All piping and fittings shall be cleaned on the inside when installed and the Contractor shall take all necessary precautions to insure that the lines are kept free of any foreign matter and dirt until the work is completed. All pipes shall be carefully placed and supported at the proper lines and grades as shown on the Plans. Piping runs shown on the Plans shall be followed as closely as possible, except for minor adjustments as approved by the Engineer to avoid other piping or structural features. Bedding material shall first be placed so that the pipe is supported for the full length of the barrel with full bearing on the bottom segment of the pipe. Hunching of the pipe shall not be allowed. Pipe will be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe

after it has been laid, it shall be subject to rejection by the Engineer. Any corrective work shall be approved by the Engineer. Pipe shall be laid true to line and grade with uniform bearing under the full length of the barrel of the pipe. Suitable excavation shall be made to receive the bell or collar which shall not bear upon the subgrade or bedding. Any pipe which is not in true alignment or shows any undue settlement after laying shall be taken up and relaid at the Contractor's expense. Pipe shall be laid upgrade with the socket ends of the pipe upgrade unless otherwise authorized by the Engineer. Pipe sections shall be laid and joined in such a manner that the offset of the inside of the pipe at any joint will be held to a minimum at the invert. The maximum horizontal offset at the invert of the pipe shall be 1% of the inside diameter of the pipe or 0.02 feet, whichever is smaller. The vertical grade shall be ± 0.02 feet of the design invert. In joining socket pipe, the spigot of each pipe shall be so seated in the socket of the adjacent pipe as to give a uniform annular space all around the pipe in the socket.

The following pipe installation items shall be required:

1. No pipe shall be laid which is damaged, cracked, checked or spalled or has any other defect deemed by the Engineer to make it unacceptable, and all such sections shall be permanently removed from the Work.
2. At all times when the Work of installing pipe is not in progress, all openings into the ends of the pipelines shall be kept tightly closed with suitable plywood or sheet metal bulkheads to prevent the entrance of animals and foreign materials and to prevent water from entering the pipe.
3. Keep the pipe trench free from water at all times and take all necessary precautions to prevent the pipe from floating due to water entering the trench from any sources. Any damage is the Contractor's full responsibility. Restore and replace the pipe to its specified conditions and grade if it is displaced due to floating.
4. All pipelines adjoining concrete structures (including manholes) shall have a flexible joint, such as sleeve transition couplings, within 36 inches from the face of such concrete structures. Flexible joints shall be installed on all pipe 4" and larger whether or not a flexible joint is illustrated on the Plans. Where the flexible joint is illustrated on the Plans, install the joint at the location indicated.

3.06 COMPACTION OF PIPE BEDDING AND BACKFILL

Unless specified in the Plans or Earthwork Specification (Section 02200), the following compaction test for piping shall be required.

- A. One (1) compaction test for the granular sand fill pipe bedding along each 100 lineal foot of water, sewer or stormwater pipe placed for each 8-inch lift of material installed.
- B. One (1) compaction test shall be obtained for each 8-inch lift of Class 2 Base material along each 100 foot section of water, sewer or stormwater pipeline installed.
- C. One (1) compaction test shall be required for each 8-inch of vertical sand fill material placed along each 100 feet of water, sewer or stormwater pipeline installed.
- D. One (1) compaction test shall be obtained for each 8-inch lift of native material along each 100 foot section of water, sewer or stormwater pipeline installed.
- E. One (1) compaction test shall be obtained for each 8 inch of vertical native material lift placed around stormwater or sanitary sewer manholes. A geotechnical testing representative shall be present at the time the sanitary sewer or stormwater pipeline and sanitary sewer or stormwater manholes are backfilled to monitor the placement of backfill material and complete compaction testing. Additional lifts shall not be installed until previous lifts have attained the specified compaction and is approved by the on-site geotechnical representative and Engineer.

3.07 CLEAN-UP

Immediately upon completion of Work for this Section, all rubbish and debris shall be removed from the Site. All pipe trench areas shall be finish graded with a "blade" or "motor patrol". All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean and acceptable condition.

*****END OF SECTION*****

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SECTION 02510
ASPHALT CONCRETE PAVING

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 DESCRIPTION

Requirements specified in the Specifications form a part of this Section. Provide labor, equipment, tools and materials to accomplish asphalt concrete paving as indicated on the Plans and/or on the Proposal forms.

1.03 PAVEMENT REMOVAL AND REPLACEMENT

A. General: Pavement removal and replacement for all public roads, including aggregate base and temporary paving where required, shall comply with all requirements of the agency issuing the Encroachment Permit. In roads established under formation of a special road district, the specifications of the Encroachment Permit shall apply. Any private roads and streets, including driveways in which the surface is removed or damaged, shall be restored to the original grade and crown by the Contractor in accordance with the paving requirements described herein. Removed or damaged sections shall be restored with the type of improvements (or better) conforming to that which existed at the time the Contractor entered upon the work.

It shall be the responsibility of the bidder to satisfy himself as to the existing pavement sections prior to submitting his bid.

B. Pavement Cutting: Pavement shall be cut to a straight edge parallel to the pipe alignment, curb and gutter, barrier curb, pavement edge, etc., prior to excavation. Method of pavement cutting shall be sawcutting for the full depth of the pavement. Under no circumstances shall excavation be started prior to sawcutting of the pavement. If the adjacent pavement is disturbed during the Contractor's operation, the pavement shall be recut on straight lines to remove the damaged pavement before resurfacing. Portland cement concrete pavement and sidewalk shall also be saw cut full depth as required.

C. Asphalt Concrete Pipe Trench Pavement: Where required by the agency issuing the Encroachment Permit or other agency having jurisdiction, and where specified in the Contract Documents, an asphalt concrete cap shall be placed in the area of the pipe trench or pipe excavation area. The installation of the asphalt concrete pavement shall be in accordance with the specifications and policies of the agency having jurisdiction. In the event the agency requirements conflict with the Plan requirements, the most stringent will apply.

1.04 TEMPORARY PAVEMENT

Install temporary pavement in accordance with the requirements of the agency issuing the Encroachment Permit. Steel plates may be allowed to cover excavation areas within road right of ways as approved by the governing agency and Engineer.

1.05 WARRANTY

Comply with the requirements of General Condition Article 5 and Section 01740.

PART 2 – PRODUCTS

2.01 ASPHALT CONCRETE PAVING

- A. MIX: Caltrans, Type A, ¾ inch aggregate gradation except for parking lot areas. Parking Lot areas shall use Caltrans Type A ½ inch aggregate gradation.
 - B. THICKNESS: 3" min.; or greater as specified on the Plans.
 - C. AGGREGATE SIZE: ¾" (1/2 inch aggregate gradation for parking areas) per Caltrans Section 39.
 - D. ASPHALT CONTENT: 4% to 8% by weight per the A.C. Mix Design.
 - E. PRIME COAT: Per Caltrans Section 39-4.02.
- 2.02 ASPHALT CONCRETE CAP
- A. MIX: Caltrans, Type A, ¾ inch aggregate gradation except for parking lot areas. Parking Lot areas shall use Caltrans Type A ½ inch aggregate gradation.
 - B. THICKNESS: 3" or greater as specified on the Plans.
 - C. AGGREGATE SIZE: ¾" aggregate gradation maximum, fine (1/2 inch aggregate gradation for parking area).
- 2.03 FOG SEAL
- A. SPECIFICATION: Caltrans Section 37.
 - B. MATERIAL: Slow setting, mixing type asphaltic emulsion per Caltrans Section 94-1.01B.
- 2.04 ASPHALT CONCRETE BERMS (Not Applicable)

PART 3 – EXECUTION

- 3.01 INSPECTION
- A. Examine the areas and conditions under which work of this Section will be performed.
 - B. Verify that specified items may be installed in accordance with the approved design.
 - C. Correct conditions detrimental to timely and proper completion of the Work.
 - D. Do not proceed until unsatisfactory conditions are corrected.
 - E. Beginning of installation means acceptance of conditions.
- 3.02 ASPHALT CONCRETE PAVING
- A. Asphalt Concrete shall be applied with a vibratory machine. The grade of all asphalt bitumen shall be PG 70-10. The minimum bitumen shall be in accordance with the approved mix design. The Asphalt Concrete shall be compacted to 95 percent of maximum density per ASTM D-1559. The temperature of the asphalt when delivered to the application site shall range between 285° F and 359° F. The finished surface shall be within ± 0.02 feet of finish design grade with maximum high and low variance occurring in a maximum of 10 horizontal feet.
 - B. Rollers of the vibratory, steel wheel or pneumatic-tired type may be used. They shall be in good condition, capable of operating at slow speeds to avoid displacement of the bituminous mixture. The number, type and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment which causes excessive crushing of the aggregate shall not be permitted.
 - C. After spreading, the mixture shall be thoroughly and uniformly compacted by rolling. The surface shall be rolled when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor.

- D. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the direction of the roller or from any other cause shall be corrected at once.
- E. Rolling shall continue until the roller marks are eliminated, the surface is of uniform texture and true to grade and cross-section and the required field density is obtained.
- F. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excessive water will not be permitted.
- G. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers.
- H. Any mixtures that become loose and broken, mixed with dirt, or in any way defective, shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense.
- I. The Contractor shall pay for all costs associated with the preparation of the Marshall Mix Design, compaction tests and extraction/gradation tests required for this project. The Contractor shall incur all costs relative to the preparation of the Marshall Mix Design. The density testing relative for this project is to be performed by the Owners Material Testing Consultant.
- J. A sample of the bituminous mix shall be obtained each morning pavement operations are occurring. The sample shall be obtained by the material testing consultant. The maximum density of the sample shall be determined. The results of the test shall be used to base the field density tests against. An extraction from the sample shall be taken to determine the percentage of bitumen in the mix. The gradation of the sample shall also be obtained. Density tests shall be taken during the rolling operation. The pavement shall continue to be rolled until the desired density is obtained. The costs associated with the testing shall be borne by the Contractor. The Contractor shall provide two (2) sets of test reports to the Engineer. A field technician provided by the material testing consultant shall be made available during the asphalt placement to continuously monitor the density of the asphalt if so required by the Engineer.
 - 1. Application: Mixing transporting and placing of asphalt concrete shall be in accordance with all applicable provisions of Caltrans Section 39. Asphalt concrete shall not be placed when the atmospheric temperature is below 60°F, or during unsuitable weather.
 - 2. Repairs: Deficient paving and/or low areas with inadequate drainage and damaged paving due to subgrade failure, inadequate trench compaction, etc., shall be repaired by the Contractor at no additional cost to the Owner.

3.03 ASSOCIATED PAVING RELATED WORK

- A. Manhole Covers: Adjust sewer and storm drain manhole covers three (3) inches below the finish design pavement surface prior to the installation of A.C. pavement. Raise the manhole covers to finish pavement grade after paving operations are completed. Place a one (1) foot wide, one (1) foot deep 4,000 PSI concrete ring concentric around the manhole level with the finish pavement surface.
- B. Valve Covers: Adjust water valve risers and covers three (3) inches below the finish design pavement surface prior to the installation of A.C. pavement. Raise the valve risers and covers to finish pavement grade after paving operations are completed. Place an eight (8) inch wide, eight (8) inch deep 4,000 PSI concrete ring concentric around the water valve riser and cover level with the finish pavement surface.
- C. Striping: Replace the traffic striping and pavement markers over the areas receiving the overlay.
- D. Traffic Signs: Replace traffic signs temporarily removed during the construction work.

E. Payment: Payment for all associated paving related work as described herein shall be included in the appropriate bid item(s) indicated on the Proposal forms and no additional compensation shall be made therefore.

3.04 FOG SEAL

A. Application: Apply fog seal at a rate of 0.06 to 0.10 gallons per square yard of surface area.

B. Fog Seal Schedule: Apply fog seal not less than fourteen (14) days following placement of asphalt concrete surfacing.

3.05 PAVING SCHEDULE

Unless otherwise approved by the Engineer, all permanent paving shall commence only after construction of all other contract work is completed.

*****END OF SECTION*****

SECTION 02640

PVC PIPE

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SECTION INCLUDES

The Contractor shall furnish and install all PVC and polyethylene plastic pipe, fittings, transitions, connections and appurtenant work, complete and in accordance with the requirements of the Contract Documents.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

Commercial Standards:

ASTM D 1784 and ASTM D 1785	Specifications for Polyvinyl Chloride (PVC) Plastic Pressure Pipe
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ASTM D 3034	Specifications for Polyvinyl Chloride (PVC) Plastic Gravity Sewer Pipe
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AWWA C 900 and AWWA C 905	Specifications for Polyvinyl Chloride (PVC) Plastic Water Pressure Pipe
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ASTM D 2321	Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
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1.01 SUBSTITUTIONS

Substitutions will be considered per General Condition Article 3.11.4.

1.04 CONTRACTOR SUBMITTALS

- A. Provide in accordance with Article 3.11 of the General Conditions.
- B. Contractor shall submit copies of the manufacturer's product specifications according to the Submittal requirements for this project.

1.05 WARRANTY

Comply with the requirements of General Condition Article 5 and Section 01740.

PART 2 – PRODUCTS

2.01 PVC (POLYVINYL CHLORIDE) PRESSURE PIPE, 4 INCHES AND SMALLER SOLVENT-WELDED

All PVC pressure pipe 4 inches and smaller shall be made from all new rigid unplasticized polyvinyl chloride and shall be Normal Impact Class 12454-B, Schedule 80, to conform to ASTM D 1785, unless otherwise shown. Elbows and tees shall be of the same material and schedule as the pipe. Unless otherwise shown, joint design shall be for solvent-welded construction.

2.02 AWWA C 900 AND AWWA C 905 WATER PIPELINE WITH BELL AND SPIGOT JOINTS

This Specification designates general requirements for unplasticized polyvinyl chloride (PVC) plastic class water pipe with integral bell and spigot joints for the conveyance of water. Pipe shall meet the requirements of AWWA C 900 or AWWA C 905 "Polyvinyl Chloride (PVC) Water Distribution".

All pipe shall be suitable for use as pressure conduit, provisions must be made for expansion and contraction at each joint with an elastomeric ring. The bell shall consist of an integral wall section with a factory installed, solid cross-section elastomeric ring which meets the requirements of ASTM F 477. The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of AWWA C 900. Sizes and dimensions shall be as shown in this Specification. Joint design shall meet qualification requirements of ASTM F 3139. Each pipe shall be tested to four times the pressure class of the pipe for a maximum of 5 seconds. The integral bell shall be tested with the pipe. Standard laying lengths shall be 20 feet (±1") for all sizes.

The pipe stiffness using $F/\Delta Y$ for PVC class water pipe is contained in the table below:

<u>CLASS</u>	<u>DR</u>	<u>F/Δy (PSI)</u>
100	25	129
150	18	364
200	14	815

Pipe shall withstand, without failure at 73°F, an impact of a falling missile, TUP C, at the following levels (per ASTM D 2444):

<u>Pipe Size (IN.)</u>	<u>Impact (FT./LBS.)</u>
4	100
6	100
8	100
10	120
12	120

There shall be no visible evidence of shattering or splitting when the energy is imposed.

Randomly selected samples tested in accordance with ASTM D 1599 shall withstand, without failure, pressures listed below when applied in 60-70 seconds.

<u>Class</u>	<u>Minimum Burst Pressure At 73°F (PSI)</u>
100	535

150

755

200

985

Pipe for this Project shall conform with the specifications for AWWA C 900, Class 150 PVC pipe material for diameter sizes 4-inches through 12 inches and AWWA C 905, DR 25 PVC pipe material for diameter sizes 14 inches through 36-inches unless otherwise indicated on the Plans.

2.03 PVC (POLYVINYL CHLORIDE) GRAVITY PIPE

- A. Pipe shall conform to the requirements of ASTM D 3034 for SDR 35 gravity pipe.
- B. All pipe joints shall be of the bell and spigot type with electrometric seals and conform to the requirements of ASTM D 3212. Gaskets shall be factory installed and chemically bonded to the bell end of the pipe. Gasket material shall conform to the requirements of ASTM F 477.
- C. All fittings shall be fabricated from pipe meeting the requirements of these standards. Fabricated miter joints shall be reinforced by fusion heat welding. All fittings shall be approved for use by the pipe manufacturer and shall be capable of accepting bell and spigot connections.
 - 1. There shall be no sign of flaking or disintegration when immersed in anhydrous acetone for 20 minutes as described in ASTM D 2152.
- D. All pipe shall be from quality PVC resin, compounded to provide physical and mechanical properties that equal or exceed cell class 12454 as defined in ASTM 1784.
- E. Minimum pipe stiffness at 5 percent deflection shall be 46 PSI for all sizes when tested in accordance with ASTM D 2412, External Loading Properties of Plastic Pipe by Parallel-Plate Loading”.
- F. Each pipe shall be identified with the name of manufacturer, nominal size, cell classification, ASTM designation F 1803, the pipe stiffness designation “PS-46” and manufacturer’s date code.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION OF PIPE

- A. All pipe, fittings, etc., shall be carefully handling and protected against damage, impact shocks and free fall. All pipe handling equipment shall be acceptable to the Engineer. Pipe shall not be placed directly on rough ground, but shall be supported in a manner which will protect the pipe against injury whenever stored at the work site. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor.
- B. The Contractor shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe. Damaged pipe shall be replaced with new undamaged sections of pipe.
- C. Before placement of the pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance which may have collected thereon and shall be kept clean at all times

thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the Work. As pipe laying progresses, the Contractor shall keep the pipe interior free of all debris. The Contractor shall completely clean the interior of the pipe of all sand, dirt, rocks and any other debris following completion of pipe laying prior to testing, disinfecting and placing the completed pipeline in service.

- D. Pipe shall be laid directly on the imported bedding material. No blocking will be permitted and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Bell holes shall be formed at the ends of the pipe to prevent joint loading at the bells or couplings.
- E. Where necessary to raise or lower the pipe grade due to unforeseen obstructions or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer.
- F. No pipe shall be installed upon a foundation into which frost has penetrated or any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. No pipe shall be laid unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.
- G. Immediately before jointing bell and spigot pipe, both the bell and spigot end of the pipe shall be thoroughly cleaned and lubricated with an approved vegetable-based lubricant. The spigot end of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper alignment. Tilting of the pipe to insert the spigot into the bell will not be permitted.
- H. Solvent-welded and heat-fused joints shall be carefully and thoroughly cleaned immediately before jointing the pipe. Particular care shall be taken in making solvent-welded joints to ensure a uniform, homogeneous and complete bond.
- I. Pipe installation shall conform with Technical Specification Section 02221 - Trenching, Backfilling and Compacting. If this installation of pipe section and Section 02221 conflict, the most stringent specification shall apply.

*****END OF SECTION*****

SECTION 02763
PAINTED TRAFFIC LINES AND MARKINGS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SUMMARY

Section includes Painted traffic striping and symbols on pavements and curbs.

1.03 REGULATORY REQUIREMENTS

Provide pavement markings meeting the accessibility requirements of the 2010 California Building Code (CBC).

1.04 SUBSTITUTIONS

Substitutions will be considered per General Condition Article 5.1 and Section 01630.

1.05 SUBMITTALS

Provide in accordance with Article 3.11 of the General Conditions.

1.06 PRODUCT HANDLING

A. Comply with the requirements of Section 01620.

B. Deliver paints and paint materials in original sealed containers that plainly show the designated name, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the project site for maintaining materials at temperatures recommended by the manufacturer.

1.07 ENVIRONMENTAL CONDITIONS

Do not apply paint when either air or pavement temperature is below 50 degrees F or above 95 degrees F; or when rain, fog, condensation, or temperatures below 50 degrees F are anticipated during the drying period.

1.08 CLOSE-OUT

A. Reports:

None required.

B. As-Builts:

None required.

C. Operation and Maintenance Data:

None required.

D. Extra Materials:

None required.

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Pavement Marking Paint: Vinyl acrylic type for use on asphaltic concrete and portland cement concrete, colors as indicated, specified herein, or required by CBC Title 24 Part 2.

- A. Pavement Marking Paint: Vinyl acrylic type for use on asphaltic concrete and portland cement concrete, colors as indicated, specified herein, or required by CBC Title 24 Part 2.
- B. Acceptable products or equal: Frazee Paint Company; 502 Vinyl Traffic Paint Dunn-Edwards Corp.; Traffic Paint W-801

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

- A. Immediately before applying the paint, thoroughly clean the pavement surface of dust, dirt, sand, scale, water, oil, grease or other objectionable matter. Do not use solvent material that will damage pavements as cleaning agents. Immediately before painting, give pavement surfaces a final cleaning by means of a power broom and a power blower using compressed air following the brooming.
- B. Provide warning devices required to protect the painting operations and the finished work.

3.03 APPLICATION

- A. Do not apply pavement markings until after sealer has been applied as specified in Section 02743. Apply the paint only when the pavement is dry and clean. Under inclement weather conditions, or when temperature is below 50 degrees F, painting will not be permitted.
- B. Equipment: Apply the traffic and parking striping [and game markings] with a traffic stripe painting machine with a compressor capacity of at least 105 cubic feet and capable of operating at an air pressure of 125 psi. Mechanically agitate paint while the machine is in operation. Equip the striping machine with a pointer so designed that the machine will hold exactly to the alignment. Equip the propelling vehicle with a speedometer or tachometer, and with a suitable device for determining the quantity of paint in the container. Thoroughly clean the paint container and spray nozzles on the machine before starting each day's work.
 - 1. Equipment used for applying reflectorized striping shall be equipped with a bead dispenser capable of applying the beads at the specified rate.
 - 2. Where the configuration or location of a traffic stripe is such that a striping machine is not suitable, use hand spraying equipment and stencils or templates.
 - 3. Apply paint for word markings, letters, numerals, and symbols using hand spraying equipment and stencils or templates.
- C. Application: Immediately following the preparation of the pavement surface, apply the striping at the rate of 100 to 110 square feet per gallon of paint. Apply lines 4 inches wide unless otherwise indicated. Apply the stripe of the indicated or specified width, with clean true edges and without sharp breaks. Repaint, to the applicable specifications, portions of the stripe damaged by any type of traffic within 24 hours after the stripe has been applied.
 - 1. Provide International Symbol of Accessibility for each parking stall for the disabled at location indicated. Symbol shall be 36 inches square, white on standard blue background and shall conform to CBC Title 24 Part 2, Chapter 11; and ADA Accessibility Guidelines for Buildings and Facilities.

2. Tactile warning lines shall be in conformance with CBC Section 1133B.8.3 and 1133B.8.4.
- D. Tolerances: Apply striping within a tolerance of 1/2 inch in 50 feet. Apply markings and stripings to the widths indicated within a tolerance of 1/4 inch on straight sections and 1/2 inch on curved sections.
 - E. At completion touch up stripes and markings which are not clear and distinct or which are not uniform in color.

*****END OF SECTION*****

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SECTION 02781
DETECTABLE WARNING SURFACE

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SUMMARY

- A. Perform all work required to complete, as indicated by the Contract Documents and furnish all supplementary items necessary for the proper installation of Precast Concrete Pavers.
- B. System shall consist of precast concrete pavers installed on Latex thinset mortar setting bed.
- C. The paver installation shall be absolutely rigid and even large slabs when subjected to vehicular traffic, shall not be displaced.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C 33: Specification for Concrete Aggregates
 - 2. ASTM C 150: Specification for Portland Cement
 - 3. ASTM C 67: Method of Sampling and Testing Brick and Structural Clay Tile
 - 4. ASTM C 140: Specification for concrete
- B. T.C.A. Tile Council of America
 - 1. Installation Method Cement Mortar Bonded F102 - 95.
- C. A.N.S.I. American National Standards Institute
 - 1. A-118.4 Latex Portland Cement Mortar
 - 2. A-118.6 Grout – Latex

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:

- 1. All products covered under this Section shall be produced by a single manufacturer unless otherwise specified.
- 2. Manufacturer shall submit evidence of having not less than ten (10) years successful production of this product.
- 3. The paver manufacturer shall demonstrate, either by proven field performance of the laboratory freeze-thaw test that the paving units have adequate durability if they are to be subjected to a freeze-thaw environment.
 - a. Satisfactory field performance is indicated when units similar in composition and made with the same manufacturing process as those to be supplied to the purchaser, do not exhibit objectionable deterioration after at least 3 years.
 - b. The units used as the basis for proven field performance shall have been exposed to the same general type of environment, temperature range and traffic volume as is contemplated for the units supplied to the purchaser.

B. Subcontractor Qualifications:

Subcontractor shall submit evidence of skill and not less than five (5) years specialized experience with this product.

1.05 SUBSTITUTIONS

Substitutions will be considered per General Conditions Article 3.11.4 and Section 01630.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Manufacturer's Literature: Materials descriptive literature, installation instructions and paver color selection chart.

1. Test Reports: Three (3) copies, showing compliance with specified ASTM requirements
2. Quality Assurance Qualifications – see Item 1.04.
3. Shop drawings:
 - a. Layout drawings of each paved area showing the pattern of pavers, indicate pavers requiring cutting, indicate setting bed methods in each area, drainage patterns and drains. Include details of setting beds, noting all materials and their thickness, show details at curbs and vertical surfaces.
 - b. Details of custom (nonstandard) curbs and stair tread/risers, include methods of installation
4. Samples: Three (3) sample pavers of each manufacturer, type, size and color selected or specified.

1.07 PROJECT/SITE CONDITION

A. Environmental Requirements: Do no work during freezing weather or on wet or frozen sub-base.

B. Mock-up Installation

1. Prior to the start of precast concrete paver work construct mock-ups of each type of paver size and pattern area including precast curb for the Owner and Architect to review. The mock-ups will be at the project site at a location mutually agreed to by the Owner and Contractor.
2. Construct the two (2) mock-up installations a minimum 8 foot x 8 foot area of typical precast concrete units and slabs with all setting beds, joints, edge and curb details as shown on the drawings.
3. After review of the mock-ups, they should be retained and used as a standard of quality for the precast concrete paver work. At completion of the work remove the mock-up installations and related materials from the project site. If the mock-ups are incorporated in the actual construction, record their actual locations and sizes on the actual built record drawings for the project.

1.08 SEQUENCING AND SCHEDULING

Coordinate sequencing and scheduling of work with other supporting, adjacent, contiguous or otherwise related material trades.

1.09 PRODUCT HANDLING

Adhere to requirements of Section 01620.

1.10 CLOSE-OUT

A. Reports: None required.

- B. As-Builts: None required.
- C. Operation and Maintenance Data: None required.
- D. Extra Materials: None required.
- E. Extended Warranty: Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. System Source: Wausau Tile, Wausau WI, 1-800-388-8728
- B. System Name: Thinset Mortar Method - Pedestrian Installation
- C. Precast Concrete Pavers
 - 1. Name: Detectable Warning Pavers
 - 2. Size: As shown on the drawings
 - 3. Texture: ADA-2 Truncated Dome
 - 4. Finish and Color: To be picked from Standard color and finish.
 - 5. Reference Standard:
 - a. Cementitious Materials: Materials shall conform to the following applicable ASTM Specifications
 - 1) Portland Cement: ASTM C 150 for Portland Cement
 - b. Aggregates shall conform to these ASTM specifications, except that grading requirements shall not necessarily apply:
 - 1) Normal Weight: ASTM C 33 for Concrete Aggregates
 - c. Other constituents: Coloring pigments, integral water repellents, etc., shall be previously established as suitable for use in concrete and either shall conform to ASTM Standards where applicable, or shall be shown by test or experience not to be detrimental to the durability of the concrete.
 - 6. Performance Requirements:
 - a. Compressive Strength: At the time of delivery to the work site, the average compressive strength shall not be less than 7,000 psi with no individual unit less than 6,500 psi per ASTM C 140.
 - b. Absorption: The average shall not be greater than 5% per ASTM C140.
 - c. Flexural Strength: Not less than 600 psi per ASTM 293.
 - d. Load carrying capacity: Paver units shall have a tested center load capacity of 1,750 lbs.
 - e. Latex Mortar Mix: A.N.S.I A-118.4
 - f. Water: Clean and free of deleterious acids, alkalies or organic materials
 - g. Grout: A.N.S.I. A-118.6, Grout – Latex
 - h. Sealant: As specified in Section 07920 -0 Sealants and Caulking
 - i. Back-up: As specified in Section 07920 - Sealants and Caulking
 - j. Bond Breaker: As specified in Section 07920 - Sealants and Caulking

2.02 MIXING

- A. Latex Portland Cement Mortar setting bed: As recommended by the manufacturer.
- B. Grouting Mix: Latex as recommended by manufacturer. Color as selected.
- C. Rework mixes from time to time to maintain proper consistency, as recommended by manufacturer but do not add ingredients. Discard mortar that has reached its initial set.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSPECTION

- A. Examine all surfaces to receive the parts of the work specified herein. Concrete slab shall not exceed 1/8" in 10'-0" from required plane. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected. Installation of precast concrete pavers and associated construction constitutes acceptance of the adjacent and underlying construction.
- B. Installation of Mortar bed as per TCA F102 - 95. All materials used follows instructions of manufacturer for use in mortar method.
- C. Install precast concrete pavers
- D. Grouting of pavers in strict accordance with grout manufacturer's directions and instructions. Latex or acrylic additives of the same manufacturer as the grout.
- E. All control and expansion joints to be installed as per TCA EJ 171-94. All joint materials said to follow manufacturer's directions and instructions.
- F. Field cut precast pavers in accordance with manufacturer's recommendations for methods, equipment and precautions.

3.03 CLEANING AND PROTECTION

- A. Remove and replace pavers that are loose, chipped, broken, stained or other wise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.
- B. Cleaning: Remove mortar stains and all other types of soiling from exposed paver surfaces, wash and scrub clean.
- C. Provide final protection and maintain conditions in a manner acceptable to installer, which ensures paver work being without damage or deterioration at time of substantial completion.

***** END OF SECTION *****

SECTION 02830
TUBULAR STEEL FENCES AND GATES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SUMMARY

Provide tubular steel fence system where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.03 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 SUBSTITUTIONS

Substitutions will be considered per General Conditions Article 3.11.4 and Section 01630.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;
4. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures for the Work.

1.06 PRODUCT HANDLING

Adhere to requirements of Section 01620.

1.07 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

None required

D. Extra Materials:

None required

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Pickets shall be 5/8" square regular style. Pickets shall be spaced as shown on the Drawings.
- B. Rails shall be 1" square - regular style. This shall also be the size of all members of gate frames up to 25 sq. ft.
- C. Posts:
 - 1. Sizes:
 - a. 1-1/2" square regular weight - for end, corner and line posts for fences up to 5'-0" in height.
 - b. 2" square regular weight- end, corner and line posts for 6'-0" high fence and gateposts for regular iron gates up to 15 sq. ft.
 - c. 2" square heavy weight for end, corner and line posts up to 6'-0" high and gates between 15 and 25 s. f.
 - d. 2-1/2" square - for gateposts for iron gates between 25 and 40 sq. ft.
 - 2. Provide pressed steel caps with all posts.
 - 3. Add 1'-6" to the gross height of the fence for posts going into concrete footings. If posts are designed to be flange mounted, no additional length is required.
- D. Finishes:
 - 1. All ornamental steel fencing shall be cleaned in hot caustic solution and coated with an oakite to prevent flash rust and give paint adhesion. After fabrication, panels and posts are to be dipped in black primer coating inside and out of all metal surfaces and then electrostatically sprayed with a finish coat of low sheen, alkalide resin, and zinc chromate rust inhibiting paint.

2.02 HARDWARE

- A. Swing Gate Hardware:
 - 1. Hinges: Provide clamp-on hardware for flat wall or post installation as shown on the Drawings.
 - a. Operation shall be one- way self-closing butt hinges unless shown otherwise on the Drawings.
 - b. Hinges, which are shown on the drawings to be dual acting, will also be self-closing butt hinges.
 - 2. Latches:
 - a. If no other latch / lock is specified, gate manufacturer shall provide padlock hasp at post and gate for securing the gate. Latch shall be a forked or plunger bar to permit operation from either side of the gate.
 - 3. Gate pairs shall be provided with drop rod, which shall be accessible only from the interior of the gate and protected by a welded steel box.
- B. Rolling Gate Hardware: Provide following for each gate:
 - 1. Latches:
 - a. Provide forked type or plunger-bar type to permit operation from either side of the gate.

- b. Provide padlock eye as integral part of latch.
- 2. Universal Track Bracket:
 - a. Provide 10 gage galvanized steel brackets with 3/8" diameter galvanized J-Bolts and nuts.
- 3. Rear Wheels:
 - a. Provide 5" outside diameter, 4" diameter V-Groove, galvanized steel roller bearing wheel.
 - b. Anchor rear wheels to gate frame with 5/8" diameter.
- 4. Double Wheel Carriage:
 - a. Provide 1" x 2" x 14 ga. galvanizing steel tube axle with 3/8" diameter galvanized J-Bolts and 6" diameter rubber tire with galvanized steel roller bearing hub.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. General:

- 1. Install posts at a maximum spacing of 8 feet on centers.
- 2. Install corner of slope posts where changes in line or grade exceed a 30° deflection.
- 3. The distance between end or corner posts shall be divided equally into panels not over 8'-0" long.
- 4. Install panels at a bias when there is more than a 4" drop for the distance that the panels in this section cover and more than 2" drop within the length of a given panel. A post shall be installed at the top and bottom of each bias.

B. Excavating:

- 1. Drill holes for post footings in firm, undisturbed or compacted soil, strictly adhering to the dimensions and spacing shown.
- 2. Post hole dimensions:
 - a. Provide 24" deep by 6" diameter foundations for line posts.
 - b. Provide 24" deep by 9" diameter foundations for all other posts. (i.e.: corner and gateposts).
- 3. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site if so directed.
- 4. When solid rock is encountered near the surface, drill into rock at least 12" for line posts and at least 18" for end, pull, gate, and corner posts. Drill hole at least 1" greater diameter than the largest dimension of the post to be placed.

5. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed minimum depths as specified above.

C. Setting posts:

1. Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.
2. Center and align posts in hole.
3. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation.
4. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
5. Trowel tops of footings, and slope or dome to direct water away from posts.
6. Extend footings for gateposts to the underside of bottom hinge.
7. Set keeps, stops, sleeves, and other accessories into concrete as required.
8. Keep exposed concrete surfaces moist for at least seven days after placement, or cure with membrane curing material or other curing method accepted by the Architect.
9. Grout-in those posts, which are set into, sleeved holes, concrete constructions, or rock excavations, using non-shrink Portland cement grout or other grouting material accepted by the Architect.

D. Concrete strength:

1. Allow concrete to attain at least 75% of its minimum 28-day strength before rails are installed.
2. Do not, in any case, install such items in less than seven days after placement of concrete.
3. Do not hang gates until concrete has attained its full design strength.

E. Rails: Install with panel mounting angle clips with screws into post top and bottom. Ensure each panel is level and plumb. Rails shall be mounted to maintain an even 4" above ground.

F. Installing gates:

1. Install gates plumb, level, and secure for full opening without interference.
2. Install ground-set items in concrete for anchorage in accordance with the fence manufacturer's recommendations as accepted by the Architect.
3. Lubricate and adjust the hardware for smooth operation.

G. Miscellaneous:

1. Repair coatings damaged in the shop or field erection, using a hot-applied repair compound applied in accordance with its manufacturer's recommendations as accepted by the Architect.

***** END OF SECTION *****

SECTION 03100
CONCRETE FORMWORK AND ACCESSORIES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SUMMARY

Design, furnish and install forms for concrete as indicated on drawings and specified here. Remove forms and shores at specified time. Clean up.

1.03 QUALITY ASSURANCE

A. General:

1. Conform to all requirements of ACI 347 and CBC Section 1906.1 and 1906.2.
2. Concrete formwork shall be designed and constructed to safely support fluid concrete and superimposed construction loads without excessive deflection or concrete leakage. Provide bracing to maintain accurate alignment and to resist all anticipated lateral loads. Forms shall conform with drawings as to shape, line, and dimension. Design, engineering and construction of forms shall be Contractor's responsibility. Formwork for exposed concrete shall be constructed to tolerances indicated in ACI 303R.
3. Cooperate and coordinate with other trades who furnish and/or install piping, conduit, reglets, anchors, inserts, sleeves, hangers, etc., as their work requires; including provisions for recesses and chases.

B. Submittals: (Submit under provisions of Section 01330)

1. Product Data. Provide manufacturers data and installation instructions for the following:
 - a. Tie rods and spreaders.
 - b. Formwork for exposed concrete.
 - c. Form coatings and release agents.

C. Standards and References: (Latest Edition unless otherwise noted)

1. 2010 California Building Code (CBC).
2. "Recommended Practice for Concrete Formwork", ACI 347, American Concrete Institute, latest edition.
3. Standard Grading and Dressing Rules #17, West Coast Lumber Inspection Bureau (For Douglas Fir Form Lumber).
4. U.S. Product Standard PS 1-83 (For Plywood Form Lumber).
5. "Guide to Cast-In-Place Architectural Concrete Practice", ACI 303R, American Concrete Institute, latest edition.

1.04 PRODUCT HANDLING

Comply with the requirements of Section 01620.

1.05 CLOSE-OUT: also comply with the requirements of section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Not required.

C. Operation and Maintenance Data:

None required.

D. Extra Materials:

None required.

E. Extended Warranty:

Comply with the requirements of General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Form Material:

1. Smooth Concrete exposed to view: 5/8 inch minimum APA Plyform or steel.
2. Concrete concealed from view: 5/8 inch minimum APA Plyform, steel or clean and sound 1 x 8 Standard Grade Douglas Fir.

B. Fiber Forms: Tubular column forms spirally constructed of laminated plies of fiber. Plies shall be laminated using a non-water sensitive adhesive and surface wax impregnated for moisture protection. Forms shall give a smooth and seamless appearance to the cast concrete. Provide reveals, as shown on the drawings, as supplied by the form manufacturer. Forms shall be as manufactured by Sonoco Products, plastic lined; Burke Smoothtube by Burke Co.; or approved equal.

C. Form Clamps: Assembly to have cone washers, (1 inch break back) 3/8" inch center rod.

D. Form Ties:

1. Concrete exposed to view: Snap ties allowing full 1 inch break back.
2. Concrete concealed from view: Snap ties or wire.
3. Verify special spacing requirements with architectural drawings at exposed concrete.

E. Spreaders: Metal (no wood).

F. Form Coating: Non-grain and non-staining types of form coating that will not leave a residual matter on the face of the concrete or adversely affect proper bonding of any subsequent paint or other surface applications.

1. Form coating containing mineral oils or other non-drying materials will not be permitted for any concrete work.

G. Joint Tape: No. 471 plastic film tape 3 inches wide, as manufactured by the Industrial Tape Division of 3M Company.

H. Expansion Joint Filler (Preformed): ½ inch thick; Flexcell by Celotex Corporation, Elastic Fiber Expansion Joint by Phillip Carey Mfg. Co., or Sealtight Fiber Expansion Joint by W.R. Meadows, Inc.

I. Extruded Polystyrene Foam: ASTM C578 type IV. Dow Chemical Corp. "Styrofoam", UC Industries "Foamular", or approved equal.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 FORM CONSTRUCTION

- A. Construct substantial forms to the shapes, lines, grades and elevations shown, sufficiently tight to prevent leakage of mortar, and tied, clamped and braced to prevent spreading, shifting or settling. Plywood joints shall be square and tight; plywood shall be arranged in such manner as to minimize number of joints and to provide a smooth, attractive finished concrete surface.
- B. Apply form coating to forms before reinforcing steel is in place.
- C. Sleeves, anchors and bolts, including those for angle frames, supports, ties and other materials in connection with concrete construction, shall be secured in position before the concrete is placed.
- D. Proper provisions shall be made for openings, blockouts, sleeves, offsets, sinkages, recesses and depressions required by other trades and suppliers prior to placing concrete.
 - 1. The Contractor shall also see that sleeves have been installed and other provisions have been made for the installation of mechanical, electrical and other equipment.
 - 2. Coordinate with all trades to insure proper placement of all items in forms and to provide proper blockouts wherever required.
- E. Concrete work out of alignment, level or plumb will be cause for rejection of the whole work affected and, if so rejected, such work shall be removed and replaced, as directed by Architect, with no additional cost to the Owner.
- F. Form Not Required: Concrete footings may be poured directly against cut earth where feasible and when the Architect's approval has been obtained.
 - 1. See structural drawings for requirements for placing concrete footings directly against earth without forms.
- G. Use ¾ inch minimum wood chamfer strips typical at all exposed corners unless noted otherwise on drawings.

3.03 CLEANING OF FORMS

- A. All dirt, chips, sawdust, rubbish, water, etc. shall be completely removed from form by water hosing and air pressure before any concrete is deposited therein. No wooden ties or blocking shall be left in concrete except where indicated for attachment of other work.
- B. Thoroughly clean and patch all holes in formwork and re-coat as required before reusing. Forms not suited to obtain concrete surfaces and tolerances in conformity with Contract requirements will be rejected by Architect.
 - 1. Reuse of forming materials shall be limited only as required to produce the finishes as specified, free from blemishes and other defects unless covered by other building materials in which case blemish free concrete is not required.

3.04 INSPECTION OF FORMS

Notify the Architect at least 48 hours in advance of the beginning of pouring operations and at the completion of formwork and location of all construction joints. An inspection of forms and joints will be made for approval of finished work and general layout only. The foregoing inspection shall in no way relieve the Contractor of responsibility of design and safety of formwork, bulkheads and shorings.

3.05 REMOVAL OF FORMS AND SHORING

- A. Do not remove forms until concrete has attained sufficient strength to support its weight and any construction loading. Concrete must be allowed to cure long enough to avoid damage during form removal. Contractor or his representative in charge of concrete construction shall be present during removal of forms and shores, and shall be personally responsible for safety of this operation at all times and under all conditions.
- B. As a minimum, formwork and shoring shall remain in place for the following periods:
 - 1. Concrete on grade: 24 hours.
 - 2. Walls and Columns: 3 days.
 - 3. Formwork may be removed and reshores installed before the times indicated above, provided the concrete has cured sufficiently to avoid damage when formwork is removed. Shores must be immediately replaced with reshores in a sequence designed to avoid inducing stress in the concrete member.

3.06 ADJUSTING AND CLEANING

- A. Upon completion of this Work, clean up and remove from Site all equipment and debris resulting from this work.
- B. Surfaces to be painted shall be smooth and free of substances such as dirt, wax, excessive latence, grease or materials that would prevent proper bonding of finishes.
 - 1. Removal of foregoing contaminants, and complete removal of parting and curing compounds affecting proper paint bond, shall be responsibility of this Section of Work. Sandblast cleaning shall not be employed without specific approval of Structural Engineer.

*****END OF SECTION*****

SECTION 03210
REINFORCING STEEL

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SECTION INCLUDES

Unless noted otherwise, furnish and install reinforcing for all concrete, including dowels, chairs, spacers, bolsters, etc., necessary for supporting and fastening reinforcement in place as shown on the Drawings and specified herein

1.03 QUALITY ASSURANCE

A. General:

1. Acceptable Manufacturers: Regularly engaged in the manufacture of steel bar and welded wire fabric reinforcing.
2. Installer Qualifications: Installation shall be done only by an installation firm normally engaged in this business. All work shall be performed by qualified mechanics working under an experienced supervisor.
3. Welding Qualifications: Welding procedures, welding operators and welders shall be qualified in accordance with AWS D1.4 - "Structural Welding Code Reinforcing Steel".
 - a. Welders whose work fails to pass inspection shall be re-qualified before performing further welding.
4. Reinforcement Work shall conform to ACI 301 and CBC Section 1907, as minimum standards.
5. Allowable Tolerances:
 - a. Fabrication:
 - 1) Sheared length: 1 inch.
 - 2) Depth of truss bars: Plus 0 minus ½-inch.
 - 3) Ties: Plus or minus ½-inch.
 - 4) All other bends: Plus or minus 1 inch.
 - b. Placement:
 - 1) Concrete cover to form surfaces: Plus or minus ¼-inch.
 - 2) Minimum spacing between bars: Plus or minus ¼-inch.
 - 3) Crosswise of members: Spaced evenly within 2 inches of stated separation.
 - 4) Lengthwise of members: Plus or minus 2 inches.
 - c. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 2 bar diameters.

A. Standards and References: (Latest Edition unless otherwise noted):

1. American Concrete Institute (ACI).
 - a. ACI 301 - "Specifications for Structural Concrete for Buildings".

- b. ACI 315 - "Details and Detailing of Concrete Reinforcing".
- c. ACI 318 – "Building Code Requirements for Reinforced Concrete"
- 2. American Society for Testing and Materials (ASTM).
 - a. ASTM A82 - "Cold Drawn Wire for Concrete Reinforcement".
 - b. ASTM A185 - "Welded Steel Wire Fabric for Concrete Reinforcement".
 - c. ASTM A615 - "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement".
 - d. ASTM A706 – "Low Alloy Steel Deformed Bars for Concrete Reinforcement".
- 3. Concrete Reinforcing Steel Institute (CRSI) - "Manual of Standard Practice".
- 4. 2010 California Building Code (CBC),.

1.04 SUBSTITUTIONS

Substitutions will be considered per General Condition Article 3.11.4 and Section 01630.

1.05 SUBMITTALS:

- A. Provide in accordance with Article 3.11 of the General Conditions.
- B. Submit the following
 - 1. Shop Drawings: Prepare in accordance ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars and shapes, dimensions and details of bar reinforcing and assemblies. Correctness of all reinforcing requirements and work is the responsibility of Contractor. Identify such shop drawings with reference thereon to sheet and detail numbers from Contract Drawings.
 - a. Do not use scaled dimensions from Contract Drawings in determining the lengths of reinforcing bars.
 - b. No reinforcing steel shall be fabricated without approved shop drawings.
 - c. Any deviations from the contract documents must be clearly indicated as a deviation on the shop drawings.
 - d. Areas of high congestion, including member joints and embed locations shall be fully detailed to verify clearances and assembly parameters and coordination with other trades.
 - 2. Certified mill test reports of supplied reinforcing indicating chemical and physical analysis. Tensile and bend tests shall be performed by the mill in accordance with ASTM A615.
 - 3. Product Data:
 - a. Manufacturer's specifications and installation instructions for splice devices.
 - b. Bar Supports.
 - 4. Certificates of Compliance with specified standards:
 - a. Reinforcing bars.
 - b. Welded wire fabric.
 - c. Welding electrodes.
 - 5. Samples: Only as requested by Architect.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Comply with the requirements of Section 01620.

- B. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.
- C. Handle and store materials to prevent contamination.
- D. Store reinforcement in a manner that will prevent excessive rusting or coating with grease, oil, dirt, and other objectionable materials. Storage shall be in separate piles or racks so as to avoid confusion or loss of identification after bundles are broken.
- E. Deliver and store welding electrodes in accordance with AWS D12.1.

1.07 TESTS AND INSPECTIONS:

- A. A testing program is required prior to start of construction. Testing program to be done in compliance with the 2010 CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.
- B. All reinforcing steel whose properties are not identifiable by mill test reports shall be tested in accordance with ASTM A615. One Series of tests for each missing report to be borne by the Contractor.
- C. When inspections are indicated for reinforcement placement on the Structural drawings, a special inspector shall be employed to inspect reinforcing placement per CBC Section 1704.
- D. When tests are indicated for reinforcing steel on the structural drawings, the reinforcing steel used shall be tested in accordance with ASTM A615. One tensile and one bend test for each 2-1/2 tons of steel or fraction thereof, shall be made.
- E. Inspect shop and field welding in accordance with AWS D1.4, including checking materials, equipment, procedure and welder qualification as well as the welds. Inspector will use non-destructive testing or any other aid to visual inspection that he deems necessary to assure himself of the adequacy of the weld.
- F. Tests and inspection shall be performed by Owners testing agency except when needed to justify rejected work, in which case the cost of retests and re-inspection shall be borne by the Contractor.

1.08 CLOSE-OUT: also comply with the requirements of Section 01770 – Contract Closeout.

- A. Reports:
Final Report related to Item 1.07.
- B. As-Builts:
Comply with the requirements of Section 01770 – Contract Closeout.
- C. Operation and Maintenance Data:
None required.
- D. Extra Materials:
None required.
- E. Extended Warranty:
Comply with the requirements of General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Reinforcement Bars: ASTM A615, Grade 60 for all bars.

1. Bar reinforcement to be welded shall meet chemical requirements of ASTM A706.
 2. Longitudinal reinforcement in column and beams of special moment-resisting frames shall meet the chemical requirements of ASTM A706.
- B. Stirrups and Ties: ASTM A615, Grade 60 for all bars.
- C. Steel Dowels: Same grade as bars to which dowels are connected.
- D. Welded wire Fabric: ASTM A185.
- E. Tie Wires: FS-QQ-W-461, annealed steel, black, 16 gauge minimum.
- F. Welding Electrodes: AWS D1.4, low hydrogen, E70XX series.
- G. Bar Supports:
1. Typical, unless noted otherwise; CRSI Class 2 wire supports.
 - a. Do not use wood, brick or other objectionable materials.
 - b. Do not use galvanized supports.
 2. Supports placed against ground: Pre-cast concrete blocks not less than 4 inches square with embedded wire.
- H. Mechanical Couplers: Comply with ACI 318 section 12.14.3.

PART 3 – EXECUTION

3.01 FABRICATION

- A. Shop fabricate reinforcement to meet requirements of Drawings.
- B. Fabricate reinforcement in accordance with the requirements of ACI 315 where specific details are not shown or where Drawings and Specifications are not more demanding.
- C. Steel reinforcement shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the Drawings shall not be used. Heating of bars for bending will not be permitted.
- D. Reinforcing shall not be field bent or straightened without structural engineer's review.
- E. Provide offsets in rebar (1:6 maximum) where required to maintain clearances.

3.02 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.03 GENERAL

- A. Concrete shown without reinforcing shall be reinforced as similar parts shown with reinforcing except where concrete is specifically noted to be unreinforced.

3.04 PLACEMENT

- A. All reinforcement shall be accurately set in place, lapped, spliced, spaced rigidly and securely held in place and tied with specified wire at all splices and crossing points. All wire tie ends shall point away from the form. Carefully locate all dowel steel to align with wall and column steel.

1. Bars shall be in long lengths with laps and splices as shown. Offset laps in adjacent bars. Place steel with clearances and cover as shown. Bar laps shall be as indicated on the Drawings. Tie all laps and intersections with the specified wire.
 2. Maintain clear space between parallel bars not less than 1-1/2 times nominal diameter, but in no case shall clear space be less than 1-1/2 times maximum size concrete aggregate.
 3. Reinforcing dowels for slabs shall be placed as detailed. Sleeves may be used if reviewed by the Structural Engineer before installation. Install dowel through all construction and expansion joints for all slabs on grade.
- B. Bar Supports: Support and securely fasten bars with chairs, spacers and ties to prevent displacement by construction loads or placement of concrete beyond the tolerances specified. Conform to CRSI as a minimum standard.
- B. Steel Adjustment:
1. Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, or embedded items.
 2. Do not move bars beyond allowable without concurrence of Structural Engineer.
 3. Do not heat, bend, or cut bars without concurrence of Structural Engineer.
 4. Reinforcement shall not be bent after being embedded in hardened concrete.
- D. Splices:
1. Splice reinforcing as shown.
 2. Lap Splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
 3. Splice Devices: Install in accordance with manufacturer's written instructions. Obtain Structural Engineer's review before using.
 4. Do not splice bars except at locations shown without concurrence of Structural Engineer.
 - a. Where splices in addition to those indicated are required, indicate location on shop drawings clearly and highlight "for Engineer's approval".
- E. Welding:
1. Welding is not permitted unless specifically detailed on Drawings or approved by Engineer.
 2. Employ shielding metal-arc method and meet requirements of AWS D1.4.
 3. Welding is not permitted on bars where the carbon equivalent is unknown or is determined to exceed 0.55.
 4. Welding shall not be done within two bar diameters of any bent portion of a bar which has been bent cold.
 5. Welding of crossing bars is not permitted.
- F. Welded Wire Fabric: Install in long lengths, lapping 24 inches at end splices and one mesh at side splices. Offset laps in adjacent widths. Place fabric in approximately the middle of the slab thickness unless shown otherwise on the Drawings by dimension. Wire tie lap joints at 12-inch centers. Use concrete blocks to support mesh in proper position.
- G. Reinforcement shall be free of mud, oil or other materials that may reduce bond at the time concrete is placed. Reinforcement with tightly adhered rust or mill scale will be accepted without cleaning provided that rusting has not reduced dimensions and weights below

applicable standards. Remove loose rust.

H. Protection against rust:

1. Where there is danger of rust staining adjacent surfaces, wrap reinforcement with impervious tape or otherwise prevent rust staining.
2. Remove protective materials and clean reinforcement as required before proceeding with concrete placement.

I. Drawing Notes: Refer to notes on Drawings for additional reinforcement requirements.

J. Mechanical and Electrical Drawings: Refer to Mechanical and Electrical Drawings for formed concrete requiring reinforcing steel. All such steel shall be included under the work of this Section.

*****END OF SECTION*****

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SUMMARY

A. Furnish, place and finish cast in place concrete and related work as indicated on the Drawings and specified here.

1. Install miscellaneous metal and other items furnished by other trades to be installed in concrete work.
2. Provide facilities for job curing of test cylinders and transporting to Testing Laboratory.

B. Provide grouting of steel base plates as indicated on the Drawings and specified here.

1.03 QUALITY ASSURANCE

A. Standards and References: (Latest Edition unless otherwise noted)

1. 2010 California Building Code (CBC)
2. AMERICAN CONCRETE INSTITUTE (ACI)
 - a. ACI 117 Standard Tolerances for Concrete Construction and Materials
 - b. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
 - c. ACI 211.2 Standard Practice for Selecting Proportions for Structural Lightweight Concrete
 - d. ACI 301 Structural Concrete for Buildings
 - e. ACI 302 Guide for Concrete Floor and Slab Construction
 - f. ACI 305R Hot Weather Concreting
 - g. ACI 318 Building Code Requirements for Reinforced Concrete
 - h. ACI 360 Design of Slabs-On-Ground
3. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
 - a. ASTM C 31 Making and Curing Concrete Test Specimens in the Field
 - b. ASTM C 33 Concrete Aggregates
 - c. ASTM C 39 Compressive Strength of Cylindrical Concrete Specimens
 - d. ASTM C 42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - e. ASTM C 94 Ready-Mixed Concrete
 - f. ASTM C 109 Test of Hydraulic Cement Concrete

- g. ASTM C 143 Slump of Hydraulic Cement Concrete
- h. ASTM C 150 Portland Cement
- i. ASTM C 172 Sampling Freshly Mixed Concrete by the Volumetric Method
- j. ASTM C 192 Making and Curing Concrete Test Specimens in the Laboratory
- k. ASTM C 260 Air-Entraining Admixtures for Concrete
- l. ASTM C 330 Lightweight Aggregates for Structural Concrete
- m. ASTM C 494 Chemical Admixtures for Concrete

- n. ASTM C 618 Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
- o. ASTM C685 Volumetric Batching and continuous mixing
- p. ASTM C1157 Hydraulic-Cement

1.04 SUBSTITUTIONS

Substitutions will be considered per General Condition Article 3.11.4 and Section 01630.

1.05 SUBMITTALS:

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Submit the following:

1. Concrete mix designs. See "Mix Design" below. Include results of test data used to establish proportions.
2. Certificates of Compliance from Manufacturer
 - a. Cement certificates
 - b. Aggregates
 - c. Admixtures.
3. Data regarding hardeners and sealers.
4. Grout samples for sacked surface textures and colors.
5. Layout drawings for construction, control and expansion joints.
6. Transit-mix delivery slips:
 - a. Keep record at the job site showing time and place of each pour of concrete, together with transit-mix delivery slips certifying contents of the pour.
 - b. Make the record available to the Architect for his inspection upon request.
 - c. Upon completion of this portion of the work, deliver the record and the delivery slips to the Architect.
7. See Section 03210 for reinforcing steel submittals.

1.06 TESTS AND INSPECTIONS:

A. A testing program is required prior to start of construction. Testing program to be done in Compliance with the 2010 CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.

B. The following tests shall be made by a recognized testing laboratory selected by the Owner and approved by the governing agency. All tests shall be in accordance with the previously mentioned standards and ACI 318 Section 5.6. A complete record of all tests and inspections shall be kept.

1. Compressive Strength: Make and cure in accordance with ASTM C-31. Test in accordance with ASTM C-39 and ACI 318 section 5.6.
 - a. A record shall be made of time and of locations of concrete from which samples were taken.
 - b. Four identical cylinders shall be taken from each pour of 150 cubic yards or 5000 square feet or part thereof, being placed each day per ACI 318 5.6.2.1. One cylinder shall be tested at age 7 days, and two at age 28 days unless otherwise specified. Preserve remaining cylinder for future use.
2. Drying Shrinkage: (applies to lightweight concrete only unless noted otherwise)
 - a. A record shall be made of time cylinders and of locations of concrete from which samples were taken.
 - b. Three identical 4" x 4" x 11" specimens shall be made from same concrete as used in structure. Percent of shrinkage shall be reported at 21 days after 7 day moist curing period. Average results of 3 specimens shall be used as the accepted value. The value for laboratory cast specimens shall not exceed .075%. If field test specimens are used in lieu of laboratory specimens, a tolerance of +33% may be used.
 - c. Test specimens in accordance with ASTM C157.
3. Concrete consistency (slump) shall be tested in accordance with ASTM C143.

C. Provide full time inspection during the taking of test specimens and during the placing of all concrete and embedded steel.

D. See Section 03210 for reinforcing steel tests and inspections.

E. Provide concrete batch plant inspections per ASTM C685.

1.07 CLOSE-OUT: also comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

Final Report related to Item 1.06.

B. As-Builts:

Not required

C. Operation and Maintenance Data:

None required.

D. Extra Materials:

None required.

E. Extended Warranty:

Comply with the requirements of General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 MATERIAL

- A. Portland Cement: ASTM C 150, Type II. One brand of cement shall be used throughout to maintain uniform color for all exposed concrete.
- B. Concrete Aggregate: Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of appropriate ASTM Standards and ACI 318.
 - 1. Concrete Aggregates for Standard Weight Concrete: ASTM C 33. Aggregate shall be crushed granite or Perkins type.
 - 2. Concrete Aggregates for Lightweight Concrete: ASTM C330 to produce concrete weighing no more than 115 pcf at 28 days. Aggregate shall be vacuum saturated expanded shale as produced through the rotary kiln method.
- C. Water: Clean and free from injurious amounts of oil, acids, alkali, organic matter and other deleterious substances; suitable for domestic consumption.
- D. Admixtures shall be subject to prior approval by the Architect, in accordance with ACI 318, Calcium Chloride is not permitted.
 - 1. Water Reducing
 - a. ASTM C494 Type A - for use in cool weather.
 - b. ASTM C494 Type D - for use in hot weather.
 - 2. Air Entraining
 - a. Conform to ASTM C 260
 - 3. Fly Ash
 - a. Conform to ASTM C 618
 - 4. Mid-Range Water-Reducers
 - a. Master Builders "Polyheed" or approved equal.
 - 5. Fly Ash Pozzolan
 - a. Conforming to ASTM A-618 Class F
- E. Slab on Grade Vapor Retarder
 - 1. Vapor Retarder must have the following qualities:
 - a. 10 mil thickness minimum
 - b. WVTR less than 0.008 as tested by ASTM E 96
 - c. ASTM E 1745 Class A (Plastics)
 - 2. Vapor Retarder Products
 - a. Stego Wrap Vapor Retarder by STEGO INDUSTRIES LLC.
 - b. W.R. Meadows Premoulded Membrane with Plasmatic Core.
 - c. Zero-Perm by Alumiseal.
 - 3. Vapor Retarder Tape
 - a. Water Vapor Transmission Rate :ASTM E 96, 0.3 perms or lower
 - b. Minimum 8-mils thick
 - c. Minimum 4 inches wide
 - d. Manufactured from High Density Polyethylene
 - e. Pressure Sensitive Adhesive

- F. Sand: Clean, dry, well graded.
- G. Abrasive aggregate for non-slip finish: Fused aluminum oxide grits, graded 12/30. Use factory-graded rustproof and non-glazing material that is unaffected by freezing, moisture and cleaning materials.
 - 1. Products offered by manufacturers to comply with the above requirements include: A-H Alox; Anti-Hydro Waterproofing Co., Toxgrip; Toch Div. - Carbolite, or approved equal.
- H. Expansion Joint Filler:
 - 1. Joint fill shall be a preformed non-extruded resilient filler, saturated with bituminous materials and conforming to ASTM D 1751. Products shall be equivalent to Burke "Fiber Expansion Joint", W.R. Meadows "Fibrated Expansion Joint Filler", or approved equal.
- I. Bonding Agent: Sonneborn "Sonobond"; the Euclid Chemical Company "Euco-Weld"; Larsen Products Corp., "Weld-Crete" or approved equivalent.
- J. Concrete Sealer: Cure and Seal, as manufactured by the Euclid Chemical Company "Aqua-Cure VOX", Sonneborn "Kure-N-Seal WB", Burke "Spartan-Cote", W.R. Meadows "Intex" or approved equal conforming to ASTM C-309, Type I, Class B requirements, and conforming to State of California Air Resources Board VOC Regulations.
- K. Concrete Hardener/Sealer: Clear, water soluble, sprayable in-organic silicate based hardener/sealer or acrylic co-polymer resin. Products shall be equal to Euclid Chemical Company "Eucosil", Burke "Spartan-Cote", Sonneborn "Sonosil", W.R. Meadows "Pena-Lith", or approved equal and must conform to State of California Air Resources Board VOC Regulations.
- L. Concrete Cure: Water based curing compound conforming to ASTM C-309, Type 1, Class A and B, and AASHTO Specification M-148; Type 1, Class A and B requirements, and State of California Air Resources Board VOC Regulations. Product shall be equivalent to Euclid Chemical Company "Kurez VOX", Burke "No. 1127" or "Aqua-Resin Cure", W.R. Meadows "1100 Clear", or approved equal.
- M. Non-Shrink Grout: See Section 2.02.A.4

2.02 CONCRETE

- A. Concrete Mixes:
 - 1. Type A Concrete: Use for unexposed foundation concrete except as otherwise specified. At Contractor's option, Type B concrete may be substituted for this.
 - a. Strength: 4000 lbs. per square inch at 28 days.
 - b. Maximum Aggregate Size: 1-1/2 inch.
 - c. Cement Content: As required by mix design (ACI 318 Section 5.2).
 - d. 6.0 sacks per yard minimum.
 - e. Maximum Water to Cement Ratio: 0.50
 - f. Admixture: Water Reducing.
 - g. Weight: 145 lbs. per cubic foot
 - 2. Type B Concrete: Use for building slab on grade
 - a. Strength: 4000 lbs. per square inch at 28 days.
 - b. Maximum Aggregate Size: 1 inch.

- c. Minimum Cement Content: As required by mix design. (ACI 318 Section 5.2).
 - d. 6.0 sacks per yard minimum.
 - e. Maximum Water to Cement Ratio: 0.45
 - f. Admixture: Water reducing.
 - g. Weight: 145 lbs. per cubic foot
 - h. Maximum Fly Ash content as a percentage of total cementitious material: 15%
3. Type C Concrete: Use for concrete sidewalks, mechanical and electrical pads, miscellaneous non-structural slabs on grade.
- a. Strength: 4000 lbs. per square inch at 28 days.
 - b. Maximum Aggregate Size: 1 inch.
 - c. Minimum Cement Content: As required by mix design (ACI 318 Section 5.2).
 - d. 6.0 sacks per cubic yard.
 - e. Maximum Water to Cement Ratio: 0.50
 - f. Admixture: Water reducing.
 - g. Weight: 145 lbs. per cubic foot.
4. Grout shall be non-shrink, non-metallic, flowable Type "713" or "928" by Master Builders.
- a. Metallic grout equivalent to Master Builders "Embeco" may be used only where covered by earth, concrete, or masonry.
 - b. Acceptance by Architect required before using.
- B. Consistency of Concrete: Concrete slump, measured in accordance with ASTM C 143, shall fall within following limits.
- 1. For General concrete placement: 3 inch plus or minus 1 inch.
 - 2. Mixes employing the specified mid-range water reducer shall provide a measured slump not to exceed 7 inch \pm 1 inch after dosing, 2 inch \pm 1 inch before dosing.
 - 3. Concrete slump shall be taken at point of placement. Use water reducing admixtures as required to provide a workable consistency for pump mixers. Water shall not be added at the jobsite without written review by the structural engineer.
- C. Mix Design:
- 1. Initial mix design shall be prepared for all concrete in accordance with ACI 318 section 5.2. Mix proportions shall be determined in accordance with ACI 318 Section 5.3 or ACI 318 section 5.4. In the event that additional mix designs are required due to depletion of aggregate sources, aggregate not conforming to Specifications, or at request of Contractor, these mixes shall be prepared as above.
 - 2. Contractor shall notify the Testing Laboratory and Architect of intent to use concrete pumps to place concrete so that mix designs can be modified accordingly.
 - 3. Fly ash shall not exceed fifteen percent of the total cementitious material.
 - 4. Provide 3% air entrainment typical, 6% for mixes exposed to freeze-thaw cycles.
 - 5. Owner's testing laboratory shall review all mix design before submittal.
- D. Mixing:

1. Equipment: All concrete shall be machine mixed. Provide adequate equipment and facilities for accurate measurement and control of materials.
2. Method of Mixing:
 - a. Transit Mixing: Comply with ASTM C 94. Ready mixed concrete shall be used throughout, except as specified below.
 - b. On-Site Mixing: Use only if method of storing material, mixing of material and type of mixing equipment is approved by Architect. Approval of site mixing does not relieve Contractor of any other requirements of Specifications.
 - c. Mixing shall be in accordance with ACI 318 5.8.
3. Mixing Time: After mix water has been added, concrete shall be mixed not less than 1-1/2 minutes nor more than 1-1/2 hours. Concrete shall be rejected if not deposited within the time specified.
4. Admixtures:
 - a. Air entraining and chemical admixtures shall be charged into mixer as a solution and shall be dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighed or measured by volume as recommended by manufacturer. Accuracy of measurement of any admixture shall be within plus or minus 3%.
 - b. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence, and provided further that admixtures used in that combination retain full efficiency and have no deleterious effect on concrete or on properties of each other.
 - c. All admixtures are to be approved by Structural Engineer prior to commencing this work.
5. Retempering:
 - a. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall be discarded, not retempered.
 - b. Indiscriminate addition of water to increase slump is prohibited.
 - c. When concrete arrives at project with slump below that suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded. Water shall be incorporated by additional mixing equal to at least half of total mixing time required. Any addition of water above that permitted by limitation of water-cement ratio shall be accompanied by a quantity of cement sufficient to maintain proper water-cement ratio. Such additions shall only be used if approved by Architect. In any event, with or without addition of cement, not more than 2 gallons of water per cubic yard of concrete, over that specified in design mix, shall be added.
6. Cold Weather Batching: When temperature is below 40 degrees F or is likely to fall below 40 degrees F during 24 hour period after placing, provide adequate equipment for heating concrete materials. No frozen materials or materials containing ice shall be used. Temperatures of separate materials, including mixing water, when placed in mixer shall not exceed 100 degrees F. When placed in forms concrete shall have a temperature between 50 degrees F and 85 degrees F.
7. Hot Weather Batching: Concrete deposited in hot weather shall have a placing temperature below 85 degrees F. If necessary, ingredients shall be cooled to accomplish this.

2.03 FLOOR LEVELING AND FILL MATERIALS

- A. Epoxy Concrete Mortar: Floor leveling, non-shrink trowel applied epoxy concrete mortar; TPM 115 General Polymers Corp., A-H Emery Epoxy Topping #170 Anti-Hydro Corp., or approved equal, where areas to fill are less than 1/4 inch thick.
- B. Concrete Mortar: Floor leveling, patching and repair, non-shrink trowel applied concrete mortar; Master Builders EMBECO 411-A, Euclid EUCO, or approved equal, where areas of fill are greater than 1/4 inch thick.
- C. Cementitious Floor Leveling Material: Shall be self-leveling or trowelable with a minimum 28 day compressive strength of 3000 psi in accordance with ASTM C-109. Material shall be equal to Quickrete No. 1249, Ardex V-800/K-55, Mapei "Ultra/Flex" or approved equal.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 PLACEMENT

- A. Before any concrete is placed, the following items of work shall have been completed in the area of placing.
 - 1. Forms shall have been erected, adequately braced, cleaned, sealed, lubricated if required, and bulkheaded where placing is to stop.
 - 2. Any wood forms other than plywood shall be thoroughly water soaked before placing any concrete. The wetting of forms shall be started at least 12 hours before concreting.
 - 3. Reinforcing steel shall have been placed, tied and supported.
 - 4. Embedded work of all trades shall be in place in the forms and adequately tied and braced.
 - 5. The entire place of deposit shall have been cleaned of wood chips, sawdust, dirt, debris, hardened concrete and other foreign matter. No wooden ties or blocking shall be left in the concrete except where indicated for attachment of other work.
 - 6. Reinforcing steel, at the time the concrete is placed around it, shall be cleaned of scale, mill scale or other contaminants that will destroy or reduce bond.
 - 7. Concrete surfaces to which fresh concrete is to be bonded shall be brush cleaned to remove all dust and foreign matter and to expose the aggregate, and then coated with the bonding adhesive herein specified.
 - 8. Prior to placing concrete for any slabs on grade, the moisture content of the subgrade below the slabs shall be adjusted to at least optimum moisture.
 - 9. No concrete shall be placed until formwork and reinforcement has been approved by Architect. Clean forms of all debris and remove standing water. Thoroughly clean reinforcement and all handling equipment for mixing and transporting concrete. Concrete shall not be placed against reinforcing steel that is hot to the touch. Notify Architect 48 hours in advance of concrete pour.
- B. Conveying: Handle concrete from mixer to place of final deposit by methods which will prevent separation or loss of ingredients. Deposit concrete in forms as nearly as practicable

at its final position in a manner which will insure that required quality is obtained. Chutes shall slope not less than 4 inches and not more than 6 inches per foot of horizontal run.

- C. Depositing: Deposit concrete into forms in horizontal layers not exceeding 24 inches in thickness around building, proceeding along forms at a uniform rate and consolidating into previous pour. In no case shall concrete be poured into an accumulation of water ahead of pour, nor shall concrete be flowed along forms to its final place of deposit. Fresh concrete shall not be permitted to fall from a height greater than 6 feet without use of adjustable length pipes or, in narrow walls, of adjustable flexible hose sleeves. Concrete shall be scheduled so that placing is a continuous operation for the completion of each section between predetermined construction joints. If any concreting operation, once planned, cannot be carried on in a continuous operation, concreting shall stop at temporary bulkheads, located where resulting construction joints will least impair the strength of the structure. Location of construction joints shall be as shown on the drawings or as approved by Structural Engineer. The rate of rise in walls shall not be less than 2 feet per hour.

1. Consolidation: Concrete shall be thoroughly compacted and worked to all points with solid continuous contact to forms and reinforcement to eliminate air pockets and honeycombing. Power vibrators of approved type shall be used immediately following pour. Spading by hand, hammering of forms or other combination of methods will be allowed only where permitted by Structural Engineer. In no case shall vibrators be placed against reinforcing steel or used for extensive shifting of deposited fresh concrete. Provide and maintain standby vibrators, ready for immediate use.
2. Hot Weather Concreting: Unless otherwise directed by the Architect, perform all work in accordance with ACI 305 when air temperature rises above 75 degrees F and the following:

- a. Mixing Water: Keep water temperature as low as necessary to provide for the required concrete temperature at time of placing. Ice may be required to provide for the design temperature.

Aggregate: Keep aggregate piles continuously moist by sprinkling with water.

Temperature of Concrete: The temperature of the concrete mix at the time it is being placed in the forms shall not exceed 85 degrees F. The method employed to provide this temperature shall in no way alter or endanger the design mix or the design strength required.

Dampen subgrade and formwork before placing concrete. Remove all excess water before placing concrete. Keep concrete continuously wet when air temperature exceeds 85 degrees F for a minimum of 48 hours after placing concrete. For slab on grade construction, see Section 3.1.E.

Protection: Minimize evaporation from concrete in place by providing shade and windbreaks. Maintain such protection in place for 14 days minimum.

3. Cold Weather Concreting: Follow recommended ACI 306 procedures when air temperature falls below 40 degrees F., as approved by Architect. Concrete placed in freezing temperatures shall have a temperature of not less than 50 degrees F. Maintain this temperature for at least 7 days. No chemicals or salts shall be used to prevent freezing and no accelerating agents shall be used without prior approval from Architect.

- D. Construction Joints: Install only as indicated and noted on Drawings. Joints not indicated on Drawings shall be so located, when approved, as to least impair strength of structure, and shall conform to typical details. Construction joints shall have level tops, vertical sides. Horizontal construction joints shall be thoroughly cleaned and roughened by removing entire surface film and exposing clean aggregate solidly embedded in mortar matrix. Joints between concrete and masonry shall be considered construction joints. Vertical construction joints need not be roughened. See Drawings for doweling and required keys.

1. Roughen construction joints by any of following methods:

- a. By sandblasting joint.
 - b. By thoroughly washing joint, using a high pressure hose, after concrete has taken initial set. Washing shall be done not less than 2 hours nor more than 4 hours after concrete has been poured, depending upon setting time.
 - c. By chipping and wire brushing.
2. All decisions pertaining to adequacy of construction joint surfaces and to compliance with requirements pertaining to construction joints shall be reviewed with the Structural Engineer.
 3. Just before starting new pour, horizontal and vertical joint surfaces shall be dampened (but not saturated).
 4. Before placing regular concrete mix, horizontal construction joint surfaces shall be covered with a layer of mortar composed of cement and fine aggregate of same proportions as that used in prescribed mix, but omitting coarse aggregate.
 5. For slabs, construction joints shall be in locations shown on plan. If not shown, locate at intervals not exceeding 150 feet in each direction. Refer to drawings for proper details for reinforcing at construction joints.

E. Concrete Slabs on Grade:

1. Exterior and interior concrete slabs on grade shall be poured as required under this Section. Base shall be accurately leveled and compacted prior to placing of concrete.
2. Typically, interior slabs on grade shall be poured over a minimum of four (4 inch) inches of compacted crushed rock, unless otherwise indicated, over a vapor retarder.
3. Protect slab on grade subbase from moisture prior to placing concrete. Avoid wetting rock layer to allow adequate concrete curing and avoid future vapor transmission. If the subbase has been wet excessively, verify that water has been eliminated prior to placement of concrete.
4. Vapor Retarder installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98.
 - a. Unroll Vapor Retarder with the longest dimension parallel with the direction of the pour.
 - b. Lap Vapor Retarder over footings and seal to foundation walls.
 - c. Overlap joints 2-feet and seal with specified tape.
 - d. Seal all penetrations (including pipes) per manufacturer's instructions.
 - e. No penetration of the Vapor Retarder is allowed except for reinforcing steel and permanent utilities.
 - f. Repair damaged areas by cutting patches of Vapor Retarder, overlapping damaged area 2-feet and taping all four sides with tape.

F. Control Jointing - Slabs on Grade:

1. Joints shall be in locations indicated on Drawings, or as directed by Architect.
2. Joints in interior slabs shall be made by one of following methods:
 - a. By use of construction joints laid out in checkerboard pattern; pour and allow alternate slabs to set; fill out balance of checkerboard pattern with second pour.
 - b. By use of dummy groove joints at least 1/4 depth of slab, and at least 1/8 inch wide. These joints may be sawcut as soon as wet concrete can support

the weight of the equipment and operator. Delaying sawcutting past this point will make jointing ineffective.

3. Control jointing in exterior paving slabs shall be laid out in a checkerboard pattern; pour as described above, but with joint edges tooled to provide a uniform joint at least 3/8 inch in depth.
4. Slab reinforcing need not be terminated at control joints.
5. Construction and expansion joints shall be counted as control joints.

G. Expansion Joints :

1. Unless otherwise indicated, use 3/8 inch thick expansion joint filler. See Section 2.1 H
2. Joints in interior slabs on grade shall be only in locations indicated.
3. Joints in exterior slabs on grade shall be installed at each side of structures, at curb transitions opposite apron joints, at ends of curb returns, at back of curb when adjacent to sidewalk, and at uniformly spaced intervals not exceeding 20 feet.
4. Edges of concrete at joints shall be edger finished to approximately 3/8 inch radius.
5. Interrupt reinforcing at all expansion joints.

H. Score markings on exterior slabs on grade shall be located as indicated. Where not indicated, mark slabs into rectangles of not less than 12 square feet nor more than 20 square feet using a scoring tool which will leave edges of score markings rounded.

3.03 CURING AND PROTECTION

A. Curing: Exposed surfaces of all concrete used in structure shall be maintained in a moist condition for at least 7 days after placing. The following final curing processes shall normally be considered to accomplish this. Concrete shall be maintained at not less than 50 degrees F nor more than 100 degrees F for a period of 72 hours after being deposited.

1. Flatwork to be exposed, stained, or painted shall have curing process submitted and approved by the architect prior to construction.
2. Initial Curing Process - Flat Work:
 - a. Mist Spraying: As soon as troweling of concrete surfaces is completed, exposed concrete shall be sprayed continuously with a special atomizer spray nozzle, capable of producing a fine mist. Spraying shall be done without any dripping of water from nozzle. Amount of spraying shall be such as to maintain surface of concrete moist without any water accumulating on surface. Maintain spraying for a minimum of 12 hours, or until such time as hereinafter described curing process is applied. Mist spraying will not normally be required when the ambient air temperature is below 90 degrees F.
3. Final Curing Process - Flatwork: Except as noted, use any of following:
 - a. Water Curing: Concrete shall be kept wet by mechanical sprinklers or by any other approved method which will keep surfaces continuously wet.
 - b. Saturated Burlap Curing: Finished surfaces shall be covered with a minimum of two layers of heavy burlap which shall be kept saturated during the curing period.
 - c. Curing Compounds: Membrane curing compounds of chlorinated rubber or resin type conforming to ASTM C309 may be used only if specifically approved by Architect. Use of membrane curing compound will not be permitted on surfaces to be painted, or to receive ceramic tile, membrane

water-proofing or hardeners and sealers. Membrane curing compound may be used in areas to receive resilient floor tile, provided it is wax-free, compatible with adhesive used and approved by adhesive manufacturer. Agitate curing compounds thoroughly by mechanical means continuously during use and spray or brush uniformly in accordance with manufacturer's recommendations. Apply immediately following final finishing operation. All curing compounds shall conform to State of California Air Resources Board VOC Regulations.

- d. Waterproof paper conforming to ASTM C 171, or opaque polyethylene film, may be used. Concrete shall be covered immediately following final finishing operation. Anchor paper or film securely and seal all edges in such a manner as to prevent moisture escaping from concrete.
4. Curing Process - Formed Surfaces: Forms heated by sun shall be kept moist during curing period. If forms are to be removed during curing period, curing as described for flatwork shall be commenced immediately.
- B. Refer to Drawings for areas of concrete slab not to receive curing compounds or hardening compounds. Where concrete floors are to receive heavy duty coatings, waterproof coatings and the like, verify with coating installer the type of finish required for specified coating.
 - C. Protection: Contractor shall be responsible for protection of finished concrete against injury by rain, cold, vibration, animal tracks, marking by visitors, vandalism, etc.
 - D. Provide additional curing agents or compounds, not necessarily listed herein, but as recommended and or required for use with shake type hardeners or other special coatings and coverings by their manufacturers for a complete and proper installation.

3.04 FINISHES

A. Formed Surfaces:

- 1. Rough Form Finish: Surfaces shall be reasonably true to line and plane with no specified requirements for selected facing materials. Tie holes and defects shall be patched and fins exceeding 1/4 inch in height shall be rubbed down with wooden blocks. Fins and other rough spots at surfaces to receive membrane waterproofing shall be completely removed and the surfaces rubbed smooth. Otherwise, surfaces shall be left with the texture imparted by forms.
 - a. Rough finish shall be used for the following areas:
 - 1) Below grade and unexposed surfaces.
- 2. Smooth Plywood Form Finish: Finish shall be true to line and plane. Tie holes and defects shall have been patched and ground with surface fins removed. Arrangement of plywood sheets shall be orderly, symmetrical, as large as practical and free of torn grain or worn edges. Surface concrete shall be treated with 1 part muriatic acid, in three parts water solution, followed immediately by a thorough rinsing with clear water. Surfaces which are glazed, have efflorescence, or traces of form oil, curing compounds or parting compounds shall be cleaned or treated to match other formed surfaces, except as otherwise indicated or specified.
 - a. Smooth Plywood Form Finish shall be used for the following areas:
 - 1) All surfaces above grade unless otherwise specified.
 - 2) At Contractor's option, may also be used in lieu of rough form finish.
- 3. Smooth Plastic Liner Finish: Surface shall be smooth, concrete free of honeycombing, air pockets larger than 1/8 inch in diameter, and fins.
 - a. This finish shall be used only where indicated on the Drawings.

B. Flatwork:

1. Unless otherwise indicated or specified, flatwork shall have an integral monolithic finish.
2. Integral Monolithic Finish: Apply as soon as freshly poured concrete slabs will bear weight of workers. Pour slabs full thickness to finish floor elevations indicated. At proper time, tamp surface repeatedly with a wire mesh or grid tamper in a manner to force aggregate down below surface and to bring sufficient mortar to surface to provide for a smooth coating of cement mortar over entire surface. Allow surface mortar to partially set, then float with wooden floats and finish with one of following, as required.
 - a. Broom Finish: Steel trowel surface to a smooth dense surface free of lines, tool marks, cat faces and other imperfections. After troweling, and before final set, give surface a broom finish, brushing in direction noted on Drawings, or as directed. Broom finish shall be used typically on exterior flatwork except as otherwise indicated or specified and shall be "medium" texture as approved by Architect.
 - b. Smooth Steel Trowel Finish: Apply 2 steel trowelings to obtain hard, smooth surface. All lips, irregularities, uneven levels, etc. shall be worked out before last troweling. All interior flatwork shall have a smooth steel trowel finish unless specified otherwise.
3. Tolerances:
 - a. For tolerances not indicated, refer to ACI 117.
 - b. Slabs on grade – Comply with F_F & F_L as specified by Architect, or at a minimum shall be sufficiently even to contact a 10' long straightedge with a tolerance of 1/8 inch.
 - c. Concrete over metal deck – Refer to Section 05 30 00 for minimum requirements, or at a minimum shall be sufficiently even to contact a 10' long straightedge with a tolerance of 1/8 inch.
 - d. Elevated slabs – Comply with Architectural requirements.
 - e. Finished surfaces of exterior integral finished flatwork shall not vary more than 1/4 inch from a 10' long straightedge, except at grade changes.

C. Sacked Surfaces: Exposed surfaces that are unacceptable in appearance to the Architect shall be sacked.

1. Prepare concrete surfaces in accordance with the referenced standards. Remove any form release materials by stoning by hand, power grinding or other method approved by the Architect.
2. Prepare concrete surfaces to receive sack finishing with a light sand blasting.
3. For best results, grout application and rubbing should be performed when areas to be treated are shaded and during cool, damp weather. When work is to be performed in hot and dry weather, a fog spray should be available for continuous use.
4. Prepare grout samples for matching of concrete surfaces for approval by the Architect. These shall be made in the following proportions of gray cement to white cement to sand: 1:1:2, 1:2:3, and 2:1:3, etc. until the correct matching color is obtained on the test areas. Sand should be fine enough to pass the Number 30 sieve. Mixes should be made to a good workable consistency in a clean container and the mix with the best color chosen, or modified if needed.
5. Provide sufficient quantities of sand and cement from the same source for the complete work at the job site.

6. Mixing and Application:

- a. Mixing of grout on the job should be timed for it to be used up within 1 to 1-1/2 hours.
- b. Let the grout stand 20 to 30 minutes after mixing, and then remixed before applying.
- c. Soak the concrete surface thoroughly with water at least 15 minutes before applying grout and again just before application so that the surface is adequately wet during the operation.
- d. Apply grout with plasterer's trowel or sponge rubber float in sweeping strokes from the bottom up. Brush or spray gun applications may be used when approved by the Architect.
- e. Work in freshly applied grout vigorously with a sponge rubber float, then let sit until some of its plasticity is gone but not until it loses its damp appearance. At this point it shall be rubbed with clean, dry burlap to remove the excess grout, leaving no visible film on the surface but filling all air holes.
- f. Keep the surface wet for a day after grouting and sack rubbing are completed.

7. Alternate methods of application and materials shall be subject to the approval of the Architect.

3.05 PATCHING

A. Formed Surfaces:

1. Promptly upon removal of contact forms and after concrete surfaces have been inspected, form ties shall be removed and all necessary patching and pointing shall be expertly done.
2. Honeycombed areas shall be removed down to sound concrete, coated with a bonding grout or approved compound and patched using a low shrinkage high bond mortar. Patched areas shall be cured by being kept damp for at least 5 days.
3. Tie holes shall be cleaned, dampened and filled solid with patching mortar or cement plugs of an approved variety.

B. Slabs on Grade: After entire slab is finished, shrinkage cracks that may appear shall be patched as follows:

1. Where slab is not exposed or where appearance is not important, cracks larger than 1/32 inch wide shall be filled with cement grout and struck off level with surface.
2. Where slab is exposed and appearance is important, unsightly cracks shall be repaired in a manner satisfactory in appearance to Architect. If this cannot be accomplished, concrete shall be considered defective.

3.06 DEFECTIVE CONCRETE

A. Defective concrete shall mean any of the following:

1. Concrete not meeting 100 percent of the specified 28 day compressive strength.
2. Concrete exhibiting rock pockets, voids, spalls, streaks, cracks, exposed reinforcing to extent that strength, durability, or appearance is adversely affected.
3. Concrete significantly out of place, line, or level.
4. Concrete not containing the required embedded items.

B. Upon determination that concrete strength is defective:

1. Should cylinder tests fall below minimum strength specified, concrete mix for remainder of work shall be adjusted to produce required strength. Core samples shall be taken and tested from cast-in-place concrete where cylinders and samples indicate inferior concrete with less than minimum specified strength.
 - a. Cores of hardened concrete shall be taken and tested in accordance with ASTM C 42 and C 39. Number and location of such cores shall be subject to the approval of Architect.
 - b. Cost of core sampling and testing will be paid for by the Contractor.
 - c. "85 percent" reduction in ACI 318 5.6.5.4 will not justify low cylinder tests.
- C. Upon determining that concrete surface is defective, Contractor may restore concrete to acceptable condition by cutting, chipping, pointing, patching, grinding, if this can be done without significantly altering strength of structure. Permission to patch defective areas will not be considered a waiver of the right to require removal if patching does not, in the opinion of the Architect, satisfactorily restore quality and appearance.
- D. If core tests indicate that concrete is below the strength specified, or if patching does not restore concrete to specified quality and appearance, the concrete shall be deemed defective, and shall be removed and replaced without additional cost to the Owner.
- E. No repair work shall begin until procedure has been reviewed by the Architect and Structural Engineer.

3.07 SURFACE HARDENER AND SEALER

- A. Seal all interior exposed flatwork with clear sealer, except surfaces receiving ceramic tile, quarry tile, poured flooring or other special finishes specified, or as scheduled on the Drawings.
 1. Apply sealer in 2 or 3 coats, in accordance with manufacturer's directions, using the maximum quantity recommended.
 - a. Concrete floors must be thoroughly cured for a minimum of 30 days and completely dry before treatment.
 - b. Surfaces to be treated must be clean, free of membrane curing compounds, dust, oil, grease and other foreign matter.
 - c. Upon completion, concrete surfaces shall be clean and without discoloration or traces of excess hardener left on the surface.
- B. Apply sprayable hardener/sealer at locations as scheduled or as indicated on the Drawings. Apply in accordance with the manufacturer's favorably reviewed application instructions and recommendations.

3.08 GROUTING

- A. Prepare and place grout materials at locations as indicated on the Drawings in accordance with the manufacturer's recommendations and installation instructions.
- B. Pack grout materials solidly between bearing surfaces and bases or plates as indicated and to ensure no voids.

3.09 ADJUSTING AND CLEANING

Remove all debris, excess materials, tools and equipment resulting from or used in this operation at completion of this work.

*****END OF SECTION*****

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SECTION 03345
CONCRETE FINISHING

PART 1 -- GENERAL

1.01 SUMMARY

Division 0, Contract requirements and Division 1, General Conditions apply to this section.

1.02 DESCRIPTION

Work included: Provide finishes on cast-in-place concrete as called for on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.03 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Except as may be modified herein or otherwise directed by the Architect, comply with ACI 301, "Specifications for Structural Concrete for Buildings".

1.04 SUBSTITUTIONS

Substitutions will be considered per General Conditions Article 3.11.4 and Section 01630.

1.05 SUBMITTALS

- A. Submit in accordance with Article 3.11 of the General Conditions.
- B. Product data, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
 - 3. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.06 PRODUCT HANDLING

Comply with pertinent provisions of Division 1.

1.07 CLOSE-OUT: also comply with the requirements of Section 01770 – Contract Closeout.

- A. Reports:
None required.
- B. As-Builts:
Not required
- C. Operation and Maintenance Data:
None required.
- D. Extra Materials:
None required.
- E. Extended Warranty:
Comply with the requirements of General Condition Article 3.5 and Section 01740.

PART 2 -- PRODUCTS

2.01 MATERIALS

A. General:

1. Carefully study the Drawings and these Specifications, and determine the location, extent, and type of required concrete finishes.
2. As required for the Work, provide the following materials, or equals accepted in advance by the Architect.

B. Liquid bonding agent: "Weld-Crete," manufactured by the Larsen Products Corporation.

C. Curing and protection paper:

1. Comply with ASTM C171, Type 1, regular.
2. Accepted products:
 - a) "Sisalkraft, Seekure 896";
 - b) Equal non-staining products faced with polyethylene film.

D. Slip-resistant abrasive aggregate:

1. Provide aluminum oxide grains, uniformly graded, screen size 12-13, 14-36 or 16-30.
2. Acceptable product:
 - a) Emerchrome Floor Hardener by L.M. Scofield Company.
 - b) Frictex H by Sonneborn.
 - c) or approved equal.

2.02 OTHER MATERIALS

Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the acceptance of the Architect.

PART 3 -- EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Beginning of installation means acceptance of conditions.

3.02 FINISHING OF FORMED SURFACES

A. General:

1. After removal of forms, give exposed concrete surfaces the finish specified below.
2. Revise the finish as needed to secure the acceptance of the Architect.

B. Rubbed finish:

1. Do not start cleaning operations until all contiguous surfaces to be cleaned are completed and accessible.

2. Do not permit cleaning as the work progresses.
3. Mix one part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint.
4. Substitute white portland cement for part of the gray portland cement as required to produce a color matching the color of surrounding concrete, as determined by a trial patch.
5. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout, and apply the grout uniformly with brushes or spray gun.
6. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes.
7. While the grout is still plastic, remove all excess grout by working the surfaces with a rubber float, sack, or other means.
8. After the surface whites from drying (above 30 minutes at normal temperatures), rub vigorously with clean burlap.
9. Keep the surface damp for at least 36 hours after final rubbing.

3.03 FINISHING SLABS

- A. Definition of finishing tolerances:
 1. "Class A": True plane within 1/8" in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction.
 2. "Class B": True plane within 1/4" in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction.
- B. Scratched finish: For surfaces scheduled to receive bond-applied cementitious applications.
 1. After the concrete has been placed, consolidated, struck off, and leveled to a Class B tolerance, roughen the surface with stiff brushes or rakes before the final set.
- C. Floated finish: For surfaces intended to receive roofing.
 1. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further until ready for floating.
 2. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
 3. During or after the first floating, check the planeness of the surface with a ten foot straightedge applied at not less than two different angles.
 4. Cut down high spots and fill low spots, and produce a surface with a Class B tolerance throughout.
 5. Rfloat the slab immediately to a uniform sandy texture.
- D. Troweled finish:
 1. Provide a floated finish as described above, followed by a power troweling and then a hand troweling which is relatively free from defects, but which still may show some trowel marks.
 - a. Monolithic Trowel Finish: For all floor surfaces not otherwise specified. Steel trowel and retrowel to smooth surface. After concrete has set enough to ring true, retrowel to a burnished impervious finish, free of trowel marks or other blemishes.

- b. Steel Float Finish: for all slabs to receive resilient tile, waterproof membrane, or carpeting. Same as monolithic finish except omit burnish retroweling.
 - c. Fine Swirl Finish (when shown on the Drawings): Prepare same as steel float finish. When ready, perform such finishing operations as necessary to produce Architect-selected fine textured, non-slip finish. Construct sample panel for Architect's acceptance prior to placement. Sample panel shall consist of tooled edges and have a tooled joint within field of panel.
 - 2 Provide a finished surface essentially free from trowel marks, uniform in texture and appearance, and in a plane of Class A tolerance.
- E. Broom finish: For slabs to receive thin set tiles, apply steel float finish followed by very fine broom finish. For surfaces to receive mortar setting beds and for exterior concrete driveway ramps, curbs and gutters, spandrels, etc.
 - 1. Provide a finished surface uniform in texture and appearance, and in a plane of Class A tolerance. Roughen surface with coarse broom.
- F. Rock Salt finish: Exterior walkways and pavings except where non-slip finish is specified.
 - 1. Provide a floated finish as described above.
 - 2. While the surface is still plastic, broadcast rock salt into the surface and embed uniformly into the surface by light tamping.
 - 3. Float the surface until it has been brought to a true plane with Class B tolerance.
 - 4. After the concrete has completely set, flood the surface with water to dissolve the rock salt, using a fine bristle brush as necessary to remove the salt.
 - 5. Provide a sample panel at the site of the proposed finish and receive the acceptance of the Architect of that finish prior to placing of the paving.
- G. Non-slip finish: For exterior platforms, steps, and landings; and Interior and exterior pedestrian ramps.
 - 1. Provide a floated finish as described above.
 - 2. While the surface is still plastic, broadcast abrasive aggregate as specified in Paragraph 2.01.F above and work into the surface according to the manufacturer's recommendations.
 - 3. Complete finishing surface as described above for a troweled finish, and as recommended by the aggregate manufacturer.

3.04 CURING AND PROTECTION

- A. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures, and mechanical injury.
- B. Preservation of moisture:
 - 1. Unless otherwise directed by the Architect, apply one of the following procedures to concrete not in contact with forms, immediately after completion of placement and finishing.
 - a. Ponding or continuous sprinkling;
 - b. Application of absorptive mats or fabric kept continuously wet;
 - c. Application of sand kept continuously wet;
 - d. Continuous application of team (not exceeding 150° F) or mist spray;

- e. Application of waterproof sheet materials specified in Part 2 of this Section;
 - f. Application of other moisture-retaining covering as accepted by the Architect.
 - g. Where forms are exposed to the sun, minimize moisture loss by keeping the forms wet until they can be removed safely.
2. Cure concrete by preserving moisture as specified above for at least ten days.
- C. Temperature, wind, and humidity:
- 1. Cold weather:
 - a) When the mean daily temperature outdoors is less than 40° F, maintain the temperature of the concrete between 50° F and 70° F for the required curing period.
 - b) When necessary, provide proper and adequate heating system capable of maintaining the required heat without injury due to concentration of heat.
 - c) Do not use combustion heaters during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.
 - 2. Hot weather: When necessary, provide wind breaks, fog spraying, shading, sprinkling, ponding, or wet covering with a light colored material, applying as quickly as concrete hardening and finishing operations will allow.
 - 3. Rate of temperature change: Keep the temperature of the air immediately adjacent to the concrete during and immediately following the curing period as uniform as possible and not exceeding a change of 5° F in any one hour period, or 50° F in any 24 hour period.
- D. Protection from mechanical injury:
- During the curing period, protect the concrete from damaging mechanical disturbances such as heavy shock, load stresses, and excessive vibration.
- 1. Protect finished concrete surfaces from damage from construction equipment, materials, and methods, by application of curing procedures, and by rain and running water.
 - 2. Do not load self-supporting structures in such a way as to over stress the concrete.

*****END OF SECTION*****

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SECTION 04050
MORTAR AND GROUT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SUMMARY

Provide all materials, labor and accessories as required and specified for complete mortar and grout installation in masonry walls.

1.03 QUALITY ASSURANCE: Standards and References: (Latest Edition unless otherwise noted)

- A. ASTM C144, Aggregate for Masonry Mortar.
- B. ASTM C150, Portland Cement
- C. ASTM C207, Hydrated Lime for Masonry Purposes
- D. ASTM C270, Standard Specification for Mortar for Unit Masonry
- E. ASTM C404, Aggregates for Grout
- F. ASTM C476, Standard Specification for Grout for Masonry
- G. ASTM C1019, Method of Sampling and Testing Grout
- H. CBC Section 2103
- I. 2010 California Building (CBC)
- J. Masonry Standards Joint Committee (MSJC)

B. SUBSTITUTIONS

Substitutions will be considered per General Condition Article 3.11.4 and Section 01630.

1.04 SUBMITTALS:

- A. Provide in accordance with Article 3.11 of the General Conditions.
- B. Mix design for mortar and grout shall be submitted for review.
- C. Supplier's certificates indicating materials comply with the specifications below. They shall include but are not necessarily limited to:
 - 1. Aggregates
 - 2. Cement
 - 3. Admixtures

1.05 PRODUCT HANDLING

Comply with the requirements of Section 01620.

1.06 TESTS & INSPECTIONS

- A. A testing program is required prior to start of construction. Testing program to be done in Compliance with the 2010 CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.

- B. All tests and inspections herein are to be performed by an independent testing laboratory approved by the building official.
 - C. Mortar and Grout Tests: If mortar and grout tests are indicated as required on the Structural drawings, at the beginning of Masonry Work, at least 1 test sample each of mortar and grout shall be taken on 3 successive working days, then once per week with at least one sample taken for each 5000 square feet of wall area, or fraction thereof.
 - 1. Test specimens shall be made in accordance with ASTM C1019 for grout and ASTM C780 for mortar.
 - 2. Test specimens shall be continuously stored in moist air until tested.
 - 3. Mortar shall show a compressive strength of not less than 1800 psi at 28 days. Grout shall show a compressive strength of not less than 2000 psi at 28 days.
 - D. If masonry placement and grouting inspection is indicated as required on the Structural Drawings, a special inspector shall be employed per CBC Section 1704 during the placement of all units, placement of all reinforcing steel, during all grouting operations and during taking of all test specimens.
- 1.07 CLOSE-OUT: also comply with the requirements of Section 01770 – Contract Closeout.
- A. Reports:
Final Report related to Item 1.06.
 - B. As-Builts:
Comply with the requirements of Section 01770 – Contract Closeout.
 - C. Operation and Maintenance Data:
None required.
 - D. Extra Materials:
None required.
 - E. Extended Warranty:
Comply with the requirements of General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Cement: ASTM C 150, Type I or II, low alkali; natural gray.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Quicklime: ASTM C 5.
- D. Lime Putty: Made from hydrated lime or quicklime.
 - 1. If made from quicklime, other than processed pulverized quicklime, slake lime and then screen through a No. 16 mesh sieve. Before using, store and protect slaked and screened lime putty for not less than 10 days.
 - 2. Processed pulverized quicklime shall be slaked for not less than 48 hours, and shall be cool when used.
 - 3. Lime putty prepared from hydrated lime may be used immediately after mixing.
 - 4. Lime putty prepared from quicklime or pulverized quicklime shall have a plasticity figure, after slaking and screening, of not less than 200, and shall weigh not less than

83 lbs. per cubic foot. Lime putty prepared from hydrated lime shall conform to ASTM C 207, Type S.

- E. Aggregate:
 - 1. For Mortar: ASTM C144.
 - 2. For Grout: ASTM C404.
- F. Admixture: "Sika Grout Aid"
- G. Water: Suitable for domestic consumption.

2.02 MORTAR

- A. Mortar shall be Type S having a 28 day compressive strength of not less than 1800 psi, and shall conform to CBC Section 2103.
- B. Mortar shall be made with admixtures that are proportioned, added and mixed in strict accordance with manufacturer's directions.
- C. Mortar mix shall be proportioned by volume; one part portland cement, not less than 1/4 part nor more than 1/2 part lime putty, and sand totaling not less than 2-1/4 nor more than 3 times sum of volumes of cement and lime used.
 - 1. Total clay content shall not exceed 2% of sand content or 6% of cement content.

2.03 GROUT

- A. Grout shall have a 28-day compressive strength of not less than 2000 psi. Proportion by volume, and with sufficient water to produce consistency for pouring without segregation so that grout will flow into masonry joints. Grout shall conform to CBC Section 2103.
- B. Fine Grout: 1 part Portland cement, to which may be added not more than 1/10 part lime putty, and 3 parts sand.
 - 1. Fine grout shall be used for all grout spaces less than 3" wide.
- C. Coarse Grout: 1 part Portland cement, to which may be added not more than 1/10 part lime putty, 3 parts sand and not less than 1 part nor more than 2 parts pea gravel (3/8" maximum aggregate size).
 - 1. Coarse grout shall be used in grout spaces 3" wide or more.
- D. Add "Sika Grout Aid" admixture to grout at the rate of 1 pound per 100 pounds cementitious material.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 MIXING MORTAR AND GROUT

- A. Accurately measure materials in suitably calibrated devices; shovel measurements are not acceptable. Each 94lb. sack of Portland cement will be considered as 1 cubic foot.

- B. Place sand, cement and water in mixer in that order and mix for at least 2 minutes; then add lime putty and continue mixing as long as necessary to secure a uniform mass, but in no case less than 10 minutes.
- C. Use mixers of at least 1 sack capacity; batches requiring fractional sacks will not be permitted unless cement is weighed for each batch.

3.03 GROUTING PROCEDURES

- A. Specified under Sections 04220 and 04210.

3.04 RE-TEMPERING

- A. When necessary to re-temper mortar, add water and remix; re-tempering by dashing water over mortar will not be permitted.
- B. Any mortar which is unused within 30 minutes after initial mixing and any mortar that has begun to set shall not be used.

3.05 DEFECTIVE MORTAR OR GROUT

- A. Should the strength of mortar or grout fall below that specified, remainder of Work shall be adjusted to reach required strength. Work in place representing inferior grout and mortar and indicating a strength less than the minimum specified shall be tested by taking and testing core samples. Number and location of cores shall be determined by Structural Engineer.
- B. Should compression tests of cores fail to meet required strength, masonry shall be deemed to be defective and shall be removed and replaced at no cost to Owner.
- C. Costs relative to taking and testing of core samples shall be paid by Owner and will be deducted from Contract Amount. Cost of patching core holes shall be borne by Contractor.

*****END OF SECTION*****

SECTION 04220
CONCRETE UNIT MASONRY

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE

A. Furnish and install all concrete unit masonry, reinforcement, and all required accessories and materials as shown on the Drawings and specified here.

1. Cooperate with other trades for embedded items, furnished under those sections and installed here.
2. Supervise setting of dowels for masonry furnished and installed under Section 03210, Reinforcing Steel.

1.03 QUALITY ASSURANCE

A. Allowable Tolerances: Maximum deviation from indicated line or plane of installed concrete masonry units shall not exceed 1/8 inch in 10 feet in any direction.

B. Standards and References: (Latest Edition unless otherwise noted):

1. 2010 California Building Code (CBC)
2. ASTM C90 - Hollow and Solid Load Bearing Concrete Masonry Units
3. ASTM C140 - Sampling and Testing of Concrete Masonry Units.
4. ASTM C426 - Standard Test Method for Drying Shrinkage Concrete Block.
5. CBC Section 2103.1.
6. Concrete Masonry Design Manual published for the Concrete Masonry Association of California and Nevada, current Edition.
7. Masonry Standards Joint Committee (MSJC)
5. See Section 03210 for reinforcing steel tests and inspections.

1.04 SUBSTITUTIONS

Substitutions will be considered per General Condition Article 3.11.4 and Section 01630.

1.05 SUBMITTALS:

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Submit the following:

1. Suppliers certificate indicating units comply with material standards indicated below:
2. See Section 03210 for reinforcing steel submittals.

C. Test Panel

1. Size: Minimum 4 feet by 4 feet.
2. Locations: As determined by the Architect.

1.06 PRODUCT HANDLING

A. Comply with the requirements of Section 01620.

- B. Scaffolding, runways and ladders required for work under this Section shall be provided by masonry contractor, and shall be heavy trades type substantially built and in compliance with State labor laws, safety codes and other regulatory agencies as applicable to this project.
- C. Environmental Requirements: Install concrete unit masonry when temperature in area surrounding work is 40°F or above. Maintain temperature of work above 40°F for at least 48 hours after installation. Grout shall not be placed when air temperatures fall below 20°F.
- D. Store masonry units off the ground in a dry location, covered and protected from absorbing moisture.

1.07 TESTS AND INSPECTIONS:

- A. A testing program is required prior to start of construction. Testing program to be done in Compliance with the 2010 CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.
- B. All tests and inspections herein are to be performed by an independent testing laboratory approved by the Building Official.
- C. If masonry tests are indicated as required on the structural drawings, three sample units will be tested during construction for each 5,000 square feet of wall area. Test also three sample units prior to construction.
 - 1. Units will be tested for compressive strength on both the net and gross area per ASTM C140.
 - 2. Units will be tested for linear drying shrinkage per ASTM C426.
- D. If masonry placement and grouting inspection is indicated as required on the structural drawings, a special inspector shall be employed per CBC Section 1704 to inspect the placement of all units, placement of all reinforcing steel, during all grouting operations and during taking of all test specimens.

1.08 CLOSE-OUT: also comply with the requirements of Section 01770 – Contract Closeout.

- A. Reports:
Final Report related to Item 1.07.
- B. As-Builts:
Comply with the requirements of Section 01770 – Contract Closeout.
- C. Operation and Maintenance Data:
None required.
- D. Extra Materials:
None required.
- E. Extended Warranty:
Comply with the requirements of General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 MASONRY UNITS

A. Masonry units shall be hollow load bearing masonry units conforming to ASTM C90 and CBC Section 2103.1.

1. Weight: Light weight.
2. Maximum lineal shrinkage from saturated to oven dry condition of not more than 0.065 percent.
3. Twenty-eight day compressive strength of 1000 psi on gross area and 1900 psi on net area.
4. Moisture controlled units.

B. Unit Type

1. 8" wide by 8" high x 16" long unless specified otherwise.
2. See Plans for finish surface, color, etc.

C. Provide bond beam units, open end units and other special units as indicated. Use open end units at cells containing vertical reinforcement wherever possible.

2.02 MORTAR AND GROUT

Specified under Section 04050.

2.03 ACCESSORY MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 40 or 60, as indicated in Section 03210, deformed bars.

1. Tie Wire: Black annealed steel wire not lighter than 16 gage.

B. Provide spacers to firmly hold reinforcement in place.

C. Anchor Bolts: All anchor bolts cast in masonry shall be headed bolts with cut threads conforming to ASTM A307 or ASTM A36 or ASTM A572.50 as indicated on drawings.

D. Expansion Anchors: All expansion bolts installed in masonry shall be Hilti Kwik Bolt 3 as manufactured by Hilti Inc. See Structural Drawings for installation requirements and tension testing requirements as applicable. See Drawings for special head requirements as needed. Substitution of other brands or anchors shall proceed only after written approval from the Structural Engineer and the Building Official as been obtained.

2.04 JOINTS

All joints shall be 3/8" thick joints for concrete block, Tool exposed interior and exterior joints and concealed exterior joints to produce a dense slightly concave surface that is well bonded to unit at edges. Tool joints behind room base, switches, and outlet plates to produce a smooth dense joint flush with the face of adjacent masonry units, where occurring on the job. Cut joints flush on concealed interior surfaces and surfaces to be plastered.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed

B. Verify that specified items may be installed in accordance with the approved design, including the following:

1. That foundation surface is level to permit bed joint with range of 1/4 to 3/4 inch.
2. That edge is true to line to permit projection of masonry to less than 1/4-inch.

3. That projecting dowels are free from loose scale, dirt, concrete, or other bond-inhibiting substances and properly located.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not begin work before unsatisfactory conditions have been corrected.
- E. Beginning of installation means acceptance of conditions

3.02 PREPARATION

- A. Clean concrete surfaces to receive masonry. Remove latence or other foreign material lodged in surfaces by sandblasting or other means as required. Joints between concrete and masonry shall be considered construction joints. See Concrete specifications.
- B. Ensure masonry units are clean and free from dust, dirt, or other foreign materials before laying.
- C. Establish lines, levels, and coursing. Protect from disturbances.
- D. Provide temporary bracing during erection of masonry work. Maintain in place until masonry has set to provide permanent bracing.

3.03 COURSING

- A. Erect masonry in accordance with CBC Section 2104.1.2.
- B. Place masonry to lines and levels indicated to the following tolerances:
 1. Variation from Unit to Adjacent Unit: 1/32-inch max.
 2. Variation from Plane of Wall: 1/4-inch in 10 feet.
 3. Variation from Plumb: 1/4-inch.
 4. Variation from Level Coursing: 1/8-inch in 3 feet; 1/4-inch in 10 feet; 1/2-inch maximum.
 5. Variation of Joint Thickness: 1/8-inch in 3 feet.
- C. Bond: Unless noted otherwise in Drawings, lay concrete masonry units in running bond with vertical joints located over score of unit in course below (and vice versa).
- D. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.
- E. Preserve the vertical continuity of cells in concrete unit masonry. The minimum clear horizontal dimensions of vertical cores shall be 3 x 3 inches for 8-inch wide block.

3.04 PLACING AND BONDING

- A. Do not install cracked, broken or chipped masonry units.
- B. Lay only dry concrete masonry units.
- C. Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.
 1. Block Cap: Lay with full mortar coverage on horizontal and vertical joints.
 2. Install grout cap where and as indicated.
- D. Fully bond intersections and external and internal corners.
- E. Do not shift or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.
- F. Remove excess mortar.

- G. Perform job-site cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.
- H. Step back unfinished work for joining with new work. Do not use toothing.

3.05 JOINTS

- A. Horizontal and vertical joints at masonry units shall be 3/8-inch wide and as follows:
 - 1. Point joint tight in unpurged masonry below ground.
 - 2. All end joints shall be fully filled with mortar and joints squeezed in bed joints shall be held back approximately 1/2-inch from cell to provide positive bond with grout.
 - 3. Joints shall be struck flush at all areas to receive plaster finish.

3.06 MASONRY REINFORCEMENT

- A. Place reinforcement in accordance with ACI 315, to a tolerance of +/- 1/2-inch from specified location.
- B. Reinforcing steel shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the plans shall not be used. Heating of bars for bending will not be permitted.
 - 1. Bars shall conform accurately to the sizes, shapes, lines and dimensions shown on drawings and with hooks and beds made as detailed. Bars shall be placed as indicated on the drawings and centered on grout space.
 - 2. At the time grout is place around it, reinforcing steel shall be clean of mill scale or other coatings that will destroy or reduce bond.
 - 3. All vertical reinforcing steel shall be installed in one piece, full height of wall, and braced throughout its height in a manner that will retain the steel in proper position and provide the proper clearance.
- C. Reinforcing steel shall be secured to all foundation dowels and held in place at spacings not to exceed 192 bar diameters.

3.07 GROUTING

- A. General Requirements:
 - 1. All cells shall be grouted solid.
 - 2. Use low lift or high lift grouting at Contractor's option.
 - 3. Use grout pump, hopper or bucket to place grout.
 - 4. Place grout in final position within 1-1/2 hours after introduction of mixing water.
 - 5. Place grout and rod with a 3/4-inch flexible cable vibrator sufficiently to case it to flow into all voids between the cells and around the reinforcing steel. Slushing with mortar will not be permitted.
 - 6. Stop grout approximately 1 1/2 inches below top of last course; except at top course bring grout to top of wall.
- B. Low Lift Grouting:
 - 1. Do not lay units higher than 48 inches before grouting.
 - 2. If mortar has been allowed to set prior to grouting, remove all fins protruding more than 1/2-inch into grout space.
 - 3. Conform to requirements of CBC Section 2104.6.1.1.2.

4. Consolidate each lift twice. Once while placing grout and once more after initial absorption of water but before set.

C. High Lift Grouting:

1. Conform to requirements of CBC Section 2104.6.1.1.3.
2. Lay up walls, subject to maximum height limitations of Masonry Standards Joint Committee, Building Code Requirements for Masonry Structures Table 1.16.1.
3. Provide clean out holes at the bottom of every pour in cells containing vertical reinforcement. Construct clean out courses with open-bottom bond beam units inverted to permit cleaning of all cells by flushing. Cleanouts shall be not less than 3x4inch openings cut from one face shell. Do not plug clean out holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected.
4. Clean mortar droppings from the bottom of the grout space and from reinforcing steel. Remove mortar fins protruding more than ½-inch into the grout space by dislodging the projections with a rod or stick as the work progresses or by washing the grout space at least twice a day during erection using a high pressure stream of water.
5. Do not place grout in hollow unit masonry until mortar joints have set for at least 72 hours and clean out plugs have cured 48 hours.
6. Place grout in lifts not to exceed 4 feet in height, with a waiting period between lifts, dependent on weather and absorption rate of the masonry, in order to place the succeeding lift after the preceding lift becomes plastic but prior to initial set. The first lift shall be consolidated using mechanical vibrators. After the required waiting period, place the second lift and consolidate with the vibrator, reconsolidating the lift below to a depth of 12 to 18 inches. Repeat the waiting, placing and consolidating process until the top of the grout pour is reached. Reconsolidate the top lift after the required waiting period. The high-lift grouting of any section of wall between lateral flow barriers shall be completed to the top of a pour in one working day unless a new series of clean out holes is established and the resulting horizontal construction joint cleaned.

3.08 WEATHER PROVISIONS FOR CONSTRUCTION

- A. Cold Weather Construction to be in accordance with CBC section 2104.3.
- B. Hot Weather Construction to be in accordance with CBC section 2104.4

3.09 EXPANSION JOINTS

See drawings for type and location of expansion joints.

3.10 BOND BEAMS

Bond beams shall be located where shown and detailed on the drawings, and shall be reinforced as indicated and as herein after specified.

3.11 BUILT-IN WORK

- A. Miscellaneous Embedded Items: All items indicated to be embedded in masonry shall be carefully located and anchored to prevent movement during grouting operations. Avoid cutting and patching.
 1. Install all anchor bolts and anchors furnished under other sections for wood nailers, ledgers, etc.

3.12 CUTTING AND FITTING

Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.

3.13 REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damage, or if units do not match adjoining units.
- B. Pointing: During the tooling of joints, enlarge any voids or holes and completely fill with mortar.
- C. Dry brush masonry surface after mortar has set, at each day's work and after final pointing.
- D. Leave work and surrounding surface clean and free of mortar spots and droppings.
- E. Cleaning: Upon completion of masonry installation, repair all holes. Defective joints shall be cut out and rejointed. Exposed masonry surfaces shall be cleaned free of mortar, green stain and efflorescence.

3.14 SEALER

Specified under Section 07190.

3.15 DEFECTIVE MASONRY

- A. Materials or workmanship not conforming to appearance or strength specified, will be deemed defective and shall be removed and replaced at no cost to Owner.
- B. Defective mortar and grout, as defined under Section 04050; "Mortar and Grout" shall constitute defective masonry.

*****END OF SECTION*****

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SECTION 05100
SUPPORTING FROM STRUCTURE

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this section.

1.02 SUMMARY

A. Work Included:

1. This section provides guidelines and limitations for supporting all mechanical, electrical, plumbing or architectural items from the building structure, and for seismic bracing for all such items.
2. Design and install all support and bracing systems except as noted. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design systems to not overstress the building structure.

B. Work Not Included:

1. The Contractor is not required to design support and bracing for items for which the contract documents provide specific attachment, support, and bracing. Items specifically noted in the CBC as not requiring bracing may be exempt from seismic bracing if all conditions of attachment in the CBC are compliant. Seismic bracing is not typically required for the following items:
 - a. Gas piping less than 1 inch inside diameter.
 - b. Piping for boilers and mechanical equipment less than 1.25 inches inside diameter.
 - c. All other piping less than 2.5 inches inside diameter, unless racked together.
 - d. All piping and duct suspended by individual hangers 12 inches or less in length with flexible connections.
 - e. All rectangular air handling ducts less than 6 square feet in cross sectional area.
 - f. All round air handling ducts less than 28 inches in diameter.
 - g. All electrical conduits less than 2.5 inches inside diameter, unless racked together.

1.03 QUALITY ASSURANCE

A. General:

1. Design and install all support systems to comply with the requirements of the 2010 California Building Code Chapter 16.
2. For seismic bracing design engage the services of a structural engineer licensed in California.
3. For guidelines regarding seismic bracing for mechanical, electrical and plumbing systems, refer to the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems". Where SMACNA guidelines deviate from CBC requirements, CBC requirements shall govern.

B. Standards and References: (Latest Edition unless specified otherwise)

1. The General Conditions, Supplementary Conditions, and applicable portions of Division 1 apply to the work of this Section as if printed herein.

2. If the year of the adoption or latest revision is omitted from the designation, it shall mean the specification, manual or test designation in effect the date of Notice to Proceed with the Work given.

1.04 SUBSTITUTIONS

- A. Substitutions will be considered per General Conditions Article 3.11.4 and Section 01630.

1.05 SUBMITTALS

- A. Provide in accordance with Article 3.11 of the General Conditions.
- B. Submit the following:
 1. Submit shop drawings for all substructures and attachment methods.
 2. Submit proposed alternative methods of attachment for review by the Architect, prior to deviating from the requirements given below.
 3. For all seismic bracing systems, submit structural calculations and details prepared and signed by the Contractor's licensed engineer which include all resultant forces applied to the building structure. Do not overstress building structure. Calculations will be reviewed for compliance with design criteria, not for arithmetic.

1.06 CLOSE-OUT: also comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

None required.

D. Extra Materials:

None required.

E. Extended Warranty:

Comply with the requirements of General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Furnish all substructures and fasteners required to comply with the limitations given below. Use materials as specified in the various sections and as appropriate to the use.
- B. All exterior materials: hot dipped galvanized or stainless steel.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 GUIDELINES AND LIMITATIONS

- A. The General Contractor shall coordinate the load requirements from all sub-contractors so that no combination of loads exceeds the limitations given below without written approval.
- B. Maximum Loading: Attach no loads greater than the following without specific approval of the Structural Engineer.
 - 1. Metal deck without concrete fill - acoustical tile and gypsum board ceilings only; no piping, ducting or conduit. Maximum ceiling weight - 3.5 psf. Maximum wire hanger load = 60#.
 - 2. Metal deck with concrete fill - ceilings as indicated for metal deck without concrete fill above, plus electrical conduits, gas piping and ducting not exceeding 3.0 psf. Maximum point load from trapeze = 200 lbs. at 8'-0" cc each way. Mechanical units hung from concrete filled deck shall not exceed 500 lbs.
 - 3. Steel beams and girders: water and gas piping, electrical conduits, ducting and trapeze of same not to exceed 3.0 psf. Maximum load on a single span = 600#. Mechanical units hung from beams shall not exceed 1000# unless specifically indicated on structural plans.
 - 4. Cast-In-Place concrete slabs - ceilings, piping, conduit and ducts shall not exceed 10 psf. Maximum hanger load 600#. Mechanical units hung from slabs shall not exceed 800#.
 - 5. Wood sawn joists - loads from ceilings, piping, conduit and ducting shall not exceed 5.0 psf. Maximum concentrated load = 300 lbs. per joist.
 - 6. Steel Joists - Loads from ceiling, piping, conduit and ducting shall not exceed 8 psf. Maximum concentrated load = 500 lbs. per joist.

3.03 SEISMIC BRACING

- A. In applying formulas from Chapter 16 of the 2010 CBC the value for I_p (importance factor) shall be assumed to be no less than 1.0. See structural drawings for other seismic factors.
- B. Design and install seismic bracing so as not to ground out vibration and sound isolation items.

END OF SECTION

B. Flatwork:

1. Unless otherwise indicated or specified, flatwork shall have an integral monolithic finish.
2. Integral Monolithic Finish: Apply as soon as freshly poured concrete slabs will bear weight of workers. Pour slabs full thickness to finish floor elevations indicated. At proper time, tamp surface repeatedly with a wire mesh or grid tamper in a manner to force aggregate down below surface and to bring sufficient mortar to surface to provide for a smooth coating of cement mortar over entire surface. Allow surface mortar to partially set, then float with wooden floats and finish with one of following, as required.
 - a. Broom Finish: Steel trowel surface to a smooth dense surface free of lines, tool marks, cat faces and other imperfections. After troweling, and before final set, give surface a broom finish, brushing in direction noted on Drawings, or as directed. Broom finish shall be used typically on exterior flatwork except as otherwise indicated or specified and shall be "medium" texture as approved by Architect.
 - b. Smooth Steel Trowel Finish: Apply 2 steel trowelings to obtain hard, smooth surface. All lips, irregularities, uneven levels, etc. shall be worked out before last troweling. All interior flatwork shall have a smooth steel trowel finish unless specified otherwise.
3. Tolerances:
 - a. For tolerances not indicated, refer to ACI 117.
 - b. Slabs on grade – Comply with F_F & F_L as specified by Architect, or at a minimum shall be sufficiently even to contact a 10' long straightedge with a tolerance of 1/8 inch.
 - c. Concrete over metal deck – Refer to Section 05 30 00 for minimum requirements, or at a minimum shall be sufficiently even to contact a 10' long straightedge with a tolerance of 1/8 inch.
 - d. Elevated slabs – Comply with Architectural requirements.
 - e. Finished surfaces of exterior integral finished flatwork shall not vary more than 1/4 inch from a 10' long straightedge, except at grade changes.

C. Sacked Surfaces: Exposed surfaces that are unacceptable in appearance to the Architect shall be sacked.

1. Prepare concrete surfaces in accordance with the referenced standards. Remove any form release materials by stoning by hand, power grinding or other method approved by the Architect.
2. Prepare concrete surfaces to receive sack finishing with a light sand blasting.
3. For best results, grout application and rubbing should be performed when areas to be treated are shaded and during cool, damp weather. When work is to be performed in hot and dry weather, a fog spray should be available for continuous use.
4. Prepare grout samples for matching of concrete surfaces for approval by the Architect. These shall be made in the following proportions of gray cement to white cement to sand: 1:1:2, 1:2:3, and 2:1:3, etc. until the correct matching color is obtained on the test areas. Sand should be fine enough to pass the Number 30 sieve. Mixes should be made to a good workable consistency in a clean container and the mix with the best color chosen, or modified if needed.
5. Provide sufficient quantities of sand and cement from the same source for the complete work at the job site.

6. Mixing and Application:

- a. Mixing of grout on the job should be timed for it to be used up within 1 to 1-1/2 hours.
- b. Let the grout stand 20 to 30 minutes after mixing, and then remixed before applying.
- c. Soak the concrete surface thoroughly with water at least 15 minutes before applying grout and again just before application so that the surface is adequately wet during the operation.
- d. Apply grout with plasterer's trowel or sponge rubber float in sweeping strokes from the bottom up. Brush or spray gun applications may be used when approved by the Architect.
- e. Work in freshly applied grout vigorously with a sponge rubber float, then let sit until some of its plasticity is gone but not until it loses its damp appearance. At this point it shall be rubbed with clean, dry burlap to remove the excess grout, leaving no visible film on the surface but filling all air holes.
- f. Keep the surface wet for a day after grouting and sack rubbing are completed.

7. Alternate methods of application and materials shall be subject to the approval of the Architect.

3.05 PATCHING

A. Formed Surfaces:

1. Promptly upon removal of contact forms and after concrete surfaces have been inspected, form ties shall be removed and all necessary patching and pointing shall be expertly done.
2. Honeycombed areas shall be removed down to sound concrete, coated with a bonding grout or approved compound and patched using a low shrinkage high bond mortar. Patched areas shall be cured by being kept damp for at least 5 days.
3. Tie holes shall be cleaned, dampened and filled solid with patching mortar or cement plugs of an approved variety.

B. Slabs on Grade: After entire slab is finished, shrinkage cracks that may appear shall be patched as follows:

1. Where slab is not exposed or where appearance is not important, cracks larger than 1/32 inch wide shall be filled with cement grout and struck off level with surface.
2. Where slab is exposed and appearance is important, unsightly cracks shall be repaired in a manner satisfactory in appearance to Architect. If this cannot be accomplished, concrete shall be considered defective.

3.06 DEFECTIVE CONCRETE

A. Defective concrete shall mean any of the following:

1. Concrete not meeting 100 percent of the specified 28 day compressive strength.
2. Concrete exhibiting rock pockets, voids, spalls, streaks, cracks, exposed reinforcing to extent that strength, durability, or appearance is adversely affected.
3. Concrete significantly out of place, line, or level.
4. Concrete not containing the required embedded items.

B. Upon determination that concrete strength is defective:

1. Should cylinder tests fall below minimum strength specified, concrete mix for remainder of work shall be adjusted to produce required strength. Core samples shall be taken and tested from cast-in-place concrete where cylinders and samples indicate inferior concrete with less than minimum specified strength.
 - a. Cores of hardened concrete shall be taken and tested in accordance with ASTM C 42 and C 39. Number and location of such cores shall be subject to the approval of Architect.
 - b. Cost of core sampling and testing will be paid for by the Contractor.
 - c. "85 percent" reduction in ACI 318 5.6.5.4 will not justify low cylinder tests.
- C. Upon determining that concrete surface is defective, Contractor may restore concrete to acceptable condition by cutting, chipping, pointing, patching, grinding, if this can be done without significantly altering strength of structure. Permission to patch defective areas will not be considered a waiver of the right to require removal if patching does not, in the opinion of the Architect, satisfactorily restore quality and appearance.
- D. If core tests indicate that concrete is below the strength specified, or if patching does not restore concrete to specified quality and appearance, the concrete shall be deemed defective, and shall be removed and replaced without additional cost to the Owner.
- E. No repair work shall begin until procedure has been reviewed by the Architect and Structural Engineer.

3.07 SURFACE HARDENER AND SEALER

- A. Seal all interior exposed flatwork with clear sealer, except surfaces receiving ceramic tile, quarry tile, poured flooring or other special finishes specified, or as scheduled on the Drawings.
 1. Apply sealer in 2 or 3 coats, in accordance with manufacturer's directions, using the maximum quantity recommended.
 - a. Concrete floors must be thoroughly cured for a minimum of 30 days and completely dry before treatment.
 - b. Surfaces to be treated must be clean, free of membrane curing compounds, dust, oil, grease and other foreign matter.
 - c. Upon completion, concrete surfaces shall be clean and without discoloration or traces of excess hardener left on the surface.
- B. Apply sprayable hardener/sealer at locations as scheduled or as indicated on the Drawings. Apply in accordance with the manufacturer's favorably reviewed application instructions and recommendations.

3.08 GROUTING

- A. Prepare and place grout materials at locations as indicated on the Drawings in accordance with the manufacturer's recommendations and installation instructions.
- B. Pack grout materials solidly between bearing surfaces and bases or plates as indicated and to ensure no voids.

3.09 ADJUSTING AND CLEANING

Remove all debris, excess materials, tools and equipment resulting from or used in this operation at completion of this work.

*****END OF SECTION*****