

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 00 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Expansive Soils
2. Site Preparation
3. Engineered Fill
4. Compaction of Soil Backfills and Fills in Landscape Areas
5. Temporary Excavations
6. Excavation for utility Trenches
7. Trench Backfill
8. Concrete Slab on Grade
9. Footing Inspections
10. Concrete Slab on Grade
11. Grading
12. Subbase and base course for asphalt paving.
13. Excavating and backfilling trenches for utilities and utility structures.
14. Field Quality Control
15. Protection

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions and Special Conditions of these Specifications.
2. Geotechnical Investigation Report.
3. Section 015639 Temporary Tree and Plant Protection
4. Section 033000: Cast-In-Place Concrete
5. Section 321216: Asphalt Paving
6. Section 321313: Concrete Paving

1.3 DEFINITIONS

- A. All reference to relative compaction, maximum density, and optimum moisture is based on ASTM Test Method D1557.
- B. Earthwork encompass all areas to receive fill or to support proposed improvements and should extend horizontally a minimum distance of 5 feet beyond the perimeter of the improvements.

- C. Backfill: Soil material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
 - D. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
 - E. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
 - F. Borrow Soil: Approved satisfactory soil imported from off-site for use as fill or backfill.
 - G. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
 - H. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by the Project Manager, shall be without additional compensation.
 - I. Fill: Soil materials used to raise existing grades.
 - J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
 - K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
 - L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
 - M. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Material test reports.

1.5 FIELD CONDITIONS

- A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.
- B. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Existing Soil on site is moderately expansive silty sand with clay soil. These expansive soils are susceptible to volume changes associated with changes in soil moisture content. The potential for future differential movement resulting from these soils can be reduced to normally tolerable levels by following the moisture conditioning and compaction recommendations presented in the Geological Report.
- C. Unsatisfactory Soils: Will be determined by sample testing by the Geotechnical Engineer.
 - 1. Undocumented fill soils discovered on site.
 - 2. Unsatisfactory soils also include satisfactory soils not maintained within 4 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: All engineered fill soils should be nearly free of organic or other deleterious debris and less than 3 inches in maximum dimension. The on-site soil exclusive debris may be used as engineered fill, provided it contains less than 3 percent organics by weight (ASTM D2974). Should any imported material be used for engineered fill, it should be sampled and tested by a representative of the project Geotechnical Engineer prior to being transported to the site.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

- H. Drainage Course: Narrowly graded mixture of washed crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, landscaping and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

3.2 EXPANSIVE SOILS

- A. The Geotechnical investigation has revealed a surface horizon of moderately expansive silty sand with clay soil. These expansive soils are susceptible to volume changes associated with changes in soil moisture content. The potential for future differential movement resulting from these soils can be reduced to normally tolerable levels by following the moisture conditioning and compaction recommendations presented in the Geological Report. Moisture conditioning and compaction mitigation implemented during grading should be consistent with the expansiveness determined. Careful attention must be paid to future maintenance, including a site drainage and irrigation practices.
- B. The moisture content attained during grading and building pad preparation should be maintained between the completion of grading and the placement of the vapor retarder, concrete slabs, and footings. If the moisture content is not maintained between the conclusion of grading and the start of building construction, the moisture content and compaction will need to be re-established prior to building construction.

3.3 SITE PREPARATION

A. Demolition of Existing Trees and Structures

1. Where project improvements dictate removal of exiting trees, the root areas should be thoroughly cleared of root balls as well as isolated roots greater than 1/2 - inch in diameter as well as concentrated smaller diameter roots and root mats, depending on the volume of smaller roots encountered. The amount of soil lost or disturbed with removal will likely vary with the moisture conditions at the time of removal, soil type, and the methods of removal. The root system removal may disturb a significant quantity of soil. It is suggested a tree service and demolition contractor be contacted for more detailed information regarding the typical soil loss and disturbance associated with tree removal. Following removal of underground utilities, structure demolition, and tree removal, disturbed soils should be mitigated as described in Sections 5.3.3 and 5.3.4 of the Geological Report.

B. Stripping

1. All surface vegetation and any miscellaneous surface obstructions should be removed from the project area, prior to any site grading. Stripping of vegetation could involve the upper 1 to 3 inches of the site. Surface strippings should not be incorporated into fill unless they can be sufficiently blended to result in an organic content less than 3 percent by weight (ASTM D2974). Stripped topsoil, with an organic content between 3 and 12 percent by weight, may be stockpiled and used as non-structural fill (i.e. landscaped areas). If used in landscape areas, soil with an organic content between 3 and 12 percent should be placed with 2 feet of finished grade and at least 5 feet outside of building perimeters. Soil with an organic content greater than 12 percent by weight should be excluded from fill.

C. Disturbed Soil, Undocumented Fill and Subsurface Obstructions

1. Initial site grading should include a reasonable search to locate and remove any undocumented fill soils, abandoned underground structures, existing utilities, etc., that may exist within the area of construction.
2. All underground utilities should be rerouted beyond the perimeter of the proposed improvements and all previous trench backfill and any loose soils generated by the utility removal should be removed to expose undisturbed native soil.
3. Any subsurface obstructions should be removed from the project area.
4. Any areas or pockets of soft or loose soils, void spaces made by burrowing animals, undocumented fill, or other disturbed soil that is encountered, should be excavated to expose firm native material.
5. Care should be taken during site grading to mitigate excavating and recompacting all soil disturbed by stripping and demolition.
6. Excavations for removal of any unsuitable conditions should be dish-shaped and backfilled with engineered fill per Section 5.4 of the Geotechnical Report.

- D. Over-excavation: Over-excavation is typically reserved for soils that, in their natural state, will not provide adequate bearing for structures. The foundation soils at the project site should provide adequate bearing for the proposed improvements. Provided the recommendations called out in sections 5.3.2 and 5.3.3 of the Geological Report are followed, no general over-excavation of the overall site is required.
- E. Scarification and Compaction: After stripping the site, and performing any other removals, the exposed subgrade soil to receive fill or areas to support proposed foundations/improvements should be scarified to a minimum depth of 12 inches, uniformly moisture conditioned to at, or above optimum moisture, proof rolled to detect soft or pliant areas, and compacted to the requirements for engineered fill see Section 5.4 of the Geotechnical Report. Soft or pliant areas should be mitigated in accordance with Section 5.3.3 Geotechnical Report.
- F. Construction Considerations: Should site grading be performed during or subsequent to wet weather, near-surface site soils may be significantly above optimum moisture content. These conditions could hamper equipment maneuverability and efforts to compact site soils to the recommended compaction criteria. Disking to aerate, chemical treatment, replacement with drier material, stabilization with a geotextile fabric or grid, or other methods may be required to mitigate the effects of excessive soil moisture and facilitate earthwork operations. Any consideration of chemical treatment (e.g. lime) to facilitate construction would require additional soil chemistry evaluation and could affect landscape areas and some construction materials.

3.4 ENGINEERED FILL

- A. Materials: All engineered fill soils should be nearly free of organic or other deleterious debris and less than 3 inches in maximum dimension. The on-site soil exclusive debris may be used as engineered fill, provided it contains less than 3 percent organics by weight (ASTM D2974). Should any imported material be used for engineered fill, it should be sampled and tested by a representative of the project Geotechnical Engineer prior to being transported to the site. Table 5.4-1 in the Geological Report provides general criteria for imported soil. The import criteria for corrosion are typical threshold limits for non-corrosive soil. Should corrosion concentrations of import soils fall outside of the threshold limits indicated above, revised protection measures will be necessary.
- B. Compaction Criteria: Soils used as engineered fill should be uniformly moisture-conditioned to at least 4 percent above optimum moisture, placed in horizontal lifts less than 8 inches in loose thickness, and compacted to at between 88 and 92 percent relative compaction. Disking and/or blending may be required to uniformly moisture condition soils used for engineered fill. The actual level of moisture conditions and compaction will be based on the expansion potential and moisture density relationships determined during grading. The general intent is to bring the expansive material to about 80 to 85 percent saturation at the time of construction.

3.5 COMPACTION OF SOIL BACKFILLS AND FILLS IN LANDSCAPE AREAS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
 - 1. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 75 percent.

3.6 TEMPORARY EXCAVATIONS

- A. General: All excavations must comply with applicable local, State, and Federal safety regulations including the current OSHA Excavation and Trench Safety Standards. Construction site safety generally is the responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations.
- B. Excavations and Slopes The Contractor should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, State, and/or Federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). All excavations should be constructed and maintained in conformance with current OSHA requirements (29 CFR Part 1926) for a Type C soil. If excavations encounter saturated soils or groundwater, temporary excavations will have to be laid back or shored and the trench dewatered to maintain stability. Contact Geotechnical Engineer if these conditions are encountered for recommendations.
- C. Construction Considerations: Heavy construction equipment, building materials, excavated soil, and vehicular traffic should be kept sufficiently away from the top of any excavation to prevent any unanticipated surcharging. If it is necessary to encroach upon the top of an excavation, contact the Geotechnical Engineer for review and comments. Shoring, bracing, or underpinning required for the project (if any), should be designed by a professional engineer registered in the State of California. During wet weather, earthen berms or other methods should be used to prevent runoff water from entering all excavations. All runoff should be collected and disposed of outside the construction limits.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: As indicated.

- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

- D. Trenches in Tree- and Plant-Protection Zones:
 - 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
 - 3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 TRENCH BACKFILL

- A. Materials: Pipe zone backfill (i.e., material beneath and in the immediate vicinity of the pipe) should consist of soil compatible with design requirements for the specific types of pipes. Refer to Geotechnical Report. Randomly excavated near surface soil will likely be Class III material per ASTM D2321.
 - 1. Trench zone backfill may consist of native soil which meets the requirements for engineered fill.

- B. Compaction Criteria: All trench backfill should be placed and compacted in accordance with recommendations provided for engineered fill. Trench backfill deeper than 5 feet should be to at least 95 percent relative compaction. Mechanical compaction is recommended; ponding or jetting should not be used.

3.9 FOOTING INSPECTION

- A. Prior to placing steel or concrete, footing excavations should be cleaned of all debris, loose or soft soil, and water. All footing excavations should be observed by a representative of the project Geotechnical Engineer immediately prior to placing steel or concrete. The purpose of these observations is to check that the bearing soils encountered in the foundation excavations are similar to those assumed in analysis and to verify the recommendations contained herein are implemented during construction.

3.10 CONCRETE SLABS-ON-GRADE

- A. Subgrade Preparation: Slabs-on-grade should be supported on recompacted soils or engineered fill placed as described in Section 5 of Geological Report. Subgrade soil within 24 inches of pad grade should have a moisture content of at least 4 percent above optimum, immediately prior to placing the slab concrete or placing the vapor retarding membrane.
- B. Capillary and Moisture/Vapor Break: Considering the groundwater depth and soil types, a capillary break (i.e. clean sand or gravel layer) is considered unnecessary.
 - 1. In areas to receive moisture-sensitive floor coverings, the subgrade is to be covered by a vapor retarding membrane meeting the specifications of ASTM E1745, (Class C with minimum puncture resistance of 475 grams. See Section 071500 – Under-Slab Vapor Barrier for materials and installation. The subgrade surface should be smooth and care should be exercised to avoid tearing, ripping, or otherwise puncturing the vapor retarding membrane. If the vapor retarding membrane becomes torn or disturbed, it should be removed and replaced or properly patched. All laps, splices, and utility penetrations should be properly sealed according to the manufacturer specifications.
 - 2. The vapor retarding membrane should be covered with approximately 1 to 2 inches of saturated surface dry (SSD) sand to protect it during construction. Concrete should not be placed if sand overlying the membrane has been allowed to attain a moisture content greater than about 5 percent (due to precipitation or excessive moistening). In addition, penetrations through the concrete slab shall be sealed or protected to prevent inadvertently introducing excess water into the sand cushion layer due to curing water, wash-off water, rainfall, etc. Excessive water beneath interior floor slabs could result in future significant vapor transmission through the slab, adversely affecting moisture-sensitive floor coverings and could inhibit proper concrete curing.

3.11 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 - 1. Turf or Unpaved Areas: Plus, or minus 1 inch.
 - 2. Walks: Plus, or minus 1/2 inch.
 - 3. Pavements: Plus, or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.12 SUBBASE AND BASE COURSES UNDER PAVEMENTS

- A. Flexible pavement design recommendations have been developed for the given Traffic Indexes based upon the California Department of Transportation (Caltrans) design procedures and a design R value of 8. The flexible asphalt concrete pavement sections associated with the assumed Traffic Indexes for on-site asphalt pavements are summarized in the Geotechnical Report on Table 6.7-1.
- B. The flexible pavement should conform to and be placed in accordance with the Caltrans Standard Specifications, 2015. The aggregate base (Class 2) should comply with the specifications in Sections 26. The aggregate base and upper 12 inches of subgrade should be compacted to a minimum of 95 percent relative compaction as determined by Caltrans Test Method 216 (Dry determination) or ASTM D1557 test procedures.
- C. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- D. On prepared subgrade, place and shape subbase course and base course under pavements to required crown elevations and cross-slope grades.

3.13 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform inspections:
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.14 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000