

SECTION 02220

GRADING AND EARTHWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Grading, earthwork and roadway excavation and/or fill.
- B. Subgrade preparation.
- C. Dust alleviation and control.
- D. Cleanup and disposal of excess material.
- E. Supplying all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.02 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the general designation only.
- B. American Society for Testing and Materials (ASTM) Publications:
 - D 424 Test Method for Plastic Limit and Plasticity index of Soils.
 - D 1556 Test method for Density of Soil in place by Sand Cone Method.
 - D 1557 Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10lb (4.54 KG) Rammer and 18-in. (457mm) Drop.
 - D 2922 Density of Soil and Soil Aggregate in Place by Nuclear Methods
 - D 2419 Sand Equivalent Value of Soils and Fine Aggregate.

1.03 QUALITY ASSURANCE

- A. Finish surface of the graded and prepared subgrade shall not vary more than 0.10 feet from that called for on the plans or detail drawings when completed, and immediately prior to placement of the roadway structural section.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM Designation D1557.
- C. Submit test results on imported material to indicate conformance with these requirements.

1.04 JOB CONDITIONS

- A.** Accurately grade and prepare the roadway subgrade section to the lines and grades called for on the plans and detail drawings with due provision for future surface improvements.
- B.** Fill required shall consist of suitable excavated material if available, and/or such approved imported borrow material as may be required for the work conforming to these requirements.
- C.** Provide dust alleviation and control measures satisfactory to the Engineer continuously during the course of the work.
- D.** Surplus excavation material remaining upon completion of the grading and roadway subgrade preparation shall be segregated as to type, and must be transported and disposed off-site in a lawful manner.

PART 2 - PRODUCTS

2.01 SOIL AND AGGREGATE MATERIALS

A. Site Fill and Backfill Materials - General:

- 1. Provide various types of materials as specified herein and indicated on the Plans.
- 2. In lieu of obtaining materials from on-site sources, approved import materials may be substituted or required.
- 3. All fill and backfill materials shall be free of deleterious substances, large rocks, garbage, rubbish, wood or organic debris.
- 4. All materials, regardless of source, are subject to approval prior to procurement or placement.

B. Unclassified Locally Obtained or Imported Fill Beneath or Adjacent to Roadways and for Structural Backfill:

- 1. Unless otherwise shown on the Plans, use suitable materials obtained from Contract excavation. Supplement with import materials, if required and authorized. Suitable materials shall be non-organic, native soil or soil-rock. Expansive silt and clay with L.L. greater than 50 is unsuitable fill material and shall not be used.
- 2. No import materials for structural fill or embankment fill will be authorized until suitable materials from Contract excavation have been exhausted.

2.02 IMPORTED MATERIAL FOR FILL

- A.** Material for fill shall consist of inert, granular soil and rock fragments supplied from previously tested and approved sources, and shall conform to the following specifications and requirements:

1. All material shall be free of organic materials, trash and debris, expansive clays or any other deleterious materials, and shall be subject to the approval and acceptance of the Engineer.
2. The contractor shall designate his proposed import sources in advance and shall provide the source samples of material proposed to be furnished for evaluation.
3. Minimum "R" value shall be 25."R" values for acceptable import material shall be determined by the procedure set forth in Test Method No. California 301 of the State of California, Department of Transportation, and the material shall conform to the following gradation requirements:
 - a. Maximum particle size 4 inches
 - b. Percent passing 1-1/2" screen 50-100
 - c. Percent passing No. 4 screen 20-100
 - d. Percent passing No. 200 screen 10-30
4. Plasticity Index for acceptable import material shall be less than fifteen (15) when determined by the procedure set forth in ASTM Designation D424.
5. Sand Equivalent for acceptable import material shall be not less than twenty-five (25) when determined by the procedure set forth in ASTM Designation D2419.

PART 3 - EXECUTION

3.01 PREPARATION

- A.** Prior to placing fill, all areas shall be stripped of all vegetation and other objectionable materials to the satisfaction of the Engineer. Such areas shall then be scarified to a minimum depth of eight (8) inches, the scarified material conditioned to a moisture content that will permit compaction to the specified density, and compacted to a density of not less than ninety (90) percent of maximum dry density as determined by the procedure set forth in ASTM Designation D1557.
- B.** Do not proceed with filling until the grade has been satisfactorily inspected.

3.02 PLACING AND COMPACTING FILL MATERIAL

- A.** Control soil compaction during construction to provide the minimum percentage of density specified for each area as determined according to ASTM D-1556 or ASTM D-2922. All operations will be subject to the approval of the Engineer.
- B.** Compact all fill material within one foot of finished grade by methods specified below, under "C," or by other methods, if approved by the City, so as to produce the specified minimum degree of compaction, as determined by ASTM D-1557.

For a minimum depth of 8 inches below existing subgrade or fill placed under roadways or parking areas shall be compacted to 95 percent compaction. In landscaped areas, place and compact fill to 1" below the surface of adjacent curbs, walks and drives. Fill in landscape areas shall be compacted to 85 percent. Unless otherwise specified or indicated, all other fill shall be compacted to 90 percent.

- C. Spread fill material in uniform lifts not exceeding 8" in uncompacted thickness. Before compaction begins, bring fill to a uniform water content within 1 to 3 percent of optimum by either:(1) aerating the material if it is too wet, or (2) spraying the material with water if it is too dry. Each lift shall be thoroughly mixed to ensure a uniform distribution of water content. If suitable compaction can be demonstrated, thickness of fill placement may be increased, subject to written approval of the Engineer.
- D. Remove and replace, or scarify and air dry soil material that is too wet to permit compacting to specified density. Soil material that has been removed because it is too wet to permit compacting may be temporarily stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing, until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests.
- E. Any fill that does not meet the specification requirements shall be removed and/or recompacted until the requirements are satisfied.

3.03 GENERAL GRADING & EARTHWORK

- A. Earthwork shall consist of excavating to the lines and grades called for on the plans and detail drawings.
- B. Materials shall be removed or placed to the lines and grades indicated for subgrade for roadway, curbs, gutters, driveways, walks or paths, and any other improvements called for on the plans and detail drawings. Materials shall be placed and compacted as specified above for fill material.

3.04 SUBGRADE PREPARATION UNDER PAVED AREAS

- A. After excavating to the subgrade elevation shown on the plans, and prior to installation of aggregate base, the entire work area shall be scarified to a minimum depth of eight (8) inches, wetted or dried to an appropriate moisture content, and compacted to the lines and grades called for on the plans and detail drawings at a density of not less than ninety five (95) percent of maximum dry density as determined by the procedure set forth in ASTM Designation D1557.
- B. The Contractor shall at all times maintain the subgrade surface in such condition as to readily drain effectively. Vehicular and equipment traffic shall be distributed across the prepared surface in such a manner as to prevent continual operation in one path. The Contractor shall repair any damage to the prepared subgrade.

- C. Storage or stockpiling of heavy loads on the roadway subgrade will not be permitted. Use only approved storage areas.
- D. The Contractor shall be responsible for any failure of the underlying native soils during the course of the work and shall repair any damage.
- E. Finished subgrade shall be subject to the approval of the Engineer and no select material or improvement shall be placed thereon until approval for same has been obtained.

3.05 SPECIAL REQUIREMENTS FOR GRADING IN BAY MUD

- A. Subject to pre-qualification and routing requirements, Contractor may select the equipment and procedures he deems most appropriate for the prosecution and completion of the Work in conformance with the requirements of the Contract documents, provided however, that the equipment and procedures selected shall not be such as to cause damage to the underlying soils in the project area, and shall demonstrate compliance with said requirements and the intent of the Work.
- B. If, in the opinion of the Engineer, the equipment or procedures selected by the Contractor are detrimental to the intent of the Work and will cause damage to the underlying soils, the Contractor shall so modify his procedures of his equipment to meet the approval of the Engineer at no additional cost to the City.
- C. Equipment will be evaluated on the basis of its performance and suitability for completing the Work within the intent of the specifications and without damage to the underlying soils. The Engineer may, at any time, upon written notice to the Contractor, exclude any vehicles or equipment which do not comply with this requirement.
- D. Equipment shall be routed to preclude pumping, and/or subgrade damage. Where, in the opinion of the Engineer, pumping and wearing have progressed to an extent where damage to subgrade has occurred as evidenced by distortion of surface, rutting or appearance at the surface of underlying undesiccated soils, the Contractor shall perform subgrade repair as follows at no additional cost to the City:
 - 1. Excavate damaged areas to the extent directed by the Engineer.
 - 2. Allow excavation to dry and condition excavated material.
 - 3. Backfill excavation with conditioned native soil and compact to a minimum density of seventy-five (75) percent of maximum dry density as determined by the procedure set forth in ASTM Designation D-1557.

3.06 FIELD QUALITY CONTROL

- A. The Engineer will inspect, test and approve subgrades and fill layers before further construction is permitted thereon; and will conduct a sufficient number of tests chosen at Engineer's discretion to enable said Engineer to approve fill as it is placed. Areas to receive structural fills and all structural excavations shall be approved before covering or filling.

- B. If in the Engineer's opinion, based on the results of testing for subgrade or fills which have been placed and compacted below the specified density, the Contractor shall provide additional compaction, with subsequent retesting by the owner until the affected subgrade or fill is approved.

3.07 DUST ALLEVIATION AND CONTROL

- A. The Contractor shall be responsible for and shall provide pollution and dust abatement and control measures continuously during the course of the work.
- B. The Contractor shall utilize reclaimed water, or dust palliatives, in compliance with the City's Water Conservation Ordinance.

3.08 DISPOSAL OF EXCESS MATERIAL

- A. Surplus materials and construction debris remaining upon completion of the work shall become the property of the Contractor unless otherwise specified herein or noted on the plans, and shall be removed from the work site by the Contractor and disposed of off-site in a lawful manner.

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