

DELAWARE CONSTRUCTION SPECIFICATION

EARTHFILL CS 14

1. SCOPE

The work shall consist of the construction of earth embankments and other earthfills required by the drawings and specifications.

2. MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. The soil material shall meet the following Unified Soil Classification: GM, GC, SM, or SC. The selection, blending, routing and disposition of materials in the various fills shall be subject to approval by the technician.

Fill materials shall contain no sod, brush, roots or other perishable materials. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill. Maximum size of rock fragments shall not exceed 2/3 of the layer thickness.

The types of materials used in the various fills shall be as listed and described in the specifications and drawings.

3. FOUNDATIONS PREPARATION

Foundations for earthfill shall be stripped to remove vegetation and other unsuitable materials or shall be excavated as specified on the drawings.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earthfill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of two inches in depth normal to the slope and shall be at such a moisture

content that the earthfill can be compacted against them to effect a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose materials by hand or other effective means and shall be free of standing water when fill is placed upon them.

Occasional rock outcrops in earth foundations for earthfill, except in dams and other structures designated to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be not steeper than 1 horizontal to 1 vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earthfill conforming to the specifications for the earthfill to be placed upon the foundation.

4. **PLACEMENT**

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the technician. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified. Materials placed by dumping in piles or windows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually directed power tampers, shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of fill compacted by manually directed power tampers. Unless otherwise specified, fill shall be placed in layers that do not exceed 6 inches in thickness except that the layers shall not exceed 4 inches in thickness for hand compacted fill.

Adjacent to structures, fill shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earthfill in dams, levees, and other structures designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

- a. The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material.
- b. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.
- c. The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of approximately 2 percent shall be maintained to insure effective drainage, and except as otherwise specified for drainfill or sectional zones.
- d. Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of stream flow during construction are specifically authorized in the contract.
- e. Embankments built at different levels as described under (c) or (d) above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all material not meeting the requirements of this specification, and shall be scarified, moistened and recompacted when the new fill is placed against it as needed to insure a good bond with the new fill and to obtain the proper moisture content and density at the contact of the in place and new fills.

5. **CONTROL OF MOISTURE CONTENT**

During placement and compaction of fill, the moisture content of the materials being placed shall be such that the soil material will form a ball when squeezed in the hand. This ball will resist crumbling when pressed between two fingers. There shall be no free water left on the hand when the soil material is squeezed, and no water shall be observed when the soil ball is shaken on the palm of the hand.

The fill material shall be brought to the proper moisture range before compaction. Material that is too wet for compaction shall be allowed to dry before compaction or be removed. The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill, if necessary. Uniform moisture distribution shall be obtained by disking.

If the top surface of the preceding layer of compacted fill or a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond it shall either be removed or scarified and moistened by sprinkling to an acceptable moisture content prior to placement of the next layer of fill.

6. **COMPACTION**

Earthfill shall be compacted according to the following requirements for the class of compaction specified on the drawings:

Class A compaction. Each layer of fill shall be compacted as necessary to make the density of the fill matrix not less than 95% of the standard proctor density as determined by ASTM D-698. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified. The in place density of the compacted fill shall be determined using test procedures ASTM D-1556, "Density of Soil in Place by the Sand-Cone Method," or ASTM D-2167, "Density of Soil in Place by the Rubber Balloon Method."

Class B compaction. Each layer of fill shall be compacted to a mass density not less than the minimum density specified on the drawings.

Class C compaction. Each layer of fill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified, or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

Fill adjacent to structures shall be placed and compacted according to the requirements of Delaware Construction Specification 15 – STRUCTURAL BACKFILL.

7. **REWORKING OR REMOVAL AND REPLACEMENT OF DEFECTIVE FILL**

Fill placed at moisture contents outside the acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable fill. The replacement fill and the foundation, abutment and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control and compaction.

8. **TESTING**

Density of the compacted fill may be tested during the course of the work by the technician following the methods described in ASTM D-698, D-1556, and D-2167. Test procedures and records shall be maintained for the installation. Testing requirements, including the type and frequency of tests, shall be as specified on the drawings.

Such tests are not intended to provide the contractor with the information required by him for the proper execution of the work and their performance shall not relieve the contractor of the necessity to perform tests for that purpose. The engineer shall maintain records for the installation. Weekly reports, including copies of the test results, shall be provided to the landowner and the Natural Resources Conservation Service during the course of the work.