

EARTHFILL

1. APPLICABILITY

Construction Specification 23 is applicable to all types of earthfill, including fill sections constructed of rocky soils and embankments constructed of soft or friable rock which is expected to break down during compaction.

2. MATERIAL SPECIFICATIONS

There are no material specifications complementary to Construction Specification 23.

3. ITEMS TO BE INCLUDED IN CONTRACT SPECIFICATIONS AND DRAWINGS

- a. Complete plans and cross sections of the required earthfills and earth backfills.
- b. Pay limits, where applicable.
- c. Borrow areas or other sources of material(s).
- d. Designation and description of the types of materials required in the various parts of the work.
- e. Maximum allowable size of rock particles.
- f. Special requirements for foundation preparation.
- g. Maximum layer thickness before compaction for earthfill. (Table A-23 of these Instructions may be used as a guide. Table A-23 gives upper limits for the general classes of material listed. The specified maximum layer thickness may have to be substantially less than the tabulated value to obtain adequate compaction.)
- h. Maximum layer thickness before compaction for earth backfill by manually directed power tampers. (The maximum thickness that can be adequately compacted depends upon the tampers and upon the soil being placed, varying from about four (4) inches for plastic clays to about eight (8) inches for coarse grained material of low plasticity.)
- i. Special instructions for sectional or phased construction where applicable.
- j. Allowable range of moisture content for each item. For example:
 - (1) "The moisture content of the fill matrix at the time of compaction shall be neither less than two (2) percent below optimum moisture content nor more than two (2) percent above optimum moisture content."

(2) "The moisture content of the fill material shall be maintained within the limits required to: (a) prevent bulking or dilatance of the material under the action of the hauling or compacting equipment; (b) prevent the adherence of the earthfill material to the treads and tracks of the equipment; and, (c) ensure the crushing and blending of the soil clods and aggregations into a reasonably homogeneous mass."

- k. Compaction class for each item. (Table A-23 may be used as a guide.)
- l. For Class A compaction: Compaction test method and required percent of maximum density. Typical compaction test results, if applicable.
- m. For Class B compaction: Minimum mass density.
- n. For Class C compaction: Type of roller; minimum weight or contact pressure of roller; minimum vibrating force and frequency for vibrating roller; minimum number of passes.
- o. Special rapid methods for moisture control, (quick dry, speedy, alcohol, nuclear gauge), if used. These methods are only to be used on soils where they prove to be a reliable approximation to ASTM D 2216. When rapid methods are used, a reference to the procedure to be followed should be included.
- p. When the "family of curves" and the one-point Proctor is the intended method for soil density standard determination and verification, it should be referenced and so specified in Section 10.
- q. Special requirements, where applicable, for placing earth backfill adjacent to structures; such as, reduced compactive effort for high, thin walled structures. This may include monitoring stresses and wall movements and/or specifying minimum in-place concrete strength requirements before the forms or other supports are removed or earth backfilling commences. Minimum in-place concrete strength requirements shall be determined by the designer and clearly stated.
- r. Required minimum strength of concrete, determined according to Section 6, for starting compaction of backfill adjacent to structures, if applicable. Use of minimum strength is encouraged over minimum times listed in Section 6.
- s. Methods of measurement and payment.
- t. Embedded structures or other elements whose volume will be excluded from the earthfill volume for payment. Major items may be listed for exclusion. The cost of measuring, computing, checking, record keeping, etc. must clearly justify the exclusion.

- u. Special requirements pertaining to furnishing and applying water, including designated source and details of ownership and water rights, if applicable, and including water quality requirements if quality may be a concern.
- v. Special requirements for control of erosion, water pollution, and air pollution, with appropriate cross-reference to Construction Specification 5, Pollution Control.
- w. Surface finish requirements, such as completed surface grade tolerances.

4. DISCUSSION OF METHODS

a. Section 9, Measurement and Payment

Note in Section 10 when volume calculations other than by the average cross-sectional end area method will be used and describe the applicable method. Example - "In lieu of computing volumes by the method of average cross-sectional end areas, the volume may be computed by the prismatic formula method with the assistance of computer aided design program."

- (1) Method 1 is intended for structure earth backfill and other cases where pay limits can best be shown on the drawings.
- (2) The selected methods for pay limits must be compatible with those selected for use in Construction Specification 21, Excavation.
- (3) Method 6 or 7 must be used with any or all Methods 1 through 5.
 - (a) Method 6 is intended for use when no separate payment is to be made for water.
 - (b) Method 7 is intended for use with Construction Specification 10, Water for Construction, when the Contractor is to be paid under a separate item for the water needed to bring the earthfill and earth backfill materials to the specified moisture content.

When specifications are prepared using electronic procedures and all but one method are deleted for use in a contract specification, delete "All Methods The following provisions apply to all methods of measurement and payment." and left justify the remaining text.

TABLE A – 23

Grading Characteristics of Soil Fill Material		Approximate Compaction Classes	Maximum Layer Thickness (Before Compaction)			
% > No. 4	% Fines (Passing #200)		Tamping Roller	Pneumatic Roller	Vibrating Roller	40000 lb. Track Trctr.
0 – 35	Over 5	A	9"	9"	---	---
	Under 5	A B, C	9" ---	12" 18"	24" 30"	--- 12"
35 – 65	25 – 50	A	9"	12"	24"	---
		B, C	9"	18"	24"	---
	5 – 25	A B, C	--- ---	12" 18"	24" 24"	--- ---
Over 65	Under 5	B, C	---	24"	24"	18"
	Over 5	B, C	---	18"	24"	---

Note: Tabulated values are upper limits. Actual maximum layer thickness for uniform compaction of a given soil material may be substantially lower. Maximum size of rock or rock fragments should not exceed 2/3 of the layer thickness prior to compaction. Soil plasticity should be a consideration.

For Weathered or weakly indurated rock materials:

For materials such as shales, schists, disintegrated granite, soft sandstone, and siltstone, the appropriate compaction classes depend upon the degree of breakdown under the action of the excavating and compacting equipment. The maximum layer thickness before compaction must be determined on the basis of special laboratory tests or field compaction tests or both. Field test fills should be considered to determine the least effort required to meet minimum density requirements.