

Item 132

Embankment



1. DESCRIPTION

Furnish, place, and compact materials for construction of roadways, embankments, levees, dikes, or any designated section of the roadway where additional material is required.

2. MATERIALS

Furnish approved material capable of forming a stable embankment from required excavation in the areas shown on the plans or from sources outside the right of way. Provide one or more of the following types as shown on the plans:

- **Type A.** Granular material that is free from vegetation or other objectionable material and meets the requirements of Table 1.

Table 1
Testing Requirements

Property	Test Method	Specification Limit
Liquid limit	Tex-104-E	≤ 45
Plasticity index (PI)	Tex-106-E	≤ 15
Bar linear shrinkage	Tex-107-E	≥ 2

Perform the Linear Shrinkage test only as indicated in [Tex-104-E](#).

- **Type B.** Materials such as rock, loam, clay, or other approved materials.
- **Type C.** Material meeting the specification requirements shown on the plans. Type C may be further designated as Type C1, C2, etc.
- **Type D.** Material from required excavation areas shown on the plans.

Meet the requirements of the pertinent retaining wall Items for retaining wall backfill material.

3. CONSTRUCTION

Meet the requirements of Item 7, "Legal Relations and Responsibilities," when off right of way sources are used. Notify the Engineer before opening a material source to allow for required testing. Complete preparation of the right of way in accordance with Item 100, "Preparing Right of Way," for areas to receive embankment.

Backfill tree-stump holes or other minor excavations with approved material and tamp. Restore the ground surface, including any material disked loose or washed out, to its original slope. Compact the ground surface by sprinkling in accordance with Item 204, "Sprinkling," and by rolling using equipment complying with Item 210, "Rolling," when directed.

Scarify and loosen the unpaved surface areas, except rock, to a depth of at least 6 in. unless otherwise shown on the plans. Bench slopes before placing material. Begin placement of material at the toe of slopes. Do not place trees, stumps, roots, vegetation, or other objectionable material in the embankment. Simultaneously recompact scarified material with the placed embankment material. Do not exceed the layer depth specified in Section 132.3.4., "Compaction Methods."

Construct embankments to the grade and sections shown on the plans. Construct the embankment in layers approximately parallel to the finished grade for the full width of the individual roadway cross-sections unless

otherwise shown on the plans. Ensure that each section of the embankment conforms to the detailed sections or slopes. Maintain the finished section, density, and grade until the project is accepted.

- 3.1. **Earth Embankments.** Earth embankment is mainly composed of material other than rock. Construct embankments in successive layers, evenly distributing materials in lengths suited for sprinkling and rolling.
- Treat material in accordance with Item 260, "Lime Treatment (Road-Mixed)" or Item 275, "Cement Treatment (Road-Mixed)" when required. Obtain approval to incorporate rock and broken concrete produced by the construction project in the lower layers of the embankment. Place the rock and concrete outside the limits of the completed roadbed when the size of approved rock or broken concrete exceeds the layer thickness requirements in Section 132.3.4., "Compaction Methods." Cut and remove all exposed reinforcing steel from the broken concrete.
- Move the material dumped in piles or windrows by blading or by similar methods and incorporate it into uniform layers. Featheredge or mix abutting layers of dissimilar material for at least 100 ft. to ensure there are no abrupt changes in the material. Break down clods or lumps of material and mix embankment until a uniform material is attained.
- Apply water free of industrial wastes and other objectionable matter to achieve the uniform moisture content specified for compaction.
- Roll and sprinkle each embankment layer in accordance with Section 132.3.4.1., "Ordinary Compaction," when ordinary compaction is specified. Compact the layer to the required density in accordance with Section 132.3.4.2., "Density Control," when density control is specified.
- 3.2. **Rock Embankments.** Rock embankment is mainly composed of rock. Construct rock embankments in successive layers for the full width of the roadway cross-section with a depth of 18 in. or less. Increase the layer depth for large rock sizes as approved. Do not exceed a depth of 2-1/2 ft. in any case. Fill voids created by the large stone matrix with smaller stones during the placement and filling operations.
- Ensure the depth of the embankment layer is greater than the maximum dimension of any rock. Do not place rock greater than 2 ft. in its maximum dimension, unless otherwise approved. Construct the final layer with graded material so that the density and uniformity is in accordance with Section 132.3.4., "Compaction Methods." Break up exposed oversized material as approved.
- Roll and sprinkle each embankment layer in accordance with Section 132.3.4.1., "Ordinary Compaction," when ordinary compaction is specified. Compact each layer to the required density in accordance with Section 132.3.4.2., "Density Control," when density control is specified. Proof-roll each rock layer as directed, where density testing is not possible, in accordance with Item 216, "Proof Rolling," to ensure proper compaction.
- 3.3. **Embankments Adjacent to Culverts and Bridges.** Compact embankments adjacent to culverts and bridges in accordance with Item 400, "Excavation and Backfill for Structures."
- 3.4. **Compaction Methods.** Begin rolling longitudinally at the sides and proceed toward the center, overlapping on successive trips by at least 1/2 the width of the roller. Begin rolling at the lower side and progress toward the high side on super elevated curves. Alternate roller trips to attain slightly different lengths. Compact embankments in accordance with Section 132.4.1., "Ordinary Compaction," or Section 132.3.4.2., "Density Control," as shown on the plans.
- 3.4.1. **Ordinary Compaction.** Use approved rolling equipment complying with Item 210, "Rolling," to compact each layer. Use specific equipment when required by the plans or the Engineer. Do not allow the loose depth of any layer to exceed 8 in., unless otherwise approved. Bring each layer to the moisture content directed before and during rolling operations. Compact each layer until there is no evidence of further consolidation. Maintain a level layer to ensure uniform compaction. Recompact and refinish the subgrade at no additional expense to the Department if the required stability or finish is lost for any reason.

- 3.4.2. **Density Control.** Compact each layer to the required density using equipment complying with Item 210, "Rolling." Determine the maximum lift thickness based on the ability of the compacting operation and equipment to meet the required density. Do not exceed layer thickness of 16 in. loose or 12 in. compacted material unless otherwise approved. Maintain a level layer to ensure uniform compaction.

The Engineer will use [Tex-114-E](#) to determine the maximum dry density (D_a) and optimum moisture content (W_{opt}). Meet the requirements for field density and moisture content in Table 2 unless otherwise shown on the plans.

Table 2
Field Density Control Requirements

Description	Density	Moisture Content
	Tex-115-E	
$PI \leq 15$	$\geq 98\% D_a$	
$15 < PI \leq 35$	$\geq 98\% D_a$ and $\leq 102\% D_a$	$\geq W_{opt}$
$PI > 35$	$\geq 95\% D_a$ and $\leq 100\% D_a$	$\geq W_{opt}$

Each layer is subject to testing by the Engineer for density and moisture content. During compaction, the moisture content of the soil should not exceed the value shown on the moisture-density curve, above optimum, required to achieve:

- 98% dry density for soils with a PI greater than 15 but less than or equal to 35 or
- 95% dry density for soils with PI greater than 35.

Remove small areas of the layer to allow for density tests as required. Replace the removed material and recompact at no additional expense to the Department. Proof-roll in accordance with Item 216, "Proof Rolling," when shown on the plans or as directed. Correct soft spots as directed.

- 3.5. **Maintenance of Moisture and Reworking.** Maintain the density and moisture content once all requirements in Table 2 are met. Maintain the moisture content no lower than 4% below optimum for soils with a PI greater than 15. Rework the material to obtain the specified compaction when the material loses the required stability, density, moisture, or finish. Alter the compaction methods and procedures on subsequent work to obtain specified density as directed.
- 3.6. **Acceptance Criteria.**
- 3.6.1. **Grade Tolerances.**
- 3.6.1.1. **Staged Construction.** Grade to within 0.1 ft. in the cross-section and 0.1 ft. in 16 ft. measured longitudinally.
- 3.6.1.2. **Turnkey Construction.** Grade to within 1/2 in. in the cross-section and 1/2 in. in 16 ft. measured longitudinally.
- 3.6.2. **Gradation Tolerances.** Ensure no more than 1 of the 5 most recent gradation tests is outside the specified limits on any individual sieve by more than 5% when gradation requirements are shown on the plans.
- 3.6.3. **Density Tolerances.** Ensure no more than 1 of the 5 most recent density tests for compaction work is outside the specified density limits, and no test is outside the limits by more than 3 pcf.
- 3.6.4. **Plasticity Tolerances.** Ensure no more than 1 of the 5 most recent PI tests for material is outside the specified limit by more than 2 points.

4. MEASUREMENT

Embankment will be measured by the cubic yard. Measurement will be further defined for payment as follows:

- 4.1. **Final.** The cubic yard will be measured in its final position using the average end area method. The volume is computed between the original ground surface or the surface upon which the embankment is to be constructed and the lines, grades, and slopes of the embankment. In areas of salvaged topsoil, payment for embankment will be made in accordance with Item 160, "Topsoil." Shrinkage or swell factors will not be considered in determining the calculated quantities.
- 4.2. **Original.** The cubic yard will be measured in its original and natural position using the average end area method.
- 4.3. **Vehicle.** The cubic yard will be measured in vehicles at the point of delivery.

When measured by the cubic yard in its final position, this is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

Shrinkage or swell factors are the Contractor's responsibility. When shown on the plans, factors are for informational purposes only.

Measurement of retaining wall backfill in embankment areas is paid for as embankment unless otherwise shown on the plans. Limits of measurement for embankment in retaining wall areas are shown on the plans.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Embankment (Final)," "Embankment (Original)," or "Embankment (Vehicle)" of the compaction method and type specified. This price is full compensation for furnishing embankment; hauling; placing, compacting, finishing, and reworking; disposal of waste material; and equipment, labor, tools, and incidentals.

When proof rolling is directed, it will be paid for in accordance with Item 216, "Proof Rolling."

All sprinkling and rolling, except proof rolling, will not be paid for directly but will be considered subsidiary to this Item, unless otherwise shown on the plans.

Where subgrade is constructed under this Contract, correction of soft spots in the subgrade will be at the Contractor's expense. Where subgrade is not constructed under this Contract, correction of soft spots in the subgrade will be paid in accordance with Article 9.7., "Payment for Extra Work and Force Account Method."