

## **SECTION 14**

### **EMBANKMENT**

#### **14.1 DESCRIPTION**

##### A. General:

This work consists of constructing roadway embankments, including preparation of the areas upon which embankments are to be placed; the construction of dikes within or outside the right-of-way; the placing and compacting of material within roadway areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits and other depressions within the roadway area.

##### B. Related Work Items:

Section 11	Utility Excavation and Backfill
Section 12	Roadway and Drainage Excavation
Section 15	Disposal of Surplus Excavation and Waste
Section 17	Salvaging, Stockpiling, and Placing Topsoil
Section 18	Erosion and Water Pollution Control
Section 190	Watering

#### **14.2 MATERIALS**

Only materials approved by the Engineer shall be used in the construction of embankments and backfills.

#### **14.3 CONSTRUCTION REQUIREMENTS**

##### A. Preparation of Embankment Areas:

Undercutting shall be in accordance with Section 12. Sod, which is not within the volume of undercutting, shall be thoroughly disked before embankment is placed thereon.

When undercutting is not required and a compacted road surface containing granular material lies within three (3) feet of the subgrade surface, such old road surfacing shall be scarified or loosened with a disc or hydraulic ripper to a depth of at least six (6) inches. This scarified material shall be re-compacted to specified density.

When embankment is to be placed and compacted on hillsides, against existing embankments, or when embankment is built one-half (1/2) width at a time, the slopes that are steeper than 4:1, when measured at right angles to the roadway centerline,

shall be continuously benched as the work is brought up on horizontal layers. Benching shall be of sufficient width to permit operations of placing and compacting equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous bench cuts. Material thus cut out shall be re-compacted to the specified density, along with the new embankment material at the Contractor's expense.

B. Finished Grade:

Unless otherwise specified, all embankment will be finished to grade with plus or minus one-tenth (0.1) foot tolerance.

C. Placing Embankment:

Sod or topsoil, where not specified by the Engineer to be salvaged, shall be used in the embankment and shall be well disked and pulverized. It may be placed in either the fill slopes outside the shoulders of the subgrade or spread in the lower one (1) foot of the fill between the roadbed shoulder lines, provided the sod or topsoil placed within the roadbed area is at least four (4) feet below the top of the subgrade. Sod or topsoil, shall not be placed within ten (10) feet of pipe culverts, or within fifty (50) feet of box culverts or bridges.

Rocks, broken concrete, or other solid materials shall not be placed in areas where piling is to be driven, underground utilities are to be installed or in other areas that the Engineer may designate.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the thickness prescribed without crushing, pulverizing, or further breaking down the pieces resulting from excavation methods, such material maybe placed in the embankment in layers not exceeding in thickness the approximate average size of the larger rocks. Each layer shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments or earth. Specified density will not be required for these layers; however, the material shall be compacted to the satisfaction of the Engineer. These layers shall not be constructed above an elevation one (1) foot below the finished subgrade. The top six (6) inches of embankments shall be essentially free of rock fragments or stone that cannot be hand-passed through a four (4) inch square opening.

Excess or unsuitable excavated material, including rock and boulders, that cannot be used in embankments may be placed, with the permission and at the direction of the Engineer, on the side slopes of the nearest fill and placed to maintain a distinct shoulder line. Waste material shall be placed the maximum distance possible and at least one (1) foot below the finished shoulder elevation. In case it is impossible to dispose of all such material in the manner described, the remainder shall be disposed of as directed.

Embankments to be constructed through lakes or swamps shall be constructed by end-dump methods to an elevation, determined by the Engineer, where it is practical to start normal construction methods. Above this elevation, moisture and density requirements will apply.

Embankment materials shall be placed in horizontal layers not exceeding a loose depth of eight (8) inches and shall be compacted as specified before the next layer is placed. Material may be placed in lifts greater than eight (8) inches provided it has been demonstrated that the compacting equipment in use has the ability to compact such material to the required density for the entire depth of the lift.

Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting. As the compaction of each layer progresses, continuous leveling and manipulating will be required to assure uniform density. Construction equipment shall be routed uniformly over the entire surface of each layer.

In areas composed mainly of bentonite or unstable material, the Engineer may require additional undercutting to a depth necessary to correct such areas. Scarifying of the exposed undercut surface will be required when specified on the plans or as directed by Engineer.

Rocks, two inches in diameter and larger, exposed at the surface within the right-of-way and easement areas shall be removed from the project site.

Driveway entrances, ditch and channel blocks, and dikes shall be constructed and compacted as directed by the Engineer.

Berms for structures requiring paved slope protection must be finished to grade with plus or minus one-tenth (0.1) foot tolerance to provide a true and positive support for the slope paving. Other berms will be neatly finished to the same tolerance as the remainder of embankment.

When the foundation for a box culvert, or any portion thereof, is constructed of compacted embankment, the embankment shall be constructed to an elevation between the bedding grade and flow line grade, as shown on the plans or established by the Engineer.

Backfill moisture and density shall be determined at least every 200 feet horizontally and every three (3) feet vertically. Backfill shall be properly compacted at all depths. The Contractor shall not place the finished surface (asphalt, curb & gutter, grass, etc.) until the specified densities are met at each location and the Engineer gives his approval. Backfill material not meeting specified densities shall receive additional compaction or shall be removed and replaced at no extra cost to the City as necessary to meet specifications.

When specified moisture contents are not met, the Contractor has the options of drying wet soil, furnishing approved soil meeting specifications, or adding water to

dry soil as necessary to meet specifications. If water is added to dry soil, it must be thoroughly mixed with the soil to provide uniform moisture content prior to backfilling.

The Contractor shall provide for positive drainage away from the excavation and embankment or otherwise take steps to protect the excavation and embankment from becoming excessively wet prior to placing the finished surface.

Should the Engineer determine that any portion of the backfill or excavation has become excessively wet after placement, the Contractor shall remove the material to the satisfaction of the Engineer and furnish an approved backfill material meeting the above specifications.

The Contractor shall be responsible for the stability of constructed embankments prior to acceptance and shall replace or reconstruct any portions, which have failed at no additional cost to the City.

Watering of embankments, or use of moist soils in embankments without watering will not be permitted during freezing weather.

Watering, and the work incidental thereto, shall be done as set forth in Section 190.

**D. Compaction, Specified Density Method:**

The Contractor shall compact all embankment according to the following table:

<b>SOIL TYPE</b>	<b>BACKFILL MOISTURE CONTENT</b>	<b>DEGREES OF COMPACTION</b>
Cohesive	3% below to 8% above Optimum	Min of 92% of Maximum Dry Density
Cohesion less	Workable	Minimum of 95% of Maximum Dry Density

Maximum dry density and optimum moisture content shall be determined by the AASHTO T-180, Modified Proctor Test.

- Soil Tests:** Prior to the start of construction, the Contractor shall provide the Engineer with the results of a modified proctor soil compaction test, as determined by the AASHTO T-180 Test, for those locations and depths marked on the plans. If no locations are indicated on the plans, proctor test results shall be provided for locations determined by the Engineer.

Along with the test results, the Contractor shall provide the Engineer with no less than 25 pounds of each sample appropriately labeled with the project title, the location from which the sample was obtained, the date of sample collection, and name of the person who collected the sample, and the name of the person or

firm who conducted with compaction test. A City Inspector shall be present during sample collection.

2. Testing Frequency: Initially, soil samples will be required only at those locations indicated on the plans. However, should it become apparent during construction that the soil types encountered are significantly different from the initial samples, additional sampling and testing may be required.

Unless otherwise specified in the Detailed Specifications, field density tests, will be performed by the Engineer. The field density shall be measured with a nuclear density machine in accordance with Test No. SD114 (AASHTO T 238). Contractor will be required to provide a prepared surface in the embankment shaped to facilitate testing at locations requested by the Engineer.

E. Compaction, Ordinary Compaction Method:

Compaction may be accomplished with any type of equipment, which will give uniform satisfactory results.

A rolling procedure shall be established which will produce densities conforming to Section 14.3D. Sufficient density tests will be taken to insure that the required density is being obtained with the equipment, soil and procedure being used. Once the procedure has been established, further density tests will be taken only when deemed necessary by the Engineer.

Each layer under construction must be satisfactorily compacted before the next layer is placed. Rolling work shall also be extended to cover the subgrade width in completed cut-sections under the same general requirements, and without any additional compensation. Cut-sections excavated below grade and refilled with the removed excavation or with selected soils shall be compacted in the same manner as embankments.

F. Dirt/Dust Control

All activities associated with this contract shall conform to Rapid City Municipal Ordinance Chapters 8.34 through 8.44 and/or Pennington County Ordinance No. 12. The Contractor shall make every reasonable effort to minimize fugitive dirt or dust from construction activities. The Engineer may require the Contractor to water or take other actions necessary to prevent blowing dirt and/or dust and other nuisance conditions.

#### 14.4 METHODS OF MEASUREMENT

Final measurement of embankments as a pay item will not be made.

#### **14.5 BASIS OF PAYMENT**

Embankments, including all the work (labor and equipment) specified in this section, will not be paid for directly but shall be understood to be subsidiary work pertaining to the several classes of excavation.

Payment for AASHTO T-180 proctor\_density\_tests shall be on a, per each basis.

Contractor provided field density tests, shall be incidental to the several classes of excavation, unless provided for in the Bid Proposal. In such case, payment shall be as called out in the Detailed Specifications.

**END OF SECTION**