

## SECTION 1100 GRADING

1101 SCOPE. This section governs the performance of all work required to excavate, remove, dispose or compact all materials encountered within the limits of the project, at the locations shown on the contract documents.

### 1102 DEFINITIONS.

- A. Grading. Grading as used herein shall mean the performance of all excavation, embankment, and backfill in connection with the construction of all improvements.
- B. Excavation. Excavation is defined as the removal of materials from the construction area to the lines and grades shown on the plans.
- (1) Unclassified Excavation. Unclassified excavation is defined as the removal of all material encountered regardless of its nature. All material excavated will be considered as Unclassified Excavation unless the Special Provisions specify Classified Materials.
- (2) Rock Excavation. Rock excavation is defined as the removal of all rock ledges 6 inches or more in thickness, and detached rock or boulders having a volume of more than 1 1/2 cubic yards and shale occurring in its natural state, hard and unweathered.
- A rock ledge is defined as a continuous body of rock which may include thin interbedded seams of shale or other soft materials less than 12 inches thick. The vertical limit of each ledge shall be defined by interbedded seams of soft materials 12 inches in thickness. The beds of soft interbedded material 12 inches in thickness shall not be included in the measurement of "Rock Excavation" but shall be included in the measurement for "Earth Excavation".
- (3) Earth Excavation. Earth excavation is defined as the removal of all material not defined as rock.
- C. Embankment or Backfill. Embankment or backfill is defined as the placing and compacting of material in the construction area to the lines and grades shown on the plans.
- (1) Unsuitable Material. Unsuitable material is defined as muck, frozen material, organic material, top soil, rubbish, and rock with a maximum dimension greater than 24 inches.
- (2) Suitable Material. Suitable material is defined as entirely imperishable with that portion passing the No. 40 Sieve having liquid limit not exceeding 40 and a plastic index not exceeding 25, when tested in accordance with ASTM D-423 and D-424, respectively.

- a. Rock Embankment. Material for rock embankment shall be free of unsuitable material and shall contain, by volume, greater than 10 percent rock or gravel having a maximum dimension greater than 3 inches but not greater than 24 inches.
  - b. Earth Embankment. Material for earth embankment shall be free of unsuitable material and shall, contain by volume, less than 10 percent rock or gravel having a maximum dimension greater than 3 inches.
- D. Borrow. Borrow is defined as approved material excavated from an area outside the project limits and required for the construction of the embankment.
- E. Waste. Waste is defined as excavation material not used in the embankment and disposed of outside the embankment areas.
- F. Structures. Structures, as used herein, refers to bridges, culverts, storm sewer and/or sanitary appurtenances, retaining walls and similar construction.

1103 CONSTRUCTION DETAILS - GENERAL. The contractor shall adhere to any and all statutes regarding the notification of utilities prior to beginning any work within public right-of-way. Relocation or protection of any existing utilities, located in street right-of-way, shall be governed by the applicable section of these Specifications. The relocation and/or protection of any utility that is shown on the plans, that lies within a utility easement and is endangered by this construction shall be the responsibility of the contractor.

The contractor shall make every reasonable effort to protect private facilities. These facilities may not be shown on the plans. When these facilities are disturbed or damaged by work, the contractor shall make necessary arrangements for repairs to the facilities for continuous service prior to the close of that workday.

It shall be the responsibility of the contractor to protect all property lot corners and control monumentation. Should it be necessary to disturb such monument, whether stake, pin, bar, disk, box, or other, it remains the responsibility of the contractor to reference such markers prior to removal, reset them, and file such relocations or monumentation documents as the law may require. Any such references, removal, replacement and certification of monuments shall be performed by a surveyor, registered and licensed in the State of Missouri. A copy of all such certification documents shall be provided to the Engineer prior to completion to the project. Any monument destroyed or improperly reset by the contractor may be replaced by the Engineer to the standards required by law at the expense of the contractor.

Grading, excavation, and backfilling for all improvements, shall be made to the lines, grades, and cross section indicated by the plans.

In addition, to any erosion control measures shown on the plans, the contractor shall schedule and conduct his operation in such a manner and shall provide any necessary control facilities to protect downstream and adjacent properties, including structures, from pollution, sedimentation or erosion caused by the grading operations. Any pollution or damage occurring as a result of the work shall be the responsibility of the contractor.

During construction the graded area shall be maintained by the contractor in such condition that it will be well drained at all times. Roadway ditches, channel changes, inlet and outlet ditches and other ditches in connection with the roadway shall be cut and maintained to the required cross section. All drainage work shall be performed in proper sequence with other operations. All ditches and channels shall be kept free of debris or obstructions.

1104 EXCAVATION. This section governs the excavation for all improvements.

All suitable material removed by excavation shall be used as far as practicable in the formation of embankment as required to complete the work. The contractor shall sort all excavating material and stockpile when necessary, so as to provide suitable materials for embankments.

After removal of the roadway excavation material to the required section, all material between lines 1 foot outside the curbs and within the top 6 inches of the subgrade shall be compacted to 95 percent of maximum density for the material as defined in Section 1106(E).

Rock encountered within the full width of the roadway, toe of slope to toe of slope, shall be undergraded to an elevation of 6 inches below the finished subgrade elevation. Care shall be taken to void overshooting when blasting. Rock shall be removed in such a manner as to leave no excessive water pockets in the surface.

Areas of undergrading or overbreak in rock between lines 1 foot outside of the curbs shall be backfilled with spalls, rock fragments or granular type material. Backfill materials shall have a plasticity index not to exceed 10 and a gradation such that at least 50 percent of the material will be retained on the No. 4 Sieve.

1105 UNDERGRADING. Where materials are encountered which are deemed as unsuitable by the Engineer for use in the work, they shall be removed to the depth and limits as ordered by the Engineer. Areas undergraded shall be backfilled with one of the following materials:

- A. Replacement with suitable materials from excavation on the work site or from an off-site borrow area, compacted to the required moisture and density requirements where practicable.
- B. Mixing of stone base or rock materials, hydrated lime, portland cement or fly ash into the sub-grade.
- C. Placement of compacted aggregate.

1106 EMBANKMENT. This section governs embankment for all improvements.

The embankments shall be constructed using suitable materials, as herein defined, procured from excavations made on the project site or from borrow areas as required to complete the grading work.

- A. Starting the Embankment. Where embankments, regardless of height, are placed against hillsides or existing embankments, either of which have a slope steeper than 1 vertical to 4 horizontal, the existing slope shall be benched or stepped in approximately 24 inches rises as the new fill is brought up in 12 inch maximum

layers or lifts. The material bladed out, the bottom of the area cut into, and the embankment material being placed, shall be compacted to the required density. Material cut out, bladed into place and compacted shall not be measured and paid for directly but will be considered as incidental work. The existing surface upon which embankment material is to be placed shall have all unstable and unsuitable material removed before starting the embankment work.

Where embankments 2 feet or less in depth are to be placed on areas covered by existing pavement, the existing pavement shall be removed and the cleared ground surface shall be compacted to the specified density. Where embankments greater than 2 feet in depth are to be placed on areas covered by existing pavement, the existing pavement shall be broken into pieces not larger than 18 inches maximum dimension, left in place and the embankment started thereon.

- B. Placing Earth Embankment. Earth shall be placed in successive horizontal layers distributed uniformly over the full width of the embankment area. Each layer of materials shall not exceed 12 inches maximum in thickness (loose state) and shall be compacted to not less than the required density before the next layer is placed thereon. As the compaction of each layer progresses, continuous blading, or dozing will be required to level the surface and to insure uniform compaction. Embankment construction shall not be performed when material contains frost, is frozen or is snow covered.
- C. Placing Earth and Rock Embankment. When earth and stone or rock fragments are mixed in the embankment, all stones or rock fragments exceeding the thickness of the compacted lift shall be disposed of by being incorporated into the embankment outside the limits of the proposed surfaced areas. The thickness of the layer in these areas may be increased if necessary to accommodate the rocks, but shall not exceed 15 inches in thickness (loose state). The stones or rock fragments are to be placed so there will be no nesting.
- D. Consolidated Rock Embankment. When the excavated material consists predominantly of stone or rock fragments of such size that the material cannot be placed in layers of the thickness prescribed, such material shall be placed in the embankment in layers having a thickness of approximate average size of the larger rocks but not to exceed 24 inches. Rock or boulders too large to permit placing in a 24 inch layer shall be reduced in size as necessary to permit placement. Rock shall not be dumped in place but shall be distributed by blading or dozing in a manner to insure proper placement in final position in the embankment. The smaller stone fragments shall be left on the surface of each layer as formed. Each layer shall be thoroughly consolidated before the next layer is placed.
- E. Compacting the Embankment. Before placing any embankment, the surface of the existing ground shall be prepared as heretofore specified, moistened as required, and the top 6 inches compacted to a density of 90 percent as prescribed by the following paragraph.

All embankment shall be compacted to a density of at least 90 percent of the maximum density for the material used as determined by ASTM D-698 and within a

tolerance of minus 3 percent and plus 2 percent of the optimum moisture as maximum density as determined by the Moisture Density Curve obtained. In addition to the above required compaction, the subgrade between lines 2 feet outside of the curbs and within the top 6 inches of the subgrade shall be compacted to a density of at least 95 percent of the maximum density for material used as determined by ASTM D-698 and with a tolerance of minus 3 percent and plus 2 percent of the optimum moisture as maximum density as determined by the Moisture Density Curve obtained.

All work involved in either adding moisture to or removing moisture from embankment materials to within these moisture limits shall be considered incidental to the completion of the grading operation.

- F. Moisture - Density Determination. In-place density and moisture content of the embankment will be determined by the Standard Method of Test for Density of Soil in Place by the Sand-Cone Method, ASTM D-11556; or the Rubber Balloon Method, ASTM D-2167; or by Nuclear Methods, ASTM D-2911.
  
- G. Backfilling Curb and Gutter. Backfilling behind curb or curb and gutter shall be done within seven (7) days after being laid unless otherwise approved by the Engineer. The material used to fill the void behind curb or curb and gutter shall be free of rock and debris and shall be of a type that will leave no voids to pocket water and that will self-compact. Unless otherwise shown on the contract drawings, the finish grading from the back of the curb to the right-of-way line and/or utility easement line or construction easement line shall be performed to provide a smooth transition between existing yard grades at the right-of-way line and/or easement line to the curb so that positive drainage will exist.

The top portion of the backfill within right-of-way areas shall be finished with at least twelve (12) inches of topsoil corresponding to, or better than, that underlying adjoining sodded areas. Topsoil shall be approved by the Engineer prior to placement, and unless otherwise directed, shall be material previously excavated and stockpiled for the purpose during excavating and grading operations. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by discing or scarifying to a depth of two (2) inches to permit bonding of the topsoil to the underlying surface.