

SECTION 2000- EARTHWORK

PART 1- GENERAL

1.01 SCOPE: This Section covers excavation, fill, and compaction of earth and rock for roadway, embankments, structural foundations, and planted areas. Topics include acceptable materials, imported materials, topsoil stripping, dewatering, disposal of excess material, cleanup, grading tolerances, embankment subgrade, placement of fill, compaction requirements, settlement plates, and porous backfill for structures.

1.02 RELATED WORK: Refer to the following sections for related work:

Flowable Fill	Section 4000-Concrete Materials and Methods
Photographic Record	Section 1000-General Requirements
Topsoil Material and Placement	Section 7000-Seeding and Sodding
Filter Fabric for Underdrains	Section 5200-Storm Sewer

1.03 SUBMITTALS: Submit the following for review:

- A. Soil samples for moisture-density tests. One sample required for each soil type encountered.

1.04 DEFINITIONS: In this Section, the following words shall have the meanings specified:

- A. Structure: Bridges and their foundations and abutments, box culverts and arch culverts and their headwalls and wingwalls, retaining walls, manholes, drainage inlets and catch basins, and other below-grade cast-in-place concrete construction. The requirements of this Section apply to these structures even though the work may be subsidiary to other pay items.
- B. Rock: Rock ledges 6 inches or more in thickness with interbedded seams of soft materials less than 12 inches thick, or detached boulders 1-1/2 cubic yards or greater in volume.
- C. Overexcavation: Excavation below the elevation of the bottom surface of footings, or below the elevation of pavement and embankment subgrades. Overexcavation will be considered authorized when directed by Engineer to remove unsuitable material. All other overexcavation, including unsuitable material removed without Engineer's direction, shall be considered unauthorized. Payment will not be made for unauthorized overexcavation or its repair.

1.05 PERMITS: Contractor shall obtain a haul permit from the Unified Government if operations require on-street transportation of earth or rock.

1.06 SCHEDULING AND PHASING: Comply with phasing and timing requirements of the Erosion Control Plan.

PART 2 - PRODUCTS

2.01 ACCEPTABLE FILL MATERIAL: On-site or imported material free of muck, frozen material, excess moisture, organic material, topsoil, rubbish, construction debris, and rock larger than 8 inches.

2.02 POROUS FILL MATERIAL: KDOT Standard Specifications Subsection 1102, CA-5 or Subsection 1108, BD-1, crushed stone or gravel, meeting the following gradation.

CA-5		BD-1	
<u>Sieve Size</u>	<u>Percent Retained</u>	<u>Sieve Size</u>	<u>Percent Retained</u>
1-inch	0	1-1/2-inch	0
3/4-inch	0 - 5	1-inch	0 - 10
3/8-inch	40 - 60	3/4-inch	10 - 40
No. 8	95 - 100	No. 4	80 - 100
		No. 16	90 - 100
		No. 100	98 - 100

2.03 SOIL STABILIZATION MATERIALS: Stabilization materials shall meet the following requirements, and application shall be as specified in Part 3:

- A. Flowable fill as referenced in Part 1.
- B. AB-3: Aggregate for Aggregate Base Construction, gradation AB-3, KDOT Standard Specifications Subsection 1105.
- C. Surge rock: Stone for Aggregate Ditch Lining, $D_{50} = 5$ inches, KDOT Standard Specifications Subsection 1116.

2.04 FILTER FABRIC: Filter fabric for separation of soil strata and general use shall be a geotextile fabric meeting the requirements of KDOT Standard Specifications Subsection 1710. An abbreviated summary of those requirements is given below:

<u>Property</u>	<u>Limit</u>	<u>Method</u>
Tensile Strength	Min 150 lbs.	ASTM D4632
Puncture Strength	Min 80 lbs.	ASTM D4833
Apparent Opening Size	100 to 40	ASTM D4751
Trapezoidal Tear	Min 60 lbs.	ASTM D4533

2.05 COMPACTION EQUIPMENT: Equipment for compaction shall be sheepsfoot roller with minimum 200 psi bearing pressure for fine grained soils, or a pneumatic tire roller with a minimum of 225 lb. per linear inch bearing pressure for coarse sand and gravel. Confined areas and backfill adjacent to structures shall be compacted with mechanical rammers or tampers.

PART 3 - EXECUTION

3.01 GENERAL: The following requirements apply to all earthwork:

- A. General: Contractor shall complete all grading, excavation, and filling to the lines, grades, cross sections, and contours shown on the drawings.
 - B. Utilities: Utilities shown on the drawings are approximate only. Contractor shall verify location of all underground utilities before beginning work.
 - C. Photographic record: Whenever excavation will be closer to an existing improvement to remain than a plane descending at 1.5 Horizontal to 1 Vertical from a point on the original ground line at the existing improvement, Contractor shall make a photographic record of the existing improvement.
 - D. Verification: Prior to construction, Contractor shall verify that original ground surface is as shown in the drawings and that plan quantities are accurate. Starting work is acceptance of drawing cross sections as the basis of measurement.
 - E. Clearing and Topsoil Stockpile: Site shall be cleared of vegetative matter not identified to remain. Topsoil shall be stripped and stockpiled for later reuse. Depth of topsoil stockpile shall not exceed 5 feet to minimize anaerobic conditions and loss of soil fauna.
 - F. Cutting Roots: When excavating within a distance of 6 times the diameter at chest height of a tree to remain, cut roots by either of the following methods:
 - 1. Expose large roots without tugging, hacking, or scraping on root. Cut with sharp axe or saw.
 - 2. Prior to excavation, make a narrow vertical cut at limits of excavation using a utility trencher. Cut shall be at least 3 feet deep.
- This requirement does not apply to small roots that are severed with the first advance of the excavator bucket.
- G. Dewatering: Water shall be prevented from entering or standing in the excavated areas. Dewatering methods shall include pumping, sheeting and shoring, and control of runoff by ditching and berming as appropriate to the site conditions.
 - H. Unsuitable Subgrade: No fill or structure shall be placed in water or on frozen, unstable, or otherwise unsuitable subgrade.
 - I. Rock: If rock is encountered, Contractor shall inform Engineer and shall not commence excavation of rock until the upper limits of the rock strata have been defined. On Engineer's direction, overexcavate 6 inches and backfill with soil stabilization material as required for the type of excavation. A blasting permit is required for use of explosives on a construction site.

- J. Disposal: Excess material shall be disposed of on site only as permitted by the drawings or as directed by Engineer; such directions shall control the location, shape, method of placement, and types of material disposed. If on-site disposal is not permitted, Contractor shall make his own arrangements for off-site disposal.
- K. Borrow and Imported Fill: On-site borrow shall be taken only from the locations shown on the drawings, and shall conform to the requirements for excavation. At the completion of grading, borrow areas shall be regular in shape with graded sides and bottom slopes. Side slopes of borrow areas shall not be steeper than 2 Horizontal to 1 Vertical and shall be uniform for the entire length. Contractor shall make all arrangements necessary to provide the volume of imported fill required for the work.
- L. Topsoil Placement: Coordinate elevation of topsoil subgrade to allow for topsoil depth within the final elevations shown on the plans. Topsoil placement shall conform to the Section referenced in Part 1. Dispose of excess topsoil.
- M. Tolerances: Earthwork elevations shall be true to drawing elevations within the following tolerances:
 - 1. Topsoil or soil adjacent to curbs, walks, or inlets - within 1/2-inch of the elevation of the curb, walk, or inlet.
 - 2. Drainage channel flowlines, earth adjacent to structures, and topsoil for maintained lawns - within 0.1 foot.
 - 3. Intermediate subgrades, topsoil in low maintenance areas, and other items not listed above - within 0.2 foot.

3.02 BULK EARTHWORK: The following requirements apply to overlot grading, grading of drainage channels and detention areas, street cuts and embankments, and similar work where excavated areas are not subsequently backfilled and embankments are constructed above original ground surface:

- A. Preparation of Original Surface: After topsoil stripping, embankment subgrade shall be scarified a minimum of 6 inches and compacted to 90 percent of maximum density as determined by ASTM D698. If the original surface is an existing pavement and the embankment would be less than 2 feet deep, the pavement shall be removed. If the original surface is an existing pavement and embankment will be at least 2 feet deep, the pavement may be broken into pieces not longer than 24 inches and left in place.
- B. Unsuitable Foundation: If material encountered at the embankment subgrade in fill sections or at the future pavement subgrade elevation in cut sections cannot be compacted to the required limits, Engineer shall be called for identification and directions. Engineer's directions to remedy unsuitable foundations shall be followed. Remediation directed by Engineer may be drying in place; excavating, spreading to dry, re-placing, and recompacting the soft material; or overexcavation and disposal of the soft material.

- C. **Placing and Compacting Embankments:** If embankment is placed against an existing surface with a slope steeper than 4 Horizontal to 1 Vertical, the existing surface shall be benched with approximately 24-inch rises. Embankment shall be built up in approximately horizontal lifts over the full width of the embankment area. Maximum lift thickness shall be 8 inches of loose material. Lifts shall be continuously bladed or dozed to ensure uniform distribution of fill. Hauling tracks shall be varied to eliminate ruts and uneven compaction. Each lift shall be compacted to the required density before the next lift is placed. Compaction for the body of the embankment shall be such that a tamping or sheepsfoot roller will walk-out of the material and ride the top of the lift (KDOT Type B, MR-90).

Compaction of the final two feet of the embankment immediately below pavements shall be at least 95 percent of maximum density as determined by ASTM D698; moisture content shall be within 3 percent of optimum (KDOT Type AA, MR-3-3). Water shall be added or removed as necessary to maintain specified moisture.

- D. **Subgrade in Cut Sections:** Final subgrade in cut areas outside the pavement limits described above shall be prepared for topsoil placement as described in the Section referenced in Part 1.
- E. **Protection of Completed Grading:** Contractor shall protect earthwork and repair damage from erosion, blowing, settlement, drying of pavement subgrade, unauthorized excavation, sliding, or changes in position or density from other causes.

3.03 EARTHWORK FOR STRUCTURES: The following requirements apply to earthwork for defined structures and similar work where excavated volumes are subsequently replaced with backfill and where backfill is placed against walls, foundations, abutments, or arches. Also included are supplemental requirements for embankments built over the top of these structures.

- A. **Unsuitable Foundation:** If material encountered at the foundation or slab subgrade is frozen, saturated, or softer than indicated by the drawings, Engineer shall be called for identification and directions. Engineer's directions to remedy unsuitable foundations shall be followed. Remediation directed by Engineer may include resizing/redesigning of the foundation; rescheduling to avoid severe weather; or overexcavation and disposal of the soft foundation.
- B. **Overexcavation:** All overexcavation in structural excavation areas shall be filled with flowable fill or AB-3 compacted to 95 percent standard.
- C. **Porous Fill:** Methods of placement and compaction of porous fill shall be the same as for common structural fill. A minimum of 2 cubic feet of porous fill shall be placed at each weep hole.
- D. **Timing and Sequence of Backfill:** Backfill against a cast-in-place structure shall not begin until 80 percent of the 28-day design strength has been reached, except such time shall not be shorter than the minimum curing period. Verify timing and that dampproofing is in place. Fill shall be brought up uniformly on both sides of culverts, abutments, and piers. Back slopes shall be benched if necessary to avoid wedge action against the structure. Unless specified in the Special Conditions, heavy equipment shall not be allowed on the top of buried structures until at least 2 feet of earth cover is in place.

- E. Compaction: Fill within 2 feet of a structure shall be compacted with hand operated mechanical tampers. Compaction shall be at least 95 percent of maximum density as determined by ASTM D698; moisture content shall be within 3 percent of optimum. Water shall be added or removed as necessary to maintain specified moisture.

END OF SECTION 2000