

## **SECTION XXIII**

### **EXCAVATION AND BACKFILLING**

This section includes guidelines for excavation and backfilling of utilities and structures.

All Design criteria, materials, and construction shall be in accordance with DHEC regulations, AWWA, and ASTM Standards.

#### **A. DEFINITIONS**

1. Open areas: Those areas that do not include building sites, paved areas, street rights-of-way and parking areas.
2. Maximum density: Maximum weight in pounds per cubic foot of a specific material.
3. Optimum moisture: Percentage of water in a specific material at maximum density.
4. Muck: Materials unsuitable for foundation because of organic content, saturation to the extent that it is somewhat fluid and must be moved by dragline, dredge, or other special equipment, are designated as muck. No extra payment will be made for muck removal.
5. Unsuitable material: Earth material unsatisfactory for its intended use and as classified by the soils technicians. In addition to organic matter, sod, muck, roots, and rubbish, highly plastic clay soils of the CH and MH descriptions, and organic soils of the OL and OH descriptions, as defined in the Unified Soil Classification System shall be considered as unsuitable material.
6. Suitable material: Earth or materials designated as being suitable for their intended use by soils technicians or the soils engineer. Suitable material shall be designated as meeting the requirements of the Unified Soil Classification System types SW, GW, GC, SC, SM, ML, CI or as designated in these specifications.
7. Select material: Granular material to be used where indicated on the drawings or where specified herein consisting of soils conforming to the Unified Soil Classification types SW, SM, GW, or GM or as otherwise

approved by the Engineer as select fill. Select material shall contain no stones or rubble larger than 1½" in diameter.

8. Crushed stone (gravel): No. 57 aggregate or equal conforming to ASTM C-33.
9. Excavation: Excavation of every description regardless of materials encountered.

**B. EXCAVATION FOR UTILITIES**

1. Excavate for utilities by open cut.
2. Remove boulders and other interfering objects, and backfill voids left by such removals.
3. Remove wet, or other material unsuitable for foundation or sub-grade and replace with acceptable pipe foundation material.
4. Depressions:
  - a. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.
  - b. Except where rock is encountered, do not excavate below the depth indicated or specified.
  - c. Where rock is encountered, excavate rock to a minimum overdepth of 4" below the trench depth indicated or specified, and to provide 6' clearance in any horizontal direction from all parts of the utility and appurtenances.
5. Provide depth of cover shown or minimum cover of 36", whichever is greater.
6. Where minimum cover only is required, carry excavations to depths necessary to properly grade the pipe on tangents and vertical curves as directed by the Engineer.
7. Provide minimum clearance of 6" between pipe walls and trench walls or sheeting and bracing lines.

8. Where lines are constructed in the rights-of-way of the South Carolina Department of Transportation, provide minimum cover of 36" below the elevation of the pavement.
9. Comply with pertinent OSHA regulations in regards to the excavation of utilities.

C. BACKFILLING FOR UTILITIES

1. Backfill trenches and excavations immediately after the pipe are laid, unless other protection is directed or indicated.
2. Select and deposit backfill materials with special reference to the future safety of the pipes.
3. In lower portion of trench, deposit approved backfill and bedding material in layers of 6" maximum thickness, and compact with suitable tampers to the density of the adjacent soil until there is a cover of not less than 12" using special care not to damage pipe and pipe coatings.
4. Except for special materials for pavements, backfill the remainder of the trench with material free from stones larger than 6" or ½ the layered thickness, whichever is smaller, in any dimension.
5. Under roads, streets and other paved area:
  - a. Mechanically tamp in 6" layers using heavy duty pneumatic tampers or equal.
  - b. Tamp each layer to a density equivalent of not less than 100% of an ASTM D698 Proctor Curve.
  - c. Provide additional compaction by leaving the backfilled trench open to traffic while maintaining the surface with crushed stone.
  - d. Refill any settlement with crushed stone and continue such maintenance until replacement of pavement is authorized by the Engineer.

D. EXCAVATING FOR STRUCTURES

1. Conform to elevations and dimensions shown within a tolerance of 0.10', and extending a sufficient distance from footings and foundations to permit placing and removing concrete formwork, installation of services, other construction required and for inspection.
2. Where earth will stand, shallow footing excavations may be cut to the exact size of the footing.
3. Separate suitable materials and stockpile for future use.
4. Dispose of unsuitable material and excess suitable material.
5. Foundation subgrades:
  - a. Excavate foundations and footings to a level bottom in firm, solid, suitable material.
  - b. Take care not to disturb the bottom of the excavation unless further compaction of the subgrade is required.
  - c. The Developer's Design Engineer is to inspect the completed excavation prior to work being performed on the foundation subgrade.
  - d. Should unsuitable or soft material be encountered at subgrade elevation, remove such material and replace with compacted suitable material or crushed stone from firm earth up to the indicated elevation.
    - 1) In wet excavations or where groundwater is normally present, replace unsuitable material with crushed stone or lean concrete.
    - 2) In dry excavations above the normal groundwater level, replace unsuitable material with compacted suitable material.
6. Provide drainage and control grading in the vicinity of the work to prevent drainage into the excavation.
7. Unauthorized excavation:
  - a. Excavation of material to depths below the grades indicated will be deemed unauthorized excavation.
  - b. Backfill and compact unauthorized over excavation.

- 1) In wet excavation or excavations below normal groundwater elevations: use crushed stone or lean concrete.
- 2) In dry excavations above normal groundwater elevations: use compacted suitable material.

8. Dewatering:

- a. Remove all surface and subsurface waters from excavations and maintain the excavation in a dry construction operations.
- b. Maintain the water level below the excavation subgrade during excavation and construction.
  - 1) Remove material disturbed below the foundation subgrade due to improper dewatering and replace with crushed stone or lean concrete.
  - 2) Dewatering by trench pumping will not be permitted if migration of fine grained natural material (running sand) from bottom, side walls or bedding material will occur.

E. BACKFILLING AND COMPACTION FOR STRUCTURES

1. Use suitable material for all filling and backfilling operations.
  - a. Provide suitable material free from organic matter and deleterious substances, containing no rocks or lumps over 6" in greatest dimension, and with not more than 15% of the rocks or lumps larger than 2½" in their greatest dimension.
2. Fill under structures: Deposit suitable materials in layers not exceeding 8" in depth and compact each layer using proper equipment.
  - a. Do not place rock that will not pass through a 6" diameter ring within the top 12" of the surface of the completed fill or rock that will not pass through a 3" diameter ring within the top 6" of the completed fill.
  - b. Do not place broken concrete, bricks, or asphaltic pavement in fills.
3. Backfill excavations as promptly as progress of the Work permits, but not until completion of the following:
  - a. Inspection and acceptance of construction below finish grade including, where applicable, dampproofing and waterproofing.

- b. Inspecting, testing, approving and recording locations of underground utilities.
  - c. Removing concrete formwork.
  - d. Removing shoring and bracing, and backfilling of voids with satisfactory materials.
  - e. Removing trash and debris.
  - f. Cast in place foundation walls have been in place seven days.
4. Placing and compacting:
- a. Place backfill and fill materials in layers not more than 8" in loose depth.
  - b. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content with  $\pm 2\%$ .
  - c. Compact each layer to required percentage of maximum density for area.
  - d. Do not place backfill or fill material on surfaces that are muddy, frozen, or containing frost or ice.
  - e. Place backfill and fill materials evenly adjacent to structures, to required elevations.
  - f. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.
  - g. Do not operate heavy equipment closer to foundation or retaining walls than a distance equal to height to backfill above the footing.
    - 1) Compact remaining area using power driven hand tampers.
  - h. Where the construction includes basement or other underground walls having structural floors over them, do not backfill such walls until the structural floors are in place and have attained sufficient strength to support the walls.
5. Compaction requirements:

- a. Compact soils to not less than the following percentages of maximum dry density as determined in accordance with ASTM D698, Method A (Standard Proctor).
- b. Existing in place subgrade below structures where subgrade has been disturbed by water, improper dewatering, or construction traffic:

Top 12" of subgrade	100%
Below top 12" of subgrade	98%

- c. Fill beneath structures and beneath an area extending 10 feet beyond the limits of the foundation:

Top 12" of subgrade	100%
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- d. Compaction of suitable material used to replace unsuitable material below foundation subgrades:

Top 12" of subgrade	100%
Below top 12" of subgrade	98%