

4.3 TRENCHING AND BACKFILLING

4.3.01 General

- A. Work included in this section includes trenching and backfilling for underground pipelines and related structures only.
- B. Work shall conform to County requirements. Where construction is within the road right-of-way, the requirements of the Virginia Department of Transportation (VDOT) shall govern.
- C. Reference Specifications include, but may not be limited to:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American Association of State Highways and Transportation Officials (AASHTO)
 - 3. Virginia Department of Transportation (VDOT)

4.3.02 Definitions

- A. Excavation: Removal of material encountered to required subgrade and/or subsoil elevations indicated, and the subsequent disposal of materials removed.
- B. Fill: Material placed and compacted above the level of the subsoil, which existed before construction of the project.
- C. Rock: Hard bed rock, boulders, or similar material requiring the use of rock drills and/or explosives for removal. The criteria for classification of general excavation as rock is any material that cannot be dislodged by a Caterpillar D-8 Tractor, or equivalent, equipped with a single tooth hydraulically operated power ripper. The criteria for trench rock shall be that a Caterpillar 345 Backhoe, or equivalent, with a proper width bucket cannot remove the material.
- D. Subgrade: The undisturbed earth, or the compacted soil layer, immediately below granular subbase, drainage fill, or topsoil materials.
- E. Subsoil: The undisturbed earth immediately below the existing topsoil layer.
- F. Unauthorized Excavation: Removal of materials below indicated subgrade elevations or beyond horizontal excavation dimensions without specific direction of the Inspector.

- G. Undercut Excavation: Additional excavation made necessary by the presence of unsuitable bearing materials at the specified subgrade or subsoil elevation. Undercut excavation must be approved by the Inspector. Where unsuitable materials are encountered, Contractor shall perform undercut excavation as needed or as directed by the Inspector.
- H. Unsuitable Material: Material such as clay mass, frozen materials, cinders, ashes, refuse, and vegetable, organic material, or any other material deemed unsuitable by the Inspector. Unsuitable material shall be removed and replaced with suitable material as specified herein for the intended use.
- I. Bedding: Bedding is the material placed under the pipe as indicated on the appropriate Standard Detail.
- J. Backfill: Material placed on top of bedding. Backfill is used to cover the pipe and fill the trench. The contractor shall use the correct type(s) of backfill as indicated on the appropriate Standard Detail for the pipe being installed.

4.3.03 Testing and Inspection

- A. Compaction testing shall be performed by a licensed, independent testing agency. The testing shall be performed by agency personnel in the presence of the Inspector. The testing company shall submit the results to the County.
- B. In trenching operations, compaction testing shall be performed at increments of approximately 1,000 L.F. of trench, and at all commercial driveway entrance crossings.
- C. Inspector must approve subgrade prior to bedding and pipe installation, and each fill layer prior to installation of the next layer.
- D. The degree of compaction obtained shall be verified by means of field density tests made by an independent testing agency. Where tests indicate a deficiency in degree of compaction, the Contractor shall correct such conditions and the independent testing agency shall make additional tests to verify that the corrected work is satisfactory.

4.3.04 Explosives

- A. Work with explosives shall be executed by persons who are licensed or otherwise authorized by governing authorities for the work required.
- B. The Contractor shall be responsible for obtaining the necessary blasting permit(s) from the County Fire Marshal and/or other authorities having jurisdiction.

- C. Explosives shall be stored and used in accordance with all applicable Federal, State, and Local regulations. The Contractor shall be responsible for and shall satisfactorily correct all damage resulting from his use of explosives.

4.3.05 Existing Utilities

- A. Locate existing utilities, culverts and structures, above and/or below ground, before any excavation starts. Coordinate work with utility companies. Protect, maintain in service, and prevent damage to utilities not designated to be removed. When utilities are encountered which are not shown on Drawings, or when location differs from that shown on Drawings, notify the Inspector for instructions before proceeding.
- B. The Contractor shall coordinate with the local utility companies prior to constructing portions of work adjacent to utility poles and other structures. The Contractor shall stabilize utility poles and/or other structures as required by the utility owner.

4.3.06 Products

- A. Select fill shall be Type I or Type II in accordance with Section 207 of the VDOT Road and Bridge Specifications.
- B. Clean earth fill shall be approved by the Inspector and shall be free of debris, roots, frozen materials, organic matter, rock, or gravel larger than 1-½ inches in any dimension or other harmful, deleterious matter and shall be classified as ML or better material in accordance with the Unified Soils System, ASTM D2487.
- C. Fine aggregate shall be #9 or #10 stone as per VDOT Road and Bridge Specifications Section 203 or Grade A or Grade B fine aggregate as per VDOT Road and Bridge Standard Section 202.
- D. Coarse aggregate shall be #57 stone as per VDOT Road and Bridge Specifications Section 203.
- E. Where concrete is to be used, the Contractor shall submit a job mix with Laboratory Testing Reports for approval by the Department. Concrete for bedding, backfill or encasement shall be 3000 psi minimum.
- F. Riprap, where shown on the Drawings, shall conform to VDOT Specification Sec. 414.03 Dry Riprap.
- G. Topsoil is defined as the top 6 inches of original soil from the trench. Topsoil provided by the Contractor shall be fertile, friable loam, containing not less than 2 percent by weight of finely divided, decomposed vegetation. Topsoil shall be free of subsoil, clay lumps,

brush, weeds, roots larger than ½- inch diameter, stones larger than ½-inch diameter and other material toxic or harmful to growth.

4.3.07 Excavation

- A. Contractor shall strip existing topsoil, leaf mold and organic materials and deposit it in storage piles separate from other excavated material.
- B. Where the trench excavation exceeds the specified width, the Contractor shall consult with the Design Engineer to determine whether measures need to be taken to account for increased loads on pipe.
- C. Where unauthorized excavations occur, the Contractor shall restore affected areas to the elevations and dimensions shown on the Drawings using granular fill material.
- D. The Contractor shall be responsible for removal of any/all unsatisfactory material from the site.

4.3.08 Trenching and Bedding

- A. Trenches may be opened only as far in advance of pipe laying as permitted by the Inspector.
- B. Excavate to the lines and grades indicated for pipelines and structures making proper allowance for pipe bedding materials, pipe bells and concrete form work.
- C. Excavate pipeline trenches with vertical walls. Specified trench width shall be maintained from bottom of trench to a point 18 inches above top of pipe.
- D. Where unsuitable soil is encountered, Contractor shall excavate to a depth acceptable to the Inspector, and shall replace unsuitable material with thoroughly and uniformly compacted pipe bedding material as indicated on the applicable Standard Detail.
- E. The width of the trench at and below the top of the pipe shall not exceed the width of the trench as shown on the applicable Standard Detail.
- F. Pipe bedding and backfill shall be performed as follows:
 - 1. Pressure Pipe:
 - a. Ductile iron pressure lines and PVC pressure lines 4 inches and larger shall be installed with bedding and backfill in accordance with Standard Detail TR-01 – Pressure Pipe Trench.

- b. Pressure pipe 3 inches and smaller of PVC, polyethylene pipe and copper tubing shall be backfilled with a minimum of 6 inches of sand or fine aggregate all around.
 - c. Excavate for bell holes at each joint so that entire barrel of pipe shall be fully supported the entire length.
 - d. Where rock is encountered, excavate and remove rock to a minimum 6 inches below the bottom of the pipe and use bedding and backfill as specified on Standard Detail TR-01 – Pressure Pipe Trench, regardless of pipe material.
2. Gravity Sewer:
- a. Ductile iron and PVC gravity sewer lines shall be installed with bedding and backfill as specified on Standard Detail TR-02 – Gravity Sewer Trench.
 - b. Where rock is encountered, excavate and remove rock to a minimum 6 inches below the bottom of the pipe and use appropriate bedding and backfill as specified on Standard Detail TR-02 – Gravity Sewer Trench.
- G. All pipes shall be installed in a dry trench. Dewater excavation as necessary to provide proper protection. The method and equipment used for dewatering shall be subject to the approval of the Inspector.
- H. All soil is unclassified unless indicated otherwise.
- I. All foundation soils and subgrades shall be tested by a licensed, independent, testing agency to determine subgrade soil bearing capacity.
- J. Adequate positive drainage away from trenches and excavations shall be maintained throughout construction. Keep excavation free of water while work is being performed and until backfilled. Where underground streams or springs are found, provide temporary drainage or pumping and notify the Inspector.
- K. Where rock is encountered so that a manhole, vault, or other structure will bear entirely on rock, it shall be used to support the foundation. Where only a part of the foundation would bear on rock, Contractor shall excavate the entire structure to an even depth at least 8 inches below the bottom elevation of the structure and shall back-fill with coarse aggregate fill and thoroughly compact. Provide a minimum of 8 inches between rock excavation and sides of structures.

4.3.09 Sheeting and Shoring

- A. Contractor shall maintain trench walls in a safe condition at all times. The use of sheeting and/or shoring may be required at the discretion of the Inspector.
- B. Unless otherwise directed by the Inspector, all sheeting and bracing shall be removed in such a manner so the construction or other structures are not endangered. All voids left or caused by the withdrawal of sheeting shall be backfilled immediately with approved material and compacted by ramming with tools especially adapted for that purpose, or by other means approved by the Inspector.
- C. Sheeting and shoring left in place shall be cut off to a depth of not less than 24 inches below grade. The cutoff sections shall be removed from the site.

4.3.10 Compaction

- A. Power-driven hand tampers shall be used for compacting materials adjacent to structures and in areas inaccessible to rollers. Use equipment capable of adding moisture to the soil material as determined by moisture-density tests. Where required, uniformly apply water to the surface of the subgrade or layer of soil material in such a manner as to prevent free water appearing on the surface, either during or subsequent to compacting operations.
- B. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified percentage of maximum density.
- C. Do not place or compact material that is muddy, frozen, or contains frost or ice.
- D. Where compaction 90 percent or greater is required, test reports shall be submitted to the Department prior to Substantial Completion (e.g., for private development projects, prior to Tentative Acceptance).

4.3.11 Backfill

- A. Unless otherwise required by DPU Standards or as directed by the Inspector, the Contractor shall backfill all trenches immediately after the pipes and appurtenances are laid therein.
- B. Backfill shall be properly placed uniformly on each side of the pipe and compacted as required. Contractor shall not backfill on muddy or frozen soil, nor shall muddy or frozen soil be used as backfill.

- C. Backfill shall be compacted to the density specified for the areas in which it is located except that minimum compaction in any area shall be to the density of the adjacent soil. Settlement may be achieved by puddling, mechanical tamping, or other means which satisfy the compaction requirements.
- D. Depressions caused by removal of stumps or other clearing operations shall be excavated to firm subgrade and filled with clean earth fill compacted as specified.
- E. Around and adjacent to structures, backfill shall be of material of suitable stability and perviousness. Backfill shall be placed in 6-inch layers, each layer being compacted by approved means. No backfill shall be placed against a structural wall until all connecting structural members are in place. It shall be the Contractor's responsibility to provide compaction to such a degree that the resultant subsidence after placing shall not be detrimental to the stability or appearance of the structure or adjacent areas. The Contractor shall provide adequate protection to all structures during backfilling and use every precaution to avoid damaging or defacing them.
- F. The Contractor shall compact soil materials using equipment suitable for materials to be compacted and work area locations.
- G. Coarse aggregate fill placed under manholes and other structures shall be compacted to the required density.

4.3.12 Grading

- A. The Contractor shall:
 - 1. Uniformly grade all areas within the limits designated on the Drawings including adjacent transition areas. Finish surfaces within specified tolerances with uniform levels or slopes between points where elevations are shown and existing grades.
 - 2. Finish all surfaces free from irregular changes.
 - 3. Finish subgrade areas to receive topsoil to within 0.10 foot of required subgrade elevations.
 - 4. Shape subgrade under walks to line, grade, and cross-section to within 0.10 foot of required subgrade elevations.
 - 5. Shape subgrade under pavement to line, grade, and cross-section to within ½ inch of required subgrade elevations.

6. Protect newly graded areas from traffic and erosion. Repair and reestablish grade in settled, eroded, or rutted areas to the specified tolerances.
 7. Locate and adjust all manholes, valve boxes, etc. to final grade.
- B. Where compacted areas are disturbed by subsequent construction or adverse weather, the Contractor must scarify the surface, reshape and compact to the required density. Hand tampers shall be used for recompacting areas over underground utilities.
- C. Unless otherwise shown on the drawings, all disturbed areas shall be restored to original grade.

4.3.13 Utilities to be Abandoned or Removed

- A. When underground utilities are to be abandoned in place, plug, cap, or seal with concrete at the Construction Limits or as otherwise indicated on the Plans.
- B. Remove underground utilities indicated on the Drawings to be removed and backfill resulting excavation with suitable material, compacted as specified.
- C. All abandoned underground pipe shall be removed or filled with flowable fill.
- D. The Contractor is responsible for the proper off-site disposal of all pipes and appurtenances removed as part of the Work.

4.3.14 Erosion Control

- A. The Contractor shall implement the approved erosion and sediment control plan, and continually comply with federal, state and local erosion control laws and the latest edition of the *Virginia Erosion and Sediment Control Handbook*.
- B. All required erosion and sediment control measures shall be in place prior to work starting.
- C. No more than 100 feet of trench shall be open at any one time without the approval of the Inspector. At the end of the day, all but the last length of pipe installed shall be backfilled at minimum.
- D. The ends of any pipes to be left open at the end of a workday shall be temporarily plugged or blocked.
- E. All disturbed areas shall be stabilized as soon as possible after backfilling.

- F. Graded areas shall be protected from the action of the elements. Settlement or other damage that occurs prior to acceptance of the work shall be repaired and grades satisfactorily reestablished.
- G. Upon completion of work, after spoils and debris have been removed, final grading shall be performed, and permanent seeding applied to any areas disturbed by operations.
- H. Any additional and/or alternate ground cover shown or described on the Plans shall be installed at the time of final grading, or as otherwise specified on the Plans.

4.3.15 Clean Up

- A. The Contractor shall keep the entire work area clean at all times and shall promptly remove all materials and debris not intended for incorporation into the project. The surfaces of all paved areas shall be cleaned in accordance with VDOT requirements.
- B. Maintain the work area from the nuisance of dust, mud and/or settling during the entire length of the project and for one year from the date of Final Acceptance.

END OF SECTION 4.3