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SECTION 6 – TRENCH EXCAVATION & BACKFILL STANDARDS

6.1 DEFINITIONS

COMMON EXCAVATION – Defined as the removal of all material that is not classified as rock excavation. The term "rock excavation" shall be understood to indicate a method of removal and not a geological formation.

HAUNCH – That portion of the pipe below the spring line.

NATIVE MATERIAL – Earth, gravel, rock, or other common material free of humus, organic matter, vegetative matter, frozen material, clods, sticks, and debris, isolated points or areas, or larger stones that would fracture or dent the structure or subject it to undue stress.

PIPE BEDDING – The furnishing and placing of specified materials on the trench foundation to uniformly support the barrel of the pipe, from the trench foundation to the spring line of the pipe.

PIPE ZONE – The full width of the trench, from 12 inches above the top outside surface of the barrel of the pipe to the spring line of the pipe.

ROCK EXCAVATION – Defined as the removal of material that cannot, in the Public Works Director's judgment, be reasonably excavated with equipment comparable in machine weight and rated horsepower to a hydraulic hoe excavator with a minimum weight of 45,000 pounds and a net horsepower rating of 130 to 140. Rock excavation is also the removal of material by drilling and blasting (see "Explosives" in Subsection "Excavation," for blasting restrictions) or power-operated rock-breaking equipment. Boulders or concrete pieces larger than ½ cubic yard encountered in the trench excavation shall be classified as rock excavation if removing them requires any of the above excavation methods, in the opinion of the Public Works Department authorized representative.

SPRING LINE – Halfway up the sides of the pipe (horizontal centerline) when the pipe is laid on the pipe bedding.

TRENCH BACKFILL – The furnishing, placing, and compacting of material in the trench between the top of the pipe zone material and the bottom of the pavement base rock, ground surface, or surface materials.

TRENCH EXCAVATION – Trench excavation is the removal of all material encountered in a trench to the depths shown on the plans or as directed by the Public Works Department authorized representative. Trench excavation shall be classified as either common or rock excavation.

TRENCH FOUNDATION – The bottom of the trench on which the pipe bedding will lie. The trench foundation supports the pipe bedding.

6.2 MATERIALS

6.2.1 Trench Foundation

Trench foundation shall be native material in all areas except where groundwater or other conditions exist, and, in the opinion of the Public Works Department authorized representative, the native material cannot support the bedding and pipe. Under those conditions, geotextile fabrics approved by the Public Works Department authorized representative shall be installed, or the unsuitable material shall be removed, as determined by the Public Works Department authorized representative, and the trench foundation backfilled with Class B backfill.

6.2.2 Pipe Area

A. Pipe bedding material shall be Class B backfill, uniformly graded from course to fine, or as approved by the Public Works Department authorized representative.
B. Pipe Zone material shall consist of Class B backfill.

1.2.3 Trench Backfill

Above the pipe zone, trench backfill will be divided into the following classifications (from ODOT SSC)

A. Class A Backfill: Class A backfill shall be native or common material, which in the opinion of the Public Works Department authorized representative meets the characteristics required for the specific surface loading. Selected trench fill material shall contain no frozen soil, gravel, or cobbles larger than 6 inches in diameter, and shall be free of organic or other deleterious material.
B. Class B Backfill: Class B backfill shall be ¾"-0" granular grade crushed aggregate material, unless otherwise approved by the Public Works Department authorized representative. The aggregate shall conform to the following.
    1. The aggregate shall consist of uniform-quality, clean, tough, durable fragments of rock or gravel and shall be free of flat, elongated, soft, or disintegrated pieces, or other objectionable matter occurring either free or as a coating on the stone.
    2. The aggregate shall meet the requirements for fractured faces and durability as specified in ODOT SSC Section 02630.10 "Dense-Graded Aggregate."
    3. Gradation and plasticity index requirements of the crushed aggregate shall be as shown for ¾"-0" rock in **Table 2.13**, "Gradation Requirements of Granular Backfill."
    4. Class B backfill material shall be approved by the Public Works Department authorized representative prior to placement.

6.3 CONSTRUCTION

6.3.1 Excavation

A. Clearing and Grubbing: When clearing the right-of-way is necessary, clearing shall be completed before the start of trenching. Clearing and grubbing shall follow the procedures outlined in Chapter 2 Subsection "Clearing and Grubbing." Under no condition shall excavated materials be permitted to cover brush before the brush is cleared and disposed of. Excavated material shall be stockpiled where, and so it does not create a hazard to, pedestrian or vehicular traffic; nor shall it interfere with the function of existing drainage facilities.
B. Erosion Control: The contractor shall be responsible for erosion prevention and sediment control on the jobsite and shall use appropriate prevention measures as outlined in Chapter 1 Subsection "Erosion Prevention and Sediment Control." The contractor shall maintain the erosion-prevention and sediment-control facilities as specified in Chapter 1 Subsection "Maintenance."
C. Interferences and Obstructions: Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established in Chapter 1 Subsection "Interferences, Obstructions, and Abandoned Utilities."
D. Open Trench Limit
    1. Construction shall proceed in a systematic manner that will result in minimum inconvenience to the public. Construction staking for the work being performed shall be completed before the start of excavation.
    2. The contractor shall limit their operations to a small work area per crew. The length of the excavated trench shall always be kept to a minimum. At no time shall the trenching equipment be farther than 100 feet ahead of the pipe-laying crews, unless advance written permission is given by the Public Works Department authorized representative.
    3. The trench shall be backfilled so that no section of trench is left open longer than 24 hours. Before the contractor stops construction for the day, trenches located in the right-of-way shall be completely backfilled, unless the trench is covered with Steel

Plates. Use of Steel Plates shall conform to Chapter 1 Subsection “Progress of Construction.”

E. Trench Width
   1. The trench width at the surface of the ground shall be kept to the minimum necessary to safely install the pipe. All aspects of excavation, trenching, and shoring shall meet current OSHA standards and regulations. In all cases, trenches must be wide enough to allow for shoring and to permit proper joining of the pipe and backfilling and compaction of material along the sides of the pipe.
   2. Trench width in the pipe zone must provide a minimum clear working space outside the maximum outside diameter of the pipe. Minimum clear working space shall be 6 inches for pipe up to 12-inch interior diameter; for pipe greater than 12-inch interior diameter the minimum clear working space shall be ½ the inside pipe diameter up to a maximum of 24 inches. Excavation for manholes and other structures shall be wide enough to provide at least 12 inches between the structure’s surface and the sides of the excavation or shoring.
   3. Maximum width of the trench at the top of the pipe shall be 12 to 24 inches plus the width of the pipe bell. When required by the project design, the maximum trench width shall be shown on the plans.
   4. If the contractor exceeds the maximum trench width shown on the plans without written authorization, the contractor shall be required to contact the design engineer or the geotechnical engineer and obtain written approval allowing installation of the pipe as specified, or contractor shall provide, at their cost, pipe of a higher strength designation, a higher class of bedding, or both, as recommended by the design engineer or the geotechnical engineer, and approved by the Public Works Department authorized representative.
   5. The contractor shall confine the top width of the trench to rights-of-way or easements. If circumstances require extending the width of the trench beyond the right-of-way or easement boundary, the applicant shall obtain written agreements with the affected property owner(s) and provide them to the Public Works Department authorized representative before commencing excavation.

F. Grading
   1. The bottom of the trench shall be graded to the line and grade to which the pipe is to be laid, with proper allowance for pipe thickness and bedding material, or for greater base when specified or indicated. Before laying each section of the pipe, check the aggregate grade and correct any irregularities.
   2. The trench bottom shall form a continuous and uniform bearing surface and support the pipe on solid and undisturbed ground at every point between bell holes, except that the grade may be disturbed for removing lifting tackle.

G. Rock Excavation
   1. Where the bottom of the trench encounters ledge rock, boulders, or large stones that meet the definition of “rock excavation,” rock excavation shall be performed to create six inches of clearance on each side and below all pipe and accessories.
   2. Excavations below subgrade in rock shall be backfilled to subgrade with Class B backfill material and compacted to not less than 90% of its maximum dry density as determined by AASHTO T-180.

H. Explosives
   1. Explosives shall not be used in the City of Independence without prior written approval from the Public Works Director.

6.3.2 Installation

A. Shoring

1. The contractor shall provide all materials, labor, and equipment necessary to adequately shore trenches to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench.
2. Cribbing or sheeting that extends below the spring line of rigid pipe or below the crown elevation of flexible pipe shall be left in place, unless a satisfactory means can be demonstrated for reconsolidating bedding or side support that would be disturbed by removing the cribbing or sheeting.
3. If a movable box is used instead of cribbing or sheeting and the bottom cannot be kept above the spring line of the crown elevation of the flexible pipe, the bedding or side support shall be carefully reconsolidated behind the movable box before backfill is placed.
4. The use of horizontal strutting below the barrel of pipe, or the use of pipe as support for trench bracing, will not be permitted.

B. Dewatering
1. The contractor shall provide and maintain ample means and devices for promptly removing and disposing of all water entering the trench excavation while the trench is prepared for pipe laying, during the laying of the pipe, and until the backfill is placed and compaction is complete.
2. Groundwater shall be controlled to keep it from softening the bottom of the excavation. Dewatering systems shall be designed and operated to prevent removal of the natural soils and to keep the groundwater level outside the excavation from being reduced to an extent that would damage or endanger adjacent structures or property.
3. Dewatering systems shall be discharged to a stormwater detention/retention facility unless otherwise approved by the Public Works Department authorized representative.

C. Grade
1. The contractor shall excavate the trench a minimum of 6 inches plus the pipe wall thickness below the specified pipe grade, or as established by the geotechnical engineer. The subgrade on which the bedding is to be placed shall be firm, undisturbed, and true to grade.

D. Trench Foundation
1. When in the judgment of the geotechnical engineer or the Public Works Department authorized representative, the existing material in the bottom of the trench is unsuitable to support the pipe, the contractor shall excavate below the pipe, as directed.
2. The contractor shall backfill the trench to the subgrade of the pipe bedding with Class B backfill material over the full width of the trench and shall compact in layers not exceeding 6 inches deep.
3. Fill material shall be compacted to not less than 90% of its maximum dry density, as determined by AASHTO T-180.

E. Pipe Bedding
1. Class B backfill material shall be placed under all pipes.
2. Pipe bedding consists of leveling the bottom of the trench on the top of the foundation material and placing bedding material to the horizontal centerline of the pipe, unless otherwise specified.
3. Granular base shall be placed in the trench to a depth of 6 inches, loose, for the full width of the trench. The contractor shall spread the bedding smoothly to the proper grade, so the pipe is uniformly supported along the barrel.
4. The contractor shall excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Bedding under the pipe shall provide firm, unyielding support along the entire pipe length.

5. Contractor shall be aware of the importance in proper placement and compaction of backfill material placed below the spring line of the pipe (haunch area). Proper backfilling ensures that adequate stability and support is provided to the pipe during final backfilling of the pipe zone. Backfill material shall be worked under the haunches by hand.

F. Backfill in Pipe Zone
   1. After the pipe is in place and ready for backfilling, place Class B backfill to a minimum depth of 12 inches over the top of the pipe. The material shall be placed at approximately the same rate on each side of the pipe, so that the elevation of the aggregate on each side of the pipe is always equal.
   2. Particular attention shall be given to the backfilling and tamping procedure to assure that there are no unfilled or non-compacted areas under the pipe.

G. Trench Backfill
   1. Backfill shall be placed in the trench in such a way as to not permit material to freefall until the top of the pipe is covered by at least 2 feet of material. Under no circumstances shall the contractor allow sharp, heavy objects to drop directly onto the pipe or pipe zone material around the pipe.
   2. If the required compaction density cannot be obtained, the contractor shall remove the backfill from the trench and recompact. The process shall be repeated until the contractor establishes a procedure that will provide the required density. The contractor will then be permitted to proceed with backfilling and compacting the rest of the pipeline under the approved compaction procedure.
   3. Within the public right-of-way, trench backfill shall consist of granular fill meeting the requirements of Chapter 2 Subsection “Granular Fill.”

H. Native or Select Class A Backfill
   1. Backfill the entire depth of the trench above the pipe zone with excavated trench materials placed in 12-inch layers. Remove all cobbles and stones 2 inches in diameter and larger from material used for backfill in the upper 12 inches of the trench.
   2. Compact each layer using mechanical tampers or vibratory compactors to 85% of its maximum dry density, as determined by AASHTO T-180. Bring the fill to the required surface grade, and compact so that no settlement will occur.

I. Granular Backfill
   1. Granular backfill material shall meet the requirements of Chapter 2 Subsection “Granular Fill.” Granular backfill shall be tested at a minimum of every 200 feet of trench length and at depths specified by the Public Works Department authorized representative.
   2. The aggregate backfill within 2 feet of base grade shall be compacted to not less than 95% of its maximum dry density, as determined by AASHTO T-180. Backfill placed more than 2 feet from base grade shall be compacted to not less than 90% of its maximum dry density.