SECTION 02250

TRENCH EXCAVATION, BACKFILL, AND COMPACTION

02250.01 GENERAL

A. Description

Trench excavation, backfill, and compaction shall include, but not necessarily be limited to, the excavation, backfill, and compaction of trenches for storm drains, water mains, sanitary sewers, and other underground utility systems shown on the Plans, and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Maintenance of traffic; Sections 01410 through 01470.
2. Protection of the environment; Section 01500.
3. Test pits; Section 02012.
4. Clearing and grubbing; Section 02110.
5. Tree removal and protection; Section 02120.
6. Adjusting and replacing fences, shrubs, hedges, etc.; Section 02130.
7. Protecting and adjusting existing utilities and underground structures; Section 02140.
8. Removal or abandonment of existing utilities and underground structures; Section 02150.
9. Removal of existing pavement, sidewalk, curb, and combination curb and gutter; Section 02160.
10. Tamped fill; Section 02265.
11. Excavation support; Section 02400.
12. Dewatering; Section 02512.
13. Sidewalks; Section 02660.
14. Curb, combination curb and gutter; Section 02670.
15. Patching paving; Section 02680.
16. Salvaging topsoil; Section 02811.

C. Quality Assurance

1. Materials

   All materials removed from trench excavations and used for backfill will be subject to test by the Engineer to determine the material's suitability for use as backfill. The material may be tested to determine organic content, mechanical properties, density, or any other properties pertinent to the satisfactory completion of trench backfilling.

2. Field Tests

   a. The County will arrange for all in-place moisture/density testing on the Project. The Engineer shall determine the number of samples to be taken, the location of samples, and the frequency of tests required to confirm compliance with the Specifications. The Contractor shall assist the Engineer in obtaining samples and shall provide a smooth surface for conducting moisture/density tests. The Contractor will not be entitled to any claim for additional compensation due to the testing requirements specified herein.

   b. At the start of the trenching operation, the Contractor shall demonstrate to the Engineer that the compaction density specified in Section 02550.03 can be attained by the compaction equipment and methods the Contractor intends to use. Once the method and equipment has been approved, no substitutions will be permitted without the Engineer's approval. Additional demonstration of the suitability of the compaction equipment and methods will be required whenever there is a significant change in material characteristics.

   c. Should testing determine that the required density is not being met, or the material is outside the specified moisture range, the Contractor shall, without additional compensation, re-excavate, rework, and/or recompact the particular layer or section until the required density and/or moisture is attained.

D. Submittals

1. The Contractor shall submit for approval to the Engineer a list of compaction equipment he intends to use on the project, the recommendations of the equipment manufacturer as to the maximum lift thickness, which can be placed, and the method of compaction to be used with this equipment to achieve the required compaction.

2. The Contractor shall submit for approval to the Engineer the sources of common borrow, select borrow, and flowable fill.

3. Flowable Fill Fly Ash

   a. Fly ash shall be supplied from a source approved by the Engineer.

b. Material test data of fly ash representative of the source shall be submitted to the Engineer a minimum of 30 days prior to use. Test data shall include characteristics of the ash leachate as determined by the Toxicity Characteristics Leaching Procedure (TCLP) in accordance with EPA SW-846, with respect to leachate metals.

c. The sources of all materials and mix design must be submitted to the Engineer a minimum of 30 days prior to use, in order to allow testing of the mix design by the Engineer. The design must produce a material with a 28-day compressive strength of 50 to 200 psi.

4. Delivery Tickets

The Contractor shall submit delivery tickets with each load of common borrow, select borrow, and flowable fill material brought to the site under the authorization of the engineer showing the following information.

a. Name and location of supplier or source.

b. Type and amount of material delivered.

c. Test information on the material as required by the specifications.

02250.02 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for trench backfill other than those materials that are available from the site.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Use and Ownership of Excavated Material

a. All suitable material available from the site shall be used, as far as practicable, for backfill in trenches.

b. When specifically noted in the contract documents, the Contractor shall properly store, stockpile and protect all materials that are to be reused in the work. The Contractor shall replace, at his own expense, material that was suitable when excavated, which has subsequently become unsuitable because of careless, neglectful, wasteful, or unprotected storage. The Contractor shall have no property right in any material taken from any excavation and no excavated material shall be wasted or otherwise removed from the project

site without permission of the Engineer. All unsuitable and surplus suitable material, as determined by the Engineer, shall be removed from the excavation and disposed of off-site by and at the expense of the Contractor.

2. Common Borrow

Borrow material for trench backfill shall meet the requirements of Section 02240.02.

3. Selected Backfill

Selected backfill for pipe foundation and bedding shall meet the requirements of Section 02245.02.

4. Graded Aggregate Subbase

Graded aggregate subbase for trench backfill shall meet the gradation requirements specified in Section 02621.02.

5. Bituminous Concrete

Bituminous concrete for temporary surfacing material shall meet the requirements specified in Section 02641.02.

6. Flowable Fill

a. Flowable fill shall consist of a mixture of fly ash, Portland cement, fine aggregate and water.

b. Portland cement, fine aggregate, when used, and water shall conform to the requirements of Section 03310, "Portland Cement Concrete", Article 03310.02C of the Anne Arundel County Standard Specifications.

02250.03 EXECUTION

A. Surface Preparation

1. Clearing and Grubbing

a. The Contractor shall clear and grub the surface over the line of the trench in accordance with the requirements of Section 02110.03.

b. To protect against accidental clogging, sanitary sewer channels in existing manholes shall be covered, as directed by the Engineer, prior to any grubbing or grading operations. This will not be a separate pay item, but shall be included in the cost of other bid items.

2. Removing Pavement, Sidewalk, Curb, etc.

   a. The Contractor shall remove pavement, sidewalk, curb, etc. over the line of the trench in accordance with the requirements of Section 02160.03.

   b. The Contractor shall remove paving only to the width shown on the Standard Details, noted in the Special Provisions, or as directed by the Engineer. When the Contractor removes paving for a greater width than is deemed necessary or disturbs paving, sidewalk, curbs, etc. due to settlement, slides, or cave-ins, or in making excavation outside the limits of the trench without written order of the Engineer, the County will require the Contractor to replace the excess damaged area and may retain from payments due the Contractor such amounts required to permanently replace the excess material removed. The Contractor shall be responsible for repaving or surfacing roadbeds or sidewalk, curbs, etc. that have failed, settled, or have been damaged at any time before expiration of the Contract maintenance period due to work or any other activities by the Contractor, his subcontractors, or suppliers.

3. Removing Street Signs, Fences, Shrubs, Trees, and Other Improvements

   a. The Contractor shall remove improvements from the working strip in accordance with the requirements of Section 02130.03.

   b. In addition to the requirements contained in Sections GP-7.15 and GP-7.17 the following shall apply:

      1) Existing fences shall be carefully removed to the extent required to permit construction operations and as directed by the Engineer. The Contractor shall safely store all elements during the time that they are down.

      2) Shrubs, hedges, and trees shall be transplanted with sufficient earth to ensure that no damage to the root system occurs. General reference is made to Section 02860.03 for acceptable planting methods. After transplanting has been accomplished, it shall be the Contractor's responsibility to water all plants. The transplanting of trees will only be required when indicated on the Plans.

4. Maintaining Traffic

   The Contractor shall furnish all labor, tools, equipment, and materials specified in Sections 01410 through 01470 for the maintenance of traffic during construction.

B. Trench Excavation

1. General

   a. Excavation for the installation of utilities shall be unclassified and shall consist of the excavation of all material encountered to the lines, grades, and sections shown on the Plans and/or the Standard Details, as specified, or as directed by the Engineer.

   b. Trenches may be excavated and backfilled either by hand or by machinery as the Contractor may elect. The Contractor shall have no claims, nor will extra compensation be allowed, for hand excavation or backfill, which may be required by these Specifications or by the Engineer for protection of existing utilities or structures.

   c. Ground profiles shown on the Plans represent the elevations along the centerline of the street for all work in streets and along the centerline of the trench for work not in streets.

2. Protection of Property and Structures

   The Contractor shall, at his own expense, sustain in place and protect from direct or indirect injury all existing facilities in the vicinity of the excavation, whether above or below the ground, or that may appear in the trench. The Contractor shall be responsible for the implementation of protective measures associated with the presence or proximity of pipes, poles, tracks, walls, buildings, property markers, and other structures and property of every kind and description in or over his trenches or in the vicinity of his work whether above or below the surface of the ground. The Contractor shall be responsible for all damage and assume all expense for direct or indirect injury caused by his work, to above ground facilities or below ground facilities shown on the Plans.

3. Utility Adjustments

   a. All adjustments to utilities other than those owned by the County shall be performed by the utility owner.

   b. Adjustments to water services between the property line and the water main shall be performed by qualified Utility Contractors. Adjustments between the property line and the house shall be performed under the supervision of a Registered Master Plumber.

      Adjustments to sanitary sewers within the County right-of-way may be accomplished by either a qualified Utility Contractor or registered Master Plumber. Adjustments to sanitary sewers outside the County right-of-way shall be performed under the supervision of a Registered Master Plumber. It shall be the contractor's responsibility to obtain all permits necessary for the performance of this work.

4. Obstructions Shown on Plans

   a. Certain information regarding the reputed presence, size, character, and location of existing underground utilities and structures has been shown on the Plans based upon available records. There is no certainty of the accuracy of this information, and it shall be considered by the Contractor in this light. If test pit data is not shown on the Plans, the Contractor shall excavate test pits in advance of his work in accordance with Section 02012 to locate existing utilities. The Contractor shall hereby distinctly understand that the County is not responsible for the correctness or sufficiency of the information given. The Contractor shall have no claim for delay or extra compensation on account of incorrectness of information given, or on account of the insufficiency or absence of information regarding obstructions. The Contractor shall have no claim for relief from any obligation or responsibility under the Contract in case the location, size, or character of any underground facility is encountered that is not shown on the Plans.

   b. It shall be the responsibility of the Contractor to notify "Miss Utility" at 1-800-257-7777, all municipal utilities, all pipeline owners, and any other parties affected prior to the beginning of work.

5. Removing Obstruction

   a. Should the position of any pipe, conduit, or other structure above or below ground be such as, in the opinion of the Engineer, to require its removal, realignment, or change due to the work to be done under the Contract, the work of removal, realignment, or change will be done as extra work, or will be done by the owner of the obstructions without cost to the Contractor; but the Contractor shall uncover and support the structures in the limits of his trench at his own expense before such removal, and before and after such realignment or change. Whether the obstruction is shown on the Plans or not, the Contractor shall not be entitled to any claim for damage or extra compensation on account of the presence of said structure or on account of any delay in the removal or rearrangement of the same; however, if said structure is not shown on the Plans, time extension will be allowed if deemed to be warranted by the Engineer.

   b. The Contractor shall break through and reconstruct if necessary, the invert or arch of any sewer, culvert, or conduit that may be encountered if said structure is in such position in the judgment of the Engineer as not to require its removal, realignment, or complete reconstruction. The reconstruction shall not interfere with the flow through the conduit. Payment for the reconstruction of the existing sewer invert or arch will be made as Extra Work in accordance with Paragraph GP-4.10.

   c. In the event that obstructions would delay the work of pipe installation, the Contractor will be permitted to leave a gap in the work and return to fill the

gap after the obstructions have been removed. The installation shall be completed by laying full pipe lengths and appropriate closure pieces or, for storm drains constructing standard brick sections of a size equivalent to the pipe with reinforced concrete tops as shown on Standard Details D/14 or D/15.

d. The Contractor shall not interfere with any persons, firms, or corporations or with the County in protecting, removing, changing, or replacing pipes, conduits, poles, or other structures.

e. In the event that the County has entered into any agreement with an affected utility owner or owners which will have an effect on operations or financial responsibilities of the Contractor, the requirements of these agreements will be included in the Special Provisions of the Contract.

6. Change of Trench Location

a. In case the Engineer shall direct that the location of a trench be changed to a reasonable extent from that shown on the Plans on account of the presence of an obstruction or from other cause or if changed location shall be authorized upon the Contractor's request, the Contractor shall not be entitled to extra compensation or to a claim for damage provided that the change is made before the excavation is begun. If, however, such change is made at the direction of the Engineer involves the abandonment of excavation already made, such abandoned excavation together with the necessary backfill will be classified as Class 3A Excavation and Embankment Backfill for the case where the full width of trench has not been abandoned. When the full width of trench has been abandoned, payment will be based on the widths shown in the Standard Details or as specified in the Contract Documents. In the event that the trench is abandoned in favor of a new location at the Contractor's request, the abandoned excavation and backfill shall be at the Contractor's expense.

b. If an obstruction occurs within the trench in such manner that the trench has to be excavated to extra width in order that sheeting or bracing may be properly placed or in order that the structure to be placed in the trench may be properly built, such extra width of trench shall be classified as Class 3A Excavation and Embankment Backfill. No sloping of sides of excavations, however, for the purpose of avoiding the necessity of placing sheeting or bracing, either in the presence of or absence of an obstruction, will be considered as Class 3A Excavation.

7. Width and Depth Trenches

a. Trenches shall be excavated to the necessary width and depth as may be shown on the Plans or Standard Details, as specified in the Special Provisions, or as directed. The trench subgrade shall be such as to provide a

uniform and continuous bearing and support for the pipe on solid undisturbed earth for the full length of each pipe, except for that portion at the bell hole. Any part of the bottom of the trench excavated below subgrade shall be backfilled with approved material, thoroughly compacted.

b. Subgrade, in the case of pipelines, shall be the underside of the barrel of the pipe, where the pipe is laid on a natural foundation, or the bottom of granular bedding or concrete foundation, where indicated on the Plans or Standard Details, and the underside of ribs or sills where the pipe is installed on a timber foundation. For appurtenant concrete or masonry structures, subgrade shall be termed the underside of the masonry, or gravel base, or fill material as shown on the Plans or Standard Details.

c. Trench sides shall be vertical to a distance of at least 1 foot above the top of the pipe. Above this point, the remainder of the trench shall be practically plumb when located in paved roadway rights-of-way. In easement areas, the side of the trench from 1 foot above the top of the pipe to the existing ground surface may be sloped or cutback, subject to the approval of the Engineer. Should the Contractor elect to slope or cut-back the sides of the trench, no additional payment will be made for extra excavation, backfill, restoration, or contingent items beyond the limits indicated on the Standard Details.

d. Where trench walls are stable or supported, provide a width sufficient, but no greater than necessary, to working room to properly and safely place and compact haunching and other embedment materials. The space between the pipe and trench wall must be wider than the compaction equipment used in the pipe zone. In addition to safety considerations, trench width in unsupported, unstable soils will depend on the size and stiffness of the pipe, stiffness of the embedment and in-situ soil, and depth of cover.

    1) For PP, minimum trench width shall be not less than the greater of either the pipe outside diameter plus 16 in. or the pipe outside diameter times 1.25, plus 12 in. or in accordance with ASTM D2321.

    2) For RCP, minimum clearance between pipe and trench wall shall be wide enough to specified compaction of backfill material, but not less than outside diameter divided by 6 or in accordance with ASTM C1479.

e. Where trench walls or sub-grade are not stable or consist of unsuitable material, trench shall be widened as required in ASTM D2321 or ASTM C1479 as appropriate per material. Trench widths may be widened up to three diameters wide and subgrade increased to one half pipe diameter or as required by ENGINEER.

f. Minimum Cover: See Standard Details D-92, D-106, and D-107 for minimum cover requirements.

g. Bell holes shall be excavated in the bottom of the trench whenever necessary to permit the proper making of joints, without extra payment therefore.

h. When a pipe, structural plate pipe, or pipe arch is to be installed on existing ground on or under fill, the embankment shall be constructed to a height of at least 9 inches above but not more then 3 feet above the top of pipe and then a trench excavated to receive the pipe.

i. Excavations for concrete encased electric duct banks shall be sufficiently wide to allow placement of ducts and spacers and to allow placement of forms for the concrete encasement on the sides of the duct banks, if required by site conditions.

j. Where sheeting or trench boxes are used, the maximum width below the top of the pipe, as prescribed above, shall be measured between the interior faces of the sheeting as driven, or inside face of trench box, but in no case shall stringers or nailing strips be so placed as to interfere with the proper ramming of earth under and around the pipe. In case the sheeting, or trench box does not extend below a point 6 inches above the pipe as installed, the maximum width allowed shall be measured between the faces of the excavation below the bottom of the sheeting or box.

8. Length of Open Trench

The Contractor shall not excavate more trench in any day than can be completed (facility installed and trench backfilled) in the same day, unless by written permission of the Engineer. The Engineer shall be empowered at any time to require the backfilling of open trenches over completed pipelines if, in his judgment, such action is necessary; and the Contractor shall thereby have no claim for extra compensation, even though to accomplish said backfilling, he is compelled temporarily to stop excavation or other work at any place.

If work is stopped on any trench for any reason except by order of the Engineer, and the excavation is left open for 48 hours in advance of construction, the Contractor shall, if so directed, backfill such trench at his own cost, and shall not again open said trench until he is ready to complete the structure therein. If the Contractor shall refuse or fail to backfill such trench completely within 48 hours after said notice, the Engineer is authorized to have the trench backfilled; and the County will charge the expense thereof to the Contractor and retain the same of any monies due or to become due to the Contractor under the Contract.

The excavation of all trenches shall be fully completed at least one full pipe length in advance of pipe installation, unless otherwise authorized.

9. Responsibility for Condition of Excavation

The Contractor shall be responsible for the condition of all excavations made by him. All slides and caves shall be removed without extra compensation.

10. Trench Support

    a. The Contractor shall support the sides and ends of all excavations wherever necessary with braces, sheeting, shoring or stringers, trench boxes, or other acceptable excavation support systems. All timbering shall be installed by men skilled in such work and shall be so arranged that it may be withdrawn as backfilling proceeds, without injury to the utility or structure constructed or to any roadbed or adjacent structure or property.

    b. All work shall be performed in accordance with the latest OSHA requirements.

    c. All timbering in excavations, trench boxes, or excavation support systems shall be withdrawn as the backfilling is being done, except where and to such extent as the Engineer shall order in writing that said timbering or excavation support system be left in place or where the Engineer permits the trench support to be left in place at the Contractor's expense and upon his request. The Contractor shall cut off any sheeting left in place 2 feet below finished grade and shall remove the material cut off without compensation, therefore.

    d. Wherever necessary, in running sand, or soft ground, or for the protection of any structure or property, sheeting shall be driven without extra compensation to such a depth below the bottom of the trench as may be required or directed. Where directed by the Engineer to leave sheeting in place, payment will be made under the appropriate contingent item.

    e. The support of the trench shall be the sole responsibility of the Contractor.

    f. When supports such as trench sheeting, trench jacks, trench shields or boxes are used, that support of the pipe and its embedment is maintained throughout installation. that sheeting is sufficiently tight to prevent washing out of the trench wall from behind the sheeting. Provide tight support of trench walls below viaducts, existing utilities, or other obstructions that restrict driving of sheeting.

11. Drainage and Dewatering

    a. The Contractor shall grade the site as necessary to prevent surface water from flowing into the trench or other utility excavations and shall provide all necessary temporary surface drainage and keep the same operating to the satisfaction of the Engineer until permanent drainage or finished grading and permanent surface stabilization has been completed. Damming or ponding of water in gutters or storm drains will not be permitted.

    b. It shall be the Contractor's responsibility to adequately control water that may be present in the excavation. He shall provide for the disposal of water removed from excavations in such a manner not to cause damage to public or private property or to any portion of the work completed or in progress or

cause any impediment to the use of any area by the public; nor shall the Contractor discharge any flushing or ground water or any material of any nature into existing sanitary sewer system during the construction of the facilities. All water shall be discharged through an approved sediment control device. The costs of dewatering trench excavations will not be paid for directly, but will be included in prices bid for other related items.

c. For polypropylene pipe, all pipe trenches and excavation for structures and appurtenances shall be kept free of water during pipe laying and other related work. The method of dewatering shall provide for a dry foundation at the final grades of excavation.

d. Dewatering. Water shall be disposed of in a manner that does not inconvenience the public or result in a menace to public health. Pipe trenches shall contain enough backfill to prevent pipe flotation before dewatering is discontinued. Dewatering shall continue until such time as it is safe to allow the water to rise in the excavation.

e. Do not lay or embed pipe fittings or drainage structures in standing or running water. At all times prevent runoff and surface water from entering the trench.

f. When water is present in the work area, dewater to maintain stability of in-situ and imported materials. Maintain water level below pipe bedding and foundation to provide a stable trench bottom. Use, as appropriate, sump pumps, well points, deep wells, geotextile fabrics, perforated underdrains, or stone blankets of sufficient thickness to remove and control water in the trench. When excavating while depressing ground water, the ground water is below the bottom of cut at all times to prevent washout from behind sheeting or sloughing of exposed trench walls. Maintain control of water in the trench before, during, and after pipe system installation and until embedment is installed and sufficient backfill has been placed to prevent flotation of the pipe, fitting, or drainage structures. To preclude loss of soil support, employ dewatering methods that minimize removal of fines and the creation of voids in in-situ materials.

g. For flotation cover requirements, see Detail D-92. If adequate cover cannot be achieved, anchoring systems are to be used to prevent flotation. See manufacturer specifications for anchoring requirements.

12. Tunneling and Jacking

a. Unless otherwise indicated, excavation shall be by open cut, except that short sections of a trench may be tunneled, or the pipeline jacked, if, in the opinion of the Engineer, the pipe, cable, or duct can be safely and properly installed.

b. In addition to the requirements contained in Section 02920.03, the following shall apply:

Tunnels for installing pipelines or other utilities shall be of sufficient size to allow, at all points, the proper joining of pipes and the proper compacting of the refill around them. Tunnels shall be timbered or lined where and to such extent as may be necessary to support the tunnel in accordance with accepted methods. All methods of tunneling used shall be subject to the approval of the Engineer, however, the safety of the tunnel construction and the protection, repair, or replacement of the tunneled obstruction shall be the sole responsibility of the Contractor.

c. Jacking or boring pipe shall be in accordance with the requirements of Section 02910.03.

d. No extra payment beyond that made for trench excavation and backfill will be made for tunnels or jacking pipe under trees, sidewalks, curbs, pipelines, or similar obstructions.

C. Foundation Preparation

1. General

The Contractor shall complete the excavation as far as practicable to the neat lines shown on the Standard Details or Plans or as directed by the Engineer.

2. Excavation Below Subgrade

a. The Contractor shall, without additional compensation, before any pipe or appurtenance is installed, fill all unauthorized depressions or irregularities in the bottom of the trench or tunnel with firmly compacted embankment or other approved material.

b. Where the bottom of the trench, at subgrade, is in unstable or unsuitable material, excavation shall be carried to such depth as ordered by the Engineer. The trench bottom shall be restored to subgrade with Selected Backfill. Excavation and backfill for removal of unsuitable material will be paid for as Class 3A Excavation and Selected Backfill.

D. Class 3A Excavation

Class 3A Excavation shall include removal of unsuitable material when encountered at or below trench subgrade. It shall also include increases or decreases in the limits or amounts of excavation resulting from changes in pipe grade or location as previously described.

E. Backfill, Compaction, and Maintenance of Backfilled Trench

1. Backfill

a. The Contractor shall backfill all trenches as rapidly as practicable after the installation of the utility therein, or after the excavation has served its purpose.

b. Backfill material around and over pipelines for a distance of 2 feet above the top of pipe shall consist of clean unfrozen earth, free of ash, putrecible refuse, large stones, or other material of an unsatisfactory character as may be determined by the Engineer. Backfilling shall commence by depositing and then compacting by hand operated mechanical tampers suitable material in layers not more than 6 inches thick, measured loose, under, around, and over the pipe to a point not less than 1 foot in depth over the top thereof.

c. The remainder of the trench may be backfilled in layers not exceeding the maximum limits determined by equipment and methods demonstrated in compliance with Paragraph 02250.01.C.2. However, if the demonstration lift thickness is followed and the specified compaction is not obtained based on the Engineer's testing during backfilling, the Contractor shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified compactions. In backfilling the remainder of the trench, stones of not more than 6 inches in largest dimension which have been taken out in excavating may be mixed with earth in an amount not exceeding 25% of the backfill volume. Stones of larger size or in greater quantities shall not be used, unless directed by the Engineer. The Contractor shall not permit excavations to be used for the disposal of refuse.

d. In paved areas, the Contractor shall furnish and backfill the top foot of trench below the pavement base course with graded aggregate subbase.

e. Backfill over arches and pipe arches shall be placed uniformly on both sides of the arch so as to load the arch uniformly and symmetrically. For structures without headwalls, backfill shall be commenced in the center of the structure. If the structure includes headwalls or spandrel walls, backfilling operation may commence at one wall and extend toward the opposite side, care being taken in all cases to bring embankment or sections thereof up evenly on each side to a height of not less than 18 inches above top of structural plate pipe structures.

f. The Contractor, without extra compensation, shall take whatever special precautions are necessary in the placing and tamping of backfill around the sides of non-rigid pipe to ensure that allowable deflections will not be exceeded.

g. Should additional material be required for backfilling in excess of that available from all on site excavations, the Contractor shall obtain Borrow material from off-site sources, to complete the trench backfill.

2. Backfilling Polypropylene Pipe in Trenches

a. Backfill shall be placed in accordance with ASTM D2321 (PP), ASTM C1479 (RCP), and Standard Details.

b. After the pipe has been laid on the bedding and is ready for backfill. Appropriate backfill at moisture content that will facilitate compaction, shall be placed in layers along both sides of the pipe at depths to specified density in 6-inch lifts is achieved evenly throughout the backfill material. Prior to compaction, backfill shall be placed under the haunches of the pipe.

c. Appropriate compaction methods shall be utilized in order to uniformly compact backfill to specified densities. Inappropriate or excessive compaction may damage the pipe and disturb line and grade.

d. Each layer shall be uniformly compacted with mechanical means. Backfill and compaction shall continue until fill has reached an elevation of at least 6 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted as noted on the plans or as directed by the ENGINEER.

e. Tests for density shall be made as directed by the ENGINEER to conform to the compaction requirements specified below.

f. Where it is necessary, in the opinion of the ENGINEER, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3. Backfilling Polypropylene Pipe in Fill Sections

a. Select bedding and backfill material may be required and shall be so shown on the construction drawings.

b. For pipe placed in fill sections, fill shall be constructed to at least 6 inches above the top of proposed pipe prior to trench excavation. Bedding shall be distributed in six-inch (6") maximum layers over the full width of the trench and simultaneously on both sides of the pipe. Special care shall be taken to achieve full compaction under the haunches and joints of the pipe. Fill shall be placed in 6-inch lifts and shall be compacted to achieve 90% of maximum density, or as shown on plans.

c. PP - Bedding and backfill materials shall conform to an ASTM D2321, unless approved in writing by the ENGINEER. Special attention shall be made to based on an ASTM D2321 that fill over the pipe falls within the manufacturer’s and ENGINEER’s allowable limits.

d. RCP - Bedding and backfill shall conform to an ASTM C1479 Type I, II, or III installation, unless approved in writing by the ENGINEER. Special attention shall be made to based on an ASTM C1479 Type I, II or III

installation that fill over the pipe falls within the manufacturer's and ENGINEER's allowable limits.

4. Flowable Fill

   a. Flowable fill shall be used only where indicated on the Drawings.

   b. Materials for this item shall be central mixed, truck mixed, or as approved by the Engineer.

   c. Flowable fill shall be transported to the project in ready-mix trucks or as approved by the Engineer. The elapsed time between introduction of water and placement of the fill shall not exceed three hours.

   d. The temperature of the flowable fill shall be a minimum of 40 degrees Fahrenheit at time of placement. Flowable fill shall not be placed against frozen surfaces and shall be protected from freezing for at least 24 hours using insulation.

   e. Prior to placement, the contractor shall provide positive containment of the flowable fill material to prevent flow beyond the desired placement location. Flowable fill shall be discharged at a rate that will allow the material to flow into the placement location, fill all voids and not dislodge the existing containment or interior items. Any interior items shall be capable of withstanding lateral hydraulic pressures of the flowable fill. Lift thickness shall not exceed five feet in depth. Prior to placement of successive lifts or other loadings, fill shall be allowed to cure until it is self supporting.

   f. The flowable fill shall be placed to the final lines and grades as shown on the Drawings. All confining and supporting structures, protective covers and barriers shall be maintained by the Contractor until the flowable fill is self supporting.

   g. The flowable fill shall be protected from direct contact with vehicular traffic and shall be protected from prolonged exposure to rain and or running water.

   h. Flowable fill for polypropylene plastic pipe trenches shall follow the Standard Details.

   i. Compliance with compressive strength requirements shall be tested in accordance with the following AASHTO test methods:

      T 22 Compressive Strength of Cylindrical Concrete Specimens

      T 23 Making and Curing Concrete Test Specimens in the Field

5. Compaction

a. The Contractor shall, in unimproved areas outside the public rights-of-way, compact each trench backfill layer in such a manner as to obtain a dense backfill free of voids and not susceptible to undue settlement or depression. Trench backfill extending to not less than I foot in depth above the top of pipe shall be compacted to at least 92% of maximum density at a moisture content within 3% of the optimum in accordance with AASHTO T180.

b. For polypropylene pipes, non-cohesive materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, silts, and very fine sands. Non-cohesive soils consolidate best with vibratory compaction. Cohesive soils consolidate with equipment that kneads the soil in place. Backfill must be compacted with appropriate equipment to the backfill uniformly consolidates to specified limits, without causing damage to or movement in the pipe during compaction operations

c. Trench backfill within all public rights-of-way and improved, or paved areas shall be compacted to at least 95% of maximum density at a moisture content within 3% of the optimum moisture in accordance with AASHT0 T 180. The final 1-foot of trench backfill to pavement subgrade shall be compacted to at least 95% of maximum density at a moisture content within 3% of the optimum in accordance with AASHTO T180.

For polypropylene pipes, under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 95 percent of standard proctor density for cohesive material and 90 percent of standard proctor density for non-cohesive material, up to the elevation where requirements for pavement subgrade materials and compaction shall control. Testing shall be the responsibility of the CONTRACTOR and performed at no additional cost to the Owner. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval by the Engineer.

Tests shall be performed in sufficient number to that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D1557 except that mechanical tampers shall be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D2922. When ASTM D2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in the Calibration paragraph of the referenced publications. ASTM D2922 results in a wet unit weight of soil and when using this method ASTM D3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D3017 or ASTM D2922. Test results shall be furnished to the Engineer. The calibration checks of both the density and moisture gauges shall be made at

the beginning of a job on each different type of material encountered and at intervals as directed.

d. The County will arrange for compaction density testing as specified in Section 02250.01.

6. Maintenance of Backfilled Trench

a. The Contractor shall maintain, at his own expense, all backfilled trenches in acceptable condition.

b. If the Contractor fails to fill depressions in the backfilled trench within 24 hours after the receipt of written notice from the Engineer, the Engineer may refill said depressions and the cost thereof shall be retained from any monies due the Contractor, under the Contract. In case of emergency, the Engineer may refill any dangerous depression or protect with lights wherever necessary without giving previous notice to the Contractor; and the cost of so doing shall be retained from any monies due or to become due the Contractor under the Contract.

c. The contractor shall be responsible for any injury or damage that may result from lack of maintenance of any refilled excavation at any time prior to acceptance of the Project.

d. The Contractor shall furnish the Engineer with names, addresses, and telephone numbers of at least 2 members of the Contractor's organization that may be contacted in an emergency.

F. Restoration

1. General

After the completion of backfilling, all materials not used therein shall be removed and disposed of in such a manner and at such point or points as shall be approved or directed by the Engineer; and all roads, sidewalks, and other places on the line of the work shall be left free of debris, clean, and in good order. Said cleaning-up shall be done by the Contractor without extra compensation; and if he shall fail to do such work within 1 week after receipt of notice, the Engineer may arrange to have the cleaning-up done by others; and the cost shall be retained out of the monies due or to become due to the Contractor under the Contract.

2. Paved Areas

a. Immediately upon completion of the trench backfill and compaction as previously specified, the Contractor shall temporarily fill the trench to within 2 inches of finished grade with graded aggregate subbase. The remaining 2 inches of trench shall be filled with a temporary surfacing material in accordance with Section 01470. Temporary surfacing material shall be either

graded aggregate subbase or bituminous concrete as specified by the Engineer.

b. For graded aggregate subbase temporary surfacing, weather permitting, the Contractor shall remove and dispose of the temporary surfacing materials, cut-back the edge of the existing pavement as shown on the Standard Details, and patch-pave the area as specified in Section 02680.03 within 30 calendar days after the backfilling and compacting the trench.

3. Concrete Improvements

Sidewalks, curbs, combination curb and gutter, driveway aprons, and other concrete improvements removed or damaged by the Contractors activities shall be replaced by the Contractor in accordance with Sections 02651.03, 02660.03, 02670.03, or as directed by the Engineer.

4. Non-paved Areas

a. Immediately upon completion of the trench backfill and compaction as previously specified, the Contractor shall temporarily stabilize the area in accordance with the requirements of Section 01500.

b. Weather permitting, within 14 days after the completion of trench backfill and compaction, the Contractor shall permanently stabilize the area with seeding and mulching or sodding, as appropriate, as specified in Sections 02812.03 through 02850.03.

5. Street Signs, Fences, Shrubs, Trees, and Other Improvements

In addition to the requirements contained in Section GP-7.15, the following shall apply:

a. Existing street signs and traffic control devices stored or relocated by the Contractor will be reset by the County after construction in the area is complete and the work accepted by the Engineer.

b. Fences shall be re-erected by the Contractor at locations designated by the Engineer. Materials not capable of being re-erected through no fault of the Contractor shall be replaced on a force account basis as provided for in the "General Provisions" for materials only.

02250.04 METHOD OF MEASUREMENT

A. Trench Excavation

Trench excavation, backfill, and compaction will not be measured as a separate item, but will be included with other items of work contained in the Proposal.

B. Class 3A Excavation

Class 3A Excavation will be based on the trench widths shown on the Standard Details, or as noted in the Contract Documents for the various utility standards.

02250.05 BASIS OF PAYMENT

A. General

1. No separate payment will be made for trench excavation, backfill, and compaction. The cost shall be included in the price bid for installing pipe, conduit, or other underground utility, or constructing the various appurtenances included in the Contract. The bid prices shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents, and accepted by the Engineer.

2. Trench excavation, backfill, and compaction shall include the following unless specified and listed in the Proposal as separate items:

    a. Maintenance of traffic as specified herein and in Section 01410 through 01470.

    b. Sediment control as specified herein and in Section 01500.

    c. Clearing and grubbing as specified herein and in Section 02110.

    d. Tree removal and protection as specified herein and in Section 02120.

    e. Adjusting and replacing fences, shrubs, hedges, etc. as specified herein and in Section 02130.

    f. Protecting and adjusting existing utilities and underground structures as specified herein and in Section 02140.

    g. Removal of existing sidewalk, curb, and combination curb and gutter as specified herein and in Section 02160.

    h. Excavation support as specified herein and in Section 02400.

    i. Dewatering as specified herein and in Section 02512.

    j. Temporary paving and/or surface stabilization.

    k. Surface restoration as specified herein and in Sections 02811 through 02850.

    l. Replacing sidewalks, curb, and combination curb and gutter as specified herein and in sections 02660 and 02670.

3. Payment for removal of existing pavement, trimming existing paving and all other work incidental to patch-paving as specified in Section 02680 will be made as a separate item unless otherwise specified.

4. Payment will be made for contingent items when ordered by the Engineer. Payment will be as specified in Sections 02951, 02952, 02953, 02954, 02955, 02956, and 02957.

B. Trench Excavation, Backfill, and Compaction

In addition to the work listed above, trench excavation, backfill, and compaction shall also include the removing, storing, and re-handling of surface materials over the trench, including paving; the scoring of existing paving in a straight and uniform line; the excavation of all materials encountered in the trench including excavation at manholes, inlets, structures, vaults, and other appurtenances that may be shown or required, and any extra excavation necessary for sheeting or bracing or installation of other excavation support systems; the backfilling and compaction of trenches; the removal and disposal of unsuitable and/or surplus material; and all other incidental work necessary to complete the work.

END OF SECTION