SECTION 02200
PIPE TRENCH WORK

PART 1 GENERAL

1.01 - Section Includes
   A. Trench Excavation.
   B. Trench Excavation Through Rock.
   C. Dewatering.
   D. Trench Stabilization.
   E. Bedding and Backfill.

1.02 - Description Of Work
   A. Trench Excavation - includes the excavation of trenches for storm sewer, subdrains, sanitary sewer, water main, and appurtenances, through all normal earth materials, such as loam, silt, gumbo, peat, clay, soft shale, sand, gravel, fragmentary rock and weathered ledge rock which may be handled in a manner similar to normal earth materials. This also includes any required sheeting, shoring and bracing.
   B. Trench Excavation Through Rock - includes the trench excavation, storing, and rehandling of granite, trap, quartzite, chert, limestone, sandstone, hard shale, or slate in natural ledges or displaced masses that are so firmly cemented together that they cannot be removed without continuous use of pneumatic tools or blasting. This item shall also include the removal of rock fragments or boulders which occur on the surface or in subsurface deposits mixed with earth, sand, or gravel when their size, number, or location prevents them from being handled in a manner normal to trench excavation.
   C. Dewatering - includes the removal of ground water from the trench excavation utilizing a well system, portable pumps, or some other means appropriate to maintain a reasonably dry trench.
   D. Trench Stabilization - includes the overexcavation and disposal of unsuitable or unstable trench material and the backfilling with an aggregate material to form a stable foundation for the pipe being installed.
   E. Bedding and Backfill - includes backfilling and compacting the trench with material in accordance with the Contract Documents.

1.03 - Submittals
   A. Submit certificate of compliance indicating the materials incorporated into the Work comply with the Contract Documents.
   B. Submit dewatering plan to the Engineer if dewatering is necessary.
   C. Submit samples and test results as set forth in the Contract Documents.

1.04 - Delivery, Storage And Handling
   Store excavated material in locations which will minimize the interference with operations, minimize environmental damage, and protect adjacent areas from flooding, change in runoff characteristics and sediment disposition.

1.05 - Scheduling And Conflicts
   A. Schedule Work to minimize disruption of public streets and facilities.
   B. The Contractor shall be responsible to expose and verify potential utility conflicts in advance of commencing the trenching operation.

1.06 - Special Requirements
   A. The use of explosives is not permitted unless provided for in the special provisions of the Contract Documents.
   B. Utility location and coordination is according to Section 02000.
   C. The Contractor shall be responsible for repair of any trench settlement up to the level of the adjacent grade that occurs during construction as well as the warranty period. This shall include restoration of the finished surface, as required.
   D. All trench excavation shall be in accordance with OSHA Standards.
E. Contractor shall maintain cleanup operations within 400 feet of excavation.
F. The Contractor shall be required to obtain all necessary permits and shall be responsible for all applicable fees.

PART 2  PRODUCTS

2.01 - Trench Stabilization
A. Trench Bottom Stone required for excessively unstable trench bottoms shall have a sieve size that is predominately 1½-inch to 2½-inch crushed stone. The aggregate passing the No. 16 sieve shall not exceed 10 percent. The quality of the aggregate shall be as specified below for aggregate bedding.
B. Geotextile fabric, if specified, shall conform to Section 02100.

2.02 - Bedding
Aggregate Bedding shall meet the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size:</th>
<th>1½</th>
<th>1</th>
<th>¾</th>
<th>⅜</th>
<th>⅝</th>
<th>3/8</th>
<th>4</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Passing:</td>
<td>100</td>
<td>95-100</td>
<td>50-100</td>
<td>20-65</td>
<td>10-65</td>
<td>0-20</td>
<td>0-8</td>
<td></td>
</tr>
</tbody>
</table>

Aggregate for this material shall be either gravel or crushed portland cement concrete, limestone, dolomite, or quartzite, free of clay and objectionable clay coatings. The abrasion loss, as determined by AASHTO T96, Method A or B, shall not exceed 45 percent. The aggregate shall not contain more than 5 percent shale particles retained on the No. 16 sieve.

2.03 - Recycled Concrete Material
Recycled concrete material may be used provided it meets the gradation and mechanical properties of the material specified.

2.04 - Backfill
A. Granular backfill, when specified, shall meet the requirements of Iowa Department of Transportation (DOT) Standard Specification 4109, Gradation No. 11.
B. Drainable backfill, when specified, shall meet the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size:</th>
<th>1½</th>
<th>1</th>
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C. Native backfill (select excavated material), when specified, shall be free of organic and other deleterious materials, and in general shall conform to provisions set forth in Section 02000, 2.01 A. for suitable embankment material.
D. Flowable Mortar:
1. Flowable mortar materials shall meet the following mix ratio (approximately 1 cubic yard):

<table>
<thead>
<tr>
<th></th>
<th>Standard</th>
<th>Diggable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement</td>
<td>100 lbs.</td>
<td>40 lbs.</td>
</tr>
<tr>
<td>Fly Ash</td>
<td>400 lbs.</td>
<td>250 lbs.</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>2,600 lbs.</td>
<td>2,900 lbs.</td>
</tr>
<tr>
<td>Water</td>
<td>60-90 gals.</td>
<td>45 gals.</td>
</tr>
</tbody>
</table>
2. Portland cement shall meet requirements of AASHTO M-85, Type I.
3. Fly ash shall meet requirements of ASTM C618, Class C, from an approved source.
4. Fine aggregate natural sand shall be of the following gradation:

   | Sieve Size: | ¾-inch | 200 |
   | Percent Passing: | 100 | 0-10 |
5. The material shall be predominately passing the No. 30 sieve, and shall be flowable during placement. Clean concrete sand shall not be used.
6. K-Krete commercial mix shall only be used with approval of the Engineer.
7. For development work and when not otherwise specified, the following types of backfill shall be used above circular pipe envelopes:
   a. For sanitary sewers and water mains shall be native backfill or granular backfill.
   b. For storm sewers under or within 5 feet of pavement shall be drainable backfill.

PART 3 EXECUTION
3.01 - Trench Excavation
   A. Trench excavation shall not commence until appropriate temporary erosion and sediment control is in place, the area has been cleared and grubbed, and topsoil has been excavated and stockpiled, removal of existing facilities and improvements have been completed, and construction surveys have been completed in accordance with the Contract Documents.
   B. Trench excavation for shallow crossings under pavement areas shall not commence until after the completion of subgrade preparation and granular subbase preparation, both compacted to required specifications.
   C. Topsoil shall be stripped to a minimum 8-inch depth or as otherwise identified in the Contract Documents.
   D. Trenches shall be excavated to a width sufficient to provide ample room for proper installation of the pipe and for placing and compacting backfill material, in accordance with the Contract Documents. Sheeting, shoring and bracing shall be provided to the extent necessary to provide adequate safety to the workers engaged in the Work.
   E. The trench shall be excavated to the line and grades as indicated in the Contract Documents. The trench bottom shall be firm earth. If the trench bottom is not firm and stable, the Contractor shall be responsible to contact the Engineer prior to over excavating.
   F. Trench shall be free of standing water prior to placement of bedding.
   G. During non-working hours, the trench shall be protected by safety fence or other appropriate measures when open. No more than 20 feet of trench shall remain open over night or through a weekend or holiday. No more than 200 feet of trench shall be open at any time during performance of the Work.
   H. Excavation below grade: Where the bottom of the trench has been excavated by mistake to a greater depth than required, the Contractor shall refill this area using aggregate bedding. No additional compensation shall be given to the Contractor. Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.
   I. Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipes, appurtenances and structures for pipes, 16 inches in diameter or less and clearance of at least 8 inches for pipes larger than 16 inches in diameter. All voids shall be filled with aggregate bedding.
   J. Where pavements are to be removed, make saw cuts along all pavement edges which are to remain. Pavement shall be removed down to subgrade elevations.
   K. Trenching in Advance of Pipe Laying: Trenches shall always be completed at least 20 feet in advance of pipe laying except in quicksand where pipe laying shall follow as closely as the best interests of the Work may require.
   L. The Contractor shall make arrangements for legal disposal of all water and sewage received in the trench from temporary connections or stoppage. The Contractor shall not discharge onto public or private property outside of the construction area.

3.02 - Trench Excavation Through Rock
   A. The Contractor is responsible to contact the Engineer if rock is encountered which can not be excavated using normal methods.
   B. The Engineer will review the conditions and, if appropriate, authorize the Contractor to proceed with rock excavation.
   C. Rock shall be excavated to the trench width as specified in the Contract Documents and to a depth 6 inches below the bottom of bedding material, per the Contract Documents.
D. The Engineer shall measure the length, and depth of rock excavation for use in determining payment for this item. Width beyond that indicated in the standard details, and depth in excess of that required to allow for 6 inches of bedding material shall not be measured for payment.

E. Unless otherwise allowed by the Engineer, excavated rock shall be disposed of legally offsite. No rock shall be incorporated into the Project without the Engineer’s approval.

3.03 - Dewatering

A. The dewatering operation shall be performed in accordance with the dewatering plan submitted to the Engineer by the Contractor. Dewater to a minimum of 2 feet below the bottom of bedding elevation.

B. Dewatering operations may be modified from the plan for actual field conditions, with approval of the Engineer.

C. Provide for handling water encountered during construction. Prevent surface water from flowing into the trench.

D. Do not discharge trench water into sanitary sewers. The discharge of trench water into storm sewers requires the approval of the Engineer.

E. Do not discharge trench water onto adjacent property without written approval.

F. Trench water discharge points shall be protected from erosion.

G. Backfill trenches prior to discontinuing dewatering operations.

H. Contractor shall operate dewatering systems so as not to damage adjoining structures and facilities.

I. Contractor shall monitor adjoining structures and facilities during dewatering operations. Dewatering operations shall cease and the Engineer shall be notified if damage is observed.

J. Trench water discharge shall be maintained and controlled as necessary so not to create a safety hazard for vehicular and pedestrian traffic. Trench water discharge shall be directed away from electrical facilities or equipment, and intersections. Dewatering equipment shall include noise and fume reduction devices to minimize disturbance.

K. Contractor shall provide at least two operating pumps for each trench opened in wet ground and at the same time shall have one pump in reserve.

L. Overexcavating trench bottom and placing trench stabilization material is not a substitute for dewatering.

3.04 - Trench Stabilization

A. If the trench bottom is not firm and stable, prior to over excavating, or placing bedding material, the Contractor shall contact the Engineer. The Engineer will review the conditions and, if appropriate, authorize the Contractor to proceed with trench stabilization work. Trench stabilization shall not be substitute for adequate dewatering.

B. The trench shall be over excavated until a firm and stable bottom is reached, but in no case shall the over excavation exceed one foot.

C. Following over excavation, the Contractor shall place trench stabilization material in the trench to an elevation such that following consolidation, the top of the stabilized trench bottom is approximately equal to the trench bottom before over excavation was authorized.

D. Width beyond that indicated in the Standard Details, and depth in excess of that required to a firm and stable trench bottom or 12 inches, whichever is less, shall not be measured for payment.

E. Geotextile fabric, if installed, shall conform to manufacturer’s installation instructions and Section 02100.

3.05 - Bedding And Backfill

A. The Contractor may place bedding material after a suitable trench bottom has been obtained.

B. The pipe shall be bedded in accordance with the Contract Documents based on pipe material, pipe stiffness, and application. Install bedding material to support the full length of the pipe barrel. Shape the bedding as required to accommodate the pipe bells and fittings. Compacted thickness of bedding material shall be 4 to 8 inches.
C. Following consolidation and preparation of the bedding material, the pipe shall be placed on the line and grade as indicated in the Contract Documents.

D. Once in place, the pipe must not be pushed out of alignment for any reason.

E. The trench shall then be backfilled in accordance with the Contract Documents based on the type of pipe material being placed. For water mains, sanitary sewers, and closed-jointed storm sewers, unless otherwise specified, backfill above the pipe envelope shall be suitable excavated material. For open-jointed storm sewers, backfill shall be drainable backfill. Material layers shall be an uncompacted thickness of 8 to 12 inches, and be properly moisture conditioned within a range of -2 percent and +2 percent of optimum moisture content. Compaction shall be a minimum 95 percent of standard proctor density (ASTM D698) within City right-of-way and at locations receiving vehicular or pedestrian traffic, and any other location specified by the Engineer. Compaction shall be a minimum 90 percent of standard proctor density at locations not within City right-of-way and locations not receiving vehicular or pedestrian traffic or not otherwise specified by the Engineer.

F. If necessary, the Contractor shall repeat compaction to obtain specified density.

G. Compaction of soils with greater than 6 percent fines shall be accomplished with an impact device.

H. Compaction of soils with less than or equal to 6 percent fines shall be accomplished with vibratory devices.

I. The Contractor shall be responsible for providing results of compaction tests as set forth in the Contract Documents.

J. Areas of backfill which do not meet the compaction requirements shall be reworked and retested until they are in compliance with the Contract Documents.

3.06 - Flowable Mortar Placement:
A. Flowable mortar shall be used for filling abandoned pipes, for backfilling tunneled areas, or for filling other trench areas in accordance with the Contract Documents.

B. Flowable mortar shall be discharged from a batch mixer or by any reasonable means into the area to be filled.

C. Placement Limitations:
   1. Mortar shall not be placed on frozen ground.
   2. Placement may begin if the air temperature is at least 34° F and rising. Mortar temperature during placement shall stop when the temperature is 38° F or less and falling.
   3. The filling operation shall be as continuous as possible.
   4. When filling in stages has been specified, the Contractor shall allow a minimum of 72 hours between stages.
   5. The Contractor may be required to restrict the volume or mortar fill by sheeting, earth dam, or other means of containment.
   6. All tunneling under pavement shall be backfilled with flowable mortar. The pipe shall be anchored to prevent flotation.

3.07 - Trench Plates
The Contractor shall maintain access for emergency equipment and service vehicles, as well as employee access across the trench excavations by installation of steel trench plates. The steel plates shall be capable of withstanding HS-20 vehicle loads without substantial deflection and shall be fastened in place to prevent movement and vibration. Provide the trench plates at vehicle crossings, outside building doors and on the principal access drives around the buildings.

3.08 - Sheeting And Bracing
A. General:
   1. Sheeting and bracing of all excavations shall conform to the latest state and federal regulations governing safety of workers in the construction industry. When necessary or required, adequate sheeting and bracing shall be installed to prevent ground movement that may cause damage or settlement to adjacent structures, pipelines and utilities. Any damage
due to settlement because of failure to use sheeting or because of inadequate bracing, or through negligence or fault of the Contractor in any other manner, shall be repaired at the Contractor's expense.

2. Sides of trenches in unsuitable, loose or soft material, shall be shored, sheeted, braced, sloped, or otherwise supported by means of sufficient strength to protect employees working within them.

B. Sheeting Requirements:

1. Where excavations are made with vertical sides which require supporting, the sheeting and bracing shall be of sufficient strength to sustain the sides of the excavations and to prevent movement which could in any way injure the Work, or adjacent structures, or diminish the working space sufficiently to delay the Work. Sheeting shall be of a material that will not split in driving. Special precautions shall be taken where there is additional pressure due to the presence of other structures or moving vehicles.

2. It shall be the Contractor's responsibility to select timber for sheeting and bracing of sufficient dimensions and strength to adequately support the sides of trenches and excavations. The Contractor shall submit details of the proposed sheeting and bracing to the Engineer.

3. Timber sheeting shall conform in quality to select structural douglas fir lumber and shall be sound, live timber, free from sap, large checks, shakes, loose or decayed knots, worm holes, and other imperfections which may impair its strength or durability.

4. Sheeting shall be driven to true alignment and in such a manner as to avoid splitting to insure contact of adjacent pieces. In wet excavation grooved sheeting shall be used to prevent passage of soil. Any voids between sheeting and face of excavation shall be filled with suitable material.

5. Sheeting and bracing shall not be removed before the completion of the Work, unless otherwise directed in writing by the Engineer. Sheeting may be left in place if approved by the Engineer. Sheeting which is left in place shall be cut off 18 inches for clearance below the bottom of the pavement in streets/highways and 18 inches below the original ground surface, unless otherwise required by the Engineer.

END OF SECTION 02200