

SECTION 02221

TRENCHING, BACKFILLING AND COMPACTION

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Excavation for piped utility material.
- B. Provide necessary sheeting, shoring and bracing.
- C. Prepare trench bottom with appropriate materials.
- D. Dewater excavation as required.
- E. Place and compact granular beds, as required, and backfill.

1.02 RELATED WORK

- A. Section 02110: Clearing and Grubbing
- B. Section 02210: Grading and Excavation
- C. Section 02513: Asphaltic Concrete Paving
- D. Section 03001: Concrete Work

1.03 PRECAUTIONS

- A. Notify utility companies when necessary to disturb existing facilities and abide by their requirements for repairing and replacing.
- B. Protect all vegetation and other features to remain.
- C. Protect all benchmarks and survey points.

PART 2 PRODUCTS

2.01 BEDDING AND BACKFILL MATERIALS – GRAVITY SEWERS

- A. Class I Material: Angular, $\frac{1}{4}$ to 1 inch graded stone including a number of fill materials that have regional significance such as crushed stone, cinders, slag and crushed shells.

- B. Class II Material: Coarse sands and gravels with a maximum particle dimension of 1½ inch including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry.
- C. Class III Material: Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures.
- D. Class IV Material: Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits.
- E. Class V Material: Organic soils, as well as soil containing frozen earth, debris, rocks larger than 1½ inches and other foreign material.

2.02 BEDDING AND BACKFILL MATERIALS – STORM SEWERS

- A. Class A Material: Continuous concrete cradle constructed in conformity with details shown on drawings, consisting of 3000 PSI concrete as specified in Section 03000.
- B. Class B Material: Sand or natural sandy soil, all passing a 3/8" sieve with not more than 10% passing a No. 200 sieve; or stone, gravel, chert or slag of Gradation C or D of T.D.O.T. specifications.
- C. Class C Material: Natural ground or compacted embankment at a depth of at least 10% of the outside vertical pipe diameter.
- D. In rock cuts or other areas where free drainage bedding or backfill materials are required, use crushed stone, slag or washed gravel of size 6, 7, 8, 57 or 78 of T.D.O.T. specifications.
- E. For crushed stone pavement and shoulder replacement, use crushed stone meeting Type "A", Grading D, of T.D.O.T. specifications.

PART 3 EXECUTION

3.01 PREPARATION

- A. Install barriers and other devices to protect areas adjacent to construction.
- B. Protect and maintain all benchmarks and other survey points.

3.02 EXCAVATION TRENCHES

- A. Perform in such a manner as to form a suitable trench in which to place the pipe and so as to cause the least inconvenience to the public.
- B. Maximum width at the crown of the pipe – 2 feet plus the nominal diameter of the pipe.

- C. Cut pavement along neat, straight lines with either a pavement breaker or pavement saw.
- D. Trench depth: for water lines – sufficient to provide minimum cover of 30 inches over the top of the pipe; for sewer lines – as shown on the Plans or as specified.
- E. Align trench as shown on the Plans unless a change is necessary to miss an unforeseen obstruction.
- F. For water pipe, shape the bottom of the trench to provide uniform bearing of the pipe on undisturbed earth throughout its entire length. Dig bell holes to aid in securing uniform support of the pipe.
- G. For sewer pipe, fill the bottom of the trench with granular material as specified herein.
- H. When unstable soil is encountered at the trench bottom, remove it to a depth required to assure support of the pipeline and backfill to the proper grade with coarse aggregate AASHTO M – 43, Size No. 2 or 3. This will be a pay item under crushed stone for undercutting material.
- I. Remove rock encountered in trench excavation to a depth of 6 inches below the bottom of the pipe barrel, backfill with an approved material and compact to uniformly support the pipe. In no case shall solid rock exist within six (6) inches of the finished pipeline.
- J. When rock borings or soundings are provided, they are for information only and do not guarantee existing conditions. Make such investigations as deemed necessary to determine existing conditions.

3.03 SHEETING, SHORING AND BRACING

- A. When necessary or when directed by the Engineer, furnish, put in place and maintain such sheeting, bracing, etc., as may be required to support the sides of the excavation and to prevent movement.
- B. Take care to prevent voids outside the sheeting.
- C. If voids are formed, immediately fill and ram to the satisfaction of the Engineer.
- D. Devise plans for performing this work subject to the approval of the Engineer.
- E. Unless adjacent facilities will be injured, remove all sheeting, shoring and bracing after backfill has been placed to a depth of 18 inches over the pipeline.
- F. Cut shoring off at the top of the pipe and leave the lower section in the trench.

3.04 USE OF EXPLOSIVES

- A. Conduct all blasting operations in accordance with prevailing municipal, state or other agency regulations, codes, ordinances or laws.
- B. Exercise due caution when blasting adjacent to existing structures and pipelines.
- C. If structures or pipelines are damaged, promptly replace or repair them at no expense to Owner.
- D. Do not conduct blasting operations within 25 feet of water, sewer, gas or other utility lines, unless otherwise directed by the Engineer.
- E. Cover all shots with blasting mats to prevent flying material.

3.05 DISPOSAL OF EXCAVATED MATERIAL

- A. Satisfactorily dispose of all excess excavated material that cannot be used for or is not suitable for embankments.

3.06 UNAUTHORIZED EXCAVATION

- A. All excavation outside or below the proposed lines and grades shown the Plans or directed by the Engineer.
- B. Backfill areas of unauthorized excavation with the type material necessary (earth, rock or concrete) to insure the stability of the structure of construction involved.
- C. Unauthorized excavation or backfill to replace it shall not be a pay item.

3.07 REMOVAL OF WATER

- A. Keep excavated areas free of water while work is in progress.
- B. Well-pointing shall be performed if required.
- C. Take particular precautions to prevent the displacement of structures or pipelines as a result of accumulated water.

3.08 OBSTRUCTIONS

- A. Obstructions shown on the Plans are for information only and do not guarantee their exact locations not that other obstructions are not present.
- B. When utilities or obstructions are not shown on the plans but are present off the roadway at the location of the proposed pipeline route, the Contractor may request to relocate the pipeline in the roadway if necessary to avoid disturbing the utility or obstructions.

- C. Exercise due care in excavating adjacent to existing obstructions and do not disturb it unless absolutely necessary.
- D. In the event obstructions are disturbed, repair or replace as quickly as possible to the condition existing before their disturbance. This repair or replacement will not be a pay item.
- E. If desired by the utility company, pay for the repair or replacement work performed by the forces of the utility company or other appropriate party.
- F. If replacement or repair of disturbed obstructions is not performed after a reasonable period of time, the Owner may have the necessary work done and deduct the cost of it from payments to the Contractor.

3.09 STORM SEWER BEDDING

- A. Use Class A or B bedding, whichever is shown on the Plans. If not shown, use Class B bedding.
- B. Construct Class B bedding in a trench cut in natural ground or compacted embankment.
 - 1. Bed pipe of 6" of Class B material and sufficient additional Class B material accurately shaped by a template to fit the lower part of the pipe exterior.
 - 2. Ram and tamp in layers not over 6", in loose thickness, around the pipe to a minimum depth of that shown on the Plans.
 - 3. When bell and spigot pipe is to be placed, dig recesses in the bedding material of sufficient width and depth to accommodate the bell.

3.10 GRAVITY SANITARY SEWER BEDDING

- A. Always maintain proper grade and alignment during the bedding and tamping process.
 - 1. The Contractor at his expense shall replace any pipe dislodged during this process.
 - 2. Dig bell holes to assure uniform support of the pipe.
- B. Bedding for PVC
 - 1. Completely encapsulate each sewer pipe section with 6" of granular material on the top, both sides and the bottom of the pipe.
 - 2. For PVC sewer pipe, use Class I angular material or material as recommended by the manufacturer.
- C. Bedding for Ductile Iron Pipe Sewers:
 - 1. Lay each sewer pipe section on a 6" bed of granular material and backfill to the spring line of the pipe with granular material.
 - 2. In unimproved areas, use Classes I or II granular material.

3. In improved areas, use Class I angular material.

3.11 BEDDING FOR WATERLINES

- A. Bed in a trench cut in natural ground.
- B. Dig bell holes to assure uniform support throughout the entire length of pipe.
- C. Excavate the trench in such a manner as to form a suitable bed on which to place the pipe.

3.12 BACKFILLING AND COMPACTION

- A. Do not begin backfilling before the Town Engineer or the designated representative has inspected the grade and alignment of the pipe, the bedding of the pipe and the joints between the pipes. If backfill material is placed over the pipe before an inspection is made, reopen the trench in order of an inspection to be made.
- B. Jetting, water settling, puddling and/or settling of backfill materials as compaction methods are not acceptable.
- C. Perform backfilling by hand, together with tamping, until fill has progressed to 18" above the top of the pipe.
- D. Any discrepancy between these specifications and the manufacturers recommended installation procedures should be brought to the attention of the Town Engineer for a resolution of the discrepancy.
- E. Stabilizing trenches with extra depth soil cement will not be accepted or permitted without the written consent of the Town Engineer.

3.13 COMPACTION OF GRAVITY SANITARY SEWER

- A. Deposit Class I granular material (where required) or loose soil free from lumps, clods, frozen material or stones in layers approximately 8" thick.
- B. Compact by hand, or with manually operated machine tampers, actuated by compressible air or other suitable means.
- C. Use tamps and machines of a suitable type, which do not crush or otherwise damage the pipe.
- D. Backfill from 6" above the top of pipe to 24" above the top of pipe to be compacted to 85% relative density as determined by ASTM D-1557 modified proctor.

- E. Backfill from 24" above the top of the pipe to finished grade or pavement sub-grade with clean suitable fill material in loose lifts not more than 8" thick. Compact material in proposed pavement areas to 95% of maximum dry density as determined by the modified proctor compaction test (ASTM – D1557). Compact fill in yards or unimproved areas to 85% modified proctor. The moisture content shall be maintained to within 2% of optimum.

3.14 COMPACTION OF STORM SEWER BACKFILL

- A. Backfill from the spring line of the pipe to 12" above the top of the pipe with clean suitable fill material to be compacted to 85% relative density (ASTM D-1557) Modified Proctor.
- B. Backfill from 12" above the top of the pipe to finished grade or pavement sub-grade with clean suitable fill material in not more than 8" loose lifts. Compact fill material in proposed pavement areas to 95% of maximum dry density as determined by the modified proctor compaction test (ASTM – D1557). Compact fill in yard or unimproved areas to 85% modified proctor. Maintain moisture content to within 2% of optimum.

3.15 COMPACTION OF WATER MAIN BACKFILL

- A. Water mains and other utility trenches shall be backfilled with clean suitable fill materials. Compact to 95% modified proctor in proposed pavement areas and 85% modified proctor in lawn or unimproved areas.

3.16 FINAL BACKFILLING

- A. Backfilling in Unimproved Areas (as approved on site):
 1. Dispose of and replace all soft or yielding material that is unsuitable for trench backfill with suitable material.
 2. Deposit backfill material in 8" lifts and compact to 85% modified proctor as determined by (ASTM – D1557) Density, testing frequency in un-improved areas will be determined by Town Engineer.
 3. Proof rolling with a loaded dump truck or front-end loader may be required to locate soft spots.
 4. Dispose of surplus excavated material.
 5. Before final acceptance, remove all mounds to the elevation of the surrounding terrain.
- B. Backfilling beneath driveways and streets where non-rigid and rigid type surfacing is to be replaced:
 1. Use Class I granular material of either crushed limestone or crushed gravel of high weight and density.
 2. Carefully deposit in uniform layers, not to exceed 8" thick.
 3. Compact each layer thoroughly by rolling, ramming and tamping with tools suitable for that purpose in such a manner so as to not disturb the pipe.

C. Backfilling of shoulders along streets and highways:

1. Backfilling methods and materials for shoulders along streets and highways shall be in accordance with the requirements of governing local, county or state departments maintaining the particular roadway or highway.
2. Replace with similar materials, all shoulders that may be damaged or destroyed as a result of pipe trenching.

D. Crushed Stone for Pavement Maintenance and Shoulder Replacement:

1. Where possible, salvage and reuse all base material that is removed during construction.
2. Wet and thoroughly compact crushed stone and blade to tie into the existing surface before final acceptance.
3. Base material placed as a portion of pavement replacing items, will not be directly measured for payment unless traffic whips out the base material placed shall be paid for as crushed stone for pavement maintenance.

3.20 COMPACTION TESTING FOR TRENCHES

- A. In-place density tests should be performed at fill grade (12" above the top of the pipe) and at every 8" lift of back fill to finished grade for every 50 linear feet of pipe and shall be tested at random as directed by the Town Engineer or his representative to ensure compliance with compaction requirements.
- B. The Town Engineer may stop excavation of trenches if backfill does not comply with specified density requirements until the defective material is removed and the work is continued correctly.
- C. The contractor shall assume full responsibility for obtaining an approved testing laboratory to conduct all testing requirements and to provide geo-technical recommendations the project may require unless provided by Town.
- D. The contractor's testing lab shall submit copies of test reports and geo-technical reports to the Town Engineer.
- E. The contractor shall provide a safe trench for engineer and testing lab.

3.21 FIELD QUALITY CONTROL

- A. Compaction: The degree of bedding or backfill compaction shall be as specified. Maximum dry density – will be determined by (ASTM – D1557) Modified Proctor. The moisture content of bedding or backfill materials shall be within + or – 2.0 percent of optimum as determined by ASTM – D1557.

Compaction testing shall include moisture density relations, and density in place. If compaction testing; or other visual observations, indicate the possibility of inadequate compaction at a lower depth, the Engineer may require the Contractor to re-excavate to a lower depth to conduct additional testing.

When requested by the Engineer the Contractor shall proof roll the trench with a loaded front-end loader or truck of sufficient size to determine if soft spots exist. If the tests indicate inadequate compaction, the Contractor shall re-compact the material. In cases where there is repeated failure to achieve the required state of compaction, the Engineer may require that the backfill be removed and re-compacted to 6" lifts or replaced with imported material at Contractors expense. Testing frequency shall be as required to assure the completed work meets specifications.

END OF SECTION