

EARTHWORK

1.00 GENERAL

1.01 Description

A. The contractor shall perform all excavation and backfilling necessary to complete the work. This shall include the excavation of earth and rock, the removal and disposal of unsuitable material, dewatering, placement of suitable fill and backfill material, pipe boring and jacking and the restoration and final grading for all earth surfaces.

1.02 Work Within Right-of-Way

A. Where the governmental bodies having jurisdiction of the streets or rights-of-way have specifications relating to the requirements for work within their jurisdiction, such requirements must be met as a minimum requirement, and if these specifications impose further limitation on the work, they shall also be met as the required work standard.

B. During the operations of the contractor in the streets and roadways, the contractor shall maintain barricades, lights, and warning signs as required by the agency having jurisdiction.

1.03 Work Within Easements

A. During construction within any easements, the contractor shall confine himself to the limits shown on the plans. He shall notify property owners in advance of moving equipment on easements and use of access routes which will be designated by the owner. The owner will cooperate in working out the details of access. The topsoil over the trench shall be removed and carefully replaced upon completion of the work. The backfill of the trench in the easement may be left slightly high to provide for any slight residual settlement. Any trees, shrubs, or bushes removed shall be replaced to the satisfaction of the property owner.

1.04 Soil Borings

A. Soil boring results, if taken on site, are appended to these specifications with the locations noted. Boring logs are shown to be generally representative of the site and to assist in the design and construction of the work.

1.05 Testing

A. As directed by the engineer, where utilities are constructed under existing or proposed pavement, sidewalk, curb and gutter, or where the pipe is with a 1 on 1 influence of pavement, compaction testing shall be performed by an independent testing laboratory. The cost of all testing services shall be paid by the owner.

B. Compaction testing shall be performed at intervals of one test per 75 feet of trench or as determined necessary by the engineer.

2.00 PRODUCTS

2.01 Backfill Material

A. For areas not requiring "granular backfill" material, backfill shall be of the excavated material, with the exception that materials such as soft clay, topsoil, muck, cinders, vegetable matter, refuse, boulders, and other objectionable and non-packing earth shall be excluded from the backfill and removed from the site. Stone larger than 3 inches in any dimension shall be excluded from the backfill and removed from the site by the contractor at no additional cost to the owner.

B. Where “granular material” backfill is required as specified herein, backfill material shall be defined as material meeting granular material class II as defined in 2003 MDOT Standard Specification for Construction.

3.00 EXECUTION

3.01 General Excavation

A. Excavation shall be performed by any practical method consistent with the integrity and protection of the work and the neighboring structures, workmen, and the public. Topsoil shall be separately removed and stockpiled for reuse.

B. All excavation, except where necessary to tunnel bore or jack under roads, railroads, tree roots, and other obstructions within the limits indicated on the plans, may be open cut from the surface. Tunneling or boring under trees shall be considered as incidental to construction and will not be considered as cause for request for additional payment.

C. Foreign material or unsuitable foundation material encountered such as wood, boulders, etc., which obstruct the excavation, shall be removed. Such material found at the bottom of the excavation shall be removed and the foundation resorted with approved materials.

D. If excess excavation is made or the material becomes disturbed so as to require removal beyond the prescribed limits, the resulting space shall be filled with selected material solidly tamped into place, in not more than 12 inch layers to satisfaction of the engineer, before the construction work proceeds. At the direction of the engineer, the excess excavation may be filled with 2000 psi concrete at the contractor’s expense.

E. The excavation shall be kept dry during the work. Where water is encountered in the excavation, it shall be removed by pumping or well points. All necessary precautions shall be taken to prevent damage to existing wells and to completed or partially completed structures. The contractor shall be responsible for all damages caused by him due to inadequate or improper protection.

3.02 Excavation for Sewers and Water mains

A. Trenches shall be excavated to the depth required with allowance for bedding the pipe. The trench shall be cut wider and deeper at each pipe joint location to provide for properly completing the pipe joint and to relieve the joint of all loading.

B. The width of the trench at the top of the pipe shall be sufficient to allow the pipe to be laid and jointed properly and shall provide for a minimum net clearance of 6 inches and a maximum net clearance of 12 inches on each side of the barrel of the pipe and to allow the backfill to be placed and properly compacted.

C. The width of trench at the top of a flexible pipe backfill when using concrete bedding shall be sufficient to allow the pipe to be laid and jointed properly with the minimum net clearance of 12 inches and a maximum net clearance of 18 inches on each side of the barrel of the pipe.

D. Where the conditions of the ground require, or where the work is in close proximity of existing structures, the sides of excavation shall be securely held by bracing and/or sheeting which may be removed in units when the level of the backfill has reached a point where it is safe to pull the sheeting without disturbing the protected features. No sheeting, bracing, or other timber shall be left in excavation upon the completion of the main or other structures, except with the specific review and direction of the engineer.

E. Other underground mains, sewers, or structures encountered in the excavation shall be adequately supported during the contractor’s operations, and before backfilling shall be given permanent supports as directed by the engineer to meet standards or requirements of the owning utility or agency.

F. Water, sewer, gas, and other utilities services disturbed by the contractor and his operations shall be repaired or replaced in a manner equal to the original condition by the contractor at his own expense. Where these services are encountered and undamaged, they shall be supported and/or protected by the contractor at his expense against later settlement and/or damage after backfill. The contractor shall consult the agency or utility firm having jurisdiction over any duct line, gas main, etc., which may cross the excavation to determine method of supporting such duct or pipe.

G. All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Hydrants under pressure, valve manhole covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clean, or other satisfactory provisions made for street drainage, and natural water courses shall not be obstructed except as otherwise provided for herein on a temporary basis.

3.03 Excavation for Structures

A. Excavation for structures shall be extended sufficiently beyond the limits of the structure to provide ample room for form construction and for practical construction methods to be allowed.

B. Requirements for excavation for sewers and water mains shall also apply to this section.

3.04 Excavation for Paved Surfaces

A. In excavating around manholes and catch basins or inlets, care shall be exercised to avoid removing the casting and pushing dirt into the structures. Dirt pushed into manholes, catch basins or inlets by the contractor's operations shall be immediately removed so that the dirt will not be carried into the sewer by the flow of sewage or storm water.

B. The contractor shall take ample precaution to protect all trees and ornamental shrubbery or within the limits of the construction area, or within the construction areas shown on the plans to be retained from injury by workmen, equipment, or any other agencies connected with the work, including subcontractors. Such protection shall be provided during the progress of excavation, grading, or other phases of the work as necessary. Such trees or shrubbery shall be surrounded by protective posts or fencing before construction begins, when in the judgment of the engineer, such precautionary measures are necessary. If, as a result of any phase of the work, trees are damaged or it is necessary to remove limbs in the way of construction, the repair of the damage and such limb removal shall be done by the contractor as directed by the engineer. All cost for the protective work shall be borne by the contractor as incidental to the contract work.

3.05 Shoring, Sheeting, and Bracing

A. Where sheet piling, shoring, sheeting, bracing, or other supports are necessary they shall be furnished, placed, maintained, and except as shown or specified otherwise, removed by the contractor.

B. All piling, shoring, sheeting, and bracing shall be designed by a professional engineer engaged by the contractor with demonstrated competence and experience in such work. The sheeting shall be designed to prevent bottom failure and hydrostatic uplift within the excavation. Provision shall also be made in the design for lateral pressures due to side slope and construction equipment or other surcharge loads, as applicable.

C. The contractor shall provide to the engineer for his review, design calculation and arrangement drawings of the sheeting system prior to ordering any material for bracing, sheeting, etc., and prior to the commencement of the excavation.

D. All materials, except as otherwise specified, used for sheeting and sheet piling, lagging, bracing, shores, and stringers, or waling strips shall be of approved quality and dimensions throughout.

E. Materials for sheeting shall be furnished and driven or set in place by the contractor, where necessary or wherever order by the engineer, whether the same is or is not considered necessary by the contractor. If, in the opinion of the engineer, the material furnished by the contractor are not proper quality or sufficient size or not properly placed to ensure the safety of the work or of adjacent structures and property, the contractor shall, upon notice of the engineer to that effect, forthwith procure, furnish and set in place or drive other and satisfactory manner; and if he shall fail or neglect to do so, the engineer may order all or part of the work to be stopped until such materials so used are furnished and placed; and the contractor shall be entitled to claim, demand, or different disposal of material ordered by the engineer, nor any compensation for allowance of any kind whatsoever for or on account of any damage or delay resulting from such stoppage of work.

F. Steel sheet piling may be either new or used. It shall be of adequate strength, straight and properly braced. Steel sheet piling shall be of the interlocking type. Friction in the interlocks shall not be assumed to contribute to the strength of the sheet piling.

G. The design, planning, installation, and removal, if required, of the sheet piling, shoring, sheeting, and bracing shall be accomplished in such a manner as to maintain the required excavation or trench section and to maintain the undisturbed state of the soils below and adjacent to the excavation.

H. Steel sheet piling for the excavation shall be driven straight and inline. The piling shall be supported aboveground, before driving, by a guide frame at least 20 feet high which will keep the piling accurately in the required position and vertical. Each piece of piling shall be driven only a few feet at a time and driving shall proceed continuously around the perimeter so that the piles shall reach their full penetration together.

I. Walers and bracing shall be supplied and installed as required to complete the sheeting system. Walers and braces shall be of adequate strength for the load imposed. Splices in walers shall develop the full strength of the member in bending, shear, and axial compression.

J. If bracing member are to be removed during construction, the timing and procedure for removal shall not induce excessive stresses in the permanent structures or in steel sheet piling and bracing members.

K. If the construction sequence of structures requires the transfer of bracing to the completed portions of any structure, the contractor shall secure written acceptance of the engineer prior to the installation of such bracing.

L. In trenching operations the use of horizontal strutting below the barrel of pipe or the use of the pipe as support for trench racing will not be permitted. The use of a traveling shield for sewer construction shall require that the device be approved for use by a profession engineer. Sheet piling and timbers in trench excavation shall be withdrawn in a manner so as to prevent subsequent settlement of the pipe or additional backfill loading which might overload the pipe.

M. The neglect, failure, or refusal of the engineer to order the use of sheeting, or sheet piling or steel, or to order the same to be left in place, or the giving or failure to give of any order or direction as to the manner or method of driving or placing sheeting, sheet piling, braces, shores, etc., shall not in any way relieve the contractor of any or all obligations under this contract. The sheeting left in place shall be cut off 2 feet below the proposed grade.

N. The rules of the OSHA and the State Department of Labor with respect to excavation and construction shall at all times be strictly observed.

3.06 Backfilling for Sewers and Water Mains

A. Backfilling shall consist of placement of the prescribed materials from a level of 12 inches above the crown of the pipe. Placement shall be as follows:

1. Under gravel driveways, gravel roads and shoulders, the backfill shall be granular material which shall be solidly compacted by mechanical tamps in layers of not more than 12 inches loose thickness with backfilling carried up to within 12 inches of finished grade. Compaction of backfill shall be such as to obtain 95% of the maximum unit density as determined at the optimum moisture content.
2. Under pavements, curb, paved driveways, and sidewalks, the backfill shall be granular material compacted in layers not to exceed 12 inches loose thickness with backfilling carried to sub grade. Compaction of backfill shall be such as to obtain 95% if the maximum unit density as determined at the optimum moisture content. After a period of about 60 days or less, if the backfill compaction is satisfactory to the engineer, to provide for any slight settlement, the contractor shall re-trim neatly any broken edges of pavement and replace the top surface of the backfill within the pavement area with pavement surface equal to that surface which was removed. The pavement shall be replaced in accordance with the standard specification of the agency having jurisdiction.
3. Backfill around lift stations, or buried underground structures shall be granular material compacted in 12 inch lifts. Fill material shall be brought to a grade 12 inches above the structure. Fill above the structure to be as noted above. Compaction of backfill shall be such as to obtain 95% of the maximum unit density at the optimum moisture content.
4. For all other areas, backfilling shall consist of placing excavated material as defined in paragraph 2.01 A of this section, in 12 inch lifts to finished grade. Compaction of backfill shall be such as to obtain 90% of the maximum unit density at the optimum moisture content.

3.07 Filling and Backfilling for Structures

- A. Embankments underlying structural footings, street and drives, sidewalks and around structures shall be granular material meeting the requirements of MDOT for granular material compacted to 95% density.
- B. In all other areas, material required for embankments and backfilling shall be soil or soil-rock mixture free of organic and other deleterious matter and shall contain no more than 15% rocks or lumps larger than 2-1/2 inches in the greatest dimension, compacted to 90% density.
- C. Under all interior and exterior floor slabs, and 8 inch thick granular cushion shall be placed. This material shall be clean mineral aggregate meeting the following gradation requirements:

Passing No. 4 sieve	100%
Passing No. 200 sieve	0-3%

- D. Where embankment material is placed to achieve a new surface elevation, the top 4 inches shall be approved topsoil either salvaged from the site or hauled in by the contractor.

3.08 Filling and Backfilling for Paved Surface

- A. Embankments, including sand cushions and granular fills, shall be placed in successive layers not more than 6 inches in depth the full width of the cross section, each layer to be thoroughly compacted by means of vibratory compactors thereof, as required by the engineer. Each layer shall be compacted to not less than 95% of the maximum unit density determined at optimum moisture content. All parts of embankments shall be uniformly compacted and the contractor shall direct all earthmoving equipment used in the work so that the same shall be attained. Embankment or fill outside the limits of the sub grade where sand or gravel is not required shall be made with suitable material which is free from perishable organic matter, rubbish, stones, broken concrete, roots, or foreign materials, at no additional compensation. Before any embankments are to begin, the base shall be made firm and clear of topsoil, sod or perishable material. The sides of the embankment shall be neatly and evenly dressed to the slop shown on the plans, or such other slope as the engineer may direct.

B. Upon completion of the placing of the curbs, and after the concrete has cured sufficiently, forms shall be removed and the excavated space behind the curb shall be backfilled with good quality of surface soil, free of rubbish, stone, broken concrete, roots, or foreign material. Where adequate acceptable material for backfill behind the curb is not available, granular fill conforming to MDOT class II, shall be used. Where the area behind the curb is cut, it shall be trimmed for the top of the curb on the slope shown on the plans. If the area is in embankment or fill, an earth berm shall be placed immediately adjacent to the top of the curb and then the embankment of fill shall be finished to the slope shown on the plans. All trimming and finishing shall be done in a neat, workmanlike manner. All excess concrete and debris shall be removed from the excavation behind the curb line before backfilling begins.

C. In construction of non-rigid pavements, backfilling back of curb and gutter shall be completed before placement and compaction of the base course or the roadway.

3.09 Preparation of Sub grade for Paved Surfaces

A. The bottom of the excavation for the pavements or top of the fill shall be known as the pavement sub grade and shall be smoothed, trimmed, and compacted to the required line, grade and cross section to receive the road metal. It shall be thoroughly compacted by roller of approved type weighing not less than 3 tons. The sub grade shall be compacted to at least 95% of the maximum unit density determined at optimum moisture content. Inaccessible areas, where rolling is not practical, shall be thoroughly compacted by mechanical tampers capable of striking a blow equivalent to at least 250 foot-pounds per square foot. The sub grade thus formed shall be maintained in a smooth and compacted condition until the pavement has been placed. No base course, surfacing, curb, or curb and gutter, shall be placed until the sub grade has been reviewed by the engineer. The sub grade shall be finished in an acceptable condition at least one day in advance of the pavement construction at all times. Six inches of compacted depth of granular material shall be used where uncompactable soil is encountered. The granular fill shall conform to MDOT; class II, compacted to 95% of its density.

B. Immediately prior to placing the pavement, the sub grade shall be tested for conformity with the cross section shown on the plans by means of an approved template riding on the curb and gutter sections or on side forms. If necessary, materials shall be removed or added, as required, to bring all portions of the sub grade to the correct elevations. Corrected portions shall then be thoroughly compacted and again tested with the template. Pavement material shall not be placed at any portion of the sub grade which has not been tested for correct elevation.

C. The finished sub grade shall be maintained in a smooth and compacted condition until the pavement is laid. No storage piles of fine or coarse aggregate shall be placed directly upon the finished sub grade. Should the sub grade become rutted or disturbed in any manner, it shall be reshaped and re-compact.

3.10 Grading

A. The contractor shall grade the site to achieve the elevations as shown on the plans. All disturbed areas beyond the grading limits shall be restored to prior condition.

B. Surplus excavated material not needed for embankments shall be disposed of by the contractor. Headwalls, culverts, drains, sewers, and appurtenances filled or damaged by the contractor during the course of his operations shall be cleaned, repaired, or replaced at his expenses.

C. All temporary earth changes shall be in conformance with the soil and erosion control act.

3.11 Restoration

A. Headwalls, culverts, and drainage systems filled or damaged by the contractor during the course of his operations shall be cleaned, re-laid, or rebuilt with new materials to a condition equal to the original state, and of thickness equal to the original structure and to the original line and grade at the contractor's expense.

B. Where the excavation is located next to a ditch and/or where an existing ditch is filled or disturbed in the contractor's operations, the contractor shall clean, repair, or replace the ditch with properly pitched bottom and side slopes and of the section and capacity not less than the original section.

C. Where the excavation has been through lawned areas, the contractor shall restore the disturbed area by placing topsoil and seeding or sodding over the final backfill material.

D. The contractor shall remove excess dirt and other construction material from the site of the work and leave the site in a condition equal to its original state.

E. The final condition of the streets and roadways shall be subject to the approval of the governing body having jurisdiction thereof, as well as review by the engineer.