SECTION 312000

EARTHWORK

1. GENERAL

1.01 GENERAL CONDITIONS The General Conditions, Supplementary General Conditions and all Sections of Division 1 shall apply to each and every contract and contractor, person or persons supplying material, labor or entering into the work directly or indirectly.

1.02 SCOPE This Section includes all labor, materials and related services necessary for the work shown on the drawings and/or specified herein, including but not limited to the following:

A. Preparation of subgrade for building slabs, walks, pavement, stairs and landscaping.

B. Excavation and backfill for all new construction work indicated, within and without the building lines.

C. All other excavating, backfilling, filling, compacting and grading for the proposed work of the Project.

1. Include removal of existing pavements, curbs, walls, stairs, fencing, masonry and other items of building construction or site improvements encountered.

2. Include excavation and backfilling for all mechanical and electrical sitework.

D. Temporary or permanent shoring and bracing as required for safe prosecution of the work.

E. Pumping and bailing as required to maintain excavated spaces free from water from any source.

F. Providing of borrow material from off site as required.

G. Disposal of surplus excavated material, in location designated by Owner. Obtain all local permits required for items of work of this Section for which approval of public authorities or utilities is required.

1.03 ALTERNATES: Refer to Section 01100 to determine the extent to which work of this Section will be affected by any Alternates, Allowance or Unit Prices.

1.04 QUALITY ASSURANCE, SUBMITTALS

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: Owner shall arrange and pay for testing of compaction and optimum density. This contractor shall inform the Owner sufficiently in advance to arrange for such testing at each stage of the work.

C. Samples: Submit following samples to Architect: All fill and soil materials, including gravel, ordinary fill, drainage fill and granular fill.

1.05 JOB CONDITIONS

A. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn by Contractor. Data are made

available for convenience of Contractor. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.

B. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

2. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted by Owner and then only after acceptable temporary arrangements have been agreed to.

a. Provide minimum of 48-hour notice to Owner and receive notice to proceed before interrupting any utility.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

C. Use of Explosives: Do not bring explosives onto site or use in work without prior written permission from the Owner and authorities having jurisdiction. Con-tractor is solely responsible for handling, storage and use of explosive materials.

1. Obtain written permission and approval of method from local or governing authority, and from Owner before proceeding with blasting. Notify Architect at least 48 hrs. before intended blasting and do no blasting without his approval.

2. Use only experienced blasting personnel, licensed where applicable.

3. Comply with all applicable laws, rules and regulations concerning transit, storage and handling of explosives.

4. Submit written evidence that insurance coverages do not exclude blasting operations.

D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction.

2. Protect structures, utilities, sidewalks, pavements and other facilities from damage cause by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

3. Perform excavation within drip line of large trees to remain with care; protect root system from dryout or other damage to greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1” diameter and larger with emulsified asphalt tree paint.

2. PRODUCTS

2.01 FILL MATERIALS

A. Gravel Fill: Gravel fill shall be uniformly graded and consist of hard durable particles free from vegetable matter, lumps or balls of clay, and other deleterious substances. Gradation of portions which will pass a 3” sieve shall meet following gradation requirements.

1. Gravel shall conform to MDOT 703.06, B Specification.

2. Gravel shall contain no particles of rock with any dimension greater than 6" when delivered to jobsite.

3. Gradation test shall conform to AASHTO Method T-27

4. Minimum density shall be 110 pounds per cubic foot.

B. Ordinary Fill: All material to be placed where Specifications or Drawings call for "Fill", "Backfilling" or "Rough Grading" shall be natural soil, well graded and free from all organic, weak, compressible and frozen materials, and shall contain no stone larger than 4" in maximum dimension. It shall be of such nature and character that it can be dried and compacted and shall be free of all expansive materials (such as high plastic clays) and of materials subject to decay, decomposition or dissolution. Samples of ordinary fill shall be provided to Architect for approval.

1. If sufficient ordinary fill is not available from excavations under the Contract, provide additional material from other sources as required. Both excavated material from the site and material from other sources shall meet above requirements.

2. Use ordinary fill as specified where unstable material has been removed; for general grading; as backfill, except as otherwise specified; and as rough grading under gravel bases for walks, paved areas and the like.

C. Drainage Fill: All material to be placed where Specifications or Drawings call for crushed stone or drainage fill and crushed stone for slab and footing drainage, etc.;shall be clean washed, crushed stone of nominal 1/2" size, approved by Architect. Submit samples. Drainage fill will be uniformly graded as follows:

Sieve Size Square Openings	Percent by Weight Passing Square Mesh Sieve
1 1/2"	100
1"	90 - 100
1/2"	15 - 35
3/8"	0 - 15
No. 4	0 - 5

D. Granular Fill: Granular fill shall consist of sand or gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances.

3. EXECUTION

3.01 EXCAVATION

A. Excavation Classification: The following classifications of excavation will be made when rock excavation is encountered in work.

1. Earth excavation includes excavation of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

2. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 2.0 cubic yard (heaped) capacity (42" wide bucket on track mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90HP flywheel power and 30,000 lb. drawbar pull). Trenches in excess of 10'-0" in width and pits in excess of 30'-0" in either length or width are classified as open excavation.

3. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track

mounted heavy duty excavating equipment without drilling, blasting or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track mounted loader, rated at not less than 170HP flywheel power and developing 40,000 lb. break out force (measured in accordance with SAE J732C).

a. Typical of materials classified as rock are boulders 2 cu.yd. or more in volume, solid rock, rock in ledges and rock hard cementitious aggregate deposits.

b. Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

c. Do not perform rock excavation work, for which additional payment is expected, until material to be excavated has been cross sectioned and classified by Architect. Such excavation will be paid on basis of contract conditions relative to changes in work.

B. Rock Excavation Unit Allowances: Refer to SECTION 01200 - ALLOWANCES, for quantities of Rock Excavation to be included in Contract Price. Variations from these amounts will be credited or paid as applicable by Unit Prices established in the Contract.

C. Unauthorized Excavations: Unauthorized excavations consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be at Contractor's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable by Architect.

2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect.

D. Additional Excavation: When excavation has reached required subgrade elevations, notify Architect who will make an inspection of conditions.

1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Architect.

a. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

E. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

F. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable condition.

1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

G. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run off areas. Do not use trench excavations as temporary drainage ditches.

H. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

2. Dispose of excess soil material and waste materials as herein specified.

I. Excavation for Structures:

1. Excavate foundation areas to bottom of footing elevation or 5’ below existing grade, whichever is lower, or to ledge if ledge is within 5’ of bottom of footing or existing grade. Include in excavation the actual footing bearing area and a 3’ wide strip along both sides of footing.

2. Excavated material containing less than 14% of silt or clay particles may be used for foundation backfill.

J. Excavation for Pavements: Cut surface under pavements to comply with cross sections, elevations and grades as shown.

K. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6” - 9” clearance on both sides of pipe or conduit.

1. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.

2. Where rock is encountered, carry excavation 6” below required elevation and backfill with a 6” layer of crushed stone or gravel prior to installation of pipe.

3. For pipes or conduit 5” or less in nominal size and for flat bottomed multiple duct conduit units, do not excavate beyond indicated depth. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

4. For pipes or conduit 6” or less in nominal size, tanks and other mechanical/electrical work indicated, or, if not otherwise indicated, to 6” below bottom of work to be supported.

5. Except as otherwise indicated, excavate for exterior water bearing piping (water, steam, condensate, drainage) so top of piping is not less than 3’-6” below finished grade.

6. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

7. Backfill trenches with concrete where trench excavations pass within 18” of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.

8. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Architect. Use care in backfilling to avoid damage or displacement of pipe systems.

9. For piping or conduit less than 2'-6" below surface of roadways, provide 4" thick concrete base slab support. After installation and testing of piping or conduit, provide minimum 4" thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.

L. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F (1°C).

3.02 COMPACTION

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density relationship (cohesive soils) determined in accordance with ASTM D 1557; and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well defined moisture density relationship (cohesionless soils).

C. Structures, Building Slabs and Steps, Pavements: Compact top 12" of subgrade and each layer of backfill or fill material at 90% maximum density for cohesive material or 95% relative density for cohesionless material.

1. Compact fill beneath slabs, and behind foundation retaining wall to 95% of Modified Proctor Dry Density. Compact backfill directly behind foundation retaining walls to between 93 and 96% of Standard Proctor Maximum Dry Density (ASTM D698).

   a. Use light hand held compactors. Heavy compactors and grading equipment are not allowed to operate within 10 feet of walls during backfilling.

2. Lawn or Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 85% maximum density for cohesive materials and 90% relative density for cohesionless soils.

3. Walkways: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum density for cohesive material or 95% relative density for cohesionless material.

D. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

2. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.03 BACKFILL AND FILL

A. General: Place acceptable soil material in layers to required subgrade elevations, for each classification listed below.

1. In excavations, use satisfactory excavated or borrow material.

2. Under grassed areas, use satisfactory excavated or borrow material.

3. Under walks and pavements, use subbase material, or satisfactory excavated or borrow material, or combination of both.

4. Under steps, use subbase material.

5. Under building slabs, use gravel fill material.

6. Under piping and conduit, use subbase material where subbase is indicated under piping or conduit; shape to fit bottom 9 deg. of cylinder.

B. Backfill: Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing and perimeter insulation.

2. Inspection, testing, approval and recording locations of underground utilities.

3. Removal of concrete formwork.

4. Exterior foundation walls with backfill one side only have achieved their 28 day design strength or suitable temporary supporting has been provided.

5. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.

6. Removal of trash and debris.

7. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

C. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions and deleterious materials from ground surface prior to placement of fills. Plow, strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

1. When existing ground surface has a density less than that specified under “Compaction” for particular area classification, break up ground surface, pulverize moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density.

D. Placement and Compaction: Place backfill and fill materials in layers not more than 8” in loose depth for material compacted by heavy compaction equipment, and not more than 4” in loose depth for material compacted by hand operated tampers.

1. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.

2. Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

3.04 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition area. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent bonding. Finish surfaces free from irregular surface changes, and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.1' above or below required subgrade elevations.

2. Walks: Shape surfaces of areas under walks to line, grade and cross section, with finish surface not more than 0.1' above or below required subgrade elevation.

3. Pavements: Shape surface of areas under pavement to line, grade and cross section, with finish surface not more than 1/2" above or below required subgrade elevation.

C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.06 PAVEMENT SUBBASE COURSE

A. General: Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course.

B. Grade Control: During construction, maintain lines and grades including crown and cross slope of subbase course.

C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12" width of shoulder simultaneously with compacting and rolling of each layer of subbase course.

D. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

1. Unless shown otherwise provide the following depths of compacted subbase:

Drives and parking areas	15"
Walks	12"
Slabs on grade	12"

2. When a compacted subbase course is shown to be 6" thick or less, place material in a single layer. When shown to be more than 6" thick, place materials in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

3.07 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method), as applicable.

1. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2000 sq. ft. of paved area or building slab, ut in no case less than 3 tests. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying building slab or paved area, but in no case less than 3 tests.

2. Foundation Wall Backfill: Take at least 2 field density tests, at locations and elevations as directed.

B. Additional Testing: If in opinion of Architect, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.08 MAINTENANCE

A. Protection: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

1. Repair and reestablish grades in settled, eroded and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact and replace surface treatment. Restore appearance, quality and condition of surface of finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.09 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Acceptable Excess Soil Material: Transport acceptable excess excavated material to designated soil storage areas on Owner's property.

1. Clean stone material from blasting operations may be placed in such areas.

2. Stockpile surplus topsoil or spread as directed by Architect.

B. Waste Material: Transport waste material, including unacceptable excavated material, trash and debris offsite and legally dispose of.

1. Disposal on Owner's property, by burning, burying or otherwise, will not be permitted.

END OF SECTION