

SECTION 02315

COMMON EXCAVATION, EMBANKMENT AND COMPACTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Common excavation, stockpile subsoil for later reuse. Remove excess from site.
- B. Construct embankments with excavated subsoil and borrow.
- C. Excavate ash layer and rebury onsite in accordance with VRAP.
- D. Grade and rough contour site.
- E. Prepare subsoil and borrow to receive subbase and base gravels and topsoil materials.
- F. Preparation of foundation bearing surfaces.
- G. Place, grade and compact subbase and base gravels to receive pavement.
- H. Compaction requirements.
- I. Dust control.
- J. The following soils report, boring logs, supplemental reports, letters, etc. are included and hereby made a part of these specifications. Construct project in accordance with the recommendations contained in these reports. All references in the construction documents to "Geotechnical Report" or "Soils Report" are to the following:
 - 1. "Geotechnical Engineering Services, Proposed Pearl Place Phase 1 Development, 210 Pearl Street, Portland, Maine" prepared by S.W. COLE ENGINEERING, INC. of Gray, Maine and dated July 7, 2006. Data on the 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 therefrom by the Contractor. Additional test borings and other exploratory operations may be made by the Contractor for the purpose of preparing his bid but these will be at no cost to the Owner.
- K. Comply with the requirements contained within this specification section, the contract drawings, and the recommendations contained with the soils report. In the event of conflicting requirements, the more stringent standard shall apply.

1.02 RELATED SECTIONS

- A. Section 02250 - Dewatering: Dewatering of Excavations and water control.
- B. Section 02317 - Trenching
- C. Section 02320 - Slope Protection and Erosion Control.
- D. Section 02741- Bituminous Concrete Paving.

1.03 UNIT PRICES

- A. See Section 01270 - Unit Prices, for general requirements applicable to unit prices for excavation.
- B. Excavating Ash Materials:
 - 1. Measurement method: By the cubic yard.
 - 2. Includes: Excavating contaminated ash layer (average thickness = 6 inches), re-bury and compact in approved onsite location in accordance with VRAP. Quantity to include in base bid is 600 cubic yards.
 - 3. Does Not Include Over-Excavation: Payment will not be made for over-excavated work nor

for replacement materials.

1.04 REFERENCES

- A. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 1996a.
- B. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 1991.
- C. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 1991.
- D. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System); 1998.
- E. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 1996.
- F. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 1996.
- G. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 1998.

1.05 DEFINITIONS

- A. Common excavation: Excavated material meeting the description of MDOT Specification Section 203.01, except common excavation shall include the removal and disposal of boulders, solid mortared stone masonry, and concrete masonry when each is less than 2 cubic yards in volume.

1.06 SUBMITTALS

- A. Samples: 75 lb sample of each type of fill; submit in air-tight containers to testing laboratory.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.
- E. Moisture Density Test Reports: Results of ASTM D1557 laboratory tests.

1.07 PROJECT CONDITIONS

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Protect plants, lawns, and other features to remain.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Protect above or below grade utilities which are to remain.
- E. Underpin and shore adjacent structures which may be damaged by excavation work, including service utilities, pipe chases and roadways.
- F. Notify Owner of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.
- G. Protect excavations and soil adjacent to and beneath foundations from frost.
- H. Grade excavation top perimeter to prevent surface water runoff into excavations.
- I. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to

prevent cave-in or loose soil from falling into excavation.

- J. Maintenance of existing flows:
 - 1. Keep existing sewers and drains in operation.
 - 2. If existing sewers and drains are disturbed, provide for maintenance of such flows until work is completed.
 - 3. Do not allow raw sewage to flow on ground surface or stand in excavation.
- K. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- L. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
 - 4. Limit stockpile heights so as to preclude ground failure.
- M. The Contractor will be responsible for obtaining any necessary street opening permits from the City of Portland, and complying with the terms and conditions of said permit. The City will not waive the permit fees for this project.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Subsoil: Reused, meeting the requirements of Gravel Borrow or as Common Borrow, provided they comply with the specifications below.
- B. Common Borrow: MDOT 703.18; Earth, suitable for embankment construction, free from frozen material, perishable rubbish, peat, organics and other unsuitable material, with sufficient moisture content to provide the required compaction and stable embankment, moisture content shall not exceed 4 percent above optimum. Determine optimum moisture content in accordance with ASTM D698 (Cohesive Soils) or D1557 (Granular Soils).
- C. Gravel Borrow: MDOT 703.20; Mixture of sand, gravel and silt or reclaimed asphalt, concrete, brick, crushed rock that is crushed and blended with sand, free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that portion passing a 3 inch sieve shall meet the following requirements:
 - 1. No. 40 sieve: 0 to 70 percent passing by weight.
 - 2. No. 200 sieve: 0 to 10 percent passing by weight.
 - 3. Gravel borrow shall contain no particles or fragments with a maximum dimension in excess of one-half of the compacted thickness of the layer being placed. Gravel borrow shall not contain particles of rock which will not pass the 6 inch square mesh sieve.
- D. Aggregate Base: MDOT 703.06 Type 'A' Crushed Gravel, of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 3 inch sieve shall meet the following requirements:
 - 1. 1/2 inch sieve: 45 to 70 percent passing by weight
 - 2. 1/4 inch sieve: 30 to 55 percent passing by weight
 - 3. No. 40 sieve: 0 to 20 percent passing by weight
 - 4. No. 200 sieve: 0 to 5 percent passing by weight
 - 5. Type A aggregate shall not contain particles of rock which will not pass the 2 inch square mesh sieve.
- E. Aggregate Subbase: MDOT 703.06, Type 'D' Gravel, of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 3 inch sieve shall meet the following requirements:
 - 1. 1/4 inch sieve: 25 to 70 percent passing by weight
 - 2. No. 40 sieve: 0 to 30 percent passing by weight
 - 3. No. 200 sieve: 0 to 7 percent passing by weight

4. Type D aggregate shall not contain particles of rock which will not pass the 6 inch square mesh sieve.
- F. Structural Fill: Clean, non-frost susceptible, sand, screened or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation shall meet the following requirements:
 1. 4 inch sieve: 100 percent passing by weight
 2. 3 inch sieve: 90 to 100 percent passing by weight
 3. 1/4 inch sieve: 25 to 90 percent passing by weight
 4. No. 40 sieve: 0 to 30 percent passing by weight
 5. No. 200 sieve: 0 to 5 percent passing by weight
- G. 3/4" Crushed Stone : Meeting the MDOT 703.22 Type C Underdrain Stone.
- H. 1-1/2" Crushed Angular Stone: Meeting the following gradation
 1. 2 inch sieve: 100 percent passing by weight
 2. 1-1/2 inch sieve: 90 to 100 percent passing by weight
 3. 1 inch sieve: 20 to 55 percent passing by weight
 4. 3/4 inch sieve: 0 to 15 percent passing by weight
 5. 3/8 inch sieve: 0 to 5 percent passing by weight

2.02 ACCESSORIES

- A. Water for sprinkling: Fresh and free from oil, acid, and injurious alkali or vegetable matter.
- B. Woven Geotextile Fabric: Non-biodegradable, Mirafi 500x.
- C. Non-woven Geotextile Filter Fabric: Non-biodegradable, Mirafi 160N.
- D. Calcium chloride: ASTM D98 commercial grade except as waived by Owner.

2.03 SOURCE QUALITY CONTROL

- A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- B. If tests indicate materials do not meet specified requirements, change material and retest. Materials failing to meet specified requirements, if used prior to acceptance, shall be removed and replaced at no cost to Owner.
- C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Examine the areas and conditions under which excavating and filling is to be performed and notify Owner in writing of conditions detrimental to proper and timely completion of work
- C. Correct unsatisfactory conditions in a manner acceptable to Owner prior to proceeding with work
- D. Maintain in operating condition existing utilities, active utilities and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.
- E. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- F. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.02 INSPECTION

- A. Verify stockpiled fill to be reused is approved.

- B. Verify areas to be backfilled are free of organics, debris, snow, ice or water, and surfaces are not frozen.

3.03 PREPARATION

- A. When necessary, compact subgrade surfaces to density requirements for embankment, aggregate base and aggregate subbase materials.
- B. Identify known underground utilities. Stake and flag locations.
- C. Identify and flag surface and aerial utilities.
- D. Notify utility companies of work to be done.
- E. Locate, identify, and protect utilities that remain and protect from damage.
- F. Proofroll subgrade surface to identify soft spots.
- G. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill above the groundwater table or crushed stone below the groundwater table .
- H. A 6 to 12 inch thick layer of ash was encountered beneath the fill soil as indicated in the boring logs in the soils report. The ash material shall be segregated and buried beneath the paved area as shown on the site plans in accordance with the VRAP plan prepared by SW Cole Engineering, Inc.

3.04 FOUNDATION PREPARATION

- A. Construct building pads in such a manner as to provide positive drainage of surface water off the pad and to protect the pad surface and subgrade. Construct temporary ditches to carry any surface runoff away from the pad area, as directed by the Owner. At the start of building construction, the pad shall be prepared for foundations and temporary ditches properly backfilled.
- B. Overexcavate and remove all existing fill soils (unsuitable soils) beneath footings to exposed undisturbed stiff silty clay or dense glacial till (undisturbed stable native soils) encountered at depths ranging from about 5 to 10 feet below existing grades. Coordinate with Geotechnical Engineer of Record to observe base of overexcavation prior to backfilling.
- C. Borrow for use beneath the building shall meet the requirements of gravel borrow.
- D. Overexcavate at least 1 foot below footings. Overexcavation shall extend at least 0.5 feet outward from the edge of footings for each foot of overexcavation depth (0.5H/1V).
- E. All footings shall be underlain by a 1-foot (min) thick mat of compacted gravel borrow.
- F. Concrete slab-on-grade floors in heated areas shall be underlain by 12 inches (min) of compacted structural fill. Basement floor slabs shall be underlain by 12 inches (min) of crushed stone overlying a non-woven geotextile fabric.
- G. Soil fill placed adjacent to foundations exposed to freezing temperatures and as backfill around features such as bollards and light pole bases shall be structural fill.
- H. Soil fill placed adjacent to foundations not exposed to freezing temperatures shall be structural fill.
- I. Place all backfill in horizontal lifts and compact such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thickness for soil fills shall not exceed 12 inches, except that the bottom 2 feet of backfill in overexcavations may be placed as one lift as necessary to get above groundwater.
- J. Sub-slab fill shall be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557.

- K. Exterior foundation backfill shall be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557 beneath paved areas, entrance slabs and adjacent to sidewalk areas. All other areas shall be compacted to at least 90 percent of its maximum of its maximum dry density as determined by ASTM D-1557.
- L. Crushed stone shall be compacted to 100 percent of its dry rodded unit weight as determined by ASTM C-29.
- M. Parking garage slab beneath Building 1 shall be underlain with structural fill extending to a depth of 4.5 feet below finish grade. Structural fill shall be hydraulically connected to the perimeter underdrains.
- N. Exterior concrete approach slabs and sidewalks adjacent to the building shall be underlain by at least 4.5 feet of structural fill below the finish grade. The structural fill shall extend beneath the entire length and width of the entrance slab and sidewalk. The thickness of structural fill should transition up to adjacent sidewalk from pavement subgrade at a 1V to 3H slope or flatter. Structural fill shall be hydraulically connected to the foundation drainage system.
- O. Exterior and interior perimeter foundation drainage system using rigid 6-inch diameter SDR-35 pipe shall be provided with 3 inches of $\frac{3}{4}$ " crushed stone above and 6 inches of $\frac{3}{4}$ " crushed stone below the pipe, for a total depth of 15". The underdrain pipe & stone envelope shall be wrapped in non-woven geotextile filter fabric. Set the foundation drain adjacent to the footing, above the 12" working mat.
- P. Exterior foundation backfill shall be sealed with a surficial layer of clayey or loamy soil in areas that are not paved or occupied by entrance slabs to reduce direct surface water infiltration into the backfill.

3.05 EXCAVATING

- A. Underpin adjacent structures which may be damaged by excavating work.
- B. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Excavate materials encountered when establishing required subgrade elevations in accordance with MDOT Specification Section 203.04 and 203.05.
- D. Remove lumped subsoil, boulders, solid mortared stone masonry, concrete masonry and rock up to 2 cubic yards, measured by volume.
- E. Completely remove relic foundations below proposed building and paved areas. Removal of relic foundations is incidental to the contract and will not be paid for under rock excavation.
- F. Conform to elevations, contours, dimensions, line and grade shown on the Drawings.
- G. When excavation through roots is necessary, perform work by hand and cut roots with a sharp axe.
- H. Slope banks of excavations deeper than 4 feet to angle of repose or flatter until shored. All excavations shall be consistent with OSHA regulations.
- I. Remove all existing fill soils from beneath foundations.
- J. Do not interfere with 45 degree bearing splay of foundations.
- K. Correct areas that are over-excavated and load-bearing surfaces that are disturbed at no cost to Owner.
- L. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- M. Remove excavated material that is unsuitable for re-use from site.
- N. Surplus Material:

1. Make arrangements to provide suitable disposal areas off-site
2. Deposit and grade material to the satisfaction of the owner of the property on which the material is deposited.
3. Obtain any necessary permits for disposal.
4. Provide suitable watertight vehicles to haul soft or wet materials over streets or pavements to prevent deposits on same.
5. Keep crosswalks, streets, and pavements clean and free of debris.
6. Clean up materials dropped from vehicles as often as directed by Owner.

3.06 FILLING AND SUBGRADE PREPARATION

- A. Topsoil and pavement shall be removed from proposed fill and pavement areas.
- B. Proofroll subgrades using a 10-ton vibratory roller-compactor, unless otherwise noted. Any areas that continue to yield after 3 to 5 passes of the compaction equipment shall be over-excavated and replaced with clean gravel borrow in dry, non-freezing conditions, and structural fill in other conditions.
- C. Pavement subgrade shall consist of Gravel Borrow compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557.
- D. Landscape and vegetated subgrade shall consist of common borrow compacted to at least 90% of its maximum dry density as determined by ASTM D-1557.
- E. Place and compact fill materials in continuous layers not exceeding 12 inches loose depth upon compacted material.
- F. Fill to contours and elevations indicated using unfrozen materials.
- G. Fill up to subgrade elevations unless otherwise indicated.
- H. Employ a placement method that does not disturb or damage other work.
- I. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- J. Maintain optimum moisture content of fill materials to attain required compaction density.
- K. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- L. Correct areas that are over-excavated.
 1. Pavement areas: Use gravel above the groundwater table in the event of dry, non-freezing conditions or structural fill in other conditions and crushed stone below the groundwater table, flush to required elevation, compacted to 95 percent of maximum dry density.
 2. Other areas: Use Gravel Borrow, flush to required subgrade elevation, compacted to minimum 95 percent of maximum dry density. Use structural fill or crushed stone as necessary to backfill wet areas of overexcavation.
- M. Compaction Density Unless Otherwise Specified or Indicated:
 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 2. At other locations: 90 percent of maximum dry density.
- N. Leave stockpile areas completely free of excess fill materials.
- O. Reshape and re-compact fills subjected to vehicular traffic.
- P. Frost:
 1. Do not excavate to full indicated depth when freezing temperatures may be expected unless fill material or structures can be constructed immediately after the excavation has been completed. Protect the excavation from frost if placing of fill or structure is delayed.
 2. Fill shall not be placed over frozen soil. Soil that is frozen shall be removed prior to

placement of compacted fill. Remove all frozen uncompacted soil prior to placing additional fill for compaction.

- Q. Native soils can undergo substantial strength loss when subjected to construction traffic and excavation activities, particularly during periods of precipitation and shallow groundwater levels. Care must be exercised to minimize disturbance of the bearing soils. Should the subgrade become yielding or difficult to work, disturbed areas shall be excavated and backfilled in accordance with Section 3.06 L.
- R. Clean granular soil meeting the structural fill gradation shall be provided to a depth of 4.5 feet below the top of entrance slabs and sidewalks in contact with the structure. The thickness of structural fill shall extend horizontally from the structure outward to a point at least one foot beyond the width of the slab or sidewalk. The structural fill shall have a gradual transition up to the bottom of the adjacent subbase at a 1V to 3H slope or flatter.

3.07 CONSTRUCTION OF AGGREGATE BASE AND SUBBASE COURSE

- A. Place and compact aggregate base and subbase course materials in continuous layers not exceeding 12 inches loose depth upon compacted material, unless noted otherwise.
- B. Employ a placement method so not to disturb or damage structures and utilities.
- C. Spread well-mixed materials having no pockets of either fine or coarse material.
- D. Do not segregate large or fine particles.
- E. Compact by mechanical means to obtain 95 percent of maximum dry density as determined in accordance with ASTM D1557. Base course material shall be compacted with a minimum of two passes with self propelled vibratory compaction equipment.
- F. Maintain surface, compaction and stability until pavement course has been placed.
- G. Conform to elevations, contours, dimensions, line and grade shown on the Drawings.

3.08 DUST CONTROL

- A. Upon request of Owner, implement the following dust control measures:
 - 1. Apply water and calcium chloride as directed by Owner.
 - 2. Spread calcium chloride uniformly over designated area.
 - 3. Apply water with equipment having a tank with pressure pump and nozzle equipped spray bar acceptable to Owner.

3.09 TOLERANCES

- A. Top surface of base and subbase course: Plus or minus 3/8 inch.

3.10 FIELD QUALITY CONTROL

- A. Provide for visual inspection of base of overexcavation in building areas prior to backfilling as well as load-bearing excavated surfaces before placement of foundations.
- B. Compaction density testing will be performed by the Owner on compacted fill in accordance with ASTM D2922.
- C. Evaluate compaction results in relation to compaction curves determined by ASTM D 698 ("standard Proctor") or ASTM D 1557 ("modified Proctor") as appropriate for soil type.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.
- E. Frequency of Tests:
 - 1. Building subgrade areas, including 10'-0" outside exterior building lines: In fill areas, not less than one compaction test on each lift for every 2,500 square feet. Proofroll and densify cut areas.

2. Areas of construction exclusive of building subgrade: In fill areas, not less than one compaction test on each lift for every 10,000 square feet. Proofroll and densify cut areas.

3.11 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect newly graded areas from traffic and erosion and keep free of trash and debris.
- D. Repair and re-establish grades in settled, eroded and rutted areas within specified tolerances.
- E. Slope fill surfaces to shed water.

END OF SECTION