

SECTION 31 23 01
STRUCTURAL EXCAVATION, BACKFILL, & COMPACTION (BUILDING AREA)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.

1. Refer to Division 1 for applicable local codes and regulations.

1.2 DESCRIPTION OF WORK

- A. This section pertains to an area bounded by 20-feet-minimum outside of and parallel to the exterior walls of the building, including canopies, loading docks, and other structures attached to the building.

- B. This work includes the following:

1. Preparing subgrade for building slabs, walks, and pavements.
2. Preparing crushed stone for support of building slabs.
3. Excavating and backfilling for building structure.
4. Excavating and backfilling of trenches within building lines.
5. Excavating and backfilling for underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.
6. Excavating and backfilling for Mechanical/Electrical Work. Refer to mechanical and electrical sections for excavation and backfill required in conjunction with underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.
7. Final grading and placement and preparation for topsoil for lawns and planting are specified in Division 2.

1.3 QUALITY ASSURANCE

- A. Comply with: New York State Department of Transportation (NYSDOT) "Standard Specifications for Construction and Materials."
- B. Routine testing of existing soils and compacted material for compliance with these specifications will be performed as part of Special Inspections.
1. Compacted material not meeting density requirements shall be removed or recompacted and retested at Contractor's expense.

1.4 SPECIAL INSPECTIONS

- A. Refer to Specification Section 01 45 29 and Schedule of Special Inspections.

1.5 MATERIAL EVALUATION/QUALITY CONTROL

- A. Preconstruction Testing: Contractor shall employ Testing Agency acceptable to Engineer and Architect to perform the following services:
1. Test materials proposed for use by Contractor to verify specified requirements.
 - a. Determine optimum moisture at which maximum density can be obtained in accordance with ASTM D 1557, Modified Proctor.
 - b. Perform particle size analysis in accordance with ASTM D 422.

- B. Submit Testing Agency qualifications demonstrating experience with similar types of projects.
- C. The RDP for Geotechnical Engineering shall perform the following:
 - 1. Identify soils requiring undercutting and replacement while observing proof rolling and when subgrade is exposed.
 - 2. Verify footing bearing strata.
 - 3. Review and accept materials proposed by Contractor for use as compacted fill based on test data and information submitted by preconstruction Testing Agency. Architect shall coordinate review of submittals.
 - 4. Observe and accept filling and compaction procedures.
 - 5. Review and approve preparation of slab-on-grade subgrade and crushed stone.
- D. Geotechnical Engineer shall submit copies of reports to Special Inspector, Engineer, Architect, Construction Manager, and Contractor. Include date of site visit, description of work observed, and summary of observations and recommendations.

1.6 SUBMITTALS

- A. Submit to RDP for Geotechnical Engineering:
 - 1. Gradations for proposed fill materials and mix design proposed for flowable fill at least 15 days before start of backfilling. Flowable fill submittal shall include ASTM C 1260 test results.
 - 2. Product data, specifications, and installation instructions for proprietary materials.
 - 3. Material certifications for products specified to conform with NYSDOT references and ASTM references.
- B. Prior to placement of slab on grade, submit to Special Inspector and RDP for Structural Engineering a written protection program for slab on grade for record only.

1.7 DEFINITIONS

- A. Excavation: Removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.
- B. Unauthorized Excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect. Unauthorized excavation and 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 to Architect.
 - 2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification unless otherwise directed by Architect.

- C. Additional Excavation: If RDP for Geotechnical Engineering determines bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered, and replace excavated material as directed by Geotechnical Engineer.
 - 1. Removal of unsuitable material and replacement as directed will be paid on basis of conditions of contract relative to changes in work.
- D. Subgrade: Undisturbed earth or compacted soil layer immediately below granular subbase, base of structure, or topsoil materials.
- E. Structure: Buildings, foundations, slabs, or other man-made stationary features occurring above or below ground surface.

1.8 PROJECT CONDITIONS

- A. Site Information: Subsurface investigation reports were used for basis of design and are available to Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.
 - 1. Additional test borings and other exploratory operations may be performed by Contractor at Contractor's option; however, no change in contract sum will be authorized for additional exploration.
- B. Existing Utilities: Locate existing underground utilities in work area before starting earthwork operations. Where utilities are to remain in place, provide adequate means of protection during earthwork operations.
 - 1. If uncharted or incorrectly charted piping or other utilities are encountered during excavation, consult with utility owner and Architect immediately for directions. Cooperate with Owner and public and private utility companies to keep services and facilities in operation. Repair damaged utilities as required by utility owner.
 - 2. Do not interrupt existing utilities serving facilities occupied by Owner or others during occupied hours except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.
 - a. Provide minimum 48-hours notice to Architect and receive written notice to proceed before interrupting utilities.
 - 3. Demolish and remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.
- C. Use of Explosives: Do not bring explosives onto site or use in work.
- D. Protection of Property: Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - 1. Perform excavation by hand within drip line of large trees to remain. Protect root systems from damage and from drying out to greatest extent possible. Maintain moist condition for root system, and cover exposed roots with moistened burlap.

1.9 PRODUCT HANDLING

- A. Store materials so as to preserve their quality and fitness for work.

1.10 WORKMANSHIP

- A. Contractor shall be responsible for correction of work not conforming to specified requirements. Correct deficient work as directed by Architect.
- B. Remove work found to be defective. Replace with new acceptable work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General Fill Material: Soil materials free of clay, rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- B. Flowable Fill Material: Cementitious, flowable, excavatable, backfill material having a compressive strength of 50 to 100 pounds per square inch (psi) at 28 days. Provide mix that minimizes shrinkage and is non-expansive.
- C. Structural Fill: Sound and durable sand and gravel, free of deleterious materials such as pyritic shale, organics, or contaminants of a chemical, mineral, or biological nature and conforming to the following limits of gradation:

Percent Passing by Weight	Sieve Size
100	3 inch
90 - 100	2 inch
75 - 90	3/4 inch
35 - 65	1/4 inch
5 - 40	No. 40
0 - 8	No. 200

- D. Crushed Stone: Washed crushed stone, ASTM C 33, Blond 57.
- E. Cushion Sand: Comply with requirements of NYSDOT Section 703-06.
- F. Bedding: Comply with the requirements of NYSDOT Section 703-02, material requirements, crushed stone (703-0201).
- G. Filter Fabric: "Geotex 351" by Propex Geosynthetics; "Mirafi 140N" by Mirafi, Inc.; or accepted equivalent.
- H. Soil Stabilization Geotextile: "Geotex 315ST" by Propex Geosynthetics; "Mirafi 600X" by Mirafi, Inc.; or accepted equivalent.
- I. Excavated Materials: Do not use as structural fill. Do not use as general fill material unless accepted by Geotechnical Engineer.
- J. Vapor Retarder: Provide vapor retarder cover over prepared crushed stone material where indicated below slabs on grade. Use only materials that are resistant to deterioration when tested in accordance with ASTM E 154 as follows:
1. Polyolefin not less than 15 mils thick, in compliance with ASTM E 1745 Class A and with a perm rating less than 0.02 perms.
"Stegowrap 15 mil Class A" by Stego Industries LLC; "Moistop Ultra 15" by Fortifiber Building Products; or "Griffolyn 15 Mil Green" by Reef Industries, Inc.

2. Provide manufacturer's-recommended, pressure-sensitive/water-resistant seam tape and mastic for vapor retarder selected.

K. Geofoam Block Backfill: Molded expanded polystyrene conforming to ASTM C578, Type VIII with a density of 1.25 pounds per cubic foot, minimum block size 2 feet by 2 feet by 4 feet as manufactured by Thermal Foams, Buffalo, NY 716-874-6474; Insulated Building Systems, Winchester, VA 540-662-0882; or accepted equivalent.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Examine substrates and conditions under which work shall be performed. Do not proceed with work until unsatisfactory conditions are corrected.
- B. Maintain drainage and restrict traffic within building area during construction to maintain integrity of subgrade. Failure to observe these precautions will require Contractor to remove disturbed areas and correct at his expense.

3.2 COLD-WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.3 REMOVALS

- A. Clear, grub, and strip site of vegetation, topsoil, and other organic materials.
- B. Remove brick fragments and other construction debris. Plow-strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material can bond with existing surface.
 1. When existing ground surface has a density less than that specified for a particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- C. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris. Legally dispose off Owner's property.

3.4 PROOF ROLLING

- A. Following stripping and removing miscellaneous fill, grade and compact exposed subgrade. Proof roll subgrade by making five passes across building area in each direction using smooth-drum vibrating roller having static weight of 10 tons minimum.
- B. Under cut soft spots that develop during proof rolling and replace with compacted structural fill. Contractor shall be paid for this work on a unit cost basis.
- C. Do not perform proof rolling during or immediately after periods of inclement weather.

3.5 EXCAVATION

- A. Excavation shall be considered unclassified and understood to mean all materials encountered during excavation.

- B. Excavations shall be laid back or sheeted and braced to prevent sloughing in of sides. Maintain sides and slopes of excavations in stable condition until completion of backfill. Incline cut slopes no steeper than permitted by OSHA standards for excavations in soil type(s) encountered.
- C. Hand trim foundation excavations to remove loose soil or ridges of materials left by equipment.
- D. Keep loose material and debris out of excavations.
- E. Shoring and Bracing: Provide materials for shoring and bracing, including sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

3.6 DEWATERING

- A. Dewatering activities shall conform to Stormwater Pollution Prevention Plan (SWPPP) implemented by site operator if required as a condition of construction permit.
- B. Perform excavation and filling in manner and sequence to provide proper drainage at all times.
- C. Prevent surface water and subsurface or groundwater 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 of 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 rainwater and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

3.7 STORAGE OF EXCAVATED MATERIALS

- A. On-site storage of excavated materials shall conform to Stormwater Pollution Prevention Plan (SWPPP) implemented by site operator if required as condition of construction permit.
- B. Stockpile excavated materials acceptable for reuse. Place, grade, and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edges of excavations. Do not store within drip lines of trees indicated to remain.
 - 2. Dispose of excess excavated soil material and materials not acceptable for use as general fill.

3.8 TRENCH EXCAVATION FOR PIPES AND CONDUIT

- A. Excavate trenches to uniform width sufficiently wide to provide ample working room and minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.
- B. Do not locate trenches that are deeper than adjacent footings closer horizontally to the footing than the vertical distance separating the bottom of trench and bottom of footing.

- C. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
 - 1. For pipes or conduit less than 6 inches in nominal size and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
 - 2. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with bedding or tamped cushion sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads to ensure continuous bearing of pipe barrel on bearing surface.

3.9 VAPOR RETARDER INSTALLATION

- A. General: Do not begin installation of vapor retarder until protection is in place. See requirements in Section 03 30 20. Following placement and compaction of crushed stone, place vapor retarder sheeting with longest dimension parallel with direction of concrete slab placement.
- B. Install vapor retarder in accordance with ASTM E 1643, manufacturer's instructions, and as follows:
 - 1. Lap joints 6 inches, and seal vapor retarder joints with manufacturer-recommended seam tape.
 - 2. Extend vapor retarder up walls and penetrations 4 inches minimum.
 - 3. Seal vapor retarder to walls and penetrations with manufacturer-recommended mastic to form continuous barrier.
 - 4. Repair damaged areas by cutting patches of vapor retarder material and placing to overlap damaged areas by 6 inches each side. Seal each side of patch with seam tape.
- C. Do not allow crushed stone material to become wet prior to or after slab placement.

3.10 FILLING, BACKFILLING, AND COMPACTION

- A. Do not place fill material on surfaces that are muddy, frozen, or contain frost or ice.
- B. Place soil stabilization geotextile below crushed stone where shown in drawings after subgrade has been approved and before placement of crushed stone material.
- C. Use structural fill to increase grades within building areas, in trenches, as exterior backfill against walls with footing drains, and as exterior backfill where pavement or walkways abut building.
- D. Contractor may use flowable fill to increase grades and as interior backfill against foundations and in trenches. Allow fill to cure for at least 7 days before setting forms for concrete foundations or placing slab on grade.
- E. Use general fill material to increase grades outside building area except as otherwise specified.

- F. Use crushed stone around footing drains as detailed in drawings. Wrap drainage fill with filter fabric.
- G. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and are carried below bottom of such footings or pass under wall footings. Place concrete to level of bottom of adjacent footing.
- H. Backfill foundation excavations as soon as possible following construction of foundations and foundation walls.
- I. Backfill and fill against foundation walls evenly on both sides to prevent displacement of construction. For walls with fill on one side only, do not backfill until concrete has achieved 70 percent of its design strength and walls have been braced.
- J. Begin filling in lowest section of area.
- K. Place fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- L. Lifts or portions thereof not compacted in accordance with specifications shall be recompacted or removed and replaced to meet compaction requirements.
- M. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density in accordance with ASTM D 1557, Modified Proctor:
 - 1. Under structures, footings, foundations, building slabs, and steps: Compact top 12 inches of subgrade and each layer of fill material to 95 percent.
 - 2. Under pavements: Compact top 12 inches of subgrade and each layer of fill material to 95 percent.
 - 3. Under walkways: Compact top 6 inches of subgrade and each layer of fill material to 95 percent.
 - 4. Under lawn or unpaved areas: Compact top 6 inches of subgrade and each layer of fill material to 90 percent.
 - 5. Cushion sand: Compact to 100 percent.
- N. Where a power roller is used for compaction, do not approach nearer than 10 feet from walls of new or existing construction.
- O. 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. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - 1. Remove and replace or scarify and air dry soil material too wet to permit compaction to specified density.
 - 2. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to satisfactory value.

3.11 TOLERANCES

- A. Excavation for structures shall conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot except to facilitate drainage during construction stage.
- B. Surface of subbase under building slabs shall be graded smooth and even, free of voids, and rolled to required elevation. Provide final grades within tolerance of 1/2 inch when tested with 10-foot straightedge.

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