

SECTION 02200

EARTHWORK

PART 1.00 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work under this section includes, but is not necessarily limited to, the following:
1. Excavating and trenching.
 2. Filling, backfilling, and compacting fill conforming to these specifications where applicable.
 3. Rough grading to required tolerances.
 4. Filling, as directed, excess cut under footings, foundations, and trenches.
 5. The placing of earth for forming and shaping of embankments.
 6. Sheeting and shoring where required and/or necessary.
 7. Maintaining bench marks, monuments, and other reference points. Obtaining accurate placement of final grade. Replacement of any disturbed or destroyed site elements that must be removed due to the nature of the work, furnishing certification by a professional surveyor that all disturbed items have been accurately relocated.
 8. Written notice of readiness of footing excavations, fill materials, fill areas, compacted fills, and items requiring review and/or inspection by the CITY.
 9. Maintaining excavation and trenches free of water.
 10. Excavating, stock piling and placing material suitable for filling and backfilling.
 11. Removing from site all debris, unsuitable material and excess excavated material as specified and/or as directed by CITY.
 12. Restoration to original grades and condition, properties damaged by any activity related to the work, taking adequate precautions to avoid settlement or cave-in of properties higher than site, silting, erosion, or other damage to properties lower than site.
 13. Installing temporary barriers to deter unauthorized access to areas of excavation or other such work which could be hazardous for the duration of the contract.

PART 2.00 PRODUCTS

2.01 MATERIALS

A. Fill materials shall be reviewed, and shall conform to the following unless specifically indicated otherwise:

1. Fill, unless otherwise specified, shall be earth free of debris, cinders, combustibles, frost, ice, roots, sod, wood, cellulose, and organic materials. Up to 30 percent of fill material may be rock-like materials not more than 10" in length, evenly distributed in fill eighteen (18) inches below finished grade.
2. Upper 18 inches of fills under topsoil of lawn and planted areas shall be earth free of debris, cinders, frost, ice, sod, wood and roots of 1/4" in diameter. Up to ten (10) percent of fill materials may be rock-like materials not to exceed 4" in length.
3. Selected backfill shall be excavated materials, free-draining, clean, granular soil suitable for backfill. It shall not be frozen and shall be free from peat, vegetable or organic matter and any other debris and shall be readily compactible.
4. Bank run gravel shall be of a granular nature, the major portion of which may be sand, gravel, and other stone. It shall not be frozen and shall be free from peat, vegetable or organic matter and any other debris and shall be readily compactible. See trench backfill section for size requirements.
5. Fill under foundations and below bottom of concrete floors shall be clean, granular fill from stockpile or from off-site borrow area and shall consist of bank-run sandy gravel or gravely sand free of roots, sod, rubbish or other deleterious organic matter, fine silt, or clay.

B. Crushed gravel base shall conform to the following gradation requirements:

<u>SIEVE SIZE</u>	<u>PERCENT FINER BY WEIGHT</u>
1½"	100
½"	50 - 85
3/8"	45 - 80
No. 4	40 - 70
No. 40	0 - 45
No. 200	0 - 10

Crushed stone shall conform to the following gradation requirements:

<u>SIEVE SIZE</u>	<u>PERCENT FINER BY WEIGHT</u>
2 ¼"	100
2"	90 - 100
1 ½"	30 - 55
1 ¼"	0 - 25
1"	0 - 5

- C. Grain-size distribution curve shall be furnished to CITY by a soil test lab Engineer for all materials supplied on this project.
- D. Areas from which fill material is obtained shall have been completely stripped of topsoil and underlying sandy silt material. No fill shall be brought to site or purchased until such material has been reviewed by CITY. Fill shall conform in quality to sample as provided by the CONTRACTOR which conforms to the gradation requirements set forth herein. Sample materials shall be submitted for review by CITY and maintained as representative for contract duration.
- E. Fill, outside of building toe of slope, shall be earth free of debris, cinders, combustibles, frost, ice, wood, roots, cellulose, and organic materials. Up to 40 percent of fill material may be rock-like materials not to exceed 0.02 cubic foot in volume, nor more than 3" in length.
- F. Class C bedding shall be screened, crushed stone meeting the requirements of ASTM Designation C 33-71A, Gradation 67.

PART 3.00 EXECUTION

3.01 GENERAL EXCAVATION REQUIREMENTS

- A. Where used herein "finished grade" refers to final grade at elevation indicated. Spot elevations govern contour elevations. Subgrade under lawn areas shall be maintained at 6" lower than "finished grade", unless indicated otherwise.
- B. The extent of excavation open at any one time shall be controlled by the conditions, but shall always be confined to the limits prescribed by the CITY.
- C. At least one lane of traffic shall be open at all times. The CONTRACTOR shall take the necessary care in the placement of excavated materials so as not to block the passage of vehicles or pedestrians where access maintenance is required.
- D. No excavated material shall be placed on lawns, driveways or other private property. All disturbed areas shall be restored to conditions as described herein at no additional cost to the CITY.
- E. The CONTRACTOR shall take all necessary measures to protect trees not to be removed from the site of the work against damage from machinery and from excavated material. Branches and roots shall not be cut unless permitted by the CITY.

- F. Trees, cultivated plants, shrubs and hedges which might be damaged by the CONTRACTOR's operations shall be protected or shall be transplanted, maintained, watered, and replanted. Trees to be saved shall be protected by the installation of 2 x 4's wrapped around the trunk to a height of at least six (6) feet with approximately 6-inch to 8-inch spacing, depending on trunk diameter and a snow fence installed at the drip line. If such trees, plants, shrubs or hedges are damaged to the degree that their growth or beauty is affected, they shall be replaced by the CONTRACTOR at their own expense. All surfaces which have been damaged by the CONTRACTOR's operations shall be restored to a condition at least equal to that in which they were found just prior to the start of construction.

Damaged trees shall be replaced at a cost of One Hundred Dollars (\$100.00) per caliper inch and maintained as specified herein.

- G. The restoration of existing property shall be done as promptly as practicable and not left to the end of the construction work.
- H. All existing pipes, poles, wires, curbing, property line markers, fences, walls, or other structures which, in the opinion of the CITY, must be preserved in place without relocation shall be carefully supported and protected by the CONTRACTOR. In the event of damage they shall be restored to their original condition by the CONTRACTOR at their own expense.
- I. The CONTRACTOR shall note that the proposed structures and/or the line of the sewers cross existing utilities in certain locations. These have been shown based on best available information, but not guaranteed as to completeness or accuracy. Notify DIGSAFE before starting earthwork.
- J. As excavation approaches existing utilities or other underground structures, digging with machinery shall cease and the excavation shall be done manually, as directed.
- K. Excavation and backfill operations adjacent to existing utilities, structures, and construction shall be done in such a manner as will prevent the loss of ground or caving in of excavation, the undermining, damage or disturbing of existing pipelines, utilities and structures or any completed construction of the project.

Backfill shall be placed, compacted, and done in such a manner as to prevent future settlement and damage to the existing pipelines, utilities, structures, or construction. Existing pipelines, utilities, structures, new construction, or property damaged due to excavation, backfilling and settlement of the backfill, shall be the responsibility of the CONTRACTOR, and shall be corrected in a manner satisfactory to the CITY, at no additional expense to the CITY.

- L. Unsuitable excavated material shall systematically be separated and removed from suitable material to the satisfaction of the CITY.
- M. Unsuitable material shall be disposed of properly by the CONTRACTOR at no additional cost to the CITY.

- N. Surplus suitable material shall be the property of the CITY and stored on site as directed, or at the CITY's request, this material shall be removed from the site by the CONTRACTOR at no additional cost to the CITY.
- O. Boulders over 16" in length, if encountered, shall be removed from subgrade of cut areas.
- P. Remove obstructions to depth of 6" below new construction and 8" below subgrade in other areas.
- Q. Support banks of excavations, where necessary, to protect persons and property, using suitable combinations of shoring, sheet piling, bracing or other methods.
- R. If excavation goes beyond lines shown in details, CONTRACTOR shall use backfill conforming to materials specified herein and shall compact backfill to 95% or as otherwise directed by the CITY.
- S. Excavations shall be carried to design depths.
- T. If excavation is carried beyond line or below grade, except as directed, or subgrade is made unsatisfactory by act or neglect of CONTRACTOR, they shall remove such unsatisfactory material. No extra payment will be made for replacement with satisfactory fill, or additional concrete, or other method as directed.
- U. CONTRACTOR shall provide adequate dust control during earthwork operations. Public ways shall be cleaned daily if required by intensity of the work, traffic, and weather.
- V. CONTRACTOR shall provide and maintain temporary barricades and traffic controls as required.
- W. Contractor shall install and maintain all erosion control measures in accordance with the Rhode Island erosion control manual.

3.02 CUTTING PAVEMENT

- A. Excavations made on pavement shall be made in a careful manner so as to cause the least amount of damage to the pavement. Roadway pavement in state highways, local roads, sidewalks, and easement having Class 1 and Class 2 bituminous concrete pavement shall be saw cut prior to trench excavation. Pavement and/or cement concrete will be cut six (6) inches either side of the maximum allowable trench width. Any damage to the cut line due to the excavations, backfilling, or removal of temporary pavement shall be recut to neat lines at no additional cost to the CITY prior to replacement of the specified finished pavement. The width of pavement removed shall be kept as narrow as practicable. Existing pavement and base course disturbed or damaged beyond the payment lines indicated shall be replaced by the CONTRACTOR to match existing pavement and base course, at no additional cost to the CITY.
- B. CONTRACTOR shall remove and dispose of existing bituminous concrete pavement as is necessary to perform work of this contract as indicated.

- C. CONTRACTOR shall saw cut, remove and dispose of concrete and bituminous pavement as is necessary to perform the work of this contract. Removal of concrete and bituminous walks shall be performed in a neat manner at the nearest joint of the remaining walk pavement.
- D. Excavated pavement shall not be mixed with other excavated material which is to be used as backfill, and shall be removed immediately from the site of the work. This pavement may be reused as backfill so long as it is cold processed to a maximum dimension of two inches in any dimension and depth of processing is two to three times the depth of the existing bituminous concrete pavement and mixed to a homogeneous gradation.

3.03 ROCK EXCAVATION AND DISPOSAL

- A. Rock excavation shall mean removal and disposal of rock material as directed by CITY.
- B. It is not anticipated that rock shall be encountered. However, CONTRACTOR shall be paid for all rock encountered based on unit prices and items of rock (open/trench) stated elsewhere in this specification.
- C. All rock removal shall be in conformance with local and state authorities having jurisdiction over this work.
- D. Definition of "rock excavation" shall mean:
 - 1. Materials that cannot be removed without systematic drilling and blasting, such as rock material in ledges, or aggregate conglomerate deposits so firmly cemented as to possess the physical characteristics of solid rock.
 - 2. Concrete or masonry structures larger than one (1) cubic yard in volume, and not less than thirteen (13) inches in least dimension.
 - 3. Reinforced concrete larger than one (1) cubic yard in volume, with steel reinforcement.
 - 4. Boulders one (1) cubic yard or more in volume, sound rock material in ledges, bedded deposits and unstratified masses which cannot be removed without blasting.
- E. When, during excavation, material is encountered that CONTRACTOR may classify as rock excavation, such material shall be uncovered and CITY notified by CONTRACTOR. CONTRACTOR shall **not** proceed with excavation of this material until CITY has classified material as earth excavation or rock excavation. Failure on part of CONTRACTOR to uncover such material and notify CITY will cause forfeiture of CONTRACTOR's right of claim for payment of rock excavation.
- F. Blasted rock shall be removed from the site of the work and deposited in such areas as directed by the CITY or at locations selected by the CONTRACTOR with approval of the CITY.

- G. Soft or disintegrated rock or hardpan which can be removed with a hand pick or power operated excavating machines, or loose, previously blasted rock, will not be considered as rock excavation.
- H. Before blasting commences, the CONTRACTOR shall uncover all ledge to be removed. Elevations shall be taken by the CITY Engineering Division. After completing rock removal, elevations shall be taken again by the surveyor. Amounts of ledge removed will be agreed to by CONTRACTOR and CITY.
- I. CONTRACTOR shall develop cross sections to show and determine rock quantities for payment purposes. Cross sections shall be reviewed by the CITY.
- J. Prior to blasting, the CONTRACTOR shall obtain written permission and approval of method from local or other authorities having jurisdiction before proceeding with the work. Explosives shall be stored, handled and employed in accordance with state and local regulations or, in the absence of such, in accordance with the provisions of the Manual of Accident Prevention in Construction of the Associated General CONTRACTORS of America, Inc. In general, no blasting will be allowed within 100 feet of new construction or, in trenches, within 25 feet of laid utility piping. All blasting shall be well covered with heavy mats or timers chained together and the CONTRACTOR shall take great care to do no damage to existing buildings, foundations, and glazed areas. Any damage caused by the work of the CONTRACTOR shall be repaired to the full satisfaction of the CITY.
- K. Wherever rock is shattered below grade and is unfit for foundations, the shattered rock shall be removed and replaced as specified. No extra payment will be made for overbreak or backfill as required.

3.04 STRUCTURE FILL, BACKFILL AND COMPACTED FILL

- A. Fill, backfill and compact fills as necessary to complete the work, with suitable power equipment in accordance with the following, unless specifically indicated otherwise:
- B. Do not start work until fill material, fill areas, and equipment to be used in performing the work have been reviewed by the CITY and foreign materials have been removed.
- C. Loosen existing soil for a depth of 2" just prior to filling.
- D. Surfaces of new subgrades shall be left clean.
- E. Prior to placing fill, existing surface (subgrade) shall have been prepared as specified. When at proper moisture content, surface shall be compacted by rubber-tired roller compactor or drum type vibrator. Maximum thickness of layers measured before compaction shall be 8" for 10 wheel truck or rubber-tired roller compactor and 8" for drum type vibrator, or as otherwise specified. No fill material shall be placed on frozen soil, nor shall snow, ice or frozen earth be brought in as fill. Fill material shall not be placed on material which has been affected by frost or moisture.

- F. No fill materials shall be placed and spread in area within which roller or 10 wheel truck is being operated for compaction. In large areas, fill material shall be placed and spread in layers prior to compaction which will permit orderly pattern for operating compaction equipment. Except as otherwise provided, surface of fill in reach being constructed shall be maintained approximately level.
- G. Placement of fill shall be done in a manner to prevent contamination of selected granular fill by less suitable material being hauled by, or placed adjacent to, building area.
- H. Acceptable on-site material and/or off-site borrow shall be placed in successive, even, horizontal layers to a depth no greater than 8" loose measure for fills within the building areas. Stones larger than 4" shall be removed prior to compaction of each lift. Areas around foundations, walls, or other restrictions which are inaccessible to roller-compactors, shall have granular fill placed in layers to a depth not than 6". Stones larger than 3" shall be removed prior to compaction.
- I. After each layer of fill has been spread, cleared of large stones, and inspected, lift shall be compacted by not less than 4 complete coverages with specified roller, to percent maximum dry density specified, as determined by laboratory tests in accordance with ASTM D 698-66, and field tests in accordance with ASTM D 1556-64.
1. Fill under structure foundations, 95 percent.
 2. Fill under lawn and planted areas, 90 percent.
 3. Fills under surfaced areas: Floors, areaways, gutter curbs, parking areas, walls, walks, terraces, steps, etc., 95 percent.
 4. Top 2' of fill under parking lots and roadways, 95 percent.
 5. Fills and backfills within 4' from outside of walls and fills not otherwise specified, 90 percent.
 6. In confined areas around piers, support posts and adjacent to building foundation walls, where fill cannot be compacted by equipment described above, compaction shall be performed by hand-operated power driven vibratory plate compactors of acceptable type, upon material spread in 8" layers as described above. Compaction shall attain the same relative density of 95 percent, as specified.
 7. Backfill or fill around pipes using hand tools to a point of 12" above pipe. Compact remainder of such fills using small tools such as power-driven tampers and vibrators, to suit fill materials.
 8. Keep power-driven, rider-operated spreading, compacting and other heavy equipment away from damaging in place structures, utilize temporary protection as required. Damaged structures, supports or other site improvements shall be reviewed by CITY,

and manufacturer's representative. If warranties from manufacturer cannot be maintained due to damages sustained, the CONTRACTOR shall replace damaged material with new at no extra cost to the CITY.

9. Where fill is placed around, or on, two sides of any structure, carry it up evenly. Avoid displacement or other damage to such structure.

3.05 COMPACTION EQUIPMENT

- A. CONTRACTOR shall use, for compaction of subgrade and fill in designated areas, equipment at number of coverages stipulated depending upon suitability of equipment for the work, as follows:

1. Rubber-tired roller-compactor, having 4 wheels equipped with pneumatic tires of such size and ply as can be maintained at pressures between 80 and 100 psi with 25,000 lb. wheel load during rolling operation.

Roller-wheels shall be located abreast, and so designed that each wheel will carry approximately equal load in traversing over even ground. Spacing of wheels shall be such that distance between nearest edges of adjacent tires will not be greater than one-half width of one tire at operating pressure for 25,000 lb. wheel load.

Roller shall have body suitable for ballast loading such that load per wheel may be varied, if so directed, between 10,000 lb. and 25,000 lb. roller shall be towed at speeds not exceeding 20 miles per hour.

2. Acceptable drum type vibratory compactor operating at not less than 2,000 vibrations per minute.

- B. In any event, regardless of equipment used, compaction of soil shall meet the relative densities stated in this sections.

3.06 PROJECT CONDITIONS

- A. "Dig-Safe" Damage Prevention System: All Contractors or Subcontractors performing drilling, boring, augering, jetting, sheeting or pile installation, demolition, excavation or like work shall, prior to commencement of these activities, contact utility companies having responsibility for underground transmission systems for information relative to locations of existing underground utilities and/or appropriate dig-safe damage prevention and notification agency.
- B. "OSHA" requirements shall be met and adequate protection measures shall be provided to protect workers and pedestrians passing by the site. Streets adjacent to the property shall be fully protected throughout the operations.

- C. Shoring, sheeting, and bracing and/or prefabricated trenching boxes shall be provided to prevent caving, erosion or gullyng sides of excavation.

- D. Provide for surface drainage and erosion control during the period of construction in a manner to avoid creating a nuisance to adjacent areas. Keep all excavations free of water during the entire progress of the work, regardless of the cause, source or nature of the water.

END OF SECTION