# SECTION 02210

# EXCAVATION AND EMBANKMENT

## PART 1 GENERAL

### 1.01 SUMMARY

A. This work shall consist of excavation, disposal, or compaction of all materials not being removed under some other item, which is encountered within the limits of the work necessary for the construction of the project in accordance with the specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown in the plans. All excavation will be denoted as borrow special excavation, muck excavation, or unclassified excavation as hereafter described.

## PART 2 PRODUCTS

### 2.01 BORROW EXCAVATION

A. Borrow excavation shall consist of excavation made from borrow areas within the project limits and outside the normal grading limits for the completion of embankments. Borrow areas or areas within the project limits from which borrow may be obtained will be designated on the plans.

B. Borrow excavation shall be made only at those designated locations and within the horizontal and vertical limits as stated or directed. On completion of borrow operations, the borrow area will be adequately drained and finished to a neat and uniform grade acceptable to the ENGINEER. Borrow excavation, if required, shall be paid for at the contract unit price bid for "Unclassified Excavation."

### 2.02 IMPORTED BORROW EXCAVATION

A. Imported borrow excavation shall consist of excavation made from areas outside the project limits and outside the normal grading limits for the completion of the embankments. Borrow areas or areas outside the project pits from which the imported borrow may be obtained will be designated. However, any source chosen by the CONTRACTOR will be subject to the approval of the ENGINEER.

B. Imported borrow excavation, if required, shall be paid for at the contract unit price bid for "Imported Borrow."

### 2.03 MUCK EXCAVATION

A. Muck excavation shall consist of the removal and disposal of saturated organic mixtures of soils or organic matter from within the project, not associated with culvert installations, which requires additional work or equipment which would not normally be required for unclassified excavation. When it is necessary that the muck excavation be stockpiled prior to final placement, classification of the material for the second handling shall be determined by the ENGINEER.

## 2.04 UNCLASSIFIED EXCAVATION

A. Unclassified excavation shall consist of the excavation and/or the on-site hauling, stock piling, or placement of the material encountered in the Work, including excavation obtained from borrow sources, not classified under other items of the contract.

## 2.05 SURPLUS MATERIAL

A. Surplus material shall be the quantity of excess suitable material not classified under any other items of the contract, as determined by the ENGINEER, that may be in part the balance between any cut and fill operations, minus any associated shrinkage, that is to be disposed of from the Project.

## 2.06 REJECTED MATERIAL

A. Rejected material shall be the quantity of unsuitable, deleterious, or overly saturated excavated material not classified under any other items of the contract, as determined by the ENGINEER, which is to be disposed of from the Project.

B. For a material to be automatically rejected by the Engineer due to saturation, the moisture content as determined by the nuclear density gauge prior to or during the initial excavation, must be at least twelve (12) percent above optimum moisture. If the material is unsuitable due to moisture content within the range of greater than six (6) percent and less than twelve (12) percent above optimum, the Contractor shall either dry or blend the material to bring it within the specified range for both moisture and density standards, unless it is otherwise in the opinion of the Engineer to be rejected. Import and rejected material associated with blending shall be as quantified, documented, and approved by the Engineer. Material six (6) percent or less above optimum shall be worked, dried or otherwise made compliant with the specified moisture and density.

## 2.07 UTILITY LOCATES IN SUBGRADE PROCESSING FOR ALLEYS

A. The Standard Bid Items of Section 02220 for Utility Locates and Crossings for Trenching operations may be applied to the Subgrade Processing Work, as determined necessary by the Engineer.

# PART 3 EXECUTION

## 3.01 CONSTRUCTION

A. All excavation and embankment work shall be constructed to neat lines and elevations staked by the ENGINEER or shown on the plans. No materials shall be wasted without permission from the ENGINEER. All grading and related operations shall be conducted so that the terrain outside of the limits of construction will not be disturbed. Prior to the commencement of grading operations, all necessary clearing and grubbing in the areas shall have been performed in accordance with Section 02110, CLEARING AND GRUBBING.

B. When embankments are to be placed on a hillside, or where new fill is placed against existing embankment, the slope of the original hillside, or old fill respectively, shall be benched or stepped by cutting into it horizontally, for a minimum distance of thirty-six inches (36”) to provide for secure bonding of the embankment while it is being brought up in layers. Each bench shall be cut as

C. close to the one below as the slope of the ground will permit. Materials thus cut out of the benches shall be incorporated into the new fill at the CONTRACTOR's expense.

D. If it should become necessary, because of weather or other conditions, to suspend grading operations, the entire area worked upon shall be bladed until smooth, free of depressions and ruts, and graded so that no water can collect or be impounded.

E. Embankment placed adjacent to structures shall be brought up in equal layers on all sides to prevent distortion of any of these parts. If it is necessary to deposit embankment on only one side of abutments, wing walls, piers, or culvert headwalls, compaction shall be accomplished without causing overturning of or excessive pressure against the structure. Areas inaccessible to tamping rollers or power rollers shall be compacted by hand or mechanical tampers or other means until the density conforms to adjacent embankment, compacted in accordance with these specifications.

F. Embankment material shall be placed in uniform approximate horizontal layers not exceeding eight inches (8") in loose thickness, for the entire width of the embankment. Each layer of embankment shall be completed, leveled and compacted before the succeeding layer is placed.

G. Embankment which has been subjected to freezing shall be refinished to grade, cross-section and compaction requirements after the frost is out of the ground and the embankment is in suitable condition to work.

H. If, before acceptance of the work, softening of the subgrade surface takes place under construction traffic to a degree unsatisfactory to the ENGINEER, the soft area shall be dug out and backfilled with the same classification of material, and compacted in layers at the required water content to obtain a satisfactory embankment. All cost of such work shall be borne by the CONTRACTOR.

## 3.02 MOISTURE AND DENSITY CONTROL

A. Soil layers shall be processed to satisfy the following moisture and compaction requirements as determined by AASHTO T-180, Modified Proctor Density, unless otherwise specified by the ENGINEER.

Lean clays, sandy lean clays (CL), and Clayey Sands (SC)
Moisture content: Optimum or above
Degree of compaction: minimum 90% of maximum dry density

Fat clay (CH)
Moisture content: minimum of 3% above optimum
Degree of compaction: minimum 88% of maximum dry density

Silty sands, sandy silt, silts, well graded sands, or gravel (SM, ML, SP, SW)
Moisture content: optimum plus 2% or minus 4%
Degree of compaction: minimum 92% of maximum dry density

B. Within the areas indicated on the plans, or as directed by the ENGINEER, earth shall be removed to the designated depth of Subgrade Processing, or to the designated depth of Excavation Below Subgrade. At this depth, it is the CONTRACTOR's responsibility to assure that the exposed soil is inspected for saturated or yielding conditions prior to the spreading, relaying, and compaction of the subgrade material or the excavation below subgrade material. These areas

shall then be reestablished to the specified optimum moisture and density controls for the material type.

C. For Subgrade Processing or for Excavation Below Subgrade, the lower six inches (6") of the specified depth may be left in place and then made uniform by scarifying and thoroughly blending with the moisture content increased or reduced as necessary. Payment for any subsequent necessity to remove this lower six inches shall be incidental to the associated Subgrade Processing or Excavation Below Subgrade bid item.

## 3.03 FREQUENCY OF COMPACTION TESTS

A. For concrete curbs, combined curbs and gutters, and trickle channels a minimum of one test for every one hundred fifty (150) lineal feet, or one per placement if less than one hundred fifty (150) lineal feet, or as otherwise determined necessary by the ENGINEER.

B. For concrete sidewalks, driveway approaches, curb return fillets, valley gutters, and miscellaneous new concrete construction, a minimum of one test for every five hundred (500) square feet, or one per placement if less than five hundred (500) square feet, or as otherwise determined necessary by the ENGINEER.

C. For street, alley, or parking lot paving, a minimum of one test for every five hundred (500) square yards of subgrade surface.

D. For embankment there shall be at least one (1) compliance compaction test for each one-thousand (1000) cubic yards of compacted soil.

E. Additional testing may be required by the OWNER or ENGINEER.

Any failed tests shall be retested after the area has been reworked by scarifying, moisture conditioning, compaction, or other means to obtain desired density requirements.

Testing technician shall have a copy of the proctor curve from which the maximum density and optimum moisture content is derived available on site for review at the time of the test, or otherwise upon request of the ENGINEER.

All expenses incurred to perform retests of failed test areas shall be at the CONTRACTOR'S expense.

The OWNER or ENGINEER may require confirmation tests by an independent testing lab. Acceptance of the compacted soil can be delayed and re-work of the material may be required based on discrepancies between primary tests and confirmation tests.

## 3.04 HAUL

A. When constructing embankments as specified, or wasting, as the case may be, no haul will be allowed on excavated material as a haul item but shall be included in the contract unit price bid for earthwork item or items listed on the Proposal.

## 3.05 FINE GRADING

A. After the earthwork has been substantially completed and after all underground utilities, manholes, catch basins, valve boxes, etc., have been installed or adjusted

to grade, the subgrade shall be brought to the lines, grades, and cross-sections shown on the plans, and compacted to the required density.

B. All soft and unstable material and other portions of the subgrade, which, in the opinion of the ENGINEER, cannot be compacted satisfactorily, shall be removed to lines and grades as directed by the ENGINEER.

C. All boulders appearing in the earth excavation shall be removed or broken off to a depth of not less than four inches (4") below subgrade. All rock sections shall be brought to grade by depositing a satisfactory cushion material to a depth authorized by the ENGINEER.

D. If the surface of an old stone or gravel roadbed conforms approximately to the surface of the finished subgrade, such sections shall be scarified and mixed for the full width of the subgrade to a minimum depth of 1.0 foot (1') to provide uniform moisture and density for the full width.

E. At all times, ditches and drains along the subgrade shall be so maintained as to drain effectively. When ruts of two inches (2") or more in depth are formed, the subgrade shall be brought to grade and if necessary be reshaped and re-rolled. In no case shall any surface course or pavement be placed on a frozen or muddy subgrade. Not less than the top twelve inches (12") of the subgrade shall have a minimum compacted density as specified for embankment.

F. In addition, the finish grade shall not deviate more than one-tenth of a foot (1/10') at any point from the staked elevation. Until the subgrade has been checked and approved, no surface course or pavement shall be laid thereon. Under the square yard method of measurement and payment the CONTRACTOR has the option of deviating from the above tolerances as long as the specified base coarse section and profile is maintained.

## 3.06 PROOF ROLLING

A. The existing soil under areas where the subgrade preparation material has been removed may be specified to be "proof rolled" on the Design Drawings or by the ENGINEER prior to placing or compacting the subgrade material. Proof rolling may also be required at the surface of the subgrade preparation prior to placing base material or paving. This operation will be done in order to determine if there are any soft spots that will require additional work or excavation below subgrade.

B. "Proof rolling" shall be accomplished with a pneumatic tire roller with a minimum weight of twenty-seven tons (27 tons), or a different piece of equipment that exerts approximately the same tire contact pressure on the soil. The roller speed shall not exceed three miles per hour (3 MPH) so that the ENGINEER or his representative may observe any movement in the existing subgrade. A minimum of three (3) passes over the entire surface area will be required for observation, or as otherwise directed by the ENGINEER.

C. Proof rolling is incidental to the associated Subgrade Processing and Excavation Below Subgrade standard items of this section. In the event that soft spots are found on existing soil below subgrade preparation, their repair will be paid for under the associated or relevant pay items.

# PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

## 4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02210.01 UNCLASSIFIED EXCAVATION ABOVE SUBGRADE

This item shall be measured by the cubic yards of material excavated above the top of subgrade by means of average end areas, or by other applicable means as determined by the ENGINEER.

2. 02210.02 EXCAVATION BELOW SUBGRADE

This item shall be measured by the cubic yards of excavated, processed, or scarified material below the bottom of SUBGRADE PROCESSING by means of average end areas, or by other applicable means as determined by the ENGINEER.

3. 02210.03 REJECTED MATERIAL DISPOSAL

This item shall be measured by the cubic yards of rejected material disposed of at the direction of the ENGINEER by means of average end areas, or by other applicable means as determined by the ENGINEER.

4. 02210.04 SURPLUS MATERIAL DISPOSAL

This item shall be measured by the cubic yards of surplus material loaded, hauled, and disposed of from the Project site, or by other applicable means as determined by the ENGINEER.

5. 02210.05 IMPORTED BORROW (CLAY)

This item shall be measured by the cubic yards of imported borrow (clay) placed and accepted in final position by means of average end areas, or by other applicable means as determined by the ENGINEER.

6. 02210.06 IMPORTED BORROW (SAND)

This item shall be measured by the cubic yards of imported borrow (sand) placed and accepted in final position by means of average end areas, or by other applicable means as determined by the ENGINEER.

7. 02210.07X X" PAVED ROAD SUBGRADE PROCESSING

This item shall be measured by the square yard of subgrade acceptably processed to a _____ inch (__") depth and shall apply to all areas that are eleven feet (11') or greater in width and larger than one hundred square yards (100 SY) in size.

8. 02210.08X X" SUBGRADE PROCESSING FOR PATCH

This item shall be measured by the square yard of subgrade acceptably processed to a _____ inch (__") depth and shall apply to all areas that are less than eleven feet (11') in width or less than one hundred square yards (100 SY) in size.

9. 02210.09 CONSTRUCT TEMPORARY HAUL ROAD
This item shall be measured as a lump sum.

10. 02210.10 FINISH GRADING

This item shall be paid as a lump sum for all work associated with the finish grading plans.

## 4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02210.01 UNCLASSIFIED EXCAVATION ABOVE SUBGRADE

Payment shall include all tools, labor, equipment and incidentals necessary to complete all clearing, grubbing, street and drainage excavation, including excavation for sidewalk, curb and/or combined curb and gutter as shown on the Drawings; to construct, shape and slope embankments, cuts, subgrades, shoulders, gutters, ditches, street and alley intersections, approaches and private driveway entrances in the locations, to the elevations according to details shown on the Drawings; to backfill ditches, depressions and behind sidewalk, curb and/or combined curb and gutters; to remove and to place, compact, moisture condition and fine grade embankment, backfill, and compact areas where unsuitable or surplus material has been removed within the limits of the Work and above the top of subgrade; and all other incidental items and operations to complete this item.

2. 02210.02 EXCAVATION BELOW SUBGRADE

Payment shall include all tools, labor, equipment and incidentals necessary to complete the excavation, inspection of exposed soil for saturated or yielding conditions, proof rolling, scarifying, moisture conditioning, placement, and compaction of the existing soil or imported borrow material below the bottom of SUBGRADE PROCESSING.

3. 02210.03 REJECTED MATERIAL DISPOSAL

Payment shall include all tools, labor, equipment and incidentals necessary for the loading, hauling, and disposal of the rejected material.

4. 02210.04 SURPLUS MATERIAL DISPOSAL

Payment shall include all tools, labor, equipment and incidentals necessary for the loading, hauling, and disposal of the surplus material.

5. 02210.05 IMPORTED BORROW (CLAY)

Payment shall include loading and hauling imported material; and for all tools, equipment, labor and incidentals necessary to complete this item of work.

6. 02210. 06 IMPORTED BORROW (SAND)

Payment shall include loading and hauling imported material; and for all tools, equipment, labor and incidentals necessary to complete this item of work.

7. 02210.07X X" PAVED ROAD SUBGRADE PROCESSING

Payment shall include all labor, equipment, tools, and incidentals necessary to remove, scarify, moisture condition, relay and spread materials as necessary; inspect exposed soil or proof roll for saturated or yielding conditions; place and compact existing materials or imported borrow to the specified moisture and density; trim and finish grade the subgrade; proof rolling of subgrade; and any other incidentals necessary to complete this item.

8. 02210.08X X" SUBGRADE PROCESSING FOR PATCH

Payment shall include all labor, equipment, tools, and incidentals necessary to remove, scarify, moisture condition, relay and spread materials as necessary; inspect exposed soil or proof roll for saturated or yielding conditions; place and compact existing materials or imported borrow to the specified moisture and density; trim and finish grade the subgrade; proof rolling of subgrade; and any other incidentals necessary to complete this item.

9. 02210.09 CONSTRUCT TEMPORARY HAUL ROAD

Payment shall include all tolls, labor, materials, equipment and incidentals required to construct and maintain the haul road.

10. 02210.10 FINISH GRADING

Payment shall include all items and incidentals necessary to complete finish grading procedures for minor grading to blend and match from the limits of UNCLASSIFIED EXCAVATION and beyond to the construction limits.