SECTION 203 - EXCAVATION AND EMBANKMENT

203.01 Description. This section describes excavating, hauling, and disposing of surplus excavated material; and placing and compacting specified materials necessary to construct project.

Roadway excavation includes excavating and compacting, or disposing of, all materials of whatever character encountered in the work.

For terminology used in this section, refer to Section 101 – Terms, Abbreviations, and Definitions and ASTM D 653.

203.02 Materials.

Cullet and Cullet-Made Materials

Embankment material shall include mixture of excavated, selected, or borrow excavated material, or combination thereof, and cullet. When cullet is not produced on the project island, or material unit price of cullet is greater than material unit price of virgin material, cullet may be excluded. Before excluding cullet, submit availability and pricing documentation.

Unless otherwise indicated in the contract documents, the following definitions shall apply to this section:

(A) Excavated Material: All material excavated from project site for roadway construction.

(B) Selected Material: Suitable excavated material for specific use from areas within the highway right-of-way.

(C) Borrow Excavated Material: Accepted materials from designated borrow sources outside right-of-way or excavation limits, conforming to requirements of Subsection 106.02 - Material Sources. Borrow excavated material shall conform to size and quality indicated in the contract documents. When the contract documents do not indicate size or quality, borrow material shall be of quality suitable for intended purpose. Borrow material shall be free of roots and other organic matter, garbage, trash, junk, and other deleterious material.

203.03 Construction. Clear and grub in accordance with Section 201 - Clearing and Grubbing, before excavating. Excavate and construct embankment for road, road intersections, and road entrances to a smooth and uniform surface. Excavate so as not to disturb material outside limits of slopes or limits of grading.
203.03  

(A) Excavation.

(1) General. Obliterate old roadways in accordance with Section 202 - Removal of Structures and Obstructions. Blasting will not be allowed.

When encountering possible archaeological, historical, or burial site findings, comply with requirements of Subsection 107.13(B) - Archaeological, Historical, and Burial Sites.

(2) Widening or Flattening Cut Slopes. Submit proposed locations for widening or flattening planned cut slopes to obtain material required for the following:

   (a) Constructing embankment.

   (b) Precluding opening unsightly borrow pits.

   (c) Increasing stability of cut slopes.

Do not proceed with proposed slope widening or flattening until the Engineer accepts proposed locations. Steepening of cut slopes will not be allowed.

(3) Cut Slopes. Round tops and ends of cut slopes in accordance with the contract documents.

   Finish soil cut slopes true and straight in accordance with slope lines and grades indicated in the contract documents.

   Finish cut slopes that are in rock excavation, in a rough condition, with debris and loose material removed. When completed, the average plane of excavated slopes shall conform to slopes indicated in the contract documents. No points shall vary from planned slopes by more than 6 inches when measured at right angles to slope.

(4) Subexcavation. When excavation to finished grade results in subgrade or slopes of unsuitable material as defined in Subsection 101.03 - Definitions, the Engineer will require the following:

   (a) Removing unsuitable material.

   (b) Backfilling to finished grade with acceptable material in accordance with Subsection 203.03(C) - Embankment Construction.
Notify the Engineer two weeks prior to start of subexcavation operations. The Engineer will perform necessary cross-sectional measurements before authorizing backfill placement.

When relative compaction of original ground is less than compaction specified in Subsection 203.03(C)(3) - Compaction of Cut Areas and Embankments With Moisture and Density Tests and Subsection 203.03(C)(4) - Compaction of Embankments Without Moisture and Density Tests, compact upper 6 inches of exposed original ground in accordance with those subsections.

Unsuitable material shall become property of the Contactor and disposal of unsuitable material shall be at no increase in contract price or contract time.

(B) Excavated Material.

(1) Selected Material. Use selected material for the following:

(a) Embankment fill.

(b) Finishing top portion of roadbed.

(c) Constructing roadbed shoulders.

(d) Structure backfill.

(e) Constructing berms.

(f) Erosion control.

(g) Landscaping.

(h) Other purposes in accordance with the contract documents.

Place selected material on roadbed in accordance with Subsection 203.03(C) - Embankment Construction and selected topsoil for erosion control in accordance with Section 209 - Temporary Water Pollution, Dust, and Erosion Control.

Keep selected material in place until it can be hauled and compacted in its final position. If allowed by the contract documents, selected material may be stockpiled at locations accepted by the Engineer, for later placement in final position.

(2) Borrow Excavated Material. Arrange to obtain borrow excavated material and pay costs involved in accordance with
Subsection 106.02 - Material Sources. Submit certified test data demonstrating borrow excavated material to be incorporated in the work conforms to the contract documents. Acceptance of test data will be subject to field verification testing by the Engineer. Notify the Engineer 20 working days before opening borrow areas.

Control of borrow excavated material will be in accordance with Section 106 - Material Restrictions and Requirements.

Excavate to dimensions and elevations established for borrow pit. Remove borrow excavated material after the Engineer completes staking out and cross sectioning of borrow excavated and in-place sites for measurement and payment purposes. Establish and specify finished borrow areas approximately true to line and grade. Complete finished borrow areas so that no water will collect or stand therein.

Place selected material in fill before placing borrow excavated material.

(3) Surplus Selected Material. Unless otherwise indicated in the contract documents, and not over soft ground, use surplus selected material when and in locations accepted by the Engineer to do the following: widen embankments uniformly or flatten slopes; dispose of at Engineer’s designated locations. Dispose of surplus selected material below adjacent roadbed grade. Complete embankments before disposing of surplus selected material.

When indicated in the contract documents, the quantity of surplus selected material is approximate only. Replace shortage of material caused by premature disposal of surplus selected material at no increase in contract price or contract time.

Upon completion of disposal operations, grade disposal area to provide level surface. Unused selected material shall become the Contractor’s property. Supply topographic map of disposal area.

(4) Highly Sensitive Soil. When soil having high moisture content loses its stability and becomes plastic or muddy, excavate with the least manipulation or churning of soil.

(C) Embankment Construction.

(1) General. Strip live, dead, or decayed vegetation, rubbish, debris, and other foreign material from ground surface on which embankment is to be placed. When embankment is required on existing slopes steeper than five horizontal to one vertical, bench those areas as work is brought up in layers. Construct bench of sufficient width to permit operation of placing and compacting
equipment. Use suitable excavated or borrow material, and cullet, or combination thereof in embankment construction. Use of embankment material containing cullet will not be allowed on surface of embankment. Placement of rocks, broken concrete, or other solid materials will not be allowed in embankment areas where deep foundations, such as driven piles or drilled shafts, are to be placed.

When soft or swampy ground condition is encountered that cannot support weight of trucks or other hauling equipment, lower part of fill may be constructed with a working platform. Construct working platform by either placing successive loads of gravel, cobbles, and boulders in a uniformly distributed layer of thickness not greater than necessary; or by using permeable separator with granular material of adequate thickness to support construction equipment. Construct remainder of embankment in accordance with the contract documents.

For minimum depth of 2 feet from subgrade, place embankment material with maximum size of 6 inches and sand equivalent (SE) of 10 or greater, but not less than SE of soil material upon which it is placed. Except as otherwise indicated in the contract documents, embankment material below 2 feet from subgrade may consist of material with maximum size of 6 inches and SE of less than 10 but not less than SE of existing soil on which embankment is placed. Place embankment material in horizontal layers not exceeding 9 inches in loose thickness. Compact as specified before placing next layer. Manipulate material to ensure uniform density and surface smoothness, as compaction of each layer progresses. Add or remove water to obtain required density.

Embankment fill below top 2 feet from subgrade may contain material with rock fragments, hardpan, or cemented gravel larger than 6 inches but less than 3 feet in greatest dimension. Place in compacted lifts of thickness not exceeding approximate size of the rocks and not exceeding 3 feet. Process embankment material to reduce maximum size of particles so that material can be placed in specified lifts. Uniformly distribute larger rock throughout bottom of embankment and place sufficient selected material and other finer rock around large material to fill voids and to produce a dense, compact embankment. Provide earth or fine material to fill voids when not available in excavation.

Finish embankment slopes, as indicated in the contract documents, to within plus or minus 3 inches of lines and grades established and such that slopes contain no unsightly or undue irregularities. Finish top of embankment surfaces in accordance with
Subsection 203.03(D) - Subgrade Preparation. Replace portions that become displaced or damaged prior to acceptance at no increase in contract price or contract time.

(2) **Relative Compaction Test.** Relative compaction test is a procedure for determining ratio of dry unit weight (density) of in-place soil to maximum dry unit weight of same soil, as determined by the following methods:

(a) **Maximum Dry Unit Weight.** Test for maximum dry unit weight in accordance with AASHTO T 180, Method D. Use Hawaii Test Method HDOT TM 5 for sample preparation of sensitive soils when so designated by the Engineer. When oversized materials larger than 3/4 inch exceed 5 percent by weight of total sample, apply corrections to laboratory dry density in accordance with AASHTO T 224. When oversized materials larger than 3/4 inch exceed 30 percent, use compaction procedure specified in Subsection 203.03(C)(4) - Compaction of Embankments Without Moisture and Density Tests.

(b) **Density of Soil In-Place.** Test for soil in-place density in accordance with Hawaii Test Method HDOT TM 1, HDOT TM 2, and HDOT TM 3.

(3) **Compaction of Cut Areas and Embankments With Moisture and Density Tests.** Prior to shaping and compacting, condition soil to moisture content within 2 percent above or below optimum moisture content determined in accordance with AASHTO T 180. Except as specified in Subsection 203.03(C)(4) – Compaction of Embankments Without Moisture and Density Tests, moisture condition embankment material and place in layers not to exceed 9 inches in loose thickness, and compact each layer of material as specified, before placement of next lift. Determine maximum density and relative compaction in accordance with Subsection 203.03(C)(2) – Relative Compaction Test.

In-situ soil or embankment material contained in prism within 2 feet below subgrade and within width of traveled way, auxiliary lane, and shoulder on each side shall have relative compaction of 95 percent or more. When in-situ material within 2 feet below subgrade does not conform to specified relative compaction, excavate and recompact material until specified relative compaction is achieved.

Top 6 inches of in-situ material and embankment material below top 2 feet of subgrade, and beyond traveled way, auxiliary lane, and shoulder prism, shall have relative compaction of at least 90
percent. When in-situ material cannot be compacted to 90 percent, provide working platform to allow 90 percent compaction of first lift.

(4) Compaction of Embankments Without Moisture and Density Tests. Use trial fill section to determine required degree of compaction and method to obtain that compaction, for materials with sufficient coarse material that compaction cannot be determined by Subsection 203.03(C)(2) – Relative Compaction Test. Use trial section to determine type and size of compaction equipment, lift thickness, and number of passes required to obtain compaction acceptable to the Engineer.

For rock fill placement in lifts not exceeding 2 feet in loose lift, the following compaction procedures may be used in lieu of trial section. For rock sizes not exceeding 9 inches in greatest dimension, place material in 12-inch loose lift and compact material full width using one of the following methods:

(a) Two passes of a 50-ton compression-type roller.

(b) Two passes of a vibratory roller having minimum dynamic force of 40,000 pounds impact per vibration and minimum frequency of 1,000 vibrations per minute.

(c) Eight passes of a 10-ton compression-type roller.

(d) Eight passes of a vibratory roller having minimum dynamic force of 30,000 pounds impact per vibration and minimum frequency of 1,000 vibrations per minute.

Operate compression-type rollers at speeds less than 4 miles per hour and vibratory rollers at speeds less than 1.5 miles per hour. For rock sizes not exceeding 14 inches in greatest dimension, place material in 18-inch loose lift and compact material full width with increase in number of roller passes in Subsections (a) and (b) herein by two, and increase number of roller passes in Subsections (c) and (d) herein by four. For rock sizes not exceeding 18 inches in greatest dimension, place material in 24-inch loose lift and compact material full width with increase in number of roller passes in Subsections (a) and (b) herein by four, and increase number of roller passes in Subsections (c) and (d) herein by eight. Use trial fill section as specified in this subsection for embankment with rock sizes 19 to 36 inches in maximum dimension.

(D) Subgrade Preparation. Prepare subgrade to required density, cross section, and grade.
(1) **General.** Prepare subgrade after completing and backfilling drainage facilities and structures and compacting earthwork.

Remove rocks or lumps and fill voids with suitable materials. Material used to fill voids shall conform to specified material to be placed on subgrade.

(2) **Density Requirement.** Compact finish subgrade to relative compaction of 95 percent for depth of 6 inches immediately before placing subsequent material thereon.

(3) **Surface Tolerances of Subgrade.** Finish subgrade upon which pavement structure is to be placed shall not vary more than 0.04-foot above or below theoretical grade.

**203.04 Measurement.** The Engineer will measure:

(A) **Roadway excavation per cubic yard.** The Engineer will compute quantities of roadway excavation by average end area method and centerline distances. Curvature correction will not be applied to quantities within roadway prism, as indicated in the contract documents. In computing excavation quantities from outside the roadway prism, where roadway centerline is used as a base, curvature correction will be applied when centerline radius is 1,000 feet or less.

When roadway excavation quantities by average end area method cannot be computed due to the nature of a particular operation or changed conditions, the Engineer will determine and use computation method that will produce an accurate quantity estimate.

(B) **Borrow excavated material per cubic yard.** The Engineer will compute quantities of borrow material incorporated into the work on a volume basis, using average end area method in place at work site.

(C) **Selected material for planting soil and selected material for decorative boulder will be paid on a lump sum basis.** Measurement for payment will not apply.

**203.05 Payment.** The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:
Pay Item

Roadway Excavation  Cubic Yard

The Engineer will pay for:

(A)  15 percent of the contract bid price upon completion of obliterating old roadways and hauling.

(B)  30 percent of the contract bid price upon completion of preparing subgrade.

(C)  40 percent of the contract bid price upon completion of placing selected material in final position, rounding of slopes, and using water for compaction.

(D)  15 percent of the contract bid price upon completion of disposing of surplus excavation material.

Borrow Excavated Material  Cubic Yard

The Engineer will pay for:

(A)  10 percent of the contract bid price upon completion of staking out and cross sectioning existing condition at borrow excavated and in-place sites and establishing borrow area.

(B)  5 percent of the contract bid price upon completion of providing, replacing, and maintaining temporary and permanent fencing, and confining livestock.

(C)  15 percent of the contract bid price upon completion of all necessary storing and processing of borrow material.

(D)  15 percent of the contract bid price upon completion of watering and hauling material to work site.

(E)  20 percent of the contract bid price upon completion of placing, grading, and compacting material in accordance with contract requirements at work site.

(F)  15 percent of the contract bid price upon completion of restoring and regrading borrow area.

(G)  10 percent of the contract bid price upon completion of staking out and cross sectioning final condition at borrow excavated and in-place sites.

(H)  10 percent of the contract bid price upon completion of removing and disposing of excess and unsuitable material from work site.
The Engineer will pay for accepted quantities of subexcavation, as roadway excavation at the contract unit price per cubic yard, when ordered by the Engineer, for work prescribed in Subsection 203.03(A)(4) – Subexcavation. Payment will be full compensation for the work prescribed therein and in the contract documents.

The Engineer will pay for accepted quantities of unlined gutter excavation as roadway excavation at the contract unit price per cubic yard, when gutter is located as follows: within median area of a divided highway; and between roadbed shoulder and adjacent cut slope. Payment will be full compensation for removing and disposing of excavated material; backfilling and compacting; and for the work prescribed in the contract documents.

The Engineer will not pay for stockpiling selected material, placing selected material in final position, or placing selected material in windrows along tops of roadway slopes for erosion control work, separately and will consider the cost as included in the unit prices for the various excavation contract pay items. The cost is for work prescribed in this section and the contract documents.

The Engineer will not pay for selected material from ditch, channel, or structure excavation, when used instead of borrow excavation.

The Engineer will not pay for overhaul separately and will consider the cost as included in the unit prices for the various excavation contract pay items. The cost is for work prescribed in this section and the contract documents.

The Engineer will not pay for embankment separately and will consider the cost as included in the unit price for roadway excavation. The cost is for work prescribed in this section and the contract documents.

END OF SECTION 203