SPECIFICATION 150 – SURVEY AND STAKEOUT

150-1 DESCRIPTION

150-1.01 Scope - This work shall consist of the performance of all necessary survey work related to the construction of the roadway and structures, staking out, layouts, establishment of lines, elevations, grades and slopes as required, in accordance with the plans and specifications and as ordered by the Engineer. It shall include all the surveying necessary for utility relocations regardless of whether the utility work is performed by the owner or the Contractor.

150-2 MATERIALS

150-2.01 All instruments, equipment, stakes and any other material necessary to perform the work shall be provided by the Contractor. Stakes shall be of a type approved by the Engineer and shall be clearly and permanently marked so as to be legible at all times.

150-3 CONSTRUCTION REQUIREMENTS

150-3.01 General

a. The Engineer will furnish a base line and such reference bench marks as are considered sufficient for the Contractor to carry out his stakeout survey and layout of the project.

b. The Contractor shall furnish for the survey work and stakeout competent and qualified personnel acceptable to the Engineer.

c. The work shall proceed immediately upon issuance of the notice to proceed and shall be expeditiously progressed to completion in a manner and at a rate satisfactory to the Engineer. The Contractor shall keep the Engineer fully informed as to the progress of the survey.

d. It shall be the Contractor's responsibility to maintain the survey and stakeout stakes in their proper position and location at all times.

e. Any existing stakes or markers defining property lines and survey monuments which may be disturbed during construction shall be properly tied in to fixed reference points before being disturbed and accurately reset in their proper position upon completion of the work.

150-3.02 Survey and Stakeout

a. The Contractor shall remove or trim as required trees and brush and remove other interfering objects, not inconsistent with the plans, for survey lines in advance of all survey work to permit accurate and unimpeded work by his stakeout survey crews and the Engineer's cross section survey crews.

b. The exact position of all work shall be established from control points, base line points or other points which are shown on the plans or as modified by the Engineer.

c. Any error, apparent discrepancy or absence in or of data shown or required for accurately accomplishing the stakeout survey shall be referred to the Engineer for interpretation or for furnishing when such is observed or required.

d. The Contractor shall be responsible for the accuracy of his work and shall maintain all reference point stakes, etc., throughout the life of the contract. Damaged or destroyed points, bench marks or stakes, or any reference points made inaccessible by the progress of the construction shall be replaced or transferred by the Contractor. Existing or new control points that will be destroyed during construction shall be transferred or reestablished before they are damaged or

destroyed and all reference ties recorded therefor shall be furnished to the Engineer.

e. All stakeout survey work shall be referenced to the centerlines shown on the plans.

f. All computations necessary to establish the exact position of the work from control points shall be made and preserved by the Contractor. All computations, survey notes and other records necessary to accomplish the work shall be neatly made, shall be made available to the Engineer upon request, and shall become the property of the Authority and delivered to the Engineer prior to final acceptance of the project.

g. The Engineer may check all or any portion of the stakeout survey work or notes made by the Contractor. Any necessary correction to the work shall be made immediately by the Contractor. Such checking by the Engineer shall not relieve the Contractor of any responsibilities for the accuracy or completeness of his work.

h. The Contractor will not be required or permitted to take the pre-construction or final cross sections that are used for payment purposes. These will be taken by the Engineer. However, the Contractor may have a representative as an observer when the cross sections are being taken. The pre-construction cross sections for excavation will be taken before the clearing and grubbing operations. Where borrow is to be placed on the existing ground, the cross sections will also be taken prior to clearing and grubbing.

i. All required right-of-way and easement limits shall be established, staked and referenced by the Contractor concurrent with the construction stakeout survey.

j. The Contractor shall place two offset stakes or references at each centerline station and at such intermediate

points as the Engineer may direct. From computations and measurements made by the Contractor, these stakes shall be clearly marked with the correct centerline station number, offset and cut or fill so as to permit the establishment of the exact centerline location and elevation during construction. If markings become faded or blurred for any reason they shall be restored by the Contractor at the request of the Engineer. The Contractor shall locate and place all cut, fill, slope, grade or other stakes and points as the Engineer may direct for the proper progress of the work. All control points shall be properly guarded and flagged for easy identification.

k. Structures shall be staked out by the Contractor at the locations and elevations shown on the plans or ordered by the Engineer. The Contractor shall also accurately establish the centerline of bearings on bridge abutments and piers by setting special hubs or reference points, so located and protected to insure their remaining undisturbed until such time as they are no longer needed. The Contractor shall accurately mark the location of anchor bolts to be installed and check the elevations of bearing surfaces and set bearing plates at their exact elevation.

l. Before the erection of the superstructure is started, the Contractor shall verify by accurate field measurements the location, both vertically and horizontally, of all bearings and shall assume full responsibility for the superstructure fitting the bearings and substructure as constructed.

m. Permanent survey marker locations shall be established and referenced by the Contractor, including markers required under Specification 621.

n. Prior to the final cross-section survey of the project by the Engineer, the Contractor shall reestablish the centerline or base line points and stationing, as well as any necessary bench marks and control points, as required by the Engineer.

o. During the progress of the construction work the Contractor will be required to furnish the entire surveying and stakeout incidental to the proper location by line and grade for each phase of the work. For paving and other operations requiring extreme accuracy, the Contractor shall re-stake the work with pins or other acceptable hubs located directly adjacent to the work and at the spacing directed by the Engineer.

150-4 METHOD OF MEASUREMENT

150-4.0l No measurement will be made of this item as it will not be paid for directly.

150-5 BASIS OF PAYMENT

150-5.01 Payment

a. All costs of Survey and Stakeout during construction and before the project is accepted shall be included in the unit prices of the various pay items as a subsidiary obligation and the Contractor will receive no direct compensation for such work.

b. When a new contract item is added or the original unit price for a contract item is subject to adjustment under the provisions of Articles 104.02, 104.03 or 104.04 of the General Provisions, the negotiated unit price applicable to such item may include the cost of any additional survey or stakeout work that is considered necessary.

c. No additional compensation will be paid for Survey and Stakeout costs, except as provided in paragraph b above, for any increase in contract time nor for any increases or decreases in contract quantities.

SPECIFICATION 151 – MOBILIZATION

151-1 DESCRIPTION

151-1.01 Scope - This item shall consist of all preparatory work and operations performed by the Contractor, including, but not limited to, those necessary for the movement of his personnel, equipment, supplies and incidentals to the project site; the establishment of all offices, shops, warehouses and any other buildings and areas required; and for other work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site. Mobilization costs for subcontracted work shall be considered as included in this item.

151-2 MATERIALS

151-2.01 Such materials as are required for mobilization and that are not to be a part of the completed contract shall be as determined by the Contractor but they shall conform to all applicable Federal, Commonwealth and local laws, codes and regulations.

151-3 CONSTRUCTION REQUIREMENTS

151-3.01 The work and operations required to complete the mobilization shall be performed in a safe and workmanlike manner and shall comply with all applicable Federal, Commonwealth and local laws, codes and regulations**.**

151-4 METHOD OF MEASUREMENT

151-4.01 The method of measurement will be a lump sum.

151-5 BASIS OF PAYMENT

151-5.01 Partial payments will be made as the work progresses in accordance with the following schedule. Percentages shown are accumulated values.

a. When 2 1/2 percent of the original contract is earned from other bid items, 25 percent of the amount bid for

mobilization or 2 1/2 percent of the original contract amount, whichever is lesser, will be paid.

b. When 5 percent of the original contract amount is earned from other bid items, 50 percent of the amount bid for mobilization or 5 percent of the original contract amount, whichever is lesser, will be paid.

c. When 10 percent of the original contract amount is earned from other bid items, 100 percent of the amount bid for mobilization or 10 percent of the original contract amount, whichever is lesser, will be paid.

d. Upon completion of all work on the project and final acceptance as per Section 109.08 of the General Provisions, payment of any pending amount bid for mobilization will be made.

151-5.02 The total sum of all payments shall not exceed the original contract amount bid for the mobilization item regardless of the fact that the Contractor may have shut down his work in the Project or moved equipment away from the Project and then back again, except when a stop order is issued by the Authority for the convenience of the Authority and for reasons not attributable to negligence or fault on the part of the Contractor. In the case of such stop orders issued for the convenience of the Authority, a claim may be considered for expenses actually incurred by the Contractor for any required moving out and moving in of equipment if such moves are caused by the stop order.

151-5.03 No deduction will be made and no increase will be made in the lump sum mobilization item regardless of any decreases or increases in quantities of other contract item and in the final contract amount nor for any extensions in contract time.

151-5.04 When a new contract item is added or the unit price for a contract item is subject to adjustment under the provision of Sections 104.02, 104.03 or 104.04 of the General Provisions, the

negotiated unit price applicable to such item may include any additional mobilization costs which are considered necessary.

151-5.05 The contract lump sum price paid for mobilization shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in mobilization as specified herein.

151-5.06 When the contract does not include a contract pay item for "Mobilization" as above specified, full compensation for any necessary mobilization required shall be included in the unit prices paid for the various contract items of work involved in the contract and no additional compensation will be allowed therefore.

151-5.07 Payment will be made under:

Pay Item	Pay Unit
Mobilization…….	Lump Sum

SPECIFICATION 201 – CLEARING AND GRUBBING

201-1 DESCRIPTION

201-1.01 Scope - This work shall consist of clearing, grubbing, removing and disposing of all vegetation, debris and miscellaneous structures, not covered under other contract items, within the construction area as specified or directed by the Engineer, except for such objects as are designated to remain. The Contractor shall clear and grub such additional areas within the limits of the right-of-way and easement line as specified or directed. This work shall also include the preservation from injury or defacement of all vegetation and objects designated to remain.

201-2 MATERIALS

201-2.01 No materials are specified.

201-3 CONSTRUCTION REQUIREMENTS

201-3.01 General

a. Clearing shall consist of the felling and disposition of trees and the removal from the natural ground surface and disposal of upturned stumps, stubs, logs, limbs, sticks, vegetation, rubbish, debris and other objectionable matter, including concrete or masonry, occurring within the areas to be cleared.

b. Grubbing shall consist of the removal from the ground and disposal of roots, stumps, stubs, buried logs, debris and other objectionable materials from within the areas to be grubbed.

c. Clearing and Grubbing shall consist of performing both clearing and grubbing operations as set forth above.

d. The Contractor and the Engineer shall make arrangements to take the pre-construction cross sections noted

under Specification 150 before the clearing and grubbing is started.

201-3.02 Limits of Work Areas

a. Unless otherwise specified in the special provisions or shown on the plans, or otherwise directed by the Engineer, the entire length of the project shall be cleared and grubbed to the limits specified below. No payment shall be made to the Contractor for clearing and grubbing outside these limits, unless such work is specifically authorized by the Engineer.

b. The area above the natural ground surface shall be cleared within the following limits:

1. Highway construction areas, including structures, frontage roads or streets, ramps, approaches, ditches and channels, and all other accessory roads and connections that are to be constructed. Such areas shall extend to a width of 1.5 meters outside of structures and excavation and embankment slope lines, except that where slopes are to be rounded, the areas shall extend to the outside limits of slope rounding.

2. Material sites within the right-of-way.

3. Areas enclosed by interchange loops and ramps.

4. Where the construction is to be performed through cultivated areas, all vegetable growth is to be cleared from the entire right-of-way area except for such trees as may be designated to remain.

c. Within the limits of clearing, except in embankment areas where the subgrade surface is to be 1.2 meters or more above the natural ground, the areas below the natural ground

surface shall be grubbed to the depth necessary to remove all stumps, roots, buried logs and all other objectionable material. Such removed objectionable material shall not be left in or under embankments or dikes.

d. All undisturbed stumps, roots and unperishable solid objects within cleared embankment areas where the subgrade surface is to be 1.2 meters or more above the natural ground may remain provided they do not extend more than 0.2 meters above the natural ground at any point and do not extend closer than 0.6 meters to any subgrade or slope line. However, such stumps and roots are to be completely grubbed out where a structure is to be constructed, piles are to be driven, subdrainage trenches are to be excavated, unsuitable material is to be removed, or where the embankment construction requires benching under Specification 203.

e. In cuts, the grubbing of stumps and roots shall be done to such depth that in no case will any portion remaining below grade extend closer than 0.45 meter to any subgrade or slope surface.

f. In areas marked for clearance outside the road prism where no grubbing is required by the Engineer, all stumps shall be cut flush with or below the ground line and any holes backfilled.

g. Except in areas to be excavated, stump holes, cuts, depressions and other holes resulting from clearing and grubbing operations shall be backfilled with suitable material and compacted in accordance with the requirements of Specification 203. No direct payment will be made for such backfilling and compaction, nor for the material required, which are a subsidiary obligation of the Contractor under this pay item.

h. Grubbing of pits, channel changes, and ditches will be required only to the depth necessitated by the proposed excavation within such areas.

201-3.03 Trees to Remain

a. The trees that are to remain shall be pruned of undesirable wood and the resulting crown shaped to the natural form of the kind of tree and as approved. Any and all branches interfering with or hindering the healthy growth of the tree shall be removed. All diseased branches and all dead branches 2.5 centimeters or more in diameter shall be removed. Any branch which may be partly dead, yet has a healthy lateral branch at least one-third the diameter of the parent branch shall be removed beyond the healthy branch. All stubs or improper cuts resulting from former pruning shall be removed. All cuts shall be cleanly made with sharp tools, flush with parent trunk or limb, and all large bark wounds shall be scar traced to the satisfaction of the Engineer.

b. Tree wounds, cuts or scars resulting from the Contractor's operations shall be carefully dressed in accordance with accepted horticultural practice. Dressing for treating tree wounds or cuts shall be any one of the paints listed in Specification 713 - Roadside Improvement Materials.

c. Branches of trees designated to remain which extend over the roadway and which hang within 6 meters of finished grade shall be cut off close to the boles in a workmanlike manner. Other branches of these trees shall also be removed in such manner that the trees present a balanced appearance. All trimming shall be done in accordance with accepted horticultural practices.

SPECIFICATION 201 – CLEARING AND GRUBBING

201-3.04 Felling of Trees

In order to minimize damage to trees that are to be left standing, trees to be removed shall be felled toward the center of the area being cleared if so required by the Engineer. When necessary to prevent damage to structures, other trees or property, or to minimize danger to traffic, trees shall be cut in sections from the top downward.

201-3.05 Protection and Restoration

The Contractor shall prevent damage to existing pipes, conduits, wires, cables or structures above or below ground. No land monuments, property markers, or official datum points shall be damaged or removed until an authorized agent has witnessed or otherwise referenced their location and approved their removal.

201-3.06 Disposal

a. Unless other wise set forth in this Specification, the Special Provisions or contract plans, or authorized by the Engineer, all wood, brush, grubbed stumps, debris, and other objectionable materials shall be removed from the right-of-way and disposed of by the Contractor at other suitable sites in conformance with the prevailing laws, ordinances, regulations and rules bearing on this matter.

b. No burning shall be permitted.

c. Disposal locations outside the right-of-way shall be obtained by the Contractor at his own expense. The Contractor shall make all necessary arrangements and shall present to the Engineer, prior to their use, copies of the written agreements with the property owners on whose property the materials and debris are to be placed. The agreements shall be so worded as to save harmless the Authority from responsibility or liability in connection with the placing of the material on said properties.

d. All merchantable timber in the clearing area which has not been removed from the right-of-way prior to the beginning of construction, shall become the property of the Contractor, unless otherwise provided.

e. When permitted by the Special Provisions or the plans, disposable material may be buried at locations shown n the plans or approved by the Engineer within the right-of-way but outside of the embankment areas.

f. When permitted by the Special Provisions or the plans, disposable material may be used to widen embankments and flatten embankment side slopes under conditions and procedures approved by the Engineer. Such disposal requires the breakup of the material into sizes suitable for placing and covering with earth.

g. Under no circumstances is disposal to be made in swamps or wetlands.

h. There is to be absolutely no end dumping of disposable material over the side of the embankment.

i. All disposal areas on the right-of-way are to be finally covered with a minimum of 0.6 meters of earth and graded to drain properly. The earth for the covering shall be obtained by the Contractor at his own expense with no direct payment to be made. Waste material from project excavations not needed for embankments or other construction may be used provided it is suitable for the purpose and is authorized by the Engineer.

201-4 METHOD OF MEASUREMENT

201-4.01 Measurement of clearing and grubbing will be by one or more of the following alternative methods as called for in the Proposal Schedule:

SPECIFICATION 201 – CLEARING AND GRUBBING

a. Area Basis - The work will be measured by the cuerda, computed to the nearest hundredth, of area of clearing and grubbing completed and accepted. Areas not staked for clearing and grubbing will not be measured for payment. Bare areas and areas occupied by existing roadways not requiring clearing and/or grubbing will be excluded from the measurement. Clearing required for erecting right-of-way fencing will be excluded from measurement and the required clearing for such work shall be a subsidiary obligation of the Contractor under the fencing pay items, except when the clearing of such areas falls within the limits designated on the plans or within the limits indicated in Article 201-3.02 of this specification. Clearing and grubbing of disposal sites or material sites outside the right-of-way will not be measured for payment.

b. Lump Sum Basis - When clearing and grubbing is included in the Proposal Schedule as a lump sum item, no direct measurement of area will be made.

c. Individual Unit Basis - When the Proposal Schedule calls for selective cutting of trees and removal of stumps by individual unit basis, the units will be designated and measured as stated below.

1. The diameter of trees will be measured at a height of 1.0 meter above ground. Trees less than 0.30 meters in diameter will be classed as brush and will not be measured for payment.

2. Stumps will be measured by taking the average diameter at the cut-off.

3. Trees will be designated in relation to their diameter at 1.0 meter above ground and stumps by their diameter at cut-off, as follows:

0.30 to 0.60 meter	-	Small
Over 0.60 meter	-	Large

201-5 BASIS OF PAYMENT

201-5.01 The accepted quantities of clearing and grubbing will be paid for at the corresponding contract unit prices which will constitute full compensation for furnishing all materials, labor, equipment and incidentals necessary to satisfactorily complete the work as specified, including the removal and disposal of all the resulting material. Payment will be as follows:

a. Area Basis - The areas measured and approved for payment will be paid for at the contract unit price per cuerda.

b. Lump Sum Basis - The lump sum price paid shall constitute full compensation for any estimated quantities shown in the contract documents. Partial payments will be made in proportion to the amount of this work satisfactorily completed and accepted by the Engineer.

c. Individual Unit Basis - When individual unit quantities of selective cutting of trees and removal of stumps are called for in the contract, the accepted quantities will be paid for at the contract unit prices for the respective items.

201-5.02 No separate payment will be made for any excavation, backfill or earth cover necessary to complete the work of disposal outside the embankment area nor for the work in the handling, storing, rehandling and hauling of disposable material within or off the right-of-way.

201-5.03 When the item of clearing and grubbing is paid for on a lump sum basis, any adjustment in compensation due to an increase in the quantity of work to be performed which is ordered by the Engineer, will be computed on the basis of the ratio of the increase in

area cleared and grubbed to the original plan area applied to the original contract lump sum price.

201-5.04 When the contract does not include pay items for clearing and grubbing, any clearing and grubbing that may be required shall be performed by the Contractor and will not be paid for directly but this work shall be a subsidiary obligation of and its cost included under other contract pay items.

201-5.05 Payment will be made under:

Pay Item	Pay Unit
Clearing and Grubbing…….....	Cuerda
Clearing and Grubbing……	Lump Sum
Cutting and Removing Trees, Small……	Each
Cutting and Removing Trees, Large……	Each
Removal of Stumps, Small……..	Each
Removal of Stumps, Large……..	Each

SPECIFICATION 202 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

202-1 DESCRIPTION

202-1.01 Scope

a. This work shall consist of the removal, wholly or in part, and satisfactory disposal of all buildings, building foundations, fences, structures, old pavements, and any other obstructions which are not designated or permitted to remain, except for the obstructions to be removed and disposed of under other items in the contract. It shall also include the salvaging of designated materials and backfilling the resulting trenches, holes, and pits.

b. When the contract does not include pay items for removal of structures and obstructions as described in this specification, such work will not be paid for directly, but shall be performed as a subsidiary obligation of the Contractor under other contract items.

c. Regardless of the pay items included in the proposal schedule and shown on the plans, it is the Contractor's responsibility to determine the quantity and nature of structures and obstructions to be removed from within the project and to bid accordingly.

202-2 MATERIALS

202-2.01 No materials are specified**.**

202-3 CONSTRUCTION REQUIREMENTS

202-3.01 General

a. The Contractor shall raze, remove and dispose of all buildings and foundations, structures, fences and other obstructions, any portions of which are on the right-of-way,

except those items for which other provisions have been made for their removal. Any salvable material will become the property of the Contractor unless otherwise specified in the contract documents. Any salvable material specifically designated to remain the property of the Authority shall be removed without unnecessary damage and transported to the place or places specified in the contract documents at the Contractor's expense. The repair of any damage to materials designated to be salvaged for the Authority which is due to negligence by the Contractor will be at the Contractor's expense.

b. Unless otherwise specified or authorized, material not salvaged shall be disposed of outside the project right-of-way in areas selected by the Contractor. Copy of the written permissions of the property owners on whose property the material is to be deposited shall be furnished by the Contractor to the Engineer.

c. Basements or cavities left by structure removal shall be filled with suitable material to the level of the surrounding ground and, if within the prism of construction, shall be compacted in accordance with Article 203-3.05 of Specification 203 - Excavation and Embankment.

202-3.02 Removal of Bridges, Culverts and Other Drainage Structures

a. Bridges, culverts and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic.

b. Unless otherwise directed, the substructures of existing structures shall be removed down to the natural stream bottom and those parts outside of the stream removed down to natural ground surface. Where such portions of

existing structures lie wholly or in part within the limits for a new structure, they shall be removed as necessary to accommodate the construction of the proposed structure.

c. Steel structures that require special dismantling and salvaging procedures are identified in the contract documents. All other structures will be dismantled and removed by the Contractor and all salvable material will become the property of the Contractor and shall be removed from the right-of-way or disposed of in a manner approved by the Engineer.

d. Blasting or other operations necessary for the removal of an existing structure or obstruction, which may damage new construction or adjacent structures to remain, shall be completed prior to placing the new work.

202-3.03 Removal of Pavement, Sidewalks, Curbs, etc.

All pavement, base course, sidewalks, curbs, gutters, etc., designated for removal, shall be broken up and disposed of in areas approved by the Engineer.

202-3.04 Dust Control

Provision shall be made at every demolition site to control the amount of airborne dust resulting from demolition operations by wetting the debris and other materials and the immediate work area with appropriate spraying agents or other means acceptable to the Engineer.

202-3.05 Rodent Control

a. Prior to the demolition of any buildings in projects in urban areas, the Contractor shall exterminate rodents in each of the buildings to be demolished. The extermination shall be performed by an exterminator duly licensed by the

Commercial Poisons Division of the P. R. Department of Health and with at least five (5) years of experience in rodent extermination. The exterminator shall, upon request, present to the Engineer, evidence of both the license and required experience.

b. The exterminating work shall be performed in a manner acceptable to the Engineer and in accordance with the requirements of the P. R. Department of Health. Normally, bait shall be placed at least 14 calendar days and not more than 30 calendar days before actual demolition is started.

202-4 METHOD OF MEASUREMENT

202-4.01 Method of Measurement

a. When the contract stipulates that payment will be made for removal of structures and obstructions on a lump sum basis, the pay item will include all structures and obstructions encountered within the right-of-way in accordance with the provisions of this specification.

b. Where the proposal stipulates that payment will be made for the removal of specific items on a unit basis, measurement will be made by the unit stipulated in the contract. Linear, area and volume measurements will be to the nearest tenth of the pay unit.

202-5 BASIS OF PAYMENT

202-5.01 The accepted quantities of removal of structures and obstructions, determined as provided above, will be paid at the contract unit price or lump sum price as called for in the Contract, which price shall be full compensation for the removal and disposal of all structures and obstructions, for the excavation and backfill incidental to their removal and for dust and rodent control. The price

shall also include all costs for the removal and salvage of any materials specified to be retained by the Authority, their custody, preservation, storage and disposal as specified in the contract documents.

202-5.02 Payment will be made under:

Pay Item	Pay Unit
Removal of Structures and Obstructions……	Lump Sum
Removal of…….	Each
Removal of…….	Lineal Meter
Removal of…….	Square Meter
Removal of…….	Cubic Meter

SPECIFICATION 203 – EXCAVATION AND EMBANKMENT

203-1 DESCRIPTION

203-1.01 Scope - This work shall consist of roadway excavation, borrow excavation, hauling of excavated material, embankment construction, and disposal of material in accordance with these specifications and in conformance with the lines, grades, and dimensions shown on the plans or established by the Engineer.

203-1.02 Roadway Excavation - Roadway excavation will include excavation and grading for roadways, parking areas, intersections, approaches, slope rounding, benching including that under side hill fills, waterways, channels and ditches; removal of unsuitable material from the roadbed and beneath embankment areas; excavating selected material found in the roadway as ordered for specific use in the improvement; and removal of slide material. Roadway excavation will be classified as unclassified excavation, rock excavation, undercut excavation, or muck excavation as hereinafter described.

203-1.03 Unclassified Excavation - Unclassified excavation shall consist of excavation, utilization or disposal of all material of whatever character encountered in the work, including selected material, which is not classified and included in the contract under other pay items.

203-1.04 Rock Excavation - Rock excavation shall consist of excavation, utilization or disposal of igneous, metamorphic or sedimentary rock which cannot be excavated without drilling, blasting or the use of a ripper driven by a tractor having a flywheel horsepower of no less than 300. It also includes the excavation of all boulders or other detached stones each having a volume of two (2) cubic meters or more. When the contract does not include a pay item for Rock Excavation, the excavation of any rock encountered will be considered as Unclassified Excavation for measurement and payment purposes.

203-1.05 Undercut Excavation - Undercut excavation shall consist of the excavation and disposal of soils considered unsuitable

for the foundation of the roadway or embankment as shown on the plans or as ordered by the Engineer. It does not include the excavation of rock below subgrade elevation required by Paragraph 203-3.01b. Undercut excavation shall be considered for measurement and payment purposes as "unclassified excavation" unless it also meets the definition of "muck excavation" in which case it shall be so classified for measurement and payment purposes.

203-1.06 Muck Excavation - Muck excavation shall consist of the removal and disposal of saturated and unsaturated mixtures of soils and organic matter not suitable for foundation material from below the natural ground level of marshes, swamps and bogs over which embankments are to be constructed, and which can not be excavated using dozers or scrapers but which must be excavated by shovel dipper, clam shell, drag line or other similar earth lifting equipment.

203-1.07 Borrow - Borrow shall consist of the material required for the construction of embankments, replacement of unsuitable materials, or for use in other portions of the work, in excess of the quantity of suitable materials available from the required grading, cuts and excavations. Unless otherwise provided in the contract, the Contractor shall make his own arrangements for obtaining all required borrow material and shall pay all costs involved which shall be included in the contract unit price for borrow.

203-1.08 Hauling - This work shall include the hauling and placing in embankments and in miscellaneous backfills all suitable materials obtained from roadway and borrow excavation. It shall also include the hauling and disposal of all surplus and unsuitable materials at the locations in the project indicated on the plans or selected by the Engineer, or at sites outside the project limits provided by the Contractor at his expense.

203-1.09 Embankment Construction - Embankment construction shall consist of constructing roadway embankments, including the preparation of the areas upon which they are to be placed; the construction of dikes within or adjacent to the roadway,

the placing of material within roadway areas where unsuitable material has been removed and in pits, holes and other depressions within the roadway area. This work also includes the compacting of all placed material to meet the requirements of the plans and these specifications, and proof rolling when called for in the plans.

203-1.10 Proof Rolling - Proof rolling shall consist of applying test loads over the subgrade surface or the top surface of the subbase, whichever is higher, by means of a heavy pneumatic-tired roller to locate and permit the correction of deficiencies likely to adversely affect the performance of the pavement structure.

203-1.11 Clearing and Grubbing - When the contract does not include a separate pay item for clearing and grubbing, any necessary clearing and grubbing required to complete the excavation and embankment item shall be performed by the contractor as a subsidiary obligation under this item with no additional compensation to be paid to the Contractor.

203-2 MATERIALS

203-2.01 Material for embankments and roadway foundation shall consist of suitable material obtained for the roadway excavation or borrow. It shall contain no muck, and no trees or tree boles, stumps, standing or matted brush, matted roots or rubbish.

203-2.02 Unsuitable Material - Unsuitable material indicated on the plans or encountered during the roadway excavation shall be disposed of as shown on the plans or as directed by the Engineer. Unsuitable material is defined as:

a. Material determined by the Engineer to be of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content; or

b. Soils that attain their maximum density at optimum moisture content in excess of 30% as determined by AASHTO T-180 Method D; or

c. Soils that attain a maximum dry density of less than 90 pounds per cubic foot as determined by AASHTO T-180 Method D; or

d. Under certain conditions, soils classified as A-2-6, A-2-7, A-4, A-5, A-6 or A-7 under AASHTO M 145 may be considered unsuitable for the subgrade as indicated on the plans or as determined by the Engineer.

The removal and disposal of such unsuitable material will be measured and paid for as unclassified excavation except that if it falls under the classification of muck excavation as defined in Article 203-1.06 it will be paid for under muck excavation.

203-2.03 Borrow - Borrow material shall consist of fragments of rock, gravel, sand, silty or clayey sand and gravel, disintegrated rock, caliche or a mixture of these materials, that meet the requirements specified below. It shall be free from vegetable matter and lumps of clay, and of stone or rock fragments larger than specified below. Oversize material shall be removed at the pit or on the road except that if the material is of such nature that it will break down under blading and rolling, the Engineer may permit breaking it down to the required size at the pit or on the road. Borrow material shall meet the following requirements:

a. Borrow Class A - This is a general purpose borrow material. It shall be a soil or soil-aggregate mixture classifiable as A-1, A-2, A-3 or A-4. It shall be capable of meeting the construction requirements for embankments and compaction included in Articles 203-3.03, 203-3.04 and 203-3.05 of this specification including compaction to 95% of the maximum density determined as per AASHTO T-180 Method D. The maximum size of any stone or rock fragment

shall not exceed 30 centimeters except that when this material is used within 60 centimeters of the subgrade elevation, the maximum size shall not exceed 20 centimeters.

b. Borrow Class B - This borrow material shall be a granular soil classifiable as an A-1, A-3, A-2-4, A-2-5 or a soil having less than 6% passing the No. 200 sieve. It shall be free of stone or rock fragments larger than 30 centimeters in their greatest dimension. When this borrow is for use as a fill or backfill where it shall be below ground water elevation, the fraction of the material passing the No. 200 sieve shall not exceed 15%.

c. Borrow Class C - This borrow material shall consist of any non-organic soil classifiable under any of the AASHTO M-145 classification groups, except A-3 and A-8, which is acceptable to the Engineer, and which can be compacted with normal compaction efforts to the approval of the Engineer. The maximum size of any stone or rock fragment shall not exceed 20 centimeters. This borrow is normally intended for use in the flattening of slopes.

d. Borrow Class D - This borrow material shall consist of a highly impervious clayey soil classifiable as an A-6 or A-7 but with a minimum Plasticity Index (PI) of 25. It is intended for use as an impervious layer under grass medians and outside shoulder areas as indicated on the plans or ordered by the Engineer, to impede the infiltration of rainwater into the subgrade.

e. When borrow is included as a pay item in the contract but the class is not specified, Borrow Class A shall be furnished.

f. Beach sand will not be accepted as borrow material except from sources authorized by the Department of Natural Resources.

203-2.04 Sampling and Testing

a. Intentionally omitted.

b. Intentionally omitted.

c. Throughout the construction operations, the Engineer will take random samples of the borrow materials in place for testing. If the random in-place samples fail to meet the specification requirements, additional sampling and testing will be performed as necessary to ascertain the volume of failing borrow material.

d. For Borrow Class A, the Authority, at its discretion, may allow the deficient in-place material to remain provided it is not classified as unsuitable. If accepted, such deficient material will be subject to a reduction in unit price determined in accordance with the procedure included in Article 203-5.01 of this specification.

e. For Borrow Class B, in-place material with a PI excess of 20 or with a fraction passing the No. 200 sieve in excess of 15% when used below ground water elevation and 45% in other cases, shall be removed and replaced with material meeting the specification requirements at the Contractor's expense. Deficient in-place material not exceeding these limits may be accepted, at the discretion of the Engineer, but subject to a reduction in unit price determined in accordance with the procedure included in Article 203-5.01 of this specification. Material having less than 6% passing the No.200 sieve, will not be tested for Atterberg limits.

f. For both Borrow Classes A and B, the price reduction requirements will be disregarded when the fraction of the material passing the No. 40 sieve does not exceed 10%.

g. For Borrow Class D, in-place material with a PI of less than 15 shall be removed and replaced with material meeting the specification requirements at the Contractor's expense. Deficient in place material not exceeding this limitation may be accepted, at the discretion of the Engineer, but subject to a reduction in unit price determined in accordance with the procedure included in Article 203-5.01 of this specification.

h. The Contractor may elect to remove any deficient in-place borrow material and replace it with material meeting the specification requirements at his expense.

203-2.05 Selected Material

a. Selected material shall be defined as material which is excavated from a location within the right of way or other designated location as specified in the special provision or shown on the plans, and the Contractor shall have no choice in such selection. Selected material shall be used as shown on the plans or provided by the special provisions. Topsoil excavated within the limits of the project shall be considered as a selected material unless a separate pay item is provided in the contract for topsoil.

b. Whenever practicable, selected material shall be hauled directly from excavation to its final position in the roadway prism and compacted in place and such work shall be paid for at the contract price for unclassified excavation. Selected material shall remain in place until it can be placed in final position as provided above. No additional compensation will be allowed for any delay or inconvenience in excavation operations, except that if ordered in writing by the Engineer, selected material may be excavated and stockpiled at locations designated by him and later placed in final position in the roadway.

c. Excavating and stockpiling selected material, if required and authorized, will be paid for at the contract price for unclassified excavation. Removing the selected material from stockpiles and placing it in final position in the roadway will be paid for again at the contract price for unclassified excavation except that the quantities to be paid for will be determined from measurements of the material in the stockpiles prior to removal.

203-3 CONSTRUCTION REQUIREMENTS

203-3.01 General Requirements - Excavation

a. The excavation shall be finished to reasonably smooth and uniform surfaces and shall be conducted so that the materials outside of the limits of slopes will not be disturbed. Excavated material, regardless of excavation procedures used, shall conform to the size limitations required to comply with paragraphs 203-3.04c. and d. as applicable. Prior to beginning excavation operations in any area, all necessary clearing and grubbing in that area shall have been performed in accordance with Specification 201 - Clearing and Grubbing. Cross sections for the purpose of measuring the amount of excavation will be taken prior to the clearing and grubbing operations.

b. Unless otherwise specified, material classified as rock shall be excavated to a minimum depth of 15 centimeters below subgrade elevation within the limits of the roadbed between outside edges of shoulders, and the excavation backfilled with an A-1, A-2-4 or A-2-5 material. Care shall be taken that undrained pockets shall not be left on the surface of the rock.

c. Rock removed to a maximum depth of 30 centimeters below subgrade elevation will be measured and paid for at the contract unit price for “Rock Excavation” or “Unclassified Excavation”, as the case may be, provided the rock has been

removed sufficiently to permit accurate cross sectioning. The backfilling of this depth in excess of 30 centimeters with an A-1, A-2-4 or A-2-5 material will be at the expense of the Contractor.

d. Excavation of rock by use of explosives shall be done in such a manner as will result in a minimum of breakage outside the neat lines of the typical cross section shown on the plans or as directed by the Engineer. When specified, faces of cut slopes through rock shall be formed by presplitting. Presplitting is defined as the establishment of a free surface or shear plane in rock by the controlled usage of explosives and blasting accessories in appropriately aligned and spaced drill holes.

1. The Engineer reserves the right to steepen any rock slope if, in his opinion, the character of the rock and the blasting techniques employed are capable of producing a stable unshattered slope at a steeper inclination than that shown on the plans. No additional compensation for steepening slopes will be considered.

2. Blasting Operations

(a) Primary or core blasting shall be accomplished with suitable explosives and bore hole size and spacing to produce the degree of fragmentation required to comply with paragraph 203-3.04d. for rockfills.

(b) Blasting for rock excavation shall be conducted in accordance with the requirements of Article 107.12 - Use of Explosives, of the General Provisions and as specified below.

(c) The Contractor shall assign the necessary flagmen to each road within the

danger area to stop traffic at a safe distance during blasting periods. The Contractor shall inspect and clear all roadways being used by traffic of any obstruction caused by his blasting operations. He shall exercise maximum precautions, including the use of mats, to avoid damage to property and utilities adjacent to the work. The cost of the use of mats, whether ordered by the Engineer or used at the Contractor's discretion, and of all other precautionary measures except those paid for under Specification 638, Maintenance and Protection of Traffic, shall be included in the unit price for "Rock Excavation" or "Unclassified Excavation".

(d) Whenever there are structures in the vicinity of the area where blasting operations are to be performed which may be affected by blasting vibrations, the Contractor shall, when so requested by the Authority, employ seismographic equipment in the control and recording of the blasting operations.

e. Obliteration of old roadways shall include all grading operations necessary to incorporate the old roadway into the new roadway and surroundings in order to provide a pleasing appearance from the roadway. This shall be included as part of the work under this specification. Obliteration and removal of old pavement and base courses, if necessary, will be paid for under the item "Removal of Structures and Obstructions", Specification 202, when such a pay item is included in the contract; other wise it shall be an obligation of the Contractor included in the unit price for unclassified excavation.

f. When the Contractor's excavating operations encounter remains of prehistoric people's dwelling sites or artifacts of historical, paleontological or archeological

significance, the operation shall be temporarily discontinued. The Engineer will contact the proper authorities to determine the disposition thereof. The Contractor shall excavate the site when directed to do so in a manner acceptable to the Engineer, so as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper government authorities. Such excavation will be considered and paid for as extra work. However, the Authority may elect to have such excavation performed by other entities.

g. Where excavation to finished graded section, results in a subgrade or slopes of unsuitable material, the Engineer may require the Contractor to remove the unsuitable materials and backfill to the finished graded section with suitable material. The Contractor shall conduct his operations in such a way that the Engineer can take the necessary cross-sectional measurements before the backfill is placed. This shall be considered undercut excavation.

h. When the location of unsuitable material is shown on the plans, the removal and replacement shall be as shown therein. When not shown on the plans the Contractor shall remove all unsuitable material as directed by the Engineer, who shall be the sole judge of what constitutes unsuitable material. All unsuitable material shall be disposed of in accordance with Article 203-3.02.

203-3.02 Construction Methods - Excavation

a. Utilization of Excavated Material

1. All suitable material removed from the excavation shall be used in the formation of the embankment, subgrade, shoulders, slopes, bedding and backfill for structures, and for other purposes shown on the plans or as directed by the Engineer.

2. During the progress of the excavation, material encountered in cuts and deemed suitable for placing in the roadbed or for topping or for road finishing shall be saved and utilized for those purposes as directed by the Engineer.

3. Unless otherwise shown on the plans or specified in the special provisions, surplus excavated material shall be used to widen embankments uniformly or to flatten slopes, or it shall be disposed of along the roadway or at other locations as directed by the Engineer. Hauling and placing will be as indicated in Article 203-1.08. Compaction of this material will be as indicated in Article 203-3.05.

4. The quantities of surplus material, if any, shown on the plans or specified in the special provisions are approximate only. The Contractor shall satisfy himself that there is sufficient material available for completion of the embankments and other project items before disposing of any material inside or outside the right-of-way. Any shortage of material caused by premature disposal of any material by the Contractor shall be replaced by him and no compensation will be allowed the Contractor for such replacement.

5. If any surplus material not required for widening of embankments, flattening of slopes or for other purposes directed by the Engineer, is to be disposed of outside the project right-of-way, then the Contractor shall be responsible for obtaining suitable disposal locations at his expense. All the costs involved shall be in the unit price bid for excavation.

6. No surplus material shall be disposed of at elevations above the grade of the adjacent roadbed.

7. Conservation of Topsoil

(a) When a pay item for Placing Loamy Topsoil is not included in the contract, suitable topsoil encountered in excavation and on areas where embankment is to be placed will be removed to such extent and to such depth as the Engineer may direct. The removed topsoil shall be transported and deposited in storage piles at locations approved by the Engineer. The topsoil shall be completely removed to the required depth from any designated area prior to the beginning of regular excavation or embankment work in the area and shall be kept separate from other excavated materials. Payment for the excavation, stockpiling and placing at final location of this topsoil will be as provided for selected material in Paragraph 203-2.05c.

(b) When the contract includes a pay item for Placing Loamy Topsoil and this material is available from within the roadway areas, the Contractor may obtain it from this source. Such cases will be handled as provided by Article 104.06 of the General Provisions.

8. All required hauling of all excavated material, including unsuitable and waste material, to its final disposition site shall be an obligation of the Contractor and included in the unit prices for excavation.

b. Ditches

1. Ditches shall include side ditches and gutters, channel changes, irrigation ditches, inlet and outlet ditches, toe ditches, furrow ditches, and such other

ditches as may be required for the construction of the project.

2. All material excavated from ditches shall be utilized or disposed of as provided in Paragraph 203-3.02a above.

3. Ditches shall conform to the slope, grade and shape of the required cross section, with no projections of roots, stumps, rock or similar matter. The Contractor shall maintain and keep open and free from leaves, sticks, and other debris all ditches dug by him until final acceptance of the work.

c. Borrow Pits

1. The Contractor shall make his own arrangements for obtaining borrow, shall pay all costs involved and shall obtain all necessary permits.

d. Presplitting

1. The Contractor shall first completely remove all overburden soil along the lines of presplitting to expose the rock surface prior to drilling the presplitting holes.

2. Prior to area drilling and blasting, a breakline shall be established along the plane of the staked slope by the presplitting method. This breakline shall be kept ahead of the primary blasting a distance equal to about one half of the length of the primary blast for each lift of bedrock excavated unless otherwise permitted by the Engineer.

3. Drill holes for presplitting shall be made along the slope stake lines established by the Engineer, and the Contractor shall exercise sufficient care to insure

that the holes conform to the slope as established. Presplitting shall be accomplished by drilling holes not to exceed 10 centimeters (4”) in diameter at intervals of approximately 45 to 90 centimeters. The holes shall be drilled to the full depth of the cut or to a predetermined bench elevation, provided that the depth to the ditch or bench does not exceed a safe depth for accurate drilling. Holes for presplitting shall not exceed 8 meters in depth. If the depth of the rock cut or predetermined bench is greater than the maximum permissible depth of the holes, the blasting shall be done in two or more lifts. An offset of not more than 30 centimeters will be allowed to accommodate the drill head, and the slope angle and offset shall be so arranged that the toe of the finished rock slope shall coincide with the toe of the slope specified in the plans. No hole shall deviate more than 3 percent of the length of the presplitting hole from the plane of the specified slope, maintaining as nearly as possible the original spacing between holes through the entire depth of the lift.

4. The spacing and size of the drill holes may be varied, with the approval or at the direction of the Engineer, to suit the material encountered during construction so long as a smooth face, reasonably free from loose rock is produced. It shall be the Contractor’s responsibility to drill as many holes as are required to satisfactorily complete the work.

5. No portion of any primary blast hole larger than 7.5 cm. in diameter will be permitted closer than 3.75 meters to the presplit face. No portion of any blast hole will be allowed within 1.20 meters of the presplit face unless otherwise permitted by the Engineer. Before placing the charge, each hole shall be inspected. No loading will be permitted until the hole is free of all obstructions for its entire depth. The holes shall be loaded with an optimum amount of

explosives stemmed with suitable material and detonated to produce clean rock walls and to minimize rock overbreak, shattering and ground vibration. The method used shall according to the instructions of the manufacturer in order to avoid damage to structures near the job site. The annular air space around the explosive charge shall be filled completely with the stemming material Stemming material shall be reasonably clean stone chips or other approved granular material passing the 3/8" sieve and retained on the No. 10 sieve. A ten percent tolerance on either the maximum or minimum size sieve will be permitted.

6. The Contractor shall adjust his blasting operations according to the characteristics and the structure of the bedrock formations so as to obtain the required slope conditions without fracturing the rock beyond the presplit face. The firing pattern for the primary blast shall be designed with delays to afford maximum relief to the holes nearest the presplit plane.

7. Test sections will be required at the outset of presplit drilling and blasting operations for the evaluation of the presplit rock slopes by the Engineer. The Contractor will be required to completely expose the presplit rock face in the test area for the evaluation prior to any further presplit drilling.

8. Variance from the true plane of the excavated backslope shall not exceed 30 cm.; however, localized irregularities or surface variations that do not constitute a safety hazard or impairment to drainage courses or facilities may be permitted at the discretion of the Engineer.

e. Protection of Roadbed During Construction - During the construction of the roadway, the roadbed shall be maintained in such condition that it will be well drained at all

times. Side ditches or gutters emptying from cuts to embankments or otherwise shall be so constructed as to avoid damage to embankment by erosion.

f. Stream Protection and Pollution Control

1. Excavation from the roadway, channel changes, cofferdams, etc., shall not be deposited in or so near to rivers, streams or reservoirs that it will be washed away by high water or runoff.

2. Should the nature of location of the work make it impossible to prevent some material from being deposited temporarily in any stream channel the same shall be removed as soon as possible at the Contractor's expenses.

3. The Contractor shall take all necessary effective steps, acceptable to the Engineer, to keep the excavated material from reaching or fouling irrigation, water reservoirs, or streams draining into them, that may cause pollution of the water or damage to hydraulic structures. The Contractor shall be liable for all claims of any nature arising from the unauthorized presence in water courses of excavated material from his construction operations.

4. If for some reason it becomes necessary to suspend construction operations for any appreciable length of time, the contractor shall shape the top of earthwork in such a manner as to permit the runoff of rainwater. In locations where the road is to be constructed in the immediate vicinity of rivers, streams and reservoirs, the Contractor shall provide temporary slope drains to carry runoff from cuts and from embankments. The slope drains shall be located at no more than 150 meter intervals and shall be stabilized by paving or covering with waterproof

materials. Should such preventive measures fail and an appreciable amount of material begins to erode into a river, stream or reservoir, the Contractor shall act immediately to bring the erosion and siltation under control.

g. Rounding, Warping, and Finishing Slopes

1. Rounding - Except in solid rock, the tops and bottoms of all slopes, including the slopes of drainage ditches, shall be rounded as indicated on the plans. A layer of earth overlying rock shall be rounded above the rock as done in earth slopes.

2. Warping - Adjustments in slopes shall be made to avoid injury to standing trees or marring of weathered rock, or to harmonize with existing landscape features. The transition to such adjusted slopes shall be gradual. At intersections of cuts and fills, slopes shall be adjusted and warped to flow into each other or into the natural ground surfaces without noticeable break.

3. Finishing - All earth slopes shall be finished to reasonably smooth and uniform surfaces without any noticeable break and in substantial accordance with the planes or other surfaces indicated by the lines and cross sections shown on the plans, with no variations therefrom readily discernible as viewed from the road. The degree of finish for grading of slopes shall be that ordinarily obtainable either from blade-grader or dozer back-blading or hand-shovel operations, as the Contractor may elect.

h. Removal of Unsuitable Material - When unstable material or other material unsuitable for foundation, roadbed, or other roadway purposes occurs within the limits of the roadway, the Contractor shall undercut such material below

the grade as shown on the plans or as directed by the Engineer and shall backfill the areas so excavated with suitable material. The resulting excavated areas shall be backfilled with suitable material to the proper grade elevation. All material replacing rock or unsuitable material shall be placed and compacted in accordance with the applicable requirements of Article 203-3.05, Compaction.

i. Composition of Roadbed in Cuts - When material, other than solid rock, encountered below subgrade elevation in cuts is satisfactory as to quality and is to be used to form the finished roadbed, it shall be scarified to a depth of 30 centimeters and roots, sod, or other deleterious material or stones that will not pass a 3-inch square opening shall be removed. Then the material shall be shaped and compacted as required for embankments in Article 203-3.05, Compaction.

203-3.03 General Requirements - Embankment

a. Borrow material shall not be used until after assuring that all the suitable material from the roadway excavations can be placed in the roadbed. If the Contractor places more borrow material than is required and thereby causes a waste of suitable excavation material, the amount of such waste will be deducted from the borrow volume.

b. The entire existing ground surface on which an embankment is to be placed shall be cleared and grubbed in accordance with the requirements of Specification 201 - Clearing and Grubbing.

c. When an embankment is to be placed upon an existing road, the existing surface shall be scarified to such degree as will provide ample bond between old and new material.

SPECIFICATION 203 – EXCAVATION AND EMBANKMENT

203-3.04 Construction Methods - Embankment

a. Benching - When embankment is to be placed and compacted on hillsides or when new embankment is to be compacted against an existing embankment, or when an embankment is built one-half (1/2) width at a time, the slopes that are steeper than four to one (4:1) when measured at right angles to the roadway shall be continuously benched over these areas as the work is brought up in layers. Benching shall be of sufficient width to permit operation of placing and compacting equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Material thus cut out shall be recompacted along with the new embankment material at the Contractor's expense. Benching will not be measured for direct payment but shall be an obligation of the Contractor subsidiary to building embankments as per paragraph 203-4.01c.

b. Base Preparation - Where an embankment of less than 1.2 meters below subgrade is to be made, all sod and vegetable matter shall be removed from the surface upon which the embankment is to be placed and the cleared surface shall be completely broken up by plowing, scarifying or stepping to a minimum depth of 15 centimeters. This area shall then be recompacted. Sod not required to be removed shall be thoroughly disced before construction of the embankment. No direct payment will be made for this work; it shall be an obligation of the Contractor subsidiary to building embankments as per paragraph 203-4.01c.

c. Placing - Roadway embankment shall be placed in horizontal layers not exceeding 30 centimeters (loose measurement) in depth and shall be compacted as specified before the next layer is placed. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting. As the compaction of each layer progresses, continuous leveling and manipulating shall be performed to assure uniform density. Water shall be

added or removed, if necessary, in order to obtain the required density.

d. Rockfills - Embankments constructed of material consisting predominantly of rock fragments or boulders of such size that the material cannot be placed in layers of the thicknesses specified in Paragraph 203-3.04c, without crushing, pulverizing or further breaking down the pieces resulting from excavation methods shall be considered rockfills. Such material may be placed in embankments in layers not exceeding 60 centimeters in thickness. Even though the general thickness of layers is limited as provided above, the placing of individual rocks and boulders of a size not exceeding 1.20 meters in its largest dimension will be permitted provided they are carefully distributed and the interstices filled with finer material to form a dense, compact mass. Rock fills shall be constructed in accordance with the following requirements:

1. Layers - Each layer shall be leveled and smoothed before compaction with suitable leveling equipment and by distribution of rock fragments and finer fragments of earth.

2. Height of Rockfill - No portion of rock fill shall be constructed above an elevation 60 centimeters below finished subgrade. The balance of the embankment shall be composed of material meeting the requirements of Borrow Class B as defined in Paragraph 203-2.03b, smoothed and placed in layers not exceeding 30 centimeters in loose thickness and compacted as required for embankments.

e. Placing Over Swampy Ground - Where an embankment is to be constructed across low swampy ground that will not support the weight of trucks or other hauling equipment, the lower part of the fill may be constructed by dumping successive loads in a uniformly distributed layer of a thickness not greater than necessary to support the hauling

equipment while placing subsequent layers and not to exceed one meter above ground water level.

f. Whenever the plans and contract documents call for the use of special devices such as alignment stakes, inclinometers, piezometers, settlement gages and/or observation wells to control the construction of embankments over soft or unstable soils, the method and rate of construction of such embankment shall be as indicated in the plans or as directed by the Engineer.

g. End Dumping - Where an embankment is to be placed and compacted and end dumping is permitted, the slopes of the original ground or embankment shall be deeply plowed or cut into before starting end dumping except when placing over swampy ground.

h. Backfill - If an embankment can be deposited on one side only of abutments, wing walls, piers or culvert headwalls, care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that it will cause overturning of or excessive pressure against the structure. The fill adjacent to the end bent of a bridge shall not be placed higher than the bottom of the bent until the superstructure is in place. When embankment is to be placed on both sides of a concrete wall or box type structure, operations shall be so conducted that the embankment is always at approximately the same elevation on both sides of the structure.

i. Protection of Embankment - During the construction of the embankment it shall be protected in accordance with Paragraph 203-3.02e. In addition, at the close of each day's work, smooth steel wheel or pneumatic tired rollers shall be used to roll the entire working area after it has been crowned, sloped, and drained. All material eroded or otherwise removed from the embankments shall be replaced by the contractor at no extra cost to the Highway Authority.

j. Shrinkage and Settlement - The Contractor shall construct all embankments so that after shrinkage and settlement and at the time of acceptance of the project, they shall have the required grade, width, and cross section at all points. The Contractor shall be responsible for the stability of all embankments made under the contract until final acceptance of the work and shall bear the expense of replacing any portions which have become unstable due to carelessness or negligent work on the part of the Contractor.

203-3.05 Compaction

a. General - All embankments shall be constructed with moisture and density control.

b. Maximum Density - Maximum density requirements will be determined by AASHTO T 180, Method D. However, the Authority may, at its discretion, use the graph on "Modified Family of Compaction Curves for Puerto Rican Soils" that it has developed, to assist in the determination of the maximum densities and optimum moisture contents for the soils encountered in the project by the one point method, similar to AASHTO T 272. Correction for coarse particles in the soil being tested using AASHTO T 224 will be made when appropriate.

c. Embankments and Backfills

1. All earth embankments and backfills in undercut sections shall be compacted to no less than 95% of maximum density. However, in embankments that exceed 1.5 meters in height, the first 30 centimeter layer shall be compacted to not less than 90% of maximum density but all material above this initial layer shall be compacted to 95% of maximum density.

2. Where the materials in the embankment permit practical density tests, the Engineer will, during the progress of the work, make such tests as he considers necessary to ascertain the density of each compacted layer.

Tests will be made in accordance with AASHTO T 191, 204, T 205 or T 238 at the option of the Authority. If the density tests indicate that the attained density is less than the required density, additional rolling shall be performed by the Contractor until the specified density is obtained.

d. Moisture Control

1. All fill or backfill material to be compacted shall be at moisture content for proper compaction to specified density. The Contractor shall be responsible for determining the proper moisture content and for controlling it within the proper limits as the work progresses. When water must be added to a material, it may be added on the lift or in the excavation or borrow pit. However, when added on the lift, it shall be applied with an approved pressure distributor. Water added shall be thoroughly incorporated into the soil to attain uniform distribution.

2. When the moisture content of material in a lift exceeds the required amount, the compaction shall be deferred until the material has dried to the required amount. The material shall be aerated and manipulated as may be necessary to attain the required moisture content prior to compaction.

3. When suitable excavation material has excessive moisture content as to make impracticable its compaction to specified density, such material shall not be placed in embankments or backfill until the

excess moisture has been removed by aeration, manipulation or other appropriate means at the option of the Contractor.

e. Compaction and moisture control, whether adding or removing moisture, by whatever methods are used shall be a subsidiary obligation of the Contractor under this specification with the cost included in the excavation item.

f. Surplus Excavation Material - When surplus excavation material is used to widen embankments it shall be placed in layers and compacted as required in Paragraph 203-3.05c above. When the surplus material is used to flatten slopes, a definite density requirement is not specified, but it shall be placed and compacted so as to obtain a smooth and stable condition acceptable to the Engineer.

203-3.06 Proof Rolling

a. When called for in the contract and immediately prior to final trimming of the subgrade surface, or top of subbase, all areas within the roadway limits that are indicated on the plans or ordered by the Engineer shall be proof rolled according to the requirements of this specification.

b. Equipment - The proof roller shall consist of a chariot type rigid steel frame with a box body suitable for ballast loading up to 50 tons gross weight, and mounted on four (4) pneumatic tired wheels acting in a single line across the width of the roller on its transverse load centerline. The wheels shall be equipped with l8.00 x 24 or 18.00 x 25, 24-ply tires, and shall be suspended on articulated axles such that all wheels carry approximately equal loads when operating over uneven surfaces.

c. Roller Stress

1. Initially the gross ballasted weight and tire inflation of the proof roller shall be adjusted to the highest stress shown in Table 203-1 based on the general description of the subgrade soil and its relative support capacity as estimated by the Engineer. The initial roller stress for embankments constructed of rocks shall be the maximum level listed in Table 203-1.

2. The roller shall be operated briefly to establish the acceptability of the initial stress level. Proof rolling shall be performed at the next lower stress level whenever operation of the roller at a higher stress level is accompanied by consistent lateral displacement of soil out of the wheel paths.

d. Procedure - After an acceptable stress level is established, two (2) complete passes of the roller shall be applied over all elements of the area to be proof-rolled. Any deficiencies disclosed during the proof-rolling operation shall be corrected as follows:

1. In embankment sections, any depressions shall be filled with material similar to or better than the subgrade soil or subbase material and compacted in a normal manner. If necessary, the Engineer may order corrective undercut excavation and backfilling with a selected material.

2. In cut sections, where any portion of the subgrade or subbase surface fails to provide a satisfactory support for the proof rolling operations, the Engineer may order corrective undercut excavation and backfilling with a selected material to a depth determined by the Engineer.

3. Backfill material in undercut sections shall be placed in layers and compacted to at least 95% of maximum density.

4. After compaction, corrected areas shall be proof rolled again. Corrective work will be judged complete and accepted by the Engineer when all elements of the subgrade surface show a satisfactory uniform response to the proof roller.

TABLE 203-1
GUIDE FOR SELECTING THE INITIAL STRESS LEVEL FOR PROOF ROLLING

Relative Subgrade Support	Stress Level	Gross Tons	Tire PSI
POOR	MINIMUM	30	40
FAIR	1	34	50
	2	38	60
	3	42	70
GOOD	4	46	80
	5	50	80
EXCELLENT	MAXIMUM	50	80

e. Exceptions - Proof rolling of the subgrade or subbase shall not be used where the proof roller will approach a culvert, pipe or other conduit closer than 1.5M in any direction and when due to restrictions in available access and/or maneuvering space, use of the proof roller may damage adjacent work. Proof rolling will not be performed in rock cuts nor within 4.5 meters of any bridge abutment or retaining wall.

203-3.07 Subgrade Surface Tolerance - After compaction, and proof rolling when included, the finished subgrade surface shall not vary by more than ±1.5 centimeters, when tested with a 3-meter

straight edge, from that required by the plans or established by the Engineer. Any variations beyond this tolerance shall be corrected by removing or adding suitable material, trimming and rerolling as necessary until tolerance requirements are met. This corrective work shall be at the Contractor's expense. The Contractor shall furnish the 3-meter aluminum straight edge.

203-4 METHOD OF MEASUREMENT

203-4.01 Roadway Excavation - The volume of roadway excavation to be paid for will be measured in cubic meters in the original position by field measurement of cross sections of the area excavated to the lines and grades shown on the plans or as directed by the Engineer, subject to the conditions specified below. This applies to unclassified excavation, rock excavation, undercut excavation, and muck excavation. The excavation volume will be computed by the average end area method.

a. The measurement will include the following:

1. Overbreakage or slides in unclassified excavation, not attributable to carelessness of the Contractor, and authorized excavation of rock, shale, muck or other unsuitable material below the subgrade in cuts, and excavation of unsuitable material under embankments. Authorized excavation of rock, shale, muck or unsuitable material below the subgrade will consist of that excavation necessary to provide the required thickness of backfill or subbase as indicated on the plans or ordered by the Engineer.

2. Required rock excavation not exceeding 30 centimeters below grade, will be considered as authorized and will be measured for payment. Rock excavation more than 30 centimeters below subgrade will not be paid for.

3. Overbreakage in rock excavation from the backslopes, when presplitting is not specified, to an amount not to exceed in any half-station of 50 meters, 10 per cent of the actual quantity required for that half-station. However, no measurement of rock excavation will be made for overbreakage caused by faulty blasting when presplitting is specified.

4. Excavation of all ditches and the excavation and stockpiling of topsoil.

5. The volume of material removed in the rounding and warping of slopes.

6. Any excavated material requiring more than one handling, as shown on the plans or ordered by the Engineer, will be measured separately for each extra handling. No measurement and payment will be made for any extra handling which is performed at the election of the Contractor for his convenience.

b. The measurement of roadway excavation will not include the volume of any pavement structure materials found in the roadbed and merely scarified in situ and later replaced in the work entirely by road mixing or similar in situ methods of operations. This work shall be a subsidiary obligation of the Contractor under the pay item "Unclassified Excavation".

c. Scarifying, stepping, benching, plowing, and recompacting to the depth specified or ordered by the Engineer, will not be measured for payment but shall be a subsidiary obligation of the Contractor under the pay item "Unclassified Excavation".

d. When called for in the contract documents, the excavation for certain specified locations will be measured loaded loose on trucks.

e. When it is impractical to measure excavation by the cross-section method, such as may be due to erratic location of isolated deposits or where muck excavation is being simultaneously backfilled with suitable material, acceptable methods involving 3-dimensional measurements, including hauling vehicle measurements, may be used by the Engineer as provided in Article 109.01 of the General Provisions.

203-4.02 Presplitting - Presplitting will be measured by the linear meter of presplitholes drilled, loaded, stemmed, accepted and detonated, at the specified locations or as directed by the Engineer.

203-4.03 Borrow - Each class of borrow material will be measured by one of the methods specified below as called for in the contract.

a. By end area method, in cubic meters, in final position in the completed and accepted embankments or fills. The original ground cross section for this measurement will be taken prior to the clearing and grubbing operations.

b. By the ton, weighed in the vehicle at the point of delivery utilizing suitable scales furnished by the contractor and approved by the Engineer. The weight of water in the borrow in excess of the optimum moisture content will be deducted.

c. In cubic meters measured on trucks at the point of delivery.

203-4.04 Embankments - Embankments and backfills will not be measured directly for payment as such but shall be a subsidiary obligation of the Contractor under the various pay items of this specification.

203-4.05 Hauling - No hauling will be measured for payment as all hauling shall be a subsidiary obligation of the Contractor under the various pay items of this specification.

203-4.06 Proof Rolling - Proof rolling will be measured by the square meter of the areas of all roadway surfaces on which proof rolling is performed as ordered by the Engineer. Proof rolling for any surface will be measured only once; repetition of proof rolling required after correction of deficiencies will not be measured for payment but shall be a subsidiary obligation under this pay item. The two required passes of the roller are included in one unit of measurement.

203-5 BASIS OF PAYMENT

203-5.01 The accepted quantities of roadway excavation, presplitting, borrow and proof rolling, determined as provided above, will be paid for at the contract price per unit of measurement for each of the pay items listed in Article 203-5.04 below that is included in the contract. Such price and payment shall be full compensation for furnishing all materials, equipment, tools, labor and incidentals to complete all the work as required by the plans and specifications, provided, however, that deficient borrow material allowed to remain in place under the provisions of Article 203-2.04 will be paid for at a reduced unit price determines as follows:

a. Borrow Class A - The unit price will be reduced by the following percentages as applicable:

Classification of In-Place Material as per AASHTO M-145	Percentage Reduction In Unit Prices
A-5	30
A-6	40
A-7	50

b. Borrow Class B - The following formula will apply to compute the price reduction:

PR = (PI - 10) 5 + (F-35) 5

where:

PR = Percentage reduction in unit price

PI = Plasticity index of the deficient material

F = Percentage by weight of the fraction of the deficient material passing the No. 200 sieve.

The "PI" portion of the above formula will be disregarded when the PI equals or is less than 10. Similarly, the "F" portion of the formula will be disregarded when the fraction passing the No. 200 sieve equals or is less than 35%.

c. Borrow Class D - The following formula will apply to compute the price reduction:

PR = (25 - PI) 10

where PR and PI are as defined in paragraph b. above.

d. In no case will the total price reduction exceed 90%.

203-5.02 When muck is encountered in the project and the Engineer orders its excavation and disposal, and no pay item has been included in the contract for muck excavation, this work will be paid for at a unit price of two times the contract unit price for unclassified excavation.

203-5.03 No direct payment will be made for the required compacting, benching, watering, drying, and hauling operations which shall be subsidiary obligations of the Contractor under the various pay items of excavation.

SPECIFICATION 203 – EXCAVATION AND EMBANKMENT

203-5.04 Payment will be made under:

Pay Item	Pay Unit
Unclassified Excavation……	Cubic Meter or Cubic Meter (Truck Measure)
Rock Excavation…….....	Cubic Meter
Muck Excavation…….…..	Cubic Meter or Cubic Meter (Truck Measure)
Borrow Class A…….	Cubic Meter or Ton
Borrow Class B…….	Cubic Meter or Ton
Borrow Class C…….	Cubic Meter or Ton, or Cubic Meter (Truck Measure)
Borrow Class D…….	Cubic Meter or Ton, or Cubic Meter (Truck Measure)
Presplitting Drill Holes……..	Linear Meter
Proof Rolling…….	Square Meter

SPECIFICATION 204 – FINISHING SUBGRADE

204-1 DESCRIPTION

204-1.01 Scope - This work shall consist of finishing the subgrade in accordance with these specifications and in conformance with the lines, grades and cross sections shown on the plans or directed by the Engineer. It shall include the shaping and final compaction of the roadbed in order to proceed with the construction of the pavement structure and shoulders.

204-2 MATERIALS

204-2.01 No materials are specified.

204-3 CONSTRUCTION REQUIREMENTS

204-3.01 General

a. This work shall be performed after the earthwork has been substantially completed in accordance with Specification 203 - Excavation and Embankment, and all adjacent drains and structures have been completed and backfilled.

b. When the plans call for the placing of a subbase or base course, the Contractor shall comply with any requirements as to roadbed preparation specified for it.

c. Unless otherwise specified, the entire subgrade shall be compacted to not less than 95% of maximum density as required by Specification 203.

d. All holes, ruts, soft places and other defects shall be corrected. Soft and unstable material that will yield and not compact when rolled or tamped shall be removed. No subbase, base course, gutter, or curb shall be placed on a soft or unstable material, or over areas that are not drained in a manner satisfactory to the Engineer.

e. Proof rolling, if called for in the contract, shall be performed prior to final trimming of the subgrade surface.

However, if a subbase course is to be placed on the subgrade, then the proof rolling shall be performed after the subbase has been placed and compacted but prior to its final trimming. Proof rolling, when included, shall be performed in conformance with the appropriate requirements of Article 203-3.06 of Specification 203.

204-3.02 Previously Constructed Roadbeds

a. If the roadbed has been constructed under a previous contract, it shall be restored by removing all vegetation and any slide material and culvert inlet and outlet debris, filling all depressions, blading and shaping the subgrade to reasonably close conformity with the lines, grades and cross sections shown on the plans or established by the Engineer.

b. Any high places in the roadbed shall be cut to the required elevation and the resulting excess material hauled and deposited in low areas or on fill slopes as directed by the Engineer. Should there remain any depressions or narrow embankments, sufficient approved material shall be obtained and placed to bring the roadbed to conformity with the lines, grades and cross section shown on the plans or established by the Engineer.

c. The subgrade shall be compacted as required by Specification 203 and all work necessary to produce an acceptable foundation shall be completed prior to placing any subbase or base courses on it.

d. At intersections, the roadbeds of side roads shall also be treated as specified above for the distances ordered by the Engineer, or as governed by the grading performed, to provide for the proper joining of the new and existing pavements.

204-3.03 Maintenance - Ditches and drains along the roadbed shall be kept clean and maintained so as to drain effectively. The

finished subgrade shall be maintained in a smooth and compacted condition until the subbase or base courses are placed on it.

204-3.04 Subgrade Surface Tolerance - The finished subgrade surface shall not vary by more than ± 1.5 centimeters, when tested with a 3-meter straight edge, from the grade and cross section required by the plans or established by the Engineer. Any variations beyond this tolerance shall be corrected by removing or adding suitable material, trimming and rerolling until tolerance requirements are met. The Contractor shall furnish a 3-meter aluminum straight edge for testing the surface.

204-4 METHOD OF MEASUREMENT

204-4.01 Finishing the subgrade will not be measured for payment on projects where the roadbed is constructed under the same contract.

204-4.02 Finishing the subgrade on a roadbed constructed under a previous separate contract will be measured by the square meter of roadbed finished and accepted in accordance with this specification.

204-4.03 Any borrow material required to bring a previously constructed roadbed to the specified grade and cross section will be measured for payment under the provisions of Specification 203 - Excavation and Embankment.

204-4.04 Proof rolling of the subgrade, when included in the contract, will be measured as provided in Article 203-4.06 of Specification 203.

204-5 BASIS OF PAYMENT

204-5.01 The finishing of subgrade on projects on which the roadbed is constructed under the same contract shall be performed by the Contractor without any direct compensation, and this work shall be considered a subsidiary obligation of the Contractor and its cost included under other contract pay items. Payment for finishing the

subgrade as a separate pay item will be made only when the roadbed was constructed under a separate previous contract.

204-5.02 Payment for finishing the subgrade at the contract unit price per square meter for the quantities measured as provided above shall be full compensation for all the materials, labor, equipment, tools and incidentals necessary to complete this item as specified.

204-5.03 Any borrow required under paragraph 204-4.03 above will be paid for under Specification 203.

204-5.04 Proof rolling, when called for in the contract, will be paid for as provided in Article 203-5.01 of Specification 203.

204-5.05 Payment will be made under:

Pay Item	Pay Unit
Finishing Subgrade……	Square Meter

SPECIFICATION 205 – TRENCH EXCAVATION

205-1 DESCRIPTION

205-1.01 Scope

a. This work shall consist of the excavation of all materials, the placing of backfill and the disposal of surplus excavated material as required for the installation of the following items, in accordance with these specifications and in conformity with the lines, grades, cross sections and dimensions shown on the plans or established by the Engineer.

1. Pipe culverts and storm drains.

2. Manholes, inlets, catch basins, headwalls, wingwalls, aprons and end sections for pipe culverts and storm drains.

3. Underground water and sanitary sewer conduits except when the excavation for such conduits is included as a separate pay item under another specification or is included as a subsidiary obligation under the respective utility pay items.

b. The work shall also include any necessary temporary diverting of streams, bailing, pumping, draining, sheeting, bracing, water control, safety measures, and incidentals required for the proper execution of the work.

205-1.02 Ditches and channels beyond inlet and outlet treatment of culverts shall be constructed under Specification 203 - Excavation and Embankment.

205-1.03 The work under this specification does not include the excavation for underdrains, highway illumination and traffic signals conduits, and other underground structures which are covered under other specifications.

SPECIFICATION 205 – TRENCH EXCAVATION

205-1.04 Trench excavation will be classified as follows:

a. Trench Excavation - Unclassified - Shall include all structure excavation and the utilization or disposal of all excavated material of whatever character encountered in the work which is not classified and included in the contract under other pay items.

b. Trench Excavation in Rock - Shall include excavation of igneous, metamorphic or sedimentary rock which cannot be excavated without blasting or the use of pneumatic tools. It shall also include all boulders having a volume of one (1) cubic meter or more and any sound masonry and concrete requiring blasting or the use of pneumatic tools to break up and remove.

205-2 MATERIALS

205-2.01 Materials for sheet piling shall meet the applicable requirements of Specification 615 - Piling. Material for foundation fill shall meet the requirements of Specification 207 - Foundation Fill.

205-3 CONSTRUCTION REQUIREMENTS

205-3.01 General

a. The Contractor shall notify the Engineer sufficiently in advance of the beginning of any trench excavation so that the Engineer will have the time to take cross sections and other necessary measurements of the undisturbed ground. The natural ground adjacent to and at the site of the structure shall not be disturbed without the prior authorization of the Engineer.

b. Prior to starting trench excavations in any area, all necessary clearing and grubbing in that area shall have been

completed in accordance with Specification 201. The clearing and grubbing of any area outside of the area covered by the Specification 201 pay item shall be performed by the Contractor as a subsidiary obligation under the item of trench excavation.

c. The trench shall be excavated to the lines, grades, depth and dimensions shown on the plans or established by the Engineer. The width of the trench shall be sufficient to permit satisfactory jointing of the pipe and thorough backfilling and tamping of the bedding material around the pipe.

d. The Contractor shall be responsible at all times for the carrying out of all excavation operations in a safe and prudent manner so that the workmen, the public and adjacent property will be protected from unreasonable hazard. All applicable Federal and Commonwealth requirements shall be observed and any necessary permits obtained by the Contractor.

e. Adequate sheeting and bracing in conformance with safety requirements shall be used to protect employees and to satisfactorily complete the work without causing subsidence, and to prevent damage to adjacent ground and structures. Instead of using sheeting and bracing, the Contractor may, where conditions permit it and subject to approval by the Engineer, open the excavation with the sides sloped to a stable slope appropriate to the material being excavated except where a specific embankment installation method for concrete pipe is called for in the plans.

f. After each excavation is complete, the Contractor shall notify the Engineer to that effect and no bedding material shall be placed until after the Engineer has approved the depth of the excavation and the character of the foundation material.

g. Where rock, hardpan or other unyielding material is encountered, it shall be removed below the foundation grade as ordered by the Engineer to a depth sufficient to provide a Class B or C bedding as per Specification 603, unless otherwise shown on the plans or directed by the Engineer.

h. Where the foundation material encountered is a soft, spongy or otherwise unstable soil, such soil shall be removed from under the pipe or structure to a width and depth as indicated on the plans or ordered by the Engineer. The unsuitable material shall be replaced with a backfill meeting the requirements of Specification 207 - Foundation Fill, properly compacted to provide adequate support for the pipe or structure, unless other special construction methods are called for on the plans.

i. The foundation surface shall provide a firm foundation of uniform density throughout the length of the pipe. For culverts, the foundation surface shall be cambered in the direction parallel to the centerline of the conduit as shown on the plans or as directed by the Engineer.

j. When the plans require embankment construction prior to culvert installations, the embankment shall first be constructed to the required height as shown on the plans and indicated in Specification 603, before the trench is excavated. The embankment of the required height shall extend for the distance on each side of the culvert specified in the standard drawings.

205-3.02 Protection of Waterways

a. Natural stream beds upstream and downstream from culverts shall not be disturbed except as shown on the plans or directed by the Engineer.

b. Excavated material shall not be deposited near streams and other waterways where it might be washed away by high water or runoff and result in siltation of water bodies.

205-3.03 Water Control

a. Water shall be diverted or otherwise removed from all trench excavation in such a manner that the work of excavation, bedding and laying of the pipe or structure can be performed in reasonably dry materials. The methods to be used to control and remove water at trench excavations, when not specified in the contract documents, shall be at the option of the Contractor and may include but are not limited to well point systems, pumping sumps or concrete seal courses. The successful performance of whatever method is used shall be solely the responsibility of the Contractor.

b. When no piles are used and the pipe or structure is to rest on the excavated surface the following shall apply:

1. Care shall be taken during excavation to prevent disturbing the existing foundation material. If ground water is encountered during excavation, dewatering shall be commenced and shall proceed in advance of or concurrently with further excavation. The foundation shall be free of water at the time the pipes are placed.

2. If suitable foundation material has been disturbed by the Contractor's operations, has been damaged by water or has been removed for the Contractor's convenience in dewatering the foundation, the foundation shall be restored by the Contractor, at his expense, to a condition at least equal to the undisturbed foundation as determined by the Engineer. The material used to replace such damaged or removed foundation material shall conform to the

requirements of Specification 207 -Foundation Fill, and shall be compacted as required for backfill.

c. The Contractor shall protect the open trench excavation from surface water runoff by suitable methods such as dikes, diversion ditches or other methods selected at his option.

205-3.04 Sheet Piling

a. Any sheet piling required to perform the excavation shall be installed in accordance with the applicable requirements of Specification 615 - Piling.

b. Unless otherwise provided, all sheeting and bracing shall be removed after the completion of the pipe or structure installation. Removal shall be effected in such manner as not to disturb or otherwise injure the finished work. Sheet piling allowed to remain in place shall be cut off and otherwise treated as directed by the Engineer, at the Contractor's expense.

205-3.05 Bedding - Bedding for pipes shall be done in accordance with Specification 603 - Pipe Culverts and Storm Drains.

205-3.06 Utilization of Excavated Material

a. All suitable excavated material shall be used as backfill. All surplus suitable material shall be utilized or disposed or as provided in Article 203.3.02 of Specification 203 - Excavation and Embankment.

b. Unsuitable material shall be disposed of as shown on the plans or as ordered by the Engineer. If unsuitable material is to be disposed of outside the project right-of-way, the Contractor shall be responsible for obtaining suitable disposal locations and required permits at his expense.

c. No excavated material shall be deposited at any time so as to endanger a partly completed pipe or other structure, either by direct or indirect pressure.

d. All required handling and hauling of excavation material, including unsuitable and surplus material, to its final utilization or disposition site, shall be an obligation of the Contractor and the cost included in the unit price for trench excavation.

205-3.07 Backfill

a. Materials for backfill on each side of pipe culverts and storm drains for the full trench width and to an elevation of 30 centimeters above the top of the pipe, shall be a readily compactible soil or granular material acceptable to the Engineer and selected from the original excavation or from the roadway excavation. It shall be free from lumps or stones larger than 5 centimeters in diameter, chunks of clay, wood and any other deleterious or objectionable material. If sufficient suitable excavation material to complete the backfill is not available, borrow material may be used if available as a pay item in the contract; otherwise, the backfill may be completed as extra work under the provisions of Article 109.04 of the General Provisions.

b. Unless a special method for backfilling is specified on the plans or Specification 603, the backfill material shall be placed in layers not exceeding 20 centimeters in depth and each layer thoroughly compacted by the use of mechanical tampers to 95% of the maximum density of the backfill material as determined by AASHTO T 180, Method D. Care shall be exercised to thoroughly compact the backfill under the haunches of pipes.

c. The backfill shall be brought up evenly on both sides of the pipe for the full required length. Special care shall be

exercised in placing and compacting the backfill to avoid damage to the pipe or its alignment. Any pipe damaged or moved out of alignment by the Contractor's equipment or operations shall be replaced or corrected at the Contractor's expense

205-3.08 Induced Trench Method - Where the plans call for the induced trench method of culvert installation, the trench excavation, bedding, backfill and construction procedure shall be as required in the standard drawings and Specification 603 - Pipe Culverts and Storm Drains.

205-4 METHOD OF MEASUREMENT

205-4.01 Trench Excavation

a. The volume of Unclassified Trench Excavation or Trench Excavation in Rock to be paid for will be the volume in cubic meters, measured in its original position, of material acceptably excavated in conformity with the plans or as directed by the Engineer, but in no case, except as noted, will any of the following volumes be included in the measurement for payment:

1. The volume outside of vertical planes 45 centimeters outside of and parallel to the horizontal projection of the pipe. This is also applicable to culvert end sections.

2. For headwalls, wingwalls and aprons, the volume outside of vertical planes 30 centimeters outside of and parallel to the neat line of the footings.

3. The volume outside of the limits of depth and width for foundation fill ordered by the Engineer.

4. The volume of water or other liquid which can be pumped or drained away.

5. The volume included within the limits of roadway excavation, contiguous channel excavation, ditches and others for which payment is otherwise provided in the contract under Specification 203 or Specification 206.

6. The volume of excavation for underdrains and other elements and underground conduits or structures which are included and paid for under other specifications.

7. The volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed ground.

8. The volume of any material rehandled, except where the plans indicate or the Engineer directs the excavation after embankment has been placed and when the induced trench method described in Specification 603 is required.

b. When the Engineer orders that the excavation be carried below the elevations shown on the plans, the excavation for the first 1.5 meters of additional depth will be included in the quantity for which payment will be made under the contract pay item for trench excavation. The volume of any excavation ordered at a depth of more than 1.5 meters below the plan elevation will not be included in the measurement for payment at contract unit price but will be measured and paid for separately as extra work under the provisions of Article 109.04 of the General Provisions, unless the Contractor accepts payment under the contract unit price for trench excavation.

c. When rock is encountered in the trench excavation and the contract does not include a pay item for trench excavation in rock, any required trench rock excavation ordered by the Engineer will be measured for payment under the provisions of Paragraph 205-5.01b. of this specification.

205-4.02 Foundation Fill -Foundation fill will be measured and paid for separately under Specification 207 - Foundation Fill. If the contract does not include a pay item for foundation fill and the Engineer determines that such material is required, it will be covered as extra work under Article 109.04 of the General Provisions.

205-4.03 Sheet Piling and Bracing - Any required sheet piling and bracing will be an obligation of the Contractor included in the unit price for trench excavation unless such sheet piling is identified on the plans and a separate pay item under Specification 615 - Piling is included in the contract.

205-5 BASIS OF PAYMENT

205-.01 Trench Excavation

a. The quantities of trench excavation measured as provided above, will be paid for at the contract unit price per cubic meter which price and payment shall be full compensation for all materials, labor, tools, equipment and incidentals necessary to complete the item, including:

1. The excavating, hauling, utilization and disposal of any excavation ordered to a depth not more than 1.5 meters below the elevation shown on the plans. Excavation below the 1.5 meter limit will be paid as extra work or as stipulated in paragraph 4.01b. above

2. The furnishing, placing and compacting of backfill and the hauling, utilization and disposal, as

ordered by the Engineer, of any excavation material not used for backfill.

3. The installation and removal of any sheet piling, bracing and shoring not included in the contract as separate pay items.

4. Water control and dewatering of excavations.

b. Any trench excavation in rock ordered by the Engineer and measured for payment under the provisions of paragraph 205-4.01c. above will be paid for at three (3) times the contract unit price for unclassified trench excavation.

205-.02 Sheet Piling and Bracing - When included and identified as a separate pay item will be paid for under Specification 615 - Piling.

205-5.03 Foundation Fill - Material for foundation fill will be paid for under Specification 207 - Foundation Fill.

205-5.04 Payment will be made under:

Pay Item	Pay Unit
Trench Excavation, Unclassified……..	Cubic Meter
Trench Excavation in Rock……	Cubic Meter

SPECIFICATION 206 – EXCAVATION FOR STRUCTURES

206-1 DESCRIPTION

206-1.01 Scope

a. This work shall consist of the necessary excavation of all materials, the placing of backfill and the disposal of the surplus excavated material as required for bridge foundations, box culverts, retaining walls and other structures for which excavation is not otherwise provided under other specifications. The work shall be in accordance with these specifications and in reasonably close conformity with the lines, grades, cross sections and dimensions shown on the plans or established by the Engineer.

b. The work includes as a subsidiary obligation any necessary diversion of streams, bailing, pumping, draining, sheeting, shoring, bracing, safety measures and the construction of any necessary cofferdams, furnishing the materials therefore, their subsequent removal and the placing of all necessary backfill.

c. The work also includes as a subsidiary obligation any clearing and grubbing found necessary within the areas of excavation or within a 1.5 meter strip of land enclosing, and contiguous to, the areas of excavation, except any portions of said areas that are included in the contract for payment under a separate item of Clearing and Grubbing, Specification 201.

206-1.02 The work under this specification does not cover the excavations for waterways, pipe culverts, storm drains, utilities, under drains, manholes, catch basins, inlets, and other underground conduits and minor structures which are included under other specifications.

SPECIFICATION 206 – EXCAVATION FOR STRUCTURES

206-1.03 Excavation for structures will be classified as follows:

a. Unclassified Excavation for Structures - Shall include all structure excavation and the utilization or disposal of all excavated material of whatever character encountered in the work which is not classified and included in the contract under other pay items.

b. Rock Excavation for Structures - Shall include excavation of igneous, metamorphic or sedimentary rock which cannot be excavated without blasting or the use of pneumatic tools. It shall also include all boulders having a volume of one (1) cubic meter or more and any sound masonry and concrete requiring blasting or the use of pneumatic tools to break up and remove.

206-2 MATERIALS

206-2.01 Materials for cofferdams and sheet piling shall meet the applicable requirements of Specification 615 - Piling. Concrete for foundation beds shall meet the appropriate requirements of Specification 601 - Structural Concrete. Material for foundation fill shall meet the requirements of Specification 207 - Foundation Fill.

206-3 CONSTRUCTION REQUIREMENTS

206-3.01 Excavation

a. The Contractor shall notify the Engineer sufficiently in advance of the beginning of any excavation for structures so that the Engineer will have the time to take cross sections and other necessary measurements of the undisturbed ground. The natural ground adjacent to and at the site of the structure shall not be disturbed without the prior authorization of the Engineer.

b. Prior to starting excavation operations in any area, all necessary clearing and grubbing in that area shall have been performed in accordance with Specification 201.

c. Trenches or foundation pits for structures or structure footings shall be excavated to the lines and grades or elevations shown on the plans or established by the Engineer. They shall be of sufficient size to permit the placing of the full width and length of the structures or structure footings shown. The elevations of the bottom of footings, as shown on the plans, shall be considered as approximate only and the Engineer may order such changes in dimensions or elevations of footings as may be deemed necessary to secure a satisfactory foundation.

d. The Contractor shall be responsible at all times for the carrying out of all excavation operations in a safe and prudent manner so that the workmen, the public and adjacent public and private property will be protected from hazard. All applicable local, Commonwealth and Federal laws and requirements shall be observed and the necessary permits acquired by the Contractor.

e. All substructures, where practicable, shall be constructed in open excavation and, where necessary, the excavation shall be shored, braced or protected by cofferdams or sheet piling in accordance with approved methods to prevent causing subsidence or damage to adjacent ground or structures.

f. The excavation shall be dewatered when necessary and kept free from water in such manner that the construction of the structure can be performed in reasonably dry materials.

g. All rock or other hard foundation material shall be freed from loose material, cleaned and cut to a firm surface, either level, stepped, or serrated, as directed by the Engineer.

All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed.

h. When the structure is to rest on an excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation and excavation to final grade shall not be made until just before the footing is to be placed.

i. After each excavation is complete, the Contractor shall notify the Engineer to that effect and no foundation fill, footing or masonry shall be placed until after the Engineer has approved the depth of the excavation and the character of the foundation material.

j. When the foundation material is soft or mucky or otherwise unsuitable, as indicated on the plans or determined by the Engineer, the Contractor shall remove the unsuitable material and backfill with a foundation fill meeting the requirements of Specification 207 - Foundation Fill.

k. When foundation piles are used, the excavation shall be completed before the piles are driven. After the driving is completed all loose and displaced material shall be removed, leaving a smooth bed to receive the footing. Any placing of foundation fill shall be done before the piles are driven.

206-3.02 Water Control

a. The methods to be used to control and remove water from excavations, when not specified in the contract documents, shall be at the option of the Contractor and may include but are not limited to well point systems, pumping sumps or concrete seal courses. The successful performance of whatever method is used shall be solely the responsibility of the Contractor.

b. When no piles are used and the structure is to be supported on spread footings the following shall apply:

1. Care shall be taken during excavation to prevent disturbing the existing foundation material at or below the bottom of the footing elevation. If ground water is encountered during excavation, dewatering shall be commenced and shall proceed in advance of, or concurrently with further excavation. The foundation shall be free of water at the time the footings are placed.

2. If suitable foundation material has been disturbed by the Contractor's operations, has been damaged by water or has been removed for the Contractor's convenience in dewatering the foundation, the foundation shall be restored by the Contractor, at his expense, to a condition at least equal to the undisturbed foundation as determined by the Engineer. The material used to replace such damaged or removed foundation material shall conform to the requirements of Specification 207 - Foundation Fill, and shall be compacted as required.

c. The Contractor shall protect the open excavation from surface water runoff by suitable methods such as dikes, diversion ditches or other methods selected at his option.

206-3.03 Protection of Rivers, Streams and Reservoirs

a. For structures at natural streams and unless otherwise specified, no excavation shall be made outside of caissons, cofferdams, steel piling or sheeting, and the natural stream bed adjacent to the structure shall not be disturbed without authorization from the Engineer. If any excavation or dredging is made at the site of the structure before caissons or cofferdams are sunk in place, the Contractor shall, at his

expense, after the foundation base is in place, backfill all such excavation to the original ground surface of stream bed with material satisfactory to the Engineer.

b. Excavated material shall not be deposited near to rivers, streams, or reservoirs where it might be washed away by high water or run-off and result in siltation of the water bodies. Any material deposited within the stream areas from the excavations or from the filling of cofferdams shall be removed and the stream areas freed from obstruction at the Contractor's expense.

206-3.04 Utilization of Excavated Material

a. All suitable excavated material shall be used as backfill. All surplus suitable material shall be utilized or disposed of as provided in Specification 203 - Excavation and Embankment.

b. Unsuitable material shall be disposed of as shown on the plans or as ordered by the Engineer. If unsuitable material is to be disposed of outside the project right-of-way, the Contractor shall be responsible for obtaining suitable disposal locations and required permits at his expense.

c. No excavated material shall be deposited at any time so as to endanger a partly finished structure, either by direct or indirect pressure.

d. All required handling and hauling of excavation material, including unsuitable and surplus material, to its final utilization or disposition site, shall be an obligation of the Contractor and the cost included in the unit prices for excavation.

SPECIFICATION 206 – EXCAVATION FOR STRUCTURES

206-3.05 Cofferdams and Sheet Piling

a. Suitable and practically watertight cofferdams shall be used whenever water-bearing strata are encountered above the elevation of the bottom of the excavation.

b. Cofferdams for foundation construction shall be carried to adequate depths and heights, shall be safely designed and constructed and shall be made as water-tight as is necessary for the proper performance of the work which must be done inside them. The interior dimensions shall be such as to give sufficient clearance for the construction of forms and the inspection of their exteriors, and to permit pumping outside of the forms. Cofferdams, which are tilted or moved laterally during the process of sinking shall be righted or enlarged so as to provide the necessary clearance at the expense of the Contractor.

c. The Contractor shall submit for review and acceptance by the Engineer detailed drawings prepared and certified by a licensed engineer showing the proposed method of cofferdam construction and other pertinent features not shown in detail on the plans, prior to the start of the cofferdam construction. Acceptance of these drawings by the Engineer does not relieve the Contractor of his responsibility for the structural integrity, safety and adequacy of the cofferdam design and construction.

d. When conditions are encountered which, as determined by the Engineer, render it impracticable to dewater the foundation before placing the footing, the Engineer may require the construction of a concrete foundation seal of such dimensions as he may consider necessary to resist any possible uplift. Concrete for the foundation seal shall be in accordance with the requirements for depositing concrete under water included in Specification

601 - Structural Concrete. The foundation shall then be dewatered and the footing placed.

e. Cofferdams shall be constructed so as to protect green concrete against damage from a sudden rising of the stream and to prevent damage to the foundation by erosion. No timber or bracing shall be left in cofferdams in such a way as to extend into the substructure masonry without written permission from the Engineer.

f. Any pumping that may be permitted from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of any concrete materials being carried away. Any pumping required during the placing of concrete, or for a period of at least 24 hours thereafter, shall be done from a suitable sump located outside the concrete forms. Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure.

g. Any sheet piling required to perform the excavation shall be installed in accordance with the applicable requirements of Specification 615 - Piling.

h. Unless otherwise provided, cofferdams and sheet piling shall be removed after the completion of the substructure. Removal shall be effected in such manner as not to disturb or otherwise injure the finished masonry. Cofferdam and sheet piling may be left in place, at the Contractor's expense, when authorized but subject to such conditions as ordered by the Engineer.

206-3.06 Backfill

a. Excavated areas around structures shall be backfilled with suitable material from the original excavations or from the roadway excavation as approved by the Engineer. If

sufficient suitable excavation material to complete the backfill is not available, borrow material may be used if available as a pay item in the contract; otherwise, the backfill may be completed as extra work under the General Provisions.

b. Unless a special method for backfilling is specified, all filling or backfilling material around structures shall be uniformly placed in layers of not more than 20 centimeters in depth and thoroughly compacted by mechanical tampers to 95% of the maximum density as determined by AASHTO T 180, Method D, before successive layers are placed.

c. Backfill shall be placed simultaneously, insofar as possible, to approximately the same elevation on both sides of an abutment, pier or wall and behind both abutments of structures held in place by superstructures, and behind both side walls of box culverts.

d. No backfill shall be placed higher against one side of any concrete abutment, wing-wall, box culvert and retaining wall until the concrete has been in place 14 days. However, backfill shall be placed around footings to the level of the top of the footings immediately upon removal of the side forms.

e. The backfill in front of abutments, wing-walls and retaining walls shall be placed first to prevent the possibility of forward movement. Special precautions shall be taken to prevent any wedging action against the structure, and the slopes bounding the excavation for abutments wing-walls and retaining walls shall be benched or serrated to prevent wedge action. Jetting of the fill behind structures will not be permitted.

f. Adequate provisions shall be made for the thorough drainage of all backfills. Sheathing and weep holes shall be provided as called for in the plans.

SPECIFICATION 206 – EXCAVATION FOR STRUCTURES

206-4 METHOD OF MEASUREMENT

206-4.01 Excavation for Structures

a. The volume to be paid for under Unclassified Excavation for Structures or Rock Excavation for Structures will be the volume in cubic meters, measured in its original position, of material acceptably excavated in conformity with the plans or as directed by the Engineer, but in no case, except as noted, will any of the following volumes be included in the measurement for payment:

1. The volume outside of vertical planes 45 centimeters outside of and parallel to the neat line of the footings.

2. The volume of water or other liquid which can be pumped or drained away.

3. The volume included within the limits of roadway excavation for which payment is otherwise provided in the contract under Specification 203.

4. The volume of any material excavated below the bottom elevation of the footing unless otherwise provided in the plans or ordered by the Engineer.

5. The volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed ground.

6. The volume of any excavation which is covered under, or is a subsidiary item of, another specification and pay unit.

b. When the Engineer orders that the excavation be carried below the elevations shown on the plans, the

excavation for the first 1.5 meters of additional depth will be included in the quantity for which payment will be made under the contract pay items for excavation for structures. The volume of any excavation ordered at a depth of more than 1.5 meters below the lowest elevation for such footings shown on the plans will not be included in the measurement for payment at contract unit prices but will be measured and paid for separately as extra work under the provisions of Article 109.04 of the General Provisions unless the Contractor accepts payment under the contract unit price for excavation for structures.

c. Rehandling of material will not be included in the measurement for payment unless specifically indicated on the plans or directed by the Engineer.

d. When rock is encountered in the excavation for a structure and the contract does not include a pay item for rock excavation for structures, any required rock excavation ordered by the Engineer will be measured for payment under the provisiones of paragraph 206-5.01b of this specification.

206-4.02 Foundation Fill - Foundation fill will be measured and paid for separately under Specification 207 - Foundation Fill. If the contract does not include a pay item for foundation fill and the Engineer determines that such material is required, it will be covered as extra work under the General Provisions.

206-4.03 Cofferdams and Sheet Piling

a. Cofferdams when specifically identified on the plans and included as separate pay items in the contract will be measured as a lump sum price unit. If not included as separate pay items, any cofferdams required shall be an obligation of the Contractor included in the unit prices for excavation for structures.

b. Any required sheet piling will be an obligation of the Contractor included in the unit prices for excavation for structures unless such sheet piling is identified on the plans and a separate pay item under Specification 615 - Piling is included in the contract.

206-4.04 Concrete - Concrete for foundation seals shall be measured as provided in Specification 601 - Structural Concrete.

206-5 BASIS OF PAYMENT

206-5.01 Excavation for Structures

a. The quantities of excavation, measured as provided above, will be paid for at the contract unit price per cubic meter for each particular pay item, which prices and payment shall be full compensation for all work necessary to complete the item, including:

1. The excavating, hauling and disposal of any excavation for footing ordered to a depth not more than 1.5 meters below the elevation for such footings shown on the plans. Excavation below the 1.5 meters limit will be paid for as extra work.

2. The placing and compacting of backfill and the hauling and disposal, as ordered by the Engineer, of any material not used for backfill.

3. The forming and compacting of embankments made with material obtained from structure excavation.

4. The preparation and completion of subgrade and shoulders, conserving of cushion and topping material, and the finishing, rounding and warping of slopes using surplus material from the excavations.

5. The installation and removal of any sheet piling, bracing, shoring and cofferdams not included in the contract as separate pay items.

6. Water control and dewatering of excavations.

b. Any rock excavation ordered by the Engineer and measured under the provisions of paragraph 206-4.01d above will be paid for at two (2) times contract unit price for unclassified excavation for structures.

206-5.02 Cofferdams and Sheet Piling

a. Cofferdams, when included as a separate item, will be paid for at the lump sum contract price which price will be full compensation for all the work required including furnishing, constructing, maintaining and removal.

b. Sheet piling, when included as a separate pay item, will be paid under Specification 615 - Piling.

206-5.03 Concrete - Concrete for foundation seals will be paid for under Specification 601 - Structural Concrete.

206-5.04 Foundation Fill - Material will be paid for under Specification 207 - Foundation Fill.

206-5.05 Payment will be made under:

Pay Item	Pay Unit
Unclassified Excavation for Structures……	Cubic Meter
Rock Excavation for Structures……	Cubic Meter
Cofferdams……	Lump Sum

SPECIFICATION 207 – FOUNDATION FILL

207-1 DESCRIPTION

207-1.01 **Scope** - This work shall consist of furnishing, placing and compacting selected backfill material as required to replace unsuitable materials encountered and excavated below the foundation elevations of culverts, bridges, retaining walls and other structures, in accordance with these specifications and where indicated on the plans or ordered by the Engineer.

207-2 MATERIALS

207-2.01 Material for use as foundation fill shall conform to either of the following:

a. Crushed stone or gravel, or natural gravel conforming to the requirements of untreated base course material specified in Specification 703 - Aggregates.

b. Borrow material conforming to the characteristics of an A-1, A-3 or A-2-4 soil as per AASHTO M 145 except that foundation fill material that will be below ground water table elevation shall contain not more than 15% passing the No. 200 sieve.

207-3 CONSTRUCTION REQUIREMENTS

207-3.01 Foundation fill shall be placed in layers not exceeding 15 centimeters (loose measurement) in depth unless otherwise authorized by the Engineer. When borrow material is used, each layer shall be compacted to not less than 95% of the maximum density determined as per AASHTO T 180, Method D. When crushed stone or gravel or natural gravel is used, each layer shall be compacted as required by Specification 304.

207-3.02 When the structure is to be supported on piles, the unsuitable material shall be removed and the required foundation fill shall be placed and compacted before the piles are driven.

SPECIFICATION 207 – FOUNDATION FILL

207-4 METHOD OF MEASUREMENT

207-4.01 Foundation fill will be measured by the cubic meter of compacted material accepted in final position. Material placed outside of vertical planes 45 centimeters outside of a parallel to the neat line of the footings will not be included in the measurement for payment.

207-5 BASIS OF PAYMENT

207-5.01 The accepted quantity of compacted foundation fill, measured as provided above, will be paid for at the contract unit price per cubic meter which payment shall be full compensation for furnishing, placing and compacting the material including all labor, equipment, tools and incidentals necessary to complete the specified work.

207-5.02 Payment will be made under:

Pay Item	Pay Unit
Foundation Fill …….	Cubic Meter

SPECIFICATION 208 - DEVICES FOR EMBANKMENT CONSTRUCTION CONTROL AND GROUND WATER OBSERVATIONS

208-1 DESCRIPTION

208-1.01 Scope - This work shall consist of furnishing, installing, maintaining and removing alignment stakes, inclinometers, piezometers, settlement gages and observation wells in accordance with these specifications and in conformity with the details and locations shown on the plans or established by the Engineer.

208-1.02 Alignment stakes, inclinometers, piezometers and settlement gages are used for the control of embankment construction.

a. Alignment stakes and inclinometers serve for the early detection of any lateral ground displacement caused by foundation movements. Alignment stakes are for shallow depth installation while inclinometers are for measuring horizontal ground movement at greater depths.

b. The piezometers are used for the purpose of observing changes in pore water pressure in the embankment foundation during the construction of the embankment.

c. The settlement gages are used to determine the rate of settlement of soft or unstable subsoil under the fill and to detect any abnormal settlement or condition other that may affect the stability of the embankment.

208-1.03 Observation wells are used to measure the ground water table elevation and its variations to aid in determining the need for and locations of underdrains.

SPECIFICATION 208 - DEVICES FOR EMBANKMENT CONSTRUCTION CONTROL AND GROUND WATER OBSERVATIONS

208-2 MATERIALS

208-2.01 Alignment Stakes

a. Wood for alignment stakes shall be yard lumber, straight and free of decay, warps and excessive knots, and conforming to the requirements of the plans and of AASHTO M 168.

b. In lieu of wood stakes, the Contractor may use threaded and capped 3" diameter galvanized or black steel pipe, Schedule 40, conforming to ASTM A 120, or capped 3" diameter PVC pipe, Schedule 40, conforming to ASTM D 1785.

c. Paint shall be a ready-mixed Type I paint, conforming to AASHTO M 70, of the colors called for on the plans or ordered by the Engineer.

208-2.02 Inclinometers - Shall conform to the details and requirements included in the plans and other contract documents.

208-2.03 Piezometers

a. Piezometers shall be of the Casagrande open standpipe type conforming to the details and requirements shown on the plans and other contract documents. They consist of a porous brass tip which is embedded in a sealed-off filter material in a borehole. A riser pipe connects the tip with the ground surface. Water level in the standpipe is determined by lowering the probe of an electrical indicator until it encounters water and an electrical circuit is completed through the water.

1. The riser pipe shall be galvanized steel pipe, Schedule 40, conforming to ASTM A 120, or PVC

pipe, Schedule 40, ASTM D 1785, of the diameter and length indicated on the plans.

2. The well point and screen shall be manufactured of brass. The screen shall be made of No. 40 mesh or No. 18 slots and shall have a minimum length of 2 feet (0.6M) or as indicated on the plans.

3. The filter material shall consist of clean well-graded sand meeting the requirements for concrete sand included in Table 703-1 of Specification 703.

4. The electrical measuring equipment shall be battery operated and meet the approval of the Engineer. It shall consist of a volt-ohmeter and control wire. The wire shall be fitted with a weight to keep the wire taut while making measurements. The length of the control wire shall be accurately calibrated and marked with non-corrodible metal tags secured to the wire at one meter intervals.

b. In lieu of the Casagrande type piezometer, the Contractor may furnish and install at no additional cost, one of the following types of piezometer provided that complete details on the proposed equipment and installation are submitted for review and approval by the Engineer.

1. Closed hydraulic piezometer in which the sensing device consists of a filter tip containing a porous disc connected by two tubes to a pressure gauge which measures the head of water directly.

2. Pneumatic piezometer in which the sensing device consists of a sealed porous tip containing a pressure sensitive valve and diaphragm connected to a

pressure gage by two tubes. 3Air, gas, water or oil is pumped down one tube until the line pressure equals water pressure acting on the opposite side of the diaphragm.

3. Electric piezometer which has an electric sensing device mounted on the flexible diaphragm of the porous tip.

208-2.04 Settlement Gages

a. Steel plate shall conform to AASHTO M 183.

b. Pipe shall be galvanized or black steel pipe, Schedule 40, conforming to ASTM A 120.

208-2.05 Observation Wells

a. Riser pipe shall be galvanized steel pipe, Schedule 40, conforming to ASTM A 120, or PVC pipe, Schedule 40, conforming to ASTM D 1785.

b. Filter material shall consist of sand meeting the requirements for concrete sand included in Table 703-1 of Specification 703.

c. Water level indicator shall be a portable, battery operated, electrical probe similar to the one described in paragraph 208-2.03 a (4) above.

208-3 CONSTRUCTION REQUIREMENTS

208-3.01 Alignment Stakes

a. Stakes and cross-arms shall be constructed of sound 2x4 lumber in accordance with the details shown on the

plans. The stakes shall be at least 4.4 meters long without splices and shall be painted prior to driving.

b. Alignment stakes shall be firmly driven plumb at least 2 meters into the ground at the location shown on the plans or ordered by the Engineer, and shall extend not less than 2.40 meters above the ground.

208-3.02 Inclinometers - Shall be installed in accordance with the details and instructions included in the plans and other contract documents.

208-3.03 Piezometers

a. Piezometers shall be installed in accordance with the details and instructions included in the plans and other contract documents, and at the locations shown on the plans or ordered by the Engineer.

b. Piezometers shall be installed in a bore drilled to the diameter and depth shown on the plans. If no diameter is indicated, then a 6" (15 cm.) bore shall be drilled. The boring shall be held open with a suitable casing to allow placement of the sand filter around the filter tip or sensor body. The use of artificial drilling mud for drilling the hole will not be permitted. The ground water level shall be observed and recorded during drilling and this information shall be furnished to the Engineer.

c. The filter material shall extend 30 centimeters below the tip elevation of the filter tip, shall completely surround it, and extend upward in the hole to 60 centimeters minimum above it. The sand shall be thoroughly saturated prior to placing in the hole. After placement of the sand and before placement of the top impervious backfill, the casing shall be withdrawn to within 3 meters of the surface. The upper 3

meters of backfill shall be of an impervious material thoroughly compacted in 10 to 15 centimeter layers as the casing is further withdrawn.

d. Each piezometer shall be tested by filling with water to the top of the standpipe. If the water level in the piezometer does not fall to approximately the groundwater level in 48 hours, the piezometer shall be flushed out with clean water and retested. If the piezometer remains inoperative, it and shall be replaced by the Contractor at his expense.

e. The piezometers will be read and recorded by the Engineer at the intervals established by the instructions or by the Soils Engineer.

208-3.04 Settlement Gages

a. The ground surface where the fill is to be placed shall be cleared and grubbed prior to the installation of the settlement gages. At the location of the gage there shall be excavated a shallow hole to be backfilled with clear tamped sand to form a level base for the base plate and the first section of pipe. Settlement plate assemblies or gages shall be fabricated and assembled in accordance with the details shown on the plans. The pipe of each assembly shall be painted at 20 centimeter intervals measured from the plate, with a 25 millimeter band of yellow paint. Each band so painted shall be marked with the appropriate numeral.

b. The Contractor shall install the gages at the required locations prior to the placing of fill and shall add extensions to the vertical pipes as required to keep the tops of the pipes not less than 60 centimeters above the surface of the fill at all times.

c. The Contractor shall maintain pipes plumb and shall protect the gages against damage by construction equipment and should a gage be damaged, he shall immediately excavate the material from around the pipe to a depth such that the damaged section of pipe may be removed and a new section substituted and marked at the Contractor's expense.

d. Daily observations to determine the rate of settlement of the soft-unstable subsoil under the fill and for other purposes will be made by the Engineer on the gages, recording the elevations of the platforms, until the fill plus any overload reaches its final elevation. Thereafter, observations will be made every week. The Contractor shall give the Engineer such assistance as the Engineer may require in taking the readings.

208-3.05 Observation Wells

a. Observation wells shall be constructed of 1 1/4" minimum internal diameter pipe in accordance with the details and at the locations shown on the plans or ordered by the Engineer. The bottom of the pipe shall be closed with a threaded plug and the lower five feet of pipe shall be perforated by approximately twenty five 1/8" round holes uniformly staggered. The top of the pipe shall be fitted with a cap having a 1/8" to 1/4" diameter vent hole. The well pipe shall extend to one meter above the adjacent ground.

b. The observation well pipe shall be installed in a 6" minimum diameter hole drilled to the depth shown on the plans or ordered by the Engineer. If not shown on the plans, the bottom of the pipe shall be placed at a depth of two meters below the subgrade elevation of the adjacent cut or as determined by the Engineer if rock is encountered above this point.

c. The boring shall be held open with a suitable casing to allow placement of the sand filter around the perforated section of the well. The use of artificial drilling mud for drilling the hole will not be permitted. The ground water level shall be observed and recorded during drilling and this information shall be furnished to the Engineer.

d. The sand filter shall extend 6 inches (15 cm) below the tip of the well pipe, shall completely surround the perforated 5-foot section and shall extend around the well pipe up to within two meters of the ground surface elevation. As the casing is withdrawn from the upper two meters, the hole around the pipe shall be backfilled with an impervious material, thoroughly compacted in 10 to 15 centimeter layers.

e. The observation well shall be tested by filing with water to the top of the riser. If the water level in the pipe does not fall to approximately the ground water level in 48 hours, the well shall be flushed out with clean water and retested. If the well remains inoperative, it will be rejected and shall be replaced by the Contractor.

f. Readings and recording of the observation wells will be made by the Engineer at the intervals established by the instructions or by the Soils Engineer.

208-3.06 Protection of Devices

a. The Contractor shall continuously protect all the installed devices to avoid their being displaced or damaged in any way. He shall drive steel rails or other suitable protection around piezometers, settlement gages, observation wells, and such other devices as ordered by the Engineer, to protect them from the construction operations, equipment and traffic, and he shall place flags as necessary to mark their locations.

b. The contractor shall be responsible for the safety of all the devices. If any device is damaged or disturbed through his fault or negligence, the Authority shall have the option of either having it replaced at the Contractor's expense or deducting from future payments the contract unit price of the device.

208-3.07 Removal of Devices

a. The Contractor shall remove each installed device if and when so ordered by the Engineer. However, the Authority has the option of leaving any device in place beyond the contract completion date.

b. All instruments used for reading the inclinometers, piezometers and observation wells provided by the Contractor under the contract items shall remain the property of the Contractor, unless otherwise indicated in the contract documents.

208-3.08 Authority Instruments - The contract documents will indicate when and which sensors or other instruments are to be furnished by the Authority.

208-4 METHOD OF MEASUREMENT

208-4.01 Alignment stakes, inclinometers, piezometers and settlement gages will be measured by the unit.

208-4.02 Observation wells will be measured by the lineal meter to the nearest tenth. Measurement will be from the bottom of the installed pipe to the natural ground elevation.

SPECIFICATION 208 - DEVICES FOR EMBANKMENT CONSTRUCTION CONTROL AND GROUND WATER OBSERVATIONS

208-5 BASIS OF PAYMENT

208-5.01 The quantities determined as provided above will be paid for at the contract unit price per unit of measurement. Such prices and payment shall constitute full compensation for furnishing, placing, maintaining and removing all devices, and for all materials equipment, tools, labor and incidentals necessary to complete each item as required by the plans and specifications, including furnishing the specified measuring devices and instruments, and providing assistance to the Engineer in taking the readings.

208-5.02 Payments will be made under:

Pay Item	Pay Unit
Alignment Stakes…….	Each
Inclinometers……	Each
Piezometers……..	Each
Settlement Gages…….	Each
Observation Wells……...	Linear Meter

SPECIFICATION 209 - SHEATHING

209-1 DESCRIPTION

209-1.01 Scope - The work shall consist of sand, gravel, crushed gravel or crushed stone furnished and placed in layers against the inside faces of retaining walls, wing walls, back faces of abutments and over the extrados of arches, in accordance with these specifications and with the details shown on the plans or as directed by the Engineer.

209-2 MATERIALS

209-2.01 Permeable sheathing material shall consist of hard, durable, clean sand, gravel, crushed gravel or crushed stone, and shall be free from organic material, clay balls dirt or other deleterious substances. The material shall conform to either of the alternates given below.

a. Gravel, crushed gravel or crushed stone meeting the following gradation requirements when tested according to AASHTO T 27.

Sieve Designation	Percentage by Weight Passing
1 inch	100
1/2 inch	85-100
3/8 inch	40-75
No. 10	0-10
No. 200	0- 3

b. Clean, noncementitious sand meeting the requirements for fine aggregate specified in AASHTO M 6 except that the material passing the 200 sieve shall not exceed 3 percent by weight and the soundness tests will not be required.

209-2.02 In place sheathing material that fails to meet requirements of this specification shall be removed by the Contractor

and replaced with suitable material at no additional cost to the project.

209-3 CONSTRUCTION REQUIREMENTS

209-3.01 The sheathing material shall be placed adjacent to structures as specified on the contract plans.

a. The placement of the sheathing shall precede the placement of the adjacent backfill material and the thickness of each lift shall not exceed the thickness of the lifts of the adjacent material.

b. Each lift of sheathing and of backfill material located within a minimum distance of one meter from the backwall plus the footing heel projection shall be compacted simultaneously.

c. Planks or other suitable separators than can be withdrawn as the work progresses shall be kept between the sheathing and the fill when working against vertical faces or slopes steeper than the angle of repose of the material. Bagging of the sheathing in burlap bags is permitted.

d. Placement and compaction operations shall be conducted in such a manner so as to insure that the top surface of each lift of sheathing material shall not be contaminated by the adjacent backfill materials.

e. When used against a mortar protection course of membrane waterproofing, sheathing shall not be placed until the mortar has aged for at least 3 days.

f. The inlet ends of all weep holes and drains shall be covered first with large selected stones over which there shall be placed finer material in such manner as to provide free access for the drainage but prevent the leaching out of the filling material.

g. The sheathing shall form a continuous covering over the entire designated surface, extending from the elevation of the bottom of weep holes and drains to 30 centimeters from the top of the wall, unless otherwise shown on the plans or directed by the Engineer. The remaining 30 centimeters shall be filled with impermeable material thoroughly compacted, to avoid surface waters from draining through the sheathing.

h. Where waterproofing on backwall is protected by roofing felt, a 10 centimeter thick layer of sand, meeting the requirements of paragraph 209-2.01b above, shall be placed between the sheathing and the wall.

i. Unless otherwise shown on the plans or ordered by the Engineer, the layer of sheathing shall be thirty (30) centimeters in thickness.

209-4 METHOD OF MEASUREMENT

209-4.01 The quantity of sheathing to be paid for will be the number of cubic meters of material measured in final position between the limits shown on the plans or directed by the Engineer, complete in place and accepted. Sand required when the waterproofing is protected by roofing felt will be included in the measurement of sheathing material. Material placed outside the limits shown on the plans or established by the Engineer will not be included in the measurement for payment.

209-4.02 The furnishing and placing of the compacted cover of impervious material over the sheathing will not be measured for payment. This cover shall be a subsidiary obligation of the Contractor with its cost included in the Sheathing pay item.

209-5 BASIS OF PAYMENT

209-5.01 The quantity of sheathing placed and accepted, measured as specified above, will be paid for at the contract unit price, which payment will be full compensation for furnishing all

materials, equipment and labor, and incidentals necessary to complete the required work.

209-5.02 Payment will be made under:

Pay Item	Pay Unit
Sheathing ……..	Cubic meter

SPECIFICATION 210 – SOIL EROSION AND WATER POLLUTION CONTROL

210-1 DESCRIPTION

210-1.01 Scope - This work shall consist of providing temporary soil erosion and water pollution control measures as shown on the plans or as ordered by the Engineer. The control measure may include berms, dikes, check dams, silt fences, sediment basins, fiber mats, mulches, grasses, slope drains, temporary waterways and other erosion control devices or methods.

210-1.02 The temporary control measures contained herein shall be coordinated with the permanent erosion control features specified elsewhere in the contract, to the extent practical, to assure economical, effective and continuous erosion control throughout the construction and post construction period. Work under this specification will not be used and paid for in situations where permanent contract items can be practically installed at an early date in final position to provide the necessary erosion control measures.

210-1.03 This work includes the detailed planning of construction operations necessary for the preparation and submittal by the Contractor of an explicit erosion control plan and schedule to supplement the temporary and permanent erosion control measures shown on the plans which cannot be detailed without knowledge of the Contractor's specific construction operations plan.

210-2 MATERIALS

210-2.01 The following materials shall conform to the applicable requirements of the specifications indicated below:

Material	Specification
Geotextiles (Filter Fabrics)……	712-7
Plastic Liner……..…..	712-8
Lime……...	713-2
Fertilizer…….	713-3
Seed……	713-4

SPECIFICATION 210 – SOIL EROSION AND WATER POLLUTION CONTROL

Material	Specification
Mulches……..	713-6
Jute Mesh……..…….	713-8

210-2.02 Straw or Hay Bales - Shall be rectangular, approximately one meter (3.3 feet) in length and weigh approximately 70 pounds.

210-2.03 Sandbags - Shall be canvas, burlap or other approved material. Sand filler shall be clean, silt free material approved by the Engineer. The sandbags shall contain a minimum of 0.014 cubic meters (0.5 cubic feet) of sand.

210-2.04 Riprap - Shall conform to the applicable requirements of Specification 622 - Riprap.

210-2.05 Culvert Pipe - Temporary culvert pipes used for diverting live streams through work areas shall be corrugated metal or plastic, concrete, or other approved material. Temporary pipes placed beneath traveled ways shall be capable of withstanding an H-20 loading on the roadway.

210-2.06 Slope Drains - Temporary slope drains shall be constructed of pipe, fiber mats, rubble, portland cement concrete, bituminous plant mix, plastic sheeting or other material shown on the plans, on the Contractor's approved erosion control plan, or as ordered by the Engineer.

210-2.07 Other required materials shall meet the commercial grade standard for the particular product and require the Engineer's approval before incorporating into the project.

SPECIFICATION 210 – SOIL EROSION AND WATER POLLUTION CONTROL

210-3 CONSTRUCTION REQUIREMENTS

210-3.01 General

a. In the event of conflict between these specification requirements and any pollution control laws, rules or regulations of other Federal, Commonwealth or local agencies, the more restrictive laws, rules or regulations shall apply.

b. At the pre-construction conference, prior to the start of construction work, the Contractor shall submit to the Engineer for review and approval his proposed plan and schedule for the temporary and permanent erosion control work. The schedule shall detail the proposed coordination for accomplishing the temporary and permanent erosion control work in a timely and appropriate manner. No construction work shall be started until the schedule has been approved and the necessary controls installed as required for the particular operation to be in progress.

c. The Contractor shall incorporate all permanent erosion control features into the project at the earliest practical time in order to minimize the need for temporary erosion control measures and this should be reflected in his proposed schedule.

d. If the Engineer determines that the Contractor is not in compliance with the approved erosion control schedule, or field conditions warrant changes in the plan, the Contractor shall submit a revised schedule for performing erosion control work and no work contingent upon the revised schedule shall be continued or started until the revised plan has been approved.

e. Clearing and grubbing operations shall be so scheduled and performed that grading operations and

permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages. Under no conditions shall the surface of the erodible earth material exposed at one time by clearing and grubbing exceed 70,000 square meters unless such areas are protected by adequate temporary erosion control measures approved by the Engineer.

f. Excavation, borrow, and embankment operations shall also be scheduled and performed to permit permanent erosion control features to follow immediately thereafter if project conditions permit; otherwise, temporary erosion control measures may be required. Under no conditions shall the surface area of erodible earth material exposed at one time by excavation, borrow, or fill exceed 70,000 square meters without the prior installation of adequate erosion control measures approved by the Engineer.

g. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing, grubbing, excavation, borrow and embankment construction operations in progress commensurate with the Contractor's capability and progress in keeping temporary erosion control measures and the finish grading, mulching, seeding and other such permanent erosion and pollution control measures current in accordance with the accepted schedule. The Engineer has also the authority to increase or decrease the amount of surface area of erodible earth material to be exposed at any one time by clearing, grubbing, excavation, borrow and embankment construction operations as determined by his analysis and evaluation of existing project conditions.

h. The Engineer has the authority to direct the Contractor to immediately provide erosion control measures to prevent soil erosion that will adversely affect construction operations, damage adjacent properties, or cause contamination of adjacent streams, other watercourses, lakes, ponds or other

areas of water impoundment. Such work may involve the construction of temporary berms, dikes, check dams, sediment basins, slope drains and use of temporary mulches, mats, seeding or other control devices or methods as necessary to control erosion.

i. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness or failure to install permanent controls as a part of the work as scheduled or as ordered by the Engineer, such work shall be performed by the Contractor at no cost to the Government.

j. Temporary erosion and pollution control may include construction work outside the right-of-way where such work is necessary as a result of roadway construction operations. Any such work outside the project right-of-way shall be coordinated with the property owner.

k. The erosion control features installed by the Contractor shall be operated and maintained by the Contractor, at his expense, in an acceptable functional condition.

210-3.02 Erosion Check Dams - Erosion checks, constructed with hay or straw bales as specified, shall be staked in place as shown on the plans or where ordered installed by the Engineer to act as erosion filters and barriers at the toe of fills, in ditches, at pipe inlets and outlets, or for other uses as directed.

210-3.03 Silt Fences - Silt fences shall be used for silt barriers, and shall be constructed in accordance with the details and at the locations shown on the plans or designated by the Engineer, or as called for in the Contractor’s erosion control plan and schedule.

SPECIFICATION 210 – SOIL EROSION AND WATER POLLUTION CONTROL

210-3.04 Sediment Containment Structures

a. Settling ponds, basins, dikes, dams or other such containment structures shall be constructed in accordance with the details shown on the plans, specified in the contract, or as directed by the Engineer.

b. Sedimentation structures shall remain in service until all disturbed areas draining into these structures have been satisfactorily stabilized. Disturbed areas shall be considered stabilized when all seeding items have been completed and accepted, and all drainage ditches or channels have been paved or satisfactorily lined. When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed and disposed of, all excavations backfilled or otherwise graded and properly compacted, and the existing ground restored to its natural or intended final condition in a manner acceptable to the Engineer.

210-3.05 Diversion Channels - Temporary channels for diverting water around an area where a culvert is to be installed shall be lined with plastic film sheeting when so specified in the plans or ordered by the Engineer. The diversion channel shall be excavated to a depth and width adequate to accommodate stream flow during the period of culvert installation. The channel shall be reasonably smooth and free of sharp rocks, stones, roots or other projections that may puncture the plastic liner. No longitudinal seams will be permitted. Transverse seams, if necessary, shall be lapped a minimum of two feet in the direction of the flow. The liner shall be anchored in place using clean rock, gravel, or other methods approved by the Engineer.

210-3.06 Earth Berms - Temporary earth berms shall be used for diverting or channeling runoff waters to slope drains, waterways, diversion ditches, sediment traps, or other uses as directed. Earth berms shall be constructed in conformity with the dimensions shown on the plans and at the locations established by the Engineer or called

for in the Contractor's erosion control plan. Material shall be reasonably nonporous and shall contain no roots, sod or other deleterious materials.

210-3.07 Slope Drains and Waterways - Temporary slope drains or waterways shall be constructed at the intervals and locations designated by the Engineer, or in the Contractor's erosion control plan, for channeling runoff waters down embankment slopes. Slope drains shall be adequately anchored to the slopes and their outlets so placed and constructed as to prevent erosion. Waterways constructed down erodible slopes shall be lined with plastic sheeting. Waterways constructed down slopes composed of rock where erosion will not occur need not be lined with plastic sheeting.

210-3.08 Turf Establishment - When it is not practical or not permitted to perform permanent turf establishment work under Specification 627, temporary seeding, fertilizing, liming and mulching will be applied under this specification. The applicable rates and types of materials for temporary turf establishment shall be as specified in the contract or as established by the Engineer.

210-3.09 Cleanup - After the temporary erosion and pollution control installations are no longer required, the Contractor shall remove and dispose of all materials and restore the areas to their original or intended final appearance in a manner acceptable to the Engineer.

210-4 METHOD OF MEASUREMENT

210-4.01 When the following components of temporary soil erosion and water pollution control work are included as separate pay items in the contract, they will be measured as follows:

a. Straw or hay bales will be measured by the number of individual bales furnished, installed and accepted.

b. Sand bags will be measured by the number of individual bags filled with sand furnished, installed and accepted.

c. Pipe slope drains will be measured by the linear meters of each type of drain pipe furnished, installed and accepted.

d. Paved or lined slope drains will be measured by the square meters of each type of paving or lining furnished, installed and accepted.

e. Earth berms will be measured by the linear meters of berm constructed to the dimensions shown on the plans, on the Contractor's erosion control plan or ordered by the Engineer and accepted.

f. Silt fences will be measured by the lineal meters of fence furnished, installed, maintained and accepted.

g. Plastic liners for use in diversion channels, and other soil erosion control structures will be measured by the square meters of liner furnished, installed and accepted.

210-4.02 Diversion channels will be measured for payment as unclassified excavation by the cubic meter under the pay items and provisions of Specification 203 - Excavation and Embankment.

210-4.03 Turf establishment including temporary and permanent seeding, fertilizer, seed, mulch and jute mesh will be measured for payment under the applicable pay units and provisions of Specification 627 - Turf Establishment.

210-4.04 The work and materials required for the construction of sediment containment structures will be measured for payment under the applicable pay units and provisions of Specification 203 - Excavation and Embankment.

210-4.05 Riprap will be measured by the cubic meters of each type of specified riprap material furnished, installed and accepted under the pay items and provisions of Specification 622 - Riprap.

210-4.06 Where a lump sum method of payment for soil erosion and water pollution control work is specified in the contract, no separate measurement for payment will be made of all the soil erosion and water pollution control items shown in the plans or designated in the contract documents and all of this work will be considered as a single unit.

210-4.07 No direct measurement and payment will be made for furnishing, installing and subsequently removing and disposing of temporary drainage structures, such as culvert pipe, used for diverting of live streams around or through work areas, but such work will be considered a subsidiary obligation of the Contractor.

210-4.08 Work which is subsidiary to other construction pay items included in the contract under their respective specifications, will not be measured for direct payment under this specification.

210-5 BASIS OF PAYMENT

210-5.01 The accepted quantities, determined as provided in Articles 210-4.01 and 210-4.06 above, for the pay items listed in Article 5.05 below, which are included in the contract, will be paid for at the contract price per unit of measurement. Such price and payment shall constitute full compensation for furnishing, installing and maintaining all required materials, and for all labor, equipment, tools and incidentals necessary to complete the work as required by the plans and specifications.

210-5.02 When the temporary soil erosion and water pollution control work is paid for on a lump sum basis, monthly partial payments will be made for this item on the basis of the amount of work completed as estimated by the Engineer.

SPECIFICATION 210 – SOIL EROSION AND WATER POLLUTION CONTROL

210-5.03 No additional payments will be made for any adjustments, cleanout and disposal of accumulated sediments or other such maintenance work on previously installed erosion and pollution control facilities.

210-5.04 When the contract does not contain an item for any aforementioned soil erosion or pollution control, the work will not be paid for directly but will be considered as a subsidiary obligation of the Contractor under other contract items.

210-5.05 Payment will be made under:

Pay Item	Pay Unit
Straw Bales …….	Each
Sand Bags ……	Each
Pipe Slope Drains _____…….	Linear Meter
Paved or Lined Slope Drains _____(Type) …..	Square Meter
Earth Berms ……	Linear Meter
Silt-Fence ……	Linear Meter
Plastic Liner ……	Square Meter
Temporary Erosion Control Measures ……...	Lump Sum

SPECIFICATION 211–BRIDGE APPROACH EMBANKMENT

211-1 DESCRIPTION

211-1.01 Scope - This work shall consist of constructing bridge approach embankments of specified borrow materials at the locations indicated on the plans, in accordance with these specifications, and in conformance with lines, grades, cross sections shown on the plans or ordered by the Engineer.

211-2 MATERIALS

211-2.01 The material for these embankments shall consist of a granular soil material meeting the requirements of an A-1 or an A-2-4 soil as per AASHTO M 145. The maximum dimension of any stone or rock fragment in the soil shall not exceed 20 centimeters.

211-2.02 The sampling and testing of the embankment material will be performed as specified for borrow materials in paragraphs 203-2.04 a., b., and c. of Specification 203 - Excavation and Embankment. In-place material that fails to meet the specification requirements shall be removed and replaced with specification material by the Contractor at his expense.

211-3 CONSTRUCTION REQUIREMENTS

211-3.01 The specified material for these bridge approach embankments shall be furnished from any sources outside the project limits selected by the Contractor at his expense. It may also be obtained, if available, from within the roadway excavation under the provisions of Article 104.08 of the General Provisions.

211-3.02 Each bridge approach embankment shall be constructed at the location and in accordance with the cross sections and details shown on the plans, or ordered by the Engineer in advance of driving any piles or performing any abutment construction.

211-3.03 The embankments shall be constructed in conformance with all the applicable requirements of Article 203-3.04

and 203-3.05 of Specification 203 - Excavation and Embankment, modified as follows:

a. Each and every layer shall be compacted to a 100% maximum density determined as per AASHTO T 180, Method D.

b. No rock fills as defined in Article 203-3.04d., will be allowed.

211-3.04 When the contract documents call for proof rolling on a bridge approach embankment, such proof rolling shall be performed in accordance with the requirements of Article 203-3.06 of Specification 203 under a 50-ton gross load and prior to any excavation for structures or pile driving.

211-3.05 The excavation within the embankments for the construction of the bridge abutments and the wing walls, if any, shall be performed in accordance with the details shown on the plans and in conformance with the requirements of Specification 206 - Excavation for Structures modified as follows:

a. The sides of the excavation shall be maintained vertical and within the 45-centimeter clearance allowed to the neat lines of the abutment footing. The excavation shall be shored and braced if necessary to maintain the required vertical position of the excavation sides.

b. Continuous dewatering of the excavation is essential. Drainage trenches or pipes shall be provided as necessary to quickly drain storm waters from the excavation.

c. The borrow material removed from the approach embankments during the excavations for the abutments and wingwalls shall be saved and stored for use as backfill around the abutment structures. Backfilling shall be performed in strict compliance with paragraphs b. through g. of Article 206-3.06 of Specification 206.

SPECIFICATION 211–BRIDGE APPROACH EMBANKMENT

211-4 METHOD OF MEASUREMENT

211-4.01 Borrow material for bridge approach embankments will be measured by the end area method in cubic meters, in final position, determined from field cross sections of the bridge approach embankments completed and accepted. However, material placed outside the plan cross sections will not be included in the measurement for payment except as ordered by the Engineer.

211-4.02 Any excavation of the existing ground where a bridge approach embankment is to be built will be measured and paid for under the applicable pay item under Specification 203 included in the contract.

211-4.03 Proof rolling of the bridge approach embankment, when called for in the contract, will be measured and paid for under the applicable provisions of Specification 203.

211-4.04 Any required structural excavation within a bridge approach embankment will be measured and paid for as unclassified excavation for structures under Specification 206.

211-5 BASIS OF PAYMENT

211-5.01 The accepted quantity of borrow material for bridge approach embankment, determined as provided above, will be paid for at the contract unit price per cubic meter. Such price and payment shall constitute full compensation for furnishing, hauling, placing, watering, drying and compacting the embankment material; and for all labor, equipment, tools and incidentals necessary to complete the work as required by the plans and specifications.

211-5.02 Payment will be made under:

Pay Item	Pay Unit
Bridge Approach Embankment……	Cubic Meter

SPECIFICATION 212–RECONDITIONING OF SHOULDERS AND DITCHES

212-1 DESCRIPTION

212-1.01 Scope

a. This work shall consist of the reconditioning and reshaping of existing earth shoulders, ditch slopes and ditches in accordance with these specifications and in conformity with the locations, lines, grades, dimensions and sections shown in the contract documents or established by the Engineer.

b. The work includes performing any clearing and grubbing, excavation work, and removal and disposal of excess material and debris necessary to carry out the reconditioning and reshaping work within the designated shoulder, ditch slope and ditch area.

c. The work also includes the furnishing, placing and compacting of any material necessary to complete the reconditioning and reshaping work to the lines, grades and sections indicated in the contract documents or established by the Engineer.

212-2 MATERIALS

212-2.01 Material required to bring the shoulders to the specified dimensions, grade and shape shall be a granular soil classifiable as A-1, A-3, A-2-4, or A-2-5 under AASHTO M 145 but which shall be free of stones or rock fragments larger than 5 centimeters in their greatest dimension.

212-2.02 Any backfill material needed for the reconditioning and reshaping of the ditch slopes and ditches may be excess non-organic soil resulting from the excavation work which is acceptable to the Engineer or a borrow similar to the in-place material.

SPECIFICATION 212–RECONDITIONING OF SHOULDERS AND DITCHES

212-3 CONSTRUCTION REQUIREMENTS

212-3.01 Clearing and grubbing of the existing shoulders, ditch slopes and ditches shall be performed in accordance with the requirements of Specification 201 - Clearing and Grubbing.

212-3.02 After clearing and grubbing, the shoulders, ditch slopes and ditches shall be finished by means of suitable grading equipment and, where necessary, by hand tools, to the required shape and cross section.

212-3.03 All debris and excess excavation material shall be disposed of by the Contractor, at his expense, at acceptable locations outside the project limits in accordance with all applicable local, Commonwealth and Federal regulations.

212-3.04 Shoulders shall be brought to the required dimensions, grade and shape placing, as necessary, the specified shoulder material, and compacted with suitable power rollers to a firm and dense condition. Water shall be applied as needed during the compaction operations.

212-3.05 The completed work shall be uniform in appearance and in substantial conformance with the specified cross sections and grades.

212-4 METHOD OF MEASUREMENT

212-4.01 The quantity of reconditioning of shoulders and ditches to be paid for shall be the actual length in kilometers, measured horizontally to the nearest meter, completed and accepted by the Engineer.

a. The pay unit includes the complete section of shoulder, ditch slope and ditch on one side of the road. Each side of the road will be measured independently. Measurement shall be along the project centerline.

b. Sections where no work on reconditioning of shoulder and ditches is performed such as where there are existing curbs and sidewalks, will be considered exceptions and will not be included in the measurement; however, intersecting roads and driveways will not be considered exceptions.

c. Additional length of shoulder and ditch reconditioning due to intersection returns, tapers, driveways and irregular areas will not be separately measured for payment but shall be considered subsidiary to the centerline measurement provided herein.

d. When the placement, shaping and compacting of earth behind newly constructed curbs is required, such earthwork will be included in the measured length of shoulder and ditch reconditioning.

212-4.02 No separate measurement and payment will be made for clearing and grubbing, excavation work, disposal of debris and excess material, the furnishing and placing of any required borrow material, watering and compaction as all this work is subsidiary to the pay items for reconditioning of shoulders and ditches.

212-5 BASIS OF PAYMENT

212-5.01 The length of reconditioned shoulders and ditches, determined as provided above, will be paid for at the contract unit price. Such price and payment shall be full compensation for furnishing all the materials, equipment, tools, labor and incidentals necessary to complete all the work as required by the contract documents.

212-5.02 Payment will be made under:

Pay Item	Pay Unit
Reconditioning of Shoulders and Ditches……	Kilometer