

ITEM P-152 EXCAVATION AND EMBANKMENT

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct safety areas, runways, taxiways, aprons, and intermediate as well as other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical section(s) shown on the plans.

152-1.2 CLASSIFICATION. All material excavated shall be classified as defined below:

a. Unclassified Excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature, which is not otherwise classified and paid for under the following items.

b. Rock Excavation. Rock excavation shall include all solid rock in ledges, in bedded deposits, in unstratified masses, and conglomerate deposits which are so firmly cemented they cannot be removed without blasting or using rippers. All boulders containing a volume of more than 1.0 cubic yard (0.4 cubic meter) will be classified as "rock excavation."

~~**c. Muck Excavation.** Muck excavation shall consist of the removal and disposal of deposits or mixtures of soils and organic matter not suitable for foundation material. Muck shall include materials that will decay or produce subsidence in the embankment. It may be made up of decaying stumps, roots, logs, humus, or other material not satisfactory for incorporation in the embankment.~~

~~**d. Drainage Excavation.** Drainage excavation shall consist of all excavation made for the primary purpose of drainage and includes drainage ditches, such as intercepting, inlet or outlet, temporary levee construction; or any other type as shown on the plans.~~

e. Borrow Excavation. Borrow excavation shall consist of approved material required for the construction of embankment or for other portions of the work in excess of the quantity of usable material available from required excavations. Borrow material shall be obtained from areas within the limits of the airport property but outside the normal limits of necessary grading, or from areas outside the airport.

152-1.3 UNSUITABLE EXCAVATION. Any material containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction. Material, when approved by the Engineer as suitable to support vegetation, may be used on the embankment slope.

152-1.4 CONTAMINATED MATERIAL. All borrow material shall be naturally occurring and originate from a source that has not been impacted from any known or unknown environmental concern, industrial process, or other uncontrolled activities such as, but not limited to, emergency responses, hazardous material incidents or discharges of any regulated/adverse chemical compounds.

The borrow material shall be free of any industrial waste, sanitary waste, household waste or solid waste, and shall not exhibit any signs of sludge, staining, pitting, strong pungent noxious odors, non-aqueous phase liquids, foreign debris, and hazardous substance and petroleum product containers or other pollutants.

The borrow material shall not contain or have come in contact with asbestos, polychlorinated biphenyl's (PCBs), petroleum wastes, medical wastes, radioactive waste or other classified waste.

The borrow material shall not be classified as a listed hazardous waste as defined by the United States Environmental Protection Agency (USEPA) in 40 CFR Part 261 Subpart D or having the characteristics of hazardous waste (ignitability, corrosivity, reactivity or toxicity) defined in 40 CFR Part 261 Subpart C. In addition, the borrow material shall be free of petroleum contaminants of concern as defined in Table II of Chapter 62-777 Florida Administrative Code, other pollutants identified by the Florida Department of Environmental Protection Waste Management Rules or other regulated substances that have State Cleanup Standard requirements.

Prior to bringing any borrow material on-site, the Contractor shall identify the intended source(s) of borrow material he proposes to use in the project, and notify the Engineer of those locations. The Engineer shall visit the proposed borrow site(s) and perform an inspection of the site(s), perform the necessary testing of the borrow materials identified by the Contractor for use in the project to establish that the materials meet the requirements of the specifications, and to establish the boundaries of the borrow stockpiles.

The Contractor shall be required to perform limited Phase I Site Assessment of the proposed borrow materials to establish a benchmark of acceptable materials to be used in the project. The Contractor shall also perform a soil characterization study of the borrow material before such material is approved for use on-site. The Contractor shall also certify, in writing, to the Engineer and Owner that the materials delivered to the site are from the approved borrow sources.

The Engineer, at his discretion, will perform random soil characterization testing of individual truck loads of borrow materials as they enter the project site to verify they are from the approved borrow sources based upon the soil characterizations of the approved sources and those of the random tested materials.

If test results determine that soils are contaminated, construction activities will cease and the ~~Florida Department of Environmental Protection (FDEP)~~ Minnesota Pollution Control Agency Mn/PCA and the Federal Environmental Protection Agency (EPA) shall be notified of the violation(s). There may also be fines and/or penalties levied against the Contractor by any jurisdiction having authority over the project site as well as the ~~FDEP~~ Mn/PCA and EPA. Any fines or penalties levied against the Owner due to the contaminated soil shall be passed on to the Contractor who shall be solely responsible for payment of those fines. Any costs associated with the testing by the Engineer that determines that contaminated soils of materials brought to the site are present shall be paid by the Contractor. Also, any material brought to the site that is determined to be contaminated shall be removed in its totality by the Contractor at no additional cost to the Owner and remediation and/or disposal of contaminated soils shall be required in accordance with the rules and regulations of the jurisdiction(s) having authority.

CONSTRUCTION METHODS

152-2.1 General. ~~Before beginning excavation, grading, and embankment operations in any area, the area shall be completely cleared and grubbed in accordance with Item P-154.~~

The suitability of material to be placed in embankments shall be subject to approval by the Engineer. All unsuitable material shall be disposed of in waste areas shown on the plans or disposed of legally off airport property. All waste areas shall be graded to allow positive drainage of the area and of adjacent areas. When disposed of on the airport, the surface elevation of waste areas shall not extend above the surface elevation of adjacent usable areas of the airport, unless specified on the plans or approved by the Engineer.

When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued. At the direction of the Engineer, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Those areas outside of the pavement areas in which the top layer of soil material has become compacted, by hauling or other activities of the Contractor shall be scarified and disked to a depth of 4-inches (100 mm), in order to loosen and pulverize the soil.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the Engineer, who shall arrange for their removal if necessary. The Contractor shall, at his/her own expense, satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

152-2.2 EXCAVATION. No excavation shall be started until the work has been staked out by the Contractor and the Engineer has reviewed and approved obtained elevations and measurements of the ground surface. All Only suitable excavated material shall be used in the formation of embankment, subgrade, or for other purposes shown on the plans. All unsuitable material, as defined in paragraph 152-1.3, shall be disposed of legally as shown on the plans at locations off airport.

When the volume of the excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be used to grade the areas of ultimate development or disposed of as directed by the Owner/Engineer. When the volume of excavation is not sufficient for constructing the fill to the grades indicated, the deficiency shall be obtained from borrow areas.

The grade shall be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches shall be installed to intercept or divert surface water that may affect the work.

a. Selective Grading. When selective grading is indicated on the plans, the more suitable material as designated by the Engineer as approved in paragraphs 1.3 and/or 1.4 shall be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas so that it can be measured for payment for rehandling as specified in paragraph 3.3.

~~**b. Undercutting.** Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turving shall be excavated to a minimum depth of 12 inches (300 mm), or to the depth specified by the Engineer, below the subgrade. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed of at locations shown on the plans. This excavated material shall be paid for at the contract unit price per cubic yard (per cubic meter) for []. The excavated area shall be refilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary refilling will constitute a part of the embankment. Where rock cuts are made and refilled with selected material, any pockets created in the rock surface shall be drained in accordance with the details shown on the plans.~~

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turving shall be excavated to a minimum depth of 12 inches (300 mm), or to the depth specified by the Engineer, below the subgrade. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed of at locations shown on the plans. This excavated material shall be paid for at the contract unit price per cubic yard (per cubic meter) for unclassified excavation. The excavated area shall be refilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary refilling will constitute a part of the embankment. Where rock cuts are made and refilled with selected material, any pockets created in the rock surface shall be drained. A material that is high in moisture content and which yields under proof rolling does not necessarily classify as unsuitable material unless so classified in

accordance with Section 152-1.3. Undercutting of suitable but wet material does not constitute unsuitable material. The Contractor is required to manipulate and dry the material unless the material is classified as unsuitable in accordance with Section 152-1.3. If the material is classified as unsuitable material, then the Contractor shall remove the material to the depth directed by the Engineer but not greater than 3 feet below subgrade. The backfill of such areas shall not begin until the volume of the excavation is determined by cross sections or other means acceptable to the Engineer. The backfill shall be accomplished in the same manner as other embankment called out in this section with regard to the thickness and compaction requirements. The payment for the backfill shall be in accordance with a specific pay item designated for use as a backfill material and acceptable for use by the Engineer. The backfill material may consist of borrow excavation, unclassified excavation or select backfill and may be P-154, P-209, milled bituminous concrete, crushed recycled portland cement concrete or other materials acceptable to the Engineer. All select backfill shall pass 1-1/2-inch sieve.

c. Overbreak. Overbreak, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the Engineer. The Engineer shall determine if the displacement of such material was unavoidable and his/her decision shall be final. All overbreak shall be graded or removed by the Contractor and disposed of as directed; however, payment will not be made for the removal and disposal of overbreak that the Engineer determines as avoidable. Unavoidable overbreak will be classified as "Unclassified Excavation."

d. Removal of Utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by someone other than the Contractor, e.g., the utility authority having jurisdiction unless otherwise shown on the plans. All existing foundations shall be excavated for at least 2-feet (60 cm) below the top of subgrade or as indicated on the plans, and the material disposed of as directed. All foundations thus excavated shall be backfilled with suitable material and compacted as specified herein.

e. Compaction Requirements. The subgrade under areas to be paved shall be compacted to a depth of [12 inches] and to a density of not less than [100 percent] percent of the maximum density as determined by the modified Proctor Compaction Test ASTM [D1557]. The material to be compacted shall be within +/- 2 percent of optimum moisture content before rolled to obtain the prescribed compaction (except for expansive soils).

~~The in-place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2167. The~~ in-place field densities shall be determined in accordance with ASTM D2922/D3017 with verification by ASTM D1556. Stones or rock fragments larger than 4-inches (100 mm) in their greatest dimension will not be permitted in the top 6-inches (150 mm) of the subgrade. The finished grading operations, conforming to the typical cross section, shall be completed and maintained at least 1,000 feet (300 m) ahead of the paving operations or as directed by the Engineer.

In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line of finished grade of slope. All cut-and-fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the plans or as directed by the Engineer.

~~Blasting will be permitted only when proper precautions are taken for the safety of all persons, the work, and the property. All damage done to the work or property shall be repaired at the Contractor's expense. All operations of the Contractor in connection with the transportation, storage, and use of explosives shall conform to all state and local regulations and explosive manufacturers' instructions, with applicable approved permits reviewed by the Engineer. Any approval given, however, will not relieve the Contractor of his/her responsibility in blasting operations.~~

~~Where blasting is approved, the Contractor shall employ a vibration consultant, approved by the Engineer, to advise on explosive charge weights per delay and to analyze records from seismograph~~

~~recordings. The seismograph shall be capable of producing a permanent record of the three components of the motion in terms of particle velocity, and in addition shall be capable of internal dynamic calibration.~~

~~In each distinct blasting area, where pertinent factors affecting blast vibrations and their effects in the area remain the same, the Contractor shall submit a blasting plan of the initial blasts to the Engineer for approval. This plan must consist of hole size, depth, spacing, burden, type of explosives, type of delay sequence, maximum amount of explosive on any one delay period, depth of rock, and depth of overburden if any. The maximum explosive charge weights per delay included in the plan shall not be increased without the approval of the engineering.~~

~~The Contractor shall keep a record of each blast fired its date, time and location; the amount of explosives used, maximum explosive charge weight per delay period, and, where necessary, seismograph records identified by instrument number and location.~~

~~These records shall be made available to the Engineer on a monthly basis or in tabulated form at other times as required.~~

152-2.3 BORROW EXCAVATION. ~~Borrow area(s) within the airport property are indicated on the plans. Borrow excavation shall be made only at these designated locations and within the horizontal and vertical limits as staked or as directed. Unless specifically identified on the plans, there are no on-airport borrow areas available on airport property for use by the Contractor.~~

~~When borrow sources are outside the boundaries of the airport property, it shall be the Contractor's responsibility to locate and obtain the supply, subject to the approval of the Engineer. The Contractor shall notify the Engineer, at least 15 days prior to beginning the excavation, so necessary measurements and tests can be made. All unsuitable material shall be disposed of by the Contractor. All borrow pits shall be opened up to expose the vertical face of various strata of acceptable material to enable obtaining a uniform product. Borrow pits shall be excavated to regular lines to permit accurate measurements, and they shall be drained and left in a neat, presentable condition with all slopes dressed uniformly. Prior to any borrow source being utilized on the project, the Contractor shall submit test reports of material properties for the borrow source. The Engineer shall approve all sources and test results prior to any material from the borrow source being installed. The Engineer shall also have the opportunity to visit the borrow source and perform any testing, on the behalf of the Owner, to verify Contractor supplied test reports.~~

152-2.4 DRAINAGE EXCAVATION. ~~Drainage excavation shall consist of excavating for drainage ditches such as intercepting; inlet or outlet, for temporary levee construction; or for any other type as designed or as shown on the plans. The work shall be performed in the proper sequence with the other construction. All satisfactory material shall be placed in fills; unsuitable material shall be placed in waste areas or as directed. Intercepting ditches shall be constructed prior to starting adjacent excavation operations. All necessary work shall be performed to secure a finish true to line, elevation, and cross section.~~

~~The Contractor shall maintain ditches constructed on the project to the required cross section and shall keep them free of debris or obstructions until the project is accepted. The Contractor shall also be required to meet the requirements of any erosion and sedimentation control methods defined by the State in which the project is being constructed has established.~~

152-2.5 PREPARATION OF EMBANKMENT AREA. ~~Where an embankment is to be constructed to a height of 4-feet (120 cm) or less, 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 or scarifying to a minimum depth of 6 inches (150 mm). This area shall then be compacted as indicated in paragraph 2.6. When the height of fill is greater than 4 feet (120 cm), sod not required to be removed shall be thoroughly disked and recompacted to the density of the surrounding ground before construction of embankment.~~

Where embankments are to be placed on natural slopes steeper than 3 to 1, horizontal benches shall be constructed as shown on the plans.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-2.6 FORMATION OF EMBANKMENTS. Embankments shall be formed in successive horizontal layers of not more than 8 inches (200 mm) in loose depth for the full width of the cross section, unless otherwise approved by the Engineer.

The grading operations shall be conducted, and the various soil strata shall be placed, to produce a soil structure as shown on the typical cross section or as directed. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing, or other unsatisfactory conditions of the field. The Contractor shall drag, blade, or slope the embankment to provide proper surface drainage.

The material in the layer shall be within +/-2 percent of optimum moisture content before rolling to obtain the prescribed compaction. In order to achieve a uniform moisture content throughout the layer, wetting or drying of the material and manipulation shall be required when necessary. Should the material be too wet to permit proper compaction or rolling, all work on all of the affected portions of the embankment shall be delayed until the material has dried to the required moisture content. Sprinkling of dry material to obtain the proper moisture content shall be done with approved equipment that will sufficiently distribute the water. Sufficient equipment to furnish the required water shall be available at all times. Samples of all embankment materials for testing, both before and after placement and compaction, will be taken for each **[1,000 cubic yards]**. Based on these tests, the Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content in order to achieve the correct embankment density.

Rolling operations shall be continued until the embankment is compacted to **not less than the density shown in Table 1, Subgrade Compaction Requirements for Flexible Pavements 95 percent of maximum density for noncohesive soils, and 90 percent of maximum density for cohesive soils as determined by ASTM []**. Under all areas to be paved, the embankments shall be compacted to a depth of **[]** and to a density of not less than **[]** percent of the maximum density as determined by ASTM **[]**.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches (100 mm).

~~The in-place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2167.~~ The in-place field densities shall be determined in accordance with ASTM D2922/D3017 with verification by ASTM D1556.

Compaction areas shall be kept separate, and no layer shall be covered by another until the proper density is obtained.

During construction of the embankment, the Contractor shall route his/her equipment at all times, both when loaded and when empty, over the layers as they are placed and shall distribute the travel evenly over the entire width of the embankment. The equipment shall be operated in such a manner that hardpan, cemented gravel, clay, or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.

In the construction of embankments, layer placement shall begin in the deepest portion of the fill; as placement progresses, layers shall be constructed approximately parallel to the finished pavement grade line.

When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the embankment and the other material shall be incorporated under the future paved areas. Stones or fragmentary rock larger than 4-inches (100 mm) in their greatest dimensions will not be allowed in the top 6-inches (150 mm) of the subgrade. Rockfill shall be brought up in layers as specified or as directed and every effort shall be exerted to fill the voids with the finer material forming a dense, compact mass. Rock or boulders shall not be disposed of outside the excavation or embankment areas, except at places and in the manner designated by the Engineer.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in layers not exceeding 2-feet (60 cm) in thickness. Each layer shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments of rock. These type lifts shall not be constructed above an elevation 4-feet (120 cm) below the finished subgrade.

Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material.

There will be no separate measurement of payment for compacted embankment, and all costs incidental to placing in layers, compacting, diskings, watering, mixing, sloping, and other necessary operations for construction of embankments will be included in the contract price for excavation, borrow, or other items.

152-2.7 FINISHING AND PROTECTION OF SUBGRADE. After the subgrade has been substantially completed the full width shall be conditioned by removing any soft or other unstable material that will not compact properly. The resulting areas and all other low areas, holes or depressions shall be brought to grade with suitable select material. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans.

Grading of the subgrade shall be performed so that it will drain readily. The Contractor shall take all precautions necessary to protect the subgrade from damage. ~~He/she~~ The Contractor shall limit hauling over the finished subgrade to that which is essential for construction purposes.

All ruts or rough places that develop in a completed subgrade shall be smoothed and recompacted.

No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been approved by the Engineer.

152-2.8 HAUL. All hauling will be considered a necessary and incidental part of the work. Its cost shall be considered by the Contractor and included in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

152-2.9 TOLERANCES. In those areas upon which a subbase or base course is to be placed, the top of the subgrade shall be of such smoothness that, when tested with a 16-foot (4.8 m) straightedge applied parallel and at right angles to the centerline, it shall not show any deviation in excess of 1/2-inch (12 mm) 1/4-inch (6 mm), or shall not be more than 0.05-foot (.015 m) from true grade as established by grade hubs or pins. Any deviation in excess of these amounts shall be corrected by loosening, adding, or removing materials; reshaping; and recompacting by sprinkling and rolling.

On safety areas, intermediate and other designated areas, the surface shall be of such smoothness that it will not vary more than 0.10 foot (0.03 m) from true grade as established by grade hubs. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-2.10 TOPSOIL. When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its proper and final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall not be placed within **[250]** feet of runway pavement or **[100]** feet of taxiway pavement and shall not be placed on areas that subsequently will require any excavation or embankment. If, in the judgment of the Engineer, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further rehandling.

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as directed, or as required in Item T-905.

No direct payment will be made for topsoil as such under Item P-152. The quantity removed and placed directly or stockpiled shall be paid for at the contract unit price per cubic yard (cubic meter) for "Unclassified Excavation."

When stockpiling of topsoil and later rehandling of such material is directed by the Engineer, the material so rehandled shall be paid for at the contract unit price per cubic yard (cubic meter) for "Topsoiling", as provided in Item T-905.

152-2.11 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY. "Subgrade shall be accepted for density on a lot basis. A lot will consist of one day's production where it is not expected to exceed 2,400 square yards (2,000 square meters). A lot will consist of one-half day's production where a day's production is expected to consist of between 2,400 and 4,800 square yards (2,000 and 4,000 square meters).

Each lot shall be divided into two equal sublots. One test shall be made for each subplot. Sampling locations will be determined by the Engineer on a random basis in accordance with statistical procedures contained in ASTM D3665.

Each lot will be accepted for density when the field density is at least the density as specified in Table No. 1 – Subgrade Compaction Requirements of the maximum density of laboratory specimens prepared from samples of the subgrade material delivered to the job site. The specimens shall be compacted and tested in accordance with ASTM D698 or ASTM D1557. The in-place field density shall be determined in accordance with ASTM D1556 or D2922. If the specified density is not attained, the entire lot shall be reworked and/or recompact and two additional random tests made. This procedure shall be followed until the specified density is reached.

In lieu of the core method of field density determination, acceptance testing may be accomplished using a nuclear gage in accordance with ASTM D2922. The gage should be field calibrated in accordance with Paragraph 4 of ASTM D2922. Calibration tests shall be conducted on the first lot of material placed that meets the density requirements.

Use of ASTM D2922 results in a wet unit weight, and when using this method, ASTM D3017 shall be used to determine the moisture content of the material. The calibration curve furnished with the moisture gages shall be checked as described in Paragraph 7 of ASTM D3017. The calibration checks of both the density and moisture gages shall be made at the beginning of a job and at intervals as determined by the Engineer and or materials testing laboratory.

If a nuclear gage is used for density determination, two random readings shall be made for each subplot." There shall be no less than six density/moisture tests performed for each 2,000 square yards of subgrade. At least one test shall be by the sand cone method and at least five evenly distributed nuclear density/moisture tests will be taken in the area covering the 2,000 square yards of which one nuclear density/moisture test shall be taken at the sand cone test location so that calibration of the nuclear to sand cone test can be verified.

TABLE NO. 1 - SUBGRADE COMPACTION REQUIREMENTS

DESIGN AIRCRAFT	Gross Weight (Lbs.)	NON-COHESIVE SOILS				COHESIVE SOILS			
		Depth of Compaction in Inches				Depth of Compaction in Inches			
		100%	95%	90%	85%	100%	95%	90%	85%
Single Wheel	30,000	8	8-18	18-32	32-44	6	6-9	9-12	12-17
	50,000	10	10-24	24-36	36-48	6	6-9	9-16	16-20
	75,000	12	12-30	30-40	40-52	6	6-12	12-19	19-25
Dual Wheel (Incls. C-130)	50,000	12	12-28	28-38	38-50	6	6-10	10-17	17-22
	100,000	17	17-30	30-42	42-55	6	6-12	12-19	19-25
	150,000	19	19-32	32-46	46-60	7	7-14	14-21	21-28
	200,000	21	21-37	37-53	53-69	9	8-16	16-24	24-32
Dual Tandem (Incls. 757, 767, A-300)	400,000	14	14-26	26-38	38-49	12	12-15	15-22	22-30
	200,000	17	17-30	30-43	43-56	12	12-16	12-26	26-36
	300,000	20	20-34	34-48	48-63	12	12-17	12-30	30-42
	400,000	23	23-41	41-59	59-76	12	12-18	18-36	36-48
DC-10, L-1011, 747	400,000	21	21-36	36-55	55-70	12	12-18	18-32	32-48
	600,000	23	23-41	41-59	59-76	12	12-22	22-36	36-54
	800,000	23	23-41	41-59	59-76	12	12-24	24-40	40-60

Notes:

1. Noncohesive soils, for the purpose of determining compaction control, are those with a plasticity index (P.I.) of less than 6.
2. Tabulated values denote depths below the finished subgrade above which densities should equal or exceed the indicated percentage of the maximum dry density as specified herein.
3. Note that for any gross weight equal to or less than 60,000 pounds, Standard Density requirements per ASTM C698 shall be required. For any gross weights in excess of 60,000 pounds, Modified Proctor Density requirements per ASTM D1557 shall be required. Field testing of in-place densities shall be done pursuant to ASTM D1556 or ASTM D2922 as approved by the Engineer.
4. The subgrade in cut areas shall be compacted to the same requirements as specified above.
5. For any depths below those shown on this chart, compaction shall be to a minimum of 80%.
6. The bolded row defined above establishes the depths for which specific densities will be required for this project.

METHOD OF MEASUREMENT

152-3.1 The quantity of excavation to be paid for shall be the number of cubic yards (~~cubic meters~~) measured in its original position.

Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed.

152-3.2 Borrow material shall be paid for on the basis of the number of cubic yards (cubic meters) measured in its original position at the borrow pit.

~~**152-3.3** Stockpiled material shall be paid for on the basis of the number of cubic yards (cubic meters) measured in the stockpiled position as soon as the material has been stockpiled.~~

152-3.3 For payment specified by the cubic yard (cubic meter), measurement for all **[borrow]** shall be computed by the average end area method. The end area is that bound by the original ground line which shall include the area where the top 4" 3" of existing topsoil was removed established by field cross sections and the final theoretical pay line without new topsoil established by **[borrow]** cross sections shown on the plans, subject to verification by the Engineer. After completion of all **[borrow]** operations and prior to the placing of base or subbase material, the final **[borrow]** shall be verified by the Engineer ~~by means of field cross sections taken randomly at intervals not exceeding 500 linear feet (150 meters).~~ Contractor who will provide final in-place earthwork cross sections for the entire project site affected by earthwork operations with the detailed calculations as to as-built excavation and/or embankment. The Contractor shall provide cross sections at intervals of not exceeding 50 Linear Feet (15 meters) in an electronic format of AutoCad Release 2000 or higher.

In the event the borrow operations are performed in phases, the Contractor shall provide the required cross sections and calculations for each phase prior to installation of topsoil and sod or seeding so that final in-place earthwork quantities can be established and approved prior to starting another phase of work.

152-3.4 For payment specified by the cubic yard ~~(cubic meter)~~, measurement for all **[excavation]** shall be computed by the average end area method. The end area is that bound by the original ground line which includes the existing top 4- 3-Inches of topsoil established by field cross sections and the final theoretical pay line without topsoil established by **[excavation]** cross sections shown on the plans, subject to verification by the Engineer. After completion of all **[excavation]** operations and prior to the placing of base or subbase material, the final **[excavation]** shall be verified by the Engineer ~~by means of field cross sections taken randomly at intervals not exceeding 500 linear feet (150 meters).~~ Contractor who will provide final in-place earthwork cross sections for the entire project site affected by earthwork operations with the detailed calculations as to as-built excavation and/or embankment. The Contractor shall provide cross sections at intervals of not exceeding 50 Linear Feet (15 meters) in an electronic format of AutoCad Release 2000 or higher..

In the event the excavation and/or embankment operations are performed in phases, the Contractor shall provide the required cross sections and calculations for each phase prior to installation of topsoil and sod or seeding so that final in-place earthwork quantities can be established and approved prior to starting another phase of work.

~~Final field cross sections shall be employed if the following changes have been made:~~

~~a. Plan width of embankments or excavations are changed by more than plus or minus 1.0 foot (0.3 meter); or~~

~~b. Plan elevations of embankments or excavations are changed by more than plus or minus 0.5 foot (0.15 meter).~~

152-3.5 For payment specified by the cubic yard ~~(cubic meter)~~, measurement for all **[embankment]** shall be computed by the average end area method. The end area is that bound by the original ground line which shall include the area where the top 4" 3" of existing topsoil was removed established by field cross sections and the final theoretical pay line without new topsoil established by **[embankment]** cross sections shown on the plans, subject to verification by the Engineer. After completion of all

[embankment] operations and prior to the placing of base or subbase material, the final **[embankment]** shall be verified by the Engineer by means of field cross sections taken randomly at intervals not exceeding 500 linear feet (150 meters) Contractor who will provide final in-place earthwork cross sections for the entire project site affected by earthwork operations with the detailed calculations as to as-built excavation and/or embankment. The Contractor shall provide cross sections at intervals of not exceeding 50 Linear Feet (15 meters) in an electronic format of AutoCad Release 2007 or higher.

In the event the excavation and/or embankment operations are performed in phases, the Contractor shall provide the required cross sections and calculations for each phase prior to installation of topsoil and sod or seeding so that final in-place earthwork quantities can be established and approved prior to starting another phase of work.

BASIS OF PAYMENT

152-4.1 For "Unclassified excavation (WLSSD Disposal)" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.2 For "Rock Excavation " payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.3 For "Unclassified excavation (Offsite Disposal)" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, incidentals necessary to complete the item, and dispose of off Airport property.

~~**152-4.4** For "Muck Excavation" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.~~

~~**152-4.5** For "Drainage Excavation" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.~~

~~**152-4.6** For "Borrow Excavation" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.~~

~~**152-4.7** For "Stockpiled Material" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.~~

~~**152-4.8** For "Embankment in Place" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.~~

Payment will be made under:

- Item P-152-4.1 Unclassified Excavation (WLSSD Disposal)-Per Cubic Yard ~~(Cubic Meter)~~
- Item P-152-4.2 Rock Excavation - Per Cubic Yard ~~(Cubic Meter)~~
- Item P-152-4.3 Unclassified Excavation (Offsite Disposal)- Per Cubic Yard ~~(Cubic Meter)~~

Item P-152-4.4	Muck Excavation – Per Cubic Yard (Cubic Meter)
Item P-152-4.5	Drainage Excavation – Per Cubic Yard (Cubic Meter)
Item P-152-4.6	Borrow Excavation – Per Cubic Yard (Cubic Meter)
Item P-152-4.7	Stockpiled Material – Per Cubic Yard (Cubic Meter)
Item P-152-4.8	Embankment in Place – Per Cubic Yard (Cubic Meter)

TESTING REQUIREMENTS

ASTM D 698	Test for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-pound (2.49 kg) Rammer and 12-inch (305 mm) Drop
ASTM D 1556	Test for Density of Soil In Place by the Sand-Cone Method
ASTM D 1557	Test for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10-pound (4.5 kg) Rammer and 18-inch (45 cm) Drop
ASTM D 2167	Test for Density and Unit Weight of Soil In Place by the Rubber Ballon Method.
ASTM D 2922	Density of Soil and Soil Aggregate in Place by Nuclear Methods
ASTM D 3017	Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods

END OF ITEM P-152