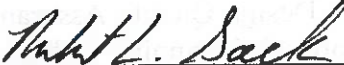


To: SUPERSEDED BY <u>ET 14-010</u> EFFECTIVE 1/8/2015		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 09-024
Title: SECTION 203 – EXCAVATION AND EMBANKMENT			
Distribution: ☐ Manufacturers (18) ☐ Surveyors (33) ☒ Local Govt. (31) ☒ Consultants (34) ☒ Agencies (32) ☒ Contractors (39) ☐ _____ ()		Approved:  Robert L. Sack, P.E., Deputy Chief Engineer (Research) <u>21 Dec 09</u> Date	

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of May 6, 2010.
- Modified issuance(s): This EI modifies EI 02-005.
- The information transmitted by this issuance will be incorporated into a future revision to the Standard Specifications.

PURPOSE: The purpose of this EI is to revise the Standard Specifications Section 203 *Excavation and Embankment*.

TECHNICAL INFORMATION:

- Standard Specification Section 203 *Excavation and Embankment* was revised as follows:
 1. The material requirements have been moved to Section 700. This move was required to embrace and align with the future that is SiteManager. To do this, the Geotechnical Engineering Bureau is changing how some of its specifications are written to align them with most Standard Specifications, which separate materials from pay items. Specification §733-08 through Specification §733-16 are being assigned the material specifications related to earthwork. Specification §733-17 and Specification §733-18 are being assigned the material specifications related to embankment construction control devices. These changes align the specifications with SiteManager's methodology in defining its Material Codes and Pay Items, with Items referring to one or many Materials.
 2. The entire Section was re-organized to institute corresponding subsections. Each subsection was arranged as a counterpart to the pay items.
 3. The restriction on winter earthwork operations has changed. The revision requires a Contractor to provide a submittal outlining the modification to the materials, methods for placement and methods for controlling weather effects on both the material and existing ground. The material requirements for winter earthwork are provided in §733-16 *Winter Earthwork*.
- Additions to Standard Specification Section 733 *Earthwork Materials* are being issued concurrently via EI 09-027.
- The Standard Specification Section 621 *Cleaning Culverts, Drainage Structure, and Existing Roadside Sections* is being issued concurrently via EI 09-026.
- A revision to Standard Specification §107-01 *Laws, Rules, Regulations and Permits* is being issued

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concurrently via EI 09-029.

- A special specification for *Subsurface Settlement Gauge* is being issued concurrently via EI 09-028.
- A revision to the Construction Inspection Manual (CIM) Section 203 *Excavation and Embankment* will be issued separately at a later date.

IMPLEMENTATION:

- The Main Office Design Quality Assurance Bureau will insert these standard specification shelf notes into contract proposals beginning with projects submitted for the letting of May 6, 2010.
- Both metric and U.S. Customary shelf notes are attached.
- The following Standard Specifications are disapproved:
 - Item 203.11 Subsurface Settlement Gauge
 - Item 203.1770 Cleaning Culverts with Span of 1300 Millimeters or Less
 - Item 203.1780 Cleaning Culverts with Span of More Than 1300 Millimeters
 - Item 203.18 Cleaning Closed Drainage Systems
 - Item 203.19 Cleaning Drainage Structures and Manholes
 - Item 203.51 Clean, Grade and Shape Existing Roadside Section

TRANSMITTED MATERIALS:

- Standard Specification shelf notes of revised *Section 203 Excavation and Embankment*. Both metric and U.S. Customary shelf notes are attached.

BACKGROUND: The NYS Department of Transportation is implementing Transport SiteManager, including both Construction and Materials functionality. Implementation of standard AASHTO software enables SiteManager to allow revising this agency's practices to be more consistent with industry-accepted best practices. The revisions to the Standard Specifications are to conform to SiteManager's methodology in defining its Material Codes and Pay Items.

CONTACT: Questions or comments regarding this issuance should be directed to Randall J. Romer, P.E., of the Geotechnical Engineering Bureau at (518) 457-4714, rromer@dot.state.ny.us.

EXCAVATION AND EMBANKMENT

Make the following changes to the Standard Specifications dated May 4, 2006:

Page 153, **Delete** the first paragraph of §202-3.09 and **Replace** it with the following:

The appropriate construction details specified for Section 203 *Excavation and Embankment*, as stated in §203-3.01 *General* through and including §203-3.02 *Unclassified Excavation and Disposal* shall apply. The excavation shall be dewatered and kept free from water, snow and ice when necessary.

Page 178, **Delete** “§203-1.01” in the first paragraph of §206-1.01 and **Replace** it with “Section 203, *Definitions*”.

Page 178, **Delete** the first paragraph of §206-3.01 entirely and **Replace** it with the following:

The appropriate construction details specified for “Excavation and Embankment” in §203-3.01 *General* through and including §203-3.03 *Embankment In Place*, and §203-3.06 *Select Granular Fill* and §203-3.14 *Select Structural Fill* shall apply to the work specified in this section.

Page 179, **Delete** the first paragraph of §206-3.03 entirely and **Replace** it with the following:

The provisions of §203-3.01D *Suitable Materials* and/or §203-3.01E *Unsuitable Materials* shall apply to all material excavated under this section which is not used as backfill.

Page 186, **Delete** “§203-3.08, Disposal of Surplus Excavated Materials” in the second bullet of the third paragraph of §209-3.02 and **Replace** it with “Section 203, *Disposal of Surplus Excavated Material*”.

Page 201, **Delete** “§203-3.16, Borrow” in the first paragraph of §302-2.03 and **Replace** it with “Section 203, *Borrow*”.

Page 208, **Delete** “§203-3.12, Compaction” in the first paragraph of §304-3.03 and **Replace** it with “Section 203, *Compaction*”.

Page 210, **Delete** “§203-3.12, Compaction” in the first paragraph of §307-3.01 D and **Replace** it with “Section 203, *Compaction*”.

Page 211, **Delete** “§203-3.12, Compaction” in the first paragraph of §307-3.10 and **Replace** it with “Section 203, *Compaction*”.

Page 272, **Delete** each use of “§203-3.12, Compaction” in the first paragraph of §411-3.03 and **Replace** it with “Section 203, *Compaction*”.

As modified by EI 08-037, **Delete** “§203-2.02 C Select Granular Fill and Select Structure Fill” in the first paragraph of §554-2.02 A 2 b and **Replace** it with “Section 203, *Select Granular Fill*”.

As modified by EI 08-037, **Delete** “§203-2.02 C Select Granular Fill and Select Structure Fill” in the first paragraph of §554-2.03 B 1 and **Replace** it with “Section 203, *Select Structural Fill*”.

As modified by EI 08-037, **Delete** “§203-2.02 C Select Granular Fill and Select Structure Fill” in the second paragraph of §554-2.03 C 2 and **Replace** it with “Section 203, *Select Structural Fill*”.

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As modified by EI 08-037, **Delete** "§203-3.12 B.6. *Compaction Equipment for Confined Areas*" in the first paragraph of §554-3.01 D 3 c and **Replace** it with "Section 203, *Compaction Equipment for Confined Areas*".

As modified by EI 08-037, **Delete** "§203-3.12 B.6. *Compaction Equipment for Confined Areas*" in the first paragraph of §554-3.02 D 4 and **Replace** it with "Section 203, *Compaction Equipment for Confined Areas*".

As modified by EI 08-037, **Delete** "§203-3.12 *Compaction*" in the first paragraph of §554-3.02 F 5 and **Replace** it with "Section 203, *Compaction*".

As modified by EI 08-037, **Delete** "§203-3.12 *Compaction*" in the first paragraph of §554-3.03 C 4 and **Replace** it with "Section 203, *Compaction*".

Page 477, **Delete** "§203-3.15, *Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables*" in the second paragraph of §597-3.02 G and **Replace** it with "Section 203, *Select Structural Fill*."

Page 485, **Delete** "§203-3.15, *Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables*" in the first paragraph of §603-3.03 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 493, **Delete** "§203-3.15, *Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables*" in the first paragraph of §604-3.11 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 502, **Delete** "§203-3.15, *Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables*" in the fourth paragraph of §606-3.01 D and **Replace** it with "Section 203, *Select Granular Fill*."

Page 502, **Delete** "§203-3.15" in the first paragraph of §606-3.01 E and **Replace** it with "Section 203, *Select Granular Fill*."

Page 586, **Delete** "§203-3.12, *Compaction*" in the first paragraph of §620-3.01 and **Replace** it with "Section 203, *Compaction*".

As modified by EI 08-020, **Delete** the first paragraph of §632-2.02 and **Replace** it with the following:

Backfill material shall conform to the material requirements as specified in Section 203, *Select Structural Fill*.

As modified by EI 08-020, **Delete** the first paragraph of §632-2.03 and **Replace** it with the following:

Unit infill material shall conform to the material requirements as specified in Section 203, *Select Structural Fill*.

As modified by EI 08-020, **Delete** "§203-3.15, *Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables*" in the second paragraph of §632-3.02 E and **Replace** it with "Section 203, *Select Structural Fill*."

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Page 621, **Delete** "§203-3.08, Disposal of Surplus Excavated Materials" in the second paragraph of §644-3.04 and **Replace** it with "Section 203, *Disposal of Surplus Excavated Material*".

Page 621, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the third paragraph of §644-3.04 and **Replace** it with "Section 203, *Select Structural Fill*."

Page 659, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the first paragraph of §659-3.04 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 659, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the first paragraph of §660-3.04 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 660, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the first paragraph of §661-3.04 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 660, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the first paragraph of §662-3.04 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 662, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the second paragraph of §663-3.04 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 671, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the first paragraph of §664-3.04 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 673, **Delete** "§203-3.12, Compaction" in the first paragraph of §667-3.03 and **Replace** it with "Section 203, *Compaction*".

Page 676, **Delete** "§203-3.08, Disposal of Surplus Excavated Materials" in the fourth paragraph of §670-3.03 and **Replace** it with "Section 203, *Disposal of Surplus Excavated Material*".

Page 676, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the fourth paragraph of §670-3.03 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 677, **Delete** the second sentence in the Method B of the sixth paragraph of §670-3.04 and **Replace** it with the following:

The clear area shall be backfilled with Select Granular Fill in accordance with §203-2.06 *Select Granular Fill*, and compacted in accordance with §203-3.06 *Select Granular Fill*.

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Page 678, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the second paragraph of §670-3.07 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 678, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the sixth paragraph of §670-3.08 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 688, **Delete** "§203-3.08, Disposal of Surplus Excavated Materials" in the second paragraph of §680-3.09 and **Replace** it with "Section 203, *Disposal of Surplus Excavated Material*".

Page 688, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the third paragraph of §680-3.09 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 690, **Delete** "§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables" in the first paragraph of §680-3.13 and **Replace** it with "Section 203, *Select Granular Fill*."

Page 156-176, **Delete** SECTION 203 entirely and **Replace** it with the following:

SECTION 203 – EXCAVATION AND EMBANKMENT

203-1 DESCRIPTION. This work shall consist of excavation, disposal, placement and compaction of all materials that are not provided for under another section of these Specifications, and shall be executed in conformance with payment lines, grades, thicknesses and typical sections specified in the contract documents.

203-1.01 Definitions.

A. Unclassified Excavation. Unclassified excavation shall consist of the excavation and disposal of all materials, of any description, encountered in the course of construction, unless otherwise specified in the contract. Estimated limits and descriptions of subsurface deposits and formations which may be shown in the contract documents are supplied as a part of Base Line Data.

B. Embankment. The embankment is the portion of a fill section situated between the embankment foundation and the subgrade surface, excluding any material placed under another section of these specifications.

C. Embankment Foundation. The embankment foundation is the surface upon which an embankment is constructed after all work required under §203-3.03A. *Embankment Foundation* has been completed.

D. Subgrade Surface. The subgrade surface is the surface of the road section upon which the select materials and/or subbase are placed.

E. Subgrade Area. The subgrade area is that portion of an embankment situated above either of the following, but excluding any material placed under another section of these specifications.

1. A line located 0.6 m below the subgrade surface and extended to the intersection with the embankment side slopes, or

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2. The embankment foundation, whichever is higher.

The material and compaction requirements for the subgrade area in embankments are found in §203-2.01A. *Subgrade Area Material* and §203-3.03C. *Compaction*, respectively.

In cut sections, the subgrade area is not defined except where undercut and backfill with a select material item is specified or ordered: in such cases, the payment lines for undercut work shall define the subgrade area.

F. Embankment Side Slope Area. The embankment side slope areas are those cross-sectional areas of an embankment situated outside of lines projected downward and outward on a one on one slope from the edges of the subgrade surface to their intersection with the embankment foundation, but excluding any portion lying within a subgrade area.

G. Topsoil. See Section 613 *Topsoil*.

H. Suitable Material. A material whose composition is satisfactory for use in embankment construction is a suitable material. The moisture content of the material has no bearing upon such designation. In general, any mineral (inorganic) soil, blasted or broken rock and similar materials of natural or man made (i.e. recycled) origin, including mixtures thereof, are considered suitable materials. Determinations of whether a specific natural material is a suitable material shall be made by the Engineer on the above basis.

Recycled materials that the Department has evaluated and approved for general use shall be considered to be suitable material for embankment construction subject to the conditions for use as determined by the Department. The Regional Geotechnical Engineer and Geotechnical Engineering Bureau are available to provide guidance on the use of such materials. In general, the use of recycled materials must be also sanctioned by the Department of Environmental Conservation, usually in the form of a Beneficial Use Determination (BUD).

Glass from recycling facilities meeting the requirements of §733-05 *Glass Backfill* shall be considered suitable material for embankment construction.

Reclaimed Asphalt Pavement (RAP), and Recycled Portland Cement Concrete Aggregate (RCA) shall be considered suitable materials for embankment construction, subject to the following conditions for use:

RAP - The Contractor shall provide and place RAP conforming to the requirements of §733-06 *Reclaimed Asphalt Pavement for Earthwork and Subbase*.

RCA-The Contractor shall provide and place RCA conforming to the requirements of §733-07 *Recycled Portland Cement Concrete Aggregate*.

Pieces of broken up concrete pavement from on-site pavement removal or in-place recycling (i.e. rubblizing, crack and seat, break and seat, etc.) may be used in embankment construction. Refer to §203-3.03A. *Embankment Foundation* and §203-3.03B. *Embankments*.

I. Unsuitable Material. Any material containing vegetable or organic matter, such as muck, peat, organic silt, topsoil or sod, or other material that is not satisfactory for use in embankment construction under §203-1.01H. *Suitable Material* is designated as an unsuitable material. Certain man made deposits of industrial waste, toxic or contaminated materials, sludge, landfill or other material may also be determined to be unsuitable materials, based on an evaluation by the Department's Geotechnical Engineering Bureau and Office of Environment, and the Department of Environmental Conservation.

J. Borrow. Borrow is material required for earthwork construction in excess of the quantity of suitable material available from the required grading, cuts and excavations. Borrow may be necessary even though not shown in the contract documents.

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K. Embankment Construction Control Devices. Embankment construction control devices allow real-time observations of embankment construction to assess the actual performance of the embankment compared to that envisioned in the design phase. Settlement and pore water pressure are common measures of embankment performance. Techniques for monitoring settlement include a settlement rod or a surface settlement gauge. A settlement rod is an optical survey technique to monitor settlement of the embankment surface. The settlement rod(s) establish monitoring point(s) in relation to a reliable bench mark.

A surface settlement gauge is an optical survey technique to monitor settlement of the existing ground surface, below the embankment installation. The surface settlement gauge is installed prior to placing the embankment and extended upwards through the fill.

Pore water pressure monitoring may be used to determine the effective overburden diagrams (the basis of all geotechnical analyses), monitoring consolidation progress of embankments constructed over soft soils, evaluating seepage in natural slopes or earth dams (slope stability), checking the effectiveness of subsurface drainage facilities, or monitoring water well tests.

A piezometer is an instrument which provides measurements of pore water pressure at the elevation of the installed sensor. Pore pressure data is needed in a foundation soil to assess the excess pore water pressure and hence the undrained strength of the soil. Piezometers are used at various depths within cohesive foundation soils. Some piezometers are used in granular foundation soils to assess their drainage behavior.

L. Proof Rolling. Proof rolling consists of applying test loads over the subgrade surface by means of a heavy pneumatic-tired roller of specified design, to locate and permit timely correction of deficiencies likely to adversely affect performance of the pavement structure.

M. Select Granular Fill – Slope Protection. Select granular fill – slope protection is a material used to protect the grade of a slope from erosion and sloughing from runoff and groundwater seepage. Seepage is the slow movement of water through small openings and spaces in the surface of unsaturated soil into or out of a body of surface or subsurface water. Sloughing is a shallow surface failure caused by erosive removal of supporting material.

Select granular fill – slope protection is highly permeable while also providing sufficient frictional resistance to resist seepage forces and remain in place.

N. Applying Water. Under this work, the Contractor shall furnish and apply water for dust control. Moisture control for compaction purposes is the Contractor's responsibility. Water shall not be applied in inclement weather or when the temperature is 0° C or less.

O. Modifying Cut Slopes and Other Means of Obtaining Borrow. The Regional Director may approve the modification of cut slopes and other means of obtaining material, which is not part of the contract, so long as provisions are made to prevent unsafe conditions, damage, and nuisances to property, wildlife areas, and haul routes within and outside the contract limits. Such approval may be granted only after review of a written proposal by the Contractor showing the final deposition of the material, the haul route, hauling hours, and provisions necessary to comply with the above. Should unanticipated conditions arise resulting in any unsatisfactory situation, the Engineer shall immediately rescind the approval pending satisfactory correction.

The following procedure shall apply to areas within the R.O.W. limits which are not designated as available sources of borrow by a Special Note in the contract proposal where the Contractor requests and is granted permission to modify slopes to obtain material for use on State contract work only. The Contractor will be required to reimburse the State with a rebate for the material obtained in these areas. Permission will not be granted to excavate material beyond the design slopes if it is to be used on other than State contract work.

The rebate to be obtained from the Contractor for this material is comprised of 1) A royalty based

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on the actual value of the excavated material, and 2) A credit for the difference in the Contractor's handling costs if these handling costs have been reduced. The royalty which is to be obtained for the excavated material shall be appropriate for the item for which it is to be utilized and shall be comparable to the current price being paid to purchase similar material in the area.

If the Contractor's handling costs associated with obtaining material from within the R.O.W. limits are greater than those for obtaining material from other acceptable sources, these additional handling costs must be borne by the Contractor. The royalty shall not be reduced to offset any increased handling costs incurred by the Contractor.

If the Contractor's handling costs associated with obtaining materials from within the R.O.W. limits are less than those for obtaining material from other acceptable sources, the differences shall be reimbursed to the State as a credit in addition to the royalty.

The difference in the Contractor's handling cost shall be determined by an analysis based on a comparison of haul lengths, hauling equipment, hauling operation, use of haul roads or public highways, preparation and restoration of the borrow areas, and any other variables involved.

Prior to modifying rock cut slopes, the Geotechnical Engineering Bureau must be consulted. If rock cut slopes are flattened sufficiently to eliminate the need for presplitting, an additional rebate will be necessary.

All special requirements to be fulfilled by the Contractor, at the Contractor's own expense, shall be clearly stated in the agreement. The foregoing requirement of receiving a rebate from the Contractor for material obtained by modification of slopes shall apply only to locations not designated in the Contract Documents.

203-2 MATERIALS

203-2.01 General. The requirements for select materials and subgrade area materials are described below. All processing operations including washing, removal of oversize material, blending, or crushing shall be completed at the source of the material. The procedure for acceptance or rejection of these materials shall be in conformance with the procedures contained in the geotechnical control procedure "Procedure for the Control and Quality Assurance of Granular Materials".

A. Subgrade Area Material. Subgrade area material shall consist of any suitable material having no particles greater than 150 mm in maximum dimension, unless Select Granular Subgrade with the well graded rock option is used. In that case, refer to §733-13 *Select Granular Subgrade*. If concrete is used, any exposed mesh or rebar shall not exceed 25 mm in length. RAP is also permitted.

B. Glass Backfill. Provide backfill material meeting the requirements of §733-05 *Glass Backfill*.

C. RAP. Provide backfill material meeting the requirements of §733-06 *Reclaimed Asphalt Pavement for Earthwork and Subbase*.

D. RCA. Provide backfill material meeting the requirements of §733-07 *Recycled Portland Cement Concrete Aggregate*.

E. Miscellaneous. Necessary fill material for cleaning, grading and shaping the existing roadside section shall conform to the requirements of §203-2.01A, *Subgrade Area Material*.

203-2.02 Unclassified Excavation and Disposal. None Specified.

203-2.03 Embankment In Place. Provide backfill material meeting the requirements of §733-08 *Embankment In Place*.

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203-2.04 Select Borrow. Provide backfill material meeting the requirements of §733-09 *Select Borrow*.

203-2.05 Select Fill. Provide backfill material meeting the requirements of §733-10 *Select Fill*.

203-2.06 Select Granular Fill. Provide backfill material meeting the requirements of §733-11 *Select Granular Fill*.

203-2.07 Select Granular Fill Slope Protection. Provide backfill material meeting the requirements of §733-12 *Select Granular Fill Slope Protection*.

203-2.08 Surface Settlement Gauges. Provide materials for the embankment construction control device surface settlement gauge meeting the requirements of §733-17 *Surface Settlement Gauge*.

203-2.09 Settlement Rods. Provide materials for the embankment construction control device settlement rod meeting the requirements of §733-18 *Settlement Rod*.

203-2.10 Piezometers. Provide materials for the piezometer installation meeting the requirements of §732-11 *Open Well Piezometer*.

203-2.11 Applying Water. Water used for dust control purposes may be obtained from any source.

203-2.12 Select Granular Subgrade. Provide backfill material meeting the requirements of §733-13 *Select Granular Subgrade*.

203-2.13 Select Structural Fill. Provide backfill material meeting the requirements of §733-14 *Select Structural Fill*.

203-2.14 Sand Backfill. Provide backfill material meeting the requirements of §733-15 *Sand Backfill*.

203-3 CONSTRUCTION DETAILS

203-3.01 General. The Contractor shall remove all soil, rock, and other material, and utilize or dispose of these materials as required by the contract documents. All excavation and embankment work shall be executed to payment lines shown in the contract documents.

All graded earth surfaces outside the roadway limits shall be smoothed and trimmed in reasonably close conformity (150± mm) of true grade. After trimming, the area shall be left in a compact and satisfactory condition, free of large stones or other objectionable materials, as determined by the Engineer.

Earthwork construction operations requiring compaction shall not be performed from November 1st thru April 1st except with a Winter Earthwork submittal subject to the provision of this Section and approved by the Regional Director or his designated representative. Winter Earthwork will be subject to the following restrictions:

- Transitioning from the normal construction season to the exempt winter earthwork months between November 1st and April 1st, the use of standard earthwork materials may continue to be permitted only under the conditions where the air temperature, ground temperature and material temperature are all above 0°C at the time of placement. Modifications to compaction procedures, including but not limited to the use of thinner lifts, may be required when the temperatures are above 0°C but below 4°C at the time of placement.
- Between November 1st and April 1st, if the air temperature, ground temperature, or material temperature is at or below 0°C at the time of placement, earthwork may only proceed using material

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that meets the requirements of §733-16 *Winter Earthwork*.

In all work incorporated into the final product, the Contractor shall not place material that is frozen, or place fill material on frozen ground regardless of the date.

A. Winter Earthwork Submittal. For Contractors choosing to proceed with earthwork compaction operations between November 1st thru April 1st, provide the Engineer with a Winter Earthwork submittal, with a copy to the Regional Geotechnical Engineer, outlining the modifications to the materials and methods including the following:

1. Material Requirements. The material meets the requirements of §733-16 *Winter Earthwork*. Provide information on material composition and source substitute, if proposed.

2. Material Placement. Provide information on the proposed methods for controlling the weather effects on the material and existing ground conditions (i.e. insulation, enclosures, canvas and framework). Devise a plan to be outlined in the Winter Earthwork Submittal such that all snow, ice, and frozen material shall be removed from the surface of the ground on which embankment or backfill material is to be placed, and from the surface under construction before succeeding lifts are added.

3. Transition Period. Provide acknowledgement of a transition period allowing the use of standard earthwork materials between November 1st and April 1st only under conditions where the air temperature, ground temperature and material temperature are all above 0° C at the time of placement. Acknowledge the transition period ends either when the air temperature, ground temperature or material temperature is at or below 0° C at the time of placement.

Proceed with Winter Earthwork only after receiving written approval by the Regional Director or his designated representative subject to the provisions of this Section.

B. Scheduling of Work to Minimize Soil Erosion and Water Pollution. The Contractor shall ensure effective and continuous soil erosion and sediment control throughout the construction period. The Contractor shall prepare and submit for approval, plans and schedules for all excavation, stripping, embankment, fill and grading operations. Such plans and schedules shall include but are not limited to temporary and permanent erosion control measures specified in Section 209 *Soil Erosion and Sediment Control*, Section 610 *Turf and Wildflower Establishment* and Section 612 *Sodding*.

C. Drainage and Grading. The Contractor shall provide and maintain slopes, crowns and ditches on all excavation and embankments to ensure satisfactory surface drainage at all times. Ditches and other drainage facilities necessary to remove ponded water shall be constructed as soon as practical to have the work area dry during the progression of work. All existing culverts and drainage systems shall be maintained in satisfactory operating condition throughout the course of the work. If it is necessary to interrupt existing surface drainage, sewers or under-drainage, then temporary drainage facilities shall be provided until the permanent drainage work is complete. Top-of-slope interceptor ditches, where shown on the contract documents, shall be completed before adjacent excavation operations are begun. In earth cuts, the Contractor shall progress excavation operations in such a manner that the portion of the cut immediately adjacent to the design slope is at least 1.5 m lower than the general level of the cut at all times until the lower payment line is reached.

The construction of these temporary drainage facilities shall be considered as incidental to the construction of the project and no additional payment will be allowed.

Any portion of an embankment or subgrade which has been damaged by the Contractor's equipment during the course of construction, shall be repaired and re-compacted by the Contractor at no additional cost to the State.

Where seepage causes instability of slopes, excavation and backfill or other corrective measures shall be performed as ordered by the Engineer and paid for under the appropriate item. Excavation for the installation of slope protection may be necessary at any time and location throughout the duration of the contract and may not necessarily coincide with the Contractor's performance of the general

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excavation work.

D. Suitable Materials. Moisture content has no bearing on the suitability of material to be used for embankment construction, however, the moisture content of a material may be such that its use will require manipulation. It is the Contractor's responsibility to determine the economics of using, or disposing of and replacing, such materials. Material determined by the Contractor to be uneconomical for use may be disposed of as specified under §203-3.02B. *Disposal of Surplus Excavated Materials* and replaced with other material at no additional cost to the State.

When a contract includes the item "Unclassified Excavation and Disposal", all excavated suitable materials, including the excavation performed under "Structure Excavation" and "Trench and Culvert Excavation," shall become the Contractor's property for disposal or use under another item of these specifications.

E. Unsuitable Materials. All excavated unsuitable materials shall be the Contractor's property for disposal as surplus materials under the provisions of §203-3.02B. *Disposal of Surplus Excavated Materials*.

F. Borrow. The management of a borrow source and the acceptability of all borrow material shall be subject to the approval of the Engineer at all times. The Contractor shall notify the Engineer at least ten (10) work days in advance of opening any borrow area, and request approval of the source under the pay item involved. Test pits required by the Engineer to evaluate the acceptability and limits of the source, shall be provided by the Contractor at the Contractor's own expense. Concurrent removal of material for more than one pay item from a single source or pit shall be prohibited except with the written permission of, and under such conditions and restrictions as may be imposed by the Engineer. All borrow pits shall be stripped of sod, topsoil and vegetable matter well in advance of any working face. The minimum distance by which stripping shall lead excavation for a given source shall be established by the Engineer to suit local conditions. Where a borrow source is not under direct control of the Contractor or where special conditions exist, the Engineer may waive any of the above requirements and establish alternative provisions for the control and acceptability of borrow.

Ordinary borrow will be accepted for use where the material qualifies under the definition of Suitable Material, §203-1.01H. *Suitable Material*. All borrow placed within the limits of Embankment or the Subgrade Area shall be placed in conformance with §203-3.03B. *Embankments* or §203-3.01G. *Subgrade Area* respectively, as appropriate, or where used for fill or backfill at structures, culverts and pipes, in conformance with §203-3.06 *Select Granular Fill* and §203-3.17 *Select Structural Fill*.

G. Subgrade Area. Where a subgrade area is defined in an embankment by §203-1.01E. *Subgrade Area*, the material placed shall conform to §203-2.01A. *Subgrade Area Material*, placed and compacted in conformance with §203-3.03B. *Embankments* and §203-3.03C. *Compaction*. Where longitudinal and transverse changes from cut to fill are encountered in the work, a subgrade transition section shall be provided in conformance with Standard Sheet *Earthwork Transition and Benching Details*. Where a subgrade area becomes defined by §203-1.01E. *Subgrade Area* in a cut section, the materials placed and other details shall be as specified under §203-3.02C. *Proof Rolling in Cut Sections* 3. *Procedure*, unless otherwise required by the contract documents. Prior to subbase course placement, the surface on which the subbase is to be placed shall be thoroughly compacted to the satisfaction of the Engineer.

1. Subgrade Surface Tolerance. After compaction, the subgrade surface shall not be above design elevation at any location.

203-3.02 Unclassified Excavation and Disposal.

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A. Rock Excavation. Presplitting is required where the design rock slope is 1 vertical on 1 horizontal or steeper and the vertical height of the exposed rock slope exceeds 1.5 m. Ripping will not be allowed within 3 m of a slope that requires presplitting. Test sections will be required at the outset of presplit drilling and blasting operations for the evaluation of the presplit rock slopes by a Departmental Engineering Geologist. The Contractor will be required to completely expose the presplit rock face in the test section for evaluation prior to any further presplit drilling.

All rock slopes shall be thoroughly scaled and cleaned. For rock excavations involving multiple lifts, scaling of upper lifts shall be completed prior to drilling and fragmenting of lower lifts. Scaled rock slopes shall be stable and free from possible hazards of falling rocks or rock slides that endanger public safety. If, after scaling, such conditions still exist, a determination of the cause will be made by a Departmental Engineering Geologist and if it is determined that the conditions are the result of poor quality work or improper methods employed by the Contractor, the Contractor shall provide approved remedial treatment, at no expense to the State. Such treatment may include, but is not necessarily limited to, laying back the slope, rock bolting, or shotcreting. In no case shall the subgrade be trimmed prior to the completion of the scaling operation at any location.

1. Presplitting. Prior to drilling presplitting holes, the overburden shall be completely removed to expose the rock surface along the presplitting line. The methods of collaring the holes to achieve required inclination and alignment shall be approved by the Engineer.

The presplitting holes shall be a maximum of 100 mm in diameter, spaced not more than 1 m center to center along the slope, and drilled at the designed slope inclination for a maximum slope distance of 20 m. When excavation operations are conducted in multiple lifts, the presplitting holes for successive lifts may be offset a distance of not more than 1 m for a design slope of 1 vertical on 1 horizontal and not more than 0.3 m for slopes of steeper design; however, a presplitting hole shall not be started inside the payment line. The Contractor shall control the presplit drilling operations by using proper equipment and technique to achieve the design slope and maximum bench between lifts. If presplitting is conducted in lifts, each lift shall be of approximately equal depth. All presplitting holes shall be checked and cleared of obstructions immediately prior to loading any holes in a round. All presplitting holes shall be loaded with a continuous column charge manufactured especially for presplitting which contains not more than 0.5 kg of explosive per meter. The top of the charge shall be located not more than 1 m below the top of rock. A bottom charge of not more than 1.5 kg of packaged explosive may be used; however, no portion of any bottom charge shall be placed against a proposed finished slope. Each presplitting hole shall be filled with No. 1A crushed stone stemming meeting the gradation requirements of §703-02 *Coarse Aggregate*. The presplitting charges shall be fired with detonating cord extending the full depth of each hole and attached to a trunk line at the surface. Detonation of the trunk line shall be with blasting cap(s) and shall precede the detonation of fragmentation charges within the section by a minimum of 25 milliseconds. Presplitting shall extend for a minimum distance equal to the burden plus 1m beyond the limits of fragmentation blasting within the section.

2. Fragmentation Blasting. Fragmentation holes, or portions thereof, shall not be drilled closer than 1.2 m to the proposed finished slope. Where presplitting is required, fragmentation holes adjacent to the presplitting holes shall be drilled parallel to the presplitting holes for the full depth of the production lift at a spacing not exceeding the spacing of the production pattern. Only packaged explosives shall be used 3 m or less from a design slope which requires presplitting regardless of the construction sequence.

Fragmentation charges shall be detonated by properly sequenced millisecond delay blasting caps.

3. Explosive Loading Limits. In the absence of more stringent requirements, the maximum

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quantity of explosives allowed per delay period shall be based on a maximum particle velocity of 50 mm/s at the nearest structure to be protected. In the absence of seismic monitoring equipment, the following explosive loading limits shall apply:

DISTANCE EQUAL TO OR LESS THAN 65 m FROM THE NEAREST STRUCTURE

- a. When the distance from the proposed blasting area to the nearest structure to be protected is 2 m or less, no blasting shall be allowed.
- b. When the distance between the blasting area and the nearest structure to be protected is greater than 2 m and equal to or less than 4.5 m, a maximum of 0.1 kg of explosives per delay period (minimum of 25 milliseconds) blasting cap shall be allowed.
- c. When the distance between the blasting area and the nearest structure to be protected is greater than 4.5 m and equal to or less than 65 m, a Scaled Distance of 9 m shall be utilized to determine the maximum amount of explosive allowed per delay period (minimum of 25 milliseconds) blasting cap. The Scaled Distance Formula is as described below:

$$SD = \frac{D}{1.5\sqrt{E_{\max}}}$$

where: SD = Scaled Distance

D = Distance from blasting area to nearest structure to be protected in meters

or

$$E_{\max} = \frac{D^2}{(SD)^2} (0.45)$$

where: $E_{\max}$ = Maximum kilograms of explosive per delay period
(minimum of 25 milliseconds) blasting cap

DISTANCE GREATER THAN 65 m FROM THE NEAREST STRUCTURE

- a. When the blaster elects to utilize more than 25 kg of explosive per delay period (minimum of 25 milliseconds) blasting cap, a seismograph shall be employed to monitor the blasting vibrations generated. The initial loading shall be computed using a Scaled Distance of 9 m. The resulting particle velocity measured by the seismograph shall be evaluated by a Department Engineering Geologist. The Geologist's evaluation shall be the basis for adjusting the Scaled Distance.

No separate payment shall be made for this work. The cost shall be included in the appropriate excavation item. The above requirements shall in no way relieve the Contractor of liability for any damage incurred as a result of the blasting operations.

B. Disposal of Surplus Excavated Materials. Only unsuitable materials, or that portion of suitable material excavated in excess of the quantity required to construct all embankments on the project, shall be considered as surplus.

Where disposal of surplus materials cannot be accommodated within the right of way, the excess shall become the Contractor's property for disposal. Surplus material disposed of within the right-of-way shall be placed in accordance with §107-10 *Managing Surplus Material And Waste*.

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C. Proof Rolling in Cut Sections. Immediately prior to final trimming of the subgrade surface and placement of subbase materials in cut sections, all areas of the subgrade surface within roadway limits shall be proof rolled according to the requirements of this subsection. This work, and any delays due to this work, shall be considered incidental to the excavation item.

1. Purpose. In cut sections, the purpose of proof rolling is to determine the location and extent of areas below the subgrade surface that require corrective undercutting and are not so specified in the contract documents.

2. Equipment. The proof roller used in embankment sections, as specified in §203-3.03D. *Proof Rolling in Embankment Sections* 1. *Equipment*, shall be employed for proof rolling in cut sections except that the roller shall be loaded to achieve a single stress level in operation, using a gross ballasted weight of 27 metric tons and all tires inflated to 275 kPa.

3. Procedure. Two complete passes shall be applied over all elements of the area to be proof rolled. Where any portion of the cut subgrade surface other than that which has been damaged by the Contractor's operations fails to provide a satisfactory support for the proof rolling operation, the Engineer may order corrective undercut and backfill work performed. Backfill of undercuts shown in the contract documents or ordered by the Engineer shall be in conformance with §203.3-13 *Select Granular Subgrade*. Where natural soil below this course will not support the weight of the construction equipment, and when ordered by the Engineer, the course shall be placed in one lift. No additional proof rolling shall follow corrective work.

4. Exceptions. Proof rolling of the subgrade surface in cut sections will not be required in any area where the subgrade surface is in a rock cut, or where undercut and backfill has been previously performed. The Engineer may order undercutting and backfill without proof rolling of any cut where the need for corrective work, as determined by the Engineer, is obvious without actual proof rolling. The Engineer may also delete proof rolling in any cut section where, based upon a written evaluation by a Departmental Geotechnical Engineer, proof rolling would be detrimental to the work.

203-3.03 Embankment In Place.

A. Embankment Foundation. After completion of the work required under Section 201 *Clearing and Grubbing*, and Section 202 *Removal of Structures and Obstructions*, the embankment foundation shall be prepared. Sod and topsoil shall be removed where the final pavement grade is 2 m or less above the existing ground surface and in other areas designated in the contract documents or by the Engineer. Prior to embankment construction and subbase course placement, the surface on which the embankment and/or subbase is to be placed shall be thoroughly compacted to the satisfaction of the Engineer. Unsuitable materials other than sod and topsoil shall be removed to the depths shown in the contract documents or as directed by the Engineer. Underwater areas shall be filled in accordance with §203-3.04 *Select Borrow* or §203-3.05 *Select Fill* and paid for under its appropriate item.

Where embankments are to be constructed over ground that will not adequately support embankment construction equipment, an initial layer of fill may be allowed to form a working platform. The need, manner of construction, and thickness of such a layer shall be subject to approval of the Engineer, and the layer will be permitted only where the lack of support is, as determined by the Engineer, not due to deficient ditching, grading or drainage practices or where the embankment could be constructed in the approved manner by the use of different equipment or procedures. Thicknesses of up to 1 m may be permitted for such a layer. Concrete or asphalt slabs may be used at the bottom of such a layer, provided they are placed horizontally.

In locations where embankments are to be constructed on hillsides or against existing

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embankments with slopes steeper than 1 vertical on 3 horizontal, the slopes shall be benched. Required benches shall be constructed as shown on the Standard Sheet *Earthwork Transition and Benching Details*.

Where old pavement is encountered within 0.6 m of the top of the subbase course, it shall be broken up or scarified.

B. Embankments. The embankment shall be constructed of suitable material as defined by §203-1.01H. *Suitable Material.* Embankment material shall not be placed on frozen earth, nor shall frozen soils be placed in any embankments. Embankment material shall be placed and spread in lifts (layers) of uniform thickness, then uniformly compacted as specified under applicable portions of §203-3.03C. *Compaction.* During embankment construction operations, earth moving equipment shall be routed so as to prevent damage to any compacted lift. Damage to any compacted lift at any time during the course of construction, such as rutting under the loads imposed by earth moving equipment, shall be fully repaired by the Contractor at his/her own expense prior to placement of any overlying materials. At the close of each day's work, the working surface shall be crowned, shaped and rolled with smooth steel wheel or pneumatic tired rollers, for positive drainage.

Particles with a dimension in excess of $\frac{2}{3}$ of the loose lift thickness are designated as oversized particles. Oversized particles shall be removed prior to compaction of the lift and may be placed in the Embankment Side Slope Area.

Pieces of concrete or asphalt may be used provided that the voids between the pieces are completely filled, and the greatest dimension of any piece does not exceed $\frac{2}{3}$ the loose lift thickness. Exposed mesh or rebar shall not exceed 25 mm in length.

Embankments constructed using rock products or pieces of concrete shall be spread by bladed equipment on each lift to minimize the formation of large voids as the work progresses. The top lift of a rock or concrete fill shall be chinked.

When permitted by a note in the contract documents, stumps, logs, and other materials may be placed in the Embankment Side Slope Area, provided that: 1) such matter is deposited and compacted concurrent with the adjacent embankment, and; 2) any stumps or woody material are covered by not less than 0.6 m of soil beneath the exposed side slope surface.

Glass shall not be placed in contact with synthetic liners, geogrids, geotextiles or other geosynthetics.

C. Compaction

1. General Requirements. It shall be the Contractor's responsibility to properly place and compact all materials in the road section and other locations specified in the contract documents, and to correct any deficiencies resulting from insufficient or improper compaction of such materials throughout the contract period. The Contractor shall determine the type, size and weight of compactor best suited to the work at hand, select and control the lift (layer) thickness, exert control over the moisture content of the material, and other details necessary to obtain satisfactory results. During the progression of the work, the Department will inspect the Contractor's operations and will permit the work to continue where:

- a. Lift thickness is controlled and does not exceed the maximum allowed according to the equipment classifications in subparagraph 2. *Compaction Equipment*, of this subsection, and the equipment meets all specified class criteria. Thinner lifts and lighter equipment than the maximum allowed may be necessary for satisfactory results on some materials.
- b. The compactive effort (number of passes and travel speed) is uniformly applied and not less than that specified for the given equipment class and lift thickness. Higher efforts than the minimum allowed may be necessary for satisfactory results on some materials.
- c. The Engineer concludes from a visual observation that adequate compaction has been attained, with the exception of backfill at structures, culverts, pipes, conduits, and direct

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burial cables. However, the State reserves the right to perform density tests at any time. When tests are performed, the results shall indicate that not less than 90% of Standard Proctor Maximum Density is attained in any portion of an embankment, or 95% in a subgrade area, or as specified for other items with a percent maximum density requirement.

d. Significant rutting under the action of the compactor is not observed on the final passes on a lift.

Whenever the Contractor's operations do not conform to the above criteria, or requirements contained in other subparagraphs of this subsection, the Engineer will prohibit placement of an overlying lift until the Contractor takes effective corrective action.

As part of the Department's Quality Assurance (QA) program, the Engineer or his representative may verify the adequacy of the compaction at any time through QA testing. When the Engineer determines that QA tests are necessary, the Contractor shall provide any assistance requested to facilitate such tests. Such assistance shall include but will not be limited to excavation and backfill of test pits and holes. This work shall be considered to be incidental construction.

Damage to any compacted lift at any time during the course of construction such as rutting under the loads imposed by earth moving equipment, shall be fully repaired by the Contractor at his/her own expense prior to placement of any overlying materials.

2. Compaction Equipment. The selection of compaction equipment is the Contractor's responsibility, but shall be subject to meeting the requirements of this subparagraph and approval by the Engineer with respect to its provisions. All compaction equipment shall be marked by a permanently attached manufacturer's identification plate designating the name of the manufacturer, model number and serial number of the machine as minimum identification. This plate shall be installed in a readily visible location. Compaction equipment lacking such an original manufacturer's identification plate, or with altered or illegible plates, will not be recognized as acceptable compaction equipment. Any equipment not principally manufactured for soil compaction purposes and equipment which is not in proper working order in all respects shall not be approved or used. The Engineer will also withhold approval of any compactor for which the Contractor cannot furnish manufacturer's specifications covering data not obvious from a visual inspection of the equipment and necessary to determine its classification.

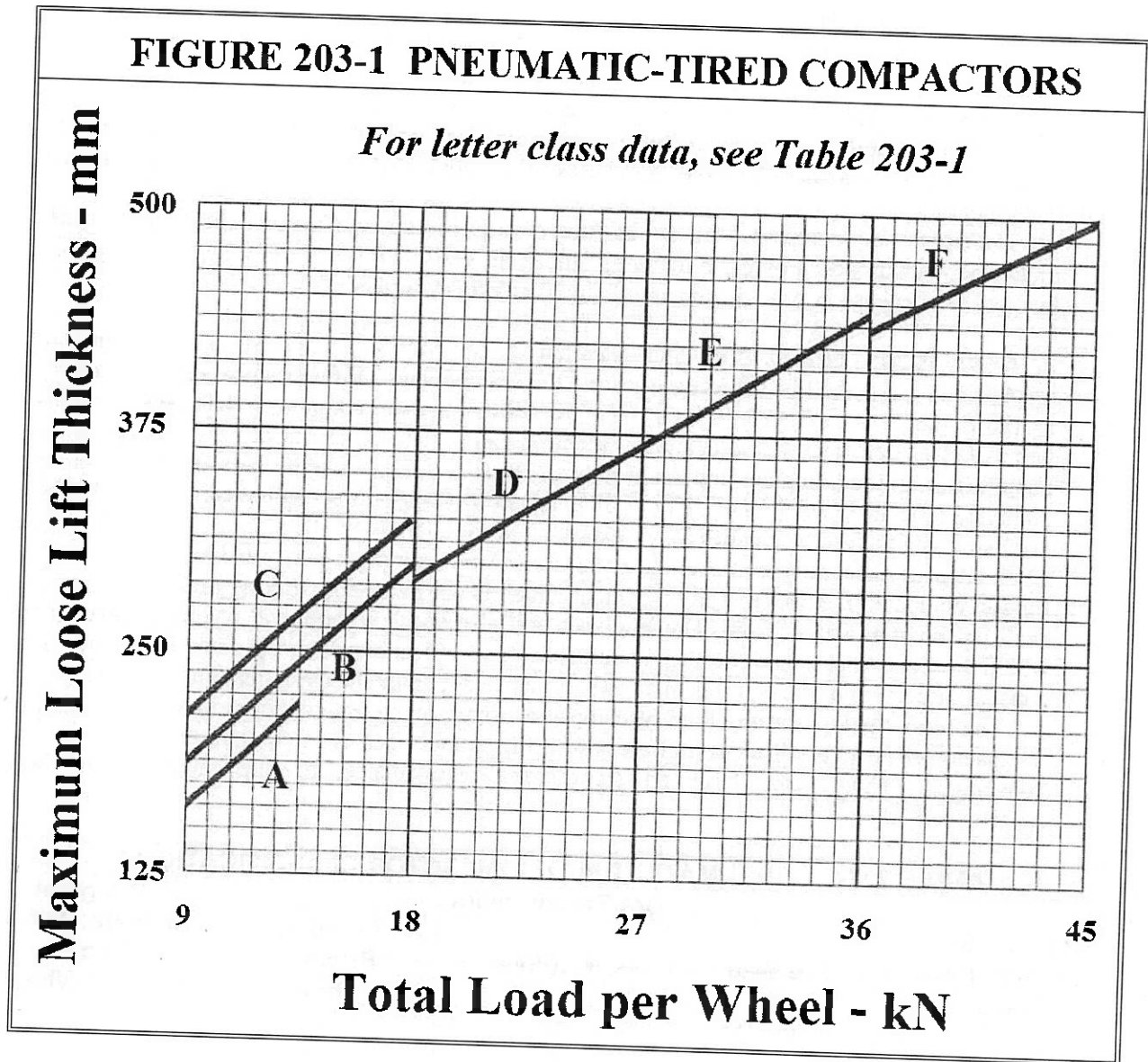
The term, "pass," for any type of compactor, shall denote one direct vertical application of compactor effort over all elemental areas of a lift surface. Terms in common parlance, such as "coverage," "trips," etc., have no significance, equivalence, or application under these specifications.

TABLE 203-1 PNEUMATIC-TIRED COMPACTOR CLASSIFICATIONS				
Pneumatic Compactor Class	Tire Requirements			Range of Ballasted Wheel Loads (kN per Wheel)
	Tire Size	No. Plys	Inflation Pressure (kPa)	
A	7.50 x 15	4	240	9 - 14
B	7.50 x 15	6	415*	9 - 18
		10	620*	
C	7.50 x 15	14	900*	9 - 18
D	9.00 x 20	10	520*	18 - 27
		12	620*	
E	11.00 x 20	12	620*	27 - 36
		18		
F	13.00 x 24	18	690*	36 - 45

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* Inflation pressure for not less than the last two passes on each lift. May be reduced during earlier passes and gradually increased to this level.

a. Pneumatic-Tired Compactors. This type of compactor shall be classified for use according to the requirements of Table 203-1. For the lift thickness selected by the Contractor, the minimum class and wheel load which will be allowed on that lift thickness, shall be as shown in Figure 203-1.



The minimum effort for all pneumatic compactors shall be 6 passes, at speeds up to 3.6 m/s on no more than the first 2 passes, and all subsequent passes at speeds of 1.8 m/s or less.

b. Smooth Drum Vibratory Compactors. This type of compactor is defined as a machine which primarily develops its compactive effort from the vibrations created and is classified for use according to the developed compactive force rating (CFR) per linear meter

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of drum width.

The CFR is defined as follows:

$$\text{CFR} = \frac{\text{Unsprung Drum Weight (kN)} + \text{Dynamic Force (kN)}}{\text{Drum Width (m)}}$$

The unsprung drum weight is the static weight of the drum and appurtenances without any reaction transmitted to the drum from the main chassis of the compactor. The dynamic force produced is dependent on the frequency of vibration, and therefore, CFR ratings shall be determined for the actual operating frequency of the compactor. Approval for vibratory compactors shall be confined, however, to equipment operating at not less than 18 Hz, nor more than 25 Hz, and those where the actual dynamic force at the actual operating frequency is at least 2.5 times the unsprung drum weight.

Conversion of manufacturer's published ratings, at a given frequency, shall be made with the following equation:

$$F_2 = \frac{F_1 (V_2)^2}{(V_1)^2}$$

where: F_1 = Dynamic Force at Rated Frequency

F_2 = Dynamic Force at Operating Frequency

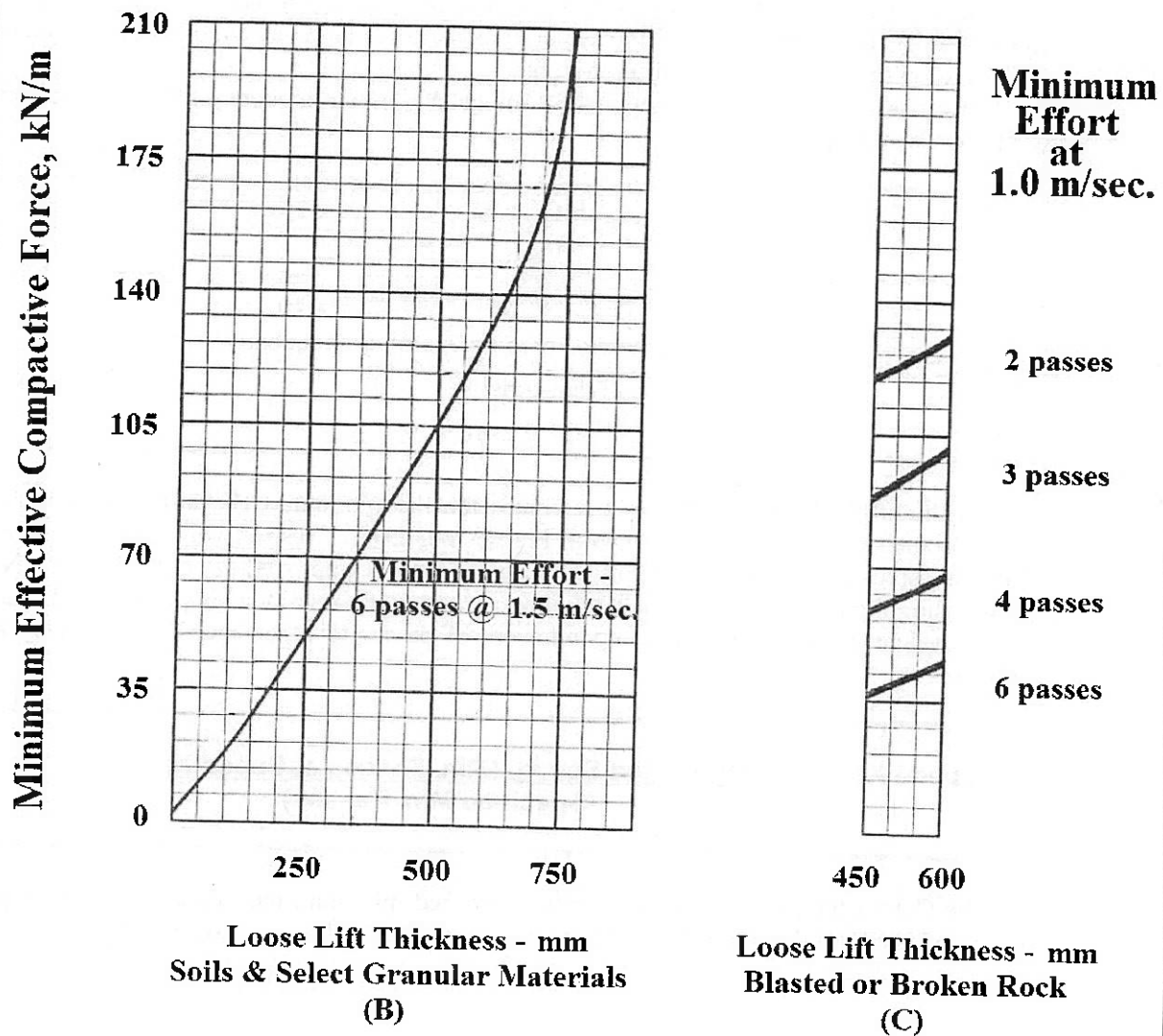
V_1 = Rated Frequency

V_2 = Operating Frequency

For the lift thickness selected by the Contractor, the minimum CFR rating and minimum effort on such a lift, shall be as shown in Figures 203-2B&C, respectively. Non-Centrifugal (Vertical force only) types of vibratory compactors shall be approved as above, less 30 kN/m before using Figures 203-2 B&C as a minimum number of passes at a single specified speed. An equivalent effort, relating varying numbers of passes to other speeds is given by the equation:

$$\text{Speed X} = \frac{(\text{Specified Speed}) (\text{Min. Passes at Speed X})}{(\text{Specified Min. Passes})}$$

The Contractor may choose to alter the specified minimum pass requirement, provided that speed is adjusted to the value given by this equation and does not exceed 1.8 m/s.

FIGURE 203-2 VIBRATORY COMPACTORS

Where vibratory compactors are used on a project, the Contractor shall furnish for the exclusive use of the Engineer, one vibrating reed tachometer per project, plus one additional tachometer for each group of two vibratory compactors in excess of two per project. Tachometers shall have a frequency range adequate to cover operating frequencies of all