



**SPECIAL PROVISION
FOR
SUBGRADE PREPARATION FOR RAILROADS**

**Pottawattamie County
IMN-080-1(366)4--0E-78**

**Effective Date
June 16, 2015**

THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

120324.01 DESCRIPTION.

The work covered by this Special Provision consists of furnishing all labor and materials and performing all operations in connection with the preparation of the subgrade to support new fill, subballast and ballast and construction of railroad embankments as designated in the contract documents for the railroad embankment sections.

120324.02 MATERIALS.

A. General.

Materials used for the subgrade preparation shall consist of: (1) native materials that will be scarified and compacted in place; (2) native materials that will be overexcavated, reconditioned, and recompacted; (3) new compacted Impervious Fill that is used to replace native soils that are considered unsuitable and are overexcavated; (4) non-woven geotextile; and (5) geogrid for railroads. No granular materials will be permitted for use as fill in the preparation of the subgrade. Materials that are removed become the property of the Contractor.

B. Impervious Fill.

1. Impervious Fill shall consist of cohesive materials having at least 50% passing the U.S. Standard 200 mesh sieve size. Cohesive materials shall consist of materials classifying as lean (CL) or fat clay (CH), having a Plasticity Index of 10 or greater and falling between the "U" line and the "A" line on Figure 4 in ASTM D 2487 – Standard Practices for Classifications of Soils for Engineering Purposes.

2. Impervious Fill shall be furnished by the Contractor.

C. Unsuitable Materials.

1. Unsuitable materials will be determined by the engineer, and are materials containing debris, brush, roots, sod, organic matter or stones with dimensions greater 3 inches and shall not be used in the subgrade. Frozen earth, snow, or ice shall not be used in the subgrade. A material will not be classified as unsuitable based on its moisture content.
2. Unsuitable materials are also subgrade materials that produce unacceptable performance when proofrolled as described in Article 120324.03, B, 4.

D. Suitable Materials.

Suitable materials for subgrade preparation will include materials described in Paragraphs A and B of this section.

E. Pre-Construction Testing of Impervious Fill.

The Contractor shall submit to the Engineer for approval the results of grain size tests (ASTM D 422) and plasticity tests (ASTM D 423 and D 424) for the impervious fill. The estimated quantity and location of materials proposed for use in the railroad embankment shall also be submitted. These submittals must be approved by the Engineer prior to the placement of fill materials on the approved subgrade.

F. Geogrid for Railroads.

Geogrid for railroads shall meet the requirements of AREMA Chapter 1, Part 10, Table 1-10-10. This table has been included below for reference.

Table 1-10-10. Physical Properties for Geogrids used in Track Stabilization

Property	Test Method	Units	Minimum Value (Sub-ballast reinforcement)	Minimum Value (Ballast reinforcement)
Aperture size (min. - max.)	Direct measurement	Inches (mm)	0.70 - 1.60 (17.8 - 40.6)	1.70 - 2.50 (43.2 x 63.5)
Open area	Direct measurement	%	70	75
Rib thickness	ASTM D1777	Inches (mm)	0.05 (1.27)	0.05 (1.27)
Junction thickness	ASTM D1777	Inches (mm)	0.16 (4.0)	0.17 (4.4)
Aperture stability modulus @ 20cm-kg	US Army Corps of Engineers 62	lb-ft/deg (kg-cm/deg)	0.470 (6.5)	0.419 (5.8)
Flexural rigidity (Machine direction)	ASTM D1388	(lb-ft) (mg-cm)	0.0542 (750,000)	0.0325 (450,000)
Tensile modulus @ 2% strain (machine x cross machine direction)	ASTM D6637-01	lb/ft (kN/m)	18,500 x 30,000 (270 x 437)	19,000 x 32,500 (277 x 474)
Junction strength	GRI GG2-87	lb/ft (kN/m)	1080 (15.7)	956 (13.9)
Junction efficiency	GRI GG2-87	%	90	90
Carbon black	ASTM 4218	%	0.5	0.5

Source: AREMA (2012) Chapter 1, Part 10, Table 1-10-10

G. Non-Woven Geotextile.

Non-woven geotextile shall meet the requirements of AASHTO M 288 Class 1.

120324.03 CONSTRUCTION.

A. Notifications.

1. Notify the Department and consulting engineer at least 1 week prior to beginning any subgrade preparation for the railroad embankment sections. The Engineer will be on-site following the stripping of top soil and organics and prior to the commencement of proofrolling operations as described in Article 120324.03, B, 4.
2. Contact information is provided below:

Iowa DOT Resident Construction Engineer

David Dorsett, P.E.
3538 S. Expressway
Council Bluffs, Iowa 51501
Phone: 712-366-0568
Email: David.Dorsett@dot.iowa.gov

Iowa DOT District 4 Construction Engineer.

George Feazell, P.E.
2210 East 7th Street
Atlantic, Iowa 50022
Phone: 712-243-3355
Email: George.Feazell@dot.iowa.gov

Consulting Engineer.

Bryan Kumm, P.E.
HDR, Inc.
8404 Indian Hills Drive
Omaha, Nebraska 68114
Phone: 402-399-1147
Email: Bryan.Kumm@hdrinc.com

B. Subgrade Preparation.

1. General.

- a. Apply Section 2107 of the Standard Specifications, except when amended by requirements of this specification. Verify that moisture and density control meets the requirements of Article 2107.03, H of the Standard Specifications.
- b. The required procedure for the subgrade preparation shall consist of the following tasks in sequential order:
 - 1) Remove topsoil and organics;
 - 2) Proofroll the subgrade with a loaded truck;
 - 3) Remove and recompact existing materials, or replace unsuitable materials with Impervious Fill;
 - 4) Scarify exposed subgrade and compact in place;
 - 5) Place non-woven geotextile; and
 - 6) Place geogrid for railroads.
- c. No construction traffic will be allowed on the geogrid for railroads and the subballast except those used to place these materials. Traffic is permitted on the subgrade and fills placed but any damage to the embankment is at the risk of the Contractor.

2. Moisture and Density Control.

Scarified and compacted in place subgrade material shall be compacted to a density of at least 95% of the maximum dry density and be within -2% to +4% of the optimum moisture content at the time the compactive effort is applied which may require the addition of water or aeration of materials.

3. Remove Topsoil and Organics.

All topsoil and organics shall be completely removed within the limits of the embankment fills. The depth of stripping on the subgrade shall not exceed 8 inches unless directed by the Engineer. All slopes upon which fill is to be placed shall be notched and broken up so that the fill material will bond with the existing material.

4. Proofrolling.

- a. The purpose of the proofrolling is to pre-load the exposed subgrade prior to the placement of fill and to identify the location of soft areas within the footprint area of the embankment.
- b. Proofrolling shall be completed using a minimum of two passes of a fully-loaded tandem axle dump truck. Rutting from the proofrolling greater than 4 inches or the development of a mud wave shall be considered unacceptable performance as determined by the Engineer.
- c. The type and extent of the remedial action to mitigate unacceptable performance will be as determined by the Engineer and may consist of overexcavation, reconditioning, and recompaction of native soils; overexcavation and replacement of native soils with Impervious Fill; or an additional layer of geogrid for railroads. Recompacted or replaced material shall be compacted to meet compaction and moisture requirements for Overexcavated, Reconditioned, and Recompacted Native Soil Construction and Testing as described in Article 120324.03, C, 2, or Impervious Fill Construction and Testing as described in Article 120324.03, D, 2.

5. Scarification and Compaction of Exposed Subgrade.

- a. Following the completion of the proofrolling, any remedial measures, and acceptance by the Engineer; the exposed subgrade shall be scarified to a depth of 9 inches and recompacted to meet compaction and moisture requirements for Subgrade Preparation as described in Section 120324.03, B, 2.
- b. All notching, scarifying, and breaking of ground surface shall be done parallel to the centerline of the embankment being constructed.
- c. The subgrade shall be approved by the Engineer prior to placement of non-woven geotextile, geogrid for railroads, subballast and ballast, or embankment fill.
- d. The surface of the exposed subgrade shall be smooth and free of rocks or clay lumps greater than 3 inches in maximum dimension.

6. Existing Embankments.

At locations where the railroad embankment sections tie to existing earth embankments to complete the construction, such embankment surface slopes and crest shall be proofrolled, notched, scarified and compacted as specified herein. When directed by the Engineer, such operations shall be accomplished parallel to the axis of the existing embankment.

7. Non-Woven Geotextile.

The non-woven geotextile shall be placed over the prepared and accepted subgrade in accordance with the manufacturer's recommendations.

8. Geogrid for Railroads.

The geogrid for railroads shall be placed over the non-woven geotextile in accordance with the manufacturer's recommendations. An additional layer of geogrid for railroads may be incorporated as directed by the Engineer.

C. Overexcavate, Recondition, and Recompact Native Soil Construction and Testing.

1. General.

At the direction of the Engineer, native soils that are excessively wet or determined to be unsuitable during proofrolling shall be overexcavated, reconditioned, and recompacted. Apply Section 2107 of the Standard Specifications, except when amended by requirements of

this specification. Verify fill placed with moisture and density control meets the requirements of Article 2107.03, H of the Standard Specifications.

2. Moisture and Density Control.

Overexcavated, reconditioned, and recompacted native soil placed in subgrade preparation shall be compacted to a density of at least 95% of the maximum dry density (in accordance with the Modified Proctor test, ASTM D1557) and be within -2% to +4% of the optimum moisture content at the time the compactive effort is applied which may require the addition of water or aeration of materials.

D. Impervious Fill Construction and Testing.

1. General.

At the direction of the Engineer, native soils that are determined to be unsuitable shall be overexcavated and replaced with Imperious Fill. Apply Section 2107 of the Standard Specifications, except when amended by requirements of this specification. Verify fill placed with moisture and density control meets the requirements of Article 2107.03, H of the Standard Specifications.

2. Moisture and Density Control.

Impervious Fill placed in subgrade preparation shall be compacted to a density of at least 95% of the maximum dry density (in accordance with the Modified Proctor test, ASTM D1557) and be within -2% to +4% of the optimum moisture content at the time the compactive effort is applied which may require the addition of water or aeration of materials.

120324.04 METHOD OF MEASUREMENT.

A. Subgrade Preparation for Railroads.

The quantity for Subgrade Preparation for Railroads will be measured in square yards for which the payment will be made for the quantity shown in the contract documents.

B. Overexcavate, Recondition, and Recompact Native Soil.

The quantity for Overexcavate, Recondition, and Recompact Native Soil will be measured in cubic yards placed.

C. Impervious Fill.

The quantity for Impervious Fill will be measured in cubic yards placed.

D. Non-Woven Geotextile.

The quantity for Non-Woven Geotextile shall be measured in square yards for which the payment will be made for the quantity shown in the contract documents.

E. Geogrid for Railroads.

The quantity for Geogrid for Railroads shall be measured in square yards for which the payment will be made for the quantity shown in the contract documents.

120324.05 BASIS OF PAYMENT.

A. Subgrade Preparation for Railroads.

Payment for Subgrade Preparation shall be full compensation for stripping, proofrolling, and scarification and compaction of exposed subgrades, and shall include furnishing a Quality Control Technician, sampling and testing, process control inspection, drying material, furnishing and applying water, controlling moisture content of the materials, and compacting the materials, as specified. No payment will be made for recompaction of areas with failed compaction tests.

B. Overexcavate, Recondition, and Recompact Native Soil.

Payment for Overexcavate, Recondition, and Recompact Native Soil shall be full compensation for overexcavation, reconditioning, and recompaction of native soils that are excessively wet or determined to be unsuitable during proofrolling; and shall include furnishing a Quality Control Technician, sampling and testing, process control inspection, drying material, furnishing and applying water, controlling moisture content of the materials, and compacting the materials, as specified. No payment will be made for recompaction of areas with failed compaction tests.

C. Impervious Fill.

Payment for Impervious Fill shall be full compensation for overexcavation and wasting of native soils that are considered unsuitable; furnishing, placing and compacting Impervious Fill material to replace the overexcavated material; and shall include furnishing a Quality Control Technician, sampling and testing, process control inspection, drying material, furnishing and applying water, controlling moisture content of the materials, and compacting the materials, as specified. No payment will be made for recompaction of areas with failed compaction tests.

D. Non-Woven Geotextile.

Payment for non-woven geotextile shall be full compensation for furnishing and placing all non-woven geotextile.

E. Geogrid for Railroads.

Payment for geogrid for railroads shall be full compensation for furnishing and placing all geogrid for railroads.