

GRANULAR SUBDRAINS

Subsection 915.02 of the Standard Specifications is void and superseded by the following:

Aggregate that is used in granular subdrains shall consist of crushed gravel or crushed rock and shall conform to the requirements of Paragraphs 1. and 2. of Subsection 1033.02.

Crushed gravel shall have a fine aggregate angularity value of 43.0 or greater. The specific gravity for calculation of the Fine Aggregate Angularity (FAA) shall be determined on a combined aggregate sample of the material passing the No. 8 (2.36 mm) sieve and retained on the No. 100 (150 μ m) sieve as defined in AASHTO T 304 Method A, except the specific gravity material shall be washed over the No. 100 (150 μ m) sieve. Gravel aggregate shall have a soundness loss of not more than 12 percent by weight at the end of 5 cycles using sodium sulfate solution.

Crushed rock shall consist of clean, hard particles of crushed limestone, quartzite, or dolomite. Crushed rock shall have a percent loss of not more than 14 at the end of 16 cycles of the freezing and thawing test.

The crushed gravel or crushed rock shall meet the following gradation requirements.

Granular Subdrains Gradation Requirements		
Sieve Size	Target Value (Percent Passing)	Tolerance
1 inch	100	0
No. 4	40	± 20
No. 10	15	± 15
No. 200	4	± 4

Paragraph 3. of Subsection 915.03 of the Standard Specifications is void.

Paragraph 5. of subsection 915.03 is void and superseded by the following:

5. Excavated material shall become the property of the Contractor and removed from the project or used for shoulder construction on the project. Excess material shall become the property of the Contractor and removed from the project.

Traffic will not be permitted to travel next to these trenched areas until the trench has been filled to top of the existing adjacent surfacing.

Earth Shoulder Construction shall be completed prior to granular subdrain installation.

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Crushed rock shall consist of clean, hard particles of crushed limestone, quartzite, or dolomite. Crushed rock shall have a percent loss of not more than 14 at the end of 16 cycles of the freezing and thawing test.

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Version to use if the shoulders were added by previous project at a later date to original project, and now there is no foundation course extending out into the shoulders.

There is existing foundation course that ends at the mainline edge. Additional handwork will be required to expose the foundation course in the trench. This additional handwork is subsidiary to the Item "Granular Subdrains."

Traffic will not be permitted to travel next to open trenched areas until the granular subdrains are installed, and the trench has been filled to the top of the existing adjacent surfacing with asphalt patch.

Granular Subdrains will be installed, and asphalt patch placed, prior to the mill and fill operations of the shoulders.

GRANULAR SUBDRAINS & LONGITUDINAL SUBDRAIN

Subsection 915.02 of the Standard Specifications is void and superseded by the following:

Aggregate that is used in longitudinal and granular subdrains shall consist of crushed gravel or crushed rock and shall conform to the requirements of Paragraphs 1. and 2. of Subsection 1033.02.

Crushed gravel shall have a fine aggregate angularity value of 43.0 or greater. The specific gravity for calculation of the Fine Aggregate Angularity (FAA) shall be determined on a combined aggregate sample of the material passing the No. 8 (2.36 mm) sieve and retained on the No. 100 (150 µm) sieve as defined in AASHTO T 304 Method A, except the specific gravity material shall be washed over the No. 100 (150 µm) sieve. Gravel aggregate shall have a soundness loss of not more than 12 percent by weight at the end of 5 cycles using sodium sulfate solution.

Crushed rock shall consist of clean, hard particles of crushed limestone, quartzite, or dolomite. Crushed rock shall have a percent loss of not more than 14 at the end of 16 cycles of the freezing and thawing test.

The crushed gravel or crushed rock shall meet the following gradation requirements.

Longitudinal & Granular Subdrains Gradation Requirements		
Sieve Size	Target Value (Percent Passing)	Tolerance
1 inch	100	0
No. 4	40	±20
No. 10	15	±15
No. 200	4	±4

Paragraph 3. of Subsection 915.03 of the Standard Specifications is void.

Paragraph 5. of Subsection 915.03 of the Standard Specifications is void and superseded by the following:

Excavated material shall become the property of the Contractor and removed from the project or used for shoulder construction on the project.

Earth Shoulder Construction shall be completed prior to granular subdrain installation.

Section 915 in the Standard Specifications is amended to include Longitudinal Subdrains. Longitudinal subdrains shall be constructed as shown in the plans and in accordance with applicable portions of Section 915 and these special provisions. The

filter fabric and work required to place it will not be measured for payment but shall be considered subsidiary to item Longitudinal Subdrain.

Paragraph 1. of Subsection 915.05 is amended to include the following:

Pay Item	Pay Unit
Longitudinal Subdrain	Linear Foot (LF)

Version with daylighting options. Used on Ravenna North, CN42576 3/16/19

**GRANULAR SUBDRAINS &
LONGITUDINAL SUBDRAIN**

Subsection 915.02 of the Standard Specifications is void and superseded by the following:

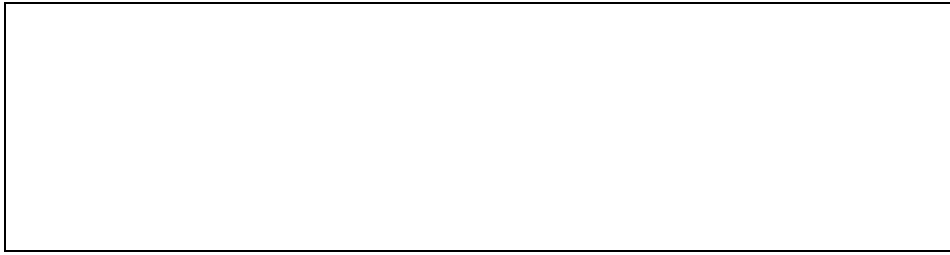
Aggregate that is used in longitudinal and granular subdrains shall consist of crushed gravel or crushed rock and shall conform to the requirements of Paragraphs 1. and 2. of Subsection 1033.02.

Crushed gravel shall have a fine aggregate angularity value of 43.0 or greater. The specific gravity for calculation of the Fine Aggregate Angularity (FAA) shall be determined on a combined aggregate sample of the material passing the No. 8 (2.36 mm) sieve and retained on the No. 100 (150 µm) sieve as defined in AASHTO T 304 Method A, except the specific gravity material shall be washed over the No. 100 (150 µm) sieve. Gravel aggregate shall have a soundness loss of not more than 12 percent by weight at the end of 5 cycles using sodium sulfate solution.

Crushed rock shall consist of clean, hard particles of crushed limestone, quartzite, or dolomite. Crushed rock shall have a percent loss of not more than 14 at the end of 16 cycles of the freezing and thawing test.

The crushed gravel or crushed rock shall meet the following gradation requirements.

Longitudinal & Granular Subdrains Gradation Requirements		
Sieve Size	Target Value (Percent Passing)	Tolerance
1 inch	100	0
No. 4	40	±20
No. 10	15	±15
No. 200	4	±4



Paragraph 3. of Subsection 915.03 of the Standard Specifications is void.

Paragraph 5.of Subsection 915.03 of the Standard Specifications is void and superseded by the following:

5. Excavated material shall become the property of the Contractor and removed from the project or used for shoulder construction on the project.

Longitudinal and Granular Subdrains shall be constructed one construction season ahead of asphalt placement to allow the existing subgrade to drain.

The ends of Granular Subdrains shall be marked prior to grading of foreslopes and Granular Subdrains shall be daylighted again after grading operations are completed. Additional material and re-establishing positive drainage is subsidiary to the pay item Granular Subdrains.

Cohesive soil with a plasticity of greater than or equal to 25 shall be used to cap the subdrains. The intent is to prevent infiltration from surface water into the subsurface drainage system. Cohesive soil shall be compacted with a motor grader wheel or similar equipment and the final elevation of the cohesive soil shall be flush or slightly higher than the adjacent soil.

Section 915 in the Standard Specifications is amended to include Longitudinal Subdrains. Longitudinal subdrains shall be constructed as shown in the plans and in accordance with applicable portions of Section 915 and these special provisions. The filter fabric and work required to place it will not be measured for payment but shall be considered subsidiary to item Longitudinal Subdrain. Supplying, placement and compaction of the cohesive soil used to cap the subdrains shall be considered subsidiary to longitudinal and granular subdrains. Trenching to build subdrains shall be considered subsidiary to longitudinal and granular subdrains.

Paragraph 1. of Subsection 915.05 is amended to include the following:

Pay Item	Pay Unit
Longitudinal Subdrain	Linear Foot (LF)

From: Varilek, Brandon

Sent: Tuesday, September 10, 2013 12:25 PM

To: Barrett, Bruce; Soula, Jeffrey; Jaber, Nicole; Meinecke, Dennis; Miller, Jim

Subject: Evolution of Granular Subdrains

FYI – Recently had a question come up. Below is the issue and answer:

5/16/13 – Chris Hunke of Paulsen called. Asked if NDOT would consider allowing 47B Coarse Aggregate to be used in granular subdrains as it is on-hand at every PCC plant.

9/9/13 – Varilek/Barrett/Miller met with Syslo to discuss history of Granular Subdrain specification.

History from Jim's Special Provision File:

- 1997 Standard Specifications – *Gravel Surfacing* used for subdrains
- 2002 Special Provisions - *Armor Coat Aggregate* used
- 2006 Special Provisions - *47B Coarse Aggregate* used
- 2008 Special Provisions – *Crushed Rock for Surfacing* used (No. 200 adjusted from 5%P to 4%P)
- Later 2008 Special Provisions – Spec revised to allow crushed gravel
- Additional modifications made along the way, but aggregate and were biggest concern

History from Syslo:

- Original *Gravel Surfacing* not ideal as round aggregate would displace under maintenance activity (mowing)
- *47B Coarse Aggregate* proved to be more stable but did not appear to drain well. Suspected infiltration of earth shoulder fines into coarse gradation
- *Crushed Rock for Surfacing* (Crusher Run) proposed by Dobson Bro. (Rea) on I80 project which was accepted and worked well. Used a second time at Weeping Water. Though water was not flowing out of drains, vegetation near outlets was taller and greener indicating drainage was occurring
 - Crusher run gradation is finer, more uniform than *47B Coarse Aggregate*.
 - Spec later revised to allow crushed gravel. 3A gravel (industry terminology) is essentially crushed 2A gravel and should be able to meet gradation.
- M&R could further research materials and drainage, but lacking this is reluctant to deviate from what has proven successful.

Brandon Varilek, P.E.

NDOT Materials & Research

Pavement Design Engineer

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