

2022
MCEA
2105 versus 2106
Grading & Base
June 16, 2022

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Grading, Base, Reclamation, & Aggregates

Outline

A) 2105/2106 Differences

- 1) Design
- 2) Specifications
- 3) Inspection

B) Specifications and Other Items

2105/2106
Earthwork
Design
General

- Don't mix 2105 with 2106 pay items.
- Check a few end areas by hand to confirm that the computer calculations are correct.
- Check that all areas are included in the quantities. Muck is the area which tends to have the most errors.

Earthwork Design General Continued

- Use this note: All material not utilized on project is the property of the Contractor. Dispose of off the R/W in accordance with 2104.
- 2106 is simply cut to a profile, fill to profile.

2105/2106
Design
General
Continued

- Design each type of project the same way, i.e.

Design so that soil quantities are balanced.

Earthwork - 2105

Earthwork Summary						
Station to Station	Excavation			Embankment		
	Common	Topsoil (1)	Subgrade	Suitable Grading (CV)	Select Granular Borrow (CV)	Topsoil (CV)
	CU YD	CU YD	CU YD	CU YD	CU YD	CU YD
SP 1113-XX						
828+56 to 831+05	120	225	250	260	226	124
81+51 to 82+39	325	200	325	345	324	225
SP 1113-XX Subtotal	445	425	575	605	550	349
SP 1112-XX						
93+12 to 93+88	475	150	775	225	470	314
100+06 to 101+72	400	225	100	325	515	571
SP 1112-XX Subtotal	875	375	875	550	985	885
Grand Total	1320	800	1450	1155	1535	1234
	2120					

(1) Paid for as Common Excavation

Earthwork – 2105 Balance

An Earthwork Balance is Required

Excavation (CY)

Common 413,400 (EV)

Subgrade 25,600 (EV)

Muck 1,265 (EV)

440,265 (EV)

Topsoil (Avail) 150,000 (EV)/1.2 = 125,000 (CV)

Select Grading 120,000 (EV)/1.2 = 100,000 (CV)

Granular 180,000 (EV)/1.2 = 150,000 (CV)

Muck 245,000 (EV)/1.4 = 175,000 (CV)

Embankment (CY)

Topsoil 125,000 (CV)

Select Grading 300,000 (CV)

Granular 325,000 (CV)

1,025,000 (CV)

Borrow (CY)

Select Grading (Common) 280,000 (LV)/1.4 200,000 (CV)

Granular 245,000 (LV)/1.4 175,000 (CV)

Select Granular 140,000 (LV)/1.4 100,000 (CV)

475,000 (CV)

Earthwork – 2106

Earthwork Summary					
Station to Station	Excavation		Embankment		
	Common (1)	Subgrade	Suitable Grading (CV) (1)	Select Granular (CV)	Topsoil Borrow Special 1 (CV) (2)
	CY	CY	CY	CY	CY
SP 1111-XX					
828+56 to 831+05	762	262	586	301	98
81+51 to 82+38	2,286	786	1,759	902	293
SP 1111-XX Subtotal	3,048	1,048	2,345	1,203	391
SP 2222-XX					
93+12 to 93+88	3,048	1,048	2,345	1203	391
100+06 to 101+72	762	262	586	300	97
SP 2222-XX Subtotal	3,810	1,310	2,931	1,503	488
Grand Total	6,858	2,358	5,276	2,706	879

(1) Includes Topsoil

(2) Only show and pay for Topsoil Borrow if it is special or not available on site. It cannot be common topsoil borrow as that is paid with common embankment

2105/2106 Specifications Differences

2105/2106.1 Description

- Slight change in Description section

2105/2106.2 Materials

- 2105 uses the term Borrow in 2105.2B in lieu of Embankment in Section 2106.2B

2105/2106.3 Construction Requirements

Same as 2106.3.

One builds it the same way.

2105/2106.4 Method of Measurement

2105: Borrow measured as EV or LV and takes into account shrinkage and swelling.

2106: Excavation measured as EV. Embankment measured as CV and does not take into account shrinkage and swelling.

2105/2106.5 Basis of Payment

2105: Borrow is used for payment

2106: Embankment and Excavation are used for payment

Section 340 MnDOT Pavement Design Manual

Section 340: Shrinkage Calculation

Provide soil shrink/swell factors if the project uses Specification 2105 for excavation and embankment. Shrinkage factors are not required when Specification 2106 is used for excavation and embankment.

A shrinkage factor of 100 percent means that a material will occupy the same volume when placed and compacted in the roadway as it did in the ground prior to excavation. A factor greater than 100 means that the natural material will shrink and more borrow or excavation material will be needed to build the planned embankment. A factor less than 100 percent indicates that the natural material will swell (i.e., its density at the borrow source is greater than its expected density in the roadway embankment).

Section 340 MnDOT Pavement Design Manual

Material Type and Depth Factors

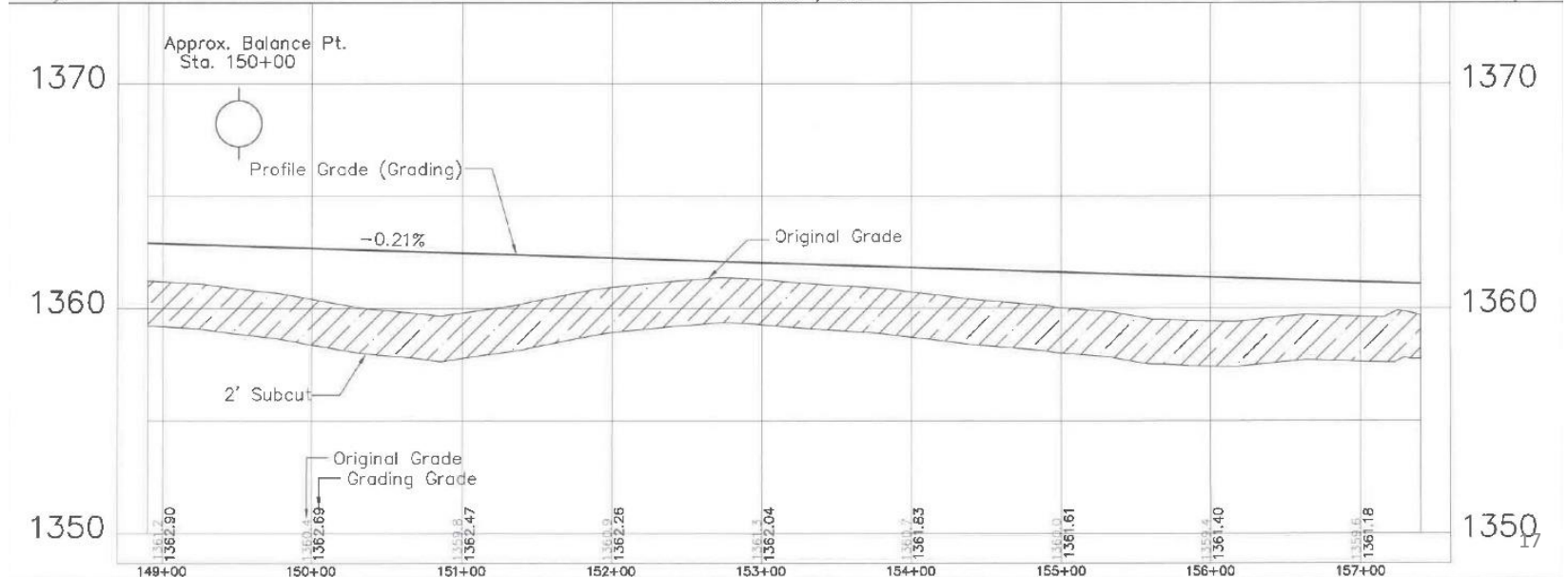
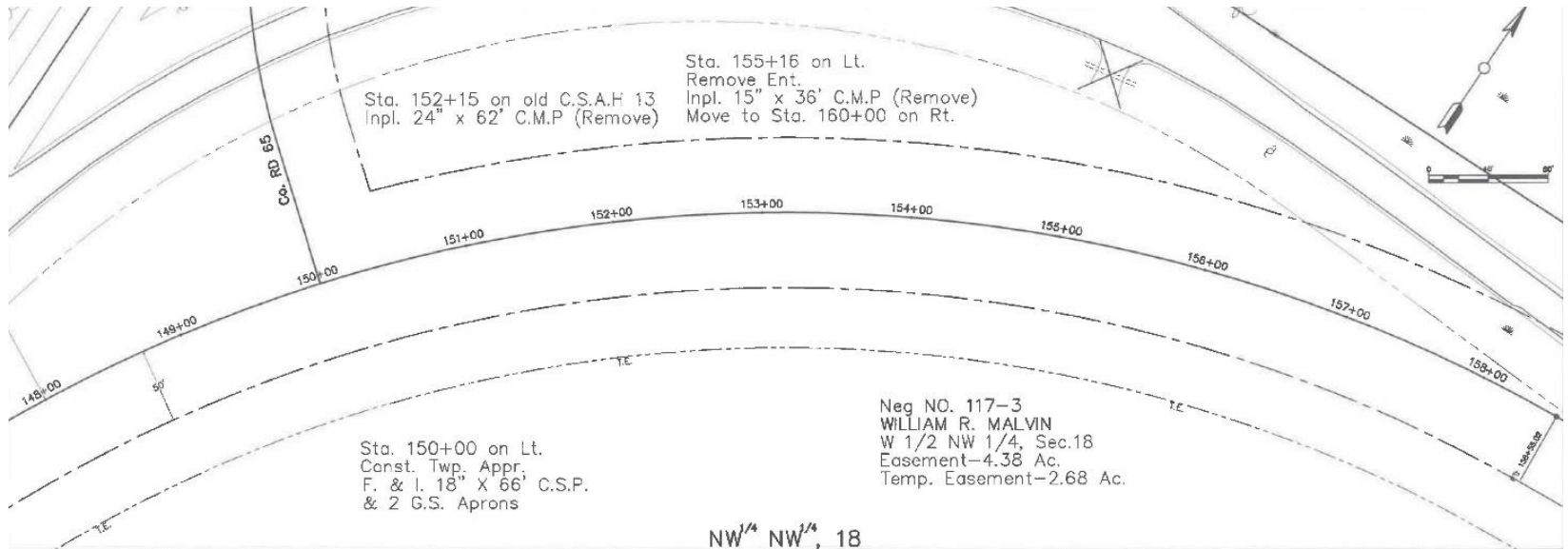
Table 340.1 Compaction Factor Versus Depth

Depth Feet	Compaction (Shrinkage) Factor
1	122
2	116

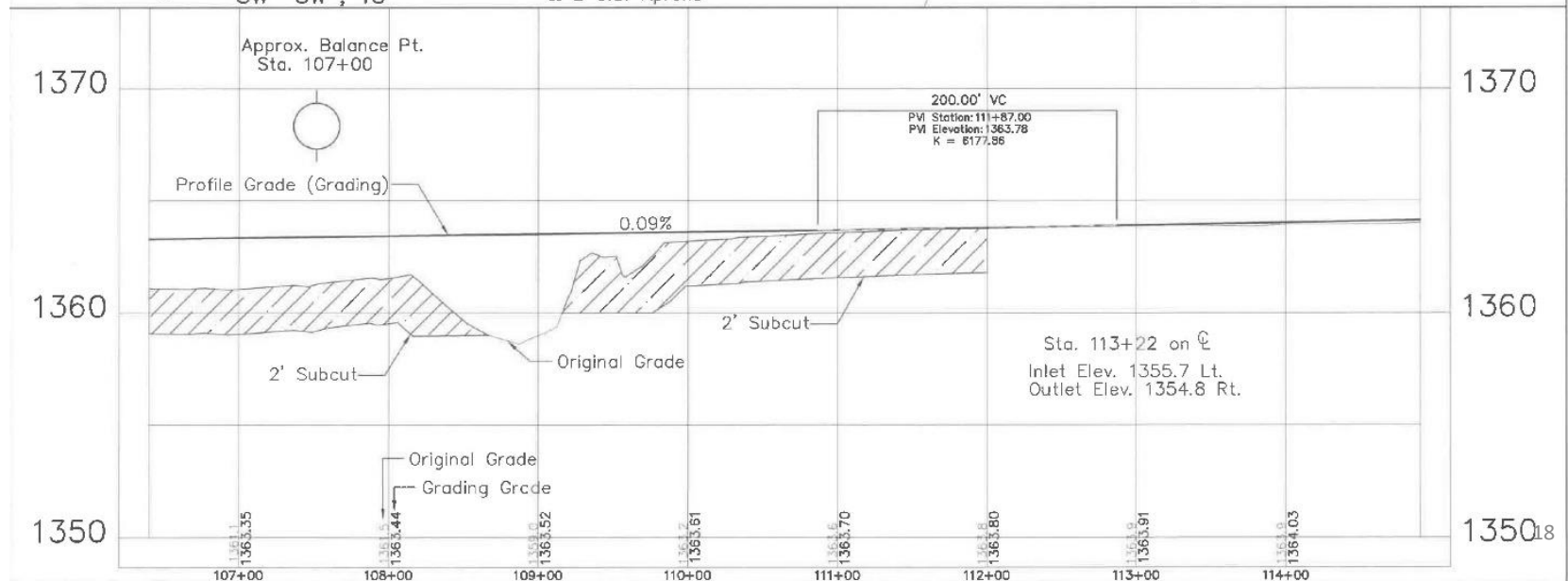
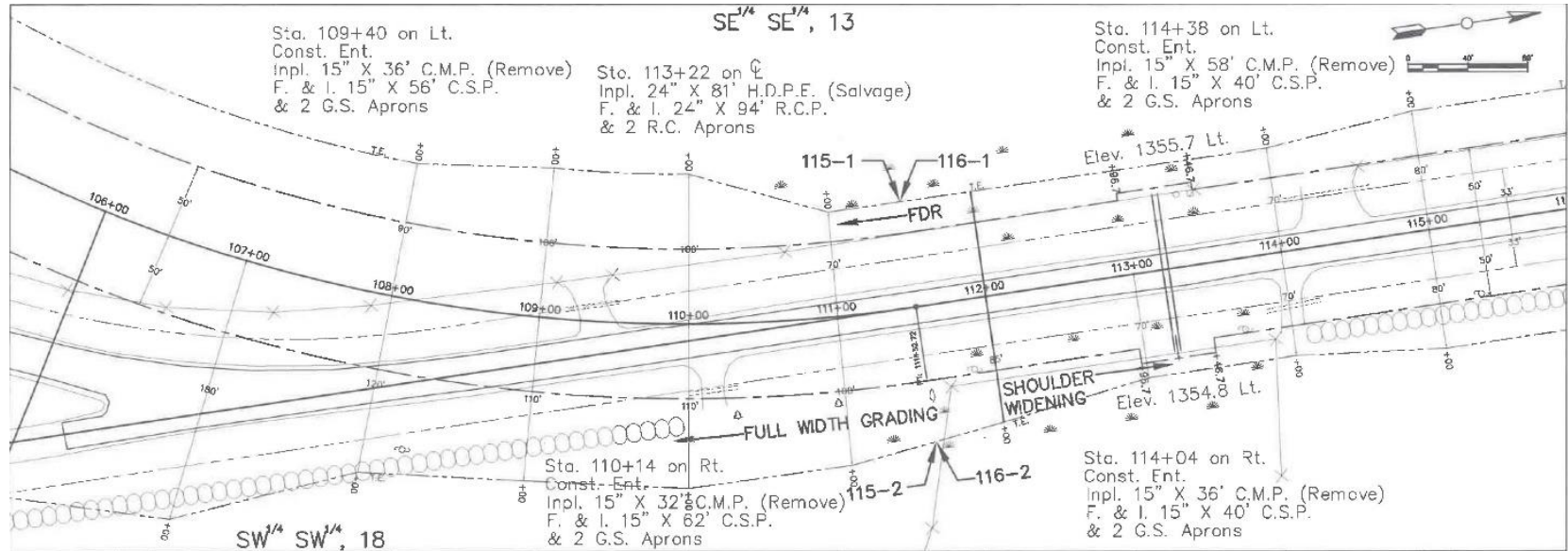
Table 340.2 – Shrinkage Factors

Type	Material/Area	Shrinkage Factor (%)
Rock	Sandstone	90 - 100
Rock	Limestone, granite, basalt, etc.	70 - 90
Rock	Shale	90 - 110
Soil	Deep cuts and high fills	100 - 130
Soil	Normal cuts and fills	130 - 140
Soil	Ditch cuts and shallow fills	135 - 150
Soil	Shoulder grading	140 - 150
Soil	Light shoulder grading	150 - 165
Swamp Backfill	Removing small amount of topsoil	130
Swamp Backfill	5 ft. below natural ground	135
Swamp Backfill	10 ft. below natural ground	140
Swamp Backfill	15 to 20 ft. below natural ground, irregular bottom	145
Swamp Backfill	About 30 ft. below natural ground, very irregular bottom	150

Plan Sheet Illustration – 2' Subcut Excavation



Plan Sheet Illustration – 2' Subcut, Areas not Subcut, and Tie into Existing Grade



2105/2106.5 Inspection Differences

For 2105: Borrow pits need to be cross sectioned before and after removal of material.

For 2105: Need to resolve issues related to shrinkage and swelling differences, therefore more likely to have claims.

Cuts and Fills need to be checked for both 2105 and 2106.

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2020
Specification
Changes



2108 Geosynthetic Construction

- New Geotextile Specification
- Type 5 not recommended.
- Use Type 4 or 7 as a minimum to separate marginable soils.
- Poor soils: Types 9 – 13 for confinement/reinforcement
(Call G&B for assistance)



Geotextile Small Quantities & Reference List

[Link on front page of G&B Website:](#)

Requirements:

- **Total amount on project less than 200 SY**
- **For pipe wrap total less than 1,000 LF**
- **Certificate of Compliance stating meets requirements**
- **Identifying label on product**

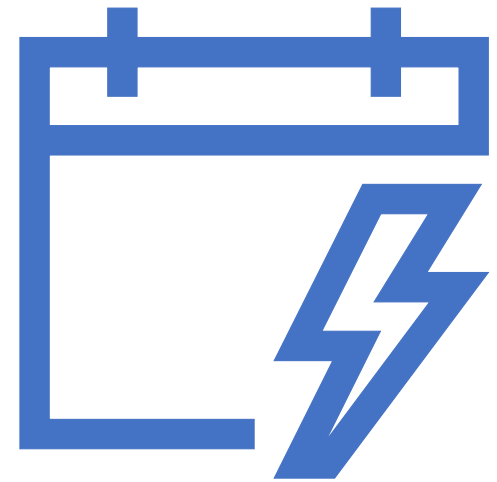
Company	Product	MnDOT 3733 Types
ADS	200 W	5
Carriff	4" Red Stripe	1
Carriff	6" Red Stripe	1
Carthage Mills	FX-45HS	1
Ferguson	DN200	3 or 5



Crushing Test Changes

- Changing the current protocol to same as HMA, i.e. based upon % crush +4
- Specs changed with test
 - Class 5: 10% → 25%
 - Class 6: 15% → 30%
- Crushing test discretionary of Engineer

Schedule of Materials Control





Compaction
under sidewalk
and trails.

New testing rates for compacting
(2020 SMC)

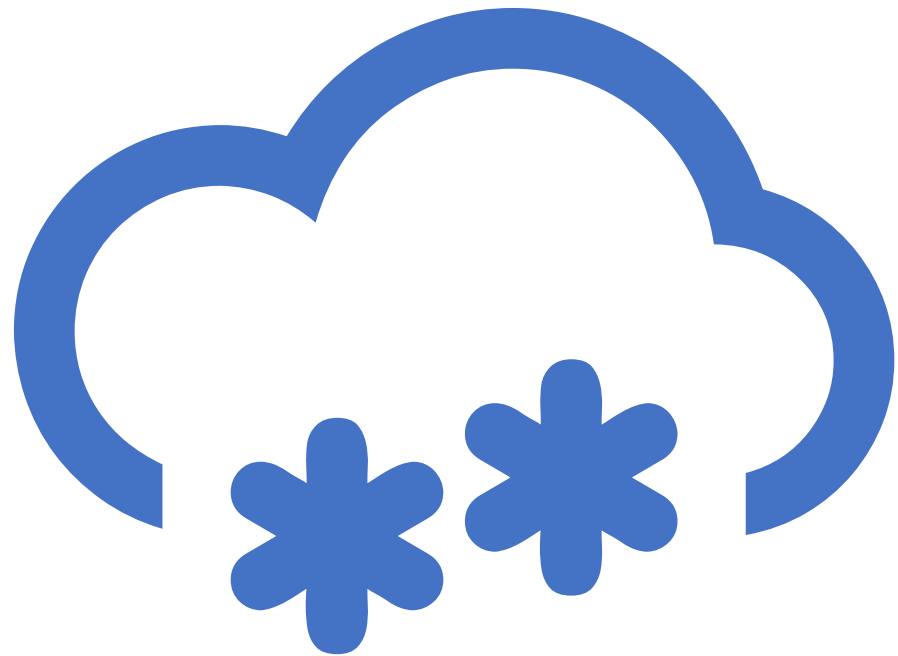
Test Rolling SMC

SMC (2018):
Base (2211),

- FDR (2215), and
- Dirty Granular

Minimum 12' x 300'
length.

Miscellaneous Topics



Design Manual Considerations In-Place Recycling

Know the
thickness and
quality

Do not reclaim
into gravel too
deep

Be cautious of
50/50 designs

10"
Recommended
Max. Depth

Have Special
Provision for
Base One

— New Small LWD about half the weight of older units

- No Full 4-point proctor test required for Density
- One point proctor for moisture.
- See Moduli in G&B manual.
- 8 K Each



LWD Minimum Elastic Moduli for Granular, Clay and Clay Loam, and Base		
Specification	Material Type	Minimum Elastic Modulus [MPa]
2106	Granular	40
	Clay and Clay Loam	20
2211	Base	50
2215	Reclamation	

DIGITAL SCALE
2500 x 0.1 GRAM
\$93.99



Portable Compact Propane Gas Burner Stove for Outdoor Picnic Camping Cooking \$19.89



Compaction in Trenches

MnDOT =
100%

Some Locals =
95% below 3'

Finis

