



2022 Minnesota AGC Construction Summit Grading & Base Nitty Gritty Specifications

Terry Beaudry
MnDOT Grading and Base Engineer

1

1

Outline

2020 Specification Changes

- 2105
- 5Q
- Monetary Price Adjustments
- Crushing Test
- Rip Rap
- Geotextiles
- Structural Backfill
- Bitumen Content
- Aluminized/Aluminum Pipe
- ARM Proposal to Modify Class 5

Miscellaneous Topics

- Sampling
- LWD
- Materials Control Schedule
- Equipment compaction Capabilities
- Sidewalks/Trails
- Geotextile Small Quantities/Reference

2

2

Outline - 2

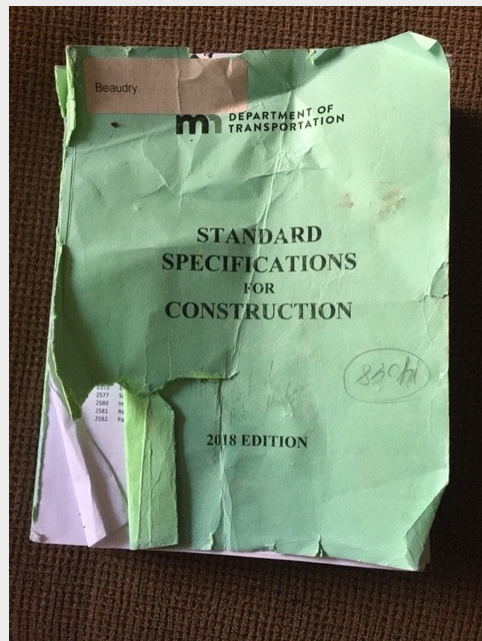
Discussion Items

- Test Roll on top of Cut Section
- Uniform Material
- Failing Tests
- Mix from two sources
- How to Sample 5Q
- Favorite calls
- Least Favorite calls

3

3

2020
Specifications



4

2020 Specifications

Goals:

- Simple to understand
- Lessen false negatives, i.e. Specs are met, but the engineering intent is not.
- Lessen false positives, i.e. Specs are not met, but engineering intent is met.

5

5

No Specification 2105 in 2020 Spec Book

Could be used by locals as a special provision

Also, please contact me, if old plan sheets or special provisions reference 2105 – I want to make sure we have continuity in the future.

6

6

5Q

- Removed 5Q for 2020 Spec Book
- May be used as Special Provision - D6
- Gradation modification, be aware if it is used as a special provision that there is a recommended changed from 2018 spec book.



7

Monetary
Price
Adjustments
for Base,
Surfacing,
etc.
Removed
from 2020
Spec Book

Use:

1512 UNACCEPTABLE AND
UNAUTHORIZED WORK

1601 SOURCE OF SUPPLY AND
QUALITY

1603.3 MATERIALS: SPECIFICATIONS,
SAMPLES, TESTS, AND ACCEPTANCE

1603.4 ACCEPTANCE

8

4



**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 Engineer₉

9

**Riprap
(Special Provision &
Schedule of Materials
Control)
Hydraulics/Bridge**

QC – focused on limestone quarries and gradation requirements (image analysis) Agency D₈₅
Forms on G&B Web page, G&B manual



10

10

2108 Geosynthetic Construction

- New Geotextile Specification
- Type 5 not recommended.
- Use Type 7 as a min. for marginable soils.
- Poor soils: Type 9, 10, 11, or 12 (Call G&B for assistance)



11

11

Geotextiles Sewing Versus Overlaps

- Geotextile overlap 36"
- Geotextile overlaps versus sewing

12

12

Structural Backfill Specification (This Picture is 24 hours after rain)

- Met super sand & structural backfill: #40/10 (0-65) & #200/10 (0-10)
- > 24 hours after a rain
- Sample was: 8% Passing #200 % & 5% Clay
- Changed Structural Backfill to:

Maximum #200: 5% & Maximum Clay: 1.5%



13

Specs Changes Other

- Bituminous limit raised to 4.0%
- No concrete or limestone bedding for aluminum pipe - so don't spec Aluminum pipe in SE MN

14

14

Request from ARM to Modify Class 5 Quarried Specifications Currently Vetting it through DOT

Sieve Size	Current Class 5 Gradation	Modified Class 5 Gradation for Quarried Rock
# 4	35-80	30-80
# 10	20-65	5-65
# 40	10-35	5-35
# 200	3-10	3-12

15

15

Class 5 Proposed Change Continued

- Quarried rock is different that Glacial gravel

- Typically quarried is coarser on upper sieves compared to glacial gravel
- 100% versus 25% crushed for Class 5 (Glacial Gravel)
- No binder soil is added to meet gradation for quarried rock as apposed to glacial gravel. For quarried rock, the fines produced are a natural consequence of the crushing process.
- What do other agencies allow: Wisconsin 12%, several local Agencies in SE Minnesota modify specification, especially to the #200 sieve. No complaints that I am aware of.
- **False positives, i.e. Specs are not met, but engineering intent is met.**

16

16

Class 5 Proposed Change Continued

- What is Typically Produced, Lab Results – Class 5 Graduations before 2010 from Lab database

District	3/4	3/8	#4	#10	#40	#200	G/S Ratio
1	95.1	72.1	56.4	43.3	20.8	6.8	1.55
2	96.8	80.7	69.0	56.8	26.6	7.1	0.87
3	96.5	79.4	67.4	55.2	26.1	7.6	0.94
4	96.7	82.3	69.8	56.3	26.0	7.7	0.90
6	<u>97.8</u>	<u>73.0</u>	<u>51.9</u>	<u>36.6</u>	<u>20.1</u>	<u>9.0</u>	<u>2.30</u>
7	97.2	81.0	67.0	54.0	26.6	8.6	1.01
8	97.6	83.9	71.2	56.0	23.9	8.5	0.93
Avg	96.8	78.9	64.7	51.2	24.3	7.9	1.13
Spec	70-100	45-90	35-80	20-65	10-35	3.0-10.0	NA

17

17



18

Sampling Criteria for Base 2020 Spec. Book

- Change from after spreading before compaction to before spreading
 - Inconsistent
 - Taking sample over dozer tracks
 - Too short a window to gather sample
 - Made change to Grading and Base Manual

19

19

— 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.



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	

20

20

Schedule of Material Control

- Engineer choose to divide lots sizes into smaller volumes/weights of non-equal sizes.
 - For example, Engineer may designate one or more turn or passing lanes as individual lots, or a lot as one or more a day(s) production.

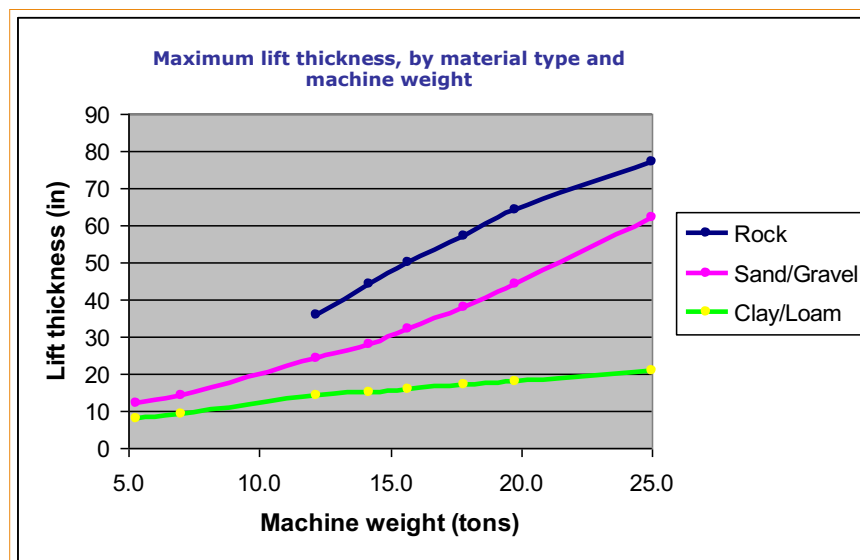
Test at Engineer's Discretion

- Bit content, clay content, concrete content, objectionable materials.

21

21

Equipment Compaction Capability Lift Thickness



22



Compaction
under sidewalk
and trails.

New testing rates for compacting
(2020 SMC)

23

Geotextile
Small
Quantities &
Reference List

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

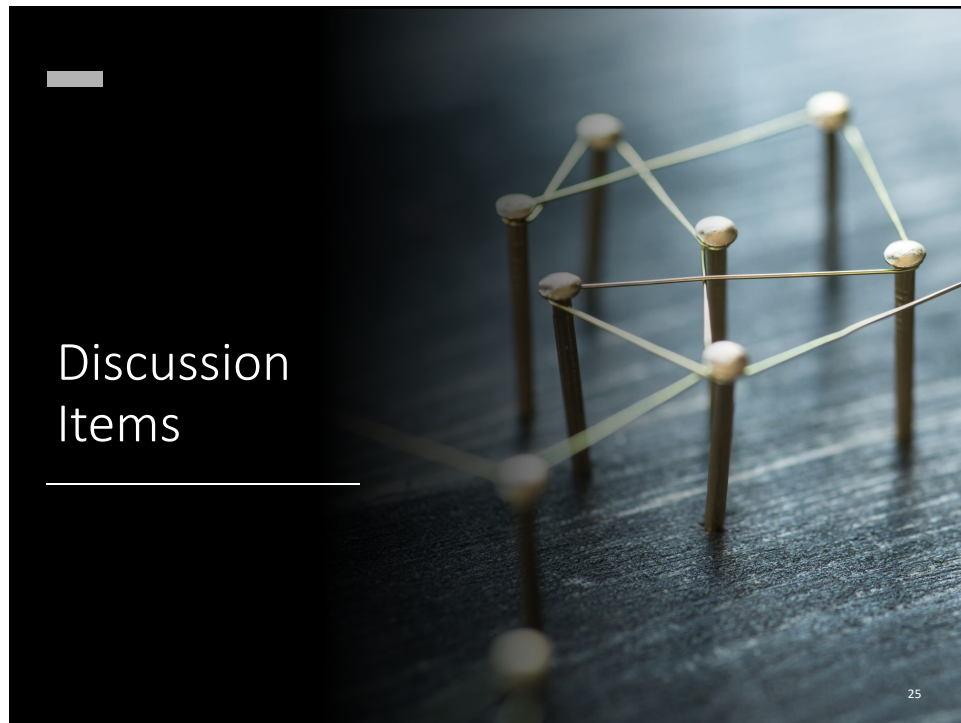
Requirements:

- 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

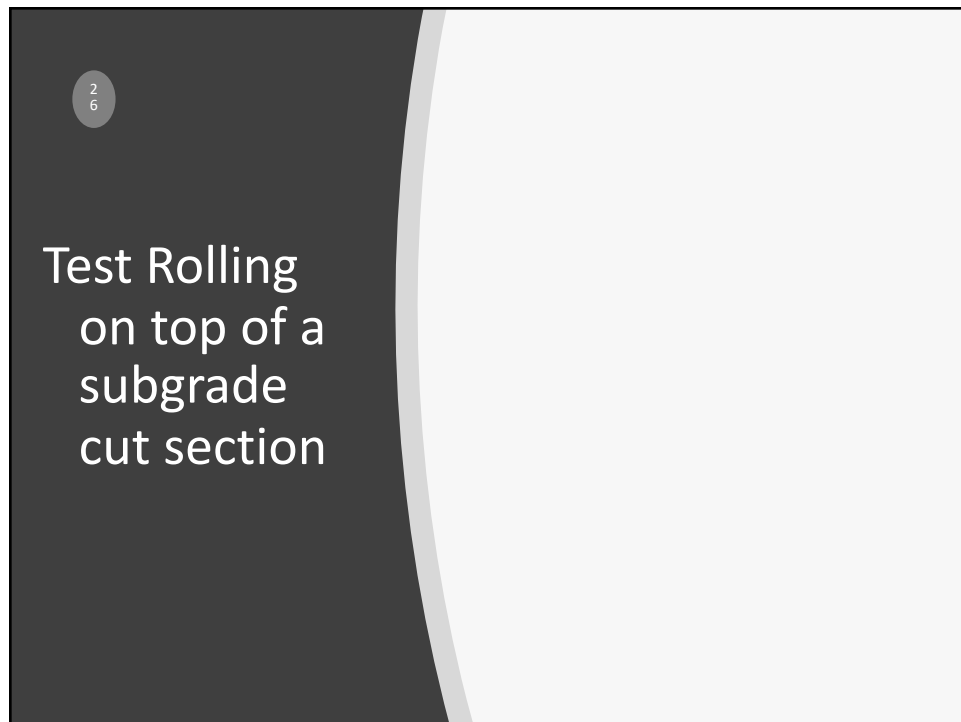
Company	Product	MnDOT 3733 Types
ADS	200 W	5
Carriff	4" Red Stripe	1
Carriff	6" Red Stripe	1
Carthage Mills	FX-45HS	1
Ferguson	DN200	3 or 5

24

24



25



26

Table 17 Requirements on when to use Test Roller 30 and 10

Specification	Site Conditions	Testing Surface	
		Test Roller 30 (Standard Test Roller, 30k axle)	Test Roller 10 (Tandem Truck)
		Mainline, passing, turn lanes, & ramps.	Mainline, passing, turn lanes, ramps, & field entrances
2106	- New Construction $\geq$ 2-lane miles Layer Thickness is $\geq$ 30 in. - No utilities within 30 in of testing surface. - No geotextiles within 60 in of testing surface.	• Top of Subgrade layers	• Top of Subgrade layers • 2 feet below Grading Grade • Grading Grade
	- New Construction < 2-lane miles 12 in. < Layer Thickness < 30 in. - Utilities are within 30 in of testing surface. - Geotextiles are within 60 in of testing surface roadway segments with relatively closely spaced bridge overpasses.	...	• Top of Subgrade layers • 2 feet below Grading Grade • Grading Grade
2211	Layer Thickness $\geq$ 4 in.	...	• Aggregate Base
2215			• FDR
2221			• Shoulder Base
2118			Aggregate ^{2.7} • Aggregate Surfacing

27

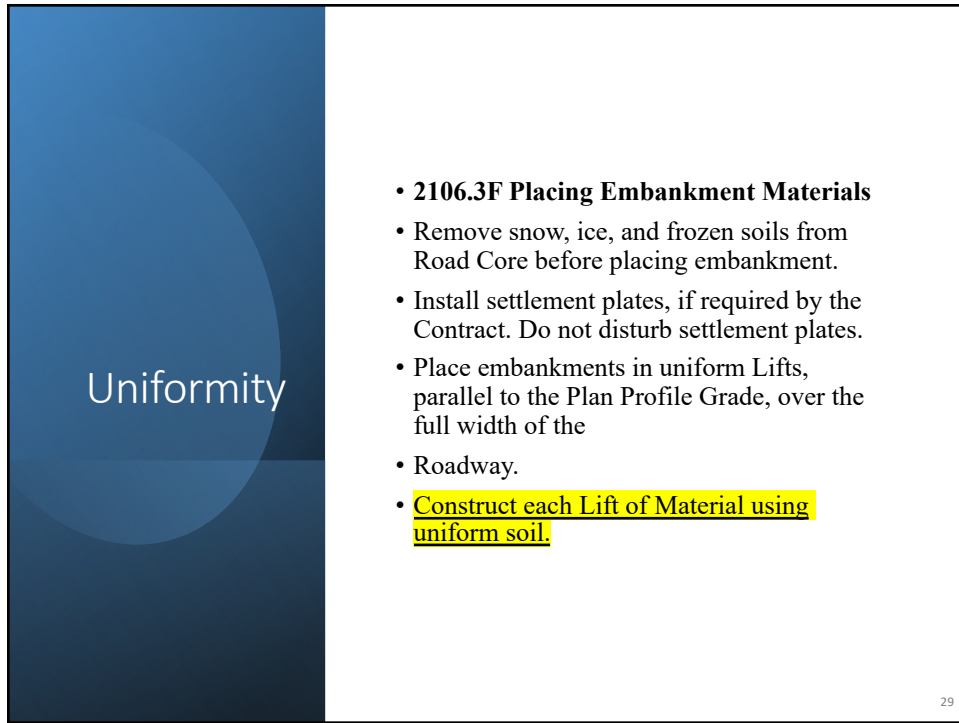
Contractor excavated rock. They are taking the friable rock and wanted to use in the embankment.

Use embankment material in the road core with particle sizes no larger than specified in Table 2106-4:

Table 2106-4 Maximum Particle Size in Road Core	
Depth from Grading Grade	Max. Particle Size Inches
< 12 in.	3
1 ft. – 3 ft.	6
3 ft. – 6 ft.	12
> 6 ft.	24
≤ 2 ft. from a non-plastic structure	3
≤ 2 ft. from a plastic structure	1
Areas where piling is to be placed	6



28

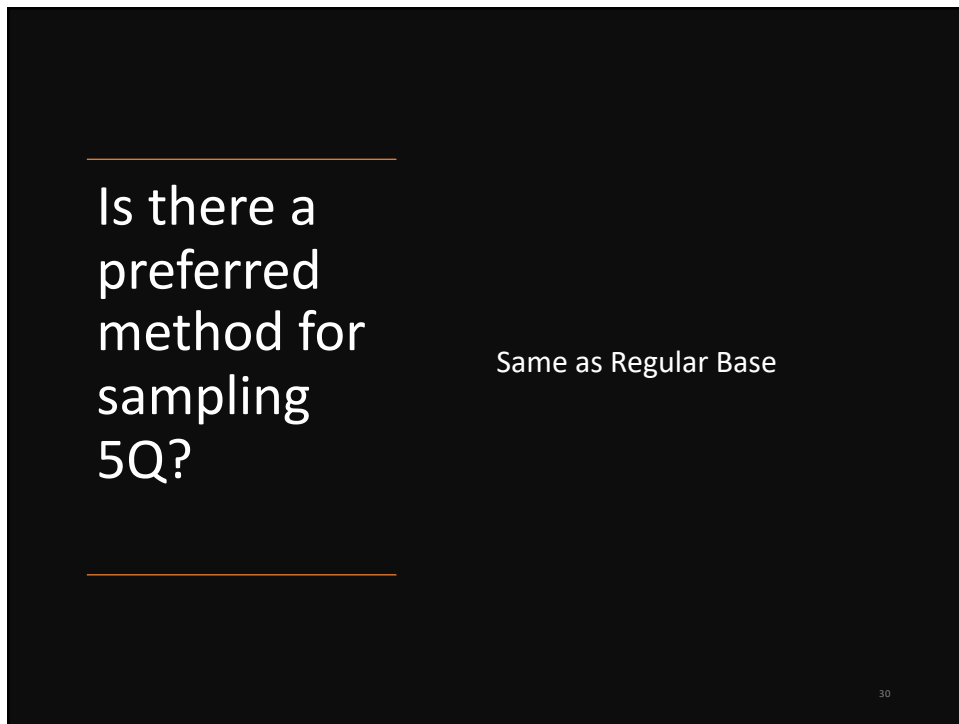


Uniformity

- **2106.3F Placing Embankment Materials**
- Remove snow, ice, and frozen soils from Road Core before placing embankment.
- Install settlement plates, if required by the Contract. Do not disturb settlement plates.
- Place embankments in uniform Lifts, parallel to the Plan Profile Grade, over the full width of the
- Roadway.
- Construct each Lift of Material using uniform soil.

29

29



Is there a preferred method for sampling 5Q?

Same as Regular Base

30

30

Failing Tests

For Base and Shouldering QA SMC requires average of two tests.

If the p200 is 10.0% and my two tests are 10.5% and 9.7%, I would be OK with that. But I would have a conversation with the Contractor.

What can they do to change their process, so that coarser material can be delivered.

If the tests were 15.0% and 4.0%, I would have them remove and replace the 15% material based on grossly failing material and the requirement for uniform material.

The Engineer can always isolate and test areas that they think are unacceptable.

31

31

% Crushing Infiltration pond

Missed a crushing test for the Med. Filter Agg. It was placed and the filter topsoil was placed overtop for an infiltration ponds.

A crushing test was performed afterwards from the stockpile, and it failed. However, the infiltration test, met the requirements (minimum of 4.0 inch/hr) for these ponds.

Best to talk with the designer, however since the material drains as required, would recommend leaving it in-place, as only very small loads will impact the material (placed outside the roadway embankment).

32

Are you ok with
mixing two sources
with differing
gradations and
qualities.

Yes, but see 3838.2C(3):
(3) When mixing recycled
Aggregate with virgin
Aggregate, the minimum Los
Angeles Rattler of Carbonate
virgin Aggregate is 40%. Meet
all other virgin Aggregate
requirements in 3138.2B.

33

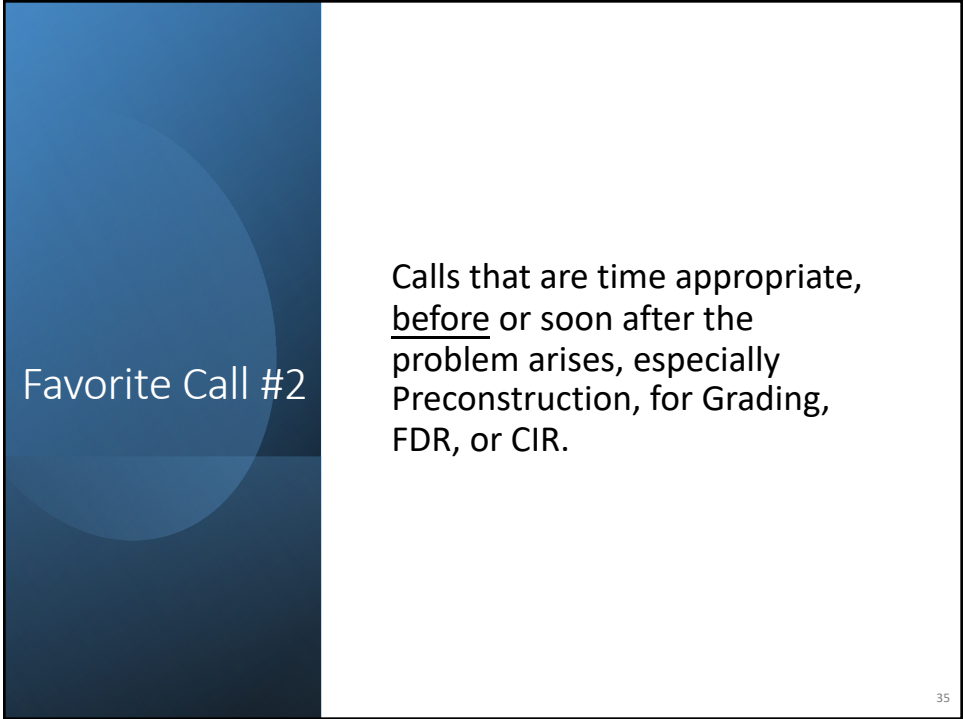
33

My Favorite
Project Call

What can we do to improve the
stiffness of the base/subgrade
design?

34

34

A presentation slide with a dark blue background on the left and a white background on the right. The left side features a large, semi-transparent blue circle. The text "Favorite Call #2" is written in white on the blue background.

Favorite Call #2

Calls that are time appropriate, before or soon after the problem arises, especially Preconstruction, for Grading, FDR, or CIR.

35

35

A presentation slide with a dark grey background on the left and a light grey background on the right, separated by a curved white line. The left side has a small grey circle containing the number "36". The text "Least Favorite Call" is written in white on the dark grey background.

Least Favorite Call

- What Should the Deduct be for the material the Contractor install in June and I get the call in November.

36

3
7

Least Favorite Call #2

My reclaim is full of Clay, I designed for a 50/50 blend of Base and HMA, why do I have this problem?

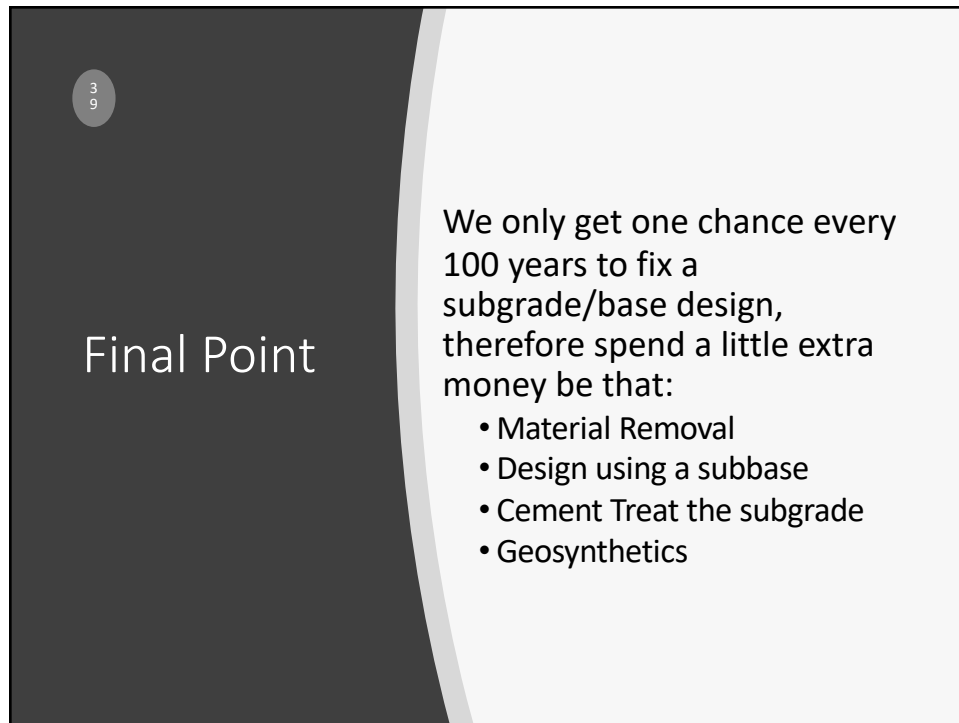
37

3
8

Next to Final Point

Design Sustainably, use local materials and reuse materials from the site.

38

The slide has a dark grey background on the left and a light grey background on the right, separated by a curved white line. In the top left of the dark area is a small grey circle containing the number '39'. The title 'Final Point' is in white text on the dark background. The main text is on the light background.

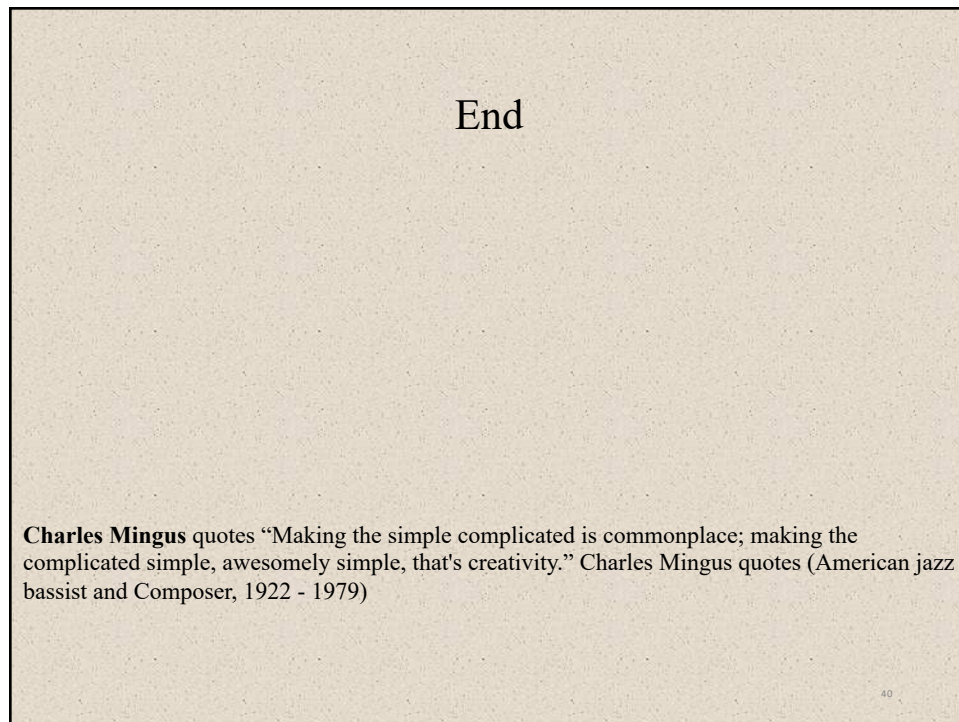
39

Final Point

We only get one chance every 100 years to fix a subgrade/base design, therefore spend a little extra money be that:

- Material Removal
- Design using a subbase
- Cement Treat the subgrade
- Geosynthetics

39

The slide has a light beige, textured background. The word 'End' is centered in a large, black, serif font. At the bottom left, there is a quote in a smaller black font. A small number '40' is in the bottom right corner.

End

Charles Mingus quotes "Making the simple complicated is commonplace; making the complicated simple, awesomely simple, that's creativity." Charles Mingus quotes (American jazz bassist and Composer, 1922 - 1979)

40

40