MAPA: MnDOT Aggregate, Grading, and Base Update

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DEPARTMENT OF TRANSPORTATION

Outline

- Recent Specification Changes
- In progress Specification Changes
- RCA
- Proposed Changes
- Other Initiatives

Recent Specification Changes

Grading and Base Specification Updates

Special Provision Changes Already Active

2108: Geosynthetics

1. Three feet (3') Overlaps is the default, Sewing allowed with prior QA test result, no glueing of Types 6 - 13.
2. Added types 9 - 13.

2215 Reclamation

1. Allowing Blended Cement
2. Foamed asphalt now allowed at 50 degrees F.

2390 Cold In Place Recycling

1. Allowing Blended Cement
2. Foamed asphalt now allowed at 50 degrees F.

Grading and Base Specification Updates

Special Provision Changes Already Active

3138 Aggregates for Surface and Base

1. Modified Class 5 gradation for quarried rock.
2. Allowing lime fines in binder for surface gravel.

3149 Granular Material

1. Removed Phi angle (φ) for structural backfill (note it is still required for some structures by special provisions).

3733 Geosynthetics

1. Added types 9 - 13

In Progress Specification Changes

Grading and Base Specification Updates

Special Provision Changes Sent Downtown

2502 Subsurface Drains

Clarifications

3245 Thermoplastic Pipe

Clarifications

3278 Corrugated Polyethylene Drainage Tubing

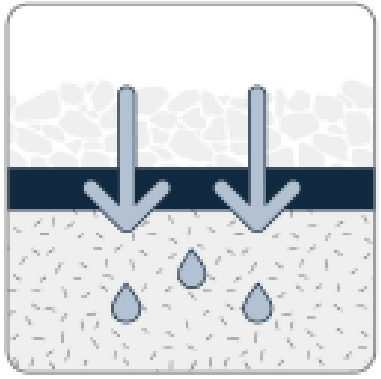
Clarifications

3733 Geosynthetic Materials

Modify Type 5 Geotextile

Modifying Type 5 Geotextile

- Current Type 5 Slit Tape has low permittivity and thus poor performance for filtration
- Gathered feedback from MEO, SEO, OMRR, OES, OCIC, Bridge Hydraulics
- Very low recent use
- New Type 5 has better permittivity and improved reinforcement
- BABA Availability



Recycled Concrete Aggregate (RCA)

Use of Recycled Concrete Aggregate (RCA)

- Changes in use of RCA driven by OES to *minimize negative environmental impacts* (e.g., high pH, tufa formation, etc.)
- Gathered feedback from multiple internal and external stakeholders (ARM, CPAM, AGC) for proposed changes
- Continue to study/research this issue with Michigan Tech University (MTU) and Michigan State University (MSU)

Use of Recycled Concrete Aggregate (RCA)
What has changed already?

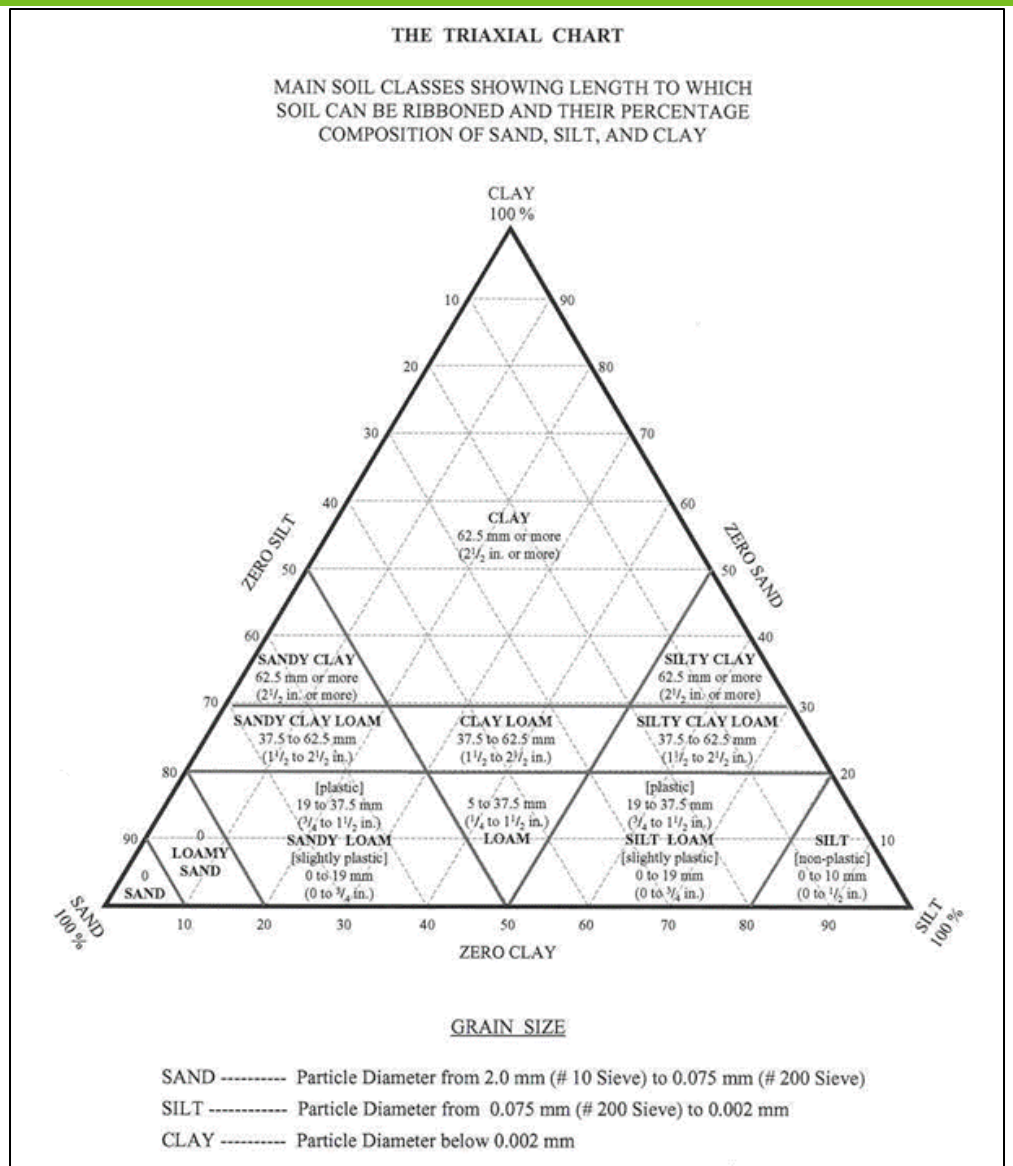
- **1717 Air, Land, and Water Pollution**: Temporary use and stockpiling of RCA must be isolated from surface water and ground water; runoff must be monitored and managed for pH and turbidity
- **2108 Geosynthetic Construction Materials**: No RCA within 6" of Type 13 Geotextile - **Rescinded**
- **2412 Precast Concrete Box Culverts**: No RCA bedding or backfill for box culverts
- **2501 Pipe Culverts**: No RCA bedding or backfill for pipe culverts
- **2515 Revetment Systems**: No RCA bedding for articulated concrete mats and concrete armor units

Use of Recycled Concrete Aggregate (RCA)
What is proposed to change in near future?

Proposed changes to **2106, 2118, 3138, and 3149**

- Restricting RCA in aggregate shouldering within 100 feet of surface waters, similar to how concrete grinding slurry is handled.
- Increase the top aggregate size for class 5 and 6 base from 1-1/2” to 2”
- Restrict RCA to the top third or 6” maximum in subbase for locations with edge drains. Where edge drains are not present, allow RCA in upper 18” of subbase. Where RCA is used in subbase, meet the gradation requirements for base.
- Cap the proportion of RCA at 75% in 3138.
- Prohibit RCA from Select Grading Material (Soil)
- Integrate research findings into specification updates and review economic impacts

Triaxial Classification: Based Upon the Percentage of Sand, Silt, and Clay



Unified Classification System to be Added

Major divisions			Group symbol	Group name
Coarse grained soils more than 50% retained on or above No.200 (0.075 mm) sieve	gravel > 50% of coarse fraction retained on No.4 (4.75 mm) sieve	clean gravel <5% smaller than No.200 Sieve	GW	well-graded gravel, fine to coarse gravel
			GP	poorly graded gravel
		gravel with >12% fines	GM	silty gravel
			GC	clayey gravel
	sand ≥ 50% of coarse fraction passes No.4 (4.75 mm) sieve	clean sand	SW	well-graded sand, fine to coarse sand
			SP	poorly graded sand
		sand with >12% fines	SM	silty sand
			SC	clayey sand
Fine grained soils 50% or more passing the No.200 (0.075 mm) sieve	silt and clay liquid limit < 50	inorganic	ML	silt
			CL	lean clay
		organic	OL	organic silt, organic clay
	silt and clay liquid limit ≥ 50	inorganic	MH	elastic silt
			CH	fat clay
		organic	OH	organic clay, organic silt
Highly organic soils			PT	peat

Unified Classification System to be Added

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests				Soil Classification	
				Group Symbol	Group Name
COARSE-GRAINED SOILS More than 50% retained on No.200 Sieve	Gravels More than 50% of coarse fraction on No. 4 Sieve	Clean Gravels Less than 5% fines	Cu ≥ 4 and 1 ≤ Cc ≤ 3	GW	Well-graded gravel
			Cu < 4 and/or Cc < 1 or Cc > 3	GP	Poorly graded gravel
		Gravels with Fines More than 12% fines	Fines classify as ML or MH	GM	Silty Gravel
			Fines classify as CL or CH	GC	Clayey gravel
	Sands 50% or more of coarse fraction passes No.4 sieve	Clean Sands Less than 5% fines	Cu ≥ 6 and 1 ≤ Cc ≤ 3	SW	Well-graded sand
			Cu < 6 and/or Cc < 1 or Cc > 3	SP	Poorly graded sand
		Sands with Fines More than 12% fines	Fines classify as ML or MH	SM	Silty sand
			Fines classify as CL or CH	SC	Clayey sand
FINE-GRAINED SOILS 50% or more passes the no. 200 Sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line	CL	Lean clay
			PI < 4 and plots below "A" line	ML	Silt
		Organic	Liquid limit—oven dried < 0.75	OL	Organic clay
			Liquid limit—not dried	OL	Organic silt
	Silts and Clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay
			PI plots below "A" line	MH	Elastic silt
		Organic	Liquid limit—oven dried < 0.75	OH	Organic clay
			Liquid limit - not dried	OH	Organic silt
HIGHLY ORGANIC SOILS				PT	Peat

Proposed Changes

Class 5, 6, and 5Q MnPAVE Inputs
Stiffness Aggregate Base Resilient Moduli (ksi)

Material	Fall	Winter	Early Sp	Late SP	Summer
Class 5	27	50	9	22	26
Class 6	30	50	10	24	30
Class 5Q	29	50	10	24	29

Very little or no change in HMA requirements between these bases.

Los Angeles Rattler (LAR)

- Currently: 40 for all aggregates, except Class 6 = 35
- AASHTO (M147) and Wisconsin = 50 for Bases
- Study this a bit more and look at some other state's criteria.

Other Initiatives

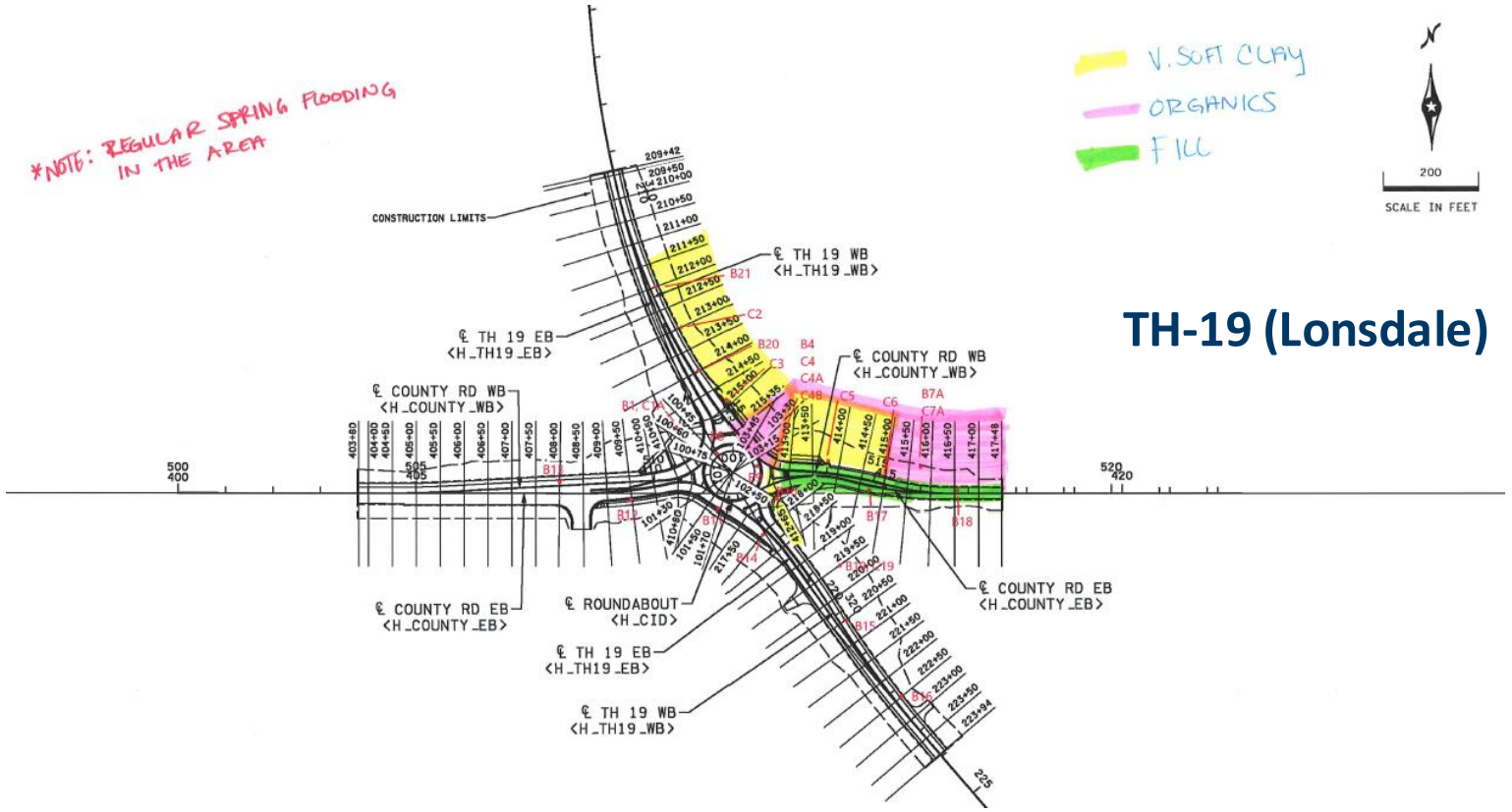
RIPRAP Gradation

- Reported issues with *FHWA Imaging Software* for QC/QA (e.g., finer gradations than actual).
- MnDOT evaluated alternative => I-RIPRAP
  - Promising results but still some issues that need to be addressed (e.g., computing time, crashing of app)
  - At this time, not planning to accept I-RIPRAP results from producers but will continue use internally
- For questions, please reach out spec owner (Bridge Office):

Block, Thomas (DOT) Thomas.Block@state.mn.us

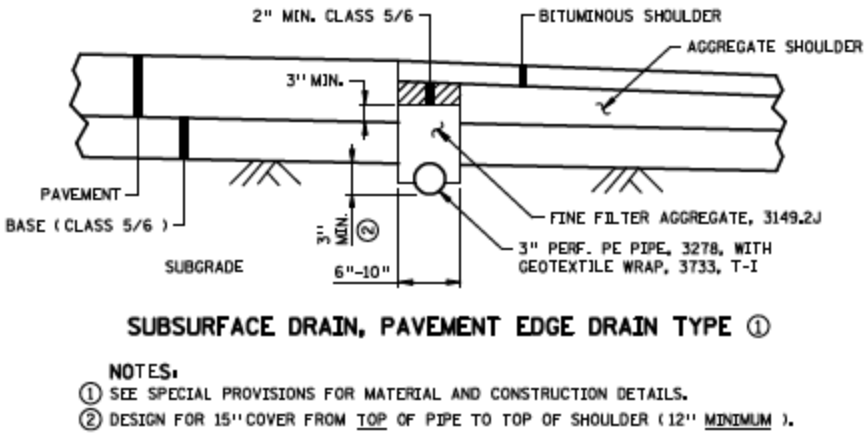
Roundabouts

- Roundabouts tend to be built in areas where subsurface/soil has not been modified/engineered or in areas with weak soils =>may need to focus more on soil exploration



Reviewing *HMA shoulders and PCC Road Design*

- Grading and Base Unit preliminary assessing and investigating influence of some of materials/specs with this observed failure
- Potentially proposing revising standard plan to minimize failures



SUBSURFACE DRAIN, PAVEMENT EDGE DRAIN TYPE ①

NOTES:
① SEE SPECIAL PROVISIONS FOR MATERIAL AND CONSTRUCTION DETAILS.
② DESIGN FOR 15" COVER FROM TOP OF PIPE TO TOP OF SHOULDER (12" MINIMUM).

subsurface standard plan sheets .430 - .433

Finis