Michigan Concrete Association
Winter Conference

Subgrade Stabilization Break-out Session

February 21, 2019

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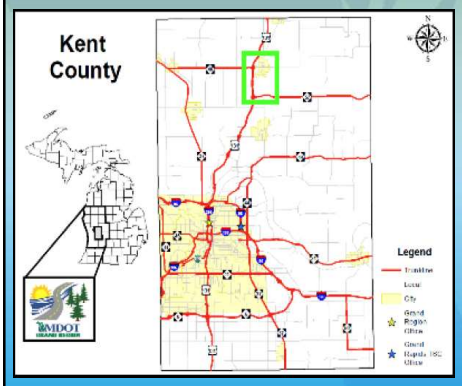
US-131 – 10 Mile to 14 Mile Concrete Reconstruct Kent County

- US-131 Project Details
- History of Subgrade Stabilization use at MDOT
- Why was it used on US-131?
- Where it was used on US-131
- How Did it go?

Project Location



Project Details

- Construction Details
  - Cost: $26.4 Million
  - Toebe Construction
- Traffic
  - Volume: 42,000 ADT
  - 8% commercial
- Pavement History
  - 2001 un-bonded concrete overlay
  - 1968 Concrete Freeway Construction

Project Details

- Project Scope:
  - 20 year Concrete pavement on SB roadway
  - 50 year concrete pavement on a portion of the NB roadway
  - Bridge CPM fixes
    - Shallow overlay on Rogue River bridges
    - Deck patching and epoxy overly on 13 Mile bridges

RITF

RITF Pilot Projects			
Project 119012: US-131 from 14 Mile Rd to 17 Mile Rd (20 and 30 Year HMA Pavement)			
	2017 as-constructed costs per lane mile	Lane Miles	Total cost
20 Year Pavement Section	$ 1,291,517.31	9.77	$12,617,713.21
30 Year Pavement Section	$ 1,462,106.13	4.72	$6,906,646.01
Project 117992: US-131 from 10 Mile Rd to 14 Mile Rd (20 and 50 Year Concrete Pavement)			
	2018 As-bid prices per lane mile	Lane Miles	Total cost
20 Year Pavement Section	$ 1,453,499.85	11.11	$16,152,584.21
50 Year Pavement A Section	$ 1,595,145.96	3.52	$5,620,472.61
50 Year Pavement B Section	$ 1,671,238.70	2.77	$4,635,693.31

117992 50 Year - Concrete
Implementation of Chemically Stabilized subbase on 2.77 lane miles of NB road section
Implementation of cement treated OGDC for both 50 year concrete pavements.
Durability based field testing to include Surface Resistivity and System Air Metrics
Did not allow the use of crushed concrete for the Open Graded Drainage Course (OGDC).
Ditch depth from sand subbase was kept at a minimum of 3 feet to bottom of subbase layer

119012 30 Year - HMA
Job specific ride quality requirements – Mean Roughness Index values reduced by 5 inches per mile
Use of material transfer device required for all mainline paving with echelon paving
Modified HMA Specification to increase mat density from 92.5% to 93% and reduced allowed fine aggregate to HMA binder ratio from 1.4 to 1.2
Modified Gap Graded HMA specification for surface course- modified crush content from 95 to 100% maximum
Ditch depth from sand subbase was kept at a minimum of 2 feet to bottom of subbase layer

Pavement Section

PAVEMENT DESIGN

Prepared By: J. Schenkel, P.E.
Date: 6/8/2017

CS 41132 (& 41133), JN 117992
CS MP: 8.904 - 13.095 (& 0.000 - 0.166)
US-131 from 10 Mile Rd to 14 Mile Rd in Kent County

Concrete Construction

20 Year Design

Mainline Lanes
10.5" JPCP (14' joint spacing, 1.5" Dowel Bars)
6.0" Open Graded Drainage Course
Geotextile Separator
10.0" Sand Subbase
6.0" Underdrains

Ramp Lanes & Shoulders
8.0" JPCP (12' joint spacing, 1.25" Dowel Bars)
6.0" Open Graded Drainage Course
Geotextile Separator
10.0" Sand Subbase
6.0" Underdrains

50 Year Design

Mainline Lanes
10.5" JPCP (14' joint spacing, 1.5" Dowel Bars)
6.0" Cement Stabilized Base
6.0" Open Graded Drainage Course
Nonwoven Geotextile Separator
20.0" Sand Subbase
6.0" Underdrains

Mainline Lanes – *where subgrade stabilization is needed*
10.5" JPCP (14' joint spacing, 1.5" Dowel Bars)
6.0" Cement Stabilized Base
Woven Geotextile Separator
6.0" Dense-Graded Aggregate Separator
8.0" Sand Subbase
6.0" Underdrains

Ramp Lanes & Shoulders
9.5" JPCP (14' joint spacing, 1.25" Dowel Bars)
6.0" Cement Stabilized Base
6.0" Open Graded Drainage Course
Nonwoven Geotextile Separator
20.0" Sand Subbase
6.0" Underdrains

Ramp Lanes & Shoulders – *where subgrade stabilization is needed*
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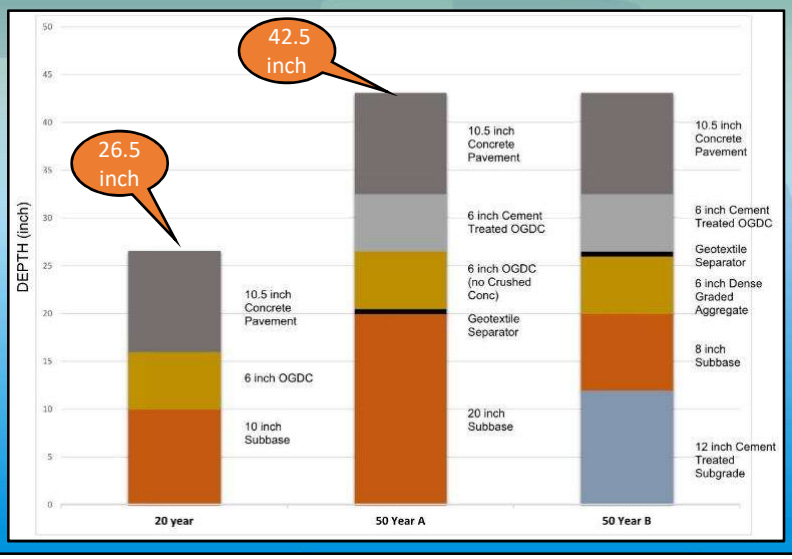
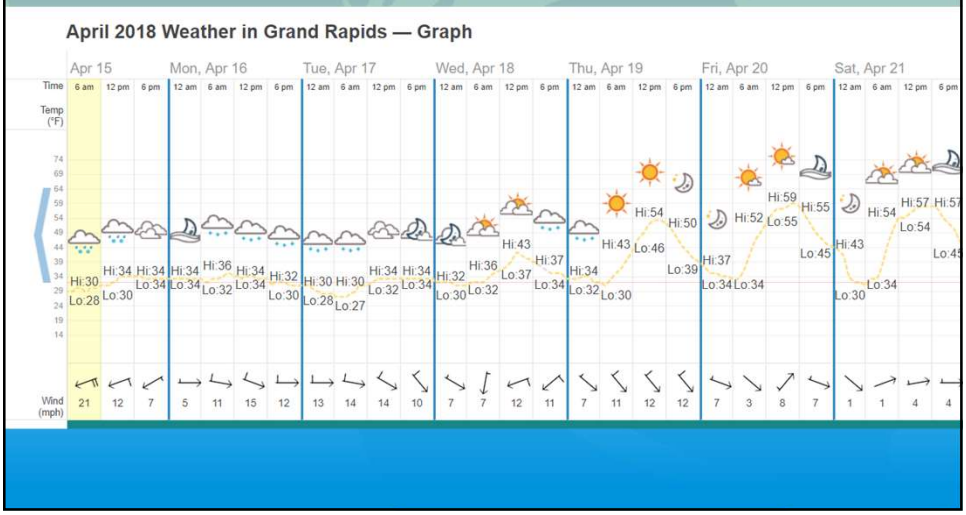
Pavement Sections



Weather



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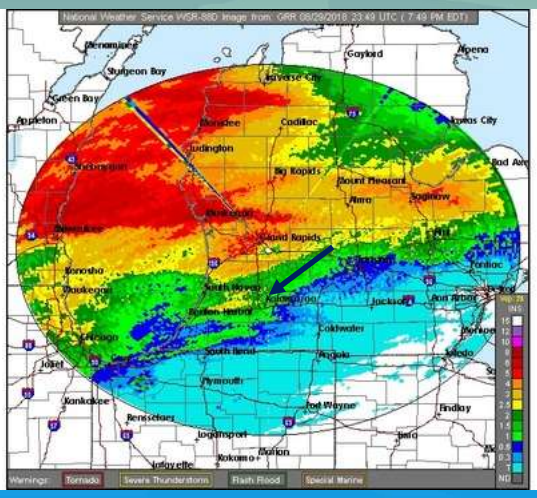
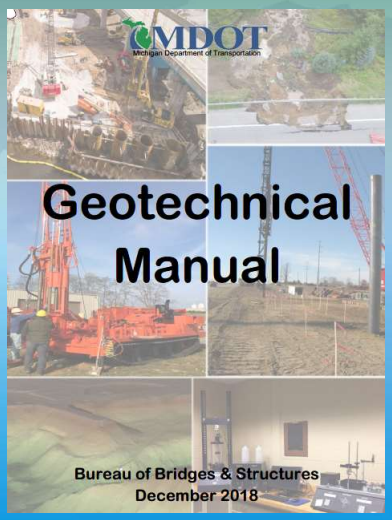


MDOT Geotechnical Manual



Soil Samples

Summary of Initial Laboratory Testing Results
US-131 Subgrade Stabilization
Algoma Twp, MI
SME #078481.00

Sample	Station	AASHTO Soil Type	AASHTO Description	ASTM Soil Type	As received moisture content (%)	Sulfate Concentration (ppm)	Liquid Limit	Plasticity Index	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Passing #200 Sieve
C1	NB 830+00	A-3	SAND	Brown Poorly Graded SAND (SP-SM)	--	0	NP	NP	0	95	1	4	5
C2	NB 843+00	A-3	SAND	Brown Poorly Graded SAND (SP-SM)	--	0	NP	NP	1	91	3	5	8
C3	NB 855+00	A-3	SAND	Brown Poorly Graded SAND (SP-SM)	--	116	NP	NP	1	89	4	6	9
C4	NB 870+07	A-2-4	Brown Gravel and/or Stone Fragments with Sand and Silt	Brown Silty SAND (SM)	--	4	NP	NP	2	65	28	5	34
C5	NB 875+10	A-3	SAND	Brown Poorly Graded SAND (SP-SM)	--	67	NP	NP	2	89	3	6	9
C6	NB 883+00	A-2-4	Brown Gravel and/or Stone Fragments with Sand and Silt	Brown Silty SAND (SM)	--	0	NP	NP	5	74	13	8	21
C7	NB 895+00	A-2-4	Brown Gravel and/or Stone Fragments with Sand and Silt	Brown Silty SAND (SM)	--	64	NP	NP	15	74	5	6	11
BC 4/5	Material Composite from Embankment near NB 870+07 and 875+10	A-6	Brown SILTY CLAY SAND (SC)	Brown Clayey	14	51	29	15	3	51	19	27	46
HB	SB 869+80 (Median ROW)	A-6	Brown SILTY CLAY	Brown Clayey SAND (SC)	14	18	25	11	3	48	21	28	48

Mix Design

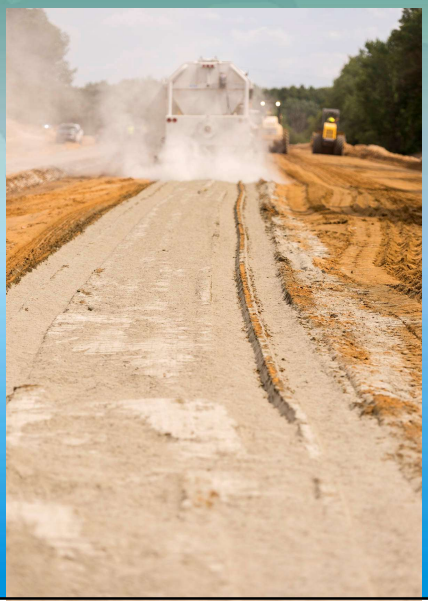
MIX DESIGN RECOMMENDATION

The project's Special Provision for Chemically Stabilized Subgrade indicates that cement, lime, or a lime-fly ash combination must be used to stabilize the subgrade. Our initial testing indicates that all of the seven soil samples obtained along the main roadway were non-plastic. The clay samples we were able to obtain had plasticity indices of 15 and 11; however, clay is not the main material on this site and (if present) will likely manifest itself as small seams or pockets. Based on this, we have concluded that Portland cement would be the most appropriate additive for this site.

We recommend completing a total of three (3) mix designs, one each for A-3, A-2-4, and A-6, for the proposed 12-inch stabilized subgrade section. We will design and test using Portland cement at application rates of 1, 5, 7, 9, and 11 percent. The high percentages are to ensure that we are able to meet the 300 psi compressive strength requirement due to the gap gradations we are seeing between the #40 and #100 sieves in the A-3 and A-2-4 materials.

Construction

Construction



Construction

Construction

Construction

Construction

Rain

Questions?