MnROAD / NCAT Pavement Preservation Report of Delta-S Experiment

by Eddie Johnson

For more information contact MnDOT:

Eddie Johnson, eddie.johnson@state.mn.us
Jerry Geib, jerry.geib@state.mn.us
Paul Nolan, paul. nolan@state.mn.us

MnROAD
Safer, Smarter, Sustainable Pavements Through Innovative Research

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

5/14/2018

MnROAD / NCAT Pavement Preservation
Summary of Delta-S Experiment

by Eddie Johnson

Date	5/14/2018
Observer (s)	MnDOT

Pavement Preservation Treatments: Background

In 2015 the Minnesota Department of Transportation's Road Research facility (MnROAD) partnered with the National Center for Asphalt Technologies (NCAT) to research two important national issues:

- Develop of a National Pavement Preservation research effort to determine the life extending benefit curves of a number of different pavement preservation techniques constructed in both Alabama and Minnesota.
- Develop and implement asphalt performance tests to predict cracking for common distress found in North America.

In 2015 and 2016 NCAT and MnROAD installed test sections to support this effort. Visit http://www.dot.state.mn.us/mnroad/ncatpartnership/pavementpreservation/Cell%20Map%20Pavement%20Preservation%20March%202018.pdf for a map of the Minnesota sections.
Alabama is the Lead State for the pooled fund that supports this effort. Currently a total of 17 states are sponsoring these projects. The Foundation for Pavement Preservation and the National Center for Pavement Preservation are also active members. More pooled fund details are available at http://www.pooledfund.org/Details/Study/496 and http://www.dot.state.mn.us/mnroad/ncatpartnership/pavementpreservation/index.html.

Pavement Preservation Treatments: Delta-S Modification

MnDOT installed a total of 60 pavement preservation test sections in 2016 (31 low traffic volume and 29 high volume) in Mille Lacs County, Minnesota as part of a MnDOT/NCAT research partnership. Thinlay sections were constructed August 2016. Section lengths were 0.1 mile and the depth of mill and overlay treatment was 0.75 in.

- Low Volume Location: CSAH 8 westbound – Traffic: 710 AADT (2014)
- High Volume Location: US 169 northbound – Traffic: 16,500 AADT (2016)

Each road received a thinlay treatment modified with Delta-S and a corresponding unmodified thinlay to be used as a control.

- Low Volume Location: cell 8029 (delta-s), cell 8024 (no delta-s)
- High Volume Location: cell 169022 (delta-s), cell 169026 (no delta-s)

Mixture Information

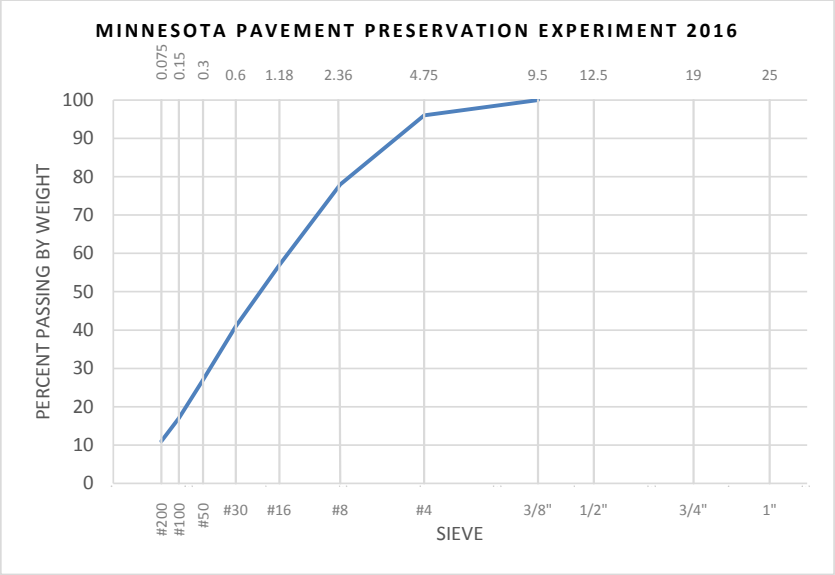
A PG 64-34 asphalt binder was used for all of the cells. Delta-S was added to the mixture along with the asphalt binder at a **rate of 28 ounces per ton of HMA.**

MnROAD / NCAT Pavement Preservation
Summary of Delta-S Experiment

Mixtures were designed at 75 gyrations to 4.0 percent air voids and a VMA of 14.0 percent. The design incorporated 5.0 percent new binder for a total binder content 6.4 percent. The asphalt film thickness of the design was calculated as 8.0 microns. Mixture unit weight at design conditions was 148.1 lb/cu ft.

The aggregate blend included Kingsway Screened Man Sand, Martin Marietta Washed Sand, Kingsway Pit Man Sand, Manufacture Waste Scrap Shingles, and Vonco Screened Fine RAP.

Sieve Size	Composite Formula
3/8" (9.5 mm)	100
#4 (4.75 mm)	96
#8 (2.36 mm)	78
#16 (1.18 mm)	57
#30 (0.6 mm)	41
#50 (0.3 mm)	27
#100 (0.15 mm)	17
#200 (0.075 mm)	11.0



4.75mm aggregate gradation used for Minnesota Thinlay mixtures with and without Delta-S.

General Notes: Construction used a tack distributor and mixture transfer equipment. The paving contractor was East Alabama Paving.

Performance Observations

MnROAD / NCAT Pavement Preservation
Summary of Delta-S Experiment

Sections with Delta-S

Mill and Delta-S Thinlay on County Road - Low Volume Cell 8029						
Date	**IRI in/mi**	**Locked Wheel Friction FN_{40}**	**Fatigue**	**Raveling**	**# Transverse Cracks**	**Reflected Cracks**
2016, Untreated	119.6	Not measured, Control Cell 8030 = 51.0 at time of 2016 treatments	Not Obs.	Not Obs.	Not Obs.	Not Obs.
2016, Treated	41.2	51.3	0	0	0	0%
April-May 2017, Treated	43.5	55.8	0	0	7	90%
September 2017, Treated	44.6	54.7	0	0	7	90%
May 2018, Treated	56.9	Scheduled	0	0	8	100%
Mill and Delta-S Thinlay on US Highway - High Volume Cell 169022						
Date	**IRI in/mi**	**Locked Wheel Friction FN_{40}**	**Fatigue**	**Raveling**	**# Transverse Cracks**	**Reflected Cracks**
2016, Untreated	81.1	46.7	Not Obs.	Not Obs.	Not Obs.	Not Obs.
2016, Treated	44.0	48.5	0	0	0	0%
July 2017, Treated	41.0	51.1	0	0	21	70%
May 2018, Treated	50.4	Scheduled	0	0	24	80%

Cell 8029: As constructed in 2016 (left) and on 4-20-18 (right).

Cell 169022: As constructed in 2016.

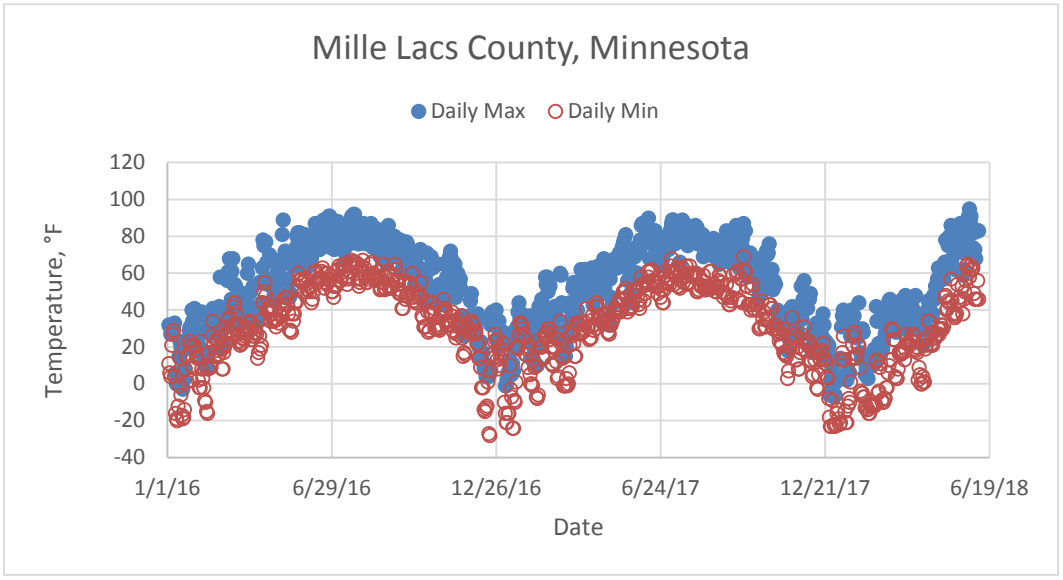
MnROAD / NCAT Pavement Preservation
Summary of Delta-S Experiment

Sections without Delta-S.

Mill and Thinlay on County Road - Low Volume Cell 8024						
Date	**IRI in/mi**	**Locked Wheel Friction FN_{40}**	**Fatigue**	**Raveling**	**# Transverse Cracks**	**Reflected Cracks**
2016, Untreated	88.0	47.8	Not Obs.	Not Obs.	Not Obs.	Not Obs.
2016, Treated	33.5	55.5	0	0	0	0%
April-May 2017, Treated	36.2	54.4	0	0	7	100%
September 2017, Treated	37.4	52.0	0	0	8	100%
May 2018, Treated	42.7	Scheduled	0	0	8	100%
Mill and Thinlay on US Highway - High Volume Cell 169026						
Date	**IRI in/mi**	**Locked Wheel Friction FN_{40}**	**Fatigue**	**Raveling**	**# Transverse Cracks**	**Reflected Cracks**
2016, Untreated	81.1	46.7	Not Obs.	Not Obs.	Not Obs.	Not Obs.
2016, Treated	44.0	48.5	0	0	0	0%
July 2017, Treated	41.0	51.1	0	0	14	83%
May 2018, Treated	75.2	Scheduled	0	0	14	90%

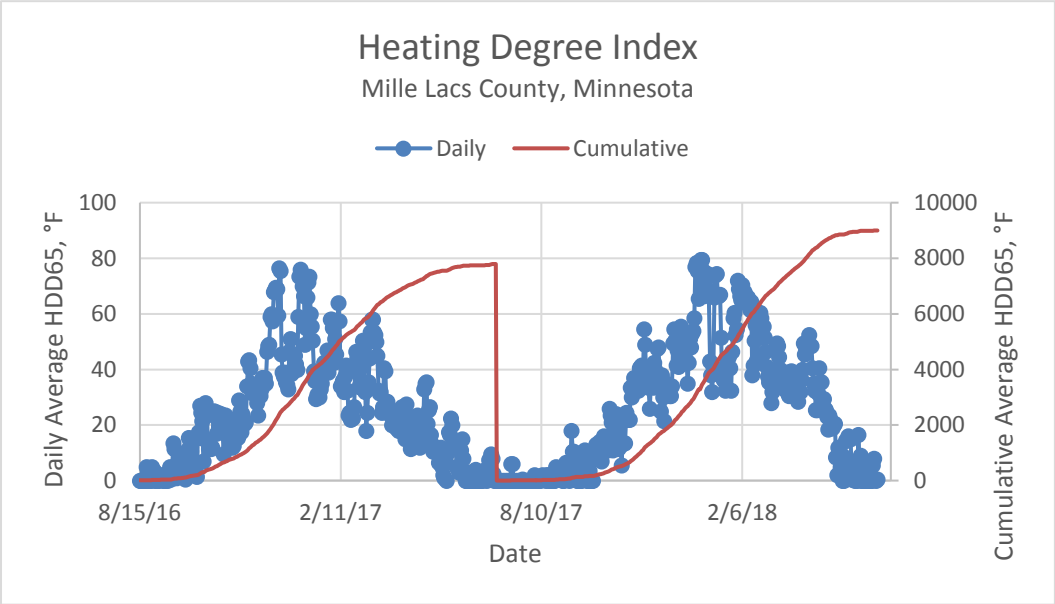
Cell 8024 as constructed in 2016 (left) and on 4-20-18 (right).

Cell 169026 as constructed in 2016.



Daily High and Low Temperatures from the first two years of the preservation study.

MnROAD / NCAT Pavement Preservation
Summary of Delta-S Experiment



Heating Degree Days from the first two winters of the preservation study.

For more information contact MnDOT.

Eddie Johnson, eddie.johnson@state.mn.us
Jerry Geib, jerry.geib@state.mn.us
Paul Nolan, paul. nolan@state.mn.us