Northern Climate Preservation Test Sections Placed in August

By Buzz Powell, P.E.

fter months of preparation, northern climate pavement preservation sections were placed on Minnesota highways in late summer 2016.

The northern sections were placed to complement southern climate sections in Alabama being quantified by the National Center for Asphalt Technology, as part of the *National Long-Term Pavement Preservation Benefit Experiment*, funded in part by FP² Inc. and its partners in the private sector, and state DOTs.

Full-scale accelerated pavement testing has been conducted at the NCAT Pavement Test Track since 2000. Practical research in surface mix performance, structural pavement design, and pavement preservation has been cooperatively funded in three-year research cycles by state DOTs located primarily in the southeastern United States.

In the meantime, the Minnesota DOT's Road Research Facility (MnROAD) has been conducting research in these same focus areas for northern states since 1994. Now, the sixth research cycle at the NCAT Pavement Test Track and the third phase of MnROAD research are for the first time officially engaged in a research partnership that is cooperatively funded by numerous state DOTs from all over the country for the purpose of executing a national long-term pavement preservation benefit experiment involving both northern and southern U.S. climates.

For the first time, performance of a comprehensive selection of treatments and combinations will be related to varying levels of pretreatment pavement condition in both hot and cold climates. This will equip agencies from all over the country with the quantitative data needed to select future treatments that will provide the best life cycle investment for each individual roadway.

Funding is provided through the national Transportation Pooled Fund that supports the NCAT Pavement Test Track (www.pooledfund.org/ Details/Study/496). The objective of the preservation group (PG15) experiment, in which FP² is an equal funding partner, is to quantify the benefits of pavement preservation on both low-volume and high-volume roadways with results that are implementable in both northern and southern U.S. climates.

In the southern sections of the experiment, low-traffic test sections were built on Lee County Road 159 (near the main NCAT location in Auburn, Ala.), and high-traffic sections were built on U.S. 280 (near the NCAT Pavement Test Track in Opelika, Ala.).



In the northern sections of the experiment, low-traffic sections were built on Mille Lacs County Road 8, and high-traffic sections were built on U.S. 169 (both about 45 minutes north of the main MnROAD facility in Pease, Minn.).

Field performance will be monitored with similar automated technologies at both locations, and data will be stored in a common database. It's expected that sections that do not fail before the end of the current (2015) research cycle at the NCAT track will be monitored well into the future, as long as it takes to satisfy the stated research objectives to fully quantify life extending and condition improving benefits.



Plant mix asphalt Thinlay placement on Mille Lacs Country Road 8

FP²



Overview: Northern high-traffic sections on U.S. 169 adjacent to low-traffic sections on Mille Lacs County Road 8

NORTHERN TEST PLACEMENTS

MnROAD worked with state DOTs with a northern research focus to develop a consensus to utilize 2.1 miles on which pavements to use. Martin Marietta Aggregate's Waite Park granite was the aggregate source, Flint Hills Resources provided the asphalt emulsions, and Hardrives provided the thin asphalt overlay (*Thinlay*) plant mix. Age and pretreatment condition of the existing pavement surfaces on County Road 8 and U.S. 169 were the primary factors in selecting both locations. Placement of the emulsion sections was completed the week of Aug. 1, 2016, and placement of the Thinlays was completed the week of Aug. 15 under traffic control provided by Astech. Weekly pavement condition data collection began after the completion of construction in a manner identical to the southern sections, with all performance data saved in a common format to facilitate the development of uniquely regional life extending and condition improving benefit curves.

The original treatments/ combinations from Lee Road 159 were placed in both locations to encompass the effects of thermal cracking and snowplow damage. Vance Brothers was the placement contractor for the northern emulsion-based treatments and East Alabama Paving was the placement contractor for the Thinlays, just as they were for the southern portion of the experiment, which eliminated the otherwise confounding effect of placement quality on performance.

The Fall 2016 sponsor meeting was held at MnROAD in October so funding partners could walk both the low- and high-volume road treatments/combinations, and assess post-treatment condition by visual inspection.

To facilitate placements, MnDOT's Milaca Maintenance Yard was used as a base of operations for aggregate stockpiling, equipment storage/ staging, rate calibrations, and verified trial treatment placements.

Routing and crack sealing were completed first on both roadways by Crafco. With crack sealing in place, Vance Brothers moved back and forth between County Road 8 and U.S. 169 to place the emulsion treatments using Martin Marietta granite aggregates and Flint Hills' asphalt emulsions. COLAS also mobilized the first week of August to place *FiberMat* chip seals.

Rates for emulsions and chips were measured at either the beginning or end of each test sections. Micro surface proportioning was verified by chute samples that were burned in an ignition furnace. Residual asphalt contents were calculated by correcting total mass loss using moisture contents measured on identical split samples. Testing for all treatments was run in the NCAT mobile laboratory, which was setup in MnDOT's yard.

Milling in early August for HMA cape seals was completed by Midwest Paving, while milling in mid-August for standalone Thinlay paving was donated by Roadtec. Hardrives-produced mixes were placed by East Alabama Paving the week of Aug. 15 using a bond coat distributor truck provided by Astech, a *Shuttle Buggy* and thin bonded overlay spray paver donated by Roadtec, and rollers donated by Sakai (steel wheeled) and Cat Paving Products (rubber-tired).

The Roadtec paver was operated with the integrated spray bar off for all the Thinlays, except for an ultra-thin bonded wearing surface. All quality measurements for the northern preservation sections (i.e., emulsion rates, chip rates, plant mix volumetrics, asphalt densities, etc.) met the same high quality standards that were previously achieved in the southern sections. Inspection and oversight was provided by MnDOT



Chip seal is placed on U.S. 169 as part of northern climate experiment



Crafco Mastic One seals longitudinal crack on U.S. 169 prior to preservation treatments

using test results generated by NCAT in the mobile laboratory.

THE NATIONAL EXPERIMENT

The partnership between NCAT and MnROAD to execute this national long-term pavement preservation benefit experiment will provide agencies with the tools they need to select pavement preservation treatments and combinations in a rational, proven manner based on the pretreatment condition data found within their existing pavement management systems.

Post-treatment feedback from pavement management systems will facilitate the calibration of these curves for local aggregates, contractors, practices, etc. Hot weather



Micro surface sampling, pre-break uniformity stirring, and quartering to facilitate laboratory testing



E.D. Etnyre & Co. distributor truck begins run placing CRS-2P asphalt emulsion on Mille Lacs County Road 8

performance, thermal cracking, susceptibility to snow plow damage, etc., will all be reflected in the shapes of curves that relate benefits to pretreatment condition. These data can be implemented with confidence because of the proven histories of construction quality and research outcomes at the partner facilities.

More information on the partnership and nationwide experiment it supports

at www.dot.state.mn.us/mnroad/ ncatpartnership/index.html.

SOUTHERN TREATMENTS AT NCAT

In retrospect, the first preservation treatments were placed in select (100 ft., single-lane) sections on the NCAT Pavement Test Track in the spring of 2014 after trigger levels of cracking (20 percent of the total lane area) were reached.

A limited number of treatments and combinations were carefully selected for accelerated traffic testing on the track to ideally complement a larger number of low-traffic treatments and combinations that were placed off the track in the summer of 2012 on Lee County Road 159 (a dead end access road to a quarry and asphalt plant). Treatments were placed in 100 ft. sections in both the inbound (lightly loaded) and outbound (heavily loaded) lanes. FP2's participation in the design and execution of the 2012 experiment was key to the success of the overall effort.

Some of the preservation treatments that were placed on the NCAT Pavement Test Track in the spring of 2014 had to be replaced in April 2016 after approximately 4.9 million equivalent single axle loadings (ESALs) had been applied in an accelerated manner.

Micro surface, Thinlay, and HMA cape seals remain in service at approximately eight million ESALs, and may survive until the end of the three-year 2015 research cycle. Over 600,000 ESALs had been applied in the more heavily loaded outbound lane of the comprehensive array of preservation treatments applied on Lee Road 159 in summer 2012. Over 700,000 ESALs had been applied to the high traffic treatments placed on U.S. 280 in summer 2015.

The performance (quantified with weekly performance measurements for roughness, rutting, macrotexture and cracking) of all treatments and combinations has generally been very good on all three southern locations (the track, Lee Road 159, and U.S. 280). Crack sealing, scrub sealing, micro surface, cape sealing, and thin overlays have continued to demonstrate short-term life extending and condition improving benefits. Long-term data collection will quantify the full benefit of pavement preservation in a southern climate.

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