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RESEARCH SERVICES & LIBRARY

TECHNICAL SUMMARY

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PROJECT COST:
$60,000

Done well, whitetopping of asphalt pavement extends pavement life for decades.

New Procedures Offer Guidance for Using Bonded Whitetopping on Asphalt Pavements

Researchers developed procedures for selecting distressed asphalt pavements for bonded whitetopping based on site examination and lab testing. While test results do not offer definitive indications of how overlaid asphalts will perform, procedures offer recommendations on pre-overlay pavement treatment, testing protocols and bonded whitetopping design considerations.

What Was the Need?

Many counties throughout Minnesota have used bonded concrete overlays to rehabilitate asphalt pavement. Though not widely used by MnDOT, a bonded concrete overlay, or whitetopping, normally involves milling a few inches of asphalt off the damaged surface and placing 4 to 6 inches of concrete over the asphalt pavement. A well-bonded overlay can add 20 years to a pavement's service life.

Bonded whitetopping performance has not been carefully tracked, and correlation of its performance with the underlying pavement condition is not well understood. Before MnDOT can expand its use of bonded whitetopping, materials engineers wanted to better understand what asphalt pavement conditions are best suited to this type of overlay, how asphalt behavior influences the concrete top layer and what underlying pavement characteristics affect the expected lifetime and performance of bonded whitetopping.

What Was Our Goal?

This project sought to develop an integrated selection procedure for analyzing existing, distressed asphalt pavement to identify good candidates for bonded whitetopping and establish design considerations for a site-specific, effective concrete overlay. By testing pavement core samples in the lab, investigators wanted to identify asphalt pavement properties that correlate with distresses in concrete overlays that are 6 inches or less. They also sought specific recommendations for managing transverse cracking in asphalt to avoid reflective cracking into concrete overlays.

What Did We Do?

Researchers began with a literature review of approaches to selecting pavements for bonded whitetopping. The results of this review were used to develop testing procedures to identify the volumetric properties of existing asphalt pavements. Researchers applied these procedures to 22 pavement cores from six concrete overlay sites in Iowa, Michigan, Minnesota and Missouri. Selected projects entailed 4-inch to 6-inch overlays in fair to good condition that were built from 1994 through 2009. Data about mix design, asphalt condition, pavement thickness, overlay thickness, site conditions and other details were available for each site.

The research team compared roadway data with falling weight deflectometer measurements from pavement cores to evaluate field performance and design recommendations suggested by the selection procedure. To refine the procedures, investigators evaluated volumetric asphalt characteristics for their potential influence on premature overlay cracking due to stripping, slab migration and reflective cracking. Finally, the team developed a detailed selection process that includes steps to identify and test asphalt pavements with potential for bonded whitetopping, repair asphalt before overlays and

continued

"This research established a procedure for testing pavement cores. However, more performance data on whitetopping is needed to correlate pavement performance and asphalt properties."

—Tim Andersen,
Pavement Design Engineer, MnDOT Office of Materials and Road Research

"These procedures address collecting field data and testing pavement core samples in the lab. They also provide useful guidance for pavement repair and design considerations for overlays."

—Dale Harrington,
Principal Engineer, Snyder and Associates, Inc.

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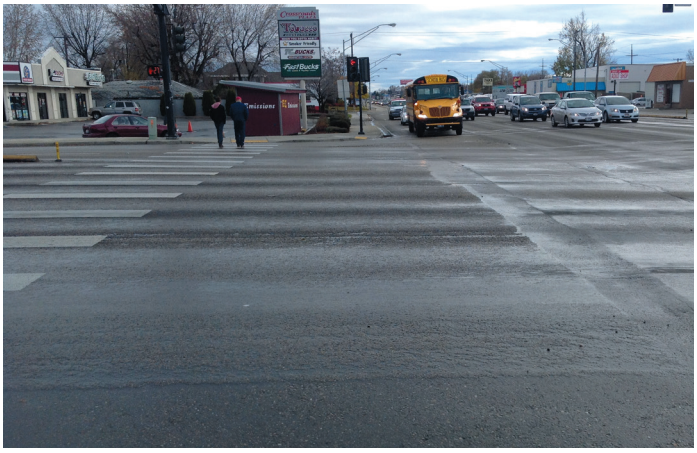

Rutted and otherwise damaged asphalt pavement is a candidate for a bonded concrete overlay that can mitigate damage under the right site conditions.

establish design considerations for overlays based on the test results from the selected asphalt pavement.

What Did We Learn?

The selection procedure, which is based on recommended practices from the National Concrete Pavement Technology Center, has six steps:

- Perform a desk review of available site data, including design, repair and environmental conditions.
- Obtain pavement core samples.
- Conduct site visits to examine existing conditions.
- Obtain additional core samples for testing, when necessary.
- Prepare preliminary cost and materials estimates, if practical.
- Provide design recommendations.

Investigators tested pavement cores for air voids, density, stiffness, fatigue, aging, stripping potential and other distress parameters. Results were inconclusive in terms of identifying asphalt properties that lead to specific bonded concrete overlay failures or to long-term performance of bonded whitetopping projects. The pavement cores showed wide variation in material properties, but few of these distresses. Researchers framed the recommendations for testing volumetric properties in the format of MnDOT's Pavement Design Manual, giving the agency an easily adoptable core testing protocol.

The selection procedures include information about the impact of transverse cracking, rutting, longitudinal cracking and other distresses on concrete overlays, and provide recommendations for treating various distresses before whitetopping. Design considerations for whitetopping are also provided based on site conditions and the results of core, ground penetrating radar and falling weight deflectometer testing.

What's Next?

Tested overlay sections should be evaluated over time to determine if life expectancy is met or if asphalt stripping, slab migration or reflective cracking has decreased overlay life. Because volumetric tests failed to provide conclusive relationships between asphalt properties and overlay distress, further research is needed to identify mechanistic or field tests that could correlate asphalt properties with concrete overlay performance. Once this additional research is completed, the selection procedures identified could be refined and placed in the design guide. A life-cycle cost analysis of overlays would also be useful for decision-makers considering bonded concrete overlays of asphalt.

This Technical Summary pertains to Report 2017-24, "MnDOT Thin Whitetopping Selection Procedures," published June 2017. The full report can be accessed at mndot.gov/research/reports/2017/201724.pdf.