



TECHNICAL SUMMARY

Technical Liaison:

Mark Maloney, City of Shoreview
mmaloney@ci.shoreview.mn.us

Administrative Liaison:

Sandy McCully, Mn/DOT
sandy.mccully@dot.state.mn.us

Principal Investigators:

Andrew Eller, Mn/DOT
Roger Olson, Mn/DOT

PROJECT COST:

\$20,000



Introducing moisture into a stream of hot asphalt creates a foam that mixes well with aggregates.



RESEARCH
SERVICES SECTION

Recycled Pavements Using Foamed Asphalt in Minnesota

What Was the Need?

Foamed asphalt is formed by injecting small quantities of cold, atomized water under pressure into hot asphalt binder. On contact with the binder, the water becomes steam, producing an asphalt foam that is mixed with pulverized asphalt pavement materials at the job site. As the mix cools, the steam evaporates, leaving the binder-coated aggregate in place as a stabilized base course. Because its surface area is greater than that of regular liquid asphalt, foamed asphalt mixes more easily with recycled pavement materials.

Consequently, foamed asphalt is commonly used with cold-in-place recycling and full depth reclamation of asphalt pavements. These processes involve pulverizing, reprocessing and recompacting existing pavements at the end of their service life to create a new base course rather than completely removing the material. The benefits of foamed asphalt include lower binder and transportation costs, increased efficiency and decreased environmental impact. Foamed asphalt also adds strength and moisture resistance to reclaimed pavement materials.

Despite these benefits and the advances in technology that have led to the wide use of foamed asphalt in Europe and other parts of the world, its use is still relatively new to the United States. In those states where foamed asphalt has been used successfully, little performance data has been generated to guide pavement engineers and designers. In Minnesota, only two counties have used foamed asphalt cold-in-place recycling with success. Minnesota does not have a foamed asphalt specification or design guide, and there was a need for data on best practices to guide its use in the state.

What Was Our Goal?

The objective of this project was to gather and record information regarding best practices, construction techniques, mix design, specifications and performance of foamed asphalt recycled pavement. This information could then be used to develop design guidelines and specifications for using foamed asphalt in Minnesota.

What Did We Do?

Investigators began by conducting a literature search to find information about topics identified as most critical to successful completion of foamed asphalt reclamation. These topics were determined by meeting with experts and reviewing reports from past construction projects using foamed asphalt, and included mix design, subgrade soils, material properties of foamed asphalt, early life-cycle performance, project selection and general site conditions, and existing pavement structure and conditions.

Investigators then surveyed city and county transportation officials to find Minnesota counties that had used foamed asphalt for road rehabilitation. Of these, Fillmore and Olmsted counties both had used foamed asphalt with cold-in-place recycling to rehabilitate roads from 2004 to 2008.

Finally, investigators visited project sites in these counties and took on-site falling weight deflectometer measurements, where the pavement's reaction to a falling weight is measured. They performed laboratory analyses on asphalt cores extracted at these sites to examine the properties of the stabilized pavement layer as well as the material properties of the foamed asphalt.

What Did We Learn?

Field observations and surveys of city and county officials indicated that Minnesota foamed asphalt projects have been successful, providing a smooth, durable platform for

continued

“Foamed asphalt technology shows a lot of promise for rejuvenating existing investments in roadways, producing a brand-new driving surface with less cost than the conventional tear-them-up, throw-away, start-all-over approach.”

–Mark Maloney,
Public Works Director,
City of Shoreview

“This project is helping to generate the awareness in Minnesota that foamed asphalt is a safe and proven technology, and it gives engineers the information they need to begin using this technology.”

–Roger Olson,
Mn/DOT Research
Operations Engineer

Produced by CTC & Associates for:

Minnesota Department
of Transportation
Research Services Section
MS 330, First Floor
395 John Ireland Blvd.
St. Paul, MN 55155-1899
(651) 366-3780

www.research.dot.state.mn.us



Foamed asphalt machines such as this one are used to pulverize the road surface and inject it with a foamed asphalt mixture that can be compacted on the roadway to form a new surface.

placing a surface treatment and apparently delaying the appearance of reflective cracking.

The falling weight deflectometer data analysis revealed that the recycled pavement layer developed a relatively uniform strength, despite the high variability inherent in most low-volume roads of the kind rehabilitated in these projects. Core data indicated that the foamed asphalt formed a cohesive matrix when mixed with the fines from the reclaimed material, which remained intact after coring.

Finally, by examining cold-in-place recycling and full depth reclamation specifications from the Iowa Department of Transportation, Nevada DOT and the Ontario Ministry of Transportation, investigators developed a preliminary specification for foamed asphalt applications in Minnesota. Special attention was paid to differences in gradation, binder grade, mix design and use of mineral stabilizing agents specified for cold-in-place recycling compared with full depth reclamation.

What's Next?

While this project developed a general preliminary specification for foamed asphalt applications in Minnesota, developing a complete specification will require more research and observation of actual construction to identify other factors and address potential issues or difficulties. Investigators recommend monitoring actual construction and performing falling weight deflectometer and ground-penetrating radar measurements along with core analysis before and after foamed asphalt projects. They also recommend continuing to monitor existing sites and collecting data throughout the lives of these pavements to properly examine their long-term performance.

One of the biggest obstacles to foamed asphalt use in Minnesota is lack of knowledge among engineers about its effectiveness and safety. Consequently, investigators will also be developing brochures about foamed asphalt and presenting the results of this study at upcoming conferences.

This Technical Summary pertains to the LRRB-produced Report 2009-09, “Recycled Pavements Using Foamed Asphalt in Minnesota,” published February 2009. The full report can be accessed at <http://www.lrrb.org/PDF/200909.pdf>.