



TECHNICAL SUMMARY

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LRRB PROJECT COST:

\$40,000



One common LST method is applying an Otta seal, in which a relatively soft asphalt emulsion is covered by an aggregate graded with different size particles.



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Light Surface Treatments: A Cost-Effective Middle Ground for Maintaining Low-Volume Roads

What Was the Need?

As paved roads reach the end of their service lives, transportation agencies are faced with rehabilitating them, an expensive task that can cost as much as \$400,000 per mile. Because of limited funding, some agencies are considering reverting some rural roads with lower volumes of traffic to gravel. But doing so creates a surface with a much lower ride quality, and vehicles driving over gravel roads stir up substantial amounts of dust.

Fortunately, a method is available that serves as a middle ground between the costs of repaving and the drawbacks of reverting to gravel. Called a light surface treatment, this method applies a light asphalt emulsion to a thicker than usual base. LSTs can be used both to rehabilitate aged pavements and to upgrade gravel roads, producing surfaces with higher skid resistance, lower dust and less gravel loss than the typical unpaved road. LSTs also help preserve the strength of base layers by preventing water penetration.

Currently there is no design procedure specific to LSTs, and most engineers in the United States design LST roads using AASHTO procedures meant for roads with the hot-mix asphalt pavement layer that LSTs lack. Research was needed to determine the state of the practice for LSTs, and to evaluate the applicability of various pavement design methods to LSTs in particular.

What Was Our Goal?

The goal of this project was to synthesize the state of the practice for using LSTs for low-volume roads in Minnesota, the United States and internationally, and to evaluate the suitability of various existing pavement design methods for use with LSTs.

What Did We Do?

Researchers began by surveying local transportation officials in Minnesota to determine which types of light surfacing solutions have been used within the state and the extent to which these solutions have been successful. Then they conducted follow-up interviews with county officials with experience building LSTs on gravel roads. Phone interviews included 14 questions, followed by open-ended questions, concerning the location of LST projects that the county had constructed and how successful they had been.

Based on survey and interview results, researchers selected three case study sites where transportation agencies planned to use or had already successfully used LSTs. They conducted field trips to these sites to collect information about road user needs, traffic and structural support.

Researchers then reviewed the applicability of various pavement design methods to LSTs. These methods involve equations or computer models that help engineers to

Light surface treatments could help Minnesota transportation agencies save significantly on road maintenance costs for rural low-volume roads by providing an affordable way to maintain their integrity without the expense of paving.

“Light surface treatments could be a cost-effective approach to roads that have too little traffic to warrant a full pavement, but too much to be left entirely unpaved.”

—Bruce Hasbargen,
Chair, Minnesota Local
Road Research Board

“A 3.5-inch HMA pavement is unnecessary for the 69 percent of Minnesota’s 60,000 miles of state-aid highway roads bearing less than 1,000 vehicles of average daily traffic. Using LSTs in such cases could lead to significant cost savings.”

—Charles Jahren,
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Fifty percent of rural trunk highways and 90 percent of rural county state-aid highways in Minnesota have traffic levels below 2,000 cars per day, making them potential candidates for LSTs.

determine the needed thickness of a subgrade from a variety of inputs, such as soil stiffness and strength, expected climate conditions, and expected traffic volume and weight. For each case study location, researchers created sample designs using several design methods.

What Did We Learn?

Survey results showed that about 28 percent of responding Minnesota counties have experience constructing LSTs. While most counties use LSTs to upgrade their gravel roads, some use them on flexible pavements that have undergone full depth reclamation.

Most of the surveyed counties that used LSTs for aggregate-road upgrades achieved their goals of reducing construction and maintenance costs without compromising performance. The exceptions were counties with clay subgrades, which do not have enough strength for LSTs, leading to rapid deterioration. Survey results also suggested that traffic volume significantly affects the performance of LSTs, and aggregate road candidates for LSTs should not carry heavy traffic. In general, LSTs are most successful in areas with strong supporting soils and light traffic.

The case study designs indicated that in many cases it was possible to design light surface pavement sections with a reasonable layer thickness. However, in some cases where supporting soils are weak, the thickness of full-depth reclamation required for a 20-year service life would exceed the capability of typical construction equipment to pulverize and compact the material. It may be possible to design thinner layers in such cases, if the required service life could be reduced and additional maintenance or strengthening was planned near the end of the service life.

What’s Next?

The results of this project indicate that LSTs are a good compromise between current MnDOT design requirements, which call for a minimum of 3.5 inches of HMA on paved roads, and reverting to gravel. Because traffic volume significantly affects LST performance, researchers recommend further investigation to establish traffic criteria for aggregate roads with LSTs.

This Technical Summary pertains to the LRRB-produced Report 2015-06, “Lightly Surfaced Roads: Stabilized Aggregate Applications,” published February 2015. The full report can be accessed at <http://www.lrrb.org/PDF/201506.pdf>.