Taconite-Based Pavement Patches Show Promise for Pothole Repair

What Was the Need?
The Minnesota pothole season hits hard in late winter and early spring as freeze-thaw cycles and traffic together turn small pavement problems into fissures and potholes. Full-depth replacement is expensive and time-consuming. Careful cleaning and filling with hot-mix asphalt can work, but in winter is impractical or even impossible.

The typical response is throw-and-go: Drive a truck with a mound of cold-mix asphalt in back, fill the hole with a shovel, pat the asphalt down, then move on to the next pothole five minutes later. A maintenance crew can do scores of these repairs in one shift, but they may not last. Patches bond poorly to asphalt, are vulnerable to freeze-thaw, and can be damaged and loosened by snowplows. Many patched potholes have to be refilled within a week.

A durable patch—something that lasts six months or more and can be done quickly—would optimize patching crew time and reduce inconvenience to the driving public.

What Was Our Goal?
This study evaluated two potentially durable patching technologies that employ taconite tailings—magnetite containing aggregate left over from the mining and processing of taconite for steel manufacturing. Taconite industry byproducts are plentiful in Minnesota. Rapid Patch, a water-activated taconite mix, was studied for rigid and flexible pavement repair. The microwave method, employing a magnetite-enhanced mix and a 50,000-watt truck-mounted microwave unit that heats both the pavement and the patching material, was evaluated for flexible pavement repair only.

What Did We Do?
Investigators began by conducting a literature search on various pothole patching technologies and their performance and durability. They reviewed lab testing from their own previous research on the two candidate methods and selected sites for field evaluation.

In October 2012 they performed five microwave repairs and three Rapid Patch repairs on U.S. Highway 53 in Minnesota. At the same area they also evaluated patching performed with an infrared heater method and an on-site recycler that uses recycled asphalt pavement (RAP) and recycled asphalt shingles (RAS) in its hot mix. Investigators also patched three potholes with Rapid Patch and three with the microwave method on Grand Avenue in Duluth, Minnesota, where infrared patching had been conducted with little success. The research team documented performance of all patches for more than two years and some until August 2015.

What Did We Learn?
Taconite-based repairs appear durable. Many lasted three years, and though some cracked, the repairs remained in place.

Rapid Patch can perform well for years and best suits deep holes and concrete pavements in cool to moderate ambient temperatures. Challenges include clumping and inadequate blending of dry and liquid constituents, which are mixed on-site with a small
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—Lawrence Zanko, Senior Research Fellow, University of Minnesota Natural Resources Research Institute

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—Sue Lodahl, MnDOT Assistant State Maintenance Engineer

The truck-mounted microwave unit (top left) heated both the pavement and the new patching material made from Minnesota taconite mining byproducts, creating a durable bond between pavement and fill. The repair was then monitored over several months.

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Research Services & Library
M5 330, First Floor
395 John Ireland Blvd.
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