



Local Operational Research Assistance (OPERA) Program

Sand-Stabilized Dirt Roads

Kittson County has many miles of dirt roads serving its extensive cropland. But high levels of soil salinity create a naturally weak subgrade, so these roads tend to become impassible with severe rutting after a summer rain or when exposed to heavy loads from trucks hauling crops and supplies.

Kittson County Highway Department received a \$15,000 grant through the Local OPERA Program to develop a low-cost way to strengthen these dirt roads or at least make them more accessible by adding sandy aggregate (Class 3) with the dirt. An area railroad provided excess piles of this sandy aggregate for the project.

Excess sandy aggregate provides basis for comparison

The Kittson County project began in mid-June and ran through mid-August 2019. First, highway department staff selected two miles of township dirt road, which had been bladed and packed with a pneumatic roller, then test-rolled with a loaded truck before adding material to measure the deflection for a subsequent comparison.

When mixing aggregate with the top inch of the dirt road didn't work, staff adjusted by placing the aggregate material on top of the road. They created an evenly distributed 1.5-inch layer over the first mile and a 2.0-inch layer over the second mile. Still, after a few weeks and some heavy agricultural loads, the surface became rutted.

Roads with added sand hold up better to heavy loads over time

To keep costs to a minimum, Kittson County staff did not apply water — usually used to consolidate the mixture — but staff continued to monitor the road segment after rainfall events and used a motor grader to maintain the road throughout the summer. With more traffic and rainfall events, the materials became more consolidated and held up better to heavy loads as time went on.

A test-rolling in July showed an improvement of 1 inch less rutting (a 38% decrease) over the first mile and an improvement of nearly an inch less rutting (a 30% decrease) for the second mile. A second test-rolling in August showed a 42% decrease in rutting along the first mile and a 41% decrease for the second mile.

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OPERA Funding

\$15,000



After the sand consolidated with the dirt over time, the farmers felt that the road did perform better for the heavy wheat harvest loads in August.

Local farmers in the research project area had expressed skepticism about the project. But, after the sandy aggregate consolidated with the dirt over time, the farmers felt that the road did perform better for the heavy wheat harvest loads in August.

Plans fell through for a final test-rolling on the road after harvest season due to record rainfall in September and October. In fact, the extremely wet conditions did not allow travel on dirt roads and made the 2019 harvest season very difficult to complete.

Nonetheless, the team concluded that the project produced a significant reduction in rutting by applying

sand (Class 3) to the dirt road. In addition, the segment with less added aggregate showed a greater reduction in rutting than the other segment. The team theorized that the subgrade of the first segment could have been stronger and more stable or that the sand may have consolidated better with the dirt.

The Kittson County Highway Department project team feels that their findings will benefit other local agencies, townships, and even private landowners with access to low-cost material and a goal to improve local dirt roads.

About OPERA

The Local OPERA Program encourages maintenance employees from all cities and counties to get involved in operational, “hands-on” research. OPERA helps to develop innovations in the construction and maintenance operations of local government transportation organizations and share those ideas statewide.

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