Keeping aggregates in place is key to longer-lasting unpaved roads and helping counties save on maintenance and repair.

RESEARCH SOLUTIONS

Stabilization strategies for Iowa's unpaved roads may save money and increase durability

Iowa's rural communities and agricultural industry are dependent on the state's network of unpaved roads to move goods and maintain connectivity. But routine cycles of freezing and thawing temperatures, as well as the stresses inflicted by heavy equipment, can damage the roads and cause potholes, ruts, and other pavement distresses. To find effective and economical ways to help the roads last longer, researchers built 31 test sections in different regions of the state to evaluate a variety of construction and chemical stabilization strategies under real-world conditions. The results provide county engineers with increased flexibility in road construction.

THE NEED

The majority of roads in Iowa are unpaved. Built with varying foundation materials and topped with loose aggregates, these roads are cheaper to construct than those paved with concrete or asphalt, and are designed to support lower traffic volumes while still providing critical access for rural areas and farming communities. While fewer in number, the vehicles that do travel on these roads often consist of heavy equipment and agricultural machinery that degrade the surface aggregates and cause potholes and other structural damage to the exposed base layers, particularly during spring freeze-thaw cycles.

Iowa's 99 counties, which are responsible for keeping these roads in good working order, each spends upwards of $1 million or more every year to replace the surface aggregates that have been crushed and washed or blown away. Previous phases of this research project identified and investigated a number of promising stabilization methods to

(continued)

"Iowa's county engineers must consider a variety of factors when building and maintaining unpaved roads. Thanks to this research, they now have more information and tools at their disposal."

— **BRIAN MOORE,**
Secondary Roads Research Engineer,
Iowa County Engineers Association Service Bureau (ICEASB)

improve performance and reduce the amount of maintenance these roads require. This phase continued earlier efforts, evaluating additional strategies at test sections across the state.

RESEARCH APPROACH

In the seven years since the second phase of this project was completed, 13 additional construction methods and chemical stabilization strategies were identified as potentially viable solutions to improve road performance and reduce costs. To evaluate the effectiveness of these options in actual conditions, researchers built 31 test sections in four Iowa counties, each with different aggregate sources, subgrade soil types, and weather conditions.

Eight strategies affecting construction were evaluated, including alternative compaction techniques, different types and proportions of materials used, and the placement of these materials within the road's layers. The remaining five strategies involved chemical treatments that were applied either during or after construction to lock the materials in place. A control section in each of the four counties, built using standard materials and practices, provided a basis for comparing the different strategies.

The sections were monitored over two years through a variety of field and laboratory tests, digital imaging, and surface condition reports. Samples collected before and after each winter season measured changes in compaction and durability. Stress tests performed on-site evaluated the roads' strength and performance over time. To quantify any long-term economic benefits of implementing the strategies, researchers tracked the costs of construction and maintenance, and compared these to standard practices.

WHAT IOWA LEARNED

Most of the strategies evaluated in this phase of the research project were found to be relatively economical alternatives since they could be obtained or achieved using a county's existing resources. Only one strategy cost significantly more due to the specialized equipment required during construction.

The strength and durability tests conducted on-site and in the lab throughout the course of the project revealed that many of the test sections remained stable long after construction. However, performance varied greatly from section to section. Twelve of the 13 strategies were found to offer stabilization improvements over conventional methods; the section that was constructed with a rubber tire and aggregate mix in the base layer was the only one determined to have failed.

PUTTING IT TO WORK

A range of variables affect whether a stabilization strategy will ultimately reduce costs in the long run. The costs and availability of materials, the moisture content of a region's soils, weather, traffic, and the diminishing effectiveness of the different methods over time must all be considered when making construction and maintenance decisions for a particular road. But with greater knowledge of the benefits and drawbacks of each option, county engineers will have more flexibility as they build and maintain these important roads.

ABOUT THIS PROJECT

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