



A smooth drum roller equipped with modulus mapping technology can detect less compacted areas of a road's foundation during construction. An in-cab touch screen (inset) displays results in near real time.

# INNOVATION SOLUTIONS

## Advanced technologies ensure Iowa's pavement foundations are built as designed

Beneath every pavement are foundational layers of aggregate, soil, and other materials designed to suit the road's location, traffic demands, and other factors. When roadway foundations are properly constructed, the finished pavement should perform well for decades. Until recently, however, inspection methods and tools have not been able to detect certain problems within the foundation until after the road is complete, making cracks and other premature distresses difficult to prevent. Through a demonstration project, Iowa DOT piloted innovative new technologies at several project sites that make it possible to assess and remediate issues during construction, leading to stronger foundations and better-performing pavements.

### THE NEED

Road maintenance and repair activities are not just a financial expense for transportation agencies; they can also be hazardous for crews working near traffic and frustrating for travelers who experience road closures and delays. To help pavements last longer and require less maintenance,

Iowa DOT—like other transportation agencies across the United States—has reevaluated nearly every aspect of road building, implementing a variety of innovations related to design, construction, and materials. Despite real progress in this area, some pavements continue to deteriorate faster than they should.

In 2017 Iowa DOT initiated a **research project** evaluating the foundational layers of 10 highways in the state and found that most were not constructed exactly as designed. While studies have consistently shown a direct correlation between the compaction uniformity of a road's foundation and its long-term perfor-



**“We’re constantly looking for ways to make pavements perform better and last longer. We’ve already improved the materials, specifications, and construction practices we use, and evaluating foundations is another way we can extend the life of the state’s pavements.”**

**— CHRIS BRAKKE,**  
Iowa DOT Pavement Design & Pavement Management Engineer

mance, traditional testing equipment and inspection methods have not been capable of detecting under-compacted areas during the construction process.

Now, recent strides in technology are making it possible for inspectors and construction teams to assess the quality and uniformity of pavement foundations on-site and in real time, allowing contractors to fix any problems before the road is complete and assuring transportation agencies that foundations are being built as intended. With a grant from the federal Accelerated Innovation Deployment (AID) Demonstration program, which aims to help states put innovations into practice, Iowa DOT and a team of engineers piloted two new state-of-the-art technologies at five road construction projects across the state to gain hands-on experience and to develop specifications for using these tools in the future.

## PROJECT APPROACH

The project team tested two new commercially available technologies: roller mapping, which measures a foundation’s uniformity, and Automated Plate Load Testing, a proprietary innovation used to gauge the foundation’s ability to support heavy traffic loads. Project participants learned how to use and calibrate the equipment, as well as how data should be interpreted and applied.

In addition, a customized reporting tool was developed for Iowa DOT that analyzes the collected data and gener-

ates digital compaction reports within minutes to help contractors, engineers, and inspectors make informed decisions in real time.

## WHAT IOWA LEARNED

The new mapping and data analysis technologies successfully measured and reported foundation compaction values in real time as expected, revealing areas of nonuniformity at the five test sites that otherwise might have gone undetected. The reporting tool, which continues to evolve to meet Iowa DOT’s needs, helped participants share compaction results effectively.

The demonstration project also served to provide the project team with a better understanding of the interrelationships between specific procedures and measurement outcomes. This will help in the development of specifications that guide the various processes involved for maximum effectiveness.

## PUTTING IT TO WORK

Iowa DOT has developed a detailed implementation plan with a target to incorporate the new technologies into standard practice statewide by 2025. Steps include bringing key stakeholders together for process review and oversight, training agency staff and contractors, and selecting additional pilot projects to help regional engineers gain hands-on experience.

As these and other new technologies help build roads that last longer and require less maintenance and repair, Iowa DOT—and agencies across the country—stand to realize significant financial, safety, and mobility benefits.

## ABOUT THIS PROJECT

**PROJECT NAME:** Accelerated Innovation Deployment (AID) Demonstration Project: Increasing Pavement Performance Through Pavement Foundation Design Modulus Verification and Construction Quality Monitoring Final Report | Technical Brief

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**PROJECT CHAMPION:**  
**Chris Brakke, P.E.**  
Pavement Design & Pavement Management Engineer  
Iowa DOT  
[chris.brakke@iowadot.us](mailto:chris.brakke@iowadot.us)  
515-239-1882

**TECHNICAL ADVISORY COMMITTEE:**  
Ben Behnami, Bora Cetin, Brendan Fitzpatrick, Micah Loesch, Lisa McDaniel, Steve Megivern, Kevin Merryman, Brian Moore, Wes Musgrove, and Melissa Serio.

**PROJECT MANAGER:**  
**Vanessa Goetz, P.E.**  
State Research Program Manager  
Iowa Highway Research Board  
Iowa DOT  
[vanessa.goetz@iowadot.us](mailto:vanessa.goetz@iowadot.us)  
515-239-1382

**PRINCIPAL INVESTIGATOR:**  
**David White, Ph.D., P.E.**  
Ingios Geotechnics, Inc.  
[david.white@ingios.com](mailto:david.white@ingios.com)  
515-509-7587

**IOWA DOT RESEARCH:**  
[iowadot.gov/research](http://iowadot.gov/research)  
[ideas.iowadot.gov](http://ideas.iowadot.gov)

