U.S. DEPARTMENT OF TRANSPORTATION
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State Transportation Innovation Council

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Iowa – Project Summary

Secondary Road Implementation of Stiffness Modulus for Unpaved Roads

Applicant	Iowa County Engineers Association Service Bureau (ICEASB)
State Partner	Iowa Department of Transportation
Federal Funding	$125,000 (80% Federal Share)
State Funding	$31,250 (20% State Match)
Total Budget	$156,250
Allocation Date	August 5, 2025
Project Lead	Brian Moore, Executive Director, ICEASB
Iowa DOT Contact	Lee Bjerke, Secondary Road Research Engineer

Technical Report Documentation Page

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9. **Performing Organization Name and Address** Iowa County Engineers Association Service Bureau (ICEASB) 5500 Westown Parkway, Suite 190 West Des Moines, Iowa 50266		10. **Work Unit No. (TRAIS)** 11. **Contract or Grant No.** S024000
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16. **Abstract**

The objective of this to create a new application, similar to those already in use at the Service Bureau (SB) that the county engineers are accustomed to using. That application would be developed by the current SB programmers. Once completed all data collected across the State of Iowa by the mapping process including modulus values would be processed, manipulated, and be accessible to the county engineers in their desired format (modulus, ESALS, rutting, etc.). The developed OMS application, already in use, will be the umbrella tool which will feed all this data back to County Engineers. Iowa county engineers will be able to see their collected data and modulus values on a series of map layers at a project or network level. This is already available for three counties.

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Project Overview & Background

Purpose & Need

Iowa maintains one of the largest unpaved road networks in the United States — more than 66,000 miles of county-owned granular roads representing nearly 57% of the state's total roadway mileage. These roads are the backbone of Iowa's agricultural, manufacturing, and freight-based economy, providing critical access to farms, industrial facilities, residences, and emergency services.

Despite their importance, county engineers have historically lacked objective, spatially continuous data on roadway structural capacity. Traditional assessment methods rely on limited point-based testing and visual surveys — costly, time-intensive approaches that provide weak correlation to real-world performance and are impractical at network scale. The result: maintenance decisions guided by experience rather than data, leading to over-maintenance in some areas and under-investment in others.

Technology & Innovation

This project deployed COMP-Score® RT (Real-Time) instrumented rollers integrated into routine maintenance operations to continuously map roadway stiffness (resilient modulus) across Iowa's unpaved network. Mapping generates a geo-referenced record at approximately one data point per square foot, capturing:

- Resilient modulus values, roadway geometry (x, y, z), and elevation
- Surface material type, aggregate gradation, and moisture content
- Permanent deformation indicators and digital imagery
- Performance metrics including rutting potential and estimated remaining service life

To validate measurements and develop performance-based models, Automated Plate Load Testing (APLT) and Dynamic Cone Penetrometer (DCP) testing were conducted across a wide range of materials, traffic levels, and seasonal conditions — including critical spring thaw periods. Testing extended to 10,000 load cycles at selected locations to validate rutting prediction models for high-traffic segments.

Project Scale & Data Collection

Over three field seasons (late spring through fall, 2022–2024), the project team mapped approximately 12,000 miles of unpaved roadway across 24 Iowa counties using three RT-equipped rollers. The resulting dataset encompasses:

~12,000	24	400M+	3
Miles Mapped	Iowa Counties	Data Records	Field Seasons

Each one-square-foot record contains modulus values, geometry coordinates, material classification, timestamp, county identifier, and a geolocated bounding box. Data segments were automatically captured at 15-minute intervals, transmitted to cloud storage, processed into standardized datasets, and ingested by ICEASB via secure API into the Operations Management System (OMS).

Operations Management System (OMS) Integration

All collected data were integrated into the ICEASB OMS — a web-based, map-driven platform used by county engineers statewide. OMS enhancements enabled county engineers to:

- Visualize modulus and performance data at segment, project, and network scales via interactive geospatial interface
- Query structural conditions, compare performance across counties, and identify weak segments proactively
- Access AASHTO modulus road classifications and average resilient modulus values on map layers
- Integrate modulus data with existing granular road management tools (GRAMS, Granular Road Structural Design Tool)

Key Project Outcomes

Safety & Resilience

Early identification of structurally weak locations reduces road failures during spring thaw — improving safety for emergency vehicles, school buses, grain haulers, and rural residents who depend on these roads year-round.

Cost Efficiency

Continuous geo-referenced stiffness data enables targeted preventive maintenance, reducing unnecessary re-graveling, over-design, and reactive repairs. Counties report lower lifecycle costs and more efficient use of limited maintenance budgets.

Data-Driven Management

County engineers shifted from reactive, experience-based decisions to proactive, performance-driven asset management. Linking measured modulus to rutting and remaining service life gave engineers defensible, quantitative metrics for prioritization and design.

Scalability

The OMS platform is architected for statewide expansion to all 99 Iowa counties and serves as a transferable model for other states managing extensive unpaved road networks. Counties not in the original 24 have expressed strong interest in joining.

Implementation Roadmap

NEAR TERM	Finalize SOPs for data collection, validation, and QC. Complete hardware upgrades and begin vector tile mapping application development. Provide initial training for county engineers and equipment operators. Obligate funds by Iowa DOT within 6 months of allocation.
MID TERM	Complete mapping application and integrate data across ICEASB platforms. Incorporate individual county data. Expand OMS access to additional counties and continue APLT seasonal validation testing.
LONG TERM	Achieve statewide mapping of all 66,000+ miles of Iowa's unpaved road network. Integrate modulus data into standard procedures for maintenance prioritization, design support, budgeting, and emergency resilience planning across all 99 counties.

Key Lessons Learned

- Continuous mapping delivers the most value when paired with targeted APLT/DCP field validation for calibration and seasonal performance modeling.
- Early coordination on data formats, API structure, and quality-control workflows between the mapping team and ICEASB was critical to seamless OMS integration.
- Seasonal variability — especially spring thaw — significantly affects modulus and rutting behavior; multi-season data collection is essential for accurate performance assessment.
- Operator consistency and dedicated training maintained data integrity across 24 counties and three field seasons.
- Framing modulus mapping as a practical decision-support tool — not a research exercise — was key to county engineer acceptance and sustained adoption.

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