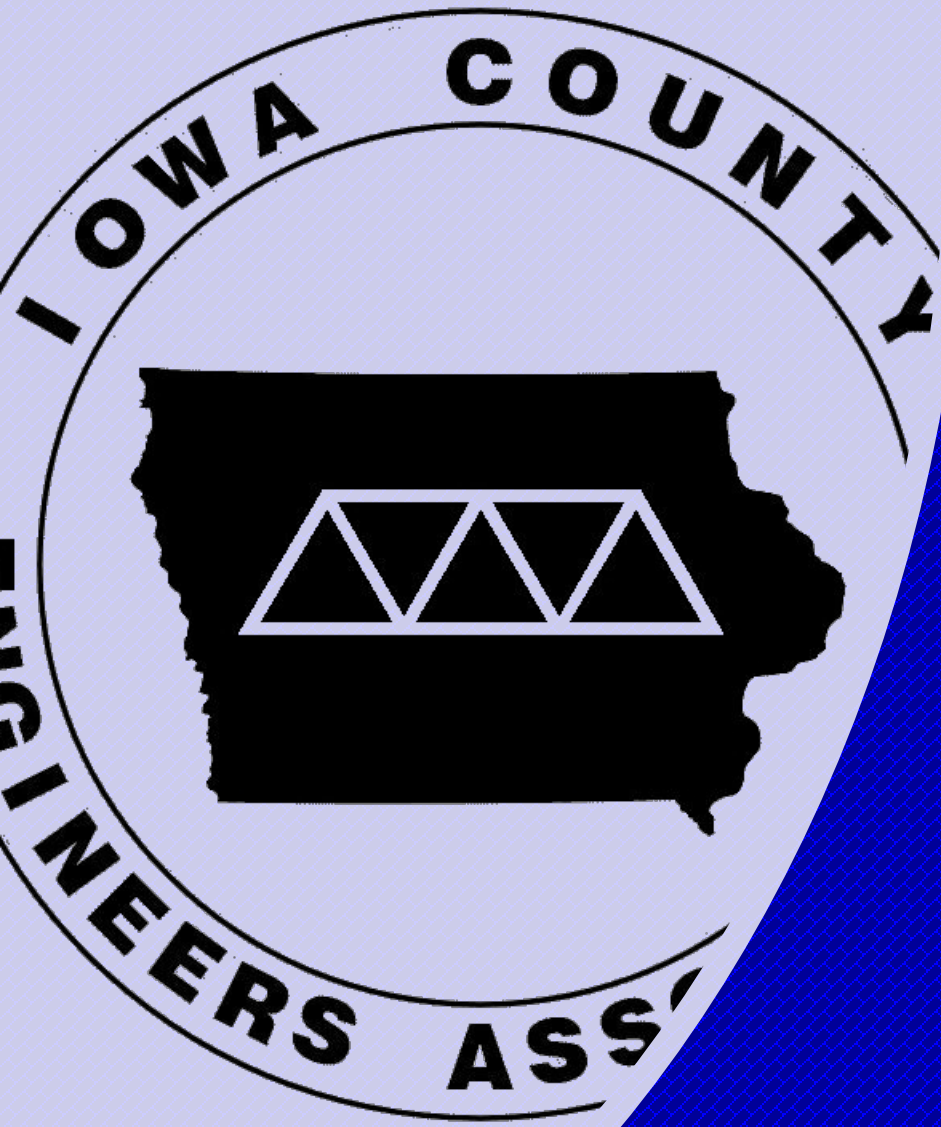




MINK 2026

Base Stabilization Research in Iowa

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Secondary Road Research Engineer

**Iowa County Engineers Association
Service Bureau**

**Iowa DOT Research and Analytics
Bureau**

The Guts of This Presentation

- Positives

- An overview of Iowa and the highway research program
- What that program has done for Base Stabilization (BS)
- How you can potentially benefit from this research
- Where you can find the research
- How you can impact the research



- Negatives

- Not going to dive deep into individual final reports
- Not going to hit every project that has been done
- I am the one giving the presentation



How is Research Chosen

- Cities and Counties hold independent focus groups to develop a list of potential research projects they would like to see
- DOT has internal meetings to discuss potential research
- Academia bring ideas to the IHRB and practitioners to promote research they feel would be beneficial
- Ideas are put into the Iowa DOT research portal (anyone can do this)

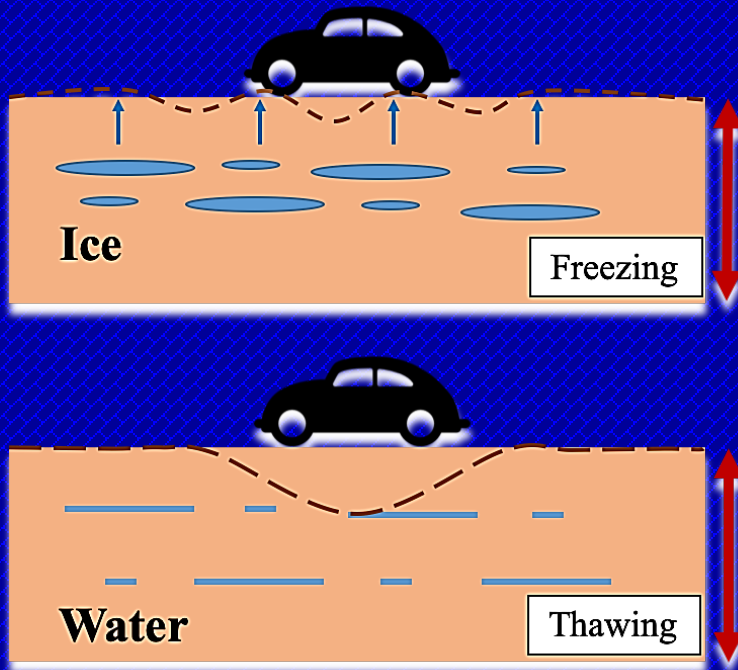
What Do We Research?

- Geomaterials
 - change across the state (like all states)
 - Soils: clay, silt, loess
 - Stone: Limestone, river gravel, Quartzite, shale
 - Qualities of materials change
 - Cost/Benefit Numbers
- Pavements
 - base, pavement, loading impacts
- Bridges
 - Types, materials, life cycle, ease of construction
- Equipment/vehicle LCCA
- Policy/Resolution/Ordinance Best Practice
- Roadway Safety Features
- **This is about base stabilization (BS). Stay on task.**

BS Research Projects

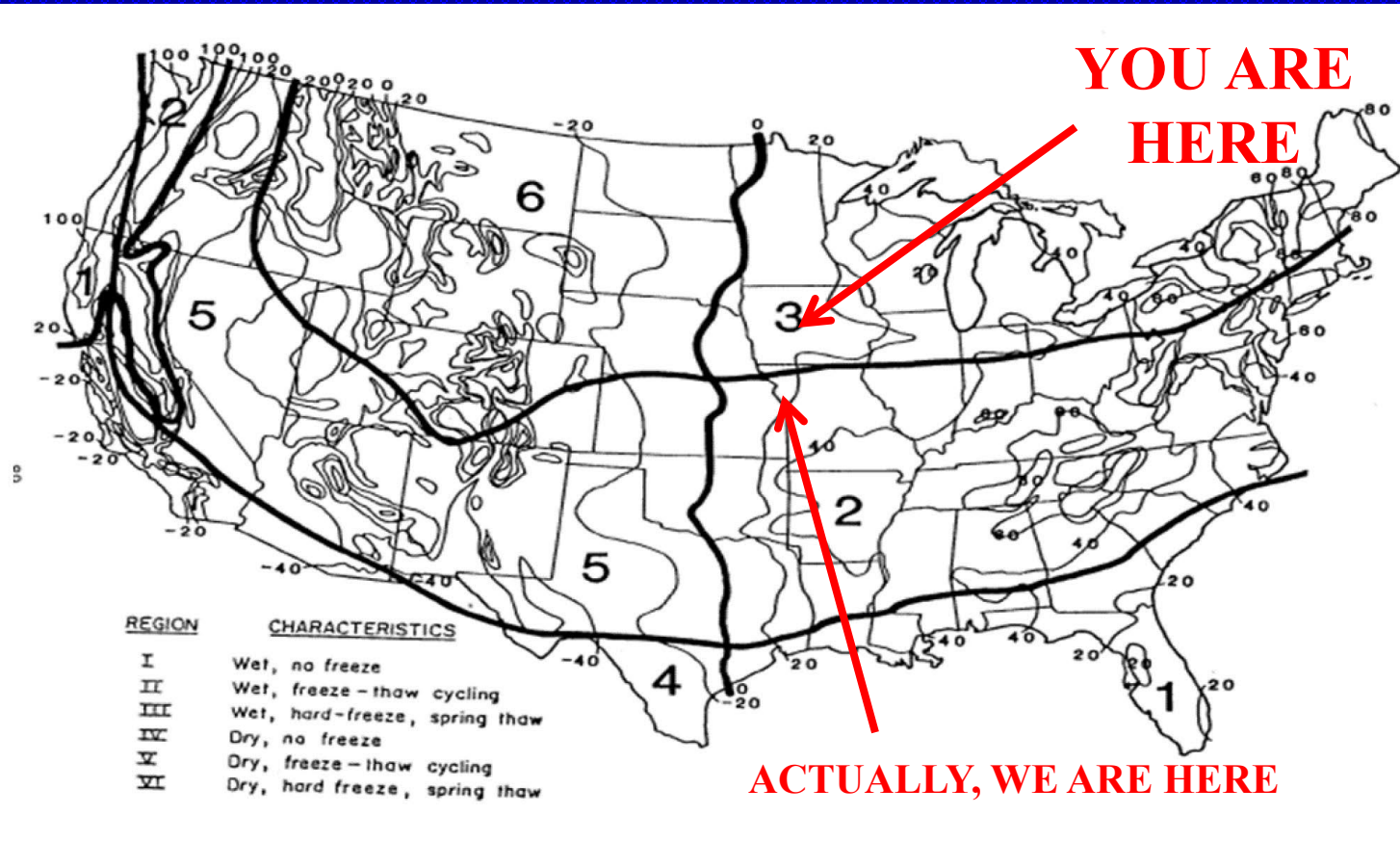
- First BS Project HR-27 – Control of Moisture in Highway Subgrades – Authorized June 1953
- Most recent: TR-848 Ongoing Evaluation of Full-Scale Test Sites – Authorized August 2026
- Since 1953, 40 BS projects have been funded
- Projects often extend and/or build off previous projects
- Projects MUST be implementable
- ~~Research just to do Research~~

Iowa's Problem



- Roads built with natural material (clay & silts)
- Great for farming, bad for roads
- Heaving
- Frost boil
- Potholes
- Seasonally impassable roads (unpaved)

Regional Characteristics



Region 3 Summer

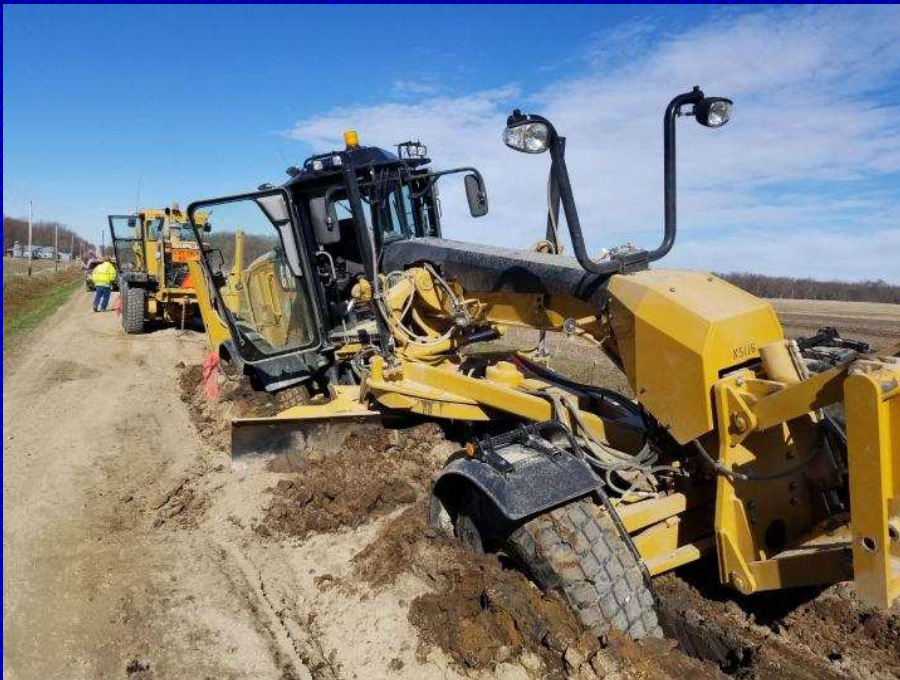


Region 3 Spring



- Local (County) roads are the access points to land and thus must support very heavy ag equipment....





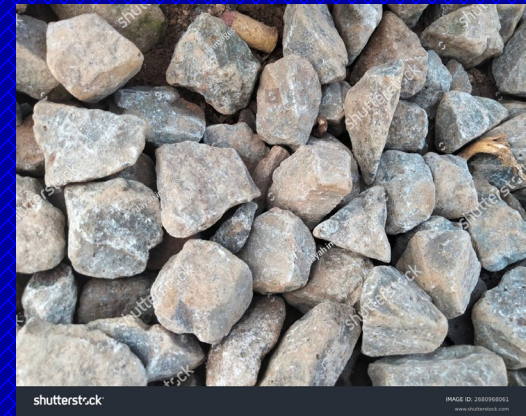
... along with heavier and heavier trucks hauling things that need to be hauled.

Even maintenance can be too much.

Base Stabilization Treatment

Mechanical Stabilization

- Macadam Stone (3" nominal) HR-175, HR-312 granular, HR-209 pavement
 - \$\$\$\$\$\$\$\$\$\$
 - Requires regular surfacing on granular roads to keep covered
 - Routine maintenance works macadam to surface making road hard to blade
 - Commonly used when roadway is paved
- Core-out/French Drains TR-654
 - Simple to do with normal equipment and labor
 - Very site specific
- Aggregate Columns TR-654
 - Simple to do with normal equipment and labor
 - Drilling holes and filling with stone
 - Varying success



Base Stabilization Treatment

Chemical Stabilization

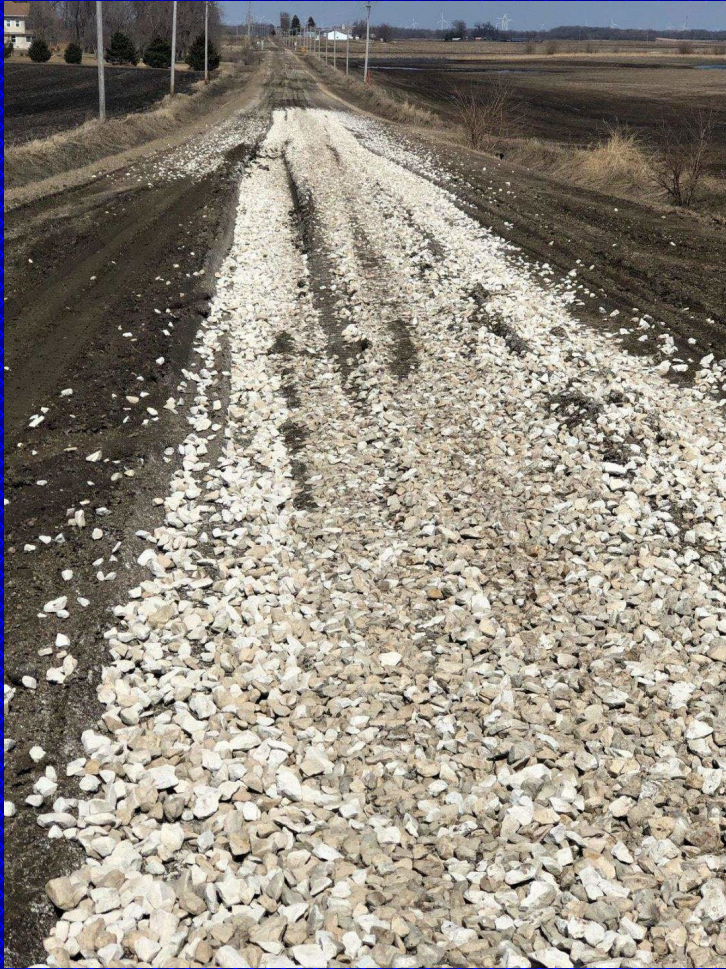
- Portland Cement/Fly Ash: HR-52, HR-75, HR-82, HR-99, HR-259, HR-260, TR-461, TR-656, TR-764
 - \$\$\$\$\$\$
 - Cement, Fly Ash, PCC Grinding Residue, Lime,



Proprietary Subgrade Treatments

- The stuff the salesman says you will love
- Base One
- Permazyme
- EMC²
- CaCL₂
- TR-582, TR-656, TR-721
- Some require some specialized equipment
- Many can be applied by mixing product with motor graders on grade
- New enough in Iowa that we don't fully know the life of them to at ROI
- None have been shown to be a waste, to date

Mechanical, Site Specific Fixes

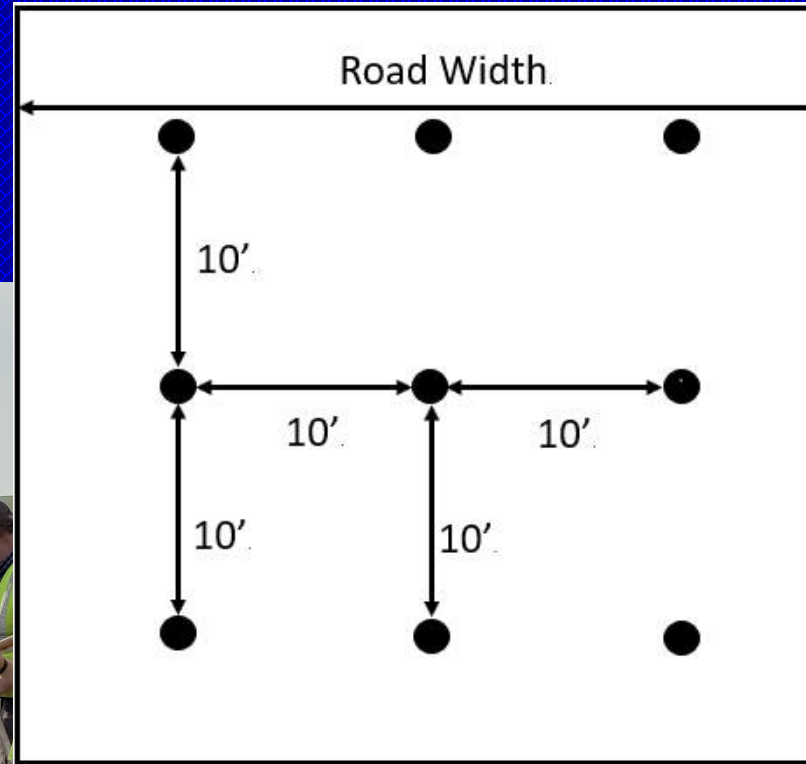


Mechanical Treatment – Site Specific



Mechanical Treatment - Aggregate Columns – Greene County

8-10" Dia Holes
6-7' Deep



Chemical Stabilization - Washington County Application

23.5 Miles 2015-2018

AADT 40-300, Avg 130

Surface stone added to ensure mixing of 4-6" of material

Done with County labor and equipment

Lower \$\$\$ - Avg \$5,600/Mile (2018 numbers?)

Bladed and rubber tired roller twice/year after rain or water truck to repair minor problems

No additional surface stone needed compared to 450 ton/mi before



Washington County Application



Research – Finding Solutions To Problems

- 1949 – County Engineers went to the Iowa Legislature and said “we are trying things but we need smarter people to run cool tests and **collect and analyze data**”
- Iowa Highway Research Board – Research Voters
 - 6 County Engineers
 - 4 DOT Engineers
 - Chair of ISU and U of I Civil Engineering Departments
 - 2 City Engineers
 - TRB Rep (County Eng)
 - Total 15 Members
 - 15 Alternates
 - 3 Year Terms



A Look Specific BS Research

- **TR-843:** Advanced Testing and Characterization of Iowa Soils and Geomaterials Phase II (TR-780 Phase I) – Resistance modulus (M_R) by triaxial testing of the anisotropic stiffness. Build a database of the materials across the state relative to its M_R



TR-783 & TR-809: Use of Organo-silanes to Mitigate the Impact of Freeze-Thaw Damage to the Granular Roadways in Iowa

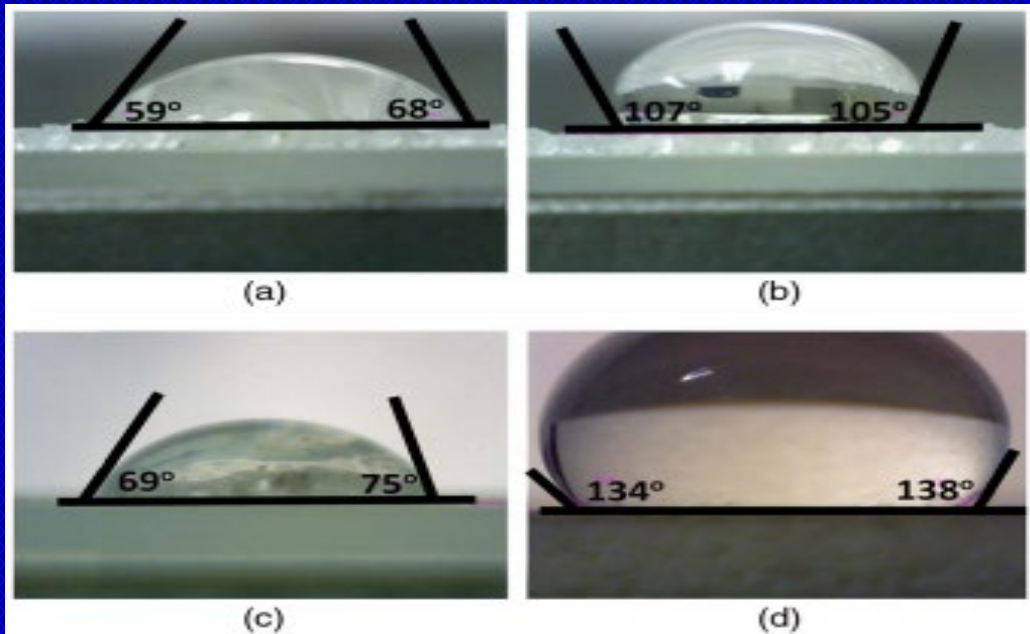
Frost action

- Freezing temperatures
- Water availability
- Frost-susceptible soils



Solution

Make Soil
Water Repellent
(Hydrophobic)



- (a) Untreated sand
- (b) OS-treated sand**
- (c) Untreated CFA
- (d) OS-treated CFA**

Current Demonstration Site in Keokuk County

- **TR-810**: Use of Iowa Eggshells as Bio-Cement Materials in Pavement And Gravel Road Geomaterial Stabilization

- Iowa is the #1 eggshell producer in the nation
- Once calcified, it has many of the same properties of Portland cement (needs 1800+°F for 5 hours)



- Currently all the shells go to landfills
- “lets try” just mixing the shells in the base material and see what happens (Wright Co)
- Working to demo on large scale project (need commercial kiln)

TR-799 Base Stabilization of Iowa Granular Roads Using Recycled Plastics

- Determine the structural benefits and environmental suitability of using recycled plastics as base stabilizers
 - Geotextiles
 - Geogrids
 - Aggregates
 - 3D Printing
- Geogrids and geotextiles were 10-15(?) times stronger than aggregates – abandon the aggregate part of the research
- Demo site in Buchanan Co

Symbol	Description	
 PETE	Clear tough plastic such as soft drink, juice and water bottles.	
 HDPE	Common white or coloured plastic such as milk containers and shampoo bottles.	
 V	Hard rigid clear plastic such as cordial bottles.	
 LDPE	Soft flexible plastic e.g. squeezable bottles such as sauce bottles.	
 PP	Hard but flexible plastic such as microwave ware, takeaway containers, some yoghurt/ice cream/jam containers, hinged lunch boxes.	
 PS	Rigid, brittle plastic such as small tubs and margarine/butter containers.	
 OTHER	All other plastics, including acrylic and nylon. Examples include some sports drink bottles, sunglasses, large water cooler bottles.	

- **HR-3013**: Collection of Freeze-Thaw Performance Data on Vail Ave. Hamilton Co

- 19 Test Sections

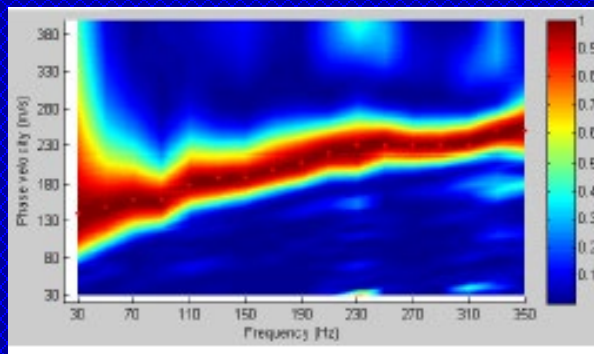
- Control – do nothing
- Mechanical
- Chemical
- Combined

Mechanical	Chemical	Combined
Ag Columns	Bentonite	Macadam/Bentonite
Geo-composite	Portland Cement	Macadam/Chloride
Geotextile	Chloride	Macadam/Geotextile
Geogrid	Fly Ash	Macadam/Geotextile Chloride
Macadam		Macadam/Geotextile Bentonite

• HR-3013:

• Years of testing
2013-2017

• Surface and
Base data



APPENDIX A. 2016 PRE-FREEZING DCP TEST RESULTS

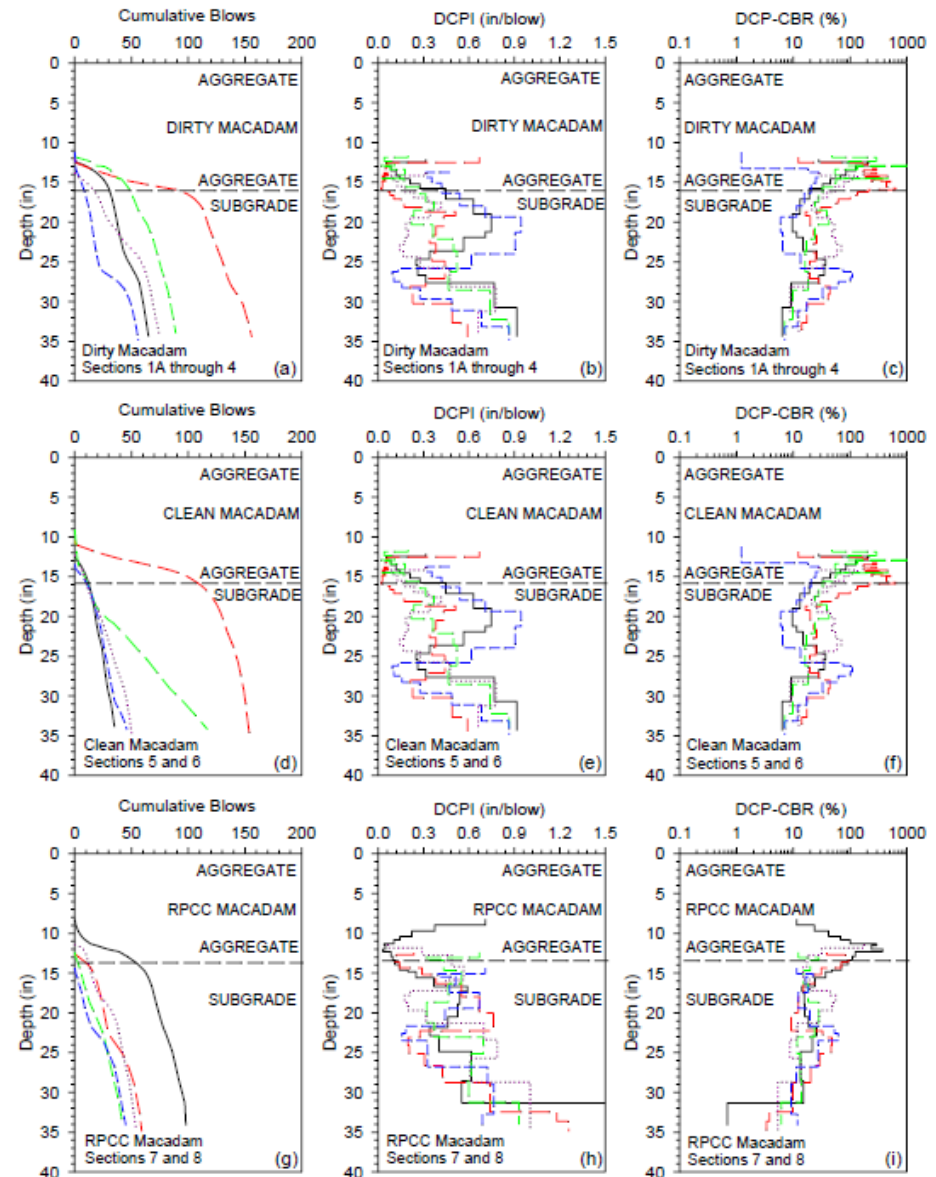


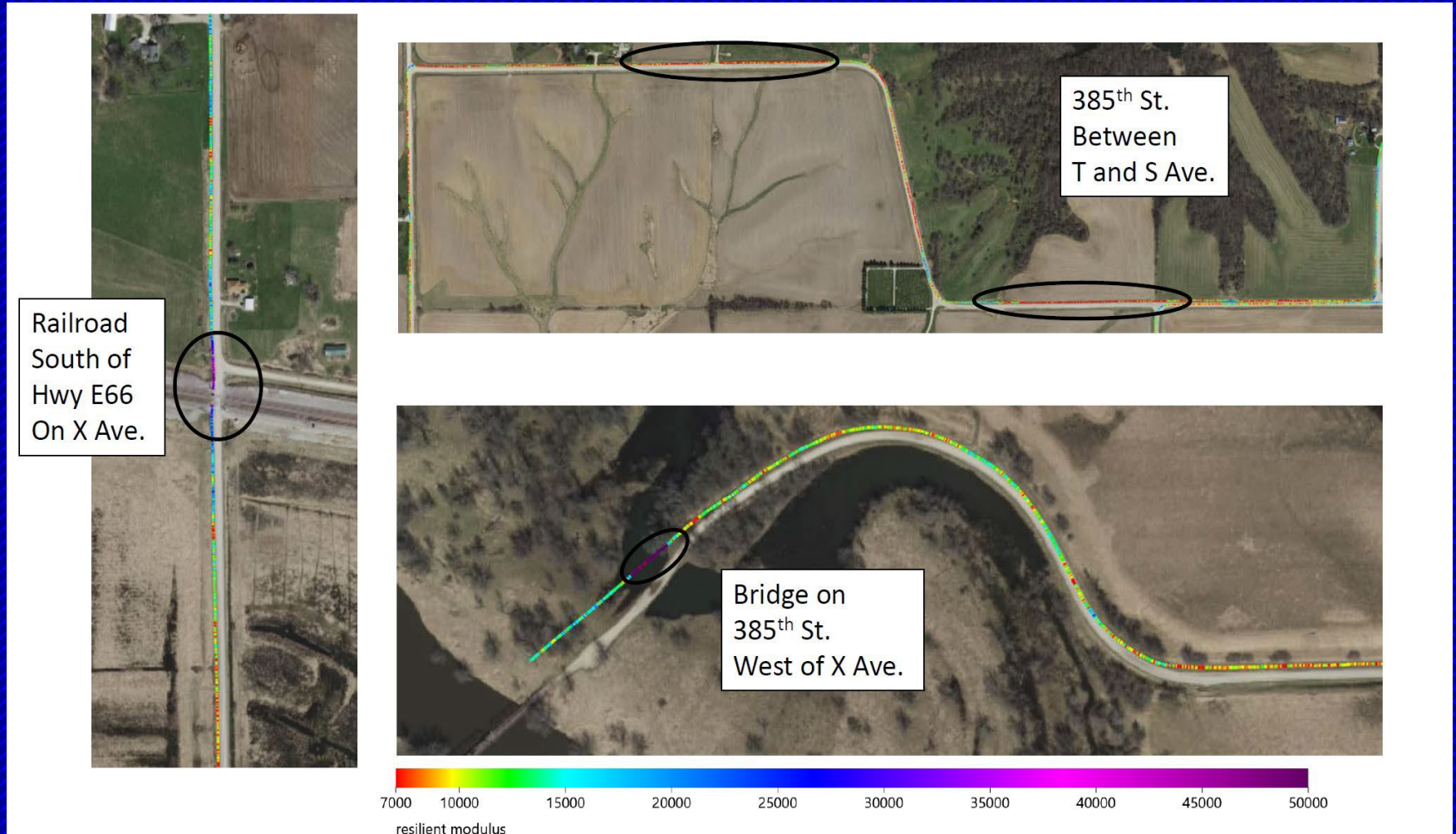
Figure 24. 2016 pre-freezing DCP test results for Sections 1A through 8

AID Grant: Gravel Road Mapping using “Validated Intelligent Compaction”

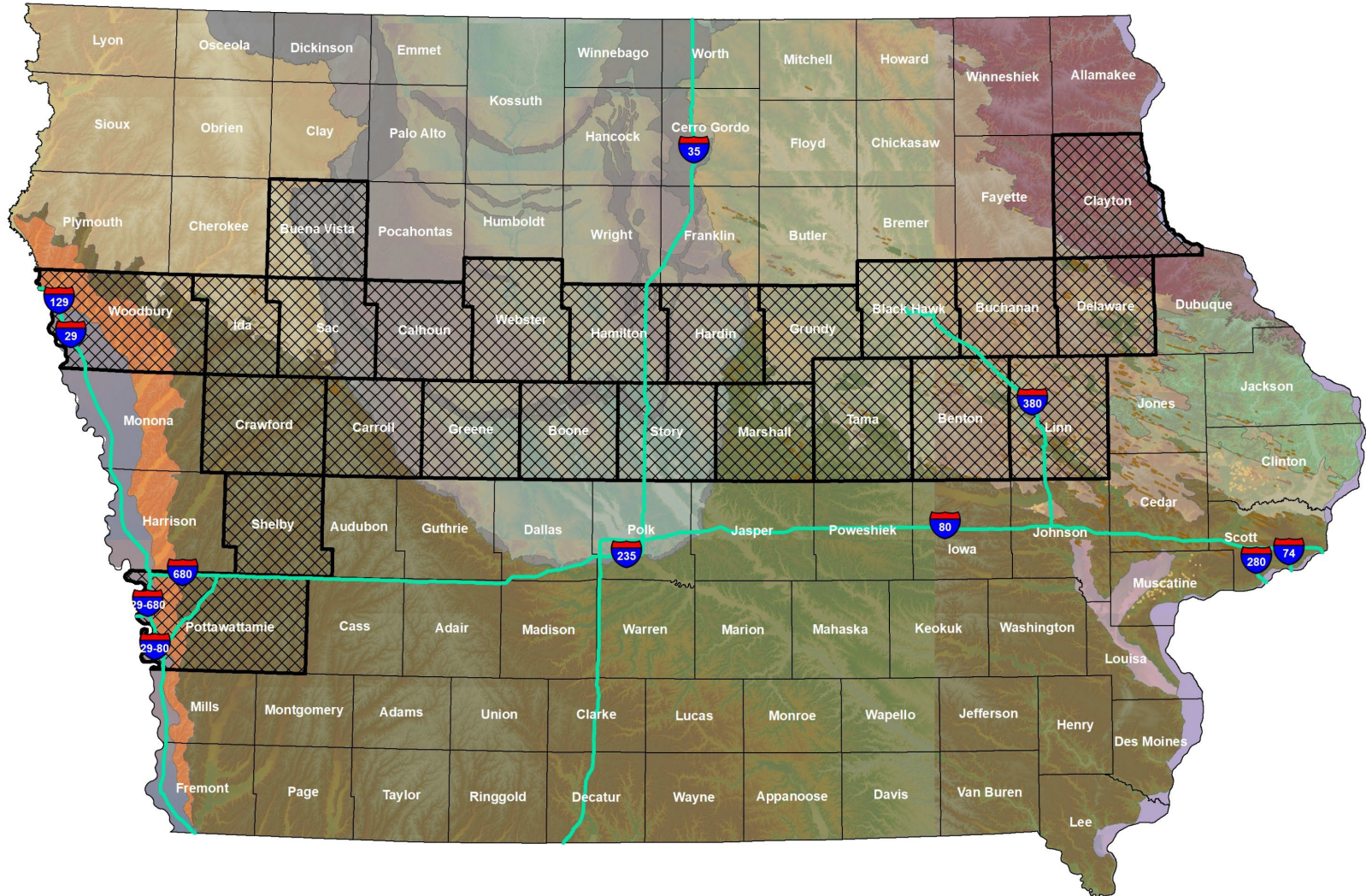


Gravel Road Mapping using VIC Roller

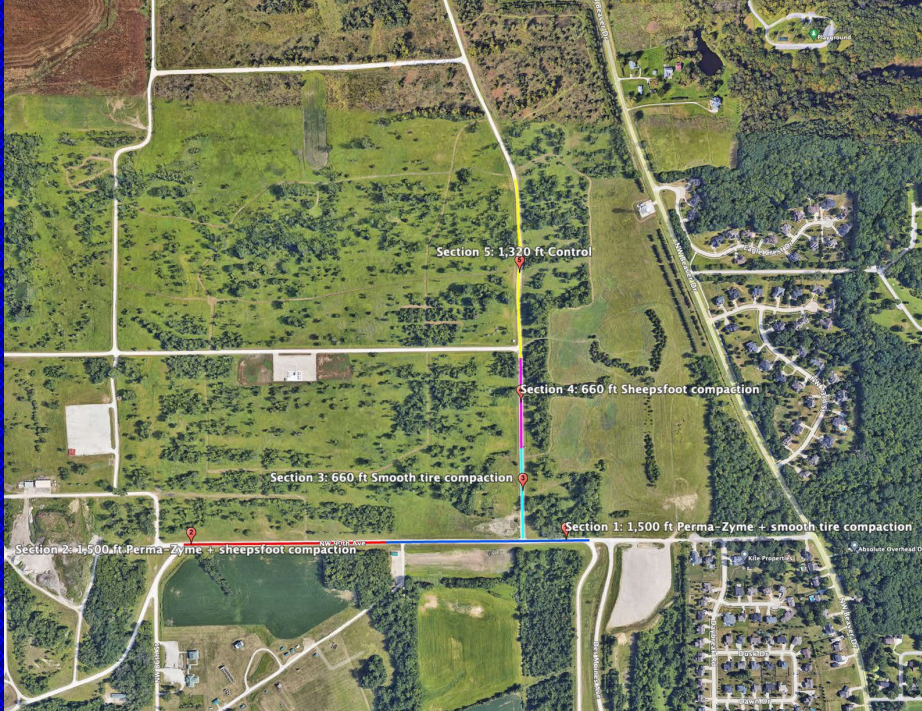
What bad is the system?



VIC Mapping 2024-2026



Camp Dodge – The IHRB Base Stabilization Sandbox



- \$500,000 from the county share of the IHRB funding – two-year project
- Work with ISU for testing
- 4 projects, 2023, 2024, 2025, 2026
- Projects are built by county operators from across the state (5 at a time) with equipment a county would own
- Projects take a week

Camp Dodge 2023 TR-823 Chemical





Camp Dodge 2024 - TR-834

Mechanical



Camp Dodge 2025 – TR-839 Mechanical



Camp Dodge 2025 – TR-839



Camp Dodge 2026 Mechanical



Full Scale - Long Term Testing TR-848

Revisit Completed Projects for Status and Performance

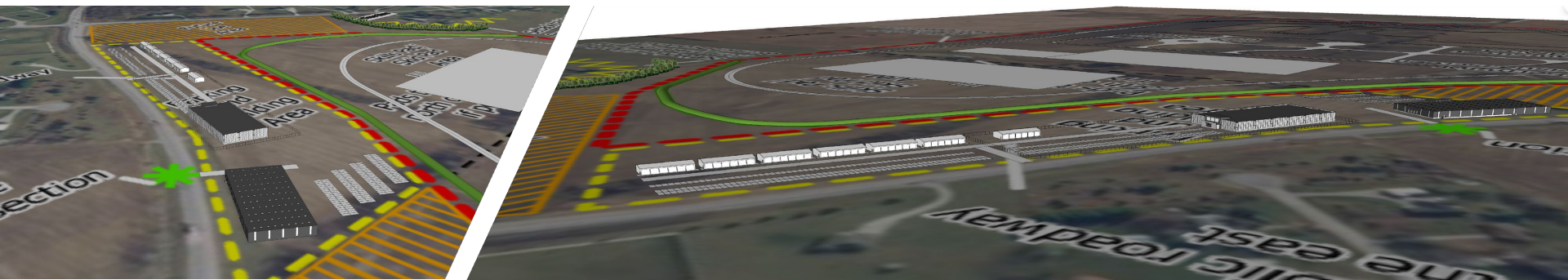
Analyze the Life Cycle of the BS Project

Develop a tool to give for BS Options

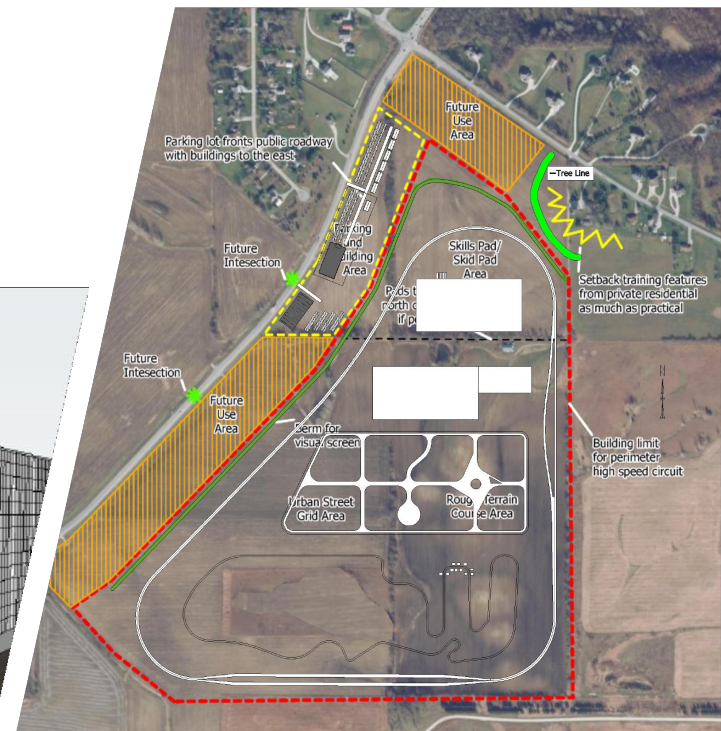
VIC Roller, M_R



Future Research &
Iowa Traffic Training
Center
“The Vision”



TTC Facility & Track – The Dream



Contact Info

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ICEA Service Bureau Research

<https://www.youtube.com/channel/UCXaplzY4i0egkEgb8lwnOZQ/playlists>

Iowa Publications Online

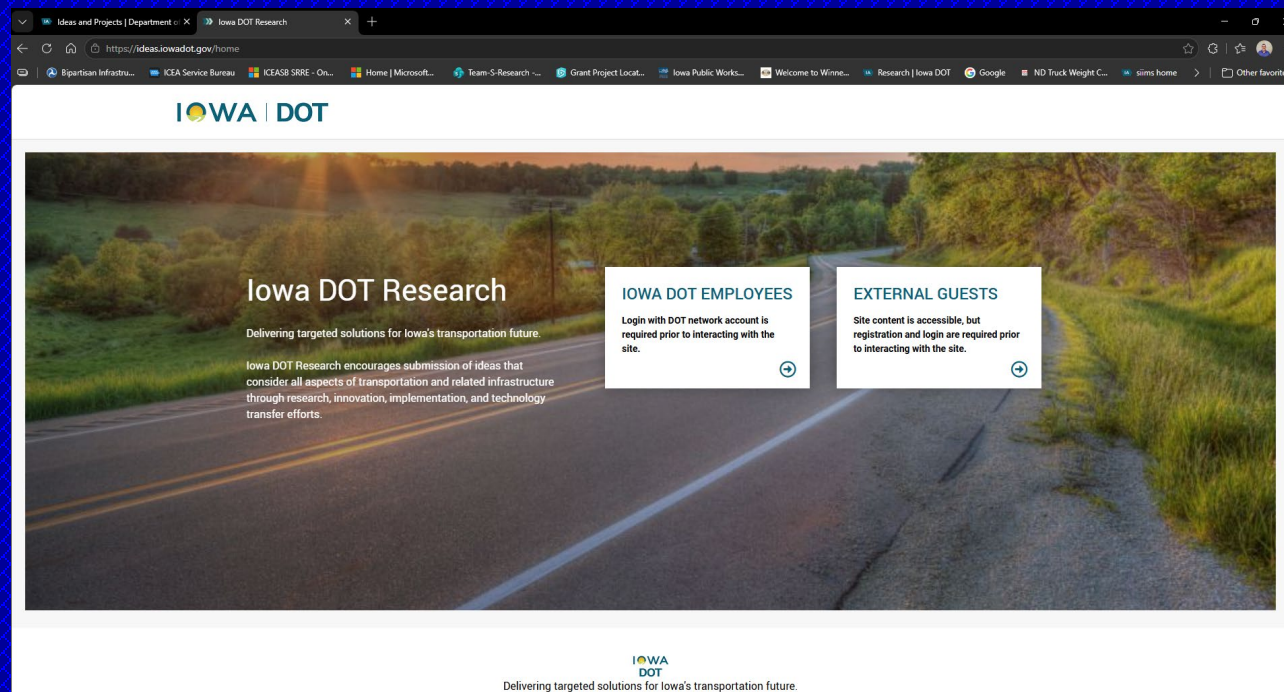
<https://publications.iowa.gov>

Last Slide!!!!!!

Iowa DOT Research Bureau's Ideas Page

You will need to create an account, and you remain anonymous to all other users

<https://ideas.iowadot.gov/home>



HA! I Lied!!!!!! Last Slide

Thank you for you time



Iowa's Secondary Roads (The County System)

- Iowa has over 89,000 miles of county owned roads
 - 66,000+ granular
 - 4,000+ earthen
 - 1,000+ seal coated (bituminous)
 - 18,000+ paved
- In 2025, Iowa's 99 County road departments spent over \$1.27 Billion on roads (maintenance)
 - \$4.23 Million on granular base stabilization
 - \$1.62 Million on paved base stabilization
 - Doing the math – 0.0046% of the maintenance budget is spent on base stabilization

Iowa's Secondary Roads

- \$31.38 Million local money on construction
 - \$0.00 on granular base stabilization/maintenance
 - \$0.00 on paved base stabilization/maintenance
- \$309 Million state and fed money on construction
 - Breakdown of stabilization items is above my pay grade
 - Assume the same % from local construction
- In total, Iowa put \$1.61 Billion into their roads with roughly \$5.0 Million into base stabilization