HIGH VALUE RESEARCH

Development of a Salt Spreader Controller Program Using Machine-Sensed Roadway Weather Parameters

This research focused on implementing a sensor-based salt spreader system to optimize deicing operations across Massachusetts' 15,000 lane miles, aiming to reduce salt usage while maintaining road safety and minimizing environmental harm. By leveraging real-time road and weather data, the system will enable more precise and cost-effective salt applications, with the ultimate goal of deploying it across MassDOT's entire winter operations fleet.
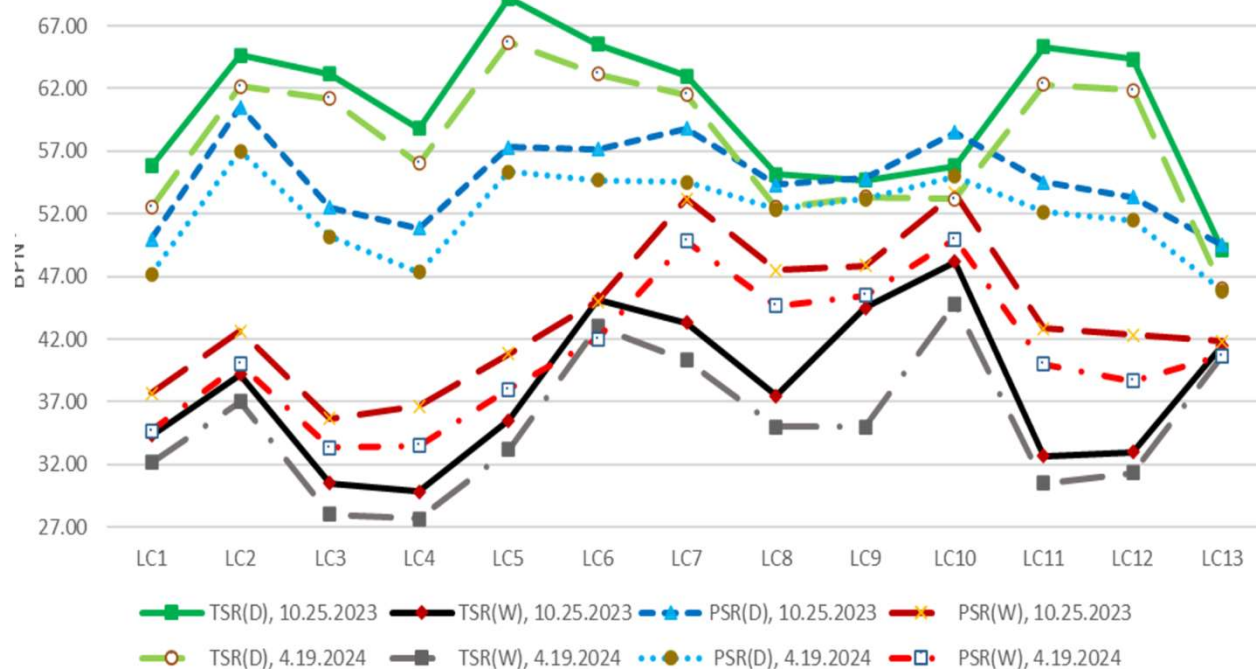
HIGH VALUE RESEARCH

Evaluating the Correlation Between Slip and Skid Resistance of Pavement Markings at Crosswalks

This study evaluated the slip resistance for pedestrians and skid resistance for vehicles on crosswalk pavement markings under various conditions. Findings showed reduced friction in wet and icy environments and supported raising Maryland's skid resistance standard, with potential benefits for both pedestrian and motorist safety.

HIGH VALUE RESEARCH

MaineDOT

Implementing Roadway Context in Maine – Creating a Statewide Context Map and a Context-Sensitive Speed Limit Setting Tool
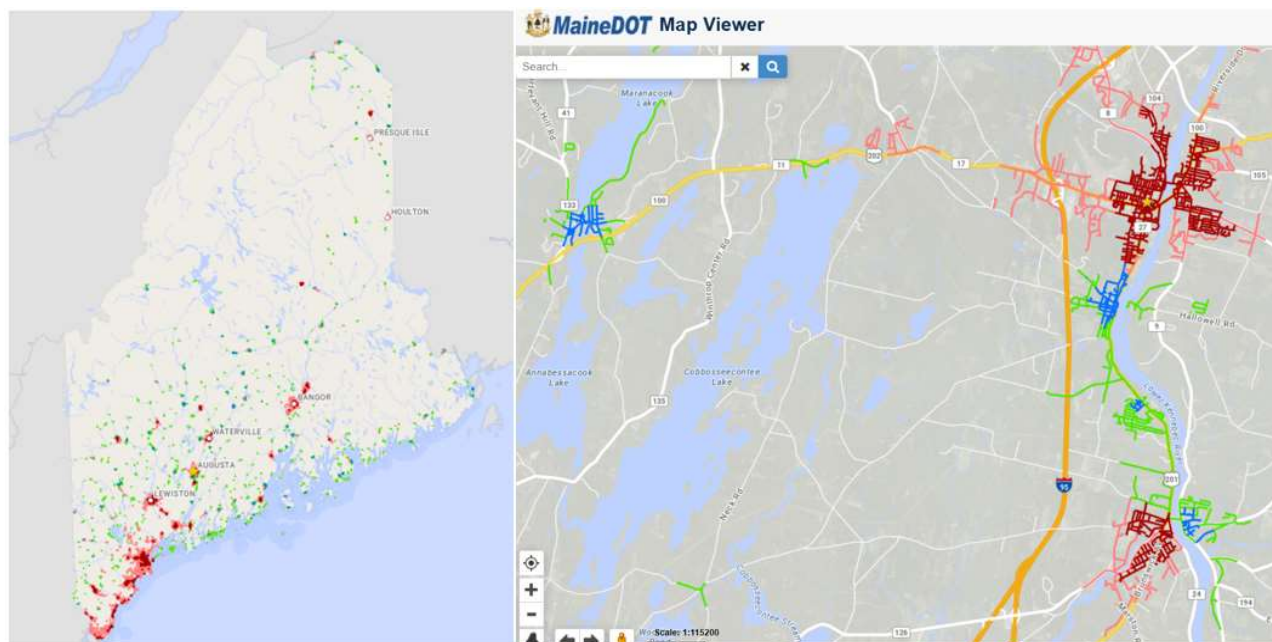
Maine DOT developed and implemented a new, context-sensitive speed limit setting process aimed at improving safety for pedestrians and bicyclists by aligning speed limits with roadway environments. A statewide context map and speed limit tool were created and are now fully integrated into planning and traffic management. These tools help target safety improvements more effectively, particularly in areas where most pedestrian and bicycle crashes occur.

HIGH VALUE RESEARCH

Pennsylvania Department of Transportation

Precast Bridge Deck Panel Testing

This study evaluated the structural performance of joints in precast concrete bridge deck panels, focusing on flexural capacity, reinforcement configurations, and alternative materials to improve joint integrity. The findings led to recommended revisions to PennDOT's design standards to enhance safety, durability, and construction efficiency. A pilot project is planned, and further research is proposed to assess long-term joint durability. These improvements aim to reduce maintenance costs and support more reliable bridge infrastructure across Pennsylvania and beyond.
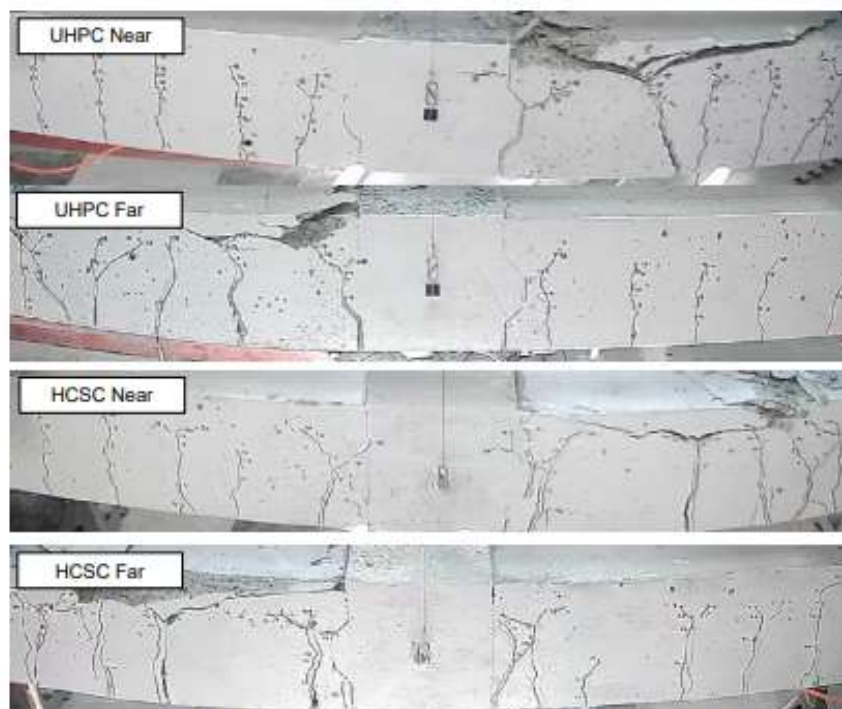

Figure 6-20: Elevation View of Cracking of D/D Panel Assemblages at Ultimate Flexural Capacity

HIGH VALUE RESEARCH

Induction and Laser Ablation Coating Removal of Potentially Hazardous Bridge Coatings

This study evaluated the structural performance of joints in precast concrete bridge deck panels, focusing on flexural capacity, reinforcement configurations, and alternative materials to improve joint integrity. The findings led to recommended revisions to PennDOT's design standards to enhance safety, durability, and construction efficiency. A pilot project is planned, and further research is proposed to assess long-term joint durability. These improvements aim to reduce maintenance costs and support more reliable bridge infrastructure across Pennsylvania and beyond.

HIGH VALUE RESEARCH

Transfer of Unmanned Aircraft Systems Technology to SCDOT for Enhanced Bridge Inspections

This project, a collaboration between Clemson University's C2M2 and SCDOT, aimed to improve bridge inspection safety, efficiency, and cost-effectiveness through the use of drones. A standardized training program, including an online course and hands-on boot camp, was developed and implemented. Early results show drones provide safer access to difficult areas and yield higher-quality inspection data, with strong positive feedback from participants. Phase II will further expand the program statewide.

HIGH VALUE RESEARCH

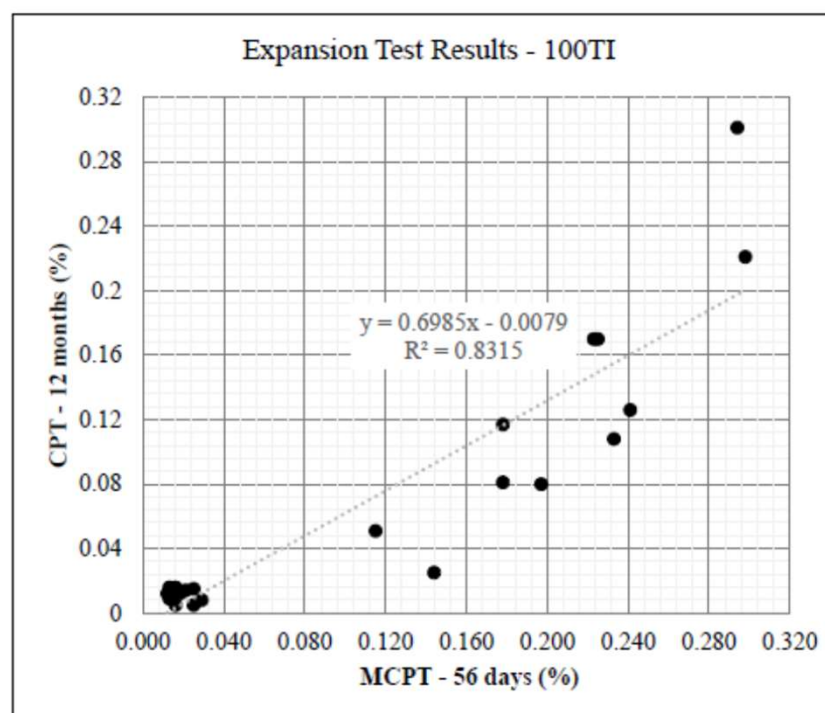## Evaluation of the Miniature Concrete Prism Test (MCPT) for Use in LADOTD

This research compared existing methods for testing alkali-silica reactivity (ASR) in aggregates and evaluated the newer Miniature Concrete Prism Test (MCPT) as a faster, reliable alternative. Unlike the traditional year-long test (ASTM C1293), MCPT delivers results in just 56 days. The Louisiana DOTD is now adopting MCPT, which will reduce aggregate approval time from over a year to under 90 days, significantly improving efficiency in materials evaluation.

Expansion Test Results - 100TI

$y = 0.6985x - 0.0079$
$R^2 = 0.8315$

HIGH VALUE RESEARCH

Guidelines for Installing Pedestrian Treatments at Midblock Locations

This project examined pedestrian safety at midblock crossings, identifying key risk factors such as traffic volume, land use, and socioeconomic conditions. Researchers developed Florida-specific guidelines to identify high-risk corridors and recommend appropriate safety treatments. As a result, pedestrian median barriers were installed at three locations in FDOT District 4, leading to observed reductions in midblock crossings and crashes. Though long-term data is still needed, early results and professional judgment suggest these barriers improve safety, reduce crash severity, and offer low-cost, low-maintenance solutions for pedestrian protection.

HIGH VALUE RESEARCH

Effectiveness of Contrast Markings on Roadways and Orange Markings in Work Zones

This study evaluated the safety impacts of contrast pavement markings on light-colored roads and experimental orange markings in work zones. Using Highway Safety Manual methods, the research found that contrast markings can reduce lane departure crashes by an average of 43%, while orange markings in work zones led to a 74% reduction, improved lane centering, and slower vehicle speeds. Public feedback was strongly positive, with most drivers reporting increased awareness. As a result, Indiana is revising its design manual to expand the use of contrast markings and is continuing research on orange markings through 2027. The project promises enhanced safety, fewer crashes, and reduced travel delays.

HIGH VALUE RESEARCH

OHIO DEPARTMENT OF TRANSPORTATION
RESEARCH

Cost Effective Alternatives for Mitigating Debris and Environmental Impacts Around Bridge Piers

This research focused on safer, more cost-effective methods for bridge debris removal, scour mitigation, and riverbed mapping. A custom knuckleboom crane with grapple and saw attachments was developed and successfully tested, reducing labor by 43% and project costs by up to 90%. Chevron and cross-vane structures were implemented to redirect debris and prevent scour, while sonar-based technologies improved subsurface inspections. The project enhanced safety, reduced permitting and road closures, and offered a fast return on investment, making the solutions practical for widespread use, especially at smaller sites.

HIGH VALUE RESEARCH

DEPARTMENT OF TRANSPORTATION

Complete Streets Speed Impacts

This study analyzed how various Complete Streets design features affect driving speeds across 19 roadway corridors in Minnesota. Key findings showed that single-lane roundabouts reduce speeds by 7 mph, raised medians by 3.1 mph, and other features like on-street parking and crosswalks also contribute to slower speeds. These speed reduction factors (SRFs) provide valuable data for designing safer, more accessible roads. The results have informed future road design standards and led to follow-up research examining additional factors influencing driver behavior around non-motorized users.

iTrain – Immersive Training of Department of Transportation Work Zone **Inspectors** using **Virtual Reality**

The iTrain project partnered with MoDOT to develop Virtual Reality (VR) training modules that provide immersive, interactive scenarios for work zone safety and flagger training. Integrated into MoDOT's training programs, these modules improved knowledge retention and practical skills, with participants showing high satisfaction and effective performance. The VR approach offers a flexible, engaging supplement to traditional training and is planned for continued use.
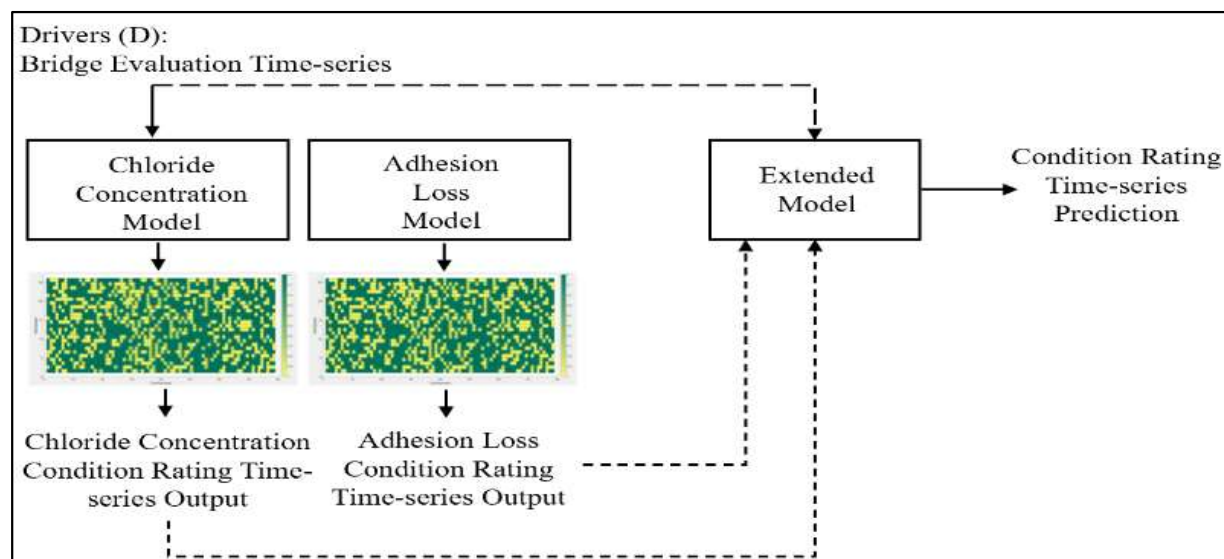
HIGH VALUE RESEARCH

Intelligent Bridge Management (i-BM) Tool for Bridge and Culvert Deterioration Forecasting and Anomaly Detection based on Physics-Guided Deep Learning

Colorado DOT developed the Intelligent Bridge Management (i-BM) tool, combining deep learning with physics-based modeling to forecast bridge deterioration and detect performance anomalies. This tool enhances safety by enabling early failure detection and reduces maintenance costs through more accurate planning. The i-BM system is improving bridge management efficiency and is being further developed for broader applications in transportation asset management.

Drivers (D): Bridge Evaluation Time-series — Chloride Concentration Model; Adhesion Loss Model; Extended Model → Condition Rating Time-series Prediction. Chloride Concentration Condition Rating Time-series Output; Adhesion Loss Condition Rating Time-series Output.

HIGH VALUE RESEARCH

Smart Data, Smarter Decisions: Maximizing Value in Transportation Data Investments

Idaho Transportation Department (ITD) developed two tools—DPAP for smaller data purchases and DINE for larger investments—to evaluate the value and cost-effectiveness of data acquisitions. These tools promote clearer decision-making, collaboration, and accountability in data investments, helping avoid waste and improve procurement efficiency. While not yet fully implemented, training and pilot efforts are underway, with potential benefits including significant cost savings, better data governance, and a replicable model for other agencies.

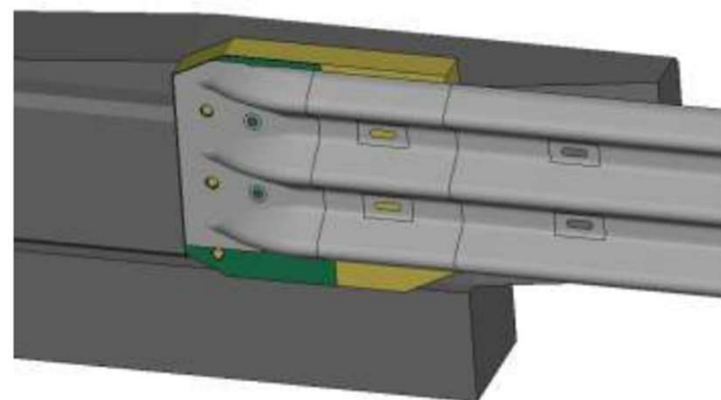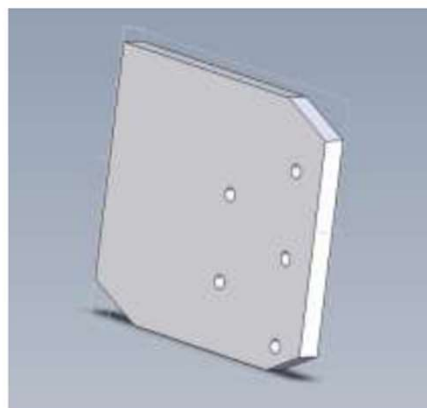### V. Benefit Cost Analysis Ratio

The return on investment for data decisions, here in the form of a BCA ratio, is integral to determining whether to invest. The cost must be reasonable and be balanced with the expected return ratio. This page summarizes the cost, benefits, and Benefic Cost Analysis (BCA) ratio. The information featured in the Costs, Time Benefit, and Added Benefits rows will automatically populate based on your responses in tabs "IV.a BCA Costs," "IV.b BCA Process Benefits," and "IV.c. BCA Added Benefits." A BCA ratio of 2 or above (highlighted green) indicates "go with confidence", a ratio of 1-2 (highlighted yellow) indicates "caution and review," and a score of less than 1 (highlighted red) indicates "stop and reassess."

The Investment Fiscal Year is populated by the "II. General Details" tab; if the Fiscal Year in the "II. General Details" is blank, then the current year is used. The requester can enter a value of 1 through 5 for the Length of Investment in Years in the blue box.

Investment Fiscal Year (linked to 'II. General Details' Investment Fiscal Year)	2024
Discount Rate	7%
Length of Investment in Years, Max of 5	5

	2024	2025	2026	2027	2028
Costs	$ -	$ -	$ -	$ -	$ -
Process Benefits	$ -	$ -	$ -	$ -	$ -
Added Benefits	$ -	$ -	$ -	$ -	$ -

Total Cost and the Benefit Needed to Reach BCA Ratio of 1	$ -

HIGH VALUE RESEARCH

NEBRASKA
Good Life. Great Journey.
DEPARTMENT OF TRANSPORTATION

Approach Guardrail Transition Retrofit to Existing Buttresses and Bridge Rails

This research developed a cost-effective retrofit allowing guardrails to connect to existing concrete buttresses without removing them during asphalt overlay projects. Implemented in NDOT's Roadway Special Plan, this method reduces construction time, enhances safety for workers and the public, and is estimated to save $600,000 in the 2026 fiscal year, with similar savings expected in future years.
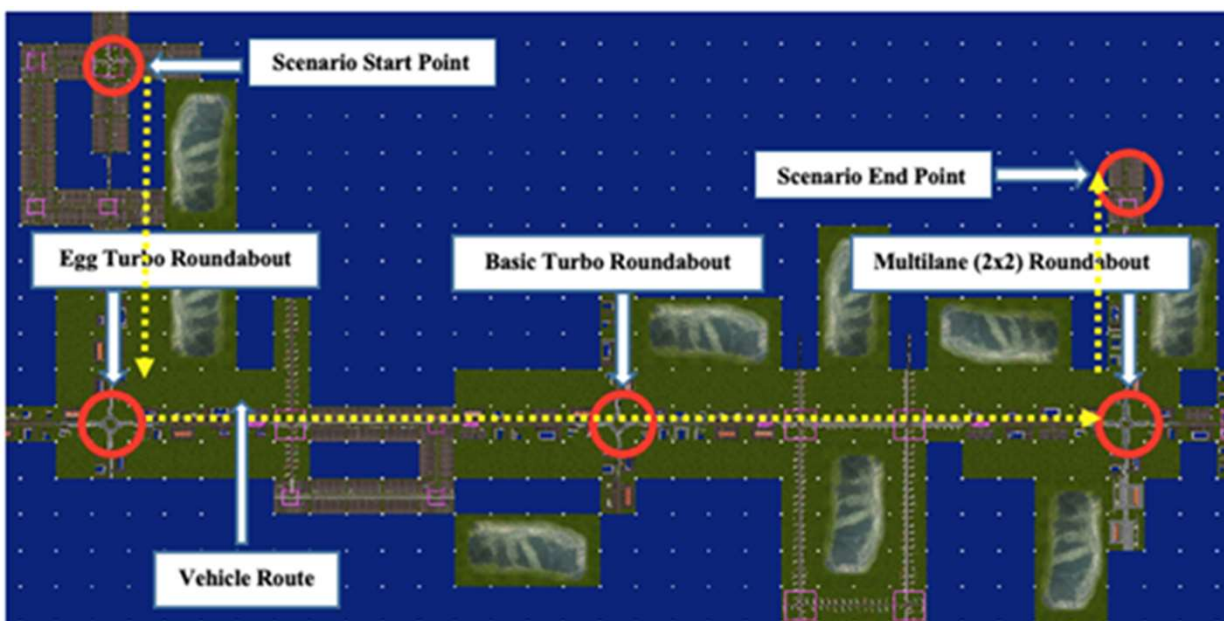
HIGH VALUE RESEARCH

Investigating Implementation Potentials of Turbo Roundabouts in Nevada

This project evaluated the feasibility and benefits of turbo roundabouts—an innovative intersection design used in Europe—in Nevada. Through microsimulation and driving simulator studies, the research showed turbo roundabouts improve safety and operations compared to traditional single- and two-lane roundabouts, reducing crash risks by 18-30% and injury severity by up to 80%. NDOT has integrated these findings into its Intersection Control Evaluation tool to help engineers efficiently compare and select intersection designs, supporting wider adoption of turbo roundabouts in the US.

HIGH VALUE RESEARCH

REAL-TIME TRAFFIC SIGNAL SYSTEM PERFORMANCE MEASUREMENT Phase III: System Integration, Intersection Deployment, and Control Center Dashboard Development
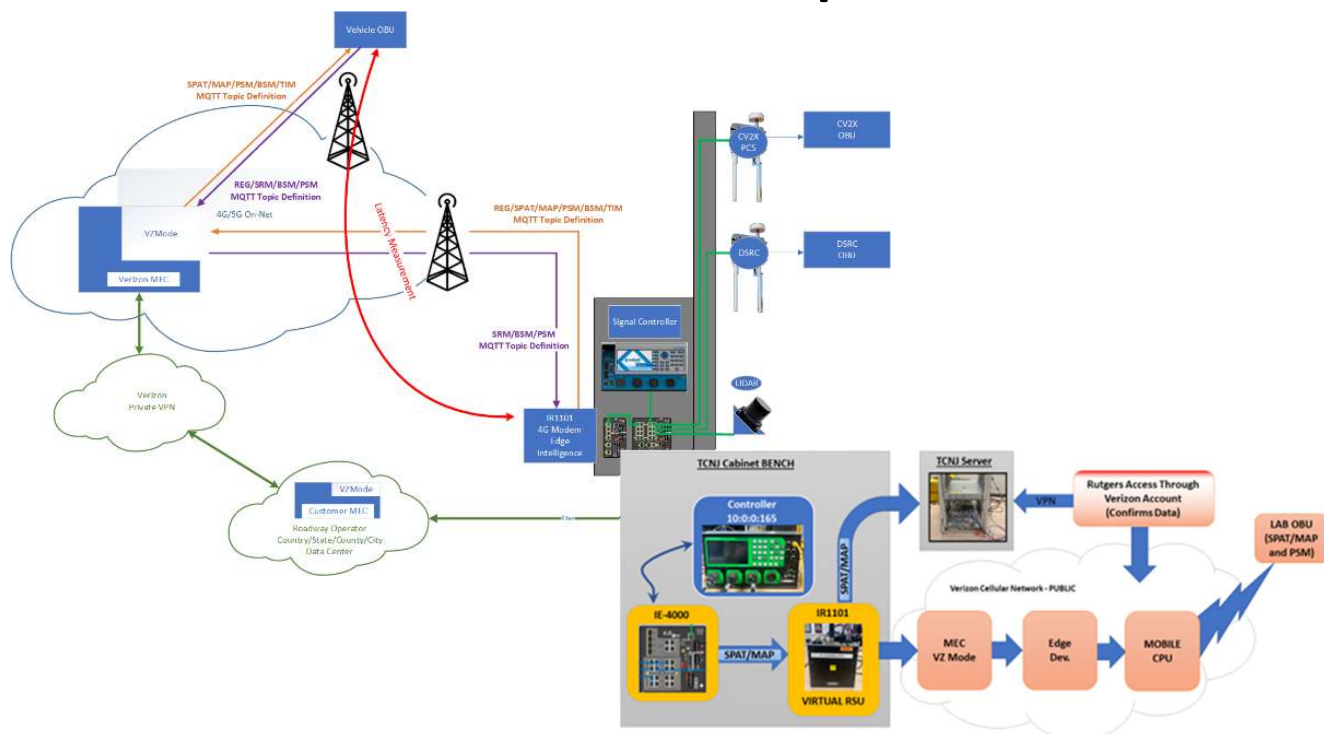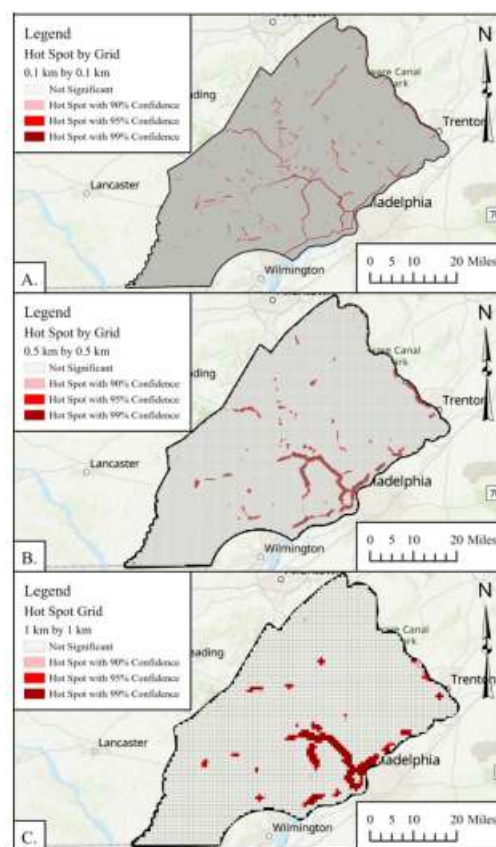
This project developed and deployed a scalable, cost-effective Automated Traffic Signal Performance Measures (ATSPM) system using SCATS and Autoscope data across 72 intersections, integrating advanced sensing, LiDAR, CCTV, and communication technologies. A pilot of Cellular Vehicle-to-Everything (C-V2X) with virtual RSUs was successfully implemented, enabling real-time messaging and pedestrian safety alerts without requiring physical roadside units. The system demonstrated significant cost savings—$2.52 million in deployment and up to $10,000 per vehicle—while improving traffic operations and safety, particularly through a validated pedestrian-in-crosswalk warning feature.

HIGH VALUE RESEARCH

Pennsylvania
Department of Transportation

Flood Mitigation Solutions

This research leveraged advanced technologies such as LiDAR, near-infrared cameras, and drone-based data collection to identify flood-prone roadway areas and assess the impacts of stormwater inundation on safety and infrastructure. While full implementation across PennDOT districts is still in early stages, the study has already informed updates to the PennDOT Drainage Manual and laid the groundwork for future adoption of geospatial and predictive tools to enhance flood resilience and infrastructure sustainability.

HONORABLE MENTION

Crash Data Analysis Tool (CDAT)

The Kentucky Transportation Cabinet developed a web-based crash data analysis tool, CDAT, that leverages advanced crash flags and mapping to streamline safety analysis for over 300 users, improving consistency and accessibility across agencies and consultants. By handling complex computations server-side and integrating with existing frameworks, CDAT simplifies crash data processing, providing interactive visuals and reports accessible on any modern device.

HONORABLE MENTION

Counting Airport Operations Using Aircraft Transponder Signals and/or Aircraft Automatic Dependent Surveillance Broadcast Data

This project improved aircraft operation counting at Florida's non-towered airports by testing and recommending a hybrid system using ADS-B technology, RADAR, and cameras for more accurate data. Implementation is nearly complete across the state, providing instant operation data that enhances airport planning, funding, and safety, with an estimated annual operational cost of $196,000.

HONORABLE MENTION

MDOT
Michigan Department of Transportation

Utilizing Video Analytics with Connected Vehicles for Improved Safety

The Michigan Department of Transportation (MDOT) evaluated video analytics technologies to assess their ability to identify collisions and near-misses in real time, aiming to enhance safety through proactive monitoring and potential integration with connected vehicle systems. The study confirmed the promise of these tools, highlighted vendor collaboration, and provided guidance for future research and deployment, despite limitations in testing real-time notifications.

HIGH VALUE RESEARCH

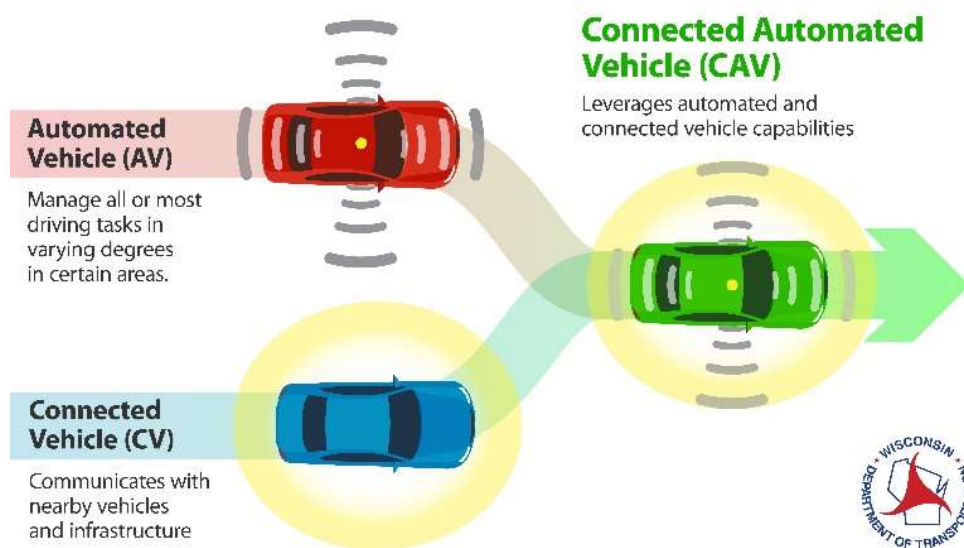## Connected and Automated Vehicles (CAVs) Attitudes and Perceptions

This research by WisDOT surveyed 915 Wisconsin residents to assess their understanding and attitudes toward connected and automated vehicle (CAV) technologies, revealing varying comfort levels—highest for driver-assistance systems and lowest for full automation. The findings provide a baseline for future CAV policy and outreach, highlighting areas where public education and targeted pilot programs could improve acceptance and guide WisDOT's implementation strategy.

Automated Vehicle (AV)
Manage all or most driving tasks in varying degrees in certain areas.

Connected Automated Vehicle (CAV)
Leverages automated and connected vehicle capabilities

Connected Vehicle (CV)
Communicates with nearby vehicles and infrastructure

HIGH VALUE RESEARCH
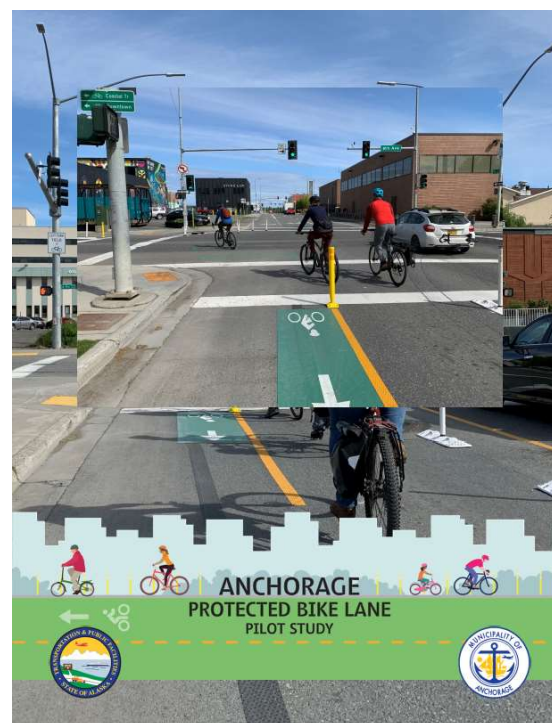
Anchorage Protected Bike Lane Pilot Study

Alaska DOT&PF and the Municipality of Anchorage conducted a two-phase pilot study in 2023 to evaluate protected bike lanes (PBLs), demonstrating improved cyclist safety, increased ridership, and minimal traffic disruption through temporary installations in both residential and commercial areas. The study identified areas for further research—such as winter maintenance, economic impact, and public perception—and provided a cost-effective, scalable model for implementing PBLs in Anchorage and other cold-climate cities.

HIGH VALUE RESEARCH
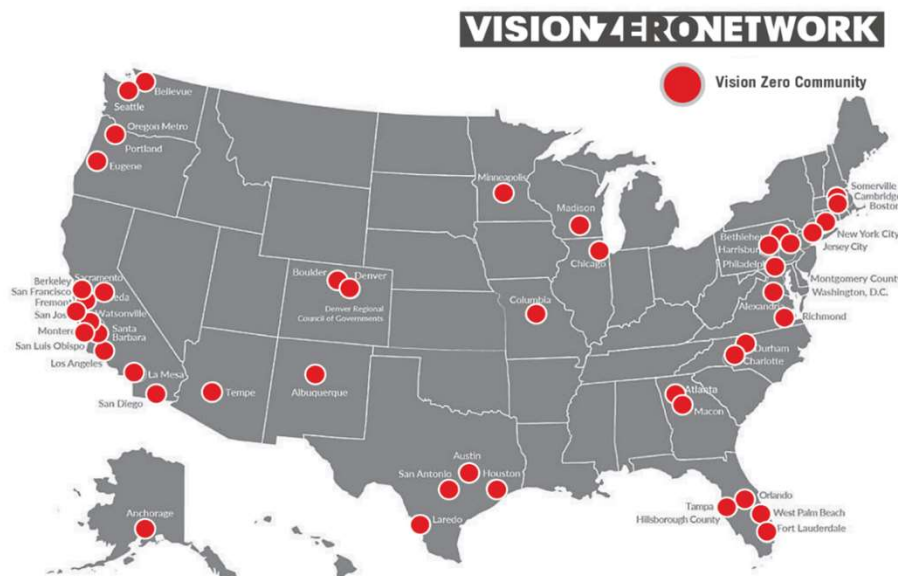
SD DOT

Reduce Fatal & Serious Injury Crashes

The South Dakota Department of Transportation developed a comprehensive implementation plan for a zero-fatality transportation safety initiative, informed by national research, peer interviews, and a review of state policies to align with South Dakota's unique needs. The ongoing implementation aims to improve safety outcomes, reduce costs, and extend infrastructure life by prioritizing high-impact improvements, evaluating effectiveness with measurable metrics, and promoting coordinated, data-driven safety efforts across agencies.
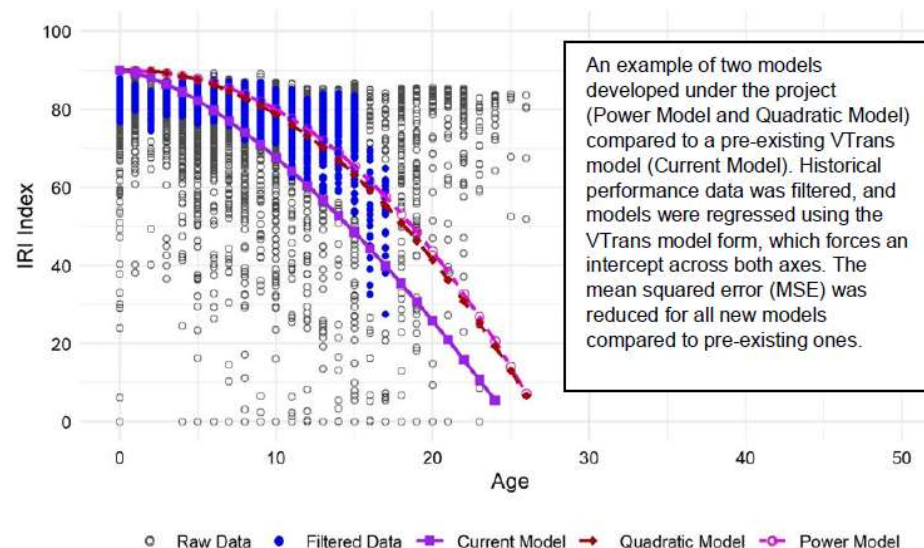
HIGH VALUE RESEARCH

VERMONT
AGENCY OF TRANSPORTATION RESEARCH PROGRAM

Pavement Deterioration Models for Pavement Management

The Vermont Agency of Transportation updated and developed new pavement performance models using Vermont-specific data to better predict how newer treatments and cracking progress over time, aligning with federal standards. These improved models enable smarter, more cost-effective road maintenance decisions, helping Vermont optimize its $100 million annual pavement budget and improve long-term road quality despite challenging weather conditions.

An example of two models developed under the project (Power Model and Quadratic Model) compared to a pre-existing VTrans model (Current Model). Historical performance data was filtered, and models were regressed using the VTrans model form, which forces an intercept across both axes. The mean squared error (MSE) was reduced for all new models compared to pre-existing ones.

HIGH VALUE RESEARCH

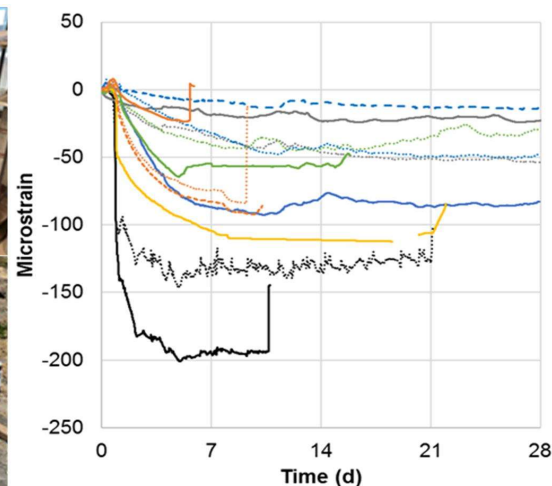## Innovative Techniques and Materials for Preventing Concrete Shrinkage Cracking

This study investigated shrinkage cracking in New Jersey's concrete infrastructure, identifying key shrinkage types and evaluating various mitigation techniques such as shrinkage-reducing admixtures, internal curing, coatings, and fibers, with findings showing that some additives, especially shrinkage-reducing admixtures, effectively reduce cracking without compromising concrete strength. By addressing shrinkage cracking, the research aims to enhance the durability and longevity of transportation infrastructure, ultimately reducing costly repairs and improving bridge performance by limiting water infiltration and structural damage.

Developing a Cross Asset Allocation Mechanism

The Kentucky Transportation Cabinet developed the asset sustainability ratio (ASR) as a robust tool to evaluate and compare the effectiveness of bridge and pavement projects in maintaining network conditions, addressing the need for cross-program performance assessment beyond existing prioritization tools. By implementing this approach—specifically introducing the Bridge Sustainability Ratio (BSR) for bridges—KYTC can make more informed investment decisions, optimizing resource allocation despite budget constraints and improving asset management outcomes.

		Bridges	Pavements	Total
Budget Need for ASR = 1.0 ($M)		$443	$507	$950
Current Funding Level	Anticipated Annual Spending ($M)	$189	$501	$690
	Shortfall	$254	$6	$260
	ASR% Met	43%	99%	73%
Equalize ASR %	Proposed Annual Spending ($M)	$322	$368	$690
	Shortfall	$121	$139	$260
	ASR% Met	73%	73%	73%
Transition to Comparable ASR%	Proposed Annual Spending ($M)	$255	$435	$690
	Shortfall	$188	$72	$260
	ASR% Met	58%	86%	73%

MDOT
MISSISSIPPI DEPARTMENT OF TRANSPORTATION

HONORABLE MENTION

Development of Advanced Landslide Investigation Protocol Using Geophysical Methods for Mississippi

Jackson State University (JSU) used advanced sensing technologies and Vetiver grass planting to monitor and stabilize highway slopes, enabling MDOT to identify failures, measure movement over time, and manage moisture effectively. MDOT has adopted these methods and is working with JSU to develop more affordable sensors and a geotechnical asset management system, which is expected to reduce costs and improve slope monitoring amid challenging soil and weather conditions.
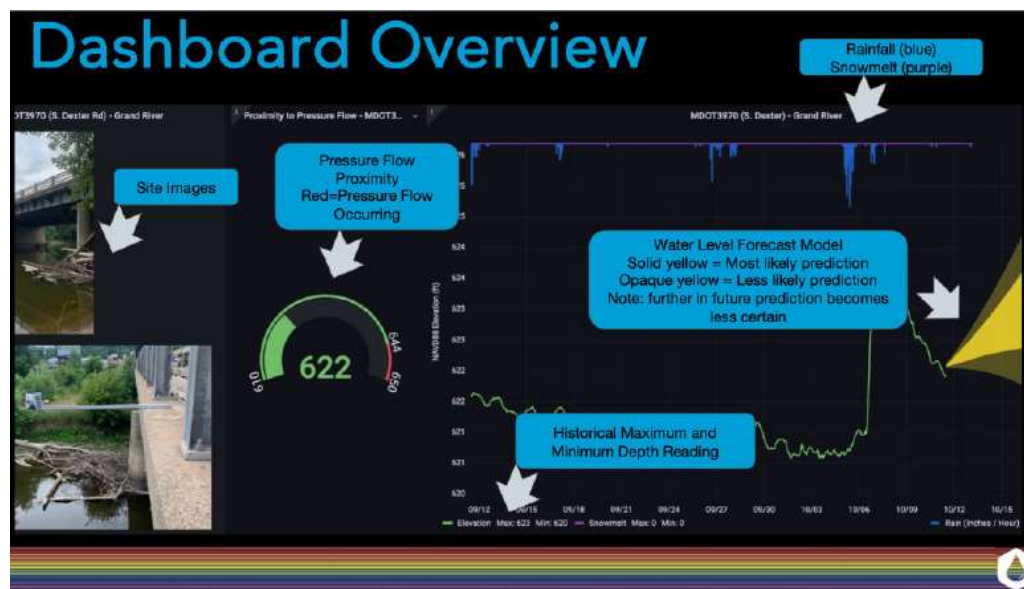
Electronic Water-Level Sensors for Monitoring Scour Critical Structures

This research developed and piloted a cost-effective water level sensor network using Open-Storm sensors on over 30 Michigan bridges, providing real-time data that improved bridge inspection efficiency and decision-making. Based on positive results and user feedback, the project recommends scaling the system statewide and integrating it with existing infrastructure to enhance bridge scour monitoring and management.
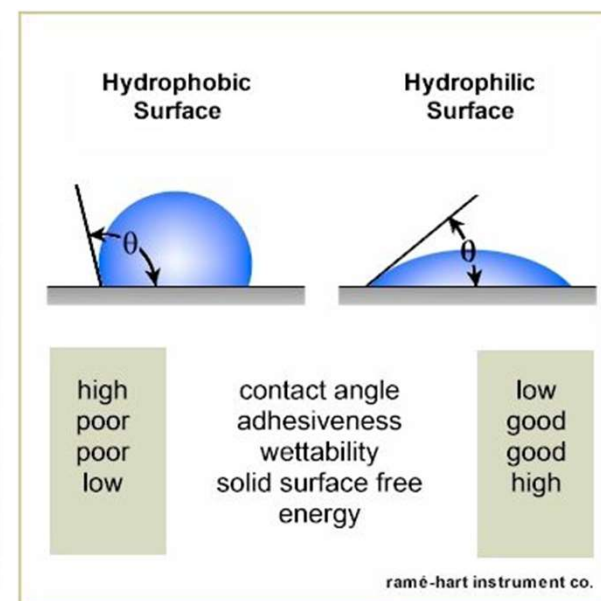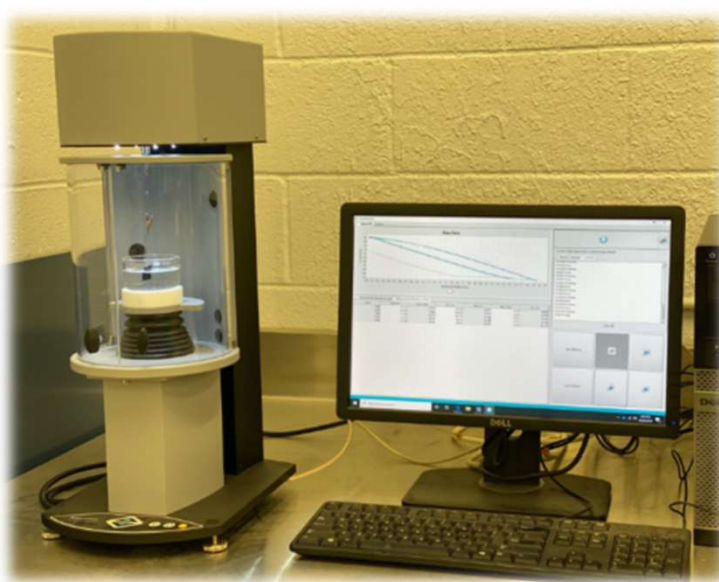
HIGH VALUE RESEARCH

Kansas
AD ASTRA PER ASPERA
Department of Transportation

Development of Test Procedures to Evaluate Moisture Susceptibility of Asphalt Mixtures Used in the State of Kansas, Phase I: Surface Free Energy of Binders

This project evaluated the surface free energy (SFE) of asphalt binders and aggregates to quantify the moisture susceptibility of asphalt mixtures, using methods like the Wilhelmy plate device to measure adhesive bond strength and develop a database of binder SFEs. The research aims to improve moisture damage prediction by providing more fundamental, reliable lab tests as alternatives to traditional mechanical tests, with ongoing work to refine testing methods and expand SFE data for both binders and aggregates.

Hydrophobic Surface		Hydrophilic Surface
high	contact angle	low
poor	adhesiveness	good
poor	wettability	good
low	solid surface free energy	high

ramé-hart instrument co.

HIGH VALUE RESEARCH

NEBRASKA
Good Life. Great Journey.
DEPARTMENT OF TRANSPORTATION

Repair Practices of Damaged Precast/Prestressed Concrete Girders

This research developed a comprehensive repair manual for precast/prestressed concrete bridge girders damaged by over-height vehicle collisions and girder end deterioration, providing damage classification, repair methods, and structural design examples based on AASHTO and ACI standards. Adopted into the NDOT Bridge Design Manual since November 2024, this work offers repair alternatives that help NDOT and contractors make timely, cost-effective decisions, reducing the need for full girder replacements and minimizing traffic disruption.