i-Probe

Economical, rapid, and consistent road condition monitoring with connected vehicles.

Improve quality, safety, and resilience of your road network with more efficient pavement inspections and superior data integrity.

Information Booklet

2025

i-PROBE CONCEPT

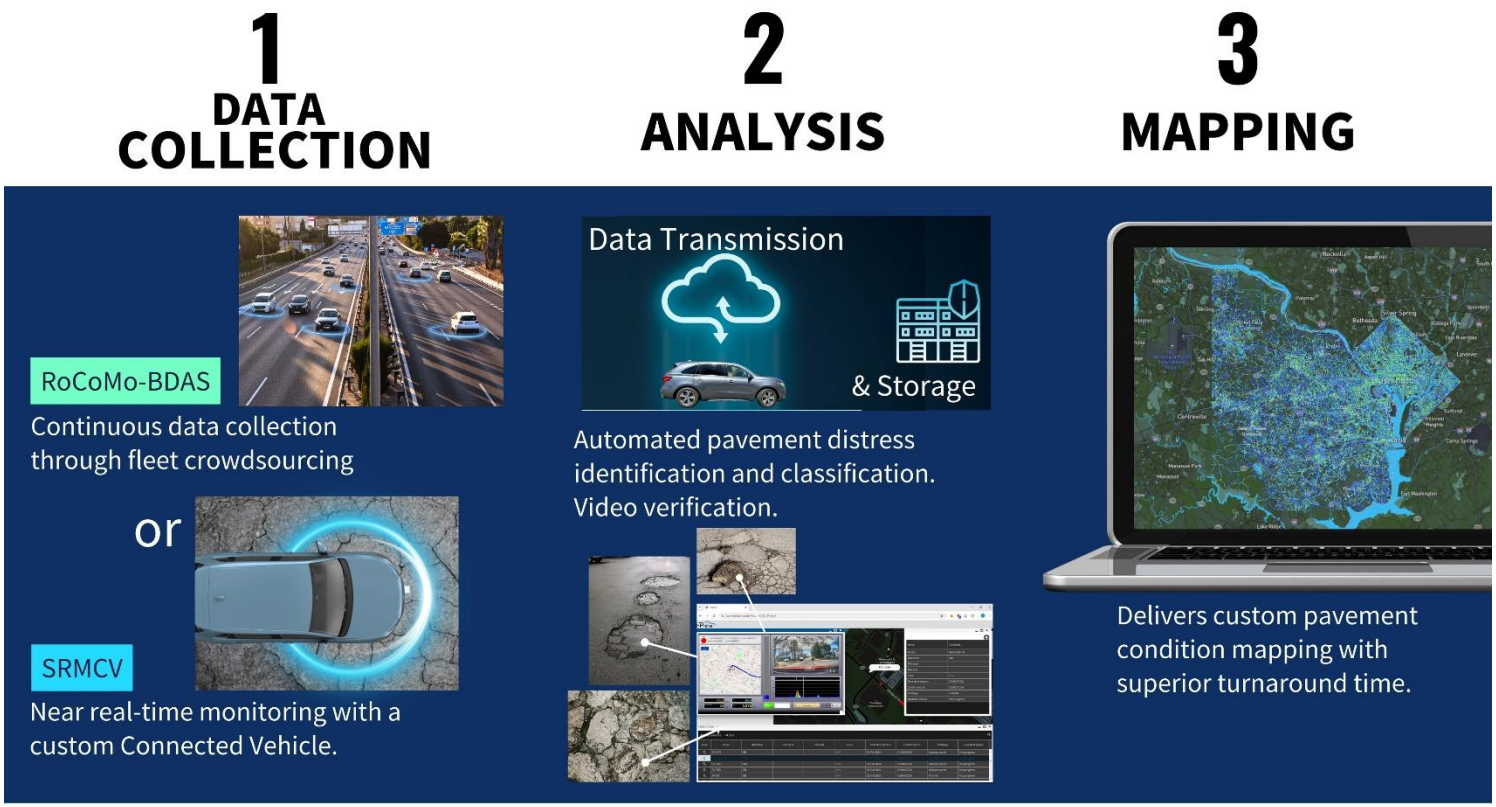
i-Probe is an innovative **data collection system** that enables road management agencies to carry out pavement condition inspections more **economically** and **rapidly**, and with greater **data consistency**.

i-Probe uses **Connected Vehicles** transmitting data in near real-time to capture road roughness, identify pavement distresses, and map these with **faster output turnaround** than traditional methods.

i-Probe technology is designed to take advantage of the **existing sensors** found in late-model production Connected Vehicles without need for aftermarket hardware installation.

i-Probe also leverages **Big Data analytics** to achieve **continuous pavement condition monitoring** of very wide areas using **crowdsourced data** from fleets of Connected Vehicles.

PROCESS



ROAD CONDITION MONITORING BIG DATA ANALYTICS SERVICE (RoCoMo-BDAS)

i-Probe offers data collection through its **Road Condition Monitoring Big Data Analytics Service (RoCoMo-BDAS)**. RoCoMo-BDAS relies on crowdsourcing to continuously monitor road conditions. Road data is harvested from hundreds of thousands of regular road users (Connected Vehicles) which enables rapid monitoring of very wide areas. It also provides access to years of unbroken historical road data.

Wide area coverage
RoCoMo-BDAS lets you capture data from a single corridor to entire regions in an instant. Specify a time period of data capture for more accurate readings or to compare historic data trends.

Consistent and reliable data
RoCoMo-BDAS machine-based detection and algorithms eliminate human subjectivity and error, improving data integrity. RoCoMo-BDAS enables you to gain insight through trends in consistent datasets.

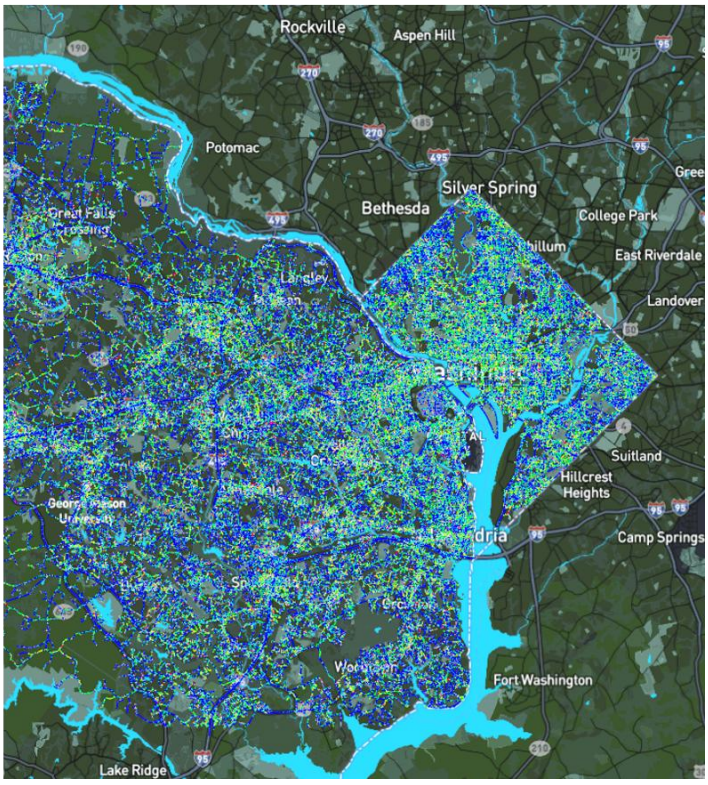
Save time, Save money
Let road users do the inspections for you every day. Reduce costs with corrective and preventive road maintenance powered by continuous road condition monitoring.

Flexible and customizable output
Customizable applications for mapping, database, and reporting. Multi-format exporting of data. To an extent, integration compatibility with various pavement management systems.

Robust data security and privacy
All data collected and transmitted from connected vehicles are protected by UTM security and stored in AWS cloud systems. Identifiable user data undergoes anonymization.

Value-added expert input
i-Probe's in-house team of maintenance engineers and consultants process data and prepare value-added analysis customized for each user.

Road condition mapping on close zoom.



Wide-area mapping.

RoCoMo-BDAS: HOW IT WORKS

POINT 1: A Connected Vehicle (CV) is a vehicle that uses bi-directional vehicle-to-everything (V2X) communication. Some estimates predict that over 90% of cars on the road will be CVs by 2035. Late model production vehicles today are typically CVs, and the number is only increasing.

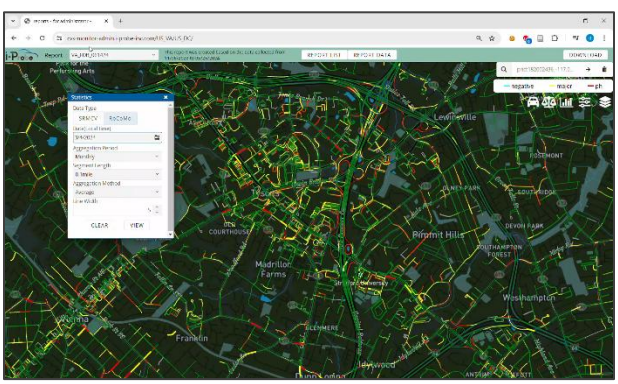
POINT 2: i-Probe enjoys a strategic partnership with Honda Motor Company. Through this partnership, i-Probe has access to its anonymous, secure data on road roughness collected from hundreds of thousands of Honda CVs in the United States. This aggregate raw data can then be analyzed to determine pavement condition insights over any specified time period.

The sensors, such as the accelerometer, equipped in late-model CVs detect road roughness and vibration patterns. These roughness readings, strongly correlated with the industry-standard International Roughness Index (IRI), are then transmitted to a secure cloud server.

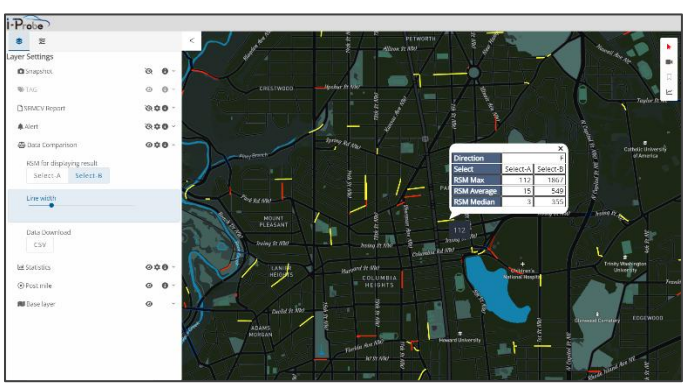
Road roughness data is stored in a secure server, processed, and aggregated. Data captured from the target monitoring area during the specified time period is isolated and extracted for processing. Only anonymized data is used, ensuring complete privacy protection.

i-Probe applies its unique algorithm to the aggregated roughness data to identify pavement distresses, such as potholes, and assess the severity.

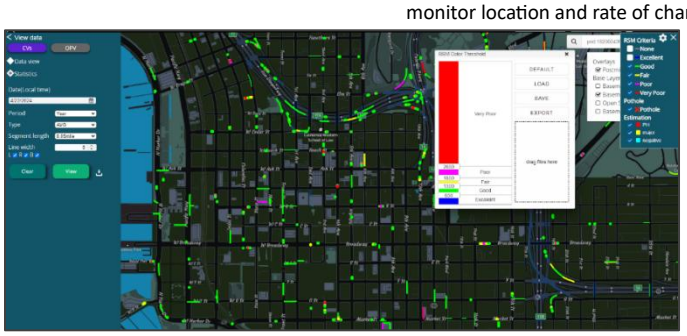
Pavement roughness condition and distress mapping are uploaded to the user side cloud dashboard. The dashboard is equipped with a suite of customizable tools and output methods.



Data outputs can be integrated with various other pavement management systems.



Datasets of separate time periods can be contrasted to isolate and monitor location and rate of changes.



Customizable tools of user side cloud dashboard.

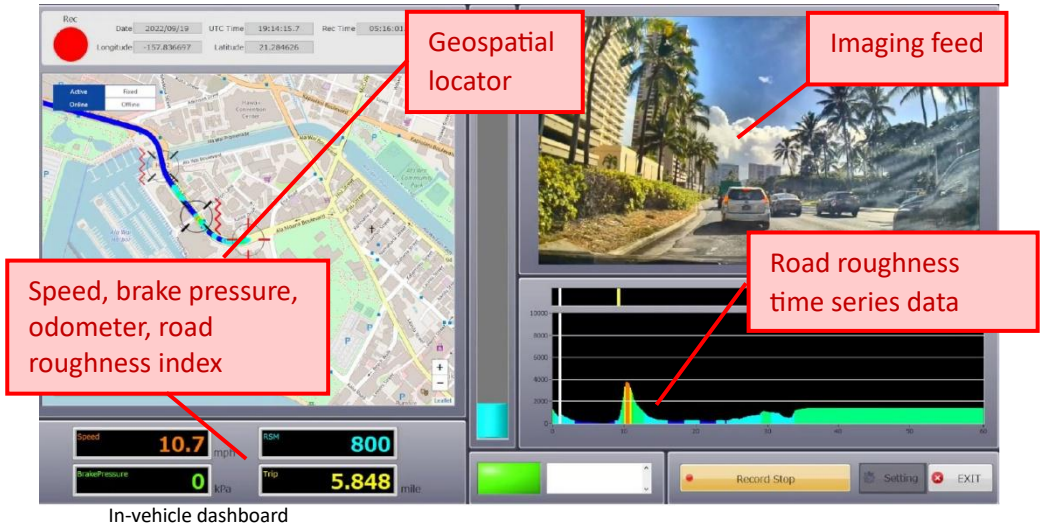
SMART ROAD MONITORING CONNECTED VEHICLE (SRMCV)

RocoMo-BDAS enables road management agencies to manage their entire road networks without having to mobilize a single field inspection team. But there are times when a road agency needs to proactively carry out inspections. For these times, i-Probe offers its **Smart Road Monitoring Connected Vehicle (SRMCV)**.

The SRMCV is a single custom CV equipped with a high-resolution dashboard camera, in-vehicle dashboard, and laptop computer. As with RoCoMo-BDAS, the SRMCV relies only on existing vehicle sensors to collect pavement data which is processed automatically by the same algorithms, and outputs pavement distress mapping via the same user side cloud dashboard.

Dashboard camera

The SRMCV offers the added benefit of high-resolution video logging which is geolocated and integrated with the road condition sensors. Video logs can be used as pavement distress verification or even as supplement to visual (windshield) road inspections.



In-vehicle dashboard

In-vehicle dashboard

SRMCV: BENEFITS & APPLICATIONS

BENEFITS

- Eliminates human bias, omissions, and errors.
- Provides consistency over entire data set. No variations due to inspectors' subjectivity.
- Operable up to 70 mph without losing accuracy.
- Detects pavement distresses almost imperceptible to human eye even at high speeds.
- Vehicle is a regular car, not a specialized truck. No special training or license required to operate.

PRACTICAL APPLICATIONS

Road monitoring during off-cycle periods
Preventive maintenance for periods between inspections.

Systematic basis for decision-making
Quickly verify decisions for capital funding or prioritization.

Rapid-response diagnostic tool
Rapidly assess entire road network after extreme weather, disasters, and unexpected incidences.

Daily / routine inspection tool
A regular car deployed easily. Can combine with other tasks.

i-PROBE SOLUTION

"You cannot manage what you cannot measure." This popular saying underscores the importance of good data. There are various reasons why many road management agencies do not carry out sufficient inspections and data collection. Many share common challenges and constraints. i-Probe offers an alternative and solution to these:

CHALLENGE

Cost related
- Restrictive budget
- Only irregular or ad hoc inspection needed / desired
- Resources prioritized elsewhere

Inspection Capacity related
- Inadequate staff capacity
- Limited technology / equipment
- Limited data management / analysis capability
- Unique inspection needs

External/Environmental related
- Road network too expansive
- Physically difficult road conditions (weather, terrain, etc.)

i-PROBE SOLUTION

- Customizable subscription plans to suit any budget.
- Inspection areas can be updated as needed.
- SRMCV vehicle purchase or lease option allows greater flexibility.

- Can be operated by only 1 staff.
- Simple hardware easily operable.
- Help Desk support, training included.
- Scope of service is customizable based on particular needs.
- Customizable reports highlight priority distresses.

- Wide area scanning capability.
- Crowdsourcing option requires no field inspection deployment.

USE CASES

Ohio Department of Transportation

i-Probe is undertaking a study to pilot its customized inspection vehicle for the Ohio Department of Transportation. During the study led by Honda and in partnership with academia and the private sector, new technology and sensing capabilities of the inspection vehicles are being developed and tested, including image-based detection and analysis for monitoring road striping, signs, guardrails, and more.

State of Hawaii Department of Transportation Ka 'Oihana Alakau

A partnership between i-Probe and HDOT for trialing the capability of its customized inspection vehicles in collecting and analyzing data in a real-world environment, and its instrumentality in supporting HDOT's particular maintenance needs. i-Probe operation was carried out on the islands of Oahu, Hawai'i, and Kauai.

MCDOT Montgomery County Department of Transportation

MCDOT in Maryland is trialing i-Probe's road monitoring technology to enhance pavement management. The pilot evaluates i-Probe's Big Data analytics and custom vehicle service within testing areas throughout the county with the goal of assessing data quality, usability, and integration potential into MCDOT's operations, while also guiding future advancements in i-Probe's technology development.

How much will i-Probe service cost?

i-Probe strives to be an economically viable alternative while providing a highly efficient, rapid and reliable service. i-Probe offers flexible pricing options based on: the size of the road network and length of target routes, number of vehicles (for SRMCV), desired frequency of the data collection and reporting, and information contained in the outputs.

i-Probe offers customizable subscription service plans to suit even constrained budgets while still providing a practical and meaningful level of pavement condition monitoring.

I already have reliable periodic inspections. Why adopt i-Probe?

i-Probe is not intended to replace periodic inspections. i-Probe services are intended to provide rapid diagnostics and verification which can be used in conjunction with periodic inspections to enhance the overall coverage across the entire road network with greater frequency throughout the road inspection cycle.

Many road agencies tend to focus periodic inspections on their main trunk roads while deprioritizing secondary and tertiary roads, some of which may not receive necessary inspections for many years. Some outsourced inspection service costs are prohibitive for repeat service or are financially feasible only every few years. Especially for agencies constrained in resources or monitoring capability, i-Probe offers a means of collecting a lot of data very quickly, systematically, and affordably. i-Probe's service is well-suited for monitoring off-cycle roads or secondary networks not covered in periodic inspections.

i-Probe also benefits road management agencies as a decision-making tool. With its rapid and easy deployment capability and fast turnaround of results, i-Probe makes an excellent verification tool for more informed decision-making and a systematic rationale for the selection of projects.

How is i-Probe different from other road inspection services?

- **EASE**: i-Probe's SRMCV requires only one person to operate the entire data collection system, and no special knowledge, skills, or license are required for the operation. i-Probe's RoCoMo-BDAS service does not require field deployment at all.
- **FLEXIBILITY**: i-Probe is not an outsourcing service, and scanning is not constrained by fixed schedules. The SRMCV is leased to the customer to use at its own convenience. RoCoMo-BDAS is a continuous data subscription that can be accessed anytime from anywhere.
- **SPEED**: i-Probe's turnaround of results after scanning is significantly faster than competition.
- **DATA-DRIVEN**: i-Probe provides you with more complete information for a proactive, data-driven maintenance approach as opposed to a reactive, customer complaint-driven model.

Learn how i-Probe can monitor your road network economically, rapidly, and consistently while addressing your needs.

Contact us today for a trial.

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