

PAVVET

Pavement Analysis Via Vehicle Electronic Telemetry

Smart cities rely on well-maintained multimodal infrastructures to support mobility, safety, and environmental health. Transportation agencies measure ride quality to plan maintenance and to identify unexpected anomalies that could pose serious hazards to road users. However, roadway agencies cannot afford to use existing methods of measuring ride quality to assess all roads continuously. The international roughness index is the prevalent method used to assess and forecast maintenance needs. However, the method precludes direct measurement of roughness, instead relying on a measurement of the elevation profile, and then a simulation that moves a fixed quarter-car model across the profile samples at a precise speed. Consequently, the procedure leads to a misrepresentation of the roughness experienced.

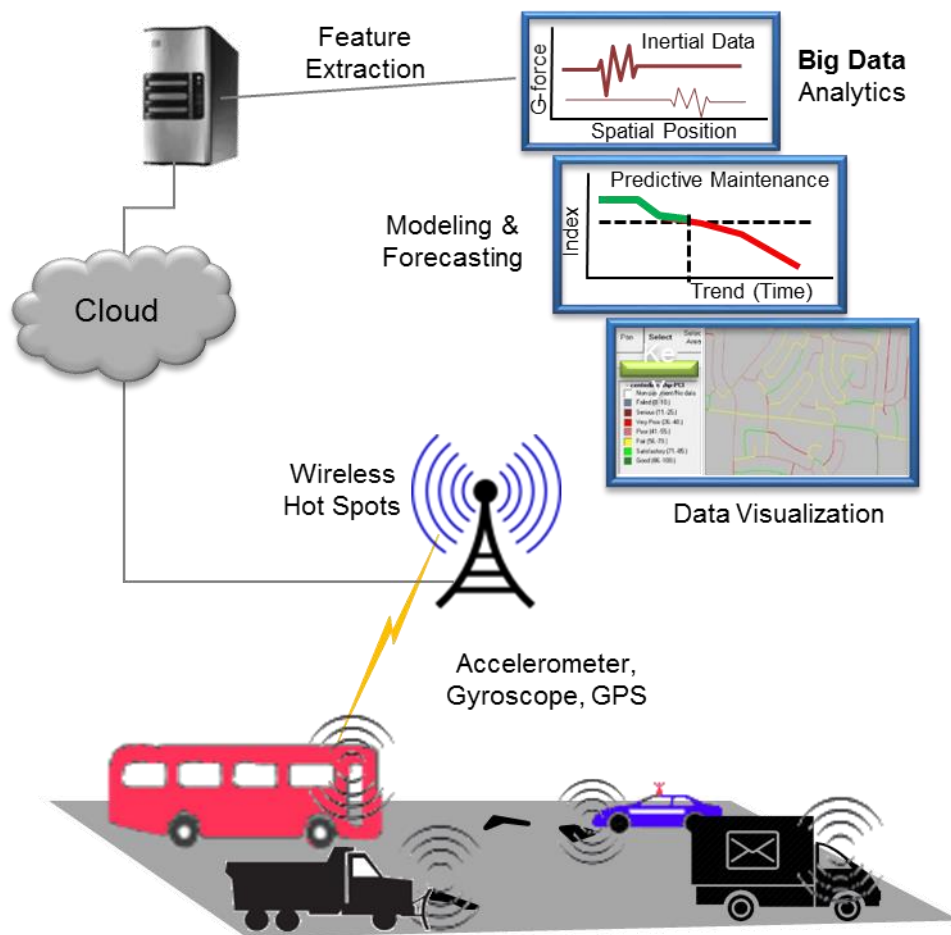


Fig 1. Pavement performance evaluations using connected vehicles.

Proposed Method

We developed a scalable and affordable method to measure ride quality that uses data freely available from connected vehicles. Figure 1 illustrates the overall approach. An algorithm transforms inertial, gyroscopic, velocity, and geospatial position data from many vehicles to summarize ride quality as a single index. The new roughness index is directly proportional to the international roughness index. Therefore, agencies can use the connected vehicle method in conjunction with historical datasets collected using the existing standard. The connected vehicle method also precludes many deficiencies of the existing methods, such as a non-direct measurement procedure and sensitivity to speed variations.

Technology Status

We tested the method successfully with industry partners such as Fugro Roadware, Inc. who are currently leaders in the field of roughness profiling services. Together, we conducted many tests on different pavement types, including those at the MnROAD facilities in Minnesota. Numerous journal articles and conference papers explain the technical details. The technology is ready for transfer to practice. At this time, we are inviting partners to:

- Integrate the algorithms into existing maintenance decision-support platforms.
- Begin the standardization process for data exchanges and data processing.
- Develop application extensions such as pavement deterioration forecasting.



Courtesy: MnROAD, Minnesota

Team Capabilities

The PI has more than 20 years of private sector experience developing wireless sensors and mobile computing products to enhance supply chain efficiencies, and to secure physical infrastructures. His qualifications include more than 140 U.S. patents issued or pending, more than 70 peer-reviewed articles, Bachelors' and Master's degrees in electrical engineering, and a Ph.D. in transportation and logistics. He leads a team of transportation research scientists and graduate students to explore application extensions of the technology.

Research Services

Our agile and responsive team is ready to work with clients on the technology transfer and standardization processes. The team has signal processing, data mining, and software development skills to extend the new methods for other applications in **smart city** developments. Our clients will have access to our exceptional liaison capabilities that are highly regarded by many state and federal agencies, and an extensible framework for future research and development.