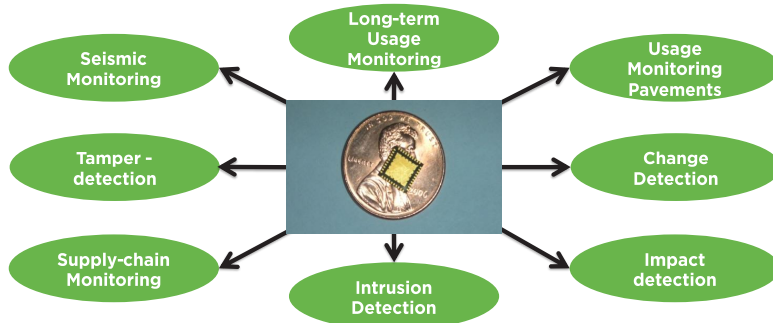


SMART HIGHWAY INFRASTRUCTURE

Michigan State University's Piezo-Floating-Gate (PFG) technology, or self-prognosticate sensors, are the future of construction and infrastructure to help increase road safety and efficiency through smart diagnostics. The sensors are designed to provide real-time detection of structural changes, damage and mechanical failure, including wear-and-tear (such as loose bolts on bridges), to avoid catastrophic failures. They also provide immediate post-disaster analytics to help assess structural damage to inform rapid and targeted response.

PFG technology: one sensor, many applications



Large-Scale Testing: Mackinac Bridge, Mich.

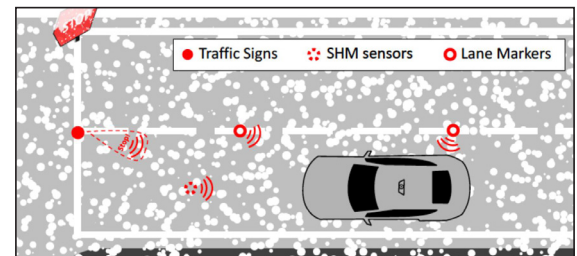
MSU PFG sensors were deployed on the Mackinac Bridge in 2016 as part of a demonstration project for the U.S. Federal Highway Administration to monitor the condition of the structure over time.



- **Self-powered, battery-free sensors** that harvest energy from vibrations (80nW power consumption)
- **Sensitive for early damage detection**, identifying tiny cracks in bridges and pavements (less than .5 inch)
- **Economical for mass production** with each unit costing less than 1 percent of competitive sensors (projected to be under \$10, per sensor)
- **Versatile technology** designed to be embedded in existing or new infrastructure
- **Compact size (approx. 1 cm x 1 cm)**, allowing for deployment of a dense network of sensors in damage-sensitive areas

Wireless infrastructure-to-everything and vehicle-to-everything communication for:

- **Autonomous computation and non-volatile storage** of sensing variables
- **Real-time decision making** for traffic management, including signal control and automatic re-routing for safety and efficiency
- **Collecting robust data** to inform traffic planning and optimization



Embedded pavement sensors can alert vehicles to road conditions and aid navigation even when road markers aren't visible.



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