FALKEN Secure Networks

RFID for Roads and Bridges

How Safe Is This Bridge?

If Bridges Could Talk…

Wireless monitoring of bridges and overpasses has gained much attention in the past few years. Bridge collapses happen suddenly and unpredictably, often leading to tragic loss of human life. In 2006, the US Federal Highway Administration listed 25.8 percent of the nation's 596,842 bridges as either structurally deficient or functionally obsolete. While many of these bridges will remain in service for years, they need monitoring and rehabilitation. Currently, bridge monitoring is performed through periodic visual inspections. In the tragic example of I-35W Mississippi River bridge collapse, the bridge passed a visual inspection a year prior to failure.

Regretably, there is no shortage of danger signals for our aging infrastructure. In November 2007, the Federation of Canadian Municipalities (FCM) and the Residential & Civil Construction Alliance of Ontario (RCCAO) released reports on the state of municipal infrastructure. The report, *Danger Ahead: The Coming Collapse of Canada's Municipal Infrastructure*, says that close to 80 percent of Canada's infrastructure is past its service life. It sets the price for repairing the municipal infrastructure at $123 billion. Also in those reports, *Ontario's Bridges: Bridging The Gap*, which states that the integrity of Ontario's municipal bridge infrastructure can no longer be assured. The report indicates that public safety is potentially at risk due to deferred maintenance, irregular inspections and lack of government oversight. In May 2008, *Transports Québec* closed the Jacques-Cartier Bridge in Sherbrooke to all traffic after finding a second crack in the structure. The Deputy-Mayor of Saint John has raised concerns over the safety of the city's Harbour Bridge, saying the current state of the bridge is close to those that have recently collapsed in the United States.

Main Cantilever Span of the Jacques-Cartier Bridge

Regulations proposed by Transport Canada in 2008 would apply to the owners of Canada's 24 vehicular international bridges and tunnels, and put into place requirements concerning reporting and scheduled inspections and structure safety. The regulations would also require reports every two years on maintenance and operations, including frequency and type of major maintenance performed, inspection results, the type of vehicles permitted, any restrictions placed on them, and the identification of any necessary actions to ensure the structures are kept in good condition. Canada's Government has identified transportation infrastructure improvements, including roads and bridges, as a priority for funding under its Building Canada infrastructure plan," said Brian Jean, Parliamentary Secretary to the Minister of Transport, Infrastructure and Communities.

By monitoring changes in vibrations of bridges it is possible to identify hidden cracks and fractures, according to bridge engineers.
It's not always possible to see damage to a bridge, but using vibrations it is possible to 'see' what can't be seen. Changes in the physical properties of a structure, such as cracks and fractures in a bridge, will cause changes in its vibration. By monitoring these vibrations it is possible to detect any changes which may indicate bridge damage. Continuously monitoring the health of bridges will enable the early identification of distress and allow appropriate retrofitting in order to avoid bridge failure or collapse.

Strain gauges are widely used and have been available for many years. Typically, the strain gauge is bonded to a rigid structure, and when a force acts upon the structure, the strain gauge changes resistance. Strain gauge sensors are commonly used for both force and pressure measurement. More recently, monolithic resistive bridge sensors have become commercially available as integrated circuits. The bridge circuit is constructed on a silicon die. When a force is exerted on the die, the resistance changes.

The wireless , solar-powered sensors now available can provide data on strain, seismic activity and vibrations on bridges, eliminating the need to manually replace batteries once the sensors are installed in hard-to-access places. Such systems have already been deployed on the Corinth Canal Bridge in Greece, and on the Goldstar Bridge in New London, Connecticut.

The solar-power feature integrated with RFID greatly expands what can be done with monitoring, since sensors can now be positioned where you cannot get at them readily and no longer have to run a wire to them, or change batteries.

Systems are also available which preserve battery life by entering a low power sleep state. The node periodically awakens and listens for commands, or wakes via event-triggered interrupt. Such a system was installed on a heavily trafficked bridge in Vermont. Displacement sensors were attached to steel girders for static and dynamic strain measurement. Strain data were acquired via an integrated wireless link. The wireless system is designed to remain long term on the bridge for interrogation under normal and controlled operating conditions as well as providing event-driven data streams.

For new bridge construction, strain-sensing systems using 13.56MHz passive-type sensor- integrated RFID have been developed in Japan which are imbedded in the concrete structure when built. The system, measures the changes and deformation caused by various types of deterioration and loading on the structure.

RFID-enabled systems from FALKEN Secure Networks provide efficient maintenance and management of roads, bridges and public housing. Any concrete and steel structure can be continuously and effectively monitored for structural health due to everyday traffic, wind and earth pressure and earthquakes. Investment in RFID-enabled systems can be further leveraged to provide vehicle traffic movement and volume data as well as cost effective conversions to a toll tracking capability . The ALE-compliant RFID middleware can discriminate among different events such as normal traffic condition, congestion, and accidents, thereby enhancing traffic safety management.

FALKEN Secure Networks(FSN)—Your partner for RFID automation

If you choose to pursue RFID implementation in your organization, here is the FALKEN Secure Networks commitment to you:

- FSN will provide solution architects to work with you to define system requirements for your particular installation. Multiple locations can be networked together for a central and real-time view and centralized management.
- FSN will do a RFID site survey to validate radio frequencies, tag types, system design and performance
- FSN will provide all necessary hardware and software to make the system work for you
- FSN will integrate the system with your existing enterprise management software
- FSN will provide documentation for the system, including operating procedures
- FSN will train your people
- FSN will provide warranty and continued system support

For RFID-enabled Document Tracking and Management, FALKEN Secure Networks (FSN) and partners bring together the right technologies to give you control over your files and make your office run more efficiently. Our automated and secure processes save time and labor, and prevent problems before they occur. With FSN ,you get the latest, non-proprietary secure RFID technology with the most powerful and flexible RFID file tracking software available.

Contact Us

FALKEN Secure Networks is a specialized System Integrator, RFID Solution Architect, and Value-Added Reseller with focused expertise in the RFID site survey, cost-effective design, and turn-key project implementation.

Contact FSN at sales@falkensecurenetworks.com

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