Monitoring the Structural Health of Bridges

MicroStrain Wireless Systems and Smart Bridges

Benefits

- Easy Retrofit on active bridges
- Long-term monitoring to track and extend bridge life.
- Reduce inspection costs
- Optimize Maintenance
- Reduce traffic closures
- Real-time remote view of infrastructure
- Custom alerts.

One in four bridges in the United States are either structurally deficient or functionally obsolete. Unique traffic loads, environmental conditions and seismic events can exert undesirable stresses on structures such as highway bridges. BridgeComposites, LLC of Hornell, NY uses a LORD MicroStrain wireless bridge monitoring system to evaluate seismic isolation bearings. A network of low-power wireless sensor nodes supply continuous synchronized performance and environmental data to engineers in real-time. Remote, cloud-based data visualization and analytic tools on MicroStrain's SensorCloud enable BridgeComposites and researchers to more efficiently and cost-effectively characterize the long-term performance of bridge components.

Scalable Networks and Rapid Installations Quantifying bridge performance requires a distributed network of monitoring capabilities. However, installing conventional hardwired solutions pose numerous cost, labor and logistical barriers to achieve adequate scale. LORD MicroStrain's wireless solution drastically reduces time and disruption associated with hardwired installations, while preserving synchronized high-speed data across any length bridge.

In a matter of hours, a team of two engineers fully deployed the wireless bridge monitoring network. The network was comprised of seven wireless sensor nodes including: two G-Link® acceleration nodes, two DVRT® linear displacement transducers, two TC-Link® temperature nodes, and an SG-Link ® strain node. Lossless, extended range, synchronized sampling ensured reliable data communication in a ferrous environment. Advanced energy management protocols and energy harvesting promise multi-year operation without battery replacement.

MicroStrain Wireless Application: Bridge Health

WSDA-1000 Wireless Sensor Data Aggregator in an environmental enclosure, with solar array.

Each sensor records a specific measurement that captures the in-service behavior of the bearings. Accelerometers continuously sample bridge vibration at 16Hz. Collected data allows researchers to determine the ability of new bearings to accommodate normal stresses but also to prevent damage from potential ground motion. Linear motion sensors installed on two different bearings measure the longitudinal movement of the bridge through thermal cycles. A strain gauge was mounted to an end diaphragm beam to measure forces that might be experienced during a seismic event.

Unlimited Bridge Performance Data on SensorCloud MicroStrain's web-enabled WSDA®-1000 gateway aggregated time-stamped data at user configurable rates from across the network. Data was communicated via cellular modem to SensorCloud, where BridgeComposites could view and share data with the bridge owner and collaborators. Furthermore, users can create threshold alerts that automatically send email or text notifications when a pre-determined condition is exceeded.

G-Link wireless accelerometer, SG Link wireless strain gauge, and DVRT linear displacement sensor monitor seismic isolation bearing.

According to BridgeComposites President, Jerome O'Connor, "While the system records data under an infrequent extreme event such as an earthquake, BridgeComposites is also able to quantitatively assess bearing performance remotely in real-time. Specifically, capturing the bearings behavior under traffic loading and changing environmental conditions enabled our engineers to observe response under actual service conditions."

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