

Sentinel AI™

Structural Health Monitoring for Bridges

StructureIQ



APPLICATION NOTE

From Reactive Inspection to Continuous Condition Intelligence

StructureIQ's Bridge Monitoring Application

Bridge infrastructure accumulates stress and fatigue across its entire service life from daily traffic cycles, overweight vehicle crossings, seismic activity, and extreme weather events. From aging highway spans to critical port and waterway crossings, the structural degradation that threatens bridge integrity develops gradually and silently across girders, bearings, piers, foundations, and deck connections -- in locations that traditional periodic inspection cannot reliably assess between visits. For bridge owners, transportation agencies, and infrastructure operators, the consequences of undetected structural deterioration are severe: accelerated degradation, unplanned closures, costly emergency inspections, and safety liability that grows with every missed anomaly.

StructureIQ deploys wireless Xnode accelerometers across the full bridge structure -- deck spans, girders, pier caps, bearing assemblies, and abutments -- capturing continuous dynamic response data and delivering real-time structural condition intelligence through Sentinel AI, its secure cloud-based SaaS platform.

Sentinel AI™



Key Highlights

- **Continuous Bridge Health Monitoring:** 24/7 real-time structural condition visibility across the full service life.
- **AI-Powered Anomaly Detection:** Sentinel AI flags fatigue accumulation, bearing degradation, and structural response changes that visual inspections miss.
- **Automated Event Alerts:** Immediate notifications for vessel strikes, overweight crossings, seismic events, or any threshold breach.
- **Condition-Based Inspection Scheduling:** Objective data replaces fixed inspection intervals, directing resources where risk is elevated.
- **Defensible Integrity Assessments:** Continuous structural records support fast, evidence-based decisions on maintenance, load rating, and remaining service life.

APPLICATION NOTE: StructureIQ AI powered SHM Service

Sentinel AI - SaaS Architecture

Xnode Wireless Smart Sensors

StructureIQ's wireless smart sensors provide real-time structural health monitoring by precisely measuring vibration and tilt. These ruggedized devices utilize onboard edge AI to filter raw data, identifying critical events. Data is transmitted via low-power protocols to a wireless gateway, eliminating the need for invasive and costly cabling across infrastructure.

Gateway and Cellular data

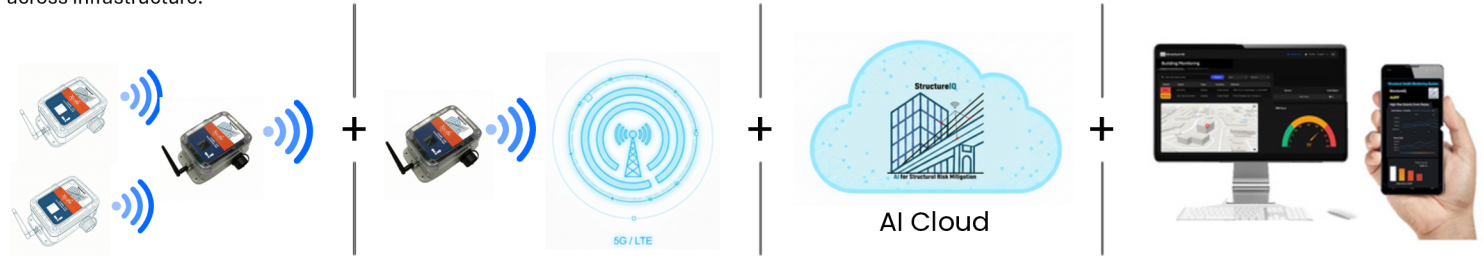
The StructureIQ Gateway acts as a secure bridge, collecting high-precision vibration and tilt data from wireless sensors via low-power protocols. After local verification and edge buffering, the gateway utilizes an encrypted 4G LTE/5G cellular uplink to transmit data through a private APN, ensuring cybersecurity.

AI Cloud Data Analysis

In the StructureIQ Data Cloud, AI algorithms de-serialize and normalize this time-series data. The engine then performs automated feature extraction to distinguish routine environmental noise from critical structural anomalies.

SaaS delivery

Insights generate real-time risk profiles and alerts delivered directly to the secure Sentinel AI SaaS dashboard for engineering and insurance assessment. The Structural Condition Index (SCI) score provides a single composite health metric per asset.



Core Capabilities

- Wireless smart sensor deployment – Rapid installation with minimal disruption
- Automated anomaly detection – Identifies deviations from established baselines
- Post-event structural assessment – Faster safety and occupancy decisions
- Secure cloud-based dashboard – Remote visibility anytime
- Secure SaaS delivery (no client IT infrastructure required)
- Scalable from single building to enterprise portfolio
- Subscription-based SaaS service model

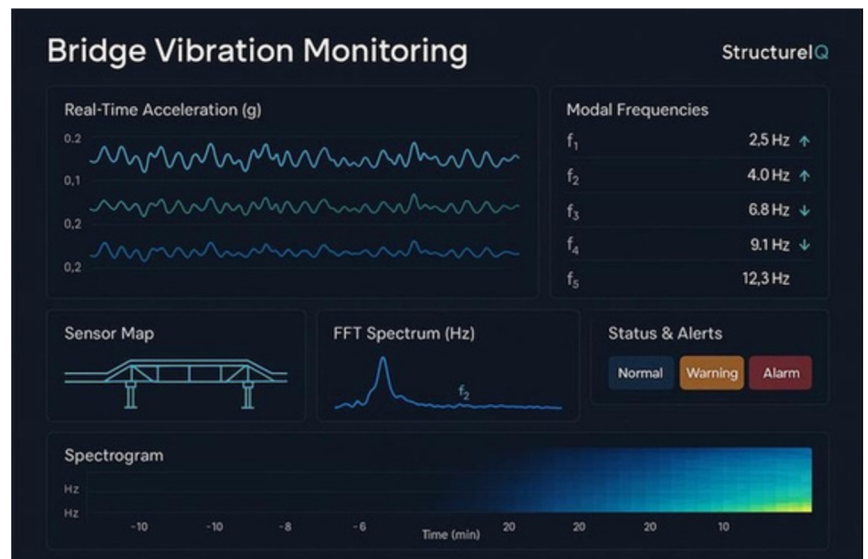
What Gets Monitored

- Vibration (Acceleration), Temperature
- Tilt – Settlement, drift, structural movement
- Impact Detection – Ship/Vehicle strikes
- Trends – Deterioration and performance shifts

SaaS Features

- Real-time alerts (SMS, email, dashboard)
- Automated event reports
- Structural health scoring
- Multi-asset portfolio dashboard

Dashboard



Sensor configurations shown are illustrative of monitored parameters; actual deployment specifications can be different.

