

## Application of a Real Time Structural Health Monitoring (SHM) System for Bridges

### Powerful benefits of real time SHM:

- Delivers important data to key users permitting informed decision making and effective emergency response
- Compares daily/weekly/monthly snapshots of a structure's evolution
- Analyzes cumulative effects of structural performance due to extreme events
- Supplies critical bridge performance information needed by structural engineers to return the bridge to operation
- Creates a knowledge-base that can serve as the foundation for bridge engineering construction for the future

### Digitex's state-of-the-art SHM system for bridges facilitates rapid assessment of structural integrity

The 2007 bridge collapse in Minneapolis was a tragic example of the dangers of aging infrastructure, heavy traffic usage and irregular inspection practices. Unfortunately, the bridge that collapsed on I-35 was not an anomaly. With more than 500,000 bridges in the United States alone and many more in the world, a booming population and a non-standardized system of visual inspections, it is only a matter of time before the catastrophe is repeated. Existing infrastructures in North America and Europe are rapidly approaching the end of their design service life. According to ASCE 2017 infrastructure report card, nearly 10% of bridges (about 56,000 bridges) in the United States only have some sort of structural deficiency, which makes them vulnerable. The situation in Europe is no better. Only in Germany from the total of about 39,000 bridges it is estimated that around 11% are structurally deficient.

In order to get out in front of the bridge deterioration curve and stay there, governmental agencies and civil engineers need a technological solution that helps them both ensure the safety, reliability and security of the nation's bridges, as well as design and develop the next generation of bridges.

We're proud to say that we have a solution for both critical needs. Based on many years of experience in the field and real time communications software, Digitex designed and developed real time structural health monitoring system (SHM). Our system is real time solution that monitors multiple locations on a bridge, analyses data and responds immediately, and archives and distributes centralized data.



xWave



xStrain



xAlarm



xGeo



xSense



xMet



Typical example: An 1850m cable-suspension bridge spanning a critical harbor in Southern California. 26 strong motion accelerometers mounted on the bridge deck and base. Data monitored in real time in multiple locations.



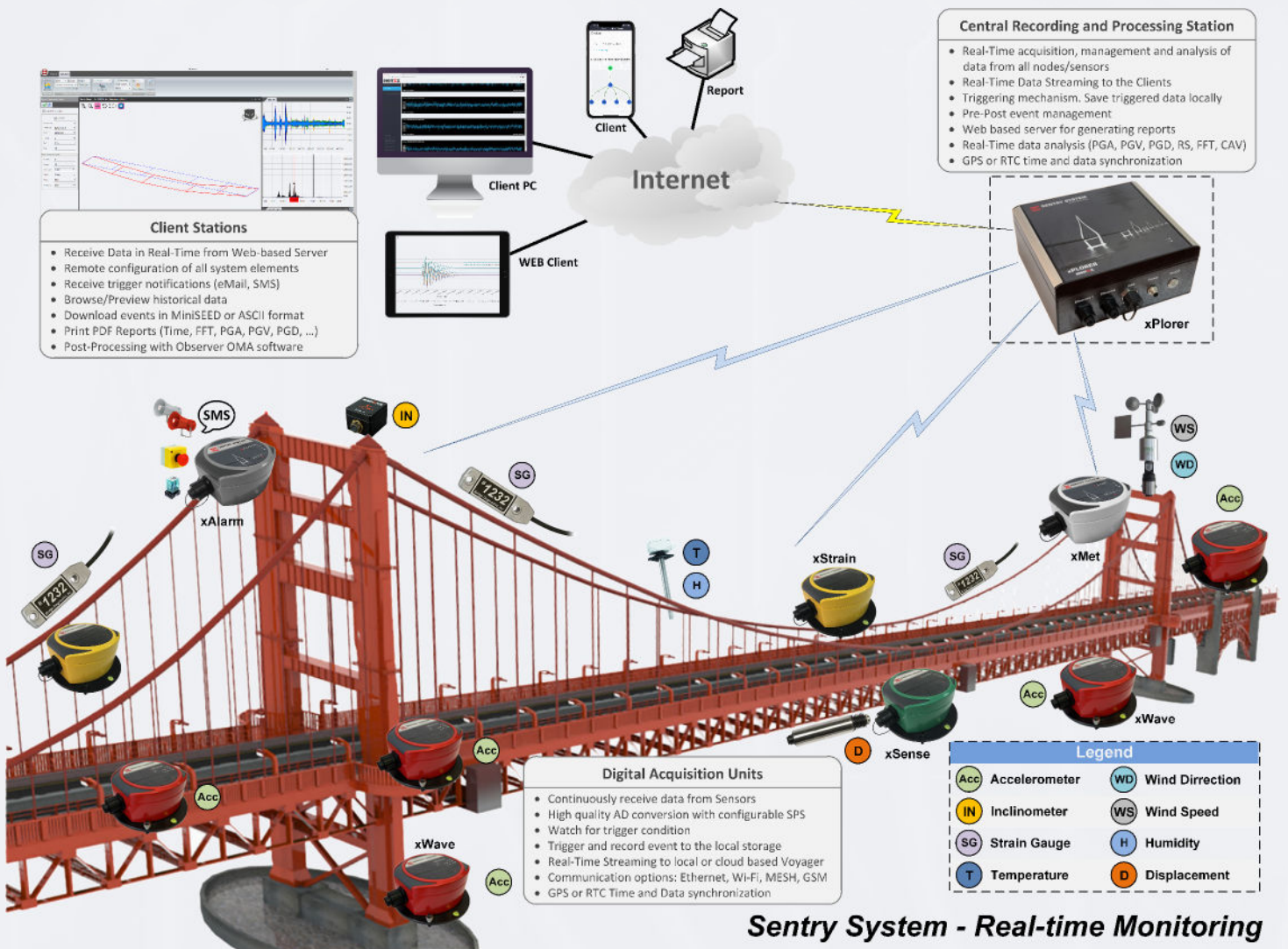
Sensors: Digitex's robust system can work with virtually all types and brands of new and existing sensors including ones for: acceleration, displacement, strain, wind and temperature.

## Real Time Monitoring System Architecture

The Digitex monitoring system is based on a highly efficient, multithreaded software design that allows the system to acquire data from a large number of channels, monitor and condition this data, and distribute it, in real time, over the Internet to multiple remote locations.

Sensors on the bridge continuously send out data to the system. If an event such as an earthquake occurs, pre-assigned thresholds of drift are exceeded in one or multiple locations, thus triggering the recording and analysing of data (including pre-event memory). Once an event is recorded, the system notifies a list of users (via e-mail or SMS) and uploads the event to secure cloud location. Data are then stored to local database and appropriate PDF report is available for remote viewing via WEB site. Also, the user has the possibility to remotely (via WEB site) schedule On-Demand recording and check the health of the bridge.

Using the "quick analysis" capability of the Digitex system, various measures of the monitored system's response can be distributed to multiple locations and displayed in real time. The system can cross correlate data from the base and the deck, plotting useful information about the interaction between the dynamic loads on the bridge and its modal characteristics. It can be used for a rapid (rough) estimation of the dominant bridge mode being observed in the selected time window, as well as an estimator of the corresponding bridge damping parameters.



## Sentry System - Real-time Monitoring

### About Digitex

Digitex is a company specialized in design and development of real time structural health monitoring systems for a variety of industries and applications including: bridges, tall buildings, campuses, windmills, oil rigs and more. Digitex's innovative solution for ambient vibration measurements and quick health assessment of structures is jointly developed and validated with our partners and advisors from the Universities. When properly configured, the Digitex system is capable of measuring and responding to both natural and man-made events such as: earthquakes, wind, explosions and accidental heavy impacts.

Rev 03/22