

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

Vincent Thomas Bridge: Los Angeles

Completed in 1963, the Vincent Thomas Bridge (VTB) was the first bridge of its kind to be constructed on pilings. A cable-suspension bridge spanning some 1850m, the VTB crosses the Los Angeles Harbor and links San Pedro with Terminal Island. The bridge was in need of sophisticated structural health monitoring and damage detection due to the high volume of traffic and the bridge's potential vulnerability to earthquakes and terrorism.

In 2003, Digitexx, in close cooperation with the bridge owner, a university research team, and a government agency, designed and installed a 26-channel, 16 bit system capable of complex structural health monitoring with data distributed to three different remote locations over the Internet—in real time. The system was in use continuously until 2006, during which time the system provided a wealth of data.

Digitexx is the leading real time solution that monitors multiple locations, analyzes and responds immediately, and archives and distributes centralized data.

Sixteen sensors (strong motion accelerometers) mounted on the bridge deck and ten sensors at its base had been installed during a seismic upgrading project in 1980. Digitexx's robust system can work with a variety of new or existing sensors. The system was connected to a commercial DSL phone line costing less than \$100 per month.



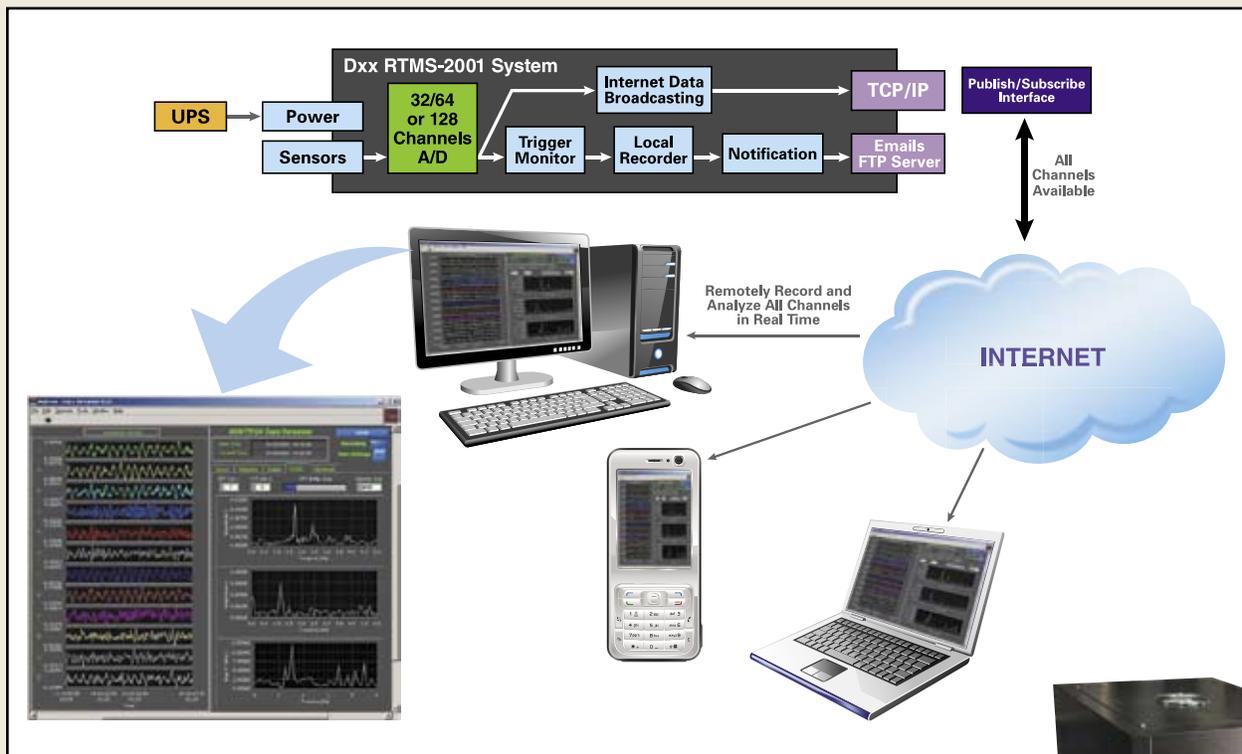


Real Time Monitoring System Architecture

The Digitexx 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 analyzing of data (including pre-event memory). Once an event is recorded, the system notifies a list of users (via e-mail) and uploads the event via FTP to another site.

Using the "quick analysis" capability of the Digitexx system, various measures of the monitored system's response can be distributed to multiple locations and displayed in real time. As an example, the Vincent Thomas Bridge system cross correlates 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.



About Digitexx

Founded in 2000, Digitexx was the first company in the industry to develop real time structural health monitoring systems for a variety of industries and applications including: bridges, tall buildings, campuses, windmills, oil rigs and more. Digitexx's innovative earthquake damage detection and locational algorithm system for tall buildings is jointly patented with Caltech. When properly configured, the Digitexx system is capable of measuring and responding to both natural and man-made events such as: earthquakes, wind, explosions and accidental heavy impacts.

