

## Application of a Real-Time Structural Health Monitoring (SHM) System for a High-Speed Railway Tunnel and Bridge System



### 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

## ERGOSE: Greece

**E**RGOSE is a subsidiary of the Hellenic Railways Organization. Tasked with the design, planning and construction of the Greek railway modernization investment program, ERGOSE recently completed a number of critical railway infrastructure projects including a high-speed railway line between Tithorea and Domokos. A substantial part of ERGOSE's construction projects are in areas with difficult geomorphological and geotechnical conditions including about 80km of tunnels.

In 2008, ERGOSE contracted Digitexx to design and install multi-channel, 24-bit

RTMS-2001 systems capable of complex structural health monitoring for multiple bridges with data distributed to remote locations over the Internet in real-time. The project incorporates wind and temperature monitoring, position transducers and 3G/GPRS wireless Internet connections.

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Digitexx is the pioneer in real-time structural health monitoring. The Internet-based system remotely monitors, analyzes, distributes and archives data and information in multiple locations concurrently.

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The Greek company, MICHANIKI SA is the contractor of the five bridges where the Digitexx System will be installed. The photo shows one of the longest and tallest bridges under construction. Completion is expected in the months to come. Installation and commissioning will be performed by special crews supported by Neotek, Greece and Digitexx, Skopje.

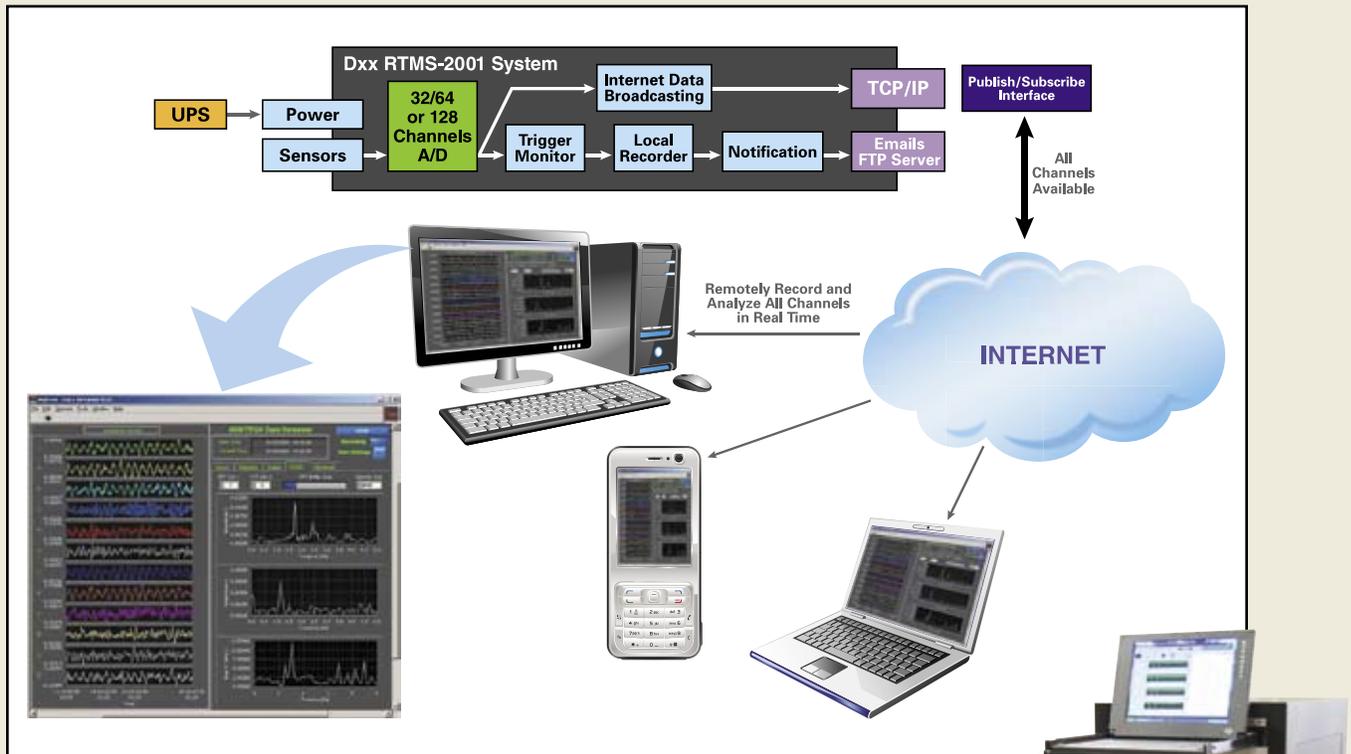


## Real-Time Monitoring System Architecture

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 various bridges and tunnels continuously send out analog data to the system. If an event such as an earthquake occurs, pre-assigned thresholds of acceleration 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. The ERGOSE system plots useful information about the interaction between the dynamic loads on the bridges and their modal characteristics. It can be used for a rapid (rough) estimation of the dominant bridge modes being observed in the selected time window, as well as estimate 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.