

Background

Regarding to the new earthquake regulations in Turkey, high-rise buildings (higher than 105 meters or having more than 35 floors) should be monitored using low-noise seismic accelerometers.

Buildings of this class is mostly concentrated in Istanbul which is located on an area of high seismicity where small earthquakes are frequent. According to the recent scientific studies, a strong earthquake is probably Istanbul's greatest natural disaster. Although the new high-rise buildings have been built to withstand an earthquake when it happens, high-rise buildings are still at risk.

Challenge

The challenge was to supply and install a real-time structural health monitoring system – in compliance with the new regulations – to monitor and record seismic vibrations of two high-rise structures in Istanbul.

Real-time structural health monitoring is one of the cutting-edge technologies which brings unprecedented results. *Structural health monitoring* means continuous or intermittent monitoring and analysis of important parameters which are considered as indicators. These parameters include cracks, strains, tilts and other static variables.

Solution

Teknik Destek Grubu (TDG) was assigned to set up a real-time structural health monitoring system inside of the two high-rise structures.

The solution consists of two **TESTBOX-2010** seismic digitizers to be installed and set to record the structures' motions (one for each structure).

High-sensitivity strong motion accelerometers **MTSS-1031A** and **MTSS-1033A** were placed at specific locations and connected to the digitizers. These sensors are manufactured by R-sensors, a Russian manufacturer of seismic instruments based on the molecular-electronic technology. The accelerometers make it possible to measure a dynamic behavior of the structure in a real-time manner.

8 axes of accelerometers totally were installed at the basement and the on top floors for each structure. Having a 130 dB dynamic range, MTSS-103x series accelerometers provide an excellent self-noise level which allows the sensing of vibrations at micro-g level.



MTSS-1033A accelerometers (R-sensors) connected to TESTBOX-2010 digitizer (TDG)



Some high-rise buildings in Istanbul



TDG site installation team

Each accelerometer is connected by wire to the TESTBOX-2010 digitizers which provide power to the accelerometers and digitize signals with a 24-bit resolution.

The data record & analysis software used in this case was MONSTER (Monitoring of Structures in Real Time) which is a special monitoring software developed by TDG.

The MONSTER software is configured to record vibration data at certain time intervals and trigger levels as well as record the frequency response of the structures at certain intervals. The data is then sent to TDG's innovative 'Monitoring Center' where more advanced analysis can be made to obtain periodic reports.

This type of system is used not only against earthquakes but also against other loads such as aging, deep excavations, explosions and natural disasters such as floods and excessive snow burdens.

Products used for the solution

Seismic accelerometers [MTSS-1031A](#), [MTSS-1033A](#)
Seismic digitizers [TESTBOX 2010](#)
Software [MONSTER](#)

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