EEW Implementation into Critical Infrastructures

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In FP7 MARsite project WP9, the integration algorithm of existing strong motion networks with the critical infrastructures strong motion networks have been studied. In Istanbul, the existing Istanbul Earthquake Early Warning (IEEW) strong motion network consists of 15 stations including 10 on land and 5 ocean bottom stations. The system provides continuous online data and earthquake early warning alert depending on the exceedance of the threshold levels in ground motion acceleration in certain number of station within the certain time interval. The data transmission is provided through the fiber optic cable and satellite line alternatively. The early warning alert is transmitted to the critical infrastructures of Istanbul Natural Gas distribution line and Marmaray Tube Tunnel line in order to activate the local strong motion networks for the automatic shut-off mechanism.

Istanbul Natural Gas distribution line has 1.800km steel and 15.200km polyethylene in total 18.000km gas pipeline in Istanbul. There are in total 750 district regulators in the city where the gas pressure is reduced from 20bar to 4bar and from there the gas is transmitted with polyethylene lines to service boxes. Currently, Istanbul Natural Gas Distribution Company (IGDAS) has its own strong motion network with 110 strong motion stations installed at the 110 of 750 district regulators. Once the IGDAS strong motion network is activated by the IEEW network, depending on the exceedance of the ground motion parameters threshold levels the gas flow is stopped at the district regulators. Other than the Earthquake Early Warning operation in IGDAS strong motion network, having the calculated ground motion parameters in the network provides damage maps for the buildings and natural gas pipeline network.

The Marmaray Tube Tunnel connects the Europe and Asian sides of Istanbul City by a rail line. The tunnel is 1.4km length and consists of 13segments. There is strong motion monitoring network in the tunnel with 2 accelerometers in each segment. The tunnel strong motion network is integrated with the IEEW network. Once the EW information is sent to the Tube Tunnel, the ground motion parameters in the tunnel are calculated and depending on the exceedance of the threshold levels the decision for further actions such as reducing the train speed or stopping the train is taken automatically.