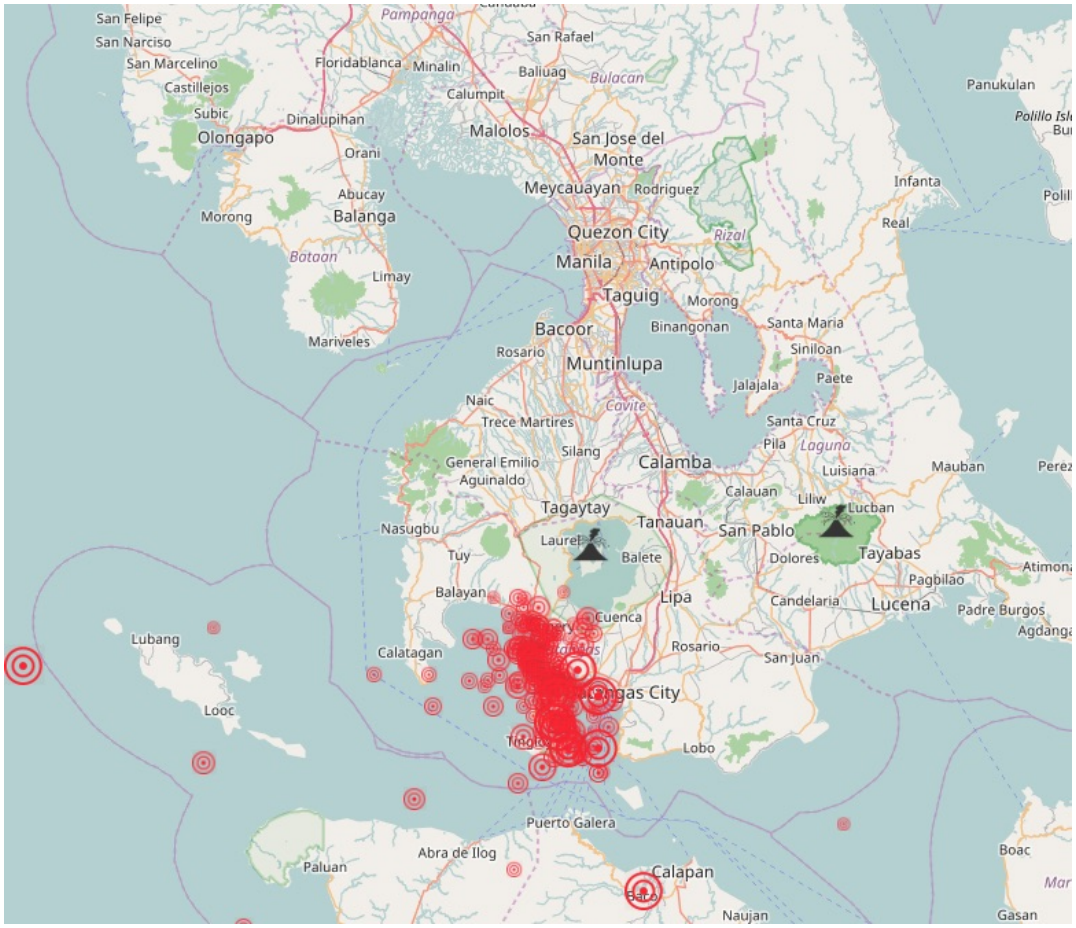

On 4 April, 2017, a shallow earthquake jolted Batangas Province creating panic in the region. The magnitude 5.5 temblor was felt as far as Metro Manila, the nation's capital. After a series of earthquakes recorded by the National Seismic network, another bigger earthquake, this time with a magnitude of 6, shook the Province of Batangas on 8 April 2017. It was again felt in Manila. The Philippine Institute of Volcanology and Seismology (Phivolcs) reported intensities from intensities II-IV in Metro Manila for both the April 4 and April 8 seismic events. Since the first earthquake recorded this year in Batangas, the seismic swarm has defined a NNW trend of earthquake epicenters, which may be related to the northward extension of the Central Mindoro Fault.

The National Structural Code of the Philippines in 2010, required earthquake-recording and instrumentation for every building in sesimic zone 4, above 50 meters in height, with no less than three approved accelerographs. The accelerographs are placed at the basement, middle portion and near the top floors of the building and interconnected for common startup and timing. Since the implementation by the Department of Public Works and Highways of the provision of building instrumentation, GEOS has installed more than a hundred accelerographs for buildings in Metro Manila.

The purpose of the provision in the National Structural Code of the Philippines series 2010 is best appreciated by building owners and building tenants in what is called as post-earthquake downtime. This is the time after the earthquake when the building owner and tenants are assured that the building is safe for re-entry or occupancy. Using the record of the accelerographs, automated calculations are performed in less than a minute and used by the Structural Engineer on Record (SOR) for initial determination of the performance level or damage of the building based on drift thresholds of the tower. Such thresholds are determined from the structural design of the building. Sometimes, especially after large earthquakes, it may take weeks to determine the structural integrity of a building, which incurs huge losses to business due to fears of tenants to re-occupy their offices. Others use the instrumental record of seismicity for insurance purposes.

Here, we demonstrate the value of GEOS installed Kinemetrics accelerographs in two example skyscrapers in Muntinlupa and Makati and the response of the installed accelerographs to the April 4 and April 8 earthquakes. The recorded seismicity were calculated within a minute ensuring reduced post-earthquake downtime to the shortest possible time. Sub-centimeter drift values were determined for all the accelerographs installed in the basement, mid-portion and top floors of the buildings, way below the life-safety performance level of both skyscrapers.

April 4, 2017 earthquake event

Top floor of Muntinlupa Skyscraper: X-axis (0.37 cm); Y-axis (0.13 cm); Z-axis (0.05 cm)

Acceleration in the basement is 0.2155 m/s2 equivalent to Instrumental intensity IV

Top floor of Makati Skyscraper: X-axis (0.12 cm); Y-axis (0.10 cm); Z-axis (0.03 cm)

Acceleration in the basement is 0.2166 m/s2 equivalent to Instrumental intensity IV

April 8, 2017 earthquake event

Top floor of Muntinlupa Skyscraper: X-axis (0.53 cm); Y-axis (0.28 cm); Z-axis (0.16 cm)

Acceleration in the basement is 0.365 m/s2 equivalent to Instrumental intensity IV

Top floor of Makati Skyscraper: X-axis (0.70 cm); Y-axis (0.93 cm); Z-axis (0.15 cm)

Acceleration in the basement is 0.1349 m/s2 equivalent to Instrumental intensity IV

The DPWH requirement to install accelerographs in buildings more than 50 meters in height is a very good program for resilience against earthquakes. This is especially true, since the possibility of a M7.2 earthquake generated by the Marikina Valley Fault System is a constant threat to the country's capital. Such programs, however, need good implementation by trusted professionals. Otherwise, the large investment in the precision instruments (accelerographs) may not be maximized or even go to waste.