QUAKELOGIC
Earthquake Risk Management Solutions

With over 16 years of experience in the field we have become an expert in signal processing, instrumentation and station installations. QuakeLogic engineers will define with you the best solution and provide a quality service to ensure optimum performance of your monitoring systems.

HOW TO DETERMINE SEISMIC STATION AND BOREHOLE ARRAY LOCATION

The locations of seismic stations on the ground surface (so-called free-field stations) and geotechnical borehole arrays need to be determined carefully because nearby structures with long periods of vibrations such as buildings, bridges, poles, or towers may adversely influence the recordings obtained from earthquakes.

Such influence occurs because the seismic waves propagating in the structure reflect from structural components (such as floor slabs or roof in buildings or deck or towers in bridges) and radiate to the foundation and ultimately into the soil. This back-propagating energy in waves carries the vibration response characteristics of the structure, and such wave signatures may appear in recordings of the nearby free-field stations and/or geotechnical borehole arrays. Such signatures may not only modify the records but also contaminate them.

In practice, the free-field stations are generally located at twice the height of the nearest structure to eliminate structural interference to recorded data (Kalkan et al., 2012).

If the free-field station and geotechnical borehole array are part of the nearby structure's seismic instrumentation, they also need to be not too far from the structure since the geological conditions of their location should represent those of the instrumented structure.

EXAMPLE

In 2003, the U.S. Geological Survey (USGS) instrumented a twenty-story regular-plan steel-moment frame office building (a.k.a. Robert B. Atwood Building)

in Anchorage, Alaska, with a 32-channel accelerometer array at ten levels. The building instrumentation is accompanied by a free-field station and downhole geotechnical array (up to 61 m depth) located in Delaney Park. This secondary seismic array, 180 m away from the building, aims to measure soft sediments' response to earthquake shaking and provide input wavefield data for the building. The photo and map view of the building and nearby Delaney Park seismic stations are presented in Figure 1.

The building's height is about 80.5 m from the basement level, and the seismic station located at 180 m away is distant enough from twice the building height (161 m).

Figure 1. Photo showing north façade of the 20-story-high Atwood Building next to the Delaney Park borehole array (fenced area) in downtown Anchorage, Alaska. Google map shows the location of Delaney Park. (Adapted from Wen and Kalkan, 2017)

REFERENCES

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