THE EFFECT OF THE NOVEMBER 2, 2002 SUMATRAN EARTHQUAKE TO MALAYSIAN PENINSULAR

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SUMMARY

Although Malaysian Peninsular is located relatively faraway from seismic source zones of Sumatra (i.e. the closest to Malaysia is approximately 400 km), tremors due to Sumatran earthquakes had been reported many times for the last 20 years. The latest data from Malaysian Meteorological Service (MMS) stated that the earthquake event near Sumatra on the 2nd. November 2002 had caused tremors to several cities in Malaysian Peninsular such as Penang and Kuala Lumpur. The tremor had caused panic among residents of high-rise buildings in Penang and thousands running out of their buildings. Several cracks on buildings had also been reported in Penang. Based on those data, MMS predicted that the local size of earthquake effect in Penang was approximately V on the MMI scale.

The National Earthquake Information Center, U.S. Geological Survey (USGS-NEIC) reported that the earthquake was located at the longitude of 96.18 E and latitude of 3.024 N. The depth of the earthquake was 33.0 km and the moment magnitude, Mw, was 7.4. The distance of the epicenter from Penang and Kuala Lumpur were approximately 523 km and 600 km, respectively. The earthquake occurred as a result of thrust faulting on the boundary between the subducting Australian plate and the overriding Sunda block of the Eurasian plate.

Our research group, SEER, has conducted seismic analysis to obtain Peak Ground Acceleration (PGA) and Spectral Acceleration (SPA) at bedrock as the effect of the earthquake to Penang and Kuala Lumpur. The analysis was carried out using attenuation relationships proposed by Youngs (1997), and Atkinson and Boore (1997). These two attenuation relationships were selected because the functions were derived for subduction zone earthquakes, which are similar to the mechanism of the Sumatran earthquake. The results of the analyses showed that the PGAs at bedrock for Penang in accordance with the attenuation relationships from Youngs (1997) and Atkinson and Boore (1997) are 3.89 gal and 4.84 gal, respectively (Figures 1 and 2). The effect of the earthquake in Kuala Lumpur is lower about 25% to 31% than Penang. According to the attenuation relationships

from Youngs (1997) and Atkinson and Boore (1997), the PGA at bedrock for Kuala Lumpur are 2.90 gal and 3.32 gal, respectively.

Local site effect has also been analyzed at one particular site in Bandar Baru Sentul, Kuala Lumpur. The analysis was carried out using 1-D shear wave propagation theory using three acceleration time history records (i.e. El Centro (1940), Loma Prieta (1989), and synthetic). Synthetic acceleration time history was generated using random vibration theorem.

The results of shear wave propagation analysis using the three acceleration time histories showed that there are amplifications of motions and changes in the shapes of the response spectrum. Acceleration obtained at the surface using synthetic record is 8.9 gal which means the acceleration at the bedrock had been amplified about 2.8 times at the surface. The results also showed that the amplification factors and the spectral accelerations from synthetic record were higher than those from El Centro and Loma Prieta records.

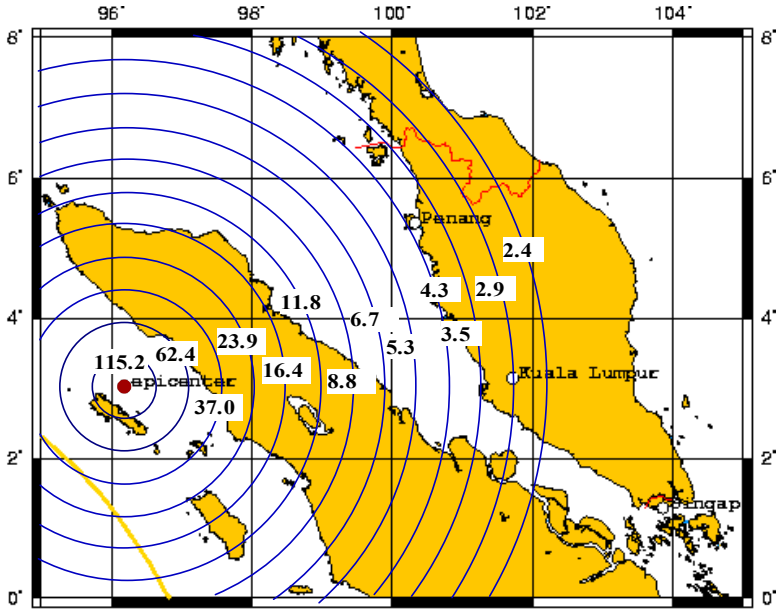

Figure 1. PGA contours at bedrock using Youngs (1997) attenuation relationship

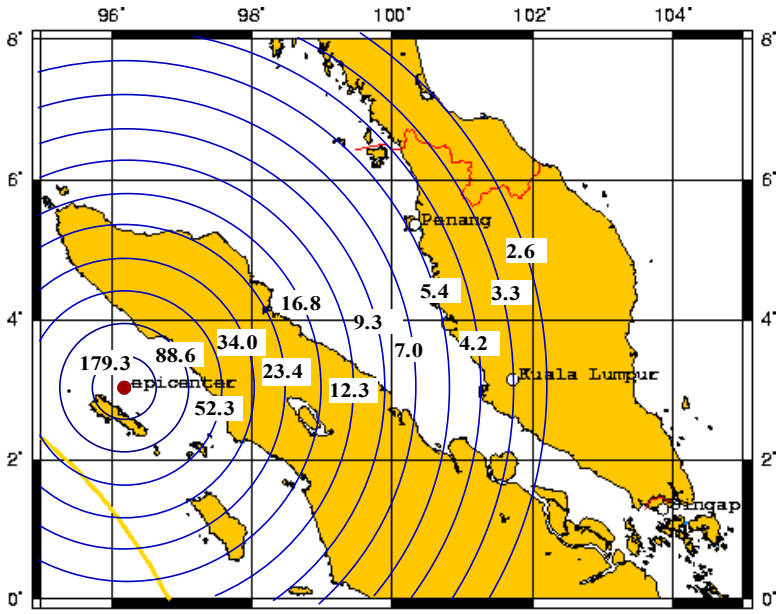

Figure 2. PGA contours at bedrock using Atkinson & Boore (1997) attenuation relationship