

The 5 February 2016 Tainan, Taiwan Earthquake

by Paul Somerville

The 5 Feb 2016 Mw 6.4 earthquake occurred at a depth of about 20 km, about 40 km east of the southern Taiwanese city of Tainan, which has a population of 1.9 million (Figure 1). The earthquake occurred about 20 km west of the 4 March 2010 Mw 6.4 Jiashian earthquake and appears to be a delayed continuation of the stress release of that event. It is not straightforward to relate the fault plane of either the 2010 or 2016 earthquake to the mapped surface faults (left side of Figure 1).

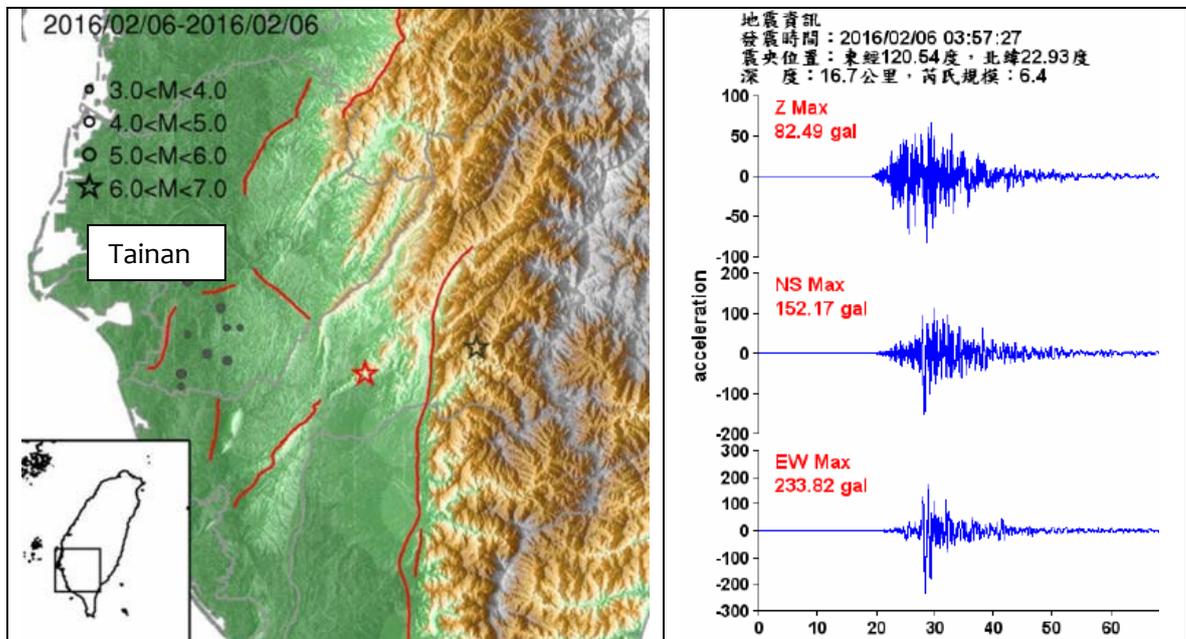


Figure 1. Left: Location map, with the epicenter of the 2016 and 2010 earthquakes shown by the orange and black stars respectively; orange lines show mapped active faults. Right: Accelerogram of the 2016 earthquake recorded in central Tainan, with the horizontal axis showing time in seconds.

The intensity of ground shaking is shown on the left side of Figure 2, with the intensity values annotated by peak acceleration in gals ($981 \text{ gals} = 1g$). The accelerogram recorded in central Tainan shown on the right side of Figure 1 has a peak acceleration of 234 gals ($0.24g$), and strong shaking lasted about ten seconds at this site.

A probabilistic ground motion map for a return period of 475 years, used in the building code, is shown on the right side of Figure 2. This map shows the response spectral acceleration at a period of 0.3 seconds; dividing that value, which is about $1.5g$ at Tainan, by 2.5 gives an approximate peak acceleration of $0.6g$ in Tainan, which is well above the value of $0.24g$ recorded in central Tainan (Figure 1, right).

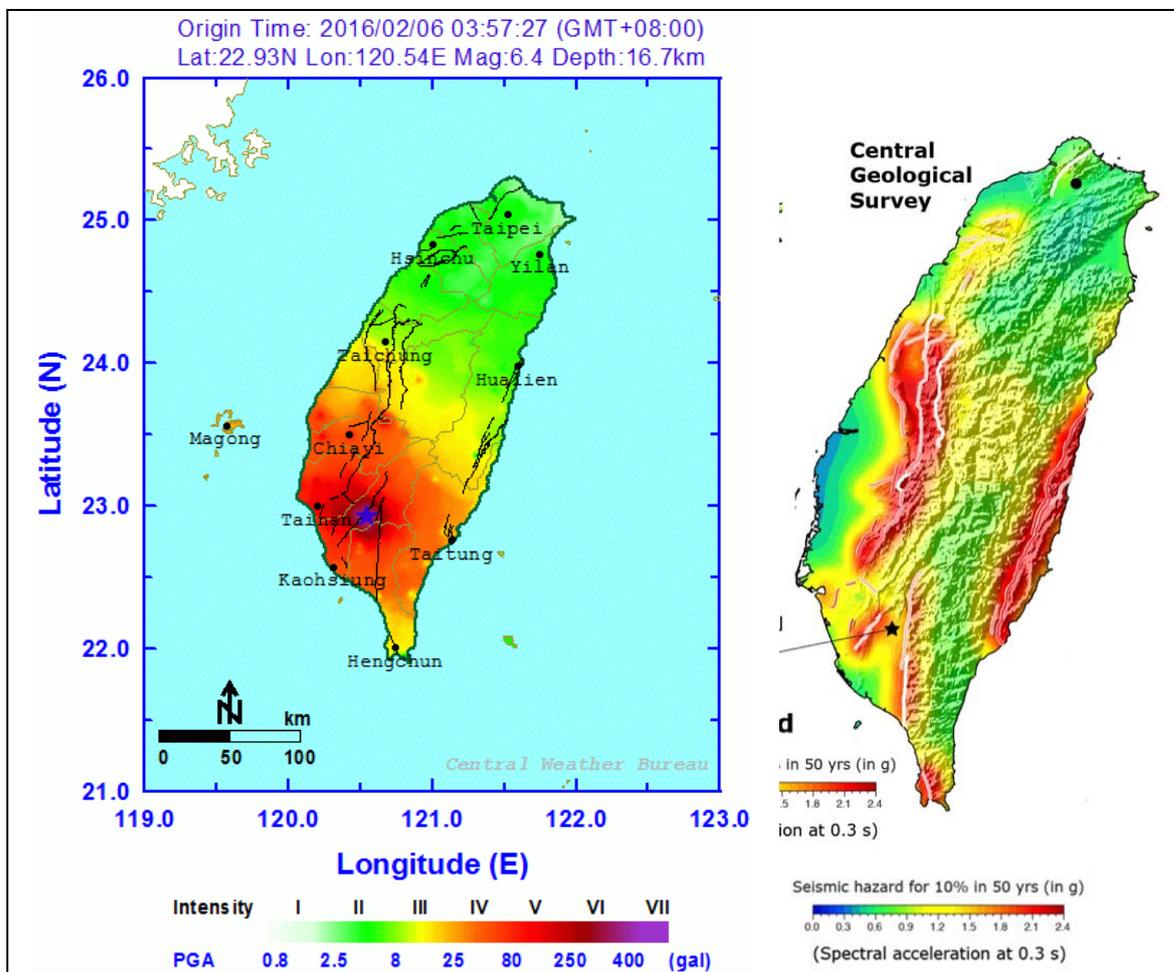


Figure 2. Left: ground motion intensity map of the Tainan earthquake (Central Weather Bureau). Right: Probabilistic ground motion map for 475 year return period, showing response spectral acceleration at 0.3 seconds period (Central Geological Survey).

The worst affected city was Tainan, where numerous buildings collapsed including a 17-story residential building with about a hundred people still trapped inside (Figure 3). Eight buildings in Tainan collapsed or were semi-collapsed, and five others were left leaning at alarming angles (Figure 4), evidently due to column failures on lower floors. According to the National Fire Agency, the quake left about 400,000 households without water nationwide. Power outages affected about 121,000 residences in Tainan and hundreds in Kaohsiung.

This earthquake is relevant to Australia because events of this magnitude occur somewhere in Australia about once per decade. The magnitude of the earthquake was not very large and the ground motions recorded in the surrounding region were not particularly strong. However, at about 0.25g, the peak accelerations in central Tainan were about four times stronger than typical building code values for Australia’s capital cities. The building code peak acceleration of about 0.6g in Tainan is about ten times higher than in Australia.



Figure 3. The Weiguan Jinlong residential building in Tainan before (left) and after (right) collapse. The surrounding buildings do not appear to have severe damage (Photo: Taipei Times).

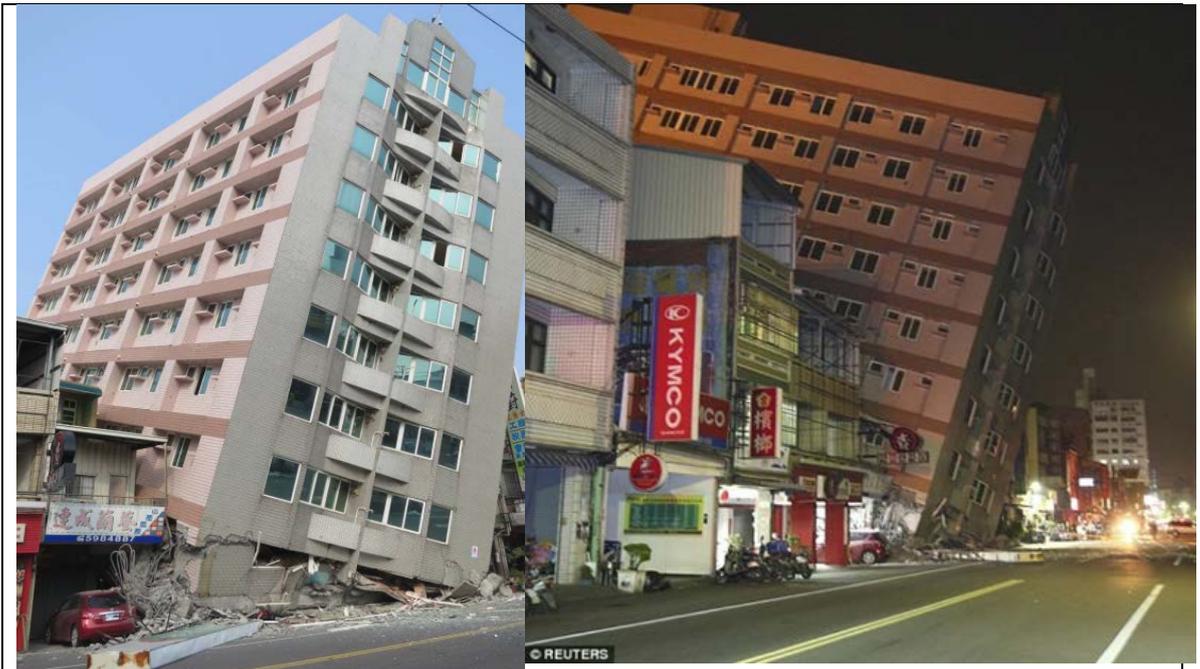


Figure 4. Hsinhua branch of King's Town Bank in Tainan.