Terr. Atmos. Ocean. Sci., Vol. 19, No. 5, 451-462, October 2008 doi: 10.3319/TAO.2008.19.5.451(T)

Effect of Surface Geology on Ground Motions: The Case of Station TAP056 - Chutzuhu Site

Kuo-Liang Wen[1, 2, *], Che-Min Lin[1], Hsien-Jen Chiang[1], Chun-Hsiang Kuo[1], Yu-Chih Huang[1], and Hsin-Chieh Pu[1]

[1] *Institute of Geophysics, National Central University, Chung-Li 320, Taiwan, ROC*
[2] *National Center for Research on Earthquake Engineering, Taipei, Taiwan, ROC*

Received 26 December 2006, accepted 8 October 2007

ABSTRACT

In the Tatun mountain area of northern Taiwan are two strong motion stations approximately 2.5 km apart, TAP056 and TAP066 of the TSMIP network. The accelerometer at station TAP056 is often triggered by earthquakes, but that at TAP066 station is not. Comparisons of vertical and horizontal peak ground accelerations reveal PGA in the vertical, east-west, and north-south components at TAP056 station to be 3.89, 7.57, and 5.45 times those at station TAP066, respectively. The PGA ratio does not seem to be related to earthquake source or path. Fourier spectra of earthquake records at station TAP056 always have approximately the same dominant frequency; however, those at station TAP066 are different due to different sources and paths of different events. This shows that spectra at TAP056 station are mainly controlled by local site effects. The spectral ratios of TAP056/TAP066 show the S-wave is amplified at around 8 ~ 10 Hz. The horizontal/vertical spectral ratios of station TAP056 also show a dominant frequency at about 6 and 8 ~ 10 Hz. After dense microtremor surveying and the addition of one accelerometer just 20 meters away from the original observation station, we can confirm that the top soft soil layer upon which the observation station is constructed generates the local site response at station TAP056.

Key words: Peak ground acceleration, Local site effect, Spectral ratio, Microtremor survey

Citation: Wen, K. L., C. M. Lin, H. J. Chiang, C. H. Kuo, Y. C. Huang, and H. C. Pu, 2008: Effect of surface geology on ground motions: The case of station TAP056-Chutzuhu site. Terr. Atmos. Ocean. Sci., 19, 451-462, doi: 10.3319/TAO.2008.19.5.451(T)

1. INTRODUCTION

The Taiwan Strong Motion Instrumentation Program (TSMIP) operated by the Central Weather Bureau (Shin 1993; Kuo et al. 1995) has about 100 free-field strong motion accelerometers installed in the Taipei metropolitan area. Two adjacent stations, TAP056 and TAP066, are located in the Tatun mountain area. These stations are separated by approximately 2.5 km horizontally, and 356 meters in elevation. TAP066 station originally housed an A800 strong motion accelerometer. For admission into the TSMIP network, an IDS3602 accelerometer was installed on 30 September 1992. In 8 September 1993 an A900 accelerometer was installed and the IDS3602 accelerometer was removed on 8 August 1994. Since that time, the operation of the station has been normal. Station TAP056 had an A900 accelerometer installed on 15 December 1994 as this accelerometer was triggered so often that the memory would fill before large events occurred. For example, the 25 June 1996 earthquake was recorded at TAP066 station but not at TAP056. Consequently, an ETNA strong motion instrument was installed because of its increased memory capacity to accommodate the amount of activity measured at TAP056.When both accelerometers are triggered by earthquakes, peak ground accelerations show marked differences between the two sites. This causes problems in intensity measurement, and can trigger emergency false alarms for the occurrence of damaging earthquakes.

Typically, ground motion recorded by seismometers after an earthquake is affected by source, path, and site effects (Chin and Aki 1991; Beresnev et al. 1994; Chen 2003). Sometimes, construction problems in the recording room may also affect ground motion records (Wen et al. 2001). In this study, earthquakes recorded by these two stations are selected. Ground motions are analyzed in terms of frequency

* *Corresponding author*
E-mail: wenkl@earth.ncu.edu.tw