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Identification of Engineering Bedrock in Taiwan based on Site Amplification and Velocity Structures of Strong-motion Stations

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There are two kinds of bedrocks that are widely used in seismology and earthquake engineering respectively. The seismology field uses the “seismic bedrock” to define an interface that has a practically lateral extent. The strata deeper than this interface is much more homogeneous in comparison with the shallower one. It is common to set the seismic bedrock within the upper crust has 3000 m/sec of the shear wave velocity. In contrast, the earthquake engineering prefers the shallower interface which dominates the main seismic site amplification, especially the predominant frequency of ground motion. The interface is called “Engineering Bedrock”, which the underlying stratum has the shear wave velocity from 300 to 1000 m/sec for different purposes. But, the reference shear wave velocity of the engineering bedrock is mostly defined as 760 m/sec for ground motion prediction and simulation. In Taiwan, the Central Weather Bureau (CWB) constructed and operates a dense strong-motion network called TSMIP (Taiwan Strong Motion Instrument Program), which provides numerous ground motion data for seismology and earthquake engineering. In our previous studies, the shallow shear wave velocity profiles of over 700 TSMIP stations were estimated by the Receiver Function method. The velocity profiles are from the ground surface to the depth with the shear wave velocity of at least 2000 m/sec. It allows us to compare the theoretical site amplification of the velocity profile of TSMIP stations with their observed one from the seismic records. The variance of fitness between theoretical and observed amplifications through shear wave velocity is analyzed to evaluate which reference velocity can appropriately define the depth of engineering bedrock, where the most site amplification occur beneath, in all of Taiwan. The difference between local geology is also discussed. Finally, an engineering bedrock map is proposed for further applications in earthquake engineering.