

考慮地質不確定性提升 Vs30 分布圖可靠度之研究

--以臺北盆地為例

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摘要

長期以來，場址效應的估算一直是工程地震學中重要的問題之一。局部的場址效應在改變地表運動方面扮演關鍵的角色，當地層下層為岩盤、上層為鬆軟沉積物時，可能會導致地表的震波產生放大的作用(Pratt et al., 2003；Vilanova et al., 2018)。該理論於 1985 年發生在墨西哥城的地震中得到證實，1999 年發生於臺灣的集集地震，震波傳遞到臺北盆地時也有相似的現象。時至今日，地表下三十公尺平均剪力波波速(Vs30)多被用來作為評估場址效應的重要參數(Lee and Tsai, 2008；Liu and Tsai, 2015)。因此，需要針對尚無 Vs30 測量值的位置進行 Vs30 的推估。郭俊良(2021)藉由全臺強震站鑽井資料進行迴歸分析，建立用於臺北盆地礫石、砂、粉土以及黏土的孔隙比(void ratio)、垂直有效應力(vertical effective stress)與剪力波速(shear wave velocity)關係之經驗式。本研究使用大量來自地調所工程鑽探資料庫以及強震測站工程鑽探資料庫之鑽井，並且參照前人對於臺北盆地地層分層之研究(Teng et al., 1999；Lee et al., 2002；Teng et al., 2004；Su et al., 2016)，將臺北盆地內的地層分為頂部之砂泥層、中部礫石層以及底部之基盤，接著加入地球物理震測資料以及電測資料補充鑽井資料不足之處，並以普通克利金法做空間內插建立模型。未來的研究會再使用隨機場模擬做砂泥層內之分層以及顯示模型之不確定性，最後導入郭俊良(2021)的經驗公式求得任意點位的 Vs 值，換算成 Vs30 後再跟前人使用空間內插作出的 Vs30 分布圖作比較，增進 Vs30 分布圖的可靠度。

關鍵字：普通克利金、場址效應、地質模型、臺北盆地、Vs30

Improve the reliability of Vs30 distribution map by considering geological uncertainty --a case study of Taipei Basin

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Abstract

For scores of years, estimation of the site effects has been a major issue in engineering seismology. It is believed that local site effects have a significant impact on ground motions. A large ground motion amplification at the surface can result from the underlying bedrock being connected to soft sediments with low seismic velocities (Pratt et al., 2003 ; Vilanova et al., 2018). This theory was confirmed by the earthquake that occurred in Mexico City in 1985, and the Chichi earthquake that occurred in Taiwan in 1999. Nowadays, the average shear wave velocity in the upper 30m(Vs30) is used as an important parameter input for studies of the site effects (Lee and Tsai, 2008 ; Liu and Tsai, 2015). Therefore, an estimation of Vs30 is required for locations that have a lack of Vs30 measurements. Using regression analysis of drilling data from the Engineering Geological Database for Taiwan Strong Motion Instrumentation Program (EGDT), Kuo (2021) established the empirical relationship between void ratio, vertical effective stress, and shear wave velocity in the Taipei Basin. This study uses lots of boreholes from the Central Geological Survey Engineering Geological Investigation Database and EGDT, and divides layers based on previous studies on stratification in the Taipei Basin (Teng et al., 1999; Lee et al., 2002; Teng et al., 2004; Su et al., 2016). Geophysical data is then imported and the model is developed through interpolation method with ordinary kriging. In the future, this study will apply stochastic modeling methods to divide sub-layers and show the uncertainty of the model. As the final step, the empirical formula will be imported to obtain the Vs value at any point, convert it to a Vs30 value, and compare it with interpolation methods done in previous studies to improve the reliability of the Vs30 distribution map.

Keyword: Ordinary kriging, Site effect, Geological model, Taipei Basin, Vs30