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Ground settlement resulting from urban tunnelling: Comparison of predictions and actual settlement

KARTHIGEYAN AL. RAMANATHAN*, RINI ASNIDA BT ABDULLAH, AFIKAH BT RAHIM,
SITI NORAFIDA BT JUSOH

School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 80990 Johor Bahru,
Johor, Malaysia

* Corresponding author email address: karthigeyan-1994@graduate.utm.my

Abstract: In Malaysia, tunnelling activities in urban areas have been widely carried out in order to reduce road congestion due to the increasing population. The effectiveness of tunnelling method has been proven in many projects, as it is capable in providing an easier method of transportation such as Light Rail Transit (LRT) and Mass Rapid Transit (MRT) in Malaysia. However, tunnelling works found to be effected towards the above surface structure. This has become a concern since various sinkholes, ground settlement and blowouts occurred globally due to the improper tunnelling monitoring, procedure and most importantly understanding the ground behaviour due to the tunnel excavation. An attempt incorporating empirical models established by previous researches to quantitatively asses these effects have delivered such a promising solution to this problem. By using these methods, a simple and early prediction of ground settlement can be compared and assessed with regards to the tunnel design parameters implemented in various project sites. The projects sites involved in this study are Museum Station of the Klang Valley Mass Rapid Transit (KVMRT Line 1) and the Serangoon Interchange Station of the Singapore Mass Rapid Transit Circle Line (SMRT CL 3). While, these projects sites will be compared to the upcoming tunnelling project at Shah Alam Station of the Light Rail Transit 3 (LRT 3). The predicted settlement induced by tunnelling can be determined by using the Peck (1969) formula. This formula is highly dependent on the maximum settlement above tunnel axis (S_{vmax}), horizontal distance from tunnel axis (x) and width of tunnel axis to the point of inflection of the settlement trough (i). Besides that, the actual settlement during tunnelling period by installing instrumentations at Museum Station and Serangoon Interchange Station will be adopted. These results obtained will then be compared with respective project sites and assessed based on the safety limits sets by relevant authorities namely MRT Corp Development Building Control (2018) and Peila *et al.*, 2019. Thus, a brief comparison of predicted settlement and actual settlement induced by tunnelling works can be obtained with alignment to the respective safety limits.

Keywords: Tunnelling, ground behaviour, predicted settlement, actual settlement, safety limits