

1 **Investigation of soil-pile-structure interaction**
2 **induced by vertical loads and tunnelling**

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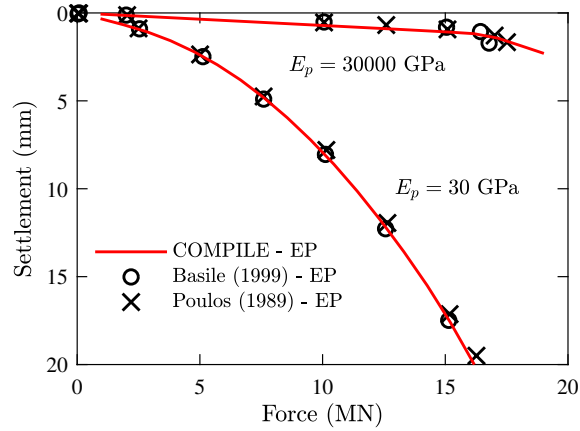


Fig. S1. Predicted elastoplastic (EP) load-settlement curves of single piles and comparison with Poulos (1989) and Basile (1999). The scenario consists of a single pile with length $L_p = 30$ m, diameter $d_p = 0.75$ m, a 50 m deep soil layer, pile Young's modulus $E_p = 30$ GPa and $30 \cdot 10^3$ GPa, soil Young's modulus $E_s = 1056$ MPa and Poisson's ratio $\nu_s = 0.49$, and a limiting shear stress of the shaft $\tau_f = 220$ kPa.

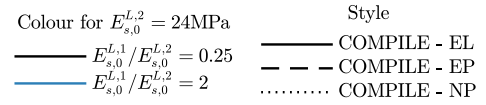
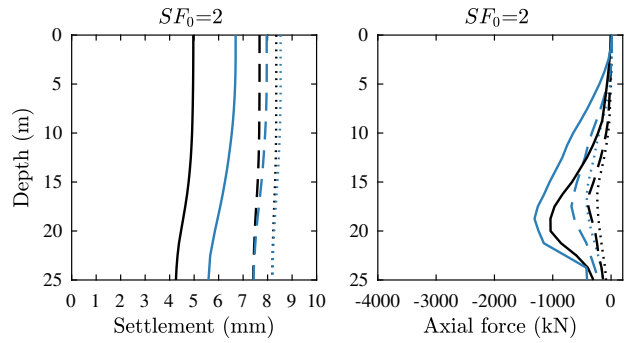
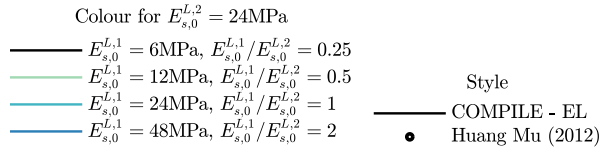
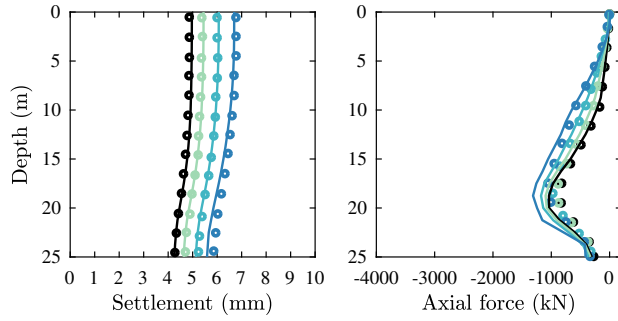


Fig. S2. Tunnelling adjacent to a single pile in a layered ground: elastic validation analyses (fixed $E_{s,0}^{L,2} = 24\text{MPa}$).

Fig. S3. Tunnelling adjacent to a single pile in a layered ground: the effects of soil behaviour (fixed $E_{s,0}^{L,2} = 24\text{MPa}$).

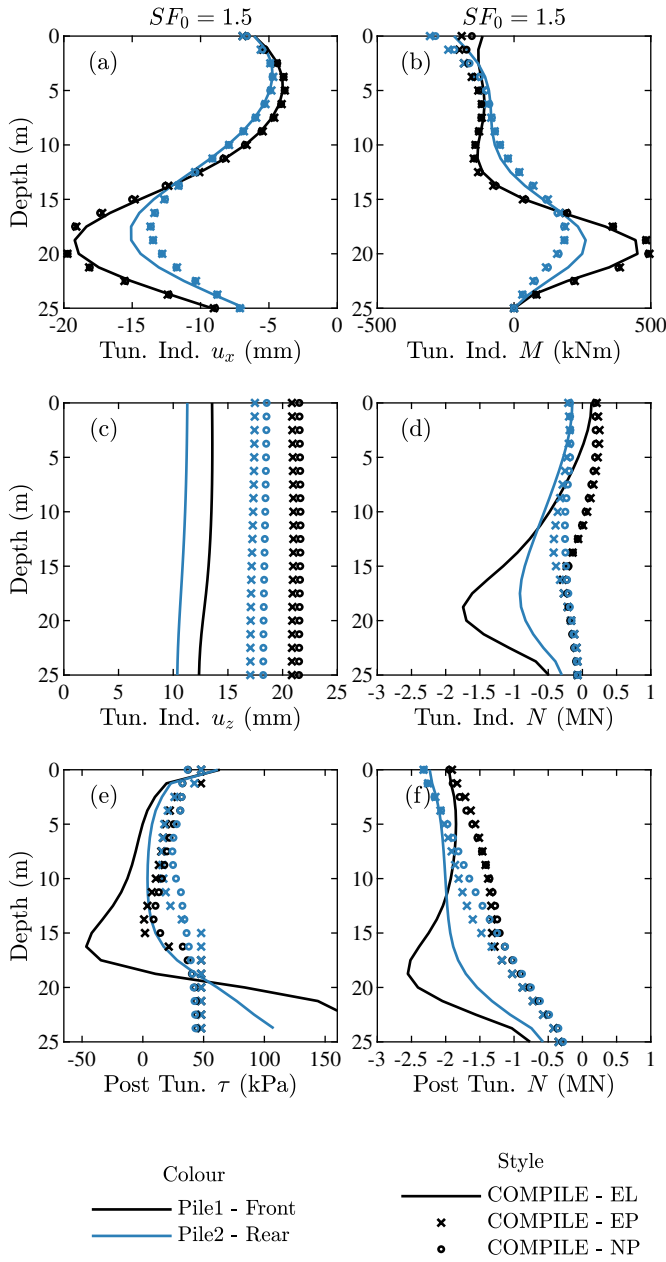


Fig. S4. Tunnelling adjacent ($z_t = 20$ m) to the pile group with $L_P = 25$ m: low initial safety factor $SF_0 = 1.5$.

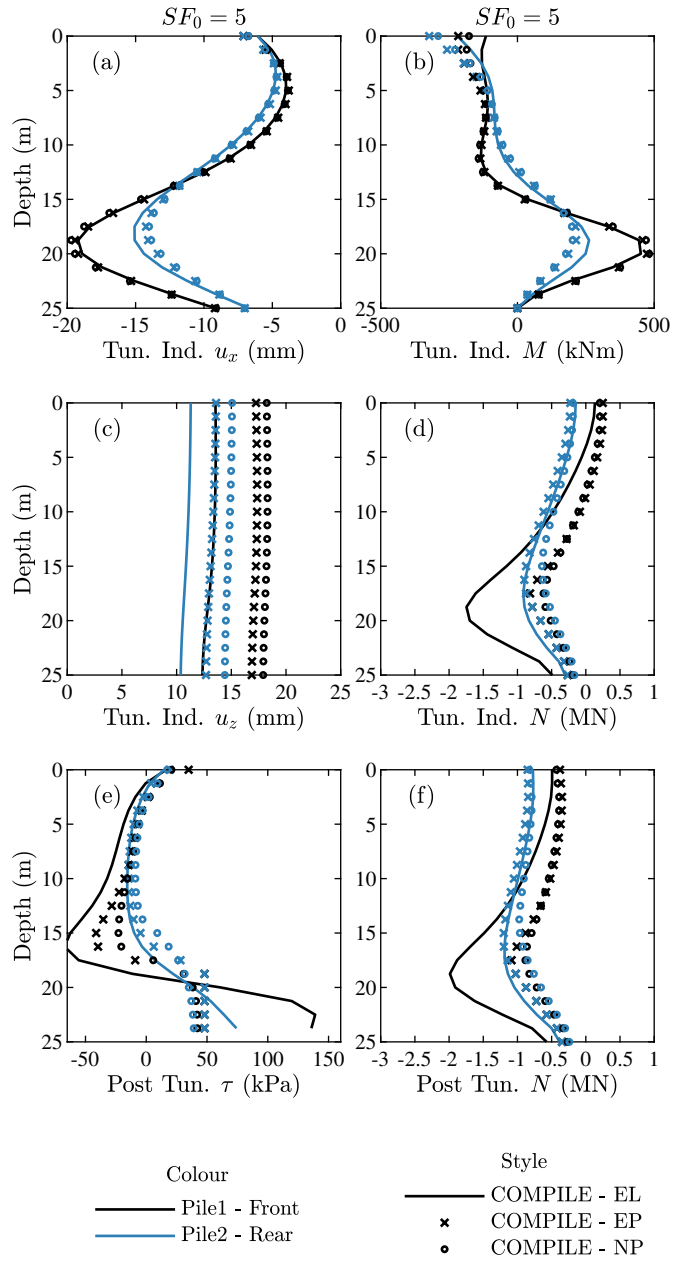


Fig. S5. Tunnelling adjacent ($z_t = 20$ m) to the pile group with $L_P = 25$ m: high initial safety factor $SF_0 = 5$.

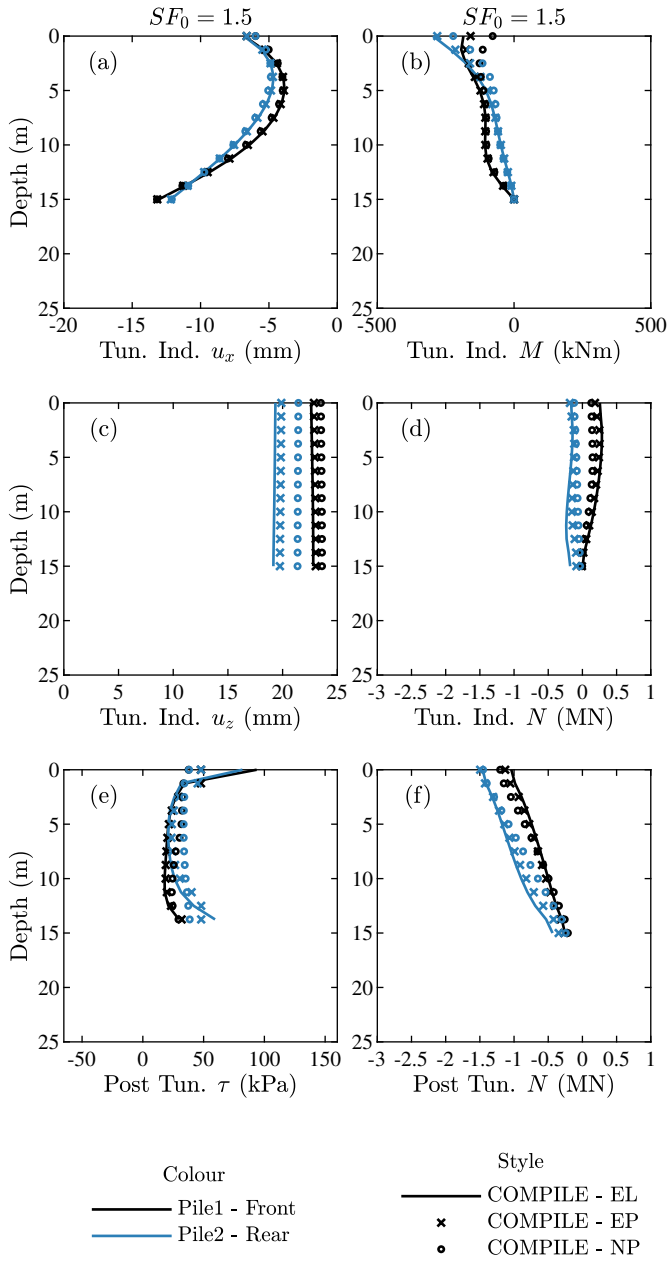


Fig. S6. Tunnelling beneath ($z_t = 20$ m) the pile group with $L_P = 15$ m: low initial safety factor $SF_0 = 1.5$.

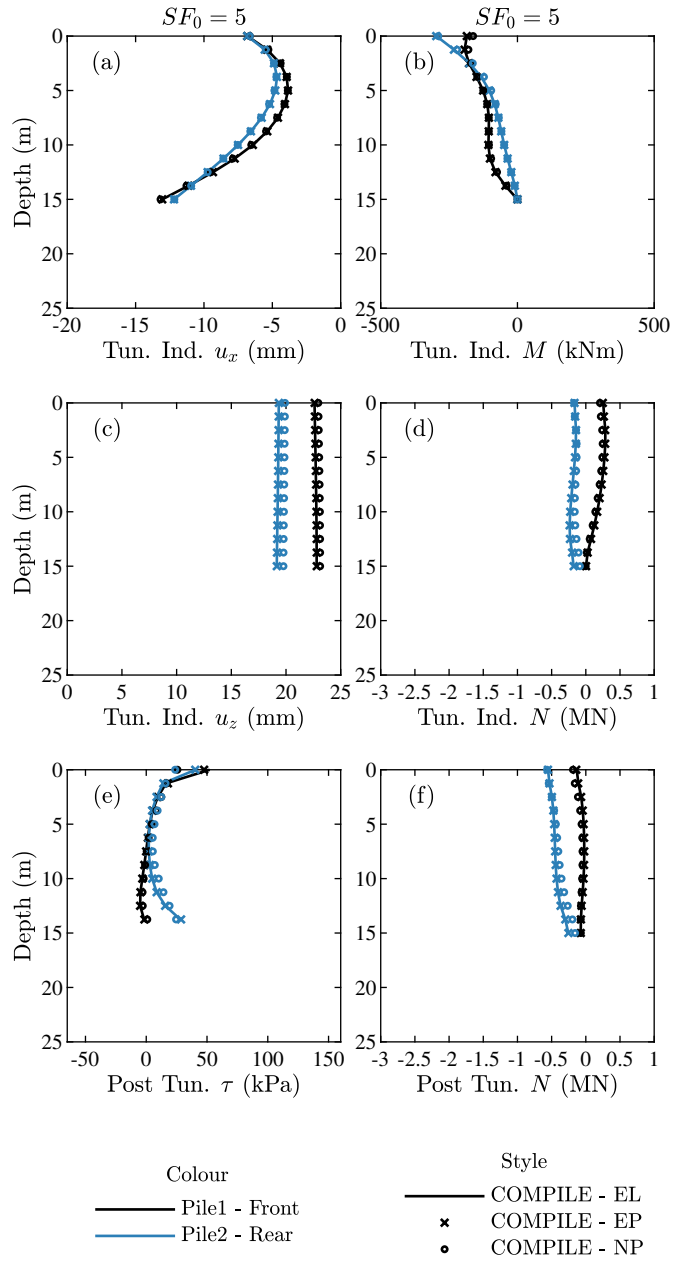


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