Abstract
Trends in the construction of deep excavations include deeper excavations situated closer to buildings. This research provides insight into mechanisms of soil-structure interaction for piled buildings adjacent to deep excavations to be used in the design and monitoring of deep excavations in urban areas. Most methods to assess building response have originally been developed for tunnelling projects or buildings with shallow foundations. Monitoring data of the construction of three deep excavations for the North South metro Line in Amsterdam, The Netherlands have been used to validate these methods specifically for piled buildings.

In all three of the Amsterdam deep excavations studied, the largest impact on the ground surface and buildings is attributed to preliminary activities instead of the commonly expected excavation stage. The in situ preliminary activities caused 55-75% of the surface settlement and 55-65% of the building settlements. Surface settlements measured behind the wall were much larger than the wall deflections and reached over a distance of 2-3 times the excavated depth away from the wall. The shape of the surface settlements found resembles the hogging shape as defined by Peck (1969). For the excavation stage only, the shape of the displacement fits the profile proposed by Hsieh and Ou (1998). Most prediction methods overestimate the soil displacement at depth.

An analytical method has been established and tested for the behaviour of piled buildings near excavations. This method includes the reduction of pile capacity due to lower stress levels, settlement due to soil deformations below the base of the pile and development of negative (or positive) skin friction due to relative movements of the soil and the pile shaft. The response of piles in the case of soil displacements depends on the working load of the pile, the percentages of end bearing and shaft friction of the pile, the size and shape of the soil settlements with depth and the distribution of the maximum shaft friction with depth. A method is derived to determine the level for each pile at which the pile and soil settlement are equal. Buildings in Amsterdam built before 1900 and without basement are most sensitive to soil displacements. For all other buildings, the pile settlement depends mainly on the working load.

The actual damage experienced in buildings depends also on the relative stiffness of the building compared to the soil. Cross sections in Amsterdam have been evaluated and it is concluded that the Goh and Mair (2011) method provides a realistic, although rather large range of possible modification factors for the deflection of buildings next to excavations, deforming in hogging shape. For the incidents that happened at Vijzelgracht some well known damage indicators have been evaluated.