UNIVERSITY OF CAMBRIDGE
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CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT

Benchmarking empirical methods of prediction of ground movement for deep excavations

Deep excavations are becoming commonplace in many cities which struggle to fit modern infrastructure into their existing built environment, and the requirement to minimise the occupation of surface space comes hand in hand with the need to minimise the impact of ground movement on third party assets.

Published case studies for ground movement induced by deep excavations are rare, but they are a useful tool for the calibration of more sophisticated numerical models. Simple empirical methods based on existing case studies were historically developed using limited case study data to provide a first estimate of ground movement.

Information from five deep excavations supported by embedded retaining walls (diaphragm walls and secant piled walls) in central London, part of the Crossrail project, have been collected and interpreted in this dissertation. The effect of the geometry of the excavation on the magnitude, extent and shape of the ground movement trough has been reviewed.

The deep excavations were all supported by embedded retaining walls up to 54m deep, either in the form of secant piles or diaphragm walls. The actual movement proved to be less than empirical methods would have suggested. The magnitude of movement induced by wall installation remained relatively small in all circumstances, unless affected by workmanship issues. With such small movements, ambient and measurement noise caused a significant issue in the collection of representative data.

Ground movement induced by box excavation was significantly reduced for those excavations with plan dimensions comparable to their depth, as shown in the data analysed for Bond Street, Tottenham Court Road and Farringdon. Several methods to approximate the shape of the settlement trough were compared with the data, and a novel method was proposed, making use of the cumulative error function.

Yet the data also demonstrated that significant variability can be encountered for the same geometry, ground conditions and support system. This exposed the importance of external structures, with their surcharge and stiffness, in determining the magnitude and distribution of ground movement around an excavation.

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