APPLICABILITY OF 2D FINITE ELEMENT ANALYSIS IN MODELLING THE BEHAVIOUR OF AXIALLY LOADED CAST IN-SITU BORED PILES SOCKETED INTO BEDROCK

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Accurate prediction of the bearing resistance of piles which is a combination of shaft and end resistance is important in the pile design process since if not, it will cause for an uneconomical and unsafe design. As an alternative method for theoretical formulas, finite element software such as Plaxis 2D can be used to investigate the behaviour of piles.

This study focuses on investigating the applicability of 2D finite element (FE) modelling in predicting the behaviour of axially loaded cast in situ bored piles socketed into bedrock under three main objectives such as investigation of the load-settlement behaviour, mobilization of skin friction & end bearing resistance. The results of 2D finite element analysis have been compared with the instrumented pile load test results conducted on 1.2 m and 1.8 m diameter cast in situ bored piles. The load-settlement behaviour, mobilization of skin friction through rock and soil layers and the mobilization of end-bearing resistance have been investigated using 2D FE analysis and compared with the results of instrumented pile load tests. The cast in-situ bored piles have been instrumented using strain gauges at 19 different levels to obtain the mobilization of skin friction and end-bearing resistance. Instrumented piles were loaded in a loading cycle including 5 loading stages. The same piles and the loading sequence have been modelled using the commercially available FE software PLAXIS 2D. It was observed that there is a high convergence of the results obtained from the PLAXIS 2D model with the actual instrumented pile load test results for all settlement, shaft friction & end bearing behaviours with an increment of pile top load. Theoretical capacities obtained for skin friction and end-bearing resistance using the ICTAD guidelines for end-bearing piles have deviated from the results from FE analysis and instrumented pile load tests.

Keywords: Finite Element Modelling; PLAXIS 2D; Load-Settlement; Shaft friction; End bearing

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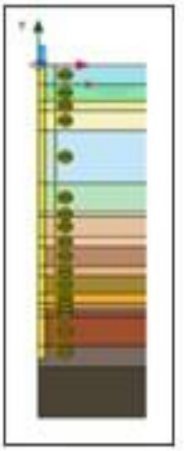
APPLICABILITY OF FINITE ELEMENT ANALYSIS TO ANALYSE THE BEHAVIOUR OF AXIALLY LOADED CAST INSITU BORED PILES

Finite Element Model (PLAXIS 2D)

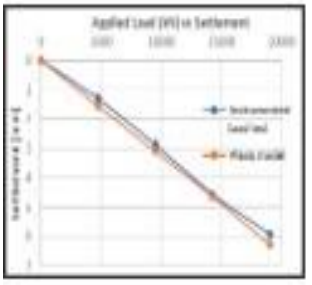
- Axis-symmetric condition
- Medium size mesh arrangement
- Soil > Mohr-Coulomb Model
- Rock > Linear Elastic Model
- Pile > Linear Elastic Model
- Boundary Distance > 5* D
- R int value > 0.67



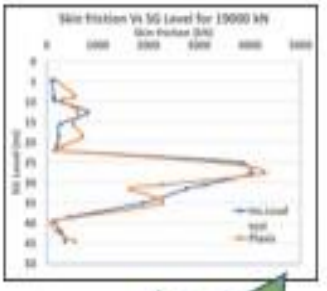
FEM Results

Instrumented Pile Load Results

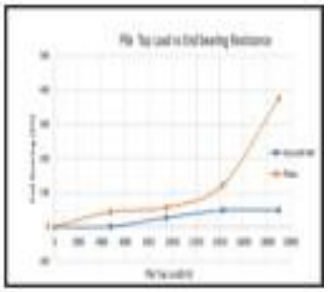
Load Vs Settlement



Mobilization of Skin Friction



Mobilization of End Bearing



Good Convergence