Structures and Building Materials V

Edited by
Yun-Hae Kim and Xun Wu

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Preface

The International Conference on Structures and Building Materials (ICSBM) is the premier forum for the presentation of new advances and research results in the fields of civil engineering and building materials. This conference series bring together international scientific community, academics and practitioners, researchers and students and provide an opportunity to discuss and share recent advances in both research and practice about all aspects of building materials and diagnostics of civil engineering, building, structures and geotechnics. After the very successful previous issues ICSBM'2011 (Guangzhou, China), ICSBM'2012 (Hangzhou, China) and ICSBM'2013 (Guiyang, China), ICSBM'2014 (Guangzhou, China), and ICSBM'2015: 5th International Conference on Structures and Building Materials was held successfully in Shenzen, China.

This book is a collection of accepted papers. All these accepted papers were subjected to strict peer-reviewing by 2-4 expert referees. The book mainly focused on geotechnical and structural engineering, monitoring and control of structures, reliability, durability and rehabilitation of structures and building materials. This book will not only provide the readers a broad overview of the latest advances but also provide the researchers a valuable summary and reference in this field.

We would like to express our sincere appreciations to all the authors for their contributions to this volume. We are indebted to all the referees for their constructive comments on the papers. Thanks are also given to Trans Tech Publications for producing this volume.

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Geotechnical and Structural Engineering

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Analysis on Influence of Shield Tunneling on Bridge Double Pile

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Keywords: Shield tunneling; Numerical Simulation; ground settlement; Viaduct pile

Abstract. Shield tunneling have varying degrees of impact on the surrounding buildings and the surrounding environment. Based on the shield tunneling of Hefei Subway Line 1 Ma'anshan viaduct, a 3D Fast Lagrangian Analysis of Continua is be used to simulate the shield tunnel construction and analyze the ground settlement and bridge pile deformation caused by tunnel construction. The numerical modeling results by analyzing the displacement variation and soil affected area at different distances show that when the shield tunnel excavation, the ground settlement becomes smaller with increasing distance from the shield center line of the pile and the maximum ground settlement is 10.778mm. The main deformation of bridge pile is in horizontal direction with a maximum horizontal direction of 2.0758mm. Horizontal displacement changes lager at the top of the pile, along with changes in the horizontal displacement of the pile depth becomes smaller, 15m is a turning point.

Introduction

With the massive development of urban underground space, more and more projects through the structure of the shield.Tunneling cause excessive deformation of the soil or the original structure, will endanger the security of neighboring structures.Regardless of shield construction technology improvements, shield forward disturbance on the surrounding soil is still inevitable[1-2].Therefore, predictive analysis should be taken to study the impact on the viaduct tunnel excavation pile before tunneling, and take appropriate measures to ensure the smooth progress of construction.

Currently, a lot of scholars have been made many research on this subject. H.H Zhao[3] use PLAXIS ^{3D} Tunnel to study the characteristic between the pile-soil-tunnel and analyzed the impact of shield construction on the surrounding in different pile side as a whole. L Liu[4]showed that due to the diffusion of pile arch tunnel arch crown slump intersect, significantly higher than the reaction piles pile side. When excavation face shield away from the pile near, will produce a negative friction of pile, reducing the carrying capacity of the pile. The pile at the end position will have a greater lateral displacement. Loganathan[5] used centrifuge model tests and numerical analysis method to reveal tunneling near the pile will cause considerable axial forces and bending moments. Based on the shield tunneling of Hefei Subway Line 1 Ma'anshan viaduct, use FLAC ^{3D} numerical simulation to analyze the impact of different post-hole distance shield construction of the viaduct double pile group and have important implications for the successful construction of the shield tunneling.

Engineering background and model parameters

Based on the shield tunneling of Hefei Subway Line 1 Ma'anshan viaduct, round shield outer diameter is 6.0m, the lining is 0.3m, grouting layer thickness is 0.15m and depth is 12m. Viaduct

pile diameter is 1.2m, pile length is 27m and pile load is 1800KN. Horizontal distance between the double piles is 25m and concrete layout is shown in Fig.1.

According to the engineering geological survey report, the proposed location of the site topography, geology broadly divided into five layers: the first layer of artificial hybrid 1.60 ~ 3.97m of fill, which contains asphalt pavement, concrete pads, loose clayey and so on; The second layer of plastic-like clay, yellowish-brown, thin silt local folder, a thickness of about 8.95m; Third layer of silty clay, moderate toughness, high dry strength, there are about 5.4m thick; The fourth layer strongly weathered muddy sandstone, local short column, soft rock, you can hand snapping, visibility along the crack surface iron infection, this layer has a 4.87m thick; The fifth layer is weathered muddy sandstone, along the crack visible on the surface of iron infection and erosion. The main physical and mechanical properties of the layers of soil are shown in Table 1.

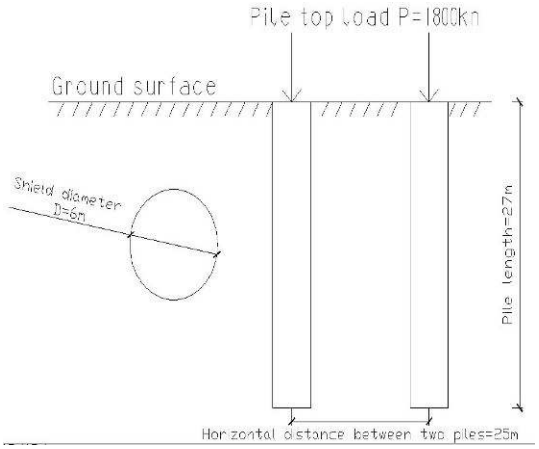

Fig.1 Concrete layout

Table 1 Mechanical parameters of soil strata

Number soil	Range (m)	Density (kg/m3)	Bulk modulus (MPa)	Shear modulus (MPa)	Friction angle (°)	Cohesion (KPa)
①	+3.97～+1.60	1850	5	2.3	14	18
②	+1.60～7.35	1920	9.83	4.53	15	38
③	-7.35～12.75	1940	9.83	4.53	15	42
④	-12.75～17.62	2100	16.6	7.96	33	52
⑤	-17.62～20.79	2200	20.83	9.61	35	56

Modeling and analysis process

Using FLAC^{3D} software model size, according to the scope of the tunnel excavation, calculated with reference to both the experience and the practical engineering conditions, the bottom of the model from the tunnel to take center 27m, the entire model size is 80m×40m×40m, where the horizontal direction x 80m, value y direction is 40m (pile length direction), z-direction (the direction of tunneling) to 40m are shown in Fig.2 and Fig.3.

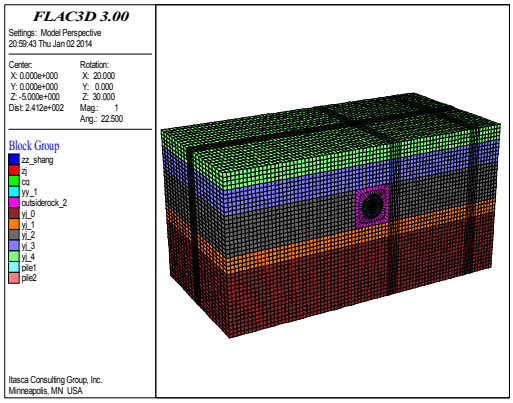

Fig.2 Two Piles whole model diagram

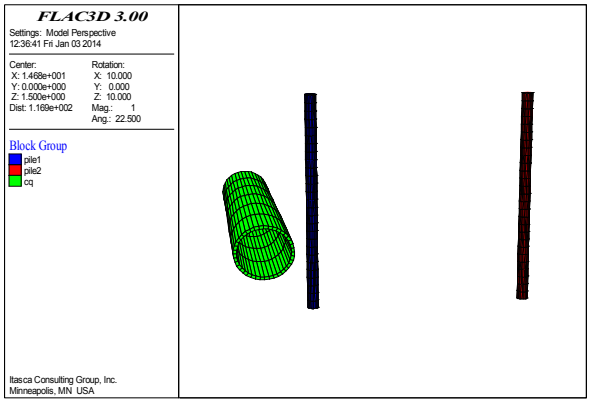

Fig.3 Double tube sheet pile and model diagram

Analysis process:

(1) First excavation face shield to be introduced to the concept of horizontal distance from the observation of H-section. When the value of H is positive, indicating the position of the shield