

Structures and Building Materials V



Edited by
Yun-Hae Kim and Xun Wu

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Selected, peer reviewed papers from the
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Edited by

Yun-Hae Kim and Xun Wu



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Phone: +1 (603) 632-7377
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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 Shenzhen, 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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Table of Contents

Preface and Conference Organization

Chapter 1: Geotechnical and Structural Engineering

Analysis on Influence of Shield Tunneling on Bridge Double Pile P.S. Xi, X. Zhao and Z. Li	3
Application of ABAQUS in Surrounding Rock Stability Analysis of Shallow Large Cross-Section Tunnel L.Z. Cai and C.L. Zhang	8
Application of Damaged Plasticity Model on Slab-Column Joints H. Ding, J.P. Wang and C. Fan	13
Dynamic Characteristics Analysis on a Super High-Rise Building Structure under Seismic Effect Z. Chen	18
Dynamic Response of a Steel Bridge under Earthquake Action in Liugong Island of Weihai X.Z. Jiao and Y.B. Shao	23
Experimental Research on Anti-Seismic Performance of the Plane Steel Frame Beam-Column Joints X.F. Li and X.W. Wang	27
Influence of Stiffness Weakening at Construction Joints on the Deflection of Cantilevering-Cast Prestressed Concrete Box Girder H.J. Li	34
Internal Force Analysis of Frame Structure Considering the Soil Constraint S.Z. Liu	38
Lateral Resistance Influencing Factor Analysis of Small Diameter Anti-Slide Pile Based on Orthogonal Test L. Liu, M.H. Bai and W.L. Lu	42
Mechanical Properties of HPC and Numerical Simulation of Mine Shaft under 3D Load H. Cao and L.L. Jiang	48
Method of Bending Stiffness Parameter Identification of Stay Cable H. Du, D.Y. Liu, F.W. Huang and J.B. Liao	52
Multi-Level Structural Characteristics and Quasi-Static Analysis of the Hagia Sophia Using Finite Element Method Q.R. Chen, C.Z. Zheng, X.Q. Ning, X.H. Liang and S.Q. Huang	59
Parameter Optimization of Liquid Viscous Damper Based on Energy and Control Indexes under Random Excitation L.X. Wang, Q.Y. Liu, S.K. Di and C.S. Xiang	64
Reliability Appraisal and Calculation Analysis of the Structure of a Heavy Industrial Plant L.Q. Jin, X.P. Zhang, H.N. Xing, Z.L. Liu and D. Li	69
Research of Surrounding Rock Classification Correction Method H.L. Deng, S.M. Wang, G. Chen and Y. Guo	74
Research of Tunnel Excavation Support Techniques H.T. Niu	85
Research on Construction Control of Long-Span CFST Arch Bridge Y. Gu, Y.D. Li and S.Z. Liu	88
Robust Optimization for Shape Design of Arch Dams Based on Strain Energy L.S. Sun and F. Du	94
Size and Pretension Optimization Design of Deployable Cable-Frame Antenna Structures Y.L. Zong, H.J. Cao and Y.J. Ma	101
Stability Analysis on High and Steep Slope of Open-Pit Based on Limit Equilibrium Method Z.H. Xie, R.Y. Xie and X.Y. Lu	106
Stability Evaluation of Filled-Subgrade with Cracks Formed after Earthquake X. Zheng and L. Cong	112

Study on Damage Effect of Concrete Bridge Model under Blast Loading L. Chen, T.H. Jiang, J. Gong and L.J. Cai	116
Study on Evaluating the Seismic Performance of Building According to Detail Seismic Condition W.Y. Zheng, J.Z. Jin, H. Gong and P. Pan	121
Study on System Reliability Analysis Method for Composite Foundation Improved by Combined Piles Z. Feng, N. Wang and Y. Da	130
The Dynamic Response of Tunnel through the Karst Cave under Impact Load H.L. Deng, S.L. Wu, S.X. Guo, L.B. Ma and Y. Guo	135
The Finite Element Analysis of Vacuum Leak Detection Container L.C. Sun, Q. Liu, J.M. Chen, G.F. Wang, D.H. Meng, Z.H. Du and H.F. Zhang	143
The Force Analysis of Anchor Anti-Slide Pile in Slope Reinforcement under Seismic Load H. Ding, J. Chen and L. Song	148
The Study of Structure Supporting System in Log Cabins Y.L. Zhang, H.R. Wang, S.J. He and B.S. Yang	154
Thoughts of Alleviating the Disadvantage Effect of Static Sinking-Pile K.L. Chen, J.B. Lei, T.S. Yue and X. Zhou	160
Experimental and Numerical Analysis on the Bonding Performance of GFRP Bolts Y.C. Kuang, L.W. Ou and J.X. Hu	166
Numerical Simulation of Z-Shaped Column Joints in RC Frame Based on Damage Plasticity Model Z.Q. Ni and Q.S. Cui	173
Prospects of Seismic Upgrading a Weak R.C. School Building Using Light Gauge Steel Walls L. Fülöp	179
Research on Shear Bearing Capacity and Sliding Performance of Modified Mortar Isolation Sliding Layer for Rural Construction J.L. Guo, K. Yuan and L.L. Zhang	185
Seismic Behavior of Partially Encased Concrete Composite Columns G.T. Zhao and Q.W. Hu	190
Test & Research on the Shearing Strength of the Continuous Seams in the Mortar-Less Fabricated Block & Masonry X.X. He and Y. Lin	194
Development and Prospects of the Shapes of Concrete Hollow Block for Building Wall J. Zhao, J.S. Zhang, L. Wang, L. Liu and Z. Wang	201

Chapter 2: Building Materials

Crack Control Measures for Cast-in-Place Concrete Slabs Y.L. Cheng	215
Effect of Corrosion Pit Position on Mechanical Properties of Corroded HRB400 Reinforced Bar H. Li, X. Wu and J.J. Yue	220
Effects of Activator on the Properties of Brick Powder Foam Concrete X. Liu and Y.J. Li	224
Effects of Fe_2O_3 on the Properties of Iron-Red Fancy Glaze with Low Thermal Expansion (II) W.X. Dong, Q.F. Bao, X.Y. Gu and S. Li	229
Effects of Si/Al Molar Ratio on the Properties of Iron-Red Fancy Glaze with Low Thermal Expansion (I) W.X. Dong, X.Y. Gu, Q.F. Bao and L. Shen	233
Features of Phase Formation in Cellular Autoclaved Composites with Nanostructured Modifier V.V. Nelubova, V.V. Strokova and Y.V. Palshina	237

CHAPTER 1:

Geotechnical and Structural Engineering

Analysis on Influence of Shield Tunneling on Bridge Double Pile

Pei sheng Xi^{1,a}, Xiao Zhao^{1,b}, Zhen Li^{1,c}

¹ Department of Civil Engineering, Anhui Jianzhu University Hefei 230601 China

^axipeisheng@163.com, ^b316004122@qq.com, ^c1069651615@qq.com

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.

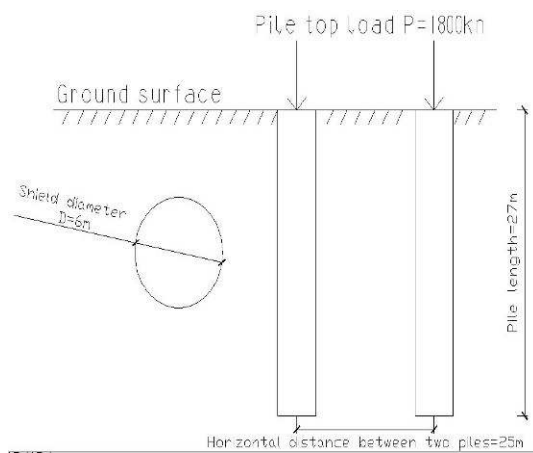


Fig.1 Concrete layout

Table 1 Mechanical parameters of soil strata

Number soil	Range (m)	Density (kg/m ³)	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.

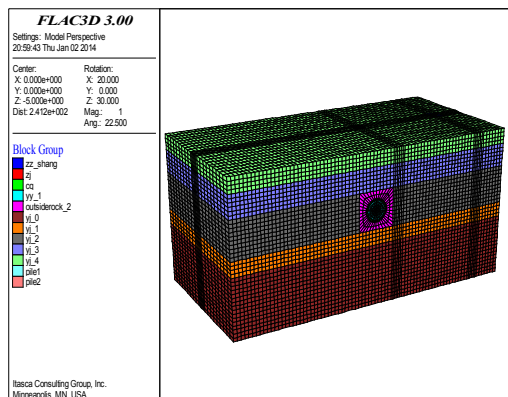


Fig.2 Two Piles whole model diagram

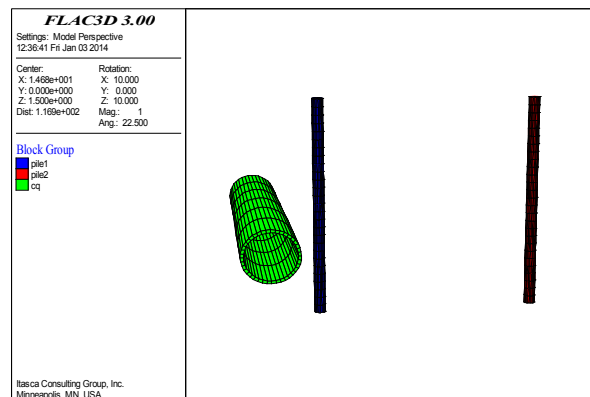


Fig.3 Double tube sheet pile and model diagram

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