

Analysis of the Influence of Foundation Pit Excavation on Adjacent Metro Tunnel

Jian ZHOU^{a,b}, Shuaihua YE^{a,b,*}, Hao ZENG^{a,b}

^a Key Laboratory of Disaster Mitigation in Civil Engineering of Gansu Province, Lanzhou University of Technology, Lanzhou 730050, China;

^b Western Center of Disaster Mitigation in Civil Engineering of Ministry of Education, Lanzhou University of Technology, Lanzhou, 730050, China;

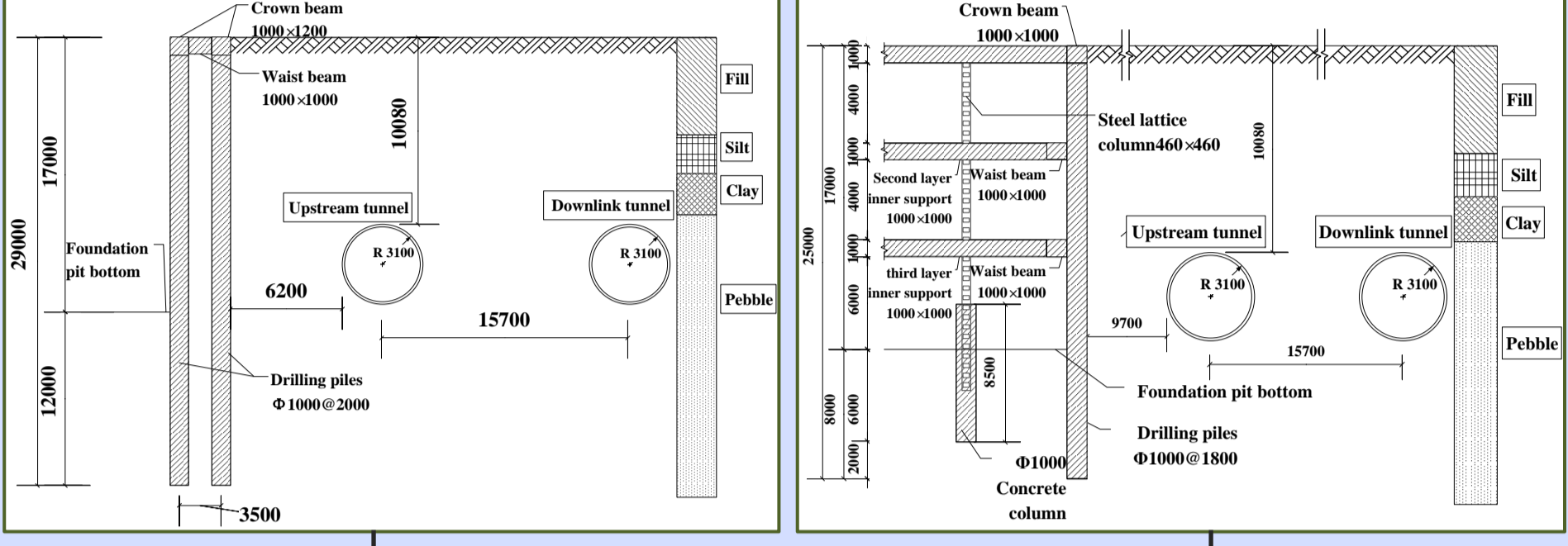
* Corresponding Author, Shuaihua YE, Nr. 287, Langongping Road, Qilihe District, Lanzhou City, Province Gansu; E-mail: yeshuaihua@163.com.

INTRODUCTION

Foundation pit excavation will cause certain damage to the surrounding above-ground buildings and underground tunnels and even lead to water seepage and cracking of tunnel segments, threatening the normal operation of the subway. The form of foundation pit supporting structure has great difference in the control of displacement and internal force of adjacent tunnel. The common supporting forms are pile-anchor supporting structure, double-row pile supporting structure, row piles (ground connecting wall) + internal bracing structure.

METHODS

In this paper, by introducing the case of foundation pit support engineering, two different support schemes are designed, and then use the numerical simulation software to establish models for comparative study. Finally, the ability of the two forms of support to control the deformation of the excavation side soil and the tunnel, as well as the practicability in this project case are obtained.

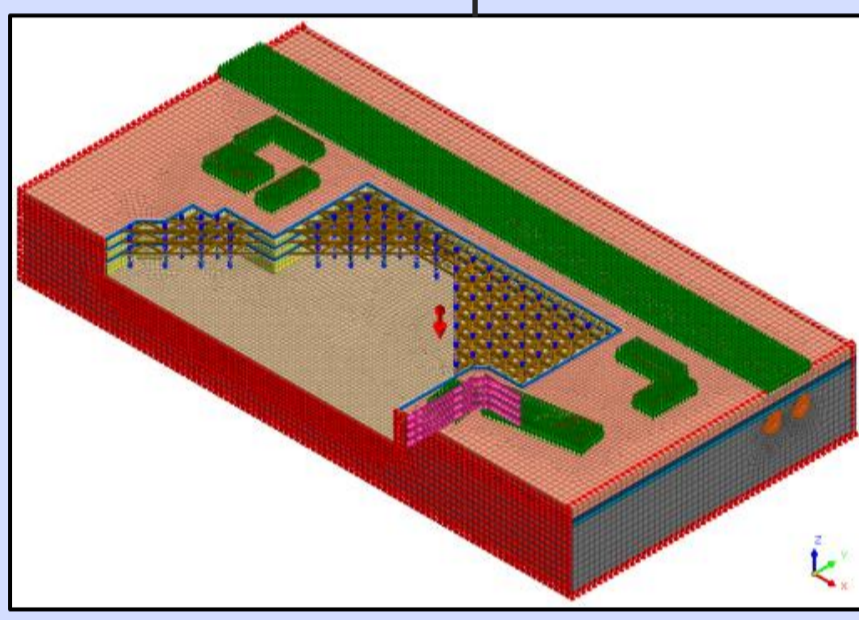
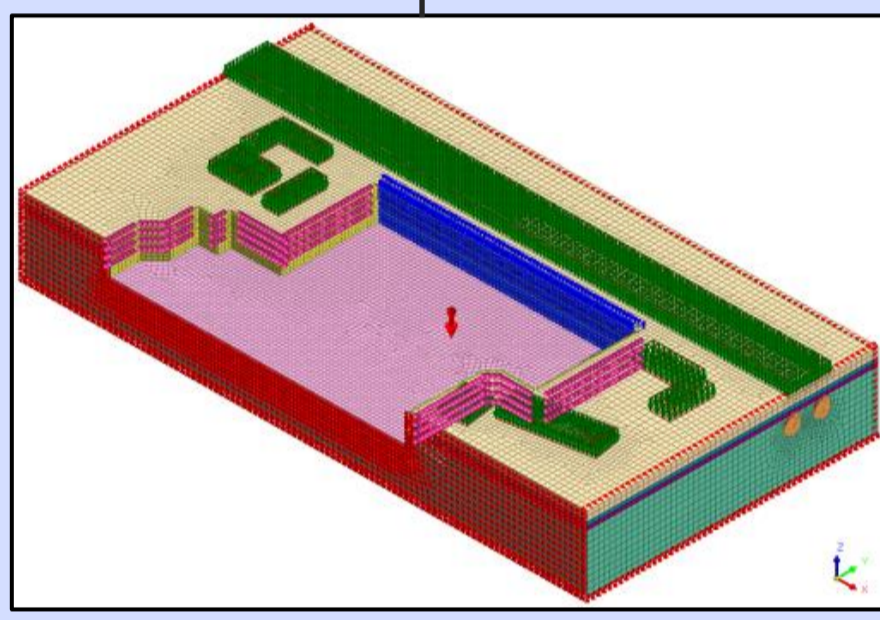


Two different forms of foundation pit support

Scheme 1: Double row pile support structure

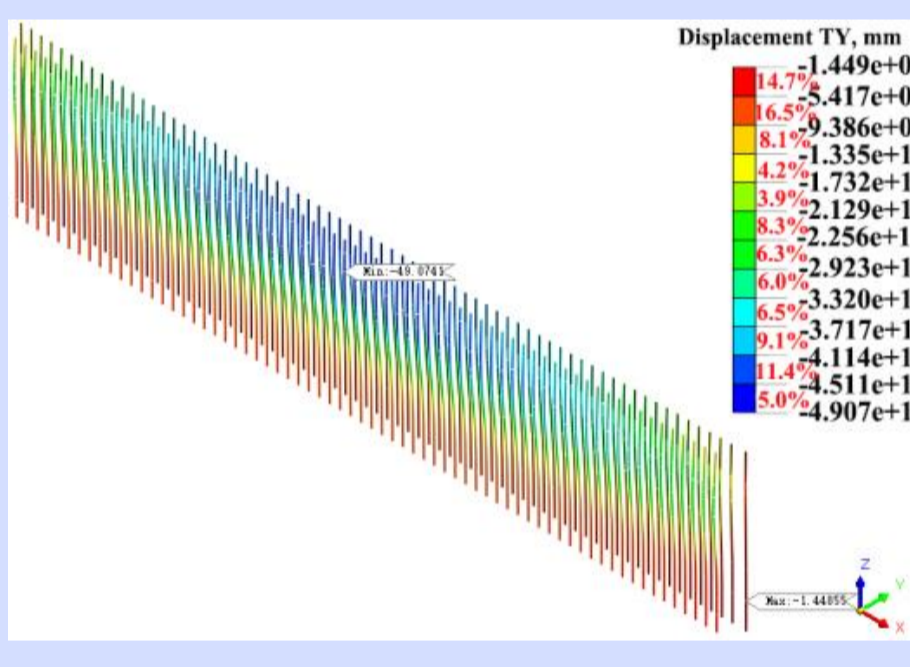
Scheme 2: row piles + internal bracing structure

Establish two finite element models

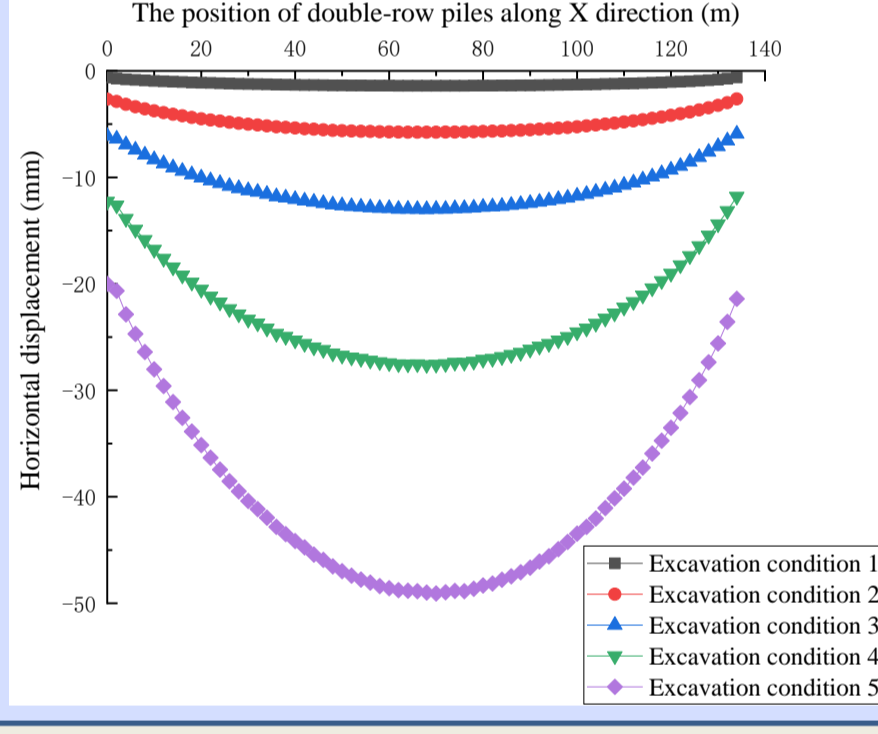


DISPLAY OF CALCULATION RESULTS

Displacement of supporting structure in scheme 1:

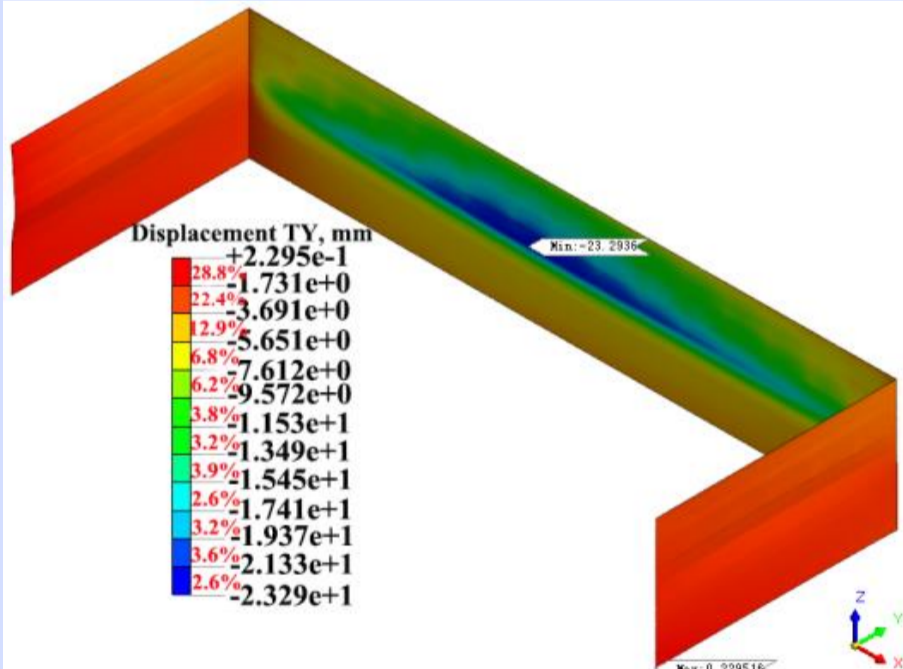


Cloud map of horizontal displacement of double-row piles

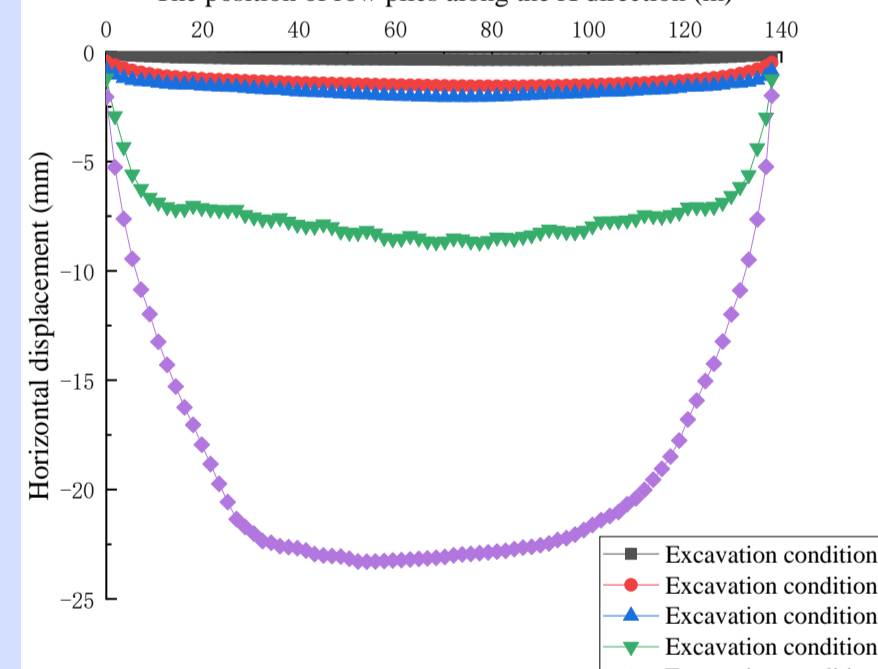


Variation of horizontal displacement of double-row piles with working conditions

Displacement of supporting structure in scheme 2:

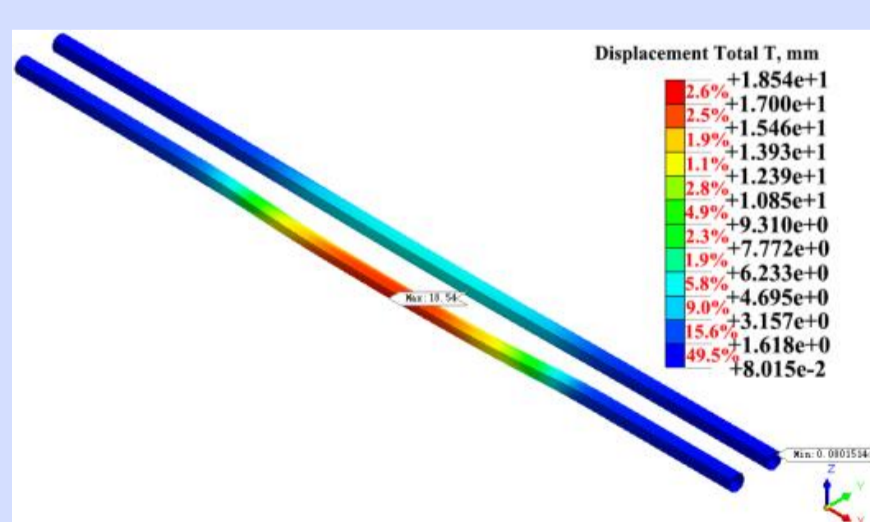


Cloud map of ground-to-wall displacement

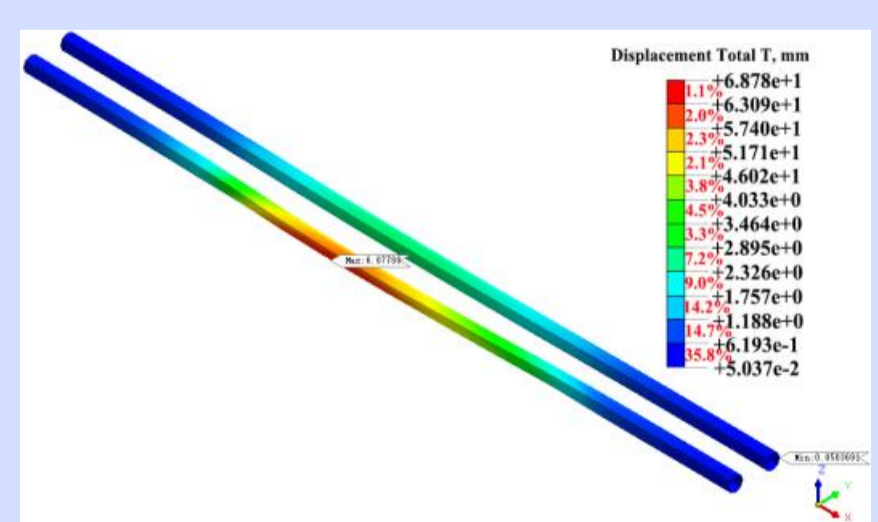


Displacement change diagram of diaphragm wall with working conditions

Tunnel displacement of different support schemes:



Double-row pile supporting structure

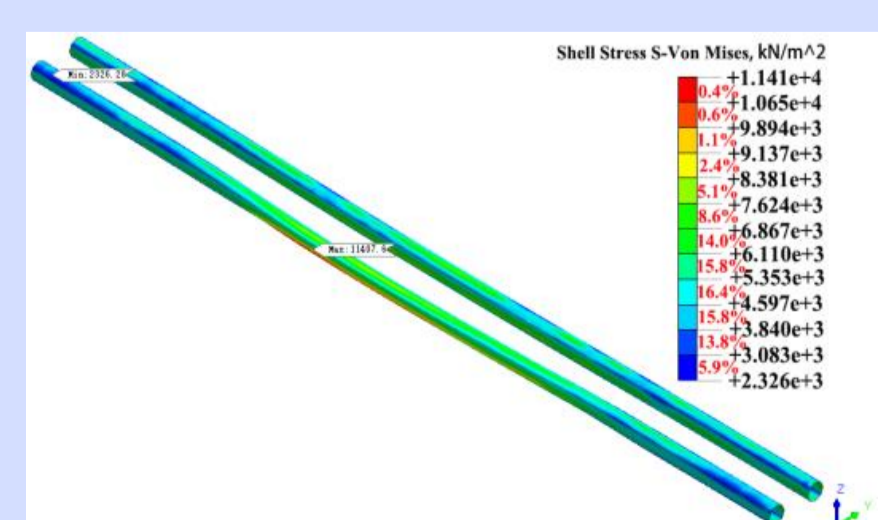


Row pile + internal bracing

Stress distribution of tunnel with different support schemes:



Double-row pile supporting structure



Row pile + internal bracing

CONCLUSION

(1) For the double-row pile supporting structure, the maximum displacement of row piles appears in the middle and upper part of row piles near the midpoint of the excavation side. For the row pile + internal bracing structure, the maximum displacement occurs in the middle of the row pile near the left position of the midpoint of the excavation part.

(2) The comparative analysis shows that the pile row + inner bracing structure is far superior to the double row pile support structure in controlling the deformation of the soil and structure on the excavation side and the deformation of the adjacent tunnel.