Research of foundation engineering mechanics

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Keywords: Strength Deduction Method; Foundation Pit; Support of Foundation Pit; Continuous Wall; Finite Element; Estimation on Stability

Abstract: This paper use Midas to build the three-dimensional research model on varied construction stages of foundation pit, in which the foundation pit applies the scheme of combing continous wall and inner support. In geotechnical engineering, the support pattern regularly applied is continuous wall, whose high security, strong adaptability, good stability and other characteristics have been widely appraised in engineering circles. Further more, this paper makes estimation on the machenical stability in varied construction stages of foundation pit and use strength deduction method to analyze the stress and strain conditions of foundation pit in different working states, the results acquired from which researches have certain reference to the engineers.

Introduction of the Model

The Characteristics & Applicable Scope of Continuous Wall

The underground continuous wall is applicable to soft soil, sand soil or other places with high requirements. The main benefits is good waterproof performance, high structural security[1], capability of combing construction with jamb wall of basement and good integration. However, it is also featured by hard construction technology, slow construction speed, high requirement for machinery and large occupation of site[2].

Building of Model

This three-dimentional support system of foundation pit chooses the scheme of combining underground continuous wall and inner support. The foundation pit is rectangular shape with excavated depth of 18m, length of 22m and width of 12m. Within the foundation pit, angle braces and cross braces are seperately applied in four corners and horizontal direction with a section of supporting beam: BxH=900x700mm. The soil mass is divided into claypan and decomposed rock; regarding to claypan, we set elastic modulus E to be 6e4kpa, cohesive strength c to be 45kpa, angle of internal friction φ to be 12°, gravity of soil mass γ=18KN/m3, saturation gravity γsat=22KN/m3, and poisson ratio v to be 0.35; in the second interface of decomposed rock, we set elastic modulus E to be 3.4e45kpa, cohesive strength c to be 65kpa, angle of internal friction φ to be 40°, gravity of soil rock mass γ=22KN/m3, saturation gravity γsat=21KN/m3, and poisson ratio v to be 0.3.

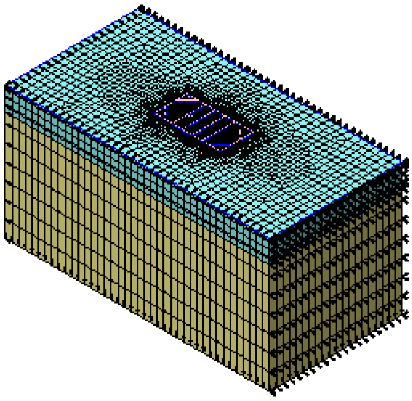

Fig.1 Three-dimensional Foundation Pit Seseau after Adding Support to the Base

Examination of Results of Varied Construction Stages

The Displacement Change in Varied Construction Conditions

The deformation monitoring and control in foundation pit construction are focal contents of informatization construction, therefore, it is essential of an immediate monitoring to the displacement change after completion of varied construction conditions in the construction. See Fig. 2～3 below for the displacement change of foundation pit in varied construction stages. The displacement changes in the figures shows that the design seems too conservative; in varied construction stages, the displacement changes along X and Y directions of foundation pit are all very small as to be less than 1mm, so does it along Z direction; the maximum displacement in final construction stage is about 6.31mm.

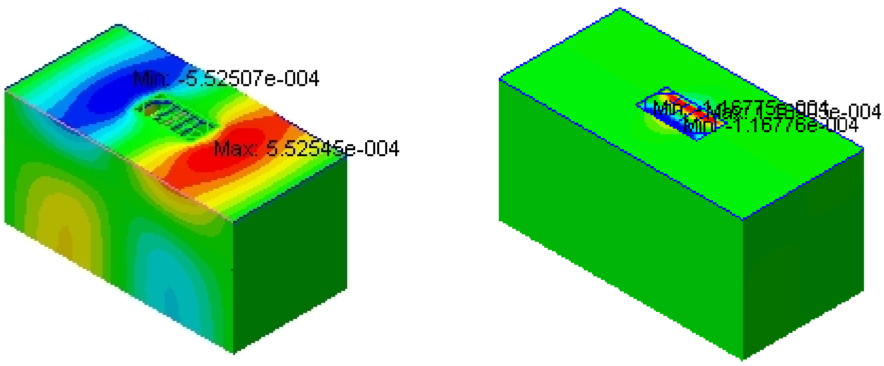

Fig. 2 Displacement along X Direction

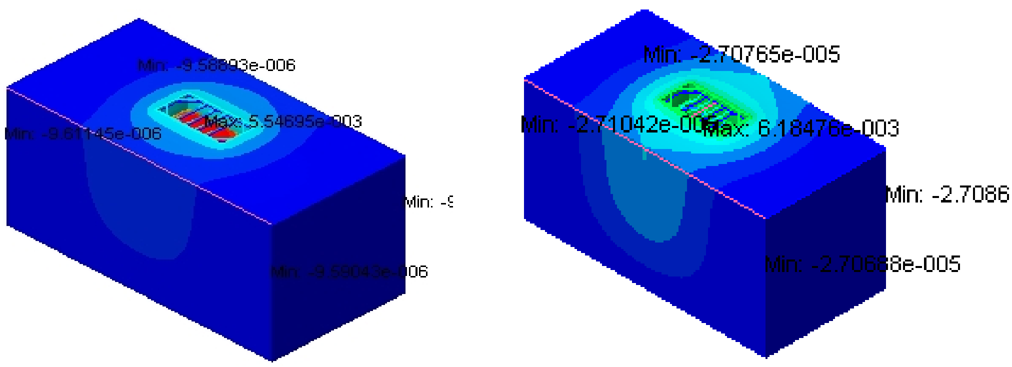

Fig. 3 Displacement along Z Direction

Comparison of Bracing Internal Force

As it includes many result options of internal forces within the varied construction conditions such as axial force, shear force and bending movement, so this paper chooses the change conditions of representative Fy and My. The result indicates that the internal force Fy changes in the horizontal direction along two left/right ends of cross brace with a large value; and the large section of My distributes in brace ends and midspan positions, of which the ends bear large compressive stress and the midspan produces upper blending and deformation. See Fig. 4below.

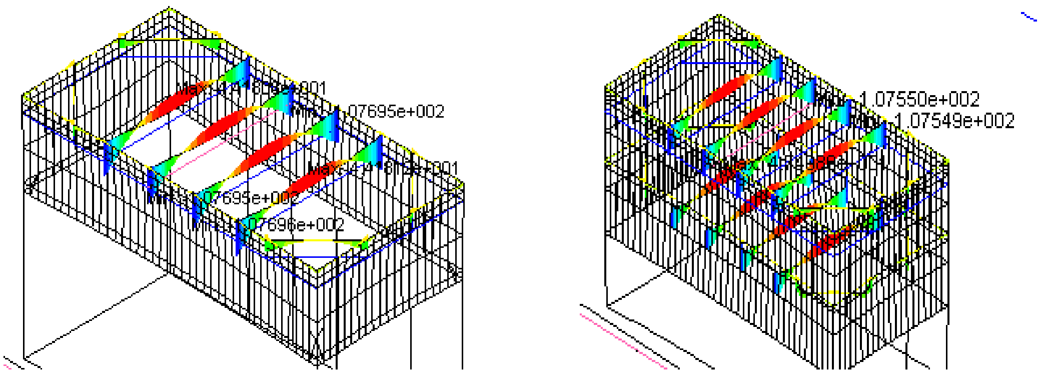

Fig.4Distributuon of My during Brace 1

Internal Forces of Continuous Wall

Under various conditions, there are also many forcing conditions of continuous wall, therefore, this paper chooses the internal force along X direction as reference. See Fig. 5below for the the internal force along X direction of continuous wall.

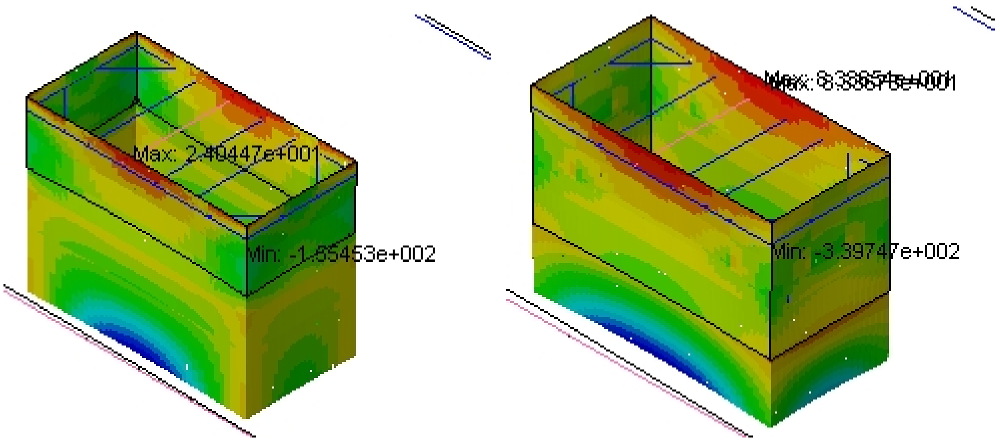

Fig. 5 Internal Force along X Direction

Conclusions

This paper use Midas-GTS to build a three-dimensional calculation and analysis model for varied construction stages of foundation pit, in which the foundation pit applies a bracing system of combining underground continuous wall with inner braces and the construction procedure is divided into three stages: excavation1, brace 1 followed by excavation 2, and brace 2 followed by excavation 3. After operation and analysis, the displacement changes, internal force and stress of inner bracing, internal force and stress changes of underground continuous wall are examined in directions of X, Y and Z of foundation pit during varied construction stages. Due to so many datas of varied costruction conditions in analysis, only several datas such as displacement changes in varied costruction conditions, Fy and My changes of inner bracing and the distribution condition of internal force along X direction of underground continuous wall are selected to get conclusions as follows:

Acknowledgement

This work was financially supported by “Southwest forestry university education scientific research project subject in 2013 (yb201301), Education department Project of yunnan province of(2015Y298), Open fund of glued wood adhesives products key laboratory in yunnan province.”and the corresponding author is Dewen Liu.

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