Study on Key Construction Procedures of CRD Method for Re Shuitang No.3 Tunnel

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Abstract. Controlling the critical construction steps of the CRD method plays an important role in ensuring construction and ensuring construction safety. When using the CRD method for the construction of the Re Shuitang No. 3 tunnel, through the numerical simulation of the initial support structure and the temporary support structure during the tunnel construction process, it is concluded that the left upper step, the upper right step and the temporary support structure are obviously stressed. Construction steps. According to the analysis results, the surrounding rock of the vault should be strengthened in advance, and the second lining structure should be applied after the surrounding rock is stabilized.

1. Introduction

When using CRD method in construction, due to the complexity of the construction process, more attention should be paid to each construction step, control the key construction steps, and ensure the construction safety in the parts with poor stability of surrounding rock. Therefore, the analysis of the key construction procedures using the CRD method can guide the key monitoring of key processes during the construction process, while ensuring construction safety has important significance [1-3].

The domestic and foreign scholars used the theory and numerical simulation to do the following research on the construction of the CRD method: Zhou Baosheng analyzed the traditional CRD construction technology and analyzed the surrounding rock based on the analysis of the supply and drainage pipelines of Shenzhen Railway Line 9. Optimization of grouting stable working face, optimization of temporary inverting arch and installation steps of profile steel [4]. Wang Zhijian analyzed the mechanized construction of the large section of Zhengwangao Iron and Steel Co., Ltd., using on-site investigation and theoretical analysis methods to optimize the control of the face surface, optimization of support parameters and construction method during mechanized construction [5].

This paper relies on the Re Shuitang No. 3 tunnel as an engineering example. The numerical simulation method is used to analyze the construction process when using the CRD method. Through the analysis and comparison of the construction steps of the excavation process, the key construction procedures are obtained, which is the construction safety and control. Rock deformation provides research support [6-10].
2. General situation of Engineering
The starting point of the Re Shuitang No. 3 tunnel is K9+780~K10+335, the length is 555m, the buried depth is 66.69m, the left hole is ZK9+765~ZK10+335, the length is 570m, the short tunnel is buried, the depth is 67.65m. The tunnel has a clear distance of 22~25m and the cross section is a separate tunnel. The elevation of the tunnel area is 1759~1830m, and the relative height difference is 73m. It belongs to the dissolution and erosion low mountain landscape. The terrain is steep, the tunnel entrance and exit has no road access, the traffic is inconvenient, the import section is now forest land, and the vegetation is relatively developed.

2.1 Engineering geological conditions.
According to the regional geological data of Yunnan Province, the area where the line is located is located in the composite part of the Yunnan-type mountain front structure and the middle branch of the eastern branch of the Qinghai-Tibet-Burma-type structure system. The geological structure is complex in the area, and the tectonic geological structure is the backbone structure. The long-term activity of the zonal structure, the meridional structure is a prominent structural system in the area, which belongs to the meridional tectonic system of the Sichuan-Yunnan system, mainly consisting of the compressive, torsional fracture and small amount of the same direction of the meridional tectonic system.

The upper part of the tunnel crossing area is dominated by limestone in the upper part of the Baoshan Formation of the Cambrian system. It belongs to the dissolution and erosion low-mountain landform. The tunnel mountain is a dome mountain. The top of the mountain is smooth and round, and the slope of the entrance section is steep. The natural slope is 20~30°; the exit section is slow, the natural slope is 15~20°, and the terrain is undulating.

2.2 Hydrogeology
The project area is located in the Shidian River Basin. The Shidian River originates from the Nangao Mountain Area of the basin. It flows through the basin from the south to the north, and flows into the Nujiang River from the sharp corner bend of Wang Street to the southwest. The basin channel is manually repaired. Straight, the longitudinal slope is small, the flow in the rainy season is large, and the dry season is cut off.

3 Numerical simulation analysis
3.1 Parameter selection
In this paper, the Midas GTS is used to numerically simulate it. As shown in Figure 2, in the simulation process, the surrounding rock adopts the Mohr-Coulomb constitutive model, the support adopts the elastic constitutive model, and the second lining adopts the plane strain model.
The surrounding rock and support parameters are shown in Table 1.

| Rock and soil | Density (g/cm³) | Bearing capacity of foundation (kPa) | friction (°) | Cohesion (MPa) |
|---------------|----------------|-------------------------------------|--------------|----------------|
| Silty clay    | 18             | 230                                 | 13.4         | 0.04           |

3.2 Parameter selection

The whole process of construction is carried out under the condition that the surrounding rock depth is 20m. The excavation and support sequence are as follows: 1 step excavation on the left side wall and full ring support → 2 left wall lower step excavation and full ring closure Support → 3 steps on the right side wall excavation and full ring closure support → 4 right side wall step excavation and full ring closure support → 5 full section initial support closure.

3.3 Analysis of results

During tunnel excavation, with the excavation of each step, the stress change of the shotcrete is shown in Figure 3. The initial support structure is gradually increased. The temporary support of the left guide pit is the main load-bearing structure, and the horizontal pressure. The largest, lateral support is the main load bearing unit. The excavation of the right guide pit makes the bearing capacity of the surrounding rock completely supported by the lateral and vertical supports. Therefore, the supporting structure should be applied in time. When the surrounding rock is stabilized, the support should be strengthened to monitor the deformation of the surrounding rock.

When the CRD method is applied, the supporting structure bears the deformation of the surrounding rock before the second lining is applied, and the temporary support is the main force-bearing unit, and the joints of the supporting structure are concentrated, as shown in Fig. 3.4. The stress at the node is at most 0.5 MPa, meeting the design requirements.
In summary, when using the CRD method for construction, attention should be paid to the upper step excavation on the left side, the excavation on the right side, and the temporary support demolition, to avoid the disturbance of the surrounding rock due to the removal of the temporary structure, and the construction takes place.

4. Conclusion
Through the comprehensive analysis of the Re Shuitang No. 3 tunnel, the influence of the construction of the two-lane tunnel on the soil above the tunnel is studied. Through the numerical simulation of the excavation section, the following conclusions are drawn:

(1) The amount of explosives should be strictly controlled during the construction of tunnel blasting excavation, and the possibility of damage to the top of the building caused by blasting vibration should be considered.

(2) The tunnel is a short tunnel. Due to the fracture of the rock mass and the requirements of the construction period, the distance between the two working faces should be strictly controlled to avoid the superposition effect of the two-hole stress release ring.

Acknowledgments
The authors would like to express their appreciation to the National Natural Science Foundation of China (41601574) , the Chongqing Basic and Frontier Research Project (cstc2015jcyjBX0118) , the Chongqing Science and Technology Innovation Leading Talent Support Program (CSTCCXLJRC201715) , and the Chongqing Social Undertakings and Livelihood Security Science and Technology Innovation and Special Program (cstc2017shmsA30010) for providing funding for this research.

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