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Research on Temporary Support of High-Speed Railway Tunnel in Low Surrounding Rock Geology

[1]Shengwei Xing; [2]Rui Chi and [3]Jie Pan,
[1,2,3]College of Resources and Civil Engineering, Liaoning Institute of Science and Technology, Benxi, China

Abstract: Based on the actual situation, the main points of the initial support construction of high-speed railway tunnel are studied. Firstly, the initial support requirements of high-speed railway tunnel are discussed, and then the common ways and key points of the initial support are discussed. Through the analysis, in the development stage of high-speed railway tunnel project, it is necessary to choose the support method reasonably according to the characteristics of highway engineering, and control the application process of support technology, so as to improve the construction quality and construction safety of highway tunnel project.

Keywords: *High-Speed Railway; Tunnel Construction; Initial Support*

I. INTRODUCTION

In the construction stage of high-speed railway tunnel, the level of initial support will affect the overall quality of tunnel construction and construction safety. According to the analysis of the characteristics of high-speed railway tunnel projects, it is known that the construction difficulty coefficient of such projects is relatively large, and in some special construction areas, it is easy to appear tunnel collapse and other problems. Therefore, it is of great significance to do a good job in the initial stage of tunnel construction.

II. ANALYSIS OF DEFORMATION CAUSES OF INITIAL SUPPORT OF HIGH-SPEED RAILWAY TUNNEL

Due to the influence of erosion, the boundary intrusion of high-speed railway tunnel will lead to the impact of the initial tunnel support structure on the secondary lining, which is easy to cause the decline of structural performance. The tunnel connection is eroded, on the one hand, because there is no soft structure surrounding rock support and lead to deformation, can not effectively control to improve the performance of surrounding rock structure, it will be transferred to the second lining structure. On the other hand, in the construction of secondary lining concrete, due to the influence of unreasonable lofting measurement and poor formwork strength, the secondary lining is greatly restricted by the tunnel. From the perspective of space, the deformation and damage of the initial support are mainly in the position of the vault and the side wall. The failure forms include spalling and block dropping of the vault concrete, which causes serious cracking problems, which degrades the structure performance and leads to serious quality problems.

III. CONSTRUCTION TECHNOLOGY OF SHOTCRETE

New Austrian method is an advanced construction concept, its key work is concrete spraying construction, dry, wet and other ways of mixed construction. The humidity in the southern coastal area of China is relatively large, small and medium-sized tunnels and the entrance to the hole can be applied to meet the requirements of tidal spray. In the case of dry and large tunnel engineering, the effective construction method is mechanical wet spray. During the construction of the tunnel project, the shadow of typhoons and rainstorms caused high humidity in the air environment. After a period of observation, serious water seepage occurred at the entrance of the cave. For concrete spraying construction, its strength performance is chosen as C25. Comprehensive analysis of these elements, the application effect of tidal spray method is more obvious, can meet the construction requirements and comprehensive benefits are obvious.

IV. TECHNICAL MEASURES OF INITIAL SUPPORT QUALITY

A. Do the preparatory work before the initial spray

In the initial stage of support construction of high-speed railway tunnel, first of all, the content prepared before the construction is determined, the construction parameters and construction standards are understood, and the optimal control of construction equipment and technology is done well, which can lay a good foundation for the follow-up work. Before the initial spraying work, the hidden trouble of water seepage on the rock face should be solved. Because of the influence of humidity and dust on the rock face, it is easy to cause the degradation of concrete bonding performance and threaten the construction effect of the project, so it is necessary to clean up the surface before construction to eliminate the adverse impact. In this way, the cleanliness of the rock face can be achieved, and the humidity of the structure can be increased, so that the environment in the cave can meet the construction requirements and ensure that the quality of the project is qualified.

B. The initial spray should be timely and effective

It is very important to choose the appropriate construction time for the initial spraying link in the hole and the surrounding rock zone of grade IV ~ V. In addition, the thickness can reach 3 ~ 5cm. The completion time of the supporting structure construction needs to be controlled, which is usually completed 2 ~ 3h after the blasting of the surrounding loose surrounding rock. In order to improve the construction efficiency and quality, the project is generally in the excavation of slag heap construction, and it is necessary to ensure the smooth implementation of the erection of steel arch and anchor rod, to meet the safety standards. It should be noted that in the stage of initial injection, it is necessary to fully predict and respond to the possible problems, understand the abnormality of the structure, and then control the scope of initial injection to ensure that the effect of initial injection meets the stiffness requirements.

C. Improve the on-site construction environment

The construction link of the tidal spray method is easy to form more dust impurities on the site. In order to contain the occurrence of this problem, the dust is generally removed by spraying, which can effectively prevent the dust from spreading and affect the quality of the project. Because the tidal spray pressure will affect the dust and concrete rebound rate, the spraying pressure should be controlled well in the spraying construction stage. At present, the construction pressure of tidal spray method is about 0.1MPa. In addition, the nozzle also needs to be strictly controlled, in line with the requirements of the construction technology and technical standards, and the sprayed surface is vertically arranged and the spacing is about 1m to ensure that the spray quality is qualified.

V. INITIAL SUPPORT TECHNICAL MEASURES FOR SPECIAL GEOLOGICAL SECTION OF TUNNEL

The tunnel that meets the requirements of the new Austrian tunneling method has the following conditions: the stability of medium rock mass structure is better; The conglomerate with relatively light cementation or poor stability; Under special geological conditions, such as expansive rock mass or serious water inrush rock mass, NEW Austrian method should be used for construction, and other auxiliary conditions should be combined. In the construction of the tunnel opening, the construction form of surrounding rock should be used in the area of 81m. The 36m length of the tunnel is used in the form of long pipe shed structure and lining structure, and the other parts are used in the construction method of small conduit surrounding rock. In the preliminary stage of construction preparation, the longitudinal map analysis of exploration geology can find that the thickness of a lot of gravel soil and silty clay is within the range of 3 ~ 4m, and the roof of the cave has the form of moderate weathering limestone greater than 4m. The excavation section in the cave is also the same material composition and there is a serious seepage situation. If the excavation section of the tunnel continues to change within this scope, technical construction is required according to the specified requirements. However, there is a sudden situation in the excavation process, so it is necessary to make timely improvement and adjustment. For example, during the excavation construction process within the 45m interval, the cave-in occurred in some locations, and the broken rock of the vault or the serious weathering occurred in the excavation process, so the dividing line was set. Need to adopt the measure is to forward the tunnel construction according to the form of the longitudinal slope of site construction, and finally the excavation section and arch on the border area of a serious problem of weathering and yellow slurry water seepage problem, this is caused by the poor geological conditions and geological exploration is not in place before construction, the situation that is not comprehensive understanding of design.

In order to effectively control the soil collapse, it is necessary to improve the stability of the vault, so it is necessary to strengthen the control of the vault, timely clean up the severely weathered soil structure, and use the structure form of advanced support. The use of improving the density, strength and other performance requirements to ensure that the structure is more secure. If there is no stable surrounding rock structure in the tunnel vault, appropriate support forms should be selected to meet the standard requirements of protection, so as to avoid the problem of collapse. Due to the short time of using this method and its application to engineering practice in an all-round way, there are obvious deficiencies in standards and technology. For the zone where the weathering of the vault is more serious, the section damage is serious. It is necessary to increase the double-layer reinforcement and bolt support within the scope of 120o of the vault to achieve the protective effect and promote the bearing performance requirements of the structure, while the lower structure can meet the safety requirements. Generally speaking, multi-layer steel mesh should be added in the initial support construction to achieve coordinated application, to ensure that the structural performance is qualified, the strength, stiffness and durability meet the requirements of use, to achieve the overall stability of the structure, and fully meet the operation standards of the project.

CONCLUSION

High-speed railway tunnel construction is prone to encounter some poor geological conditions, if the necessary countermeasures cannot be taken, will bring great impact on the quality and safety of the project, so before the construction need to determine the initial support scheme, understand the specific situation of the construction site, strengthen the construction site management and control. It is found from the analysis of practical engineering cases that the initial support method has good effect, which can improve the stability of surrounding rock structure, make the safety and durability of the project meet the requirements, and play a positive role in the smooth construction and operation of the project.

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