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Discussion on Construction Plane Control Measurement Method in Long Tunnel of High-Speed Railway

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Abstract: ***Tunnel construction plane control is the core of high-speed railway tunnel construction, and its quality directly affects the accuracy and security of tunnel technology. With the advent of GPS ink-jet technology and the emergence of precision electronic level, the quality requirements of tunnel plane control are becoming higher and higher. In this paper, taking Zheng-Wan high-speed railway as an example, the construction plane control measurement method in the long tunnel of high-speed railway is discussed.***

Keywords: high-speed railway long tunnel; Plane control survey; Cross double conductor; Data processing.

1. INTRODUCTION

The Sujiayan Tunnel of the sixth standard and third branch of Zheng-Wan high-speed Railway, with a total length of 5,360 meters, adopts large mechanized section excavation method and Leica TS16 total station instrument with automatic prism finding function. Use laser scanning section method to control the scanning section, upload the section map to the PM system, summarize and analyze the tunnel overcut and undercut, control the square amount of shotcrete, and control the cost.

2. MEASURING METHOD OF CONTROL IN LONG TUNNEL

2.1 Research background of long tunnel engineering survey technology

Recently, China's railway, especially the high-speed railway, has been developing rapidly. The construction and operation of high-speed rail accounts for more than 60 percent of the world's total length. During the 13th Five-Year Plan period, China has basically completed the construction of a high-speed rail network with five vertical lines and five horizontal lines. And in the "13th Five-Year Plan", the fast lane will continue to develop more than 10,000 kilometers, the development of intercity express and railway is inseparable from the construction of tunnel projects, the use of reasonable measurement technology to control the quality of tunnel project construction, is particularly important to promote the development of high-speed rail transportation in China.

2.2 Study the significance of control measurement methods in long tunnels

Every step from measurement data guide to design to control involves tunnels. The accuracy of measurement data is closely related to the design efficiency and quality of the whole project. If the data errors generated in the measurement work are not within the acceptable range, it will not only cause a large amount of waste of human and financial resources, but also lead to project delay, thus increasing the cost of tunnel construction project.

2.3 Research on control measurement methods in tunnel tunnels at home and abroad

As mentioned before, the application of measurement technology is very important in the construction of high-speed rail tunnels and must be comprehensively reviewed. At present, great progress has been made in tunnel research at home and abroad, so most of the measurement has been realized intelligent, high efficiency and automation. In practice, advanced measurement techniques such as GPS measurement and total station measurement are widely used, thus reducing work intensity and improving work efficiency to a great extent. We put forward various advanced methods to measure the planar control measures proposed by foreign experts. In particular, the network intersection of Freedom Station provided by Liu Chenglong and Southwest Jiaotong University [1].

3. COMMON METHODS OF CONTROL MEASUREMENT IN LONG TUNNEL

3.1 Total station measurement

Overall management mainly uses total stations. This includes GPS points that form triangular viewpoints at the entrance to the tunnel as directions. In the actual working process, in order to effectively ensure the accuracy of the measured data in the hole, we need to check the measured data. In the work, we mainly use Leica TS16 total station to control the measurement inside the tunnel, so as to select the best measurement time to check and measure the inside of the tunnel. In addition, for horizontal Angle

measurement and vertical distance measurement, we need to use different measurement methods. When making specific measurements, environmental factors such as air pressure and time, temperature, etc., must be determined.

3.2 GPS Measurement

GPS measurement is retrieved using the principle of positioning. Actual measurements require 3 or more GPS receivers to make the same measurements. So we can use more than 4 GPS or GLONASS to get a more accurate position, thus ensuring accurate control measurement. The advantage of using GPS measurement is that due to the complete cycle operation, it can improve the degree of automation of measurement, simple operation method, high positioning accuracy, and effectively reduce the workload of measurement.

4. TUNNEL PROJECT TUNNEL PLANE CONTROL AND MEASUREMENT SCHEME

4.1 Project Overview

The Sujiayan Tunnel of the sixth standard and third branch of Zheng-Wan high-speed Railway, with a total length of 5,360 meters, adopts large mechanized section excavation method and Leica TS16 total station instrument with automatic prism finding function. The scanning section is controlled by the laser scanning section method, and the section map is uploaded to the PM system to summarize and analyze the tunnel overcut and undercut, control the square amount of shotcrete, and control the cost [2].

4.2 Network Type selection

In tunnel construction projects, flight control usually selects the correct wire Measure. Based on previous design experience, the tunnel has been drilled together in less than 3 km in length, so we can use enclosed measurement (semiconductor) to meet the requirements of plane management. If the tunnel is excavated longer than 5 km, the front end of the tunnel should be in the shape of a closed closed-loop, and each ring should be composed of 4 to 6 sides to improve inspection conditions inside the tunnel. Long tunnels should be laid with cross drivers to enhance network security. Tunnel construction, blasting, bogie lining and waterproof flat-lined casing stop near the surface of the excavator and have a great impact on visibility. If crossed double conductors are placed on the line, the visible width is only 2 to 3 m, so each closed loop has two very small angles (less than 1°), thus greatly ensuring the measurement accuracy of the small angles. Through fault analysis, the overlap measurement method of cross section and the accuracy of extended closed conductor should meet the acceptance requirements of the standard.

4.3 Embedding of control points

(1) The control point is a special high quality measurement point, the electric drill, mortar or anchor buried on the filling surface. One on the left and one on the right, every 200 meters.

(2) Considering that the air quality of the tunnel is widely used, the control point is easy to be buried in the process of construction, etc., so we suggest checking the length of the tunnel conductor of about 1 meter. Edges should be as close in length as possible to minimize visual errors caused by focusing during measurement.

(3) It is recommended that the ventilation pipe of the tunnel be placed in the middle of the tunnel roof. If it is placed on both sides, the measurement visibility and settlement monitoring of the lining will be affected.

(4) The control point is buried at the top of the side wall of the cable groove and avoids the carriageway on the filling surface. The disturbance of the instrument during measurement is small, and it is conducive to the protection of the control point.

(5) The ventilation equipment of the tunnel is placed on the right side of the line.

(6) The control point is buried on the filling surface, so that the instrument is less interfered when measuring, and it is conducive to our effective protection of the control point.

(7) The automatic alignment of the whole station is realized by analyzing and calculating the laser phase.

The side wall or tunnel structure will affect the properties of laser refractory materials to a certain extent. If observed manually, the perspective can also be affected by post-tension. In order to effectively reduce the influence of the side wall or other structure of the tunnel on the side light measurement and improve the accuracy of the measurement, we need to specify the visibility distance of 0.2 m from the structure. It is important to note that the appearance is measured, not the location of the control point. Taking the side wall of the tunnel as an example, the distance between the viewpoint of the straight section and the checkpoint point. According to the formula, the minimum distance between the checkpoint of the inner curve of the tunnel and the wall adjacent to the tunnel is 0.98m.

In actual tests, the effect of spin on the level measurement was irregular, depending on volatile vapors, smoke, and other factors in the tunnel, but the distance from the checkpoint side of the tunnel wall was significant. The smaller the Angle, the more helpful to improve the measurement accuracy, the curved part of the tunnel on the side wall of the cable trough. And the side of the tunnel are provided with control points. When measuring thread, ensure the equipment distance is 1.5 m away from the side wall of the tunnel, and the minimum distance from the side wall to the end of the wall is about 1 m, which can effectively reduce the measurement error caused by the horizontal reaction force [3].

4.4 Field test

According to the technical requirements of the second type of wire, we carried out a detailed field investigation. Note the following points during measurement.

(1) Due to the large number of checkpoints, it is necessary for us to place sending equipment according to the order of points and bitmaps before field observation to avoid measurement errors.

(2) Before measurement, we must carefully check and correct the prism base of the instrument, etc.

(3) Because the temperature difference between the inside and outside of the tunnel is constant. Therefore, the instrument should be left for at least 20 minutes before measurement. Then, the instrument can adapt to the temperature of the tunnel and avoid the problem of inaccurate measurements caused by water dew.

(4) Carefully adjust the prism of the equipment. The accuracy of the measurement can be greatly improved by calibrating the equipment before starting the measurement. During the adjustment process, you can control the adjustment effect in each direction to check each direction. If the deviation is basically the same, then the adjustment error of the equipment will be reduced.

(5) After the completion of the monitoring of each site, if it does not meet the specifications, we need to adjust it in time. Whenever a closed-loop is tested, a calculator with programmable capabilities can be used to calculate whether the differential closed-loop exceeds its limits to meet specific regional requirements.

(6) Due to the complex tunnel construction process, the air quality in the tunnel is poor, and the observed quality changes greatly. Therefore, we need to take appropriate measures during the measurement of control points. Practice has proved that the accuracy of one-time observation is high, and precise control points can improve the technical characteristics of tunnel.

4.5 Data Processing

Industrial data processing is done by computer software.

4.5.1 Checking Data

The data configuration is calculated in a closed loop using cable calibration and other software and tested to see if the detection exceeds the limit. We can also use the software's error cleaning feature to eliminate excessive measurement errors.

4.5.2 Side Length correction

Due to the fluctuation between the original reference point and baseline in the field study and hypothesis study prior to adjustment, we had to correct the length of the leading edge to the height.

4.5.3 Tunnel penetration effect

By creating the appropriate control layout diagram, this tunnel is equipped with high output capacity measurement control points and strict control of every detail measurement in the domestic and international industry. The result of the needle insertion measurement is 3 mm, horizontal needle insertion error and vertical needle insertion

5. CONCLUSION

It would be very difficult to build a tunnel without all kinds of terrain data from the survey. Long tunnel has a variety of control measurement methods, so the choice of survey method is very important in the actual operation. Correct control measurement method is helpful to promote the development and design of high-speed rail tunnel project. Information asymmetry and lack of customer information feedback exist in the logistics service supply chain, which leads to problems such as low logistics service levels in the supply chain. Through combing the relevant literature, this paper clarifies the concept and composition of the logistics service supply chain, and the research on the information feedback between the subjects of the physical service supply chain, and finds that there are still deficiencies in the research of customer information feedback in the logistics service supply

chain. Propose specific ideas for integrator and provider contract design optimization.

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