Risk Identification of Urban Rail Transit Engineering Construction

Bo Su

Jilin Technology College of Electronic Information, Jilin, Jilin, 132021, China

Keywords: Urban rail transit engineering, Construction management, Risk identification method

Abstract: Starting from the characteristics of rail transit engineering construction, combined with the overall planning of Shanghai rail transit construction and the engineering practices under construction and proposed, analyze the risk identification in the unprecedented development of rail transit. The contents of construction behavior risk identification and construction risk identification are introduced respectively, and measures to avoid various engineering risks are explained.

1. Introduction

Urban rail transit project construction is a comprehensive construction project involving multiple disciplines and multiple types of work. Classified in a general sense, the rail transit system is composed of lines, vehicles and depots, boundaries, rails, station buildings, structural engineering, power supply, communications, signals, environmental control systems, water supply and drainage. To build a rail transit line, all the above-mentioned professional and technical personnel must participate together, and the coordination between the various disciplines involved in the construction process becomes very complicated and necessary. The construction of urban rail transit requires the guidance of various government agencies and competent departments such as the Planning Bureau, the Transportation Bureau, the Environmental Protection Bureau, and the Public Security Bureau, as well as major pipeline units and traffic management departments such as water supply, gas supply, power supply, communication, and drainage. The cooperation of the city is inseparable from the full support of the streets, neighborhood committees, units and residents along the line. Therefore, the boundary conditions of the rail transit construction project are complicated, and the social aspects involved in the construction process are quite wide.

According to the engineering practice of rail transit construction, avoiding various engineering risks in the construction process has always been the management focus of the builders. The risks of construction projects exist objectively. Therefore, it is necessary to systematically study the risks of rail transit projects systematically in view of the characteristics of rail transit engineering with many specialties, long construction period, complicated boundary conditions, and mostly passing through urban central areas. Especially facing the huge rail transit construction plan, facing the rapid advancement of building science and technology and the continuous application of new technology, new materials, new equipment, and new technology in engineering practice, facing the construction, construction, and supervision involved in the construction With the uneven experience and management level of other units and the relative shortage of management teams, in the face of the background of various laws and regulations in the construction field, which are constantly being established and sound, only a comprehensive analysis of the various risks in the rail transit construction process can Take practical and effective evasive measures to ensure the smooth realization of the rail transit construction plan.

2. Analysis of Dangerous Factors in Urban Rail Transit Engineering Construction

During the shield construction process, due to the influence of geological conditions, existing buildings, groundwater and other factors, the possible dangerous factors during the construction process are as follows: 1) When the tunnel passes through soft soil layers, water-rich sand layers, karst caves, and structures When the broken zone, residual soil, softened rock, top soft and bottom hard, uneven soft and hard geology and shallow overlying soil, there are risks such as surface

  DOI: 10.25236/ic3ec.2020.024

subsidence and collapse; when tunnels pass through spherical weathered bodies or boulders, there are difficulties in tunneling. Risks such as tool wear. 2) When encountering high groundwater level or confined water, there are risks such as floating of tunnel segments, difficulty in grouting and stopping water, gushing, and collapse. 3) When the tunnel crosses the railway and subgrade, there is a risk of deformation and cracking of the pile foundation and subgrade; when the tunnel crosses the existing rail transit line, there is a risk of settlement and deformation of the existing line, which affects normal operation; when the tunnel crosses the municipal overpass and road, There are risks of subsidence and deformation of overpasses and roads; when a tunnel passes through structures, there are risks of settlement, tilt, cracking, and deformation of the structures; when a tunnel crosses a river, there are risks of surging, settlement, and tunnel deformation. 4) In the process of shield tunneling, there are risks of shield passing through the station, shield attitude control risk, battery car operation risk, shield tail leakage, and soil entry into the warehouse; when the shield arrives, there is a failure of the seal of the tunnel and the leakage of the shield. The risk of poor posture control and failure to exit the hole; Water seepage and collapse when the end well is not well reinforced; The head of the shield is prone to sinking danger when the shield head is away from the start of the well; The hole is not well sealed and leaks. The segments of the tunnel opening are prone to misalignment and damage; after the shield tunnel is broken, because the shield machine cannot provide sufficient reaction force, the segment joints are prone to water leakage.

Compared with shield construction, undercut construction has greater risks in terms of preventing face collapse and impact on the surrounding environment. The possible dangerous factors in the construction process of the undercut method are as follows: 1) The working face is the most dangerous part in the process of undercutting, the worst working environment and the highest disaster rate. There are many reasons, such as geological factors, unproven underground disasters, sand inrush, and collapse. In addition, low quality of construction personnel, poor safety awareness, low professional skills, and negligence of management personnel are also the reasons for frequent hazards here. 2) During underground excavation construction, asymmetric excavation and dismantling of supporting structures may cause bias risk of each excavation section. In addition, underground excavation of high-narrow-section and large-span sections is prone to bias risk. 3) The stress field of the surrounding rock during the construction of variable-section undercutting is complex and changes greatly, and the stability of the surrounding rock is at risk.

3. Risk Identification of Urban Rail Transit Engineering Construction Behavior

The behavioral risks of the construction unit include: whether the project is contracted to a unit with the corresponding qualification level; whether the project is dismembered and contracted; whether the bidding procedures meet the relevant regulations; whether the construction drawings are entrusted to a qualified unit for review; whether the project has received a construction permit; whether it is in accordance with It specifies whether to go through quality supervision procedures and safety supervision procedures; whether to conduct various disclosures to relevant units before construction; whether various design documents are submitted to relevant government authorities for approval; whether to carry out project completion acceptance, file management and project transfer in accordance with regulations. Whether the corresponding personnel of the construction unit have obtained the qualification certificates that meet the requirements; whether the professional construction personnel hold relevant job training certificates; whether the main construction personnel are replaced without the formalities in the implementation of the contract; whether the construction permits are available before the start of the construction; the construction Whether the organization design has been approved by the relevant technical person at a higher level; whether the subcontracting or subcontracting project is illegal; whether the construction is carried out according to the drawing and the design standard is reduced; whether the applied building materials are inspected and tested.

Whether the corresponding personnel of the supervision unit has obtained the qualification certificate that meets the requirements; whether the chief supervision engineer and professional supervision engineer are stationed on the site according to the required time; during the construction of key parts and key procedures of the project, whether the supervision adopts stand-by and inspection behaviors; the supervision unit responds to the application Whether the construction materials of the project are subject to parallel testing in accordance with regulations; whether the supervision unit undertakes the project within the scope of the qualification permit; whether the supervision business is transferred; whether the supervision is implemented in accordance with the relevant national laws and regulations and relevant technical standards, design documents and contracting contracts.

Whether the survey and design unit undertakes the project within the scope of the corresponding qualification level; whether the survey and design work is subcontracted or illegally subcontracted; whether the relevant provisions of the national mandatory standards have been implemented; whether the depth and quality of the survey and design results documents meet the national regulations; the project Whether to conduct survey and design clarification to the construction unit before construction.

The risk points of natural conditions, such as engineering geology, include various unfavorable geological conditions; unknown underground obstacles; related to environmental protection, including: protection of various municipal and public pipelines, adjacent building structures and proximity to traffic protection. The risks of basic engineering technology include: landslides and landslides in the excavation stage; dredging of leakage and dredging structures; construction risks of building protective covers, including: shielding tunnels in and out of tunnels; shielding in and out of tunnels; construction of water inlets; cross-water systems ; High-rise building construction risks, including: various decline risks of high-rise buildings; shelf stability risks; impact on high-altitude wires above the surface of the construction project; construction risks of railway construction, including: transportation of railway vehicles; welding environment in caves Pollution; railway transportation and elevator safety; measurement and control risks, including: measurement accuracy of work marks; base point protection; repeated check points; timely reorganization of core construction risks of typical measuring instruments, including: fire prevention measures; environmental pollution and decorative materials; and more Functional construction site and professional cooperation; mechanical and electrical risks of construction, including various anti-electric shock measures; transportation and cargo risks of various mechanical and electrical equipment; equipment protection risks; risks of using “four new” technologies, including: “four new” identification technologies, Evaluation procedures, environmental conditions and scope.

4. Risk Prevention and Control Measures

Start with strengthening geological exploration to prevent and control geological risks; start with shield adaptive design to prevent and control shield risks; start with professional management and control to prevent and control man-made risks. Digging-Quick and effective excavation of the front soil; draining-the excavated soil is quickly discharged; stable-effectively supporting the front soil to ensure the stability of the excavation surface; durable-the key components are highly reliable It is suitable for long-distance construction. Take the earth pressure balance shield as an example: the cutter head structure is reasonable, the tool selection and arrangement are reasonable; the screw conveyor design is reasonable; the ballast improvement system design is reasonable; the key components are designed for high reliability and long life. The spoke type cutter head is suitable for the excavation of sand, gravel, and small gravel diameter sand and pebble formations; the composite cutter head is suitable for the excavation of rock formations; the small panel spoke cutter head is suitable for the excavation of clay layers; the spoke type composite cutter head is suitable for large Excavation of gravel diameter pebble layer. Bentonite system. Bentonite injection systems are often used in soils with a low proportion of fine particles, such as sand and pebble formations. Mainly used to increase the proportion of fine particles in the soil, so that the soil has better fluidity and impermeability; its role is to make the muck have better drainability, reduce the torque of the cutter head and reduce the loss of water in the formation ; When injecting, you must use better materials and master the expansion time to achieve the addition effect. Polymer system. The polymer injection system is suitable for non-cohesive soils, and is often used in sandy and gravel formations with abundant water content. It is mainly used to bind water, reduce water and soil separation, and increase the viscosity of the soil; the reflected effect is also to make the muck have better drainability, reduce the torque of the cutter head and reduce the loss of water in the formation.

Such as the high reliability and long life design of the cutter head; the high reliability and long life design of the cutter; the high reliability design and wear resistance design of the screw conveyor; the high load carrying capacity, high reliability, high sealing performance and long life of the main bearing Design; high reliability design of main drive reducer; reliability design of shield hinged seal and shield tail seal; high reliability and wear resistance design of crusher and mud pump.

5. Conclusion

The basic principles of controlling the risks of shield construction: geology is the foundation; shield is the key; people are the fundamental; technology is the support. Avoiding shield construction risks from three aspects: starting from strengthening geological exploration to avoid geological risks; starting from the adaptive design of shields to avoid equipment risks; starting from professional management and control to avoid man-made risks. Obtaining detailed and reliable geological and hydrological data is the prerequisite for safe and efficient shield construction; selecting shield equipment designed specifically for the ground conditions is the key to the success of the project; having an experienced, scientifically managed, professional and efficient construction team is The fundamental guarantee for the safe and efficient construction of shields.

References

[1] Bi Xiangli, Zhou Shunhua, Liu Wanlan. Risk Identification of Urban Rail Transit Engineering Construction. Urban Rail Transit Research, vol. 12, no. 4, pp. 36-38, 2004.

[2] Guo Ming. Risk identification of urban rail transit engineering construction. Civil Engineering Technology and Design, vol. 12, no. 18, pp.39-43, 2018.

[3] Zhang Hong. Research on Application of Safety Risk Control Technology Standards for Urban Rail Transit Engineering Construction. China Building Materials Science & Technology, vol. 25, no. 2, pp. 66-67, 2016.

[4] Feng Shangping. Research on the financing mode and financing risks of urban rail transit projects. Architectural Engineering Technology and Design, vol. 9, no. 21, pp. 61-66, 2015.

[5] Chen Shilin. Research on Risk Assessment of Urban Rail Transit Project Cost. Transportation Research, no. 20, pp.104-106, 2013.

[6] Ma Yabing. Discussion on Risk Management of Urban Rail Transit Engineering. Commodity and Quality, vol. 6, no. 37, pp. 25-26, 2015.