Overall Risk Assessment and Control of Expressway Bridge and Tunnel Construction Security

Mingtao Zhou

China Urban-Rural Holdings Group Co., Ltd, Wuhan, Hubei 430000, China

42306882@qq.com

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Abstract: The overall risk assessment of expressway bridge and tunnel engineering security is a crucial measure to reduce expressway security accidents. According to the existing risk standards in our country, the overall security risk of expressway bridge and tunnel construction can be evaluated truly and effectively, so as to ensure the timeliness and accuracy of the overall risk assessment and formulate the corresponding solutions according to the evaluation data results. Starting from the risk assessment method of expressway bridge and tunnel engineering, this paper makes an effective risk assessment for the topography and geological conditions encountered in the construction process, and puts forward the corresponding control measures, hoping to provide a reliable basis for the overall risk assessment of expressway bridge and tunnel engineering construction security in the future.

1. Introduction

The rapid progress of social economy promotes the pace of urban construction, and people's demand for expressway construction is higher and higher, which puts forward higher challenges to the construction quality of expressway and tunnel engineering. According to the requirements of the Notice on Carrying out the Trial Work of security Risk Assessment of Expressway Bridge and Tunnel Engineering Construction issued by the government, the relevant transportation departments have assessed the overall security construction risk of expressway bridge and tunnel engineering in various regions. This can not only ensure the traffic quality of expressway, but also meet the needs of people's living standards.

2. Analysis on Risk Assessment Methods of Expressway Bridge and Tunnel

According to the risk assessment methods of expressway bridge and tunnel, this paper makes a brief research and analysis from the following aspects.

2.1 Common Security Risk Assessment Methods

Generally speaking, the security risk assessment methods of expressway bridge and tunnel are mainly divided into general risk assessment and special risk assessment. Overall risk assessment:

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Firstly, the actual construction survey should be carried out on the construction site and surrounding construction environment of expressway bridge and tunnel engineering to ensure the construction quality and effect of bridge and tunnel construction, including the survey on the construction conditions, structural characteristics, geological conditions, construction scale and related risk-forming factors of bridge and tunnel. Secondly, on this basis, the effective risk assessment of the whole construction process is carried out, so as to accurately determine the possible security risk category, formation factors, risk spread scope and degree in the whole process.

Special risk assessment: Based on the overall risk assessment, the risk level of bridge and tunnel project is evaluated in detail to see whether it has reached a high risk (Level 1) or above. According to the basic evaluation standard of high-risk construction, special risk assessment is conducted for each construction link of the bridge and tunnel construction process. Thus, it can effectively judge whether there is a high risk level construction link in the construction process of bridge and tunnel project, so as to ensure the security and stability of the construction process. Meanwhile, based on the risk size and type of construction risk and the previous similar engineering accidents as reference, the method judges and reviews the possible security risks in the construction process of bridge and tunnel construction projects, traces relevant risk sources according to the risk assessment results, and makes corresponding risk control plan, so as to greatly promote the risk accident response ability and the overall construction ability of the whole construction project. In a word, in the process of similar risk assessment of construction projects, the appraisers should comprehensively take the project characteristics as the basic evaluation standard, and then select the corresponding qualitative or quantitative risk assessment, such as adopting the risk index system method or the risk analysis method of operation conditions.

2.2 Risk Assessment Steps

Firstly, we should make the overall security risk assessment of the bridge and tunnel project. Combined with the similar structural engineering security accidents, the construction environment of the project and the risk factors that may lead to security accidents are briefly studied and analyzed by combining quantitative and qualitative methods. The risk sources of the risks are traced and the corresponding control schemes are formulated. Secondly, based on the clear judgment of the overall risk assessment of the project, the relevant project management personnel need to hire professional project risk assessment personnel to conduct a special risk assessment on the possible high-risk construction links in the construction process, so as to ensure the security of the project construction process and reduce the incidence of security accidents, especially for some high-risk construction projects. Compared with the overall risk assessment standard, the special risk assessment is more targeted. Special risk assessment can carry out qualitative or quantitative systematic assessment of the possible risks in each construction link of the project construction process, play the role of project investigation for the existing high-risk projects, and formulate the most feasible response and prevention plan. Thirdly, for some high-risk construction projects, relevant personnel should make corresponding risk control and treatment scheme before project construction. Combined with the relevant risk detection and prevention standards issued by the government, real-time monitoring and management of the possible risk sources in the project are carried out, and the corresponding early warning measures are set up, so as to find out and deal with the risks in time, and minimize the project risk and economic loss. If the risk level of bridge and tunnel project is low, in the process of risk assessment of expressway and tunnel construction, the evaluators can develop corresponding risk assessment and control work according to the principle of overall cost-effectiveness of the project [1].

2.3 Assessment Unit and Risk Assessment Report

Firstly, the overall risk assessment of bridge and tunnel project construction security mainly takes the construction unit as the main content in its assessment principle. If the construction project contains many contract sections, the construction unit should take the lead, but the detailed risk assessment work is still fully responsible by the construction unit. Secondly, if the construction unit does not have the relevant security risk assessment experience or the assessment ability is insufficient, the construction unit can employ professional risk assessors or entrust the third-party assessment agency with relevant assessment qualification to carry out reasonable risk assessment and estimation for the project. Finally, the risk assessment data and related information are integrated into the assessment report, which can be used as the basis for risk assessment of related projects in the later stage. It can effectively reduce the incidence of security accidents and improve the construction quality of the project.

3. Risk Assessment and Control Scheme Analysis of Topography and Geomorphology

3.1 Forest and Grassland Fire Prevention

In the process of expressway bridge and tunnel construction, it often passes through grassland, woodland, mountainous area or forest area. Especially in the dry season, if the protection is improper, it may cause serious fire risk, leading to huge economic losses. Especially in the construction process of the project, it involves the treatment of related construction materials. If the open fire generated in the welding process of materials is scattered to the surrounding woodland or grassland, it is very easy to cause fire. Therefore, in the treatment process of construction materials, the construction unit should effectively clean up the surrounding combustible materials in advance to effectively control the risk sources, so as to effectively avoid risk accidents. When it is necessary to carry out high-altitude welding, the staff should set up the throttling device of welding slag at the welding position in advance to avoid the welding slag falling into the grass and causing fire accident due to the staff's failure to take corresponding protective measures. For the welding of steel structure materials, the construction unit can build a fence around the site of the project, which can effectively isolate the construction site from the external environment, so as to effectively prevent the occurrence of risk accidents. For the inflammable and explosive materials used in construction, such as paint and various oils, the staff should strictly comply with the storage requirements in combination with the relevant security risk prevention and control regulations. While using them, the staff should also do the corresponding protection work, and suspend the construction for the operation activities that are prone to high temperature or open fire. It is not allowed to paint on building materials that have not been thoroughly cooled [2].

3.2 Valleys and Steep Slopes

During the construction of bridge and tunnel projects, steep slope or valley sections are often encountered. In the structural design of viaduct bridges, the phenomenon of repeated overlapping construction often occurs due to the terrain. Especially in the first stage of construction activities, construction personnel have to face severe geographical forms and prevent falling objects from above that may lead to security risks. The risks are directly related to the security of people's lives, such as rolling stones and other construction materials security risks. To effectively avoid the occurrence of similar security accidents, the construction unit should take corresponding protective measures before the project construction. For example, if construction resources permit, the staff can adhere to the principle of top-down construction to avoid falling objects from above. If the conditions are not allowed, the scheme of simultaneous construction of the top and the bottom can be adopted to carry out the construction. Corresponding protective measures should be built to

protect the upper security hazards and improve the security of construction work [3].

4. Security Risk Assessment and Control Scheme Caused by Geological Conditions

4.1 Debris Flow Risk and Control Scheme in Bridge Construction

Expressway bridge construction is usually carried out in the area with complex terrain. The location of gully is relatively flat, so it has become the preferred location for bridge construction. However, this part of the construction site generally has the risk of landslide, especially after large-scale precipitation, the mountain water storage capacity is poor, which can easily lead to debris flow, landslide and other natural disasters, seriously threatening the security of people's lives and property.

Control scheme: Firstly, it is necessary to do a good job in the field geological and environmental investigation before construction, and correctly judge the feasibility of construction in this area and the potential risk of sudden security accidents. On this basis, the staff can analyze whether there are debris flow risk factors in the upstream area. Especially in the area with more rain, construction personnel should carry out real-time monitoring or regional risk assessment. Secondly, the flat position of gully can be used to place construction equipment and materials. It is not for the rest and living area of construction personnel. For the area with large amount of rainwater, it is necessary to reduce the storage of materials as much as possible [4].

4.2 Gas Risk Assessment and Control Scheme in Tunnel Construction

Gas is a kind of harmful gas in underground tunnel. When the tunnel passes through coal seam, asphalt or oil shale, the situation of encountering gas will be higher. When the gas concentration reaches a certain value, it will cause explosion, which is a great risk hazard for tunnel construction.

Control plan: Firstly, it is necessary to do the corresponding gas detection activities and ventilation work before tunnel excavation, formulate corresponding gas detection scheme and special project construction plan, make corresponding ventilation design scheme, emergency plan and estimation plan, and make effective fire prevention measures in important sections or areas. Secondly, in the excavation of tunnel, wet drilling can be adopted for construction operation. In blasting, the electric detonator device allowed for coal mine or explosive allowed for coal mining operation can be used for operation activities, and the method of series link blasting network can be selected.

5. Conclusion

To sum up, the expressway bridge and tunnel engineering construction is faced with high security risks and high diversity. The project construction personnel must do a good job in the geological and environmental investigation before construction. After comprehensive analysis of all data and construction materials, the staff can evaluate the total risk of construction security based on this, trace the risk sources, effectively and reasonably control the risk factors, so as to improve the construction security and reduce the incidence of security accidents.

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