

Safety Management Strategies for Cross-railway Interchange Widening Project in Highway Reconstruction and Extension

Heng Zhang^{1*}, Xuesong Su², Xuguang Zheng¹

¹China Merchants Chongqing Communications Technology Research & Design Institute Co., Ltd., Chongqing 400067, China

²Chongqing Rail Transit (Group) Co., Ltd., Chongqing 401120, China

Abstract: Under the background of rapid social and economic development, the traffic volume of highways has increased, which has brought tremendous pressure to the old highways. In response to this situation, the original highway must be reconstructed and extended. It is necessary to focus on the analysis and exploration of the methods of interchange reconstruction and extension in current highway reconstruction and extension to avoid affecting normal traffic, as it will inevitably have an impact on the traffic operation environment. For this situation, it is necessary to analyze and understand the format and characteristics of traffic organization of the interchange operation area in time and propose corresponding safeguard measures.

Keywords: Highway reconstruction and extension; Cross-railway overpass; Widening project; Safety management strategy

Publication date: March, 2021

Publication online: 31 March, 2021

***Corresponding author:** Heng Zhang, 960126855@qq.com

Highway interchange is a key junction of the highway lane network. The form of reconstruction and extension must be based on interchange, including direct widening or new construction. For direct widening, it is usually necessary to build temporary lane changes for the main-line foundation, road surface, bridges, ramps and other sections in the interchange area and build relevant supporting facilities in time. In the process of safety management

of highway reconstruction and extension, it is necessary to ensure that the construction plan is optimized in all aspects, to do a good job in on-site control, and to comprehensively improve the safety management level of the cross-railway interchange widening project in highway reconstruction and extension.

1 Difficulties in the safety management of cross-railway interchange widening project in highway reconstruction and extension

In highway construction and cross-railway construction, due to the existence of many cross-operations, the safety risk is very high. It is necessary to ensure both the normal passage of trains and the safety of highway projects during the construction on operating railway lines, including speed limit for adjacent trains and other related issues, so the safety risk is relatively large, and the protection level is very high^[1]. The widening of cross-rail interchanges in reconstruction and extension of highway projects involve many pipelines, which cause great interference to the construction, and large-scale machinery and equipment cannot be used as the construction site is narrow. If the highway is not well-protected, it will inevitably increase the traffic safety risks and hidden hazards. In order to ensure proper handling of highway construction, manual digging construction technology is required in the process of optimizing the construction plan. To ensure the smooth completion of the railway construction plan, it is necessary to assign special station liaison officers

to set up both ends of the construction site, and safety guards to perform on-site construction supervision and inspection.

2 Preparatory measures for safety technology

The safety technical measures in the construction preparation stage mainly include technical material preparation, on-site preparation and personnel preparation. In the construction technical preparation, a safe construction management plan should be actively drafted according to the plan organization chart of the construction design site. Conduct all-round investigations on the construction environment, promptly detect the construction conditions that may affect the safety of the surrounding environment, and strengthen protection. When measuring protection points at the construction site, ensure that the minimum and maximum distance between the edge of the protection pile and the railway centerline are between 1330mm and 2500mm. Meanwhile, the pre-construction safety review application form of the construction project must be prepared before the project starts and submitted to the supervision unit for review before the project construction management can be carried out. In the safety training for operating line construction, all personnel must pass the assessment, and the job permit can be issued after the training. The station liaison officer and the construction person-in-charge must sign relevant agreements in time. After the safety management review on operating line construction is passed, the construction company's equipment managers must also sign a construction safety management agreement for the operating line, and plan the construction management planning well. In the preparation of materials, we must focus on training to ensure adequate supply of safety protection equipment, including the timely distribution of reflective vests, helmets and small yellow hats to construction personnel, and quality inspections of tools and equipment for special construction work to ensure the technical performance of equipment is good^[2]. In the preparation of the construction site, it is necessary to sign a renewal agreement with the railway company for the reconstruction and extension project to reduce dust while ensuring the smoothness of the highway and reduce the adverse impact on the surrounding environment. Meanwhile,

the construction site must be sufficiently equipped with rescue supplies and sufficient fire-fighting equipment. Safety education must be carried out by all construction personnel during the preparation of the construction team. Only by establishing a correct awareness of safe construction can the smooth progress of reconstruction and extension projects be ensured.

3 Safety technical measures during the construction phase

Upon entering the construction site, all staffs must carefully study the relevant operating specifications of safety techniques, and can only enter the construction site after passing the assessment. For specialized workers such as electricians and welders, they need to undergo professional training by relevant departments to be issued with operating certificates, and only those who qualified in exams can operate independently. Upon entering the construction site, one must wear a safety helmet in time. It is forbidden to operate the construction site after drinking alcohol. Safety signs and warning boards must be put up at construction site. During the construction on the operating lines, a comprehensive treatment must be strictly carried out in accordance with the planning of the construction scheme. The management personnel of the construction site must wear eye-catching signs to improve their own sense of responsibility. The protection personnel should also strengthen their own sense of work responsibility. Once assigned, they must not be changed at will. It is necessary to manage protective signals and communication equipment in a timely manner, and perform blockade management in accordance with the relevant requirements for the construction personnel. For the existing construction lines, relevant applications must be made and the vehicle release procedures can only be processed after the conditions are met.

4 On-site safety control work

4.1 Pre-site work

Before the cross-railway interchange widening project construction in highway reconstruction and extension is carried out, all construction teams must arrive outside the site, wear protective equipment and carry inspection tools. The station liaison officer must

arrive at the signal building 40 minutes in advance, and the railway equipment management unit and vehicles passage organization unit need to sign in.

4.2 In-site construction steps

When carrying out in-site construction, strictly abide by the transfer order protection settings. Stop the construction when vehicles access to the construction site has been noticed. Carry out site inspection and confirm that the guard has stopped the vehicles before continuing the construction. Carry out the cyclic operation process of making steel bars under the hole, cage pouring, on-site inspection, line passage and other processes. During this period, it is necessary to strengthen the clear division of the person-in-charge, the safety officer, the administrator, the material personnel and the liaison officer^[3]. If illegal operations are found, they must be banned immediately. Protection facilities must be set up in time and the station liaison officer shall be notified of the speed limit of the person-in-charge on-site. When the construction is ordered to start, the guards must be notified in time, the deceleration signal boards must be installed, and the safety personnel at the two ends must operate in accordance with the technical specifications of the protection design.

4.3 Protective clothing for construction

The person-in-charge of the construction needs to confirm the protection, and the construction instruction can be issued after the protection is completed. The construction personnel should wear a helmet, yellow vest and non-slip shoes. During the construction period, the construction piles should be constructed in strict order. All constructions should be individually numbered to avoid mistakes. Strengthen the construction quality of concrete by manual pouring and manual vibrating. The harmful gases and their amount need to be fully checked daily before the start of construction. Inspect the currency that has been constructed, as the construction can only be carried out smoothly after it has been confirmed correct^[4].

4.4 On-site protection

The liaison officer needs to stop the on-site operation after vehicle passage is granted, and all personnel are evacuated outside the railway construction boundary. Check that there is no personnel, equipment and materials on the railway line. The construction can be continued after the train passes, and the construction

should be stopped within 20 minutes before the train arrival. Unfinished construction experts and workers should be evacuated from the site in time, and trains should be released after confirming that the conditions are met. The guards should be notified 10 minutes in advance to remove the signs on the construction site and the slow-down driving signal board. Inform the station liaison officer to open up the line according to the planned point. Both before and after the construction, they need to participate in the construction coordination meeting and report to the construction company on the approved content of the special project plan for construction. Meanwhile, it is necessary to analyze according to the project's laissez-faire situation and put forward correct management opinions to avoid similar problems from recurring in the interchange reconstruction and extension operations. It is necessary to strengthen the traffic management in a timely manner. Due to the serious interweaving of the interchange traffic during the reconstruction and extension period, the problem that large vehicles taking up a high proportion should be given focused considerations, and also impose restrictions on the speed of the vehicles. Due to the relatively small headway of traffic flow during the interchange reconstruction and extension period, the speed of vehicles entering the highway can be appropriately restricted to improve the overall level of safety protection. If the vehicle speed is too high, it is prone to abnormal events, which will make it difficult for the vehicle to be controlled and impact the personal safety of the construction personnel. During the operation control and management period, the lane merging must be fully managed during the acceleration period so as not to hinder other vehicles traveling on the main line to avoid potential emergencies as the vehicles enter the highway construction section. In addition to strengthening safety organization and management, eye-catching temporary signs and mobile variable information boards should also be put up at the interchange construction site to ensure that the road construction safety signs are clearly visible, and new technologies such as infrared lasers should be controlled to make the road construction safety signs more eye-catching.

5 Conclusion

This paper analyzes the traffic characteristics

of the highway reconstruction operation area, comprehensively discusses the safety measures for the reconstruction of interchanges, effectively improve the decision-making basis of the traffic operation environment during the construction period, and treat the reconstruction and extension of public traffic as an independent unit to strengthen the management of the reconstruction and extension in the region. It realizes the management purpose of safe highway and railway reconstruction and extension, and provides important reference basis for similar projects in the future.

References

- [1] Pang SH. Discussion on the safety management of road and bridge maintenance without road closure——Taking Jiqing highway as an example [J]. *Journal of Transportation Engineering*, 2020, 20 (05): 57-62.
- [2] Liu Y. Discussion on the “New Kaiyang traffic organization safety management” model of the highway reconstruction and extension project [J]. *China Construction Metal Structure*, 2020 (08): 60-61.
- [3] Wu XC. Research on the key points of safety and quality control and social management of highway reconstruction and extension projects [J]. *Science and Technology & Innovation*, 2020 (10): 112-113.
- [4] Sun XM. Safety factors and control analysis of reconstruction and extension of guaranteed access highway based on AHP [J]. *Building Technology Development*, 2020, 47 (08): 89-91.