

Safety Design Strategy for Highway Interchange Exit Ramp

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Abstract: Highway is an important type of road in China's road network, and it also carries a larger portion of transportation task. Safety is the first indicator in the stage of its use, so it is necessary to carry out safety design focusing on the highway interchange exit ramp to effectively prevent traffic accidents. Therefore, in this paper, the importance of the safety design of the highway interchange exit ramp and the key factors affecting its safety were discussed and studied in detail, and finally corresponding strategies were proposed for discussion and communication.

Key words: Highway; Interchange; Ramp; Safety design

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As a basic project type in social development, highway project can have a positive impact on the level of social development, and highway is also an important facility type in China's road network. Meanwhile, with the continuous improvement of the current living standards of the general public, private cars have also begun to enter tens of thousands of households, and the number of vehicles on highways has begun to increase. Therefore, the society is also paying more and more attention to travel safety issues. The exit ramp of the highway interchange is prone to traffic accidents. Therefore, it is necessary to actively carry out the safety design of the highway interchange exit ramp, and take scientific and reasonable measures to ensure the safety of the highway at the commissioning stage, avoid traffic accidents, and secure the safety of life and property

of the general public.

1 The significance of the safety design of the highway interchange exit ramp

In China's road network, highways are an important part of it, and they also undertake important transportation tasks. Interchange exits are an important part of highways. On the highways, the connecting roads are connected to the intersecting road turning known as ramps. The ramps are mainly put up to ensure that traffic flows in different directions will not interfere with each other and enter their routes orderly. Under normal circumstances, there are two functional requirements for interchange ramps on highways, namely, left turn and right turn. In practice, they are mainly put up according to the different needs of road guidance^[1]. The exit of the ramp determines the route of the vehicle entering the main road or exiting the highway. Under normal circumstances, there will be multiple ramps merging into the same lane, and if this situation exists, driving errors made by drivers may cause traffic safety accidents. Therefore, it is necessary to carry out the safety design of highway interchange exit ramps to ensure the safety of vehicles during driving, and at the same time ensure that the highway is fully functioning.

2 Factors influencing the safety of highway interchange exit ramp

During the commissioning phase of the highway interchange, safety is the most important indicator, and the exit ramp will be affected to a certain extent. Traffic safety accidents are prone to occur, which will have a certain impact on the safety performance of the

highway during the commissioning phase. Therefore, detailed analysis and research on the influencing factors of the safety of expressway interchange exit ramps are required to formulate targeted and perfect measures according to the types of influencing factors to fully ensure the safety performance of highway interchange and improve its safety. In summary, its influencing factors mainly include the following two points:

First, the impact of road factors: The safety of the highway interchange exit ramp during the commissioning stage will be affected by the road's own factors, and there are certain hidden hazards of accidents. For example, graphic design factors: for small-radius round-curved roads with highway interchanges, widening needs to be carried out, and sufficient space for vehicle passage has to be reserved on the road to reduce the probability of traffic accidents. In addition, longitudinal section design factors will also become a key factor that induces safety problems, which are mainly manifested in the impact of the slope of the highway interchange exit ramp on traffic safety, such as: If the slope is too steep, the vehicle must be braked to reduce the speed when going downhill. At this stage, the vehicle's braking system is prone to failure or slippery problems, and these problems will induce traffic safety incident once they occur. Therefore, setting the ramp slope reasonably has gradually become a key factor to ensure the safety of the highway interchange exit ramp.

Second, traffic factors: Traffic factors will also have certain impacts on the safety performance of the highway interchange exit ramp, and even in some cases, traffic safety accidents may also occur. For example: the traffic volume factor, that is, the actual traffic volume at the highway interchange exit ramp is greater than the designed capacity of the road, and the probability of traffic accidents on the road will increase accordingly, which will also cause traffic congestion and problems in other aspects etc, and have certain impacts on the public's experience of participation in transportation. In addition, when the proportion of large vehicles on the road is too high, certain safety risks will also arise, mainly due to the fact that the steering performance and acceleration/deceleration performance of large vehicles are far from that of small vehicles. Also, the blind spots of the vision of large vehicles are wider, rendering them

prone to accident types such as rear-end collisions or rollovers. At the same time, this factor is also a key factor type that threatens the safety of highway interchange exit ramps^[2]. In addition, the speed of vehicles passing through the highway interchange exit ramp will also have certain impacts on safety. In practice, due to the large speed difference between vehicles, there is a certain degree of dispersion between vehicles, resulting in the phenomenon of overtaking, thereby resulting in the problem of an increase in the incidence of traffic accidents. Therefore, it is necessary to take scientific and reasonable measures to avoid this phenomenon and ensure the safety of the traffic process.

3 Strategies for safety design of highway interchange exit ramp

3.1 Put up traffic signs reasonably

In order to ensure the safety of the highway interchange exit ramp and give play to the excellent performance of the highway, the first task is to put up traffic signs reasonably. First of all, traffic signs such as warnings and reminders need to be continuously put on the main line before the exit to remind the drivers of the position of the exit ahead and the occurrence of dangerous road conditions such as continuous downhill, so that they can serve as a reminder to the drivers^[3]. In addition, a large gantry-type traffic sign can be erected at the ramp exit to inform the drivers of the road conditions ahead, and then a turning and downhill warning sign should be put up before the small-radius section of the ramp to remind drivers to drive carefully and prevent accidents.

3.2 Put up deceleration infrastructures

The installation of deceleration infrastructures can also play a positive role in guaranteeing the safety of the highway interchange exit ramp. Therefore, in practice, it is necessary to fully consider the slope of the exit ramp to remind the drivers to control their speed^[4]. Under normal circumstances, it is necessary to put up a set of lateral deceleration markings at intervals above the main line before the diverge point, and put up the main line speed limit sign above the ramp exit, and need to be 200 meters above the ramp entrance. Put up horizontal deceleration markings within the range, and adopt the speed limit processing

method within the ramp, that is, put up a 60km/h speed limit plate at the entrance of the ramp to remind the driver to slow down and avoid traffic accidents due to excessive speeding, fully guaranteeing the safety of the highway interchange exit ramp.

3.3 Set up protective facilities on the curved downhill section

There will also be curved downhill sections at the highway interchange exit ramp. Therefore, it is necessary to set up protective facilities for the actual conditions of this section of the road to ensure the safety of the driving process. It is necessary to set the height of the roadside guardrail reasonably according to the principle of tolerance design, and strengthen the anti-collision level. SA grade semi-rigid wave beam steel guardrail should also be installed at the position of the curved road to avoid or reduce the injuries caused by traffic accidents and protect the safety of life and property of traffic users to the greatest extent. The selection of pavement materials for curved downhill sections requires the selection of pavement materials with excellent anti-skid performance to ensure stability during operation.

3.4 Optimize ramp alignment

In order to improve the safety of highway interchange exit ramps, it is also necessary to optimize the alignment of the exit ramps to ensure smoother passage of vehicles and avoid traffic accidents when vehicles drive pass. For example, engineering designers can conduct on-site surveys on the highway interchange exit ramps and then improve on the design plan. Where conditions allow, optimize the

horizontal and vertical alignment of the exit ramp. This can improve the traffic safety while ensure the smooth passage of vehicles out of the highway simultaneously, effectively reducing the probability of traffic accidents.

4 Conclusion

In conclusion, after the highway is put into use, ensuring traffic safety is a key measure, and the highway interchange exit ramp is the spot prone to traffic accidents, so it is necessary to analyze and discuss the influencing factors on traffic safety here in detail. After determining the reasons, take corresponding measures to ensure the safety of road traffic, such as: at the safety design stage, attention should be paid to setting up warning signs to remind drivers to drive carefully and slow down so as to prevent safety incidents from occurring at highway interchange exit ramp.

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