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Expressway and Urban Road Interchange Design Strategy

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Abstract: Highway is an important kind of infrastructure which the transportation sector depends on. The rationality of the interchange design between urban roads and expressways is related to the relieving of urban traffic pressure. Based on the status quo of interchange design between urban roads and expressways, this paper discusses the types and applications of interchange design, hoping to provide reference for the design and construction of highway projects and ensure the rationality of interchange design.

Key words: Expressway; Urban road; Intercommunication; Design strategy

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1 Introduction

In the process of road transport, highway belongs to an important kind of carrier. The rapid development of the current society has accelerated the urban growth to a certain extent. Large traffic volume makes requirements for the interchange of the road higher. As traffic pressure keeps increasing, it may be difficult for old urban roads to meet the actual needs of their development. In order to improve the efficiency of transportation, some expressways which were constructed near by the city and applied with loop design, can effectively relieve the internal traffic pressure. The interchange design between urban roads and expressways is helpful to solve the tension of existing urban roads. In the design phase, the actual traffic and transportation demand of the road should be taken into consideration, and regional planning, topographic features and surrounding environment should be clarified to ensure a reasonable choice of the type of interconnection.

2 Current status of expressway and urban road interchange design

2.1 Restrictions

As land resources are scarce in cities, the design of road and road interchange usually carried out at the entrances and exits to different urban boundaries. Therefore, the interchange design is usually far from the city center, and the environment is complex. There are hospitals, factories and schools and other buildings, which may have an impact on the design. At the same time, the interchange design and construction stage also needs to make full use of land resources, protect the construction area, so as to avoid a large number of excavation and destruction, and control the impact of design on the urban landscape environment. In addition, the design process also needs to consider the water and soil erosion, public facilities occupancy, to ensure that the construction can meet the expected requirements[1].

2.2 Detour design

In the design of interchanges, the design of sidewalks and non-motorized vehicle lanes should be strengthened, and the above content should be focused on, so as not to affect the use of crosswalks and non-motorized vehicle lanes. It is necessary to ensure the rationality of the interchange plan. If there are crosswalks or non-motorized vehicle lanes, a detour design scheme can be adopted to ensure that the design is connected longitudinally.

2.3 Coordination with urban planning and construction.

In the process of urban development, urban planning is an important spirit of construction, and a complete planning form is closely related to the quality of urban construction, and it will also affect the lives of residents. In terms of the interchange design of expressways and urban roads, it should be coordinated with the urban planning to ensure that the interchange design can meet the overall planning and construction requirements of the city.

3 Interworking design strategies of expressways and urban roads

Since most of the interchange designs are located at the ring road with small traffic flow, the different design spacing should be considered in the choice of the type of interchange design. The expressway mainly adopts the toll interoperability design, and the toll location should be considered. Usually, the horn interoperability, the "Y"-shaped design, and the mixed design type are used. Reasonable selection of interchange type can ensure design quality and prevent traffic from affecting the surrounding environment. In terms of the application of interoperability design strategy, it is also necessary to comprehensively confirm the type of interoperability according to the characteristics of regional traffic and interoperability functions, and then develop the graphic design and vertical design. In addition, it is necessary to follow the design requirements for interchange in the design specifications of the highway route to ensure that the ramp design, urban roads and expressways can be effectively connected.

3.1 Application of trumpet-shaped design

In terms of the design of toll intercommunication, the horn-shaped interchange is a common design type, and its application range in the transportation network is relatively wide, and the application value is relatively high. According to the traffic volume, the horn-shaped interchange can be selected, including A-shaped and B shape.

The A-shaped horn interchange design has a relatively strong capacity in ramp inflow and transportation, but the radius of vehicle driving link is relatively small. If the speed is relatively fast, it is easy to cause the danger of the vehicle overrunning the ramp. Therefore, the entry speed of the vehicle should be reasonably controlled, which should be within 40km/h. If the inner ring ramp is used, it should be noted that the radius should be controlled between 50 and 55 m to ensure the match between the radius and the design speed. Meanwhile, the safety of the vehicle in the driving process should be ensured to the maximum extent according to the characteristics of the surrounding environment,. In addition, the plane indicators should be reasonably selected under the environment of maintaining the stable driving of the vehicle, and several indicators should be selected as many as possible to complete the ramp design.

The B-shaped horn design should reserve the position of the vehicle. This design method is suitable for application in expressways with low traffic flow. Most of the B-shaped horns are designed on the lower level of the highway, so that it will not affect the traffic on the highway. The design of interchange needs to focus on the driving stability of the vehicle at the connecting position on the highway. The water-drop-shaped horn shape design can be applied in the design stage, and the crossing relationship existing in the intersecting section should also be considered. The ramp position should be adjusted reasonably to ensure the reasonable vertical and horizontal planes. design. When designing the plane and vertical line types of toll stations, it is necessary to design the acceleration and deceleration lane forms and specific lengths in the interchange design in strict accordance with the specified requirements and the design speed of the expressway. In addition, the actual situation should be considered in the design of interoperable entrances and exits. If conditions permit, direct exits can be used.

3.2 Application of Y-type interchange design

Slightly adjusting the horn-shaped design can become a "Y-shaped interchange" design method. The structure of this design method is large in scale, but the actual area occupied is relatively small, and the maximum number of floors can reach three floors. In the actual design, various technical parameters are roughly similar to the horn-shaped design, and can be adjusted according to the specific traffic flow at the location of the interchange node. The ramp speed of this design type should be within 50 km/h, and it has a good degree of coordination with the toll station location. It should be noted that there should be no sudden descents in front of the toll area to ensure the safety of the vehicle during the driving process. The advantage of using the Y-type interchange design method is that it can reduce the scale of the project, make a reasonable selection of the construction location to control the scale of the bridge, and ensure the rationality of the weight design. If the traffic

volume around the interchange design is relatively small, then the plane index should be appropriately reduced, and the interchange design should be flexibly adjusted according to the surrounding environment and the design scale[2].

3.3 Application of semi-clover leaf-shaped design

If in the design process of highway and road interchange, the semi-clover leaf design method may be selected. Its traffic capacity may not be as strong as the horn-shaped and Y-shaped designs. Therefore, the vehicle may be intertwined when driving on the top, which makes the driving There are relatively many conflict points, so this design method can meet the design of relatively small traffic flow interchange area. In the design stage, interchange interchanges should be designed, and this type of design usually has intersections with the road plane, but there are two independent ramps. A toll station should be set up on each ramp, and the management after use is scattered. . This type of interchange design is similar to a horn-shaped interchange design in terms of flat and vertical indicators. It needs to occupy relatively small ground space and has relatively small impact on the environment. It will not affect the slow-moving system in the city. The application of this design form to locations with relatively small urban traffic flow has good practicability.

3.4 Case analysis

The interchange nodes of the airport road in a city belong to an important transportation system. The existing roads belong to the ring expressway, and a cross-dimensional interchange is set up between the city's main roads and the airport expressway. As the elevated expressway of the airport road needs to be transformed, corresponding transformation measures must be taken at the interchange nodes to ensure efficient traffic conversion between the interchange nodes, the main road of the airport expressway, and the auxiliary road on the ground. Due to the double horn-shaped design used for the airport interconnection, the interchange structure between the toll station and the single horn position of the main line does not need to be modified, and the main road needs to be transformed into an urban expressway. Therefore, in the design stage, attention should be paid to the good connection between the exit section of the toll station and the elevated main line and the ground auxiliary road. It is confirmed that the design focus is to transform the original single-speaker interchange between the airport road and the toll station.

The design ideas are as follows: First, the elevated main line is connected to the interchange toll stations of the expressway to form a fast and efficient continuous flow to ensure smooth connection between traffic flows; second, because of the passenger transportation system of the elevated main line, the ground side road belongs to the freight system, so the location of the interchange toll station on the expressway should consider the demand for separation of passenger and freight; third, separate different forms of traffic to ensure traffic safety; fourth, integrate space resources and make full use of existing ramps [3].

4 Conclusion

In short, in the process of urban road construction, future urban traffic development needs should be considered, and reasonable design for interoperability between expressways and urban roads. According to the surrounding geological and topographical conditions, consider interoperability design functions, and clarify whether interoperability design will be feasible. It has an impact on the lives of residents, analyzes and formulates design plans from many aspects, and through inspection and adjustment, rationally selects the interchange design plan to ensure the practicability of the interchange design and improve the design efficiency.

Disclosure statement

The author declares no conflict of interest.

References

[1] Mao CY. Analysis of the design essentials of the special-shaped interchange between expressways and urban roads[J]. Building Construction, 2020, 42(04): 583-587.

[2] Fu CN. Research on shared traffic corridors between expressways and urban roads[J]. Enterprise Technology and Development, 2020(02): 88-89+92.

[3] Liu D. Discussion on the design of interchange between expressways and urban roads[J]. World of Transportation, 2018(36): 20-21.