

# Design Strategy of New and Reconstructed Interchanges on Expressways

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**Abstract:** China's urban development is very fast, and the continuous improvement of the national economic level in recent years has also prompted most families to have their own scooters. In this situation, the increase and transformation of road traffic has been a necessary work for the development of various regions. This paper starts with the basic reasons for the design of new and improved interchanges, and expounds the specific design type division and main influencing factors. Finally, the paper puts forward the design strategy of newly added and reconstructed interactive interchanges with high feasibility, hoping to provide reasonable reference for relevant road traffic engineering optimization.

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In the process of urbanization development, the implementation of road traffic, as well as the transformation and New Interchange Design, is the inevitable trend of the development of the times, but also the main guarantee to improve people's living standards. In the design process, it is necessary for the staff to consider whether various external factors will affect the implementation and design of the project, and make a targeted design plan according to the existing road traffic conditions and the surrounding environment, so as to ensure the rationality of the follow-up work.

## 1 The reason of expressway adding and rebuilding interchange

### 1.1 Local development

As we all know, China's urbanization development process has gradually entered the climax<sup>[1]</sup>. Therefore, due to the rapid development of a large number of cities, the original highway and transportation system has been unable to provide good travel and life security for people in the city. The main reason is that when the original expressway is built in the city, the local economic development level is usually not high enough, and the construction distance of interchanges is also a normal phenomenon. In order to promote the urban traffic to match the speed of urbanization development in various regions, it is urgent to add and transform interchanges. And the related work should be forward-looking as far as possible, starting from the optimization of urban traffic to carry out the design work, to ensure the smooth implementation of related projects.

### 1.2 The original traffic is unreasonable

With the rapid development of our country, the transportation system of most cities is quite different from that of the beginning. Especially in recent years, the process of rural urbanization is accelerating, and a large number of cities are developing and planning changes are very strong. Therefore, the original expressway system can no longer provide good services for people's lives with other local buildings. In fact, the current need for new expressway and transformation of interchange areas, are basically due to such reasons, in the face of this situation, designers should try to improve the understanding of

the original highway traffic system, on the one hand, adjust the original traffic unreasonable, on the other hand, can appropriately add interchange, relieve the pressure of urban traffic travel. In short, the reason for the design of new and reconstructed Interchanges on most urban expressways is that the previous design is not reasonable, so the starting point of the design work is to improve the rationality of expressways and interchanges.

### **1.3 Road network overlap**

Obviously, China's science and technology has developed rapidly in the past decade<sup>[2]</sup>. Most of the families and social production in the city have applied Internet technology, which leads to the increasing amount of network overlapping projects. In the process of overlapping, it is inevitable to conflict with the existing expressways and interchanges in the city. In the face of this situation, designers need to focus on the implementation of the network overlap project in the process of Expressway and interchange reconstruction. They can cooperate with relevant staff to carry out the design, so as to reduce the difficulty of the follow-up network overlap project while ensuring the relief of urban traffic pressure.

## **2 Classification of new and reconstructed interchanges on Expressways**

### **2.1 Interchange form**

According to the form of Expressway Interchange, the engineering types can be summarized as trumpet, t, y and cross. These types of interchange design are very common in major cities, which can alleviate the local road traffic pressure and reduce the probability of traffic jam. For example: In the first tier cities such as Beijing and Shanghai, where traffic congestion is very serious, the basic urban traffic contradiction has been alleviated with the addition of cross type and T-type interchanges according to the actual situation, and the effect is good.

### **2.2 Transformation scale**

According to the specific situation, the newly added interchanges can be divided into three basic forms: local reconstruction, comprehensive reconstruction and simultaneous reconstruction along the main line. The main reason is that the geological conditions and the actual traffic operation in different regions are different. Therefore, designers need to make a choice

based on the actual situation. The general principle is not to make large-scale rectification of the original traffic system as far as possible, and to achieve high quality and low cost The reconstruction design is better.

### **2.3 Reserved or not**

When the interchange is newly added and reconstructed, the designers need to focus on whether it needs to be reserved. According to the need for reservation, the design form can be divided into three forms: reservation, no reservation and reserved reconstruction conditions. The specific selection of the reconstruction method needs the staff to make a decision after considering the local environment. The principle is to ensure that the urban road traffic is more smooth after the addition and reconstruction of interchanges.

## **3 The main factors affecting the new and reconstructed interchanges on expressways**

The first is the original road traffic capacity and actual service level of the city, that is, if the staff finds that the original road traffic system can meet the use needs in the design process, they can retain the original traffic form, and add and broaden on the basis of the main line traffic.

Secondly, the reconstruction and expansion of the main line. This kind of factor has both advantages and disadvantages to the design of new and reconstructed Interchanges on expressways. The point is that after the expansion, the urban transportation capacity can be greatly improved, and the layout can be more reasonable, which is basically the upgrading of the original urban expressway traffic. However, in the related projects, it is difficult to connect the old and new pavement and ramp, and the construction will inevitably affect the original road traffic, which is also a possible malpractice.

Finally, the traffic organization, in the city to implement the new expressway and transformation interchange design, during the construction period will inevitably affect the original road traffic. Therefore, in the design, the staff need to focus on such issues, as far as possible to ensure the normal operation of urban traffic in the construction process.

## 4 Design scheme of new interchange and reconstruction of Expressway

### 4.1 Collect interworking data

In order to ensure the rationality of the design work and the smooth implementation of the follow-up projects, it is necessary for the designers to conduct in-depth investigation and collation on of the original Expressway and interchange data before the addition and reconstruction of Interchanges on expressways in various regions. In addition, the most important thing is to investigate the accident-prone locations in the interchange link of the original traffic system, and make a scientific analysis of their distribution, so as to reduce the probability of accidents as much as possible in the new reconstruction process and improve the safety factor of vehicles on the road.

For example: Before the design of expressway new interchange and reconstruction, a designer conducted a comprehensive investigation on the use of subgrade, pavement and related bridges around the original interchange. After comparing the settlement, the designer found that the local subgrade has been basically stable after long-term use, so it has been fully utilized in the new design. For the areas found that part of the pavement is damaged, but the use after repair does not affect the stability, the designer also decided to join the design after re renovation, which not only effectively controls the project cost, but also ensures the safety of the later construction. The application effect of expressway and interchange is discussed.

### 4.2 Capacity

The actual capacity of the interchange ramp is closely related to the capacity of the ramp itself. Designers should mainly add variable speed lanes in the reconstruction design, and the specific capacity is determined according to the calculation method of the main section. China's traffic law has made clear provisions on the capacity and speed of interchange ramp. The specific design needs to be confirmed according to the mixing situation of large vehicles.

If the situation is special, the capacity can be appropriately reduced in the design.

### 4.3 Connector design

The junction design of interchange is usually the core part to ensure the whole design level<sup>[3]</sup>. Therefore, designers should pay full attention to whether the connection part of the main line and ramp of the expressway can meet the traffic safety needs, which is generally reflected in the number, length and structure of the variable speed lanes. Speed change lane includes acceleration and deceleration. It is the part connecting ramp and main line of expressway. The purpose of design is to adapt to vehicle driving and not affect the main line traffic of expressway. Its function is to reduce the probability of accidents due to the inflow of vehicles on the main line.

## 5 Conclusion

In conclusion, the number of projects related to the addition and transformation of Interchanges on expressways in China has doubled in recent years. In the face of the current situation of this industry, the staff need to follow reasonable construction principles and strictly guarantee the final quality and safety factor. In addition, it should be noted that the design of new and reconstructed interchanges should be able to match with the original road traffic system and the surrounding environment, so as to avoid abrupt situations as far as possible and make contributions to the convenience of people's travel.

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