

# Research on Type Selection and Plan Design of Urban Overpass

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**ABSTRACT** The urban road overpass has its own features: (1) Calculated vehicle speed is rather low; (2) The traffic organization is complex; a huge amount of non-motorized vehicles and pedestrians are present; (3) The land use is urgent, the buildings are densely distributed around and there is a network of underground pipelines; (4) The road amplitude is rather wide and section is diversified. Therefore, the type selection and design principles of urban road overpass are different from those of highway overpass: First, the form of overpass has to be compatible with the property and traffic functions of crossed road; the selected category assures safe and smooth traffic and continuous vehicle flow; The form of overpass must adapt to the local environmental conditions; an integrated consideration is made under the condition of meeting the traffic requirements in order to make a reasonable use of typography, practice economy to the project operation expense, coordinate with the environment and realize beautiful profile and stylish structure; Special attention is paid to the integration between nearby and remote profiles before an integrated consideration is made; The main line and ramp are collocated in sequence and an integrated arrangement is made; The category is selected according to the actual conditions and favorable conditions are provided for the project construction. This article integrates with the urban overpass case, elaborates on the demand for urban overpass construction and makes use of category selection of overpass to verify the scientific and reasonable properties of plan design.

## KEYWORDS

Urban overpass  
Type selection of overpass  
Traffic demand  
Plan design

## 1. Introduction

In the design of urban overpass, the plan design is made at the outset; the importance is evident to all. It is able to clearly specify the location and direction of overpass construction, achieve the objective of traffic smoothness and safety assurance, conserve urban land, expenditure and construction and operation expenses, integrate the urban environment in a better manner, bring convenience to urban planning and improve the urban appearance. In the design of urban overpass plan, the traffic engineering

science is adopted as the basic theory; research is made according to macro traffic planning, road property and location, surrounding environment and traffic network; properties of overpass node are confirmed; subsequently mainstream traffic tunnels are collocated according to the flow of surrounding traffic to assure specific purpose of the plan.

## 2. Planning overview of urban overpass

### 2.1. Urban overpass

The urban overpass mainly aims to make use of the space to build up two or more than two crossed tunnels at the center of crossing point; in one plane or different space positions, extending from numerous tunnels. The urban overpass is gradually developed based on the plane crossing of road and it aims to achieve the objective of expanding traffic volume and settling low service efficiency in the plane crossing [1]. In a conceptual sense, the urban overpass is divided into two: road and road overpass, road and railway overpass. The road and road overpass are further divided into three categories: separate overpass, intercon-

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nected overpass and semi-interconnected overpass.

## 2.2. Role of urban overpass

In the urban road traffic, urban overpass plays an obvious role. (1) It replaces the signal administration in the horizontal intersection; (2) It basically avoids the conflict points of horizontal intersection; (3) It can assure continuous vehicle flow; (4) It enhances the operation capacity of urban road; (5) It saves time, fuel and brings about certain economic benefits. At the same time, it assures safe and smooth operation of high-level road [1].

## 2.3. Form of urban overpass

According to the quantity of urban intersections, the urban overpass includes the following forms: three-way intersection and four-way intersection. (1) Three-way intersection includes horn type, partial cloverleaf type, T type and double Y type. (2) Four-way intersection includes full cloverleaf type, partial cloverleaf type, row type, semi-directional type and directional type. Besides, there are complex intersections with above four intersections. They refer to the combination of all the above mentioned conditions.

## 2.4. Classification of urban overpass

The urban overpass enjoys numerous forms and aims to express three aspects: functional role of road network system; smoothness of traffic; connection of crossing road. Therefore, the overpass includes the following categories. In respect of functions of road network system: service type, hinge type and dredge type. In respect of traffic structural features: non-crossing type, crossing type and horizontal crossing type (partial conflict point). In respect of crossing and connection status: full interconnected type, partial interconnected type, simple interconnected type and separate type [2].

## 3. Design principle of large-scale overpass hinge plan in the city

According to the design of Guangxi overpass plan, the author concludes the following design principles of urban overpass plan:

### 3.1. Assurance of traffic functions

The urban overpass plays the traffic and transportation roles: (1) Connect with new and old roads of the city; (2) Assure traffic flow. The overpass category, road collocation, reasonability locating and traffic property objective are the primary tasks. In the design of Guangxi overpass plan, an adequate consideration is made to the selection of interconnected overpass form according to the road and traffic conditions, topographical and environmental conditions. In the crossing of two main lines or expressway with similar functions, the direct connective ramp with rather high designed speed and free flow of turning vehicle flow is collocated; in case of rather small traffic volume, the ring

ramp with rather low designed speed is collocated to improve the formal design plan, clearly specify the location and achieve the objective of reasonable traffic and urban planning in a better manner [3].

### 3.2. Maximization of overpass land requisition scope

The urban land is very tight. Demolition caused by land requisition is a difficult problem in the project construction. As for the urban overpass, land occupancy is inevitable; but overpass land scope is considered thus, less land requisition and demolition are assured. The urban overpass assures no increase in quantities, better use of space and reasonable collocation of structure; as for the collocation of Guangxi overpass, the ramps are collocated tightly, ramp is rather short, running direction is definite and convenient. G and H ramps have certain crossing which requires additional distribution lane to alleviate interruption against main line's traffic flow; however, the distribution lane still suffers from crossing. At the same time, it is able to reduce demolition difficulties and give a push to smooth construction. The overpass is collocated in a concentrated manner; bridge span is collocated with semi-directional ramp. In other traffic flow directions such as Nanning, Wuming and Laibin, the ring ramp is collocated to maintain a favorable free flow of turning vehicles and assure smooth running of main traffic flow. It is compatible with the actual typography. It can also reduce contradiction against original pipeline and play a positive role to the overpass pipeline network, road light, water discharge and afforestation [4].

### 3.3. Landscape and environmental protection

Overpass is the representative of modernized traffic. With design of the plan, an adequate consideration is made to the aesthetics principles of road and bridge and design is in accordance with the surrounding environment. The environmental protection requirements are met, vehicle noise and tail gas are reduced, and excavation of earthwork and stone is reduced. At the same time, the environmental landscape is designed. Guangxi overpass plan is featured as tight interconnected overpass model and coordination and beauty and is able to assure smooth main traffic flow, meet functions and requirements of hinge interconnected overpass between two expressways and realize traffic transfer with Du'nan Expressway. The horn type and directional type establish a pattern compatible with the surrounding environment (hill and slope) and urban landscape planning. The bridge span is collocated in single-pole light structure to assure a light profile; the green land, flowers and bonsai as well as park area for leisure are beautiful. Therefore, Guangxi overpass is a beautiful and grandeur construction.

### 3.4. Maintenance of construction traffic and assurance of construction by stage

The overpass construction assures connection with the

original traffic. In the construction projects, the construction is organized by stage and to assure the normal use of the turning panel. It is required by the overpass traffic planning.

## 4. Design difficulties and analysis

### 4.1. Type selection of overpass

As for the difficulties in overpass type selection, it suffers from small land area and limited usage space. The collocation methods are adopted to settle interconnection of roads; ring type, directional type and composite type are available for the overpass. They are featured as follows.

#### 4.1.1. Ring overpass

Ring overpass is the best method to tackle interconnection of numerous roads. In particular, the horizontal ring overpass in some old road network is upgraded to overpass. It is frequently seen in numerous cities in China. However, the swift road or main road is collocated for the connective road of large-scale overpass as the road with a small radius can not assure traffic volume; force is increased to increase the radius. Therefore, it is not suitable to the large-scale overpass [4].

#### 4.1.2. Total directional overpass

The overpass enjoys such advantages as short route, swiftness, smooth traffic and small land area. The defects include complex structural layer, numerous bridge span structures and high cost. Generally, it is suitable for the overpass connecting with five-way or below five-way swift main road.

#### 4.1.3. Composite overpass

The composite overpass is composed of two or above two overpasses; three-way and four-way overpasses are designed by normal type selection. Generally, they are suitable for six-way and above six-way overpass. This chapter introduces Guangxi overpass with such features. It enjoys such strengths as flexible structure, concentrated and distributed collocation; the ramp with clear stratification and large traffic volume makes use of directional or semi-directional type; otherwise, non-directional type is collocated. The defects include the distributed collocation, large land area and long detour [2].

### 4.2. Landscape design

In the perspective of road and bridge aesthetics, it has enjoyed a long history. However, overpass aesthetics do not refer to the unity of two; single afforestation or gardening design is made. The key requirements and gardening of urban overpass refer to landscape design; the landscape collocation and overpass user's visual effect are our research directions. At the same time, the most difficult problem lies in the unification between landscape design and plan design. The author made previous analysis. We will no lon-

ger discuss about this.

### 4.3. Integrated evaluation of design of overpass plan

The problem has been analyzed for years. However, it is not settled in the real sense. The difficulty lies in numerous evaluation indicators which pose difficulty in integrated analysis. In addition, we fail to consider the evaluation of landscape design. From the author's viewpoint, the integrated evaluation is a quite good evaluation method of overpass plan design: (1) The evaluation refers to multi-level integrated evaluation; it can make a contrast according to different impact status [5]. It is suitable for the design requirements of large-scale overpass; (2) An adequate consideration is made to the evaluation of overpass landscape design. For instance, the evaluation and quantitative indicators are integrated in the scale, pace and luster and integrated analysis made. However, detailed research is required [3,5].

## 5. Conclusion

Generally, the design category of overpass has a certain impact on the road usage functions; besides, it can affect the surrounding environment, urban planning and economic investment. According to the overpass locating, the distribution or classification is made at a certain level aimed at the traffic volume. It is able to master the overpass strengths and properties in a better manner, connect with the crossing road in a better manner, enhance development of urban road project and bring about economic benefits. Currently, China's overpass design fails to have unified requirements in the respect of standardization; however, it has attained new upgrading in the new urban construction and started to locate overpass by classification of service type, hinge type and dredge type. It is of certain significance in improving the optimization of urban overpass plan design and fundamentally changing urban traffic congestion.

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