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Original Paper

Study on The Design Scheme of The East Extension Project of Qiushi Elevated Road

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Abstract

This paper takes the east extension project of Qiushi elevated road as an example, according to the planning and status quo situation of the project, combined with the traffic forecast and the analysis of the status quo, through the comprehensive selection of the program, the most reasonable scheme is selected from the aspects of scheme feasibility, traffic function and economy.

Keywords

elevated road, interchange, comprehensive selection

1. Introduction

The East Extension Project of Qiushi Elevated Road is a part of "One Horizontal" in the "Four Horizontal, Three Vertical and One Continuous" Fast Channel of Linping Venture City, and between Linping Vice City and Hangzhou Main City. It is an important channel to enhance the central location advantage of Linping Vice City. At the same time, it bears the function of medium and long distance fast connection between various functional groups along the route. Play an important role in the development of the region (Hangzhou, 2008).

2. Engineering Overview

This project is located in Hangzhou, China. The starting point is located in the west side of the intersection of Linping Avenue and Xinghe Road, along with the current expressway.After that, the route is arranged from west to east along the current Linping Avenue, through Xinghe Road, Heyu

Road, Tangning Road, Donghu North Road, Hongfeng Road, and Xinsi Road (planning the second phase of Donghu Expressway), and ends at the intersection of Linping Avenue and Xinfang Road. The total length of the project route is about 6.5 km, and the elevated length is about 6.4 km.

3. Construction Background

Linping District of Hangzhou City, with its unique geographical location and location advantages, is in the process of rapid urbanization. With the economic growth and sustainable development of Linping New Town, Tangqi Town, Yuhang Economic Development Zone and other blocks, the connection between Linping District and other regions will be closer, and the demand for transportation will also increase day by day.

4. Overall Program

4.1 Technical Standards

1) Road grade and design speed: the grade of main road is urban expressway, and the design speed is 80 km / h; the grade of side road is arterial road, and the design speed is 50 km / h. The design speed of ramp is 40~50 km/h.

2) Clearance height: motorway: ≥ 4.5 m; sidewalks and non-motorized lanes: ≥ 2.5 m;

3) Lane width: Expressway: Truck lane width: 3.75 m, Car lane width: 3.5 m; the width of the side road width: 3.5 m; ramp width: 3.5 m (*Specification*, 2009);

4.2 Lane Size

According to the four-stage traffic volume prediction method, by the end of the traffic volume prediction year (2042) the peak hourly volume is about 5,600~6,000 pcu/h, the lane size of the main road 6 and side road 6 can meet the demand, V/C is 0.78~0.83, the level of service is Grade III, and the road adaptability is good.

4.3 Road Cross-section Arrangement

According to Specification for design of urban expressway, the specific road layout of elevated road section cross-section is as follows: 25.5 m = 1.0 m median divider + 2 × (0.5 m marginal strip + 3 × 3.5 m carriage way + 0.75 m marginal strip + 0.5 m guard rail). The road layout of side road is as follows: 43 m = 8.0 m median divider + 2 × (0.5 m marginal strip + (3.5 + 2 × 3.75) m carriage way + 0.5 m marginal strip + 1.50 m lane separator + 4.0 m turn-out lane).

4.4 General Arrangement

The viaduct scheme: the starting point of the project is located at landing abutment of the current viaduct. Firstly, demolishing the subgrade of abutment of the current viaduct, and then building the viaduct to connect the current abutment, crossing the Xinghe Road in the form of six-lane viaduct, setting up a diamond interchange at the intersection of the Xinsi Road, Landing after crossing the Xintian Road, connecting the current ground road. Because of insufficient distance in between the parallel ramp on the east side of Donghu Road and the Xinsi Road Interchange, adding collector-distributor roads according

to the requirements of the specification. The total length of the route is 6.5 km, of which the elevated length is 6.4 km, with a total of 6 pairs of parallel ramps and 1 Interchange.

Figure 1. Schematic Diagram of Elevated Scheme

The scheme of tunnel + viaduct: he starting point of the project is located at landing abutment of the current viaduct. Firstly, demolishing the subgrade of abutment of the current viaduct, and then crossing Xinghe Road in the form of four-lane tunnel. Landing after crossing Shunda Road, then crossing Heyu Road according to the viaduct. Landing after crossing the Xintian Road, connecting the current ground road. Set the East Lake hub with the East Lake Expressway (New Silk Road); Because of insufficient distance in between the parallel ramp on the east side of Donghu Road and the Xinsi Road Interchange, adding collector-distributor roads according to the requirements of the specification. The total length of the route is 6.5 km, of which the elevated length is 6.4 km, the tunnel section is 1.5 km (buried section is 870 m), with a total of 6 pairs of parallel ramps and 1 interchange.

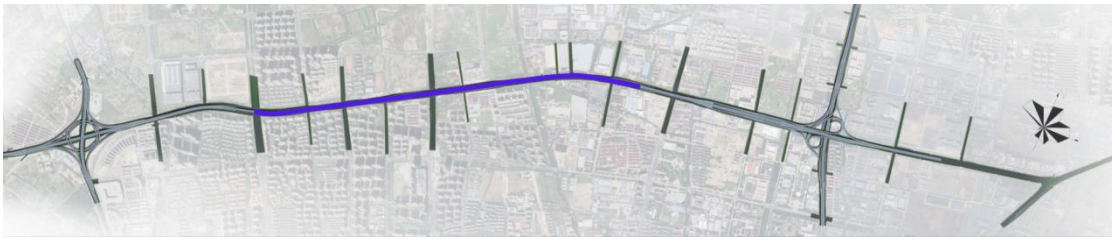

Figure 2. Schematic Diagram of Tunnel + Viaduct

Table 1. Scheme Comparison Table

	viaduct	tunnel + viaduct
Feeling of driving	The longitudinal slope of the road is gentle and the driving is comfortable.	The starting point of the continuous long steep downhill, driving comfort is poor.
The impact on the surrounding	Poor landscape, noise impact, automobile exhaust pollution.	Poor landscape, noise impact, automobile exhaust pollution.

exploitativeness	The construction of the elevated scheme is relatively simple, which has little impact on the Metro Line 9 along the Heyu Road.	The underground tunnel intersects with the subway line 9, and the distance between the bottom of the tunnel structure and the top of the subway shield is close, so it is difficult to approve and construction.
construction cycle	Short construction period	Long construction period
construction cost	lower	higher
comprehensive selection	The elevated scheme has little influence on Metro Line 9, the scale of investment and demolition is small, the condition of communication is good, and the construction period is short. Therefore, the elevated scheme is recommended for this project.	

4.5 Major Interchange Node Schemes

4.5.1 Xinshi Road Interchange Program

Node function orientation: according to the overall road network scheme, 320 national highway is positioned as an expressway. According to the traffic forecast and specification requirements, the intersection of the two expressways needs to set up a full interchange.

The node is located in the east of Linping City, so the main direction of the interchange is west-south and west-north, which is also in line with the results of traffic forecast.

The status quo around the node: According to the on-site survey aerial photos, the first to third quadrants of the interchange node are mainly industrial land, and the fourth quadrant is residential land. At the same time, the green space on the south side of 320 National Highway is relatively sufficient, which provides favorable conditions for the construction of interchange nodes.

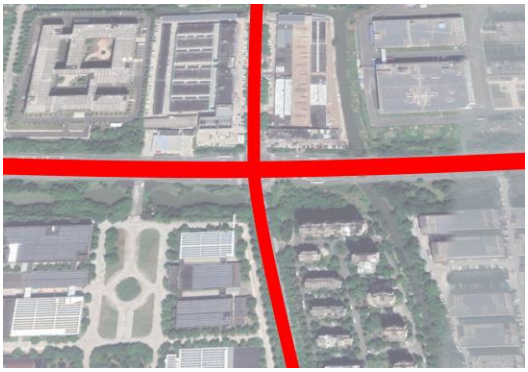

Figure 3. Current Satellite Map

Figure 4. Symmetrical Cloverleaf Interchange

Program 1: Symmetrical cloverleaf interchange, which minimizes the occupation of surrounding plots. In order to reduce the impact on Huahui Homeland in the southeast quadrant, the scheme does not set a high-level ramp from south to east, and the traffic from south to east is converted from the ground intersection through the landing parallel ramp.

Program features: to meet the functional needs of traffic, to meet the service needs of the surrounding parcels, low cost and less land occupation.

Program 2: T-type interchange, It only meets the rapid conversion of the mainstream direction. The traffic in the Haining direction on the east side and the East Lake Expressway on the south side cannot be converted through the interchange, and the traffic function is weak.

Program features: the interchange occupies a smaller area, the project investment is small, and it meets the mainstream traffic demand, but the traffic conversion with Haining on the east side needs to be carried out through the level crossing.

Figure 5. T-type Interchange

Figure 6. Cloverleaf + Semi-directional Interchange

Program 3: Cloverleaf + semi-directional interchange, the western section of Linping Avenue is connected with the East Lake Expressway through the directional ramp to meet the rapid conversion of the mainstream.

Program features: meet the traffic function demand, meet the service demand of the surrounding land, lower construction cost, demolition and relocation of less occupied land.

Table 2. Scheme Comparison Table

form	Symmetrical cloverleaf interchange	T-type interchange	Cloverleaf+ semi-directional interchange
traffic function	Except that the south to east needs to be realized through the ground plane intersection, the rest of the steering traffic is realized through the ramp, and the traffic function is strong.	It only meets the rapid conversion of the mainstream direction. The traffic in the Haining direction on the east side and the East Lake Expressway on the south side cannot be converted through the interchange, and the traffic function is weak.	The western section of Linping Avenue is connected with the East Lake Expressway through the directional ramp to meet the rapid conversion of the mainstream. Traffic is realized through the ramp, and the traffic function is the strongest.
The impact	The project covers a	The project covers the	The project covers the largest

on the surrounding	large area, avoids the current structure in the southeast quadrant, and has little impact on the surrounding area.	smallest area, avoids the current structure in the southeast quadrant, and has less impact on the surrounding area.	area, and encounters the current structure in the southeast quadrant, which has a great influence on the surrounding area.
conclusion	Symmetrical cloverleaf interchange is recommended for this project.		

5. Conclusion

This paper takes the east extension project of Qiushi elevated road as an example, according to the planning and status quo situation of the project, combined with the traffic forecast and the analysis of the status quo, through the comprehensive selection of the program, the most reasonable scheme is selected from the aspects of scheme feasibility, traffic function and economy.

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