World Journal of Education and Humanities
ISSN 2687-6760 (Print) ISSN 2687-6779 (Online)
Vol. 7 No. 4, 2025
www.scholink.org/ojs/index.php/wjeh

Original Paper

Discussion on the Optimal Design of the Cross-Section of Changhong East Street Municipal Road

Tao Yang[1] & Fajin Lin[1*]

[1] Central & Southem China Municipal Engineering Design and Research Institute Co., Ltd., Wuhan, 430064, China

[*]Corresponding author: Fajin Lin (1992-), male, master's degree holder, engineer, E-mail: 1012037112@qq.com Research direction: Bridge design

Received: June 08, 2025 Accepted: July 12, 2025 Online Published: July 25, 2025

doi:10.22158/wjeh.v7n4p09 URL: http://dx.doi.org/10.22158/wjeh.v7n4p09

Abstract

Taking Changhong East Street as an example, based on the current status of the project and combined with traffic volume forecasting, this article conducts a comprehensive comparison and selection of schemes, considering factors such as feasibility, traffic function, and economy, to select the most reasonable improvement scheme.

Keywords

road improvement and reconstruction, section widening, pavement reconstruction

1. Introduction

Changhong East Street is located in the north of Gaoxin Park, Deqing County, Huzhou City, Zhejiang Province. It is a major urban road with a total length of about 6.7 kilometers and a current cross-sectional red line width of about 35.5 meters. It is an advantageous and important passage in the north of Gaoxin Park and also serves as a medium to long distance rapid connection between various functional groups along the route. Plays an important role in the development of the region.

2. Project Overview

Changhong East Street is a key municipal project promoted by Deqing County, aimed at further improving regional infrastructure, enhancing urban functions, optimizing the business environment, and supporting the high-quality development of the high-tech zone. As an important component of the second phase of the High tech Zone project, this project will provide solid support for industrial agglomeration, residents' lives, and urban image enhancement in the region.

3. Construction Background

Huzhou Moganshan High tech Industrial Development Zone was formerly known as Deqing Economic Development Zone. In June 2010, it was approved by the Zhejiang Provincial People's Government to add the Deqing High tech Industrial Park brand. In February 2015, it was renamed Huzhou Moganshan High tech Industrial Park. In September of the same year, it was upgraded to a national high-tech industrial development zone with the approval of the State Council and officially listed in February 2016. The approved planning area of the park is 6.65 square kilometers, with a total jurisdictional area of 74.74 square kilometers, including 31.7 square kilometers of Chengbei High tech Park, 10.63 square kilometers of Kangqian Science and Education Park, 4.69 square kilometers of Geographic Information Industry Park, and 27.72 square kilometers of General Aviation Industry Park.

4. Overall Plan

4.1 Overall Design Concept

1) Adopt a reasonable construction scale based on traffic volume demand to meet transportation functional requirements.

Firstly, it is necessary to ensure that the traffic capacity and service level of the road are consistent with the level of traffic planning and prediction. By establishing a structurally complete, hierarchical, functionally complete, conveniently connected, and efficient road traffic system, the problem of vehicle travel at major nodes and along the route must be highlighted to avoid the occurrence of traffic bottlenecks.

2) Meet the service function needs of the areas along the route; Meet the external travel needs of the areas along the route.

The main road in the project is the main trunk road, and the service function is reflected in the communication with surrounding plots and roads along the line. There should not be too many openings and intersecting roads in the plots, which need to be fully considered in the overall design, and the service quality should be improved as much as possible without affecting traffic efficiency.

3) Consider short-term and long-term construction to reduce overall costs.

As an international industrial cooperation park construction project, this project will inevitably serve as an access road for surrounding land and other municipal projects in the later stage. Considering the heavy load of vehicles during the construction period and the significant damage to the road surface structure, it may be appropriate to consider delaying the laying of the upper layer of the road surface structure.

4.2 Design Principles

1) Based on the principle of planning and construction being appropriately advanced, it can adapt to the continuously growing transportation demand in the long term and leave room for future development.

2) The construction scale and standards should be adapted to the nature and functional positioning of the road, and consistent with the connecting projects.

3) Reasonably determine the design standards for this project in order to achieve the best combination of applicability and economy.

4) Emphasize quality and highlight characteristics: Emphasize the coordination between roads and natural environment, and improve design, construction, and management levels in accordance with refined design requirements, striving for complete functionality, high-end quality, and distinctive construction effects.

4.3 Road Plan Design

Changhong East Street starts from the east side of Xuanhang Railway in the west and ends at the west side of Hangning Expressway in the east. The total length of the project is about 6.0km, with a red line width of 56m (the current bridge red line width is 36m). Along the route, it intersects with Kaixuan Road, Zhongxing North Road, Quyuan North Road, Yunxiu North Road, Yongping North Road, Qingshi Road, Xinfeng Road, Xingshan Road, Nanshan Road, Shuangshan Road, and Weiye Road.

The road is positioned as a main urban road with a design speed of 50-60km/h. The Yunxiu North Road Yongping North Road section and Shuangshan Road Weiye section are affected by the current bridge positions, and the linear index adopts a design standard of 50km/h. The linear indicators of the remaining road sections are designed according to the standard of 60km/h.

Figure 4.3-1 General Layout of Changhong East Street

1. Close the side strip opening of the road section, add auxiliary lanes, and improve vehicle tr affic capacity.There are many openings along Changhong East Street (52 locations), resulting in an increase in conflict points and severe lateral interference, greatly affecting road capacity and driving safety. Optimize the openings along the road by merging side strip openings, adding au xiliary roads, and reducing the number of openings by 31. Not only can it improve road traffi c capacity, but it can also enhance driving comfort and safety.

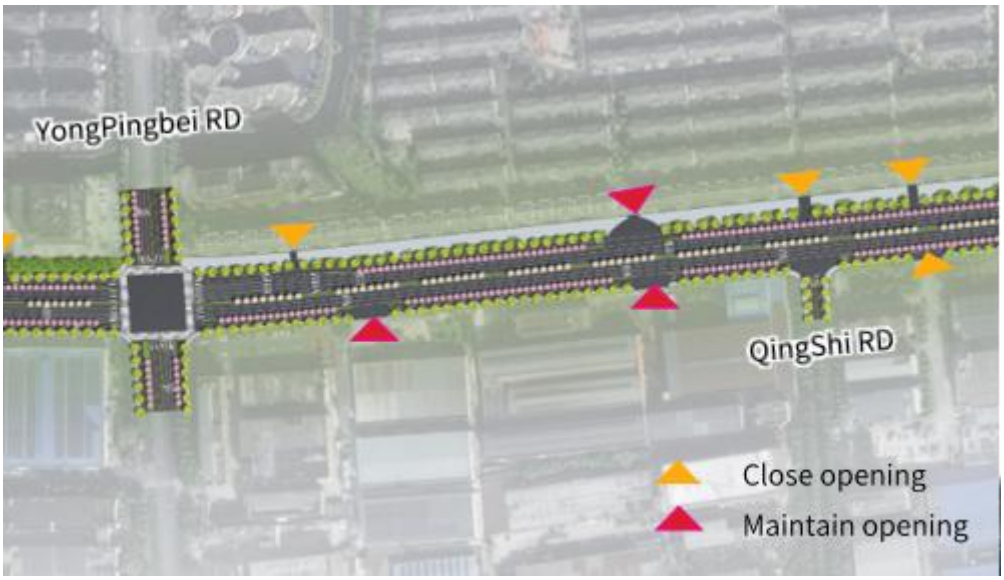

Figure 4.3-2 Schematic Diagram of Side Strip Closure

2. Reduce the opening of the median strip and improve vehicle traffic capacity.

In order to improve road traffic capacity, the intersection of Qingshi Road and Nanshan Road will be transformed into a right in and right out road according to the regional road network l ayout and traffic demand; Close the pedestrian crossings on the east side of Zhongxing North Road and the west side of Xinfeng Road.

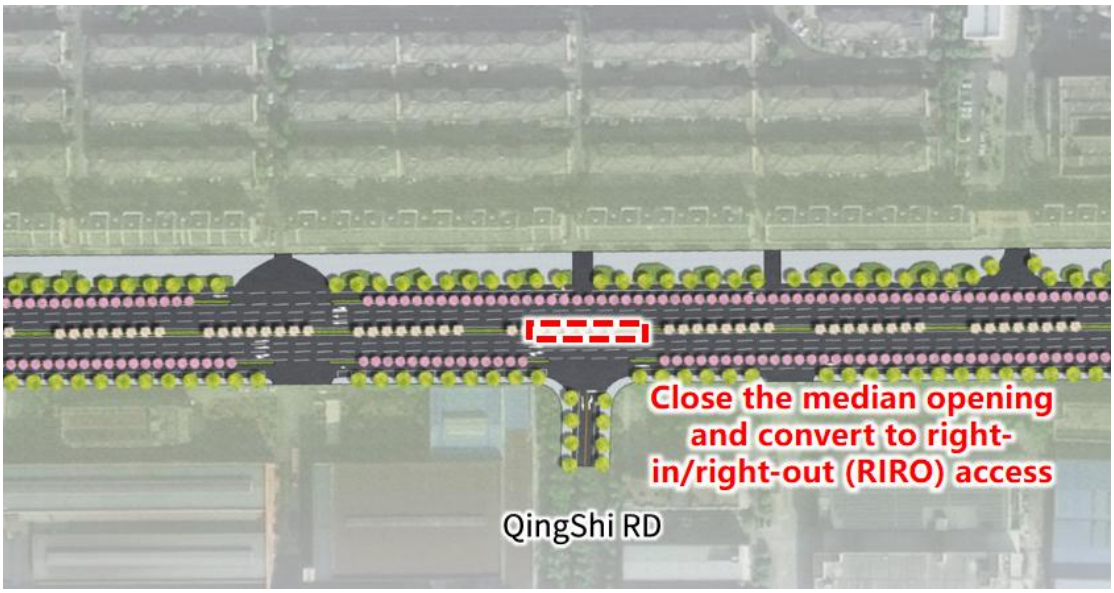

Figure 4.3-3 Schematic Diagram of Reducing the Opening of the Median Strip

3. To ensure the safety of non motorized vehicle passage, re plan auxiliary roads

The current road auxiliary road has a width of 5m and is set as a 2.5m mixed carriageway with a 2.5m roadside parking space.

The optimization of the auxiliary road in this design is as follows:

1) Widen the width of the auxiliary road from the current 5m to 5.5m.

2) At intersections where there is a need for motor vehicles to pass through the auxiliary lane after merging and opening on the opposite side, in order to ensure the efficiency of motor vehicle traffic and the safety of non motor vehicles, and to clarify their respective road rights, the cross-section is set as: 3m motor vehicle lane+2.5m non motor vehicle lane. And clear the passage space through machine non-standard lines and colored asphalt paving.

3) For road sections without motor vehicle traffic on auxiliary roads, roadside parking belts should be set up to meet the parking needs of the surrounding area, while avoiding traffic congestion and safety hazards caused by arbitrary parking of vehicles. And draw parking space markings to standardize parking and avoid vehicles being parked randomly.

4.4 Road Cross-section Design

4.4.1 Cross Section Design Ideas

(1) Ensure the horizontal drainage of the road surface is necessary and does not affect driving safety.

(2) Ensure the functionality of the cross-section and reduce project costs.

(3) Ensure smooth elevation connection of the road surface at the intersection. Coordinate with the plan and vertical sections to ensure the continuous effect of the landscape.

(4) Easy for construction layout and layout of underground planning pipelines.

4.4.2 Principles of Cross-sectional Layout

(1) The basic width of the road, the width of the curbstone, and the width of the seat belt meet the functional requirements.

(2) Ensure that the traffic protection road during road construction is not less than two lanes in both directions. Efforts should be made to utilize the original road resources to establish accessible roads.

(3) Based on the current road and red line scale, ensure the lane size.

(4) The width of the sidewalk is combined with the nature of the surrounding land, fully considering the size of pedestrian flow.

4.4.3 Cross Section Layout Ideas and Methods

(1) Independent space for pedestrians, non motorized vehicles, and vehicles to prevent various disorderly mixing on road sections.

(2) Meet the requirements of road functional positioning and planning.

(3) Ensure the horizontal drainage of the road surface is necessary and does not affect driving safety.

(4) Ensure smooth elevation connection of the road surface at the intersection. Coordinate with the plan and vertical sections to ensure the continuous effect of the landscape.

(5) Easy for construction layout and layout of underground planning pipelines.

(6) Taking into account the utilization and horizontal connection of sidewalks along the land parcels.

4.4.4 Road Cross Slope Design

The design of the cross slope is as follows: In the design of the cross slope, the centerline of the road is

based on the vertical section design elevation, and the slope is set to the outer side of the road to the edge of the side partition, with a single slope of 1.5%. The slope shape of the roadway adopts a cubic parabola+straight slope; The cross slope of the non shared board adopts an inward slope of 1.5% and a straight slope shape.

4.4.5 Road Cross-section Design

1. Road cross-section design (west of Yongping North Road)

The current road in this section is 35.5m wide and has four lanes in both directions. There is a 10.5m high-voltage tower corridor on the north side of the road, and a 10m green belt on the south side.

Retain the existing 10.5m high-voltage corridor on the north side and only enhance its landscape. Borrowing the 10m green belt on the south side, expand the existing 35.5m wide road to 45.5m wide. Add a median strip and roadside parking areas, and increase the carriageway from four lanes in both directions to six lanes in both directions.

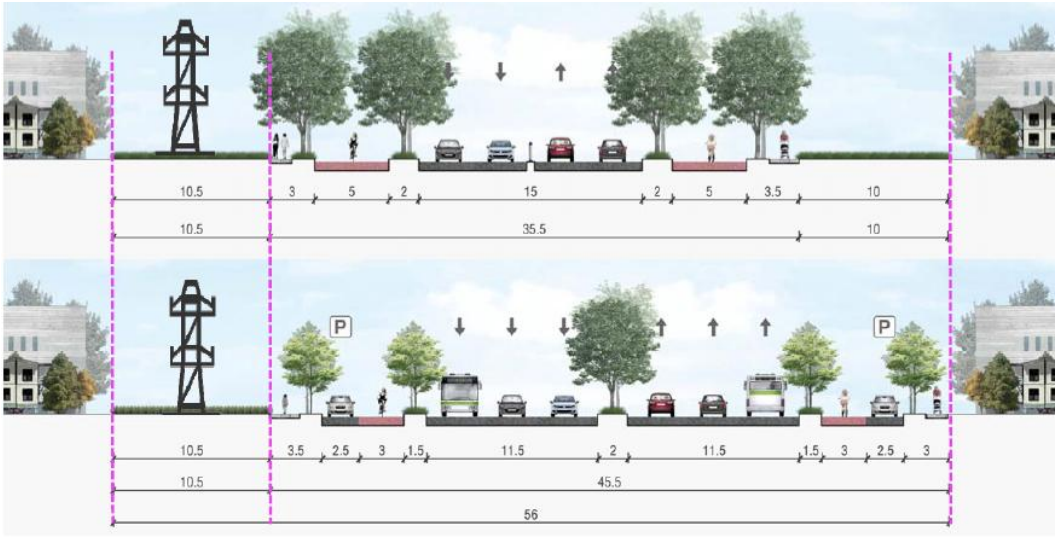

Figure 4.4-1 Road Cross Section Renovation (West of Yongping North Road)

2. Road cross-section design (Yongping North Road Xingshan Road)

The current road in this section is 32.5m wide and has four lanes in both directions. There is a 10.5m high-voltage tower corridor on the north side of the road, and a 10m green belt on the south side.

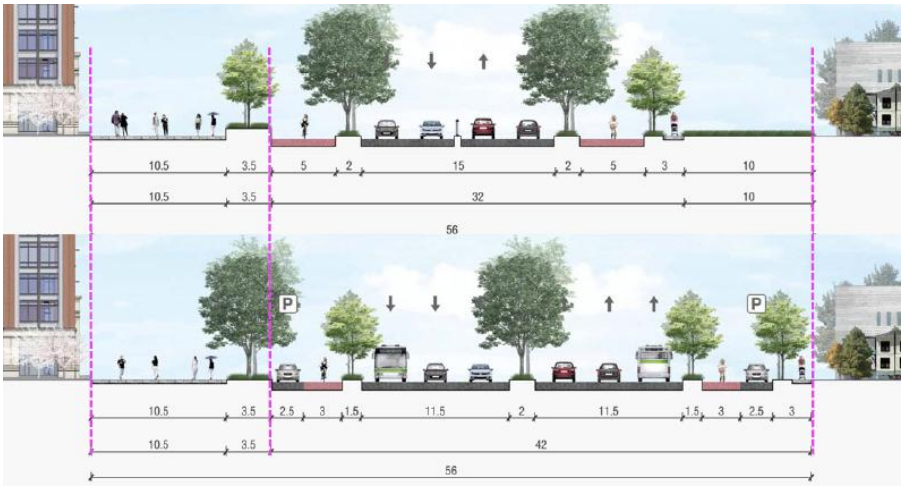

Figure 4.4-2 Road Cross Section Renovation (Yongping North Road Xingshan Road)

Retain the existing 10m trail and 3.5m green belt on the north side. Borrowing the 10m green belt on the south side, expand the existing 32.5m wide road to 42m wide. Add a median strip and roadside parking areas, and increase the carriageway from four lanes in both directions to six lanes in both directions.

3. Road cross-section design (east of Xingshan Road)

The current road in this section is 36m wide and has four lanes in both directions. There is a 10m high voltage tower corridor on the north side of the road; There is a 10m green belt on the south side, and there is a gas pipeline (about 1m wide) in the green belt.

Retain the existing 10m high voltage corridor on the north side and only enhance its landscape. Borrowing the 9m green belt on the south side (retaining the 1m gas corridor), expand the existing 36m wide road to 45m wide. Add a median strip and roadside parking areas, and increase the carriageway from four lanes in both directions to six lanes in both directions.

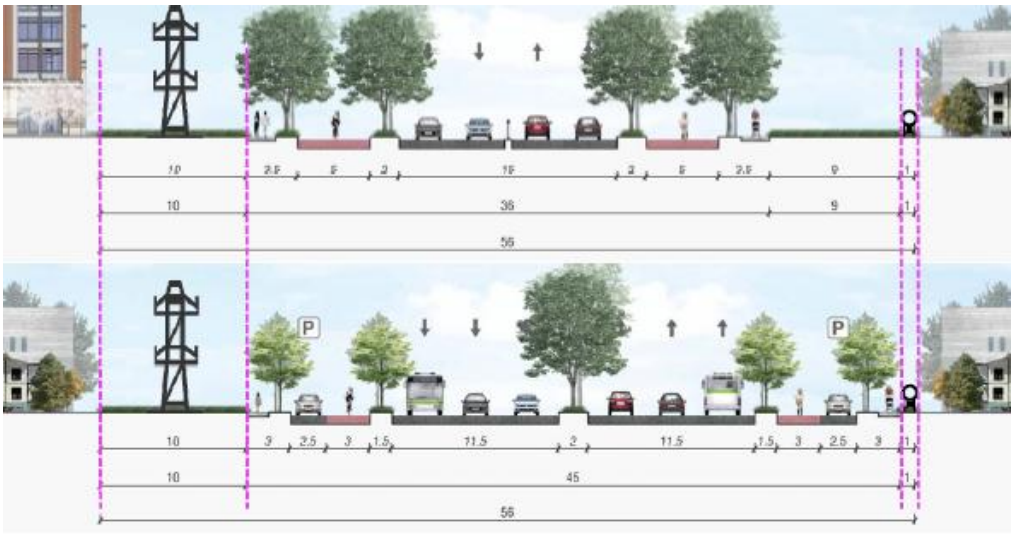

Figure 4.4-3 Road Cross Section Renovation (East of Xingshan Road)

4.5 profile Design

The overall alignment of the road profile in this project is determined based on factors such as the current road profile direction, road drainage, and smooth connection of intersecting roads.

On the premise of meeting the technical and planning requirements of the specifications, the technical standards shall be determined in accordance with the basic requirements of the specifications, including uniform and smooth longitudinal slopes, gentle undulations, appropriate slope length and vertical curve length, coordinated design of the combination of plan and vertical section, minimizing the amount of work, and providing diversity of views.

According to the requirements of driving conditions, flood control standards, road drainage, and pipeline laying, the longitudinal section of the road is mainly considered from the following factors:

1. Elevation system: 1985 National Elevation Standard

2. The elevation of road control points should refer to the vertical elevation in the control plan as much as possible, and refer to the average elevation of adjacent plots or be determined by the lowest elevation of adjacent plots; Meet the requirements of various control points, including road starting and ending points, intersections, and elevation control of land parcels on both sides of the route;

3. According to relevant regulations and taking into full consideration the drainage effect of the road, we strive for a smooth and gentle line shape with gentle undulations to ensure driving safety, comfort, and design speed. For non motorized vehicle lanes, the maximum longitudinal slope is $\leqslant$ 2.5%, and the controlled slope length is $\leqslant$ 200m.

4. Due to the fact that the majority of the road is filled after demolition, efforts should be made to minimize road filling and reduce project costs while meeting the above conditions.

According to the above principles, the longitudinal section of the road in this design is mainly analyzed based on the planned elevation, flood control elevation, surrounding land elevation, current road

connection elevation, and the level of this road.

4. Conclusion

This article takes the Changxing East Street project as an example, and based on the project's planning and current situation, compares and selects the most reasonable plan from multiple aspects such as feasibility, transportation function, and economy.

References

General Administration of Quality Supervision, Inspection and Quarantine, & Standardization Administration of China. (2009). *Road traffic signs and markings* (GB5768-2009) [S]. Beijing: Standards Press of China. (in Chinese)

Ministry of Housing and Urban-Rural Development of the People's Republic of China. (2016). *Code for design of urban road engineering* (CJJ37-2012, 2016 edition) [S]. Beijing: China Architecture & Building Press. (in Chinese)

Ministry of Housing and Urban-Rural Development of the People's Republic of China. (2012). *Code for design of urban road alignment (CJJ193-2012)* [S]. Beijing: China Architecture & Building Press. (in Chinese)

Ministry of Housing and Urban-Rural Development of the People's Republic of China. (2009). *Specification for design of urban expressway* (CJJ129-2009) [S]. Beijing: China Architecture & Building Press. (in Chinese)

Ministry of Housing and Urban-Rural Development of the People's Republic of China. (2010). *Specification for design of urban road intersections (CJJ152-2010)* [S]. Beijing: China Architecture & Building Press. (in Chinese)

Ministry of Housing and Urban-Rural Development of the People's Republic of China. (2015). *Code for design of urban underground road engineering* (CJJ221-2015) [S]. Beijing: China Architecture & Building Press. (in Chinese)

Ministry of Housing and Urban-Rural Development of the People's Republic of China. (2013). *Code for design of urban road subgrade* (CJJ194-2013) [S]. Beijing: China Architecture & Building Press. (in Chinese)

Ministry of Housing and Urban-Rural Development of the People's Republic of China. (2012). *Code for design of urban pavement (CJJ169-2012)* [S]. Beijing: China Architecture & Building Press. (in Chinese)

Ministry of Housing and Urban-Rural Development of the People's Republic of China, & State Administration for Market Regulation. (2021). *Standard for urban road traffic engineering projects* (GB55011-2021) [S]. Beijing: China Architecture & Building Press. (in Chinese)