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Study on the DaQing Interchange Type-Selection

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Abstract: This paper analyzes the relevant factors of the type-selection of DaQing highway interchange, and with the study of the importance of the interchange in the road network, the volume of traffic, and site condition, investment cost. This paper presents rhombic -shape and single-horn type schemes. Further, this paper compares the two schemes from the technical and economical aspects such as the traffic conditions ,cost and the status of area-cover, then recommends rhombic -shape scheme.

General Situation of the Engineering

National Highway 320 is an important main trunk road in Zhejiang province. It is an important channel for Hangzhou city to connect the vast areas of central and western of Zhejiang province. The project is designed as the standard of grade-I highway, and with the design speed of 100 km/h. Daqing highway interchange is located in Daqing town, Fuyang city. The crossed road is Provincial Highway 23 designed as grade-I highway and with the width of 25.5m. The function of the interchange is traffic conversion of Provincial Highway 23.

Relevant Factors of the Type-Selection of DaQing Highway Interchange

volume of traffic

According to the results of traffic forecast in engineering feasibility study report[①], the exchange traffic volume of Daqing highway interchange in 2030 is 19831pcu/d and the main traffic flow is to Hangzhou,17235pcu/d, about 87% of the total.

conditions of terrain and distribution of obstacles

Within the scope of Daqing interchange the north ground of Provincial Highway 23 is relatively flat, the ground elevation is about 10m-12m, and on the south side the ground is undulate with the elevation 14m~23m.There are crowded buildings and houses and a river named Nan is about 280m distant from the interchange. The river flows from east to west. There is a primary school near by the interchange. On the west side of the main line there are mountain and local roads and irrigation river.

Interchange Type Schemes Introduction

Daqing interchange type scheme is restricted by many factors, such as terrain conditions and specifications for requirements of the distance between the interchange and another interchange, an interchange and a tunnel [②③].

This paper presents two schemes: rhombic -shape and single-horn type schemes.

scheme I

Rhombic -shape which schemes the main line crosses over Provincial Highway 23.The design speed of the ramps is 40 km/h. Each direction have one ramp and with the roadbed width of 8.5m.

The bridge of the main line crossing the Provincial Highway 23

The intersection angle of the main line and Provincial Highway 23 is 56 angle. The bridge starts at the north of Nan-river and crosses the river ,then crosses over Provincial Highway 23 and the destination of the bridge is near by the foot of a hill named Heng. The span is arranged as: (4x25) + (4x25) + (5X25) + (25+35+25) + (5X25) m. The superstructure of the bridge is equipped with an assembly continuous box girder with partial pre-stressed concrete, and the box girder is prefabricated and hoisting construction. The whole structure is simply supported，then strengthen contacts with beams,as a result, the whole structure of the bridge superstructure turn to continuous. The second cross of the fourth league of the bridge crossing Provincial Highway 23 is designed with 35m span. The bridge crossing Provincial Highway 23 is designed with inclined piers, conversely, the other leagues of the bridge is designed with vertical ones. The edge two bridge spans of the fourth league change the angle between the axis of the river and the piers as transitional sections.The substructure of the bridge is equipped with column-type piers , plate-type abutments and bored piles foundation.

the B ramp crossing Nan-river

The span is arranged as: (5x25) m. The superstructure of the bridge is equipped with an assembly continuous box girder with partial pre-stressed concrete, and the box girder is prefabricated and hoisting construction. The whole structure is simply supported，then strengthen contacts with beams,as a result, the whole structure of the bridge superstructure turn to continuous. The substructure of the bridge is equipped with column-type pier , plate-type abutment and bored piles foundation.

the C ramp crossing Nan-river

The span is arranged as: (5x25) m. The superstructure of the bridge is equipped with an assembly continuous box girder with partial pre-stressed concrete, and the box girder is prefabricated and hoisting construction. The whole structure is simply supported，then strengthen contacts with beams,as a result, the whole structure of the bridge superstructure turn to continuous. The substructure of the bridge is equipped with column-type pier , plate-type abutment and bored piles foundation.

The scheme I is shown in Fig.1.

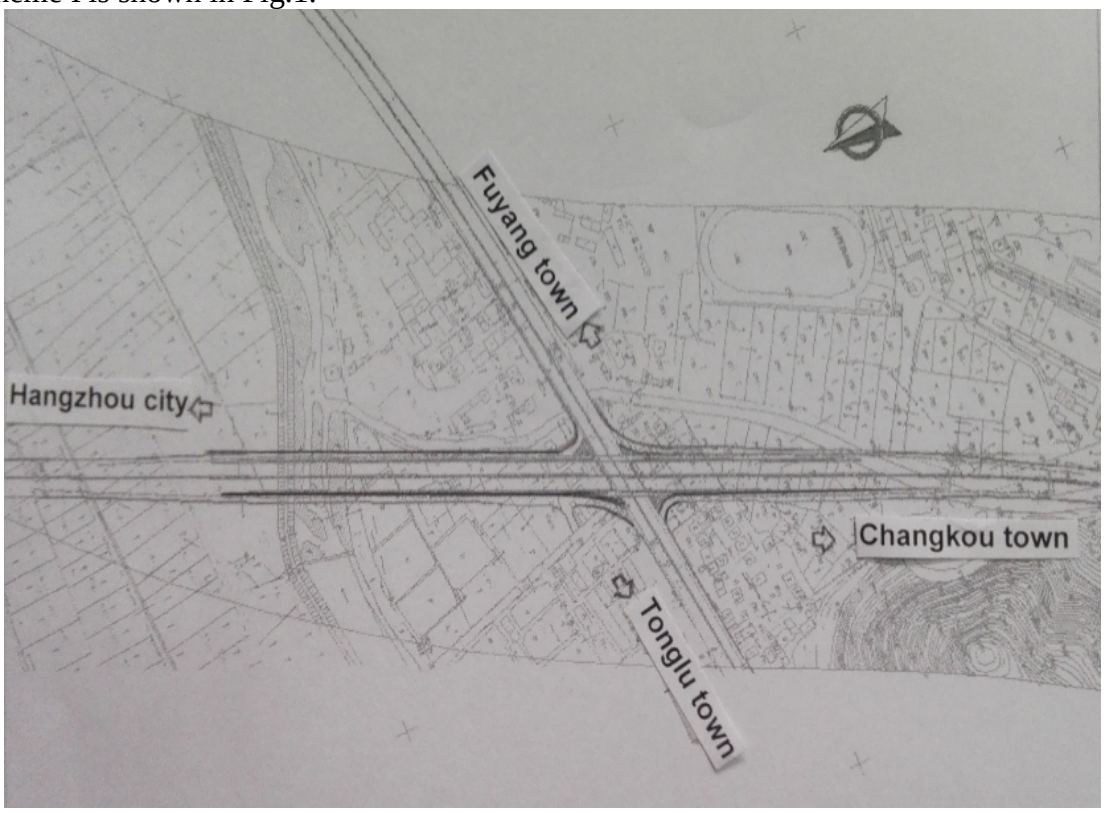

Fig.1 A diagram of the scheme Iof Daqing interchange

scheme II

Single-horn type scheme which scheme the main line crosses over No.23 provincial highway. The structure of the interchange is almost located Northeast quadrant. The unidirection lane ramps are designed with the speed of 40 km/h. The width of the roadbed is 8.5m.The width of the separate opposite-direction ramps is 15.5m.

The bridge of the main line crossing the Provincial Highway 23

The direction, trend and the span arrange of the bridge are the same as them of the schemeI which the main line crossing the Provincial Highway 23.The first bridge league is located in transition section and the superstructure of the bridge is equipped with an cast-in-place continuous box girder with partial pre-stressed concrete, and the box girder is constructed with support frame . The other bridge leagues are located in equal width section. The superstructure of the bridge is equipped with an assembly continuous box girder with partial pre-stressed concrete, and the box girder is prefabricated and hoisting construction. The whole structure is supported,then strengthen contacts with beams, as a result, the whole structure of the bridge superstructure turn to continuous.The second cross of the fourth league of the bridge across the provincial highway No.23, with 35m span. The bridge crossing Provincial Highway 23 is designed with inclined piers, conversely, the other leagues of the bridge is designed with vertical ones. The edge two bridge spans of the fourth league change the angle between the axis of the river and the piers as transitional sections. The substructure of the bridge is equipped with column-type pier , plate-type abutment and bored piles foundation.

the bridge the C ramp crossing the main line

The intersection angle of main line and C ramp is 75 degrees. The C ramp crosses the main line. In order to reduce the bridge span, single bridge column pier vertical is designed at the main line central separate belt .The bridge span is arranged as: (3x25)+(4x25)+(3x25)m . The superstructure of the bridge is equipped with an cast-in-place continuous box girder with partial pre-stressed concrete, and the box girder is constructed with support frame . The substructure of the bridge is equipped with column-type pier , plate-type abutment and bored piles foundation.

the C ramp crossing Nan-river

The span is arranged as: (5x25) m. The superstructure of the bridge is equipped with an assembly continuous box girder with partial pre-stressed concrete, and the box girder is prefabricated and hoisting construction. The whole structure is simply supported，then strengthen contacts with beams, as a result, the whole structure of the bridge superstructure turn to continuous. The substructure of the bridge is equipped with column-type pier , plate-type abutment and bored piles foundation.

The scheme II is shown in Fig.2.

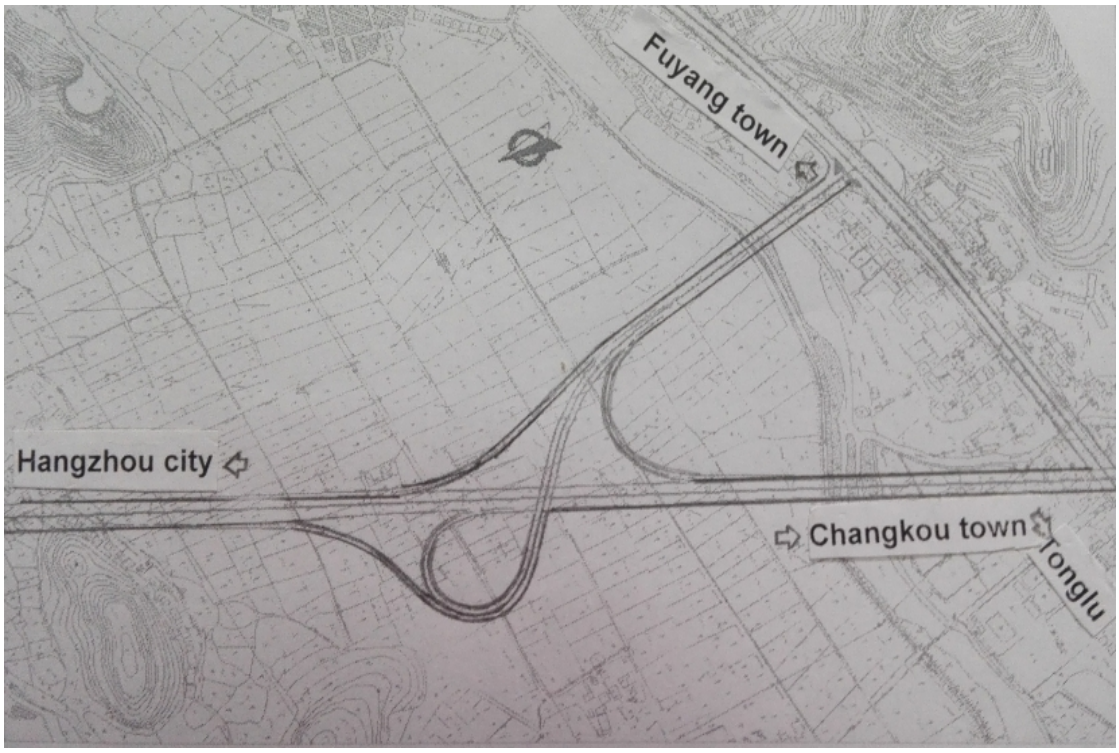

Fig.2 A diagram of the scheme IIof Daqing interchange

comparison of the schemes

The scheme Itotal costs 78 million and 117 thousand yuan, construction costs 72 million 895 thousand yuan. The scheme II total costs 85 million 631 thousand yuan, construction costs 79 million 996 thousand yuan.

The scheme I has the advantages of smaller size of the project, smoother traffic ,and less area-cover. The scheme IIhas the advantages of less interference to the traffic going straight of Provincial Highway 23. The disadvantage is that the project scale is larger, covers more area and the project cost is relatively higher. Besides, all direction traffic flow should make a detour except that Hangzhou city to Fuyan city.The total cost of scheme Iis 7 million 514 thousand yuan less than scheme II.The Interchange is near the city, so the cover-area should be restricted . In conclusion， the scheme Irhombic -shape is recommended.

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