

Analysis and optimization of Hangzhou East Area traffic based on the congestion index detection platform

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Abstract: With the rapid development of urbanization in China and the motorization's fast pace of high speed as well as the national automobile industry process, many cities in our country have been facing a huge problem - traffic congestion in recent years. And the essence of the problem is the imbalance between road traffic supply and traffic demand in the process of urban development. Aimed at the problem of traffic congestion, this paper based on Hangzhou city's traffic congestion index of monitoring data from testing platform and statistical data from field survey, studied the Hangzhou east area of road traffic running situation, analyzed the causes of the east area of Hangzhou road congestion, and thus to adjust and optimize the road traffic system of the area, put forward reasonable system solutions and proposals to improve the management level

Introduction

With the high-speed development of economy and the urbanization's fast pace of high speed, the contradiction between city traffic supply and demand is increasingly worse, which threatens the sustainable development of urban economy. The practice of the construction of urban road traffic development at home and abroad show that [1] in the process of urban development, just relying on urban road construction can not fundamentally solve the problem of city traffic congestion. Therefore, study the causes of urban traffic congestion has important significance, it will directly improve the condition of road traffic congestion.

This paper investigates the east area of Hangzhou, and connects with the road traffic statistical investigation by the testing platform in the east area of Hangzhou city traffic congestion index, analyzes the reasons of the area of traffic congestion and puts forward solutions, and thus to better adjust and optimize the road system of the film, improve the road capacity.

The basic situation of East Area

The regional scope of East Area. Hangzhou East Area is new area of Hangzhou, divided by traffic congestion index detection platform based on regional location within the core area of Hangzhou and the surrounding area, which is a range of re-division of the resulting block (Figure 1). The content of the area in the east: Desheng Road to the north, south subway line 1 and line the banks of the river across the Zhijiang road, east of Hangzhou-Ningbo Expressway, Ring Road and Zhanongkou Road to the west. On north of Hangzhou East area is the Gongshu District, south of the Riverside area and Xiaoshan District, Hangzhou Jianggan District on east and it's west is the downtown as well as West Lake Scenic Area.

The road skeleton and major buildings. Hangzhou, east of chip area, including a high-speed road, two urban expressway, 10 city roads, 13 city roads and a number of city branches. In addition to the completion of the film area has been planned subway Line 1, and is planning the construction of a subway line, also it has been built three railway lines, running to form a rich three-dimensional transport architecture (Figure 2, Table 1) [2,3].

Film area has a number of traffic and people flow more concentrated area construction: 1) the district government administrative office Jianggan, which is the urban areas administrative agencies; 2) Hangzhou International Conference Center -- the city's future commercial and office core blocks; 3) Zhejiang University of Huajiachi it is an education and teaching institutions. (Figure 3)

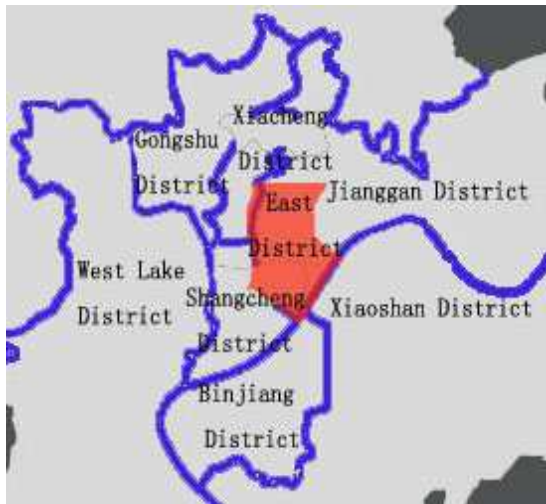


Figure 1 The bitmap of East Area in Hangzhou



Figure 2 The structure of East Area's transportation

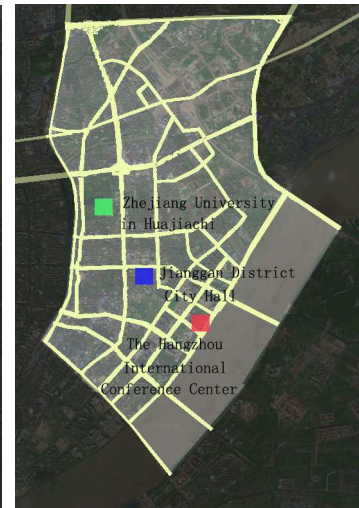


Figure 3 The main building distribution of East Area

Table 1 The main road of East Area

Road Level	The Name Of Roads
Highway	Shanghai-Hangzhou high-speed
Urban freeway	Desheng Expressway, Qiushi viaduct
The roads of the city	Airport Road, Kaixuan Road, Qiutao Road, Xintang Road, Ring Road, West Genshan Road, Fengqi Road, Qingchun Road, Jiefang Road, Qingjiang Road, Zhijiang Road
City roads	Fuchun Road, Xingye Road, Jiangjin Road, Qianchao Road, Sanxin Road, Hanghai Road, Jingyu Road, East Yunhe Road, Yan Jianong Road, Xinfeng Road, Xintang Road, Tiancheng Road, Central Station Road
City slip	Xiache Road, Qijia Road, Dingjiang Road, Dangui Road, Minxin Road and so on
Subway	Metro Line 1 (already built), Metro Line 2 (under construction)
Railroad	Shanghai-Hangzhou high-speed railway, Shanghai-Nanjing high-speed railway, Hangzhou-Huangshan high-speed railway, Hangzhou-Ningbo high-speed rail, Guangzhou-Hangzhou high-speed railway, Hangzhou-Hong Kong high-speed railway.

An analysis of current status of traffic

An analysis of overall current status of traffic.1) Time analysis

We get linear graph (Fig.4) about real-time traffic congestion index in east district, Hangzhou city, through counting and listing the traffic jam at different time, and choosing one day of the year

to measure (normal day). The data we get about traffic congestion index on the subjective and objective are almost the same. The data show that traffic jam time in Hangzhou east area is mainly center on the two periods of time, from 07:00 to 10:00 and from 14:00 to 18:30, which can easily causes traffic jam at rush hours. However, from 19:00 to 06:00, the situation is better because of small load of road.

For further investigation, it finds that people in the district prefer to choose car and bus as their vehicle, there is a small number of citizens choose to walk or ride. A large number of private cars make it a low utilization rate of urban public car and worse traffic jam.

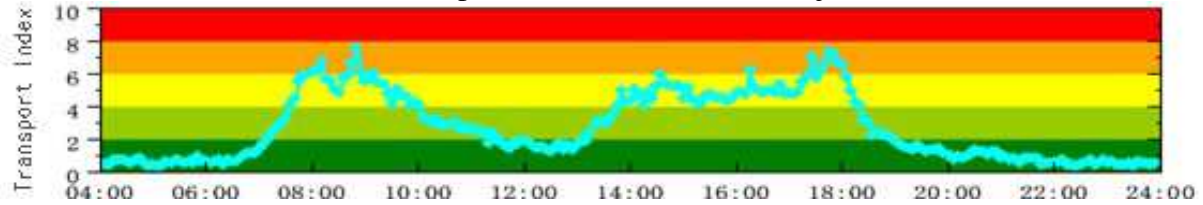


Figure 4 The time distribution of East Area road traffic congestion index

2) Space analysis

Through the analysis of the data of the platform, the result shows that the airport road , Fengqi road, Xintang road can appeal serious congestion easily. The intersection among Qiutao road, Tiancheng road, Fengqi road, Qingchun road and Jiefang road is serious traffic jam place. (figure 5). The main traffic jam is near the intersection of airport road, Qiutao road and Xintang road .And west Genshan road sections, gen autumn overpass, Desheng road on basic flow, qianjiang road, Fuchun road and Zhijiang road are of light jam.

For the main traffic jam above, a questionnaire survey shows that 36.9% of respondents think that the city roads should be widened and the lane number should be increased (figure 6) .And 12% of respondents think the road should be reprogrammed. With the sustaining development of city, the traffic problem is more severe because of overdevelopment of urban land and construction of road. However, rational program of urban traffic network can improve it.

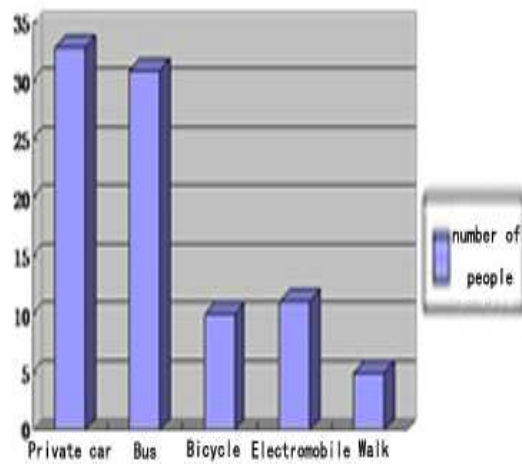


Figure 5 Table of travel mode choice



Figure 6 The congestion situation of East Area roads



Figure 8 The plan of proposed new city branch

- Set overpass to form three-dimensional traffic
- Reprogram city streets
- Time limit of private cars
- Adjust time of traffic lights
- Set the flyover to achieve the separation of people and vehicles
- Widen the lane and increase the number of lanes

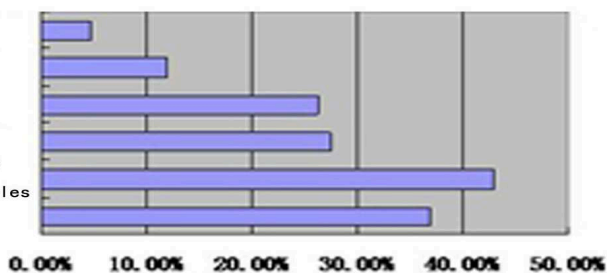


Figure 7 The solution for congested roads

The analysis of local traffic' current status. In order to analyze the relationship between the traffic problem of East Area road and main public buildings in the city, the survey targets on the roads that have severe traffic jam. The results of the survey are analyzed as follows:

The highest traffic congestion index can reach above 8.0 on the south of Qingchun East Road, the north Qiutao Road and nearby Xintang Road, especially severe at rush hours. The cause lies in the fact that there are the Jianggan District Government of Hangzhou City, hospital and airport office building nearby, gathering plenty of people. Meanwhile, the other cause is the construction of subway lines and the lack of lane numbers.

The traffic congestion index is basically between 4.0 and 6.0 on the major road, including Zhijiang Road nearby Qiantang River, Jiefang Road, Xinye Road and Fuchun Road. These roads surround the Hangzhou International Conference Centre, where are a lot of traffic jams and plenty of people. At the same time, there are main public buildings built or being built, including People Centre, Qianjiang New City Park and so on, attracting many visitors and causing traffic jam.

The road is basically smooth between the North of Qiutao Road and Kaixuan Road, and roads nearby the Hua Jiachi campus, only having traffic jam at rush hours. The situation of the road is relevant of the surrounding roads' three-dimensional traffic and rational distribution of the road network. The rationally separation of people and vehicles and sufficient lane numbers improve traffic carrying capacity

The cause and optimization of traffic congestion

Through a comprehensive analysis and comparison of subjective and objective data, the imbalance between demand and supply of traffic is the main cause of road traffic jams in Hangzhou of East Area. The direct cause is lack of urban road traffic management's level. And how to improve the traffic system management of East Area road and optimize traffic system of existing road have become an urgent requirement for the sustainable development of the area's economic. The following points are the analysis of the causes and optimizations to the road traffic system:

1) The urban land use and road network are planned irrationally, so it is necessary to re-plan some cities' branches to achieve rational distribution of urban roads.

By field survey of the East Area's current urban roads and research for the detection platform of road traffic index, it finds that the original plan of road traffic can't meet current demand. The roads near the Zhejiang college in Huajiachi is easy to occur traffic jam in the class period. As for commercial costumes center, Fengqi Road attracts a lot of people, easily causing traffic jams.

Therefore, it needs to re-plan these cities' branches to achieve rational distribution of urban roads. Comparing with Figure 2, what can be seen in Figure 7 is that Yanjianong Road is extended to Qiutao Road to reduce the traffic pressure near the Zhejiang University in Huajiachi. Extending the Qianchao Road to West of Genshan Road can reduce the traffic pressure of Fengqi Road.

2) The city develops rapidly, but road traffic lags. Cities' three-dimensional transports need to be planned and set up to achieve the separation of people and vehicles.

From the detection platform and construction, the construction of East Area's road lags behind the development of the area and three-dimensional transports is less. The study suggests to set up the overpass and underground transport rail in the place near Hangzhou Civic Center and Jianggan District Government, improving the carrying capacity of urban road traffic.

Another cause is that vehicles and people use common city roads. Thus, for particularly congested roads and intersections that appears in detection platform: the intersections of Fengqi Road and Qiutao Road, Fengqi Road and Qingchun Road, Tiancheng Road and Qiutao Road,

should be set underground walkways or bridges to achieve the separation of people and vehicles and relieve the congestion of the road.

3) Advantages of urban public transport is not reflected and traffic using rate is low. Urban public transport system needs to be planned rationally.

The public transport system of East Area is established completely. However, what lead to people willing to choose private cars or electric cars are that the construction of the public transportation infrastructure lags, right of way can't be guaranteed and structure layout of the road network is irrational. So the public transportation does not play a good role to relieve traffic.

In order to share the urban traffic pressure better, there are some improvements: ① City bus lines should be re-planned and set up lines and sites rationally; ② Reasonable bus priority road and bus priority signal should be set up in the main city roads: Qiutao Road and Qingchun Road, the east of Jiefang Road, Qingjiang Road and Xinye Road; ③ It need improve the range of transit to meet connectivity between the city to city ④ Urban public transport modes need improve, urban public transport should diversify and the subway need be constructed reasonably.

4) As the rapid development of economy, private car ownership increases. It advocates green travel and use public transportation.

Since the eleventh five-year plan, the development of economic in Hangzhou has developed up year by year, the number of private cars has increased, and the amount of residents has grown steadily. However, citizens' consciousness of low carbon environmental protection is weak. They are lacking the awareness of energy saving and efficient utilization, but generally in favor of private cars as transport, causing traffic congestion problems.

Although, Hangzhou has limited a license plate number to travel, it doesn't have obvious effect. Therefore, Hangzhou government should increase the publicity of green travel, advocate taking public transport, ease the urban road traffic congestion and improve the quality of urban life.

Summary

The management for the east area of Hangzhou city of the road traffic congestion is a comprehensive project, which needs comprehensive consideration and decision from several ways. Through the scientific and reasonable planning and layout for the east area, to perfect the advanced traffic management system and improve the use of urban public transportation is a problem that should be considered by the entire city of Hangzhou. Hangzhou as a second-tier cities is now in the high speed development, there are a lot of platforms in the future of urban road traffic development. Underground traffic is the biggest breakthrough of future development of Hangzhou and the viaduct will gradually become the leader of the Hangzhou urban road traffic. Therefore, to improve the road traffic development of Hangzhou and Hangzhou area road traffic coordination between operations can be used as the main direction of future research.

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