Zhoushan Urban Development and Traffic Planning

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Brief Introduction:

Ms. Cui Min is the Engineer of Transport Planning and Research Institute at the Ministry of Transport of the People's Republic of China. She holds an M.Eng in Transportation Planning and Management and a B.Eng in Port and Waterway Engineering from Hohai University of China. She is the participant of SIDA Training Course **IUP8.**

Cui Min has been engaging in Traffic strategy research and planning, and Transport policy research since 2003. She has undertaken a number of crucial projects funded by the Ministry of transport, Local Governments, or Local traffic management agencies. These Projects and works focus on making the regional transport development strategic plan , on the base of researches on the relationship of urbanization, economy, society, cultural and environment with transport development；and studying how to improve transport efficiency and service quality , on the base of researches on passenger and cargo transport systems.

Zhoushan Urban Development and Traffic planning

1. Background

1.1. Introduction of Zhan Shan

1.1.1 Location

Zhoushan City is a special small city of Zhejiang province in eastern China. It is comprised of more than a thousand separate islands, and its biggest island is the Zhoushan main island, which is shown in the Figure 2. Zhoushan Main Island has a resident population of 680,000，which represents about the 70% of the whole population of Zhoushan city.

Figure 1 The location of Zhoushan city

Figure 2 The Zhou Shan main island

As the figure 2 shown, Zhou Shan Main Island is connected to the mainland by Zhou Shan Island Bridges and is also connected to the Zhujiajian Island, which is shown in the smaller green circle in figure 2 by Zhujiajian Bridge. Zhujiajian Bridge opened on 31st May 1999, and Zhoushan Island Bridge opened on 25th December 2009.

1.1.2 Basic information

Zhoushan Main Island area is 502.65 km^2. And there is about 44 km from the easternmost to the westernmost point and about 18 Km from north to south. By 2010, the number of tourists visit reached 21,390,000 and the amount of locally registered cars reached 46,800.

Table 1 Basic information of the Zhoushan Main Island

City	Land Area	Length	Width	Residents	Tourists	Local cars
Zhoushan	502.65 Km2	44 km	18 Km	680,000	21,390,000	46,800

1.1.3 Characteristics

- It is an international deep-water port.

Zhoushan Port has good geography location, favourable port conditions, a large port turnover with transfer transport and correlative port industries.

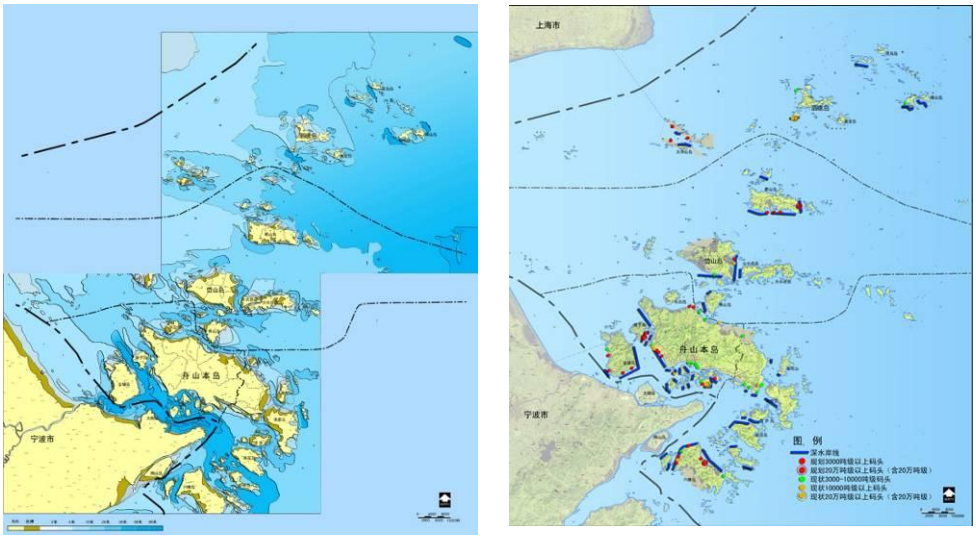


Figure 3 the Zhoushan deep-water port

- It is a popular tourist resort.

Shenjiamen fishing port is a historical seafood place, as shown in the easternmost pink circle of Figure 4.

Putuoshan is a well-known Buddhist holy land, as shown in the bigger green circle of Figure 4. Since ancient times, Buddhists have crossed the sea to worship there, as shown in Figure 5. Other islands of the Zhoushan are also famous, such as **Zhujiajian** Island, as shown in the smaller green circle of Figure 4 and figure 6, and peach blossom Island, Deng bu Island, and so on. They are all located to the south of the Zhoushan Main Island. Therefore, tourists need to pass through the whole Zhoushan Main Island to reach the easternmost point to take a ferry or alternatively they have to pass through the Zhujiajian Bridge in order to reach the Zhujiajian Island and to take ferry there.

Figure 4 the Location of Shenjiamen, Putuoshan and Zhujiajian

Figure 5 Putuoshan Island

Figure 6 the Zhujiajian Island

1.2. Problem Analysis

1.2.1 Transport development is far behind the city development.

Zhoushan is a sea gateway to the provinces along Yangtze River, and it serves the Chinese largest economic zone district of China directly. Zhejiang

Province is accelerating its economic growth based on a marine economic strategy, and Zhoushan is playing an important role in that strategy and its implementation. Linked to these favourable circumstances, Zhoushan city situation and development pattern are changing rapidly. At the same time, the Zhoushan transport system is facing an increasing number of problems. As illustrated in Figures 7 -10, the transport situation seems unable to adapt to the urban development.

Figure 7 Mixed transportation

Figure 8 No parking facilities

Figure 9 No road surface signs

Figure 10 Narrow old City streets

1.2.2 New Bridge increases the transport pressure.

Zhou Shan Island Bridge opened in 2010. It is the first and only bridge built for Zhoushan Island, which connects the island with the mainland. The number of visitors grew rapidly as soon as the bridge opened.

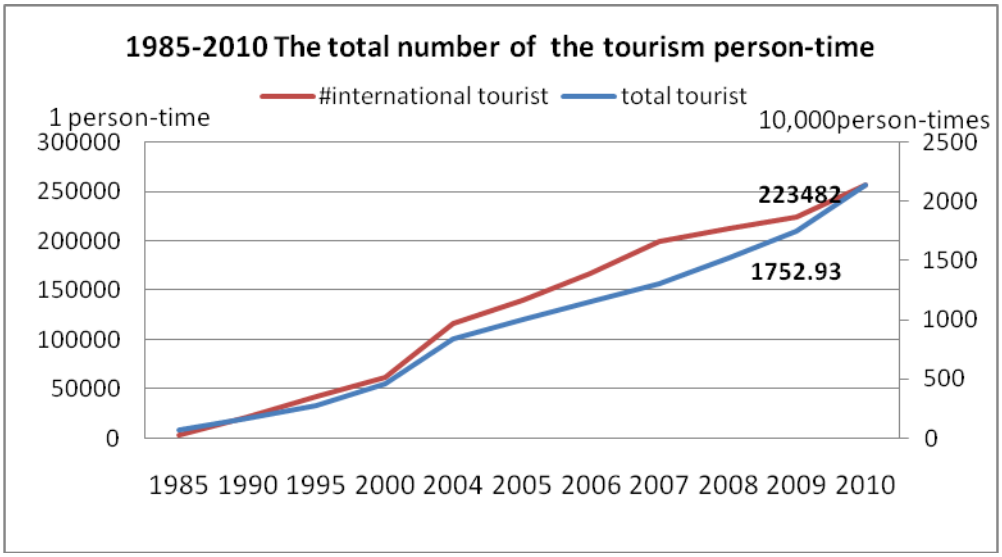


Figure 11 The number of tourism in person-time from 1985 to 2010

According to available data, the only outbound Road of the city, G329 high way, has been under the tremendous pressure from the traffic from outside. As a result the tourists experience inconvenience and agony because of the transport situation.

Figure 12 G329 high way

On peak hours, the Volume/Capacity (V/C) of G329 Highway is 1.10, and the V/C of Zhujiajian Bridge is 1.58. The overloaded roads lead to serious traffic congestion.

Figure 13 Congestion points in peak hour

Reddish-brown circles represent congestion points of the city. Visitors could not reach their destinations successfully.

1.2.3 Tourist traffic affects the unban traffic.

Tourist traffic also brings a seasonal pressure from urban internal transport. The residents complain badly, as the urban congestion is serious in the peak hour.

Figure 14 ***Shenjiamen*** *seafood place*

On peak hour, the traffic and transport of Shenjiamen seafood place is brought to a total standstill.

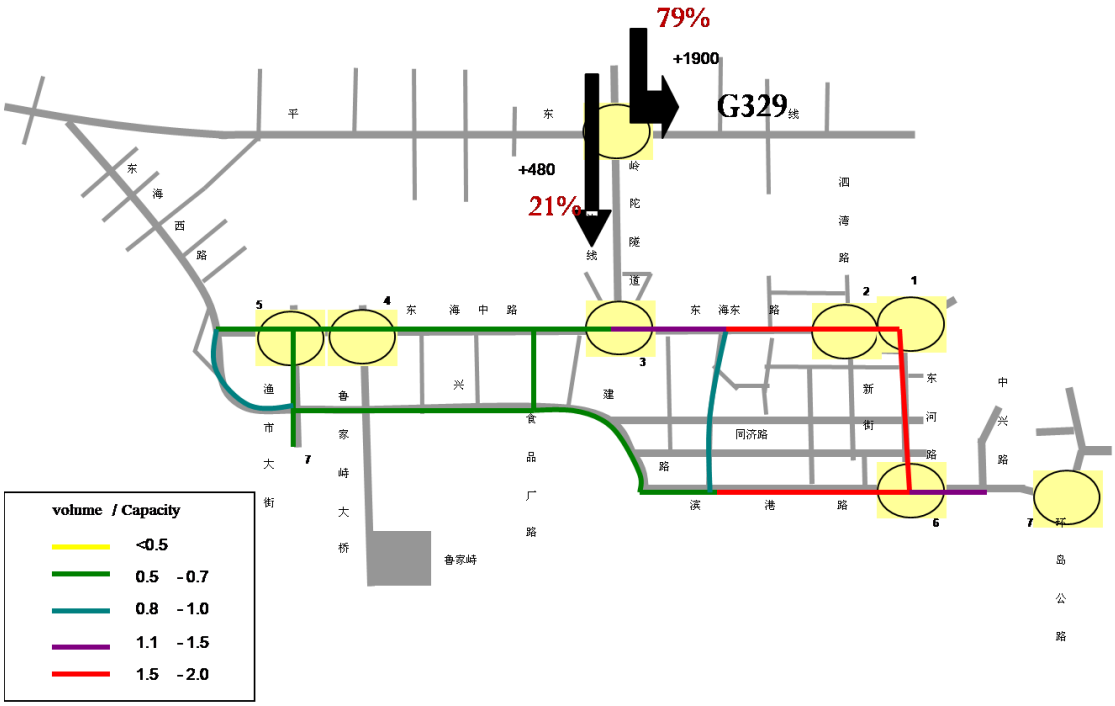


Figure 15 V/C distribution figure on peak hour
Purple and red lines indicate that the residents travel difficultly.

1.2.4 Land limitations restrict the expansion of transport infrastructure.

Island area for urban development is scattered, small, and limited, so development costs are high. Meanwhile, the area of cultivated land is declining inch by inch these years. The limited utilities land cannot afford the unlimited expansion for facilities for cars, roads and parking lots.

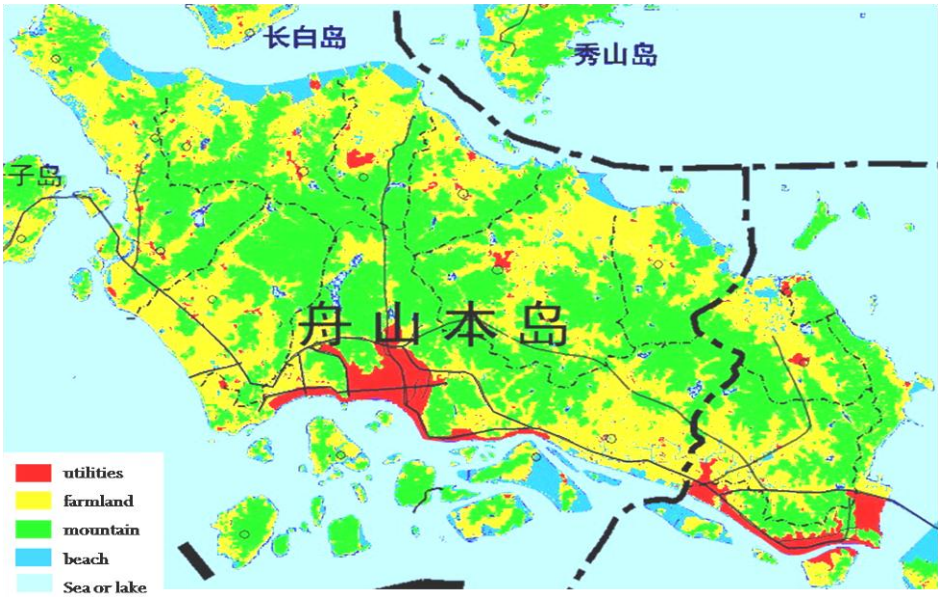


Figure 16 Land-use Distribution

The red areas indicate utilities land; the yellow areas indicate farmland.

1.2.5 Different administer departments' inconsistency leads to inefficient traffic management.

Ministry of Transport，Ministry of Railways，Zoning commission，Traffic Bureau，Land and Resources Bureau，Environmental Protection Bureau，State Oceanic Administration，Development Evolution Committee，Local people (inhabitants) and Tourist authorities influence or will be influenced by the project directly or indirectly. But different administer departments are responsible for different aspects and services, and the inconsistence amongst them leads to inefficient traffic management.

2. Objectives

2.1. Overall objectives

- Alleviate the immediate problem of traffic congestion.
- Solve future problems of traffic and urban development，in order to adapt to the quickly development of urban areas, to meet the large requirements and special needs of tourist traffic, to improve the management efficiency of traffic , and to encourage the development of public transport.

2.2. Project purpose

To give reasonable measures to deal with the new situation of urban development and transport planning. Such as: optimizing the transport infrastructure, improving the management of urban, tourism and inter-island traffic, and making some proper separation of the tourist traffic and urban traffic to reduce the interference with each other.

- To build a highly efficient traffic and transport system. Such as: Guiding the reasonable travel traffic, improving the public transport system, reducing the traffic density, and implementing the necessary traffic control policies on the special time and special place.
- To make the transport organizations efficient and the urban land use rational. Such as: innovating the institutional mechanisms to integrate the traffic and urban development, and making some differences functions and appropriate separations between the old and new city area.

3. Process

3.1. Phase 1: 2009

3.1.1 Actions

- Communicate with the participants and obtain preliminary comments. We went to the Urban Planning Bureau, Construction Bureau, Tourism Bureau, and Ministry of Railways, in order to listen to their suggestions, to collect their planning documents, and to understand their purpose.
- Investigate the resource and feasibility of the transport planning. According to the recommendations of various departments, we went to these places in person to imagine their planning.
- Discuss with the participants and experts, to find the solutions of problems. We discussed the advantages and disadvantages of various options and try to choose one preferable solution which can be accepted by all.
- Present the results to the stakeholders and planning partners, in order to obtain feedback from the public and make improvements.

3.1.2 Outcome:

There are alternative proposals and multitude of views. Especially in terms of the development options of outbound road, there are numerous controversies and opinions regarding the possible solutions such as highways, light rail, railroad or other proposals all of which have their own supporters.

- Urban planners suggested the construction of a seaside road and High Speed Traffic Line.

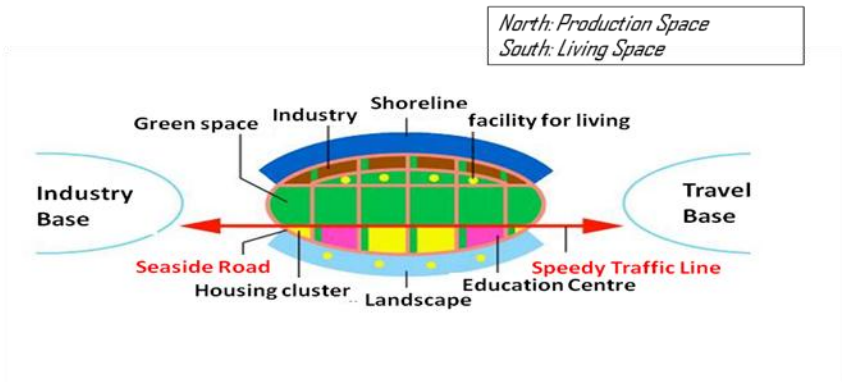


Figure 17 Speedy traffic Line

- Tourism Bureau suggested the construction of a Light Rail.

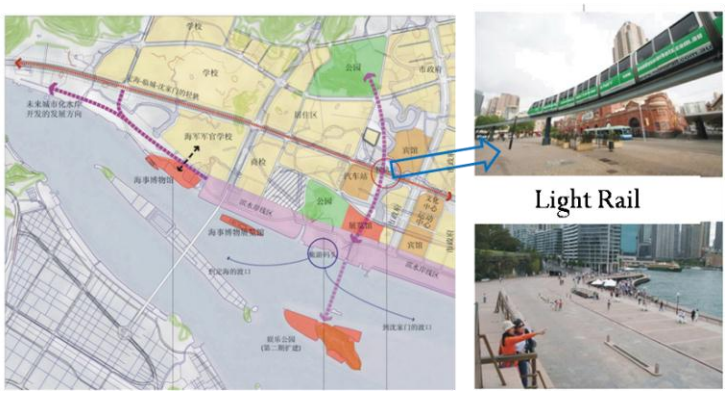


Figure 18 Light Rail

- Ministry of Railway suggested the construction of a railway shown in a red line or a yellow line for easing the pressure of bridge and in order to meet the demands of passenger traffic and freight transport.

Figure 19 Railway

- Although beneficiaries such as the residents and tourists didn't give any clear suggestions, they urgently required convenient transportation and a comfortable living environment.

As shown in the table 2, all the proposals have disadvantages and advantages, and the decision-makers find it hard to come to an agreement.

Table 2 the disadvantage and advantage of different proposes

Modes	Advantage	Disadvantage
Expressway	Closed channel, to avoid the travel peak(cross-boundary tourists traffic)impacting on	Occupation of land Endless growth of Car Air Pollution Noise Pollution Limited role in local Economic and

	local traffic	social development
Railway	Suitable for long-distance, large capacity cargo and passenger transport	Closed corridor Less efficient than light rail in short-distance passenger transport Less efficient than Expressway in Short-distance freight transport
Light rail	Large-capacity transport Operational flexibility Clean energy, Less emissions Lands saving Link well with railway	Large investment, slow return High Operating costs Low loading rates in the early operations

After a comprehensive consideration, we proposed a preliminary plan as shown in figure 20. To be honest, in this step, we just focused on the outbound traffic and wanted to find a way to satisfy the larger volumes to alleviate the new transport demands from the outside the region. However, we also have recognized that it would not solve the inner traffic congestion problems of the city. Even if the external traffic could reach the inner city smoothly. If the larger outbound volume system is provided for, more outside traffic will come into the city, and the urban traffic system will be still be under pressure. At that time, the island bridge had not been opened yet and we had not seen the real scene of traffic influx, even though we were concerned.

Figure 20 The initial plan for the first phase

3.2. Phase 2: 2010

3.2.1 Actions:

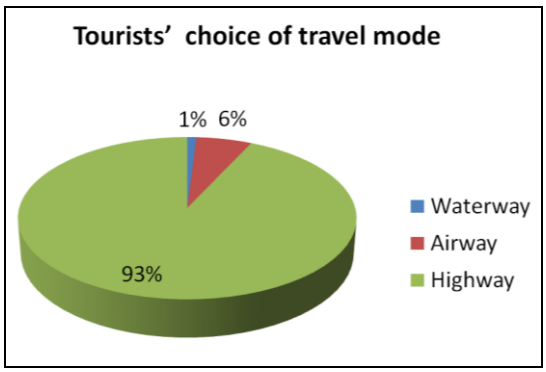
- **Restart of a more detailed investigation.** In this phase the bridge was opened, the stream of tourists brought immediately severe traffic congestion during the tourism peak season. The government had hoped that the project team would solve the problem as soon as possible. We started a new round of surveys and a more detailed investigation.

- **Invitation to more experts and planners.** Considered that the Singapore Island has similar urban characteristics and that it has some good experience on island city transport planning, we invited the planners from Singapore to assist us in finding the reasons and measures from different point of views in an investigation together with us. As shown in the table 3, Singapore's population density and rate of ownership of cars are much higher than in Zhoushan. In spite of this Singapore has less traffic congestion in the local road network based on the smart road management system. Hence, Zhoushan should have enough capacity and potential to combat the congestion in the city.

Table 3 The Comparison of Zhoushan and Singapore main island

City	Land Area	Length	Width	Residents	Tourists	Local cars
Zhoushan	502.65 Km2	44 km	18 Km	680,000	21,390,000	46,800
Singapore	538.1 Km2	43 km	23 Km	5,080,000	9,700,000	405,000

- **Take the questionnaire investigation to the residents and tourists.** As the tourist traffic affects the unban traffic obviously, we need to know tourists' travel modes and features, and analyse the impact. According to the survey, it was found：



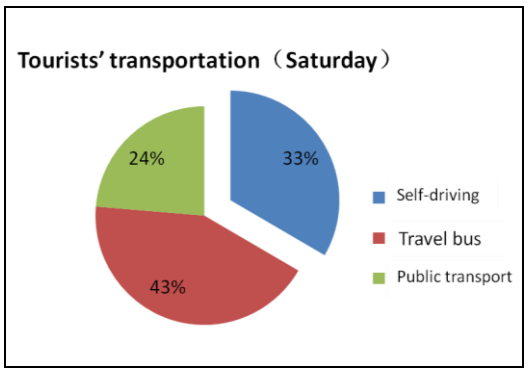


Figure 21 There are 93% Visitors entering the city by highway, and 33% Visitors choosing self-driving. Waterway and airway less be used.

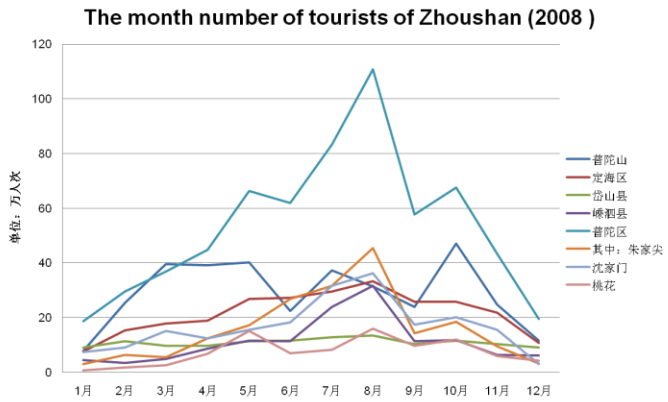
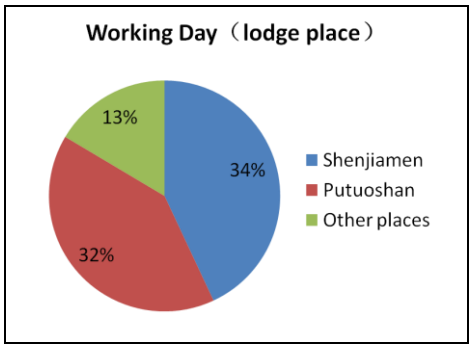


Figure 22 Visitors' entering time concentrate on summer and public holidays.



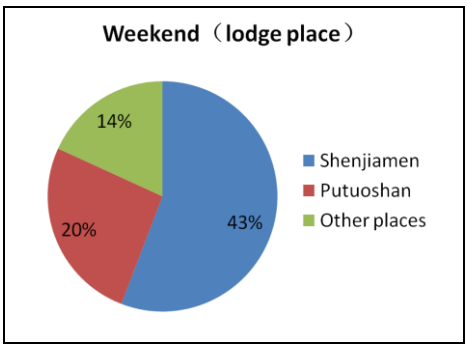


*Figure 23 On working days 34% visitors choose to live in the **Shenjiamen**, 32% choose to live in the **Putuoshan**, 13% choose to live in other places of Zhoushan, and 21% visitors choose to leave Zhoushan intraday. On the weekends, the ratios are 43%, 20%, 14% and 23%. As the data point out, visitors prefer to live in the old town, especially on vacation day.*

- Investigate the key roads and communicate with the different administrative departments again, to understand the management

reasons and the transport infrastructural facilities reasons, and to discuss how to avoid the special peak hours.

- Investigate surrounding environment and consider the alternative solutions.

3.2.2 Outcome:

- Reach a primary consensus on objectives and requirements of urban and transport development with participants.
- Research and prepare the new proposal for the stakeholders and decision-makers.
- Propose the following ideas:

1. Consider a new way to take care of the incoming traffic pressure

Figure 21 South way

2. Let Visitors pass in and out the Zhoushan main island quickly through traffic circulation.

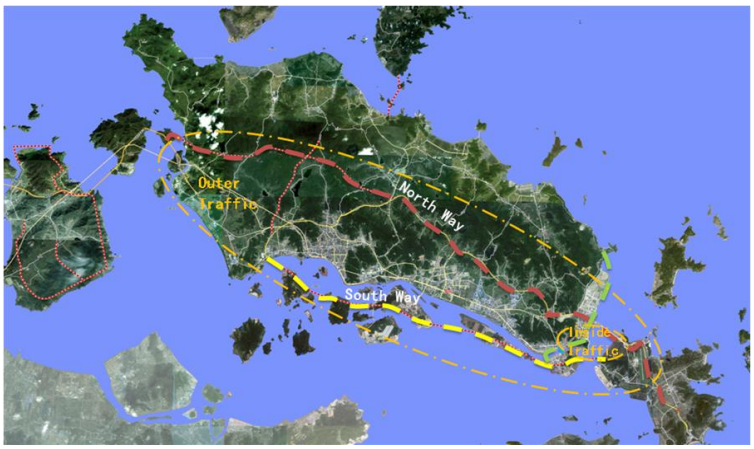


Figure 22 South outbound way and North outbound way provide for the traffic circulation for tourists and visitors from the outside.

3．Enhance the inner traffic circulation of city

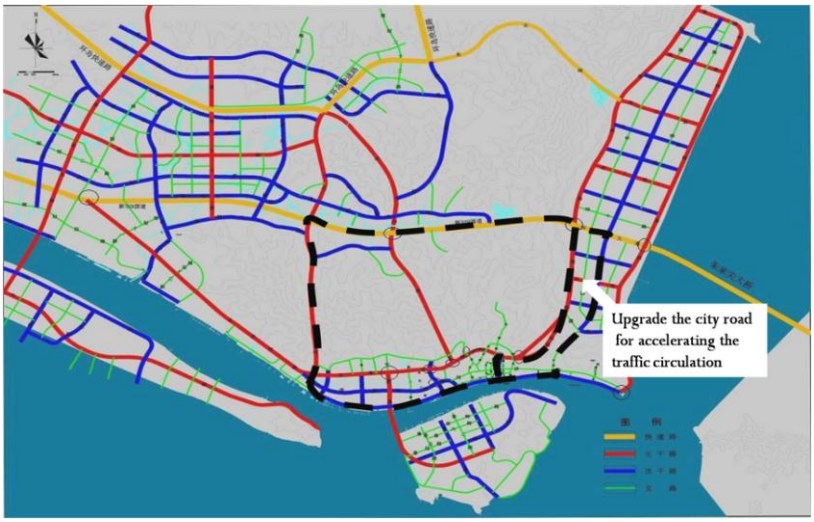


Figure 23 Upgrading of the city road which is indicated in black lines for accelerating the traffic circulation

4．Encourage public transportation systems to replace the self-drive system, especially in the congested old town.

3.3. Phase 3: Until March 2011

Propose solutions of short term emergent problem and long-term development problem. Short-term solutions are focusing on the emergency problem of traffic congestion, and long-term solutions are focusing on building an sustainable transport system to adapt to the urban development.

3.3.1 The solutions for the short term

- Improve the traffic flow at junction points

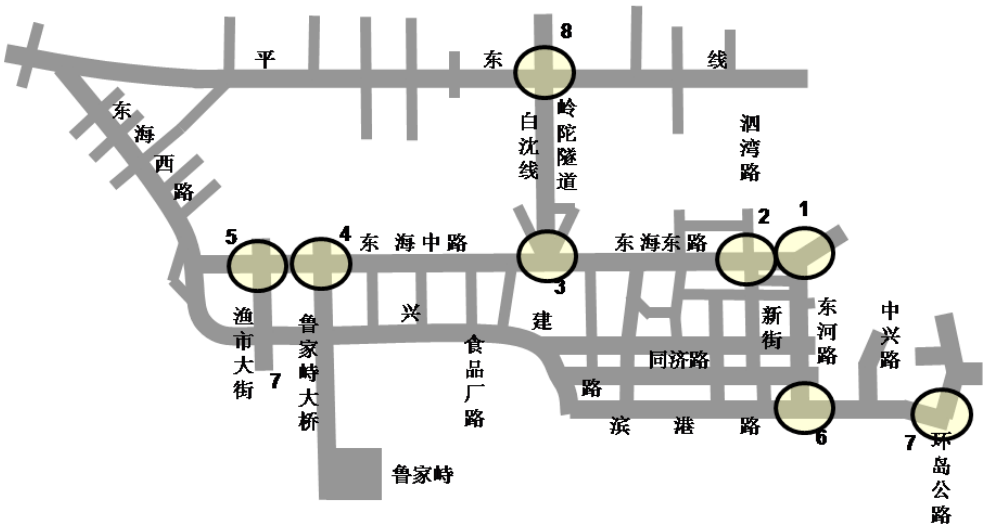


Figure 24 The junction points which are planned for improvement

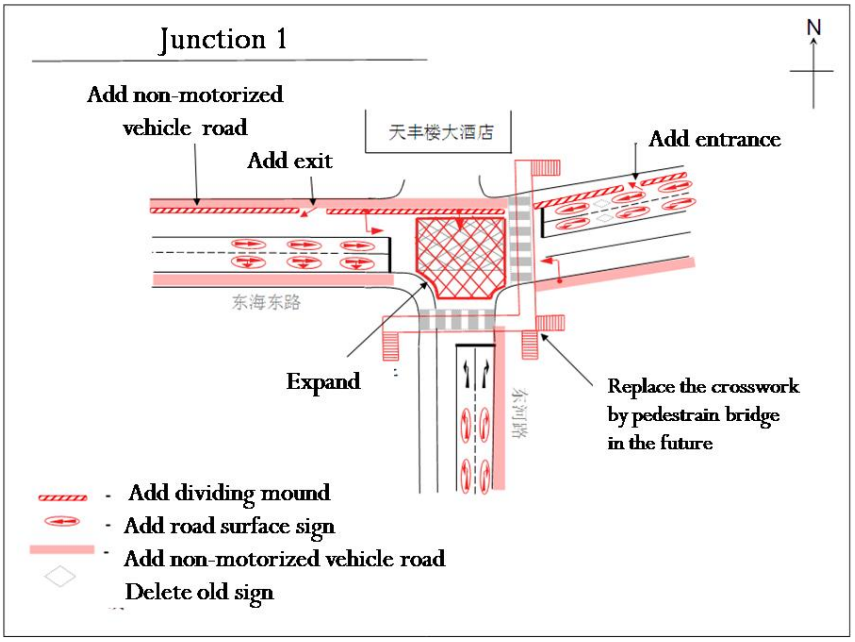


Figure 25 An example of a traffic calming measure of junction 1 in the above figure 24

- Separation of the tourism and commuting traffic functions of ferries

As shown in Figure 26, the yellow spots indicate the tourist ferries, the red spot indicate the commuting ferries, and the blue spot indicate the old ferries, which is operating in the Shenjiamen seafood place and need to be removed.

- Build some passenger transfer hubs for the public transportation system

As shown in Figure 26, the green spots indicate passenger transfer hubs. Features of these hubs include:

(1) Provide for parking services or parking transfer for self-drive visitors;

(2) Provide for information and consulting services about hotel accommodation, scenic spots, and tourist traffic and tickets reservations for passengers;

(3) Provide for connection to efficient public transport services to the hotel, city centre, scenic spots, and tourist piers for visitors;

(4) Provide for the long-distance passenger transport, urban public transportation and tourist travel lanes service.

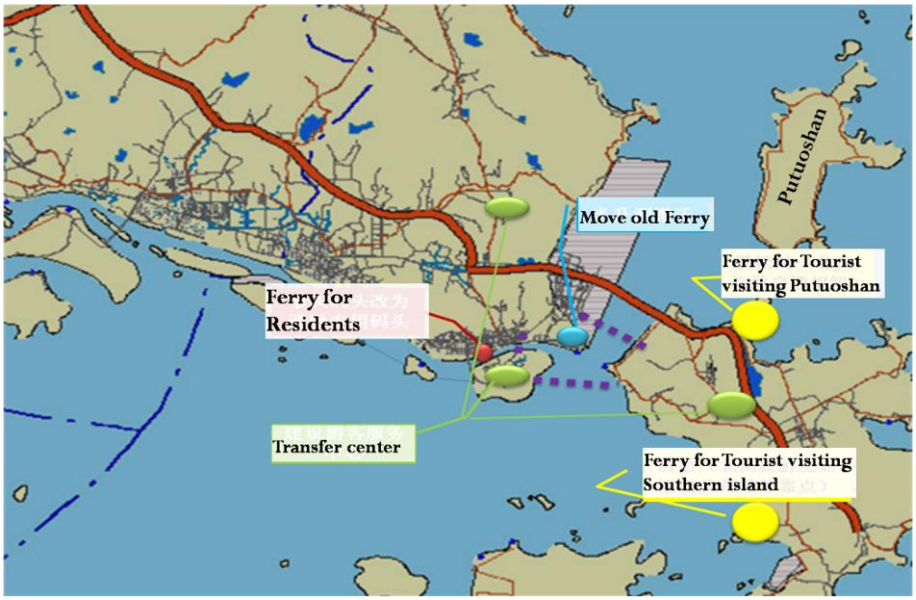


Figure 25 the passenger transfer hubs and Ferries

- Promote the integration of public transport routes
  Optimize the public transport network and establish shuttle bus service.
- Make the planning of parking facilities part of distribution and land use planning.
  Restrict the parking in the Old Town, and prepare appropriate parking lots in the New town.

3.3.2 The solutions for the long term

- Establish the fast outbound traffic routes to alleviate the pressure of G329 highway. The road route choosing and designation are still in the process of detailed investigations, and we should consider more about the land and environment factors.

- Build the external south route to form the traffic circulation. As the south route involves the several Southern Ocean islands and Ocean, we suggested that we should do more detailed environmental assessment and engineering feasibility analysis first before the last conclusion.
- Optimize the internal road network of the city
- Improve the passenger distribution system and multi-modal transport system，to promote public transport.
- Construct land transport facilities for the tourist island
- Establish the intelligent transportation systems, to improve transportation efficiency.

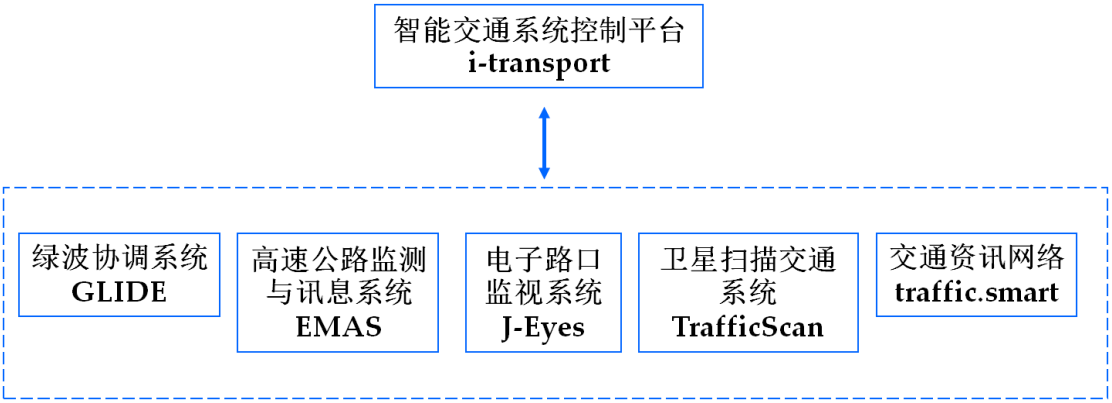


Figure 26 A Intelligent traffic system control platform with the Intelligent Signal Control System, Express way Monitoring&Advisory System (EMAS), J-Eyes system, Traffic Scan system, and Traffic smart system.

3.3.3 The solutions of management and policy

Propose improved measures for the management and policy aspects, in addition to the infrastructure construction.

- Improve the level of efficient traffic management
- Establish a traffic management coordination committee
- Establish a pre-warning mechanism for traffic overload
- Make policies for encouraging the use of public transport systems

4. Results

Controversies still exists, but we also got some consensus as follows:

Short-term solutions have reached some consensus;

Long-term solutions, have some consensus about the proposed measures have been achieved

There are still some controversial issues. The controversy related to highway construction and the new big southern bypass remains. Anyway, the two controversial schemes are presently subject to in depth investigations and further research. The project is still in progress and government has not yet taken a decision.

5. Conclusions

Urban development and transport planning are closely related, it is therefore important that transport planning must be integrated with urban planning and development. Any main policy decision for transport will involve urban development, environmental protection, land use, public transport and many other aspects. Thus a decision regarding transport development will have fundamental impact on the whole city development.

Meanwhile, solving traffic problems should not only refer to the problem of facilities. Integrated traffic systems, institutional development, policy development and management measures are also very important.

Although the project still at the present time did not arrive at a conclusion, the participation of the public, the recommendation of the departments, and the analysis of the planners and experts have brought a lot of knowledge to the project and has assisted the project team in the planning process. So, we believe that the extensive discussions do not mean no progress, and the temporary lack of results do not mean failure. We have reached a better understanding and we will be able to consider new aspects and investigate further aspects and details of the transport planning and urban development.

However, as a planner and a participant in the project team, I have still in a sense of frustration and worry, as I don’t know what the final outcome will be. I am not sure that the Government’s final decision will be based on an integrated approach. Even so, these planning efforts, the consultation processes, team work and investigations and analysis have given us many valuable experiences, so a better future is expected.