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WORLD MARITIME UNIVERSITY

Shanghai, China

**The Impact of the Ningbo-Hangzhou Bay Cross-sea Bridge on the Economic
Development of the Port of Shanghai and the Port of Ningbo**

By

ZHANG FANFAN

China

A research paper submitted to the World Maritime University in partial
Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

INTERNATIONAL TRANSPORT AND LOGISTICS

2010

DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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Abstract

China has experienced rapid and numerous development in recent decades, especially the great growth in its economy. However, this growth is inevitably associated with the supporting infrastructure such as the transportation system. Thus, this paper focuses on the construction and completion of the Hangzhou Bay Cross-sea Bridge, which is a large and major project for improving the transportation system along the Yangtze River, in particular the Port of Shanghai and the Port of Ningbo. The paper is trying to investigate its impact on the two important economic areas in China, the hinterlands of the ports of Ningbo and Shanghai. The Hangzhou Bay Bridge has brought various opportunities and challenges on various areas and aspects, including the transportation system, the logistics sector, as well as the industrial structure, so as to influence the economy. To be specific, the completion of the Hangzhou Bay Bridge has the most influence on the economic development of the hinterlands of the ports of Shanghai and Ningbo. According to the analysis, the Hangzhou Bay bridge has general impact on the overall development of Shanghai, as well as the industry development and foreign investment attraction of Shanghai. As a major project for improving the transportation system in the Hangzhou Bay area, the bridge has generated significant impact on the transportation status of the Port of Ningbo, such as the container transportation, in addition to the economy of its hinterland. Based on theoretical model analysis focusing on Ningbo, the economic ties between cities have been indicated. Moreover, the theoretical model analysis figures out the actual effects of the Hangzhou Bay Bridge on the Ningbo port and its hinterland, which include: improving regional transportation and status of Ningbo; promoting the flow of elements and resources; stimulating the development of industries and enhancing industrial competitiveness; improving the conditions of the Ningbo port so as to enhance the competitiveness of the port. Accordingly, several recommendations are in response to the research, which are: to strengthen the tracking of the bridge economy; to specify the operation and management of the bridge; and to speed up regional economy integration.

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Chapter 1 Introduction

1.1 Background

During the last three decades, the world has witnessed the miraculous growth of economy in the modern period of China, for its high speed, great balance and stability. During that period, the economy of China has turned to market economy which is more open to international trade from the original centrally planned economic system that was greatly closed to the global economy (CIA the World Factbook, 2009). Since then, China has been playing a major and significant role in the world economy, with its economy growing 8 % in Gross Domestic Product (GDP) annually (see Table 1: 1989-2007's GDP and the Growth Rate of China) due to the efficiency of economic restructuring. In 2008, China has grown to the second largest economy in the world, just after the United States (see Table 2: Rank Order - GDP (purchasing power parity)). As in China, the economy in the eastern and southern coastal areas have been developing more rapidly than the interior areas, for example, Beijing, Shanghai, Dalian and Shenzhen are more developed than Chengdu, Hefei and Xi'an.

Table 1: 1989-2007's GDP and the Growth Rate of China

Year	GDP Rmb billion at current prices	GDP per head Rmb	Real annual growth rate (%)
1989	1,690.9	1,512	4.1
1990	1,854.8	1,634	3.8
1991	2,161.8	1,879	9.2
1992	2663.8	2,287	14.2
1993	3,463.4	2,939	13.5
1994	4,675.9	3,923	12.6
1995	5,847.8	4,854	10.5
1996	6,788.5	5,576	9.6
1997	7,446.3	6,054	8.8
1998	7,834.5	6,038	7.8
1999	8,206.8	7,159	7.1
2000	8,946.8	7,858	8.0
2001	10,965.5	8,622	8.3
2002	12,033.3	9,398	9.1
2003	13,582.3	10,542	10.0
2004	15,987.8	12,336	10.1
2005	18,386.8	14,040	9.9
2006	21,087.1	16,084	11.1

2007	24,661.9		11.4
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Source: National Bureau of Statistics of China, 2007

Table 2: Rank Order - GDP (purchasing power parity)

Rank	Country	GDP (purchasing power parity)	Date of Information
1	<u>World</u>	\$ 70,650,000,000,000	2008 est.
2	<u>European Union</u>	\$ 14,960,000,000,000	2008 est.
3	<u>United States</u>	\$ 14,580,000,000,000	2008 est.
4	<u>China</u>	\$ 7,800,000,000,000	2008 est.
5	<u>Japan</u>	\$ 4,487,000,000,000	2008 est.
6	<u>India</u>	\$ 3,319,000,000,000	2008 est.
7	<u>Germany</u>	\$ 2,863,000,000,000	2008 est.
8	<u>United Kingdom</u>	\$ 2,281,000,000,000	2008 est.
9	<u>Russia</u>	\$ 2,225,000,000,000	2008 est.
10	<u>France</u>	\$ 2,097,000,000,000	2008 est.
11	<u>Brazil</u>	\$ 2,030,000,000,000	2008 est.
12	<u>Italy</u>	\$ 1,801,000,000,000	2008 est.
13	<u>Mexico</u>	\$ 1,578,000,000,000	2008 est.
14	<u>Spain</u>	\$ 1,378,000,000,000	2008 est.
15	<u>Canada</u>	\$ 1,336,000,000,000	2008 est.
16	<u>Korea, South</u>	\$ 1,278,000,000,000	2008 est.
17	<u>Indonesia</u>	\$ 932,100,000,000	2008 est.

Source: CIA the World Factbook, last updated on March 5 of 2009

However, such great development of economy in China has led to and meanwhile required the establishment of supporting infrastructure, such as the transportation and traffic system. The enhancement in transportation system will to a great extent facilitate the economic development, according to the researches of many scholars (e.g., Bowersox and Closs, 1996; Bedford and Cooke, 2001; Leontief, 1951, etc.). In this case, China, seeking for its rapid economic development, has put an intense focus on its transportation system involving waterway, railway and road, air transport.

The Ningbo Hangzhou Bay Cross-sea Bridge is an important large project for transportation engineering in the area, greatly influencing the economic development of the surrounding cities and regions. The Hangzhou Bay Bridge, extending from Zhengjiali 6 Kms west away from Zha Pu Bay to Ci Xi Shui Lu Bay, crossing the south beach of Hang Zhou Bay, is 36 Km totally and the bridge is 35.673 Km in long and 33m in wide. The Hangzhou Bay Bridge is designed to have bidirectinal 6 traffic lanes with a expected daily traffic flow 80, 000 vehicles and a speed of 100 Km per hour. The speed of the down-lead of the bridge is designed to be 120 Km per hour and the life-span of the bridge is designed to be 100 years. The completion of this bridge is with great strategic influences on the development of Shanghai, Ningbo, and

even the entire Yangtze River delta.

Specifically, the Port of Ningbo has most of the large scale and super-large scale deep water berths in China, and the port economy has played an important supporting and driving role in the development of the economy of Ningbo. However, due to the natural barriers of the Hangzhou Bay, it has made Ningbo with limited transportation in China, causing the obstructed network of collection and transmission in the area, affecting the further expansion of the hinterland economy of the Port of Ningbo, which also limited the radiating and exemplary role of Shanghai in facilitating Ningbo economy. With the establishment and completion of the Hangzhou Bay Bridge, this situation has been greatly improved, turning to a better situation.

1.2 Research Aim and Objectives

According to the changes brought by the construction and completion of the Ningbo Hangzhou Bay Bridge, the research aims to investigate these changes and its impact on the economic development of the Port of Shanghai and the Port of Ningbo, which are the two of the most important ports in the area along the Yangtze River. To be specific, there are a set of objectives of this research, which are as follows:

- To indicate the important role of transportation in the development of economy;
- To investigate the transportation system in China, as well as its significance to its economic development;
- To analyse the impacts of the construction of the Hangzhou Bay Bridge, including both opportunities and challenges;
- To further discuss the influences of Hangzhou Bay Cross-sea Bridge on the economy of the areas of Shanghai and Ningbo Ports;
- To conduct further analyse the contribution of Hangzhou Bay Bridge based on theoretical model, focusing on the Ningbo area for particular.
- To figure out counter-measures and recommendations for dealing with the issues brought by the completion of the Hangzhou Bay Bridge.

Chapter 2 Literature Review

2.1 Transportation and Economic Development

Transportation plays an important part in the development of economy as it facilitates the economic activities between different locations. In this case, nations and governments have to decide large investment on improving their transportation systems. Concerning the role of transportation in economic development, many works have indicated that the development of economic activities greatly depends on the access to the market(s) at a given location or different locations, for example, such

works like scale economies, agglomeration economies, and central place development (Christaller, 1966; Marshall, 1919; Weber and Friedrich, 1965). The improvements in transportation driven by the needs of economic development can also be explained from a business decision-making perspective. To be specific, access to locations determined by transportation will largely affect costs during the production process and then affect the supplier and buyer markets, ultimately influencing the magnitude and pattern of economic development at various locations, or industries. More specifically, transportation influences the development of business and economy in four ways: 1) to reduce cargo loss, so as to enhance reliability of existing economic or trade activities; 2) to enable the development of new patterns of trade between different locations, or among industries; 3) to have more effective access to labour, supply and buyer markets, so as to increase productivity; 4) to expand the size of markets, so as to achieve economies of scales.

2.1.1 Transport infrastructure to reduce costs and enhance reliability

Along with the investments in transport infrastructure, travelling times, transport capacities and reliability are improved. For example, thousands of miles of paved roads were built by the Romans for supporting the national defense trade network and interstate commerce routes; in addition, intermodal freight centers like Gaza were developed in the Mediterranean so as to connect the routes between Arabia and Asia so as to exchange goods. To be more specific, the use of these transport systems and routes between Arabia and Asia allowed the parties to avoid the dangers during the transportation, so as to reduce the travelling time and the losses in goods, so as to promote reliability (Bedford and Cooke, 2001).

2.1.2 Development of inter-industry trade

Economic development is often referred to the development of some national or regional economy, which is measured by the growth of income, or other indicators. As reviewed above, economic development is largely depending on the availability of access to the supplier and buyer markets, which is determined by the transportation status. For example, some ancient transportation routes like the Silk Road and the Spice Route enabled the access to the European markets with great potential, which gradually formed particular trade and distribution networks between these regions and countries, bringing more jobs and promoting the income of them. This transportation development has enabled the growth of different industries such as intermediate industry and different locations. Taking the Silk Road as example, a supply chain with added value was developed by the expansion of inter-industry between China, India, Persia and Europe, leading to the production and trade of more goods, such as silk, carpet and apparel ceramic (Bowersox and Closs, 1996).

2.1.3 Reducing isolation and enhancing access to more diverse markets

Enhanced access to the markets has been greatly engaged by the government in the

United States since the 1960s, trying to facilitate the growth of jobs and income, through enhancing access to labour, materials and customer markets. According to Federal Highway Administration, Washington, DC. (FHDA) (1970), the effective distances between areas were reduced through the development of the transportation system concerning the development of its interstate highway system. As indicated by Appalachian Regional Commission (1964), the connection to isolated areas facilitated by the development of the highway system will led to economic growth. Moreover, greater access to diverse inputs will be able to obtain more economic benefits (Fujita et al., 2001; Krugman, 1991). The reverse impact of congestion is another aspect concerning the relationships between transportation system and economic growth. To be particular, effectively limiting the throughput, enhancing travelling times and costs, as well as decreasing reliability and limiting the access will be able to hinder the positive impacts brought by the investments and improvements in transportation system.

2.1.4 Increasing markets and productivity

Since about two hundred years ago, investments in trade and freight routes were decided by the United States, for the same reasons as the Romans do. As in the early period, the federal programs were supportive for the development of the highway and waterway systems, in order to increase the access to the markets for agricultural products like Wheat, which were transported to major cities like New York, from inland regions with great distances. This has then enabled the agricultural people namely the farmers in the inland regions to access the larger markets with more potential, so as to have growing income due to the trade (Marshall, 1919).

2.2 China's Transportation System

China's transportation system is a combined network formed by railways, waterways, roads and highways, as well as pipelines and airways. Further, the most commonly used transportation modes in China currently to carry freight or passengers are highways and railways (Goh and Ling, 2003). As stated by Xie et al (2002), freight in China is predominantly transported through the railway system, compared with other transportation systems like waterways and highways. Specifically, the rail line in China achieved the total length of over 73,000 kilometers in 2003, with turnover volume of freight achieving 1.7 trillion ton kilometers. Later on in 2005, the State Council has approved the massive Medium and Long Term Plan for the Railway System, which determines to construct new railways with the length of 30,000 kilometers, in addition to some other relevant projects.

2.3 Development of the International Shipping Center of Shanghai

Many scholars have paid their attention to the fast development of the urban area in

Shanghai. According to Wu (2000) and Zhang (2002), concerning the rapid development of Shanghai in the economic context of socialist transition, two of the major driving forces are the central and the local states. In addition, the geographical advantages and other external forces like foreign direct investment and foreign trade are also indicated as important part of the rapid growth of Shanghai. These foreign economic and trade activities are largely relying on shipping, so ports and port cities have played significant role in facilitating the economic development of the area. For example, the largest cities in the United States were also developed as port cities in the 1920s (Fujita and Mori, 1996). Moreover, as indicated by Airriessv (2001a; 2001b), Chu (1994), Loo and Hook (2002), Lee et al. (2008), and Shen (2008), along with the great development of the international trade facilitated by ever-increasing production and consumption during the last decades, there are some large port cities developed in Asia, especially in China, which include Shanghai, Hong Kong and Shenzhen. This is because the port systems in the global range forms a global network that is needed by international production and consumption (Airriess, 1993; Hesse and Rodrigue, 2006; Lee and Rodrigue, 2006). With the improvements in transportation particularly shipping system through ports, the manufacturing activities have been largely transferred to the developing countries from the developed countries, in different ways, such as foreign direct investment, transporting of raw materials, parts and other products. As stated by Cullinane et al. (2004), increasing attention has been paid to the promotion of liner services at the ports so as to attract the customers, during the current market situation featured with keen competition. Since China entering into the World Trade Organization (WTO), its economic development has been more closely associated and integrated with the international economy, especially the development of economies along the coastal areas, such as the Yangtze River Delta, the Pearl River Delta and the Bohai Ring region, with growing needs for international shipping services through the ports (Luo and Shen, 2009; Shen, 2008; Yeung and Shen, 2008a; 2008b). In this case, the development of container transportation and the establishment of large container ports is in great need in the coastal areas of China, with promoted services at the ports.

2.4 Changing Relations between Port and City

As indicated above, the development of ports facilitate the regional economy, which involve the development of cities. Thus, there are close relations between ports and cities, and many scholars have studied this field concerning the relations between port and city (Ducruet and Lee, 2006; Hoyle, 1989; Lee et al., 2008; Notteboomm and Rodrigue, 2005). For example, there are different models studied by the scholars about the relations between port and city in both developed and developing countries. However, there are not so many researches about the Port of Shanghai and the city of Shanghai. It is indicated that the central and local governments in China have been playing the major part in the development of ports as well as the entire transportation systems and logistics, through a case study focused on the Port of Shanghai (Wang and Slack, 2004).

According to scholars including Airriess (1993), Fujita and Mori (1996), Lee and Rodrigue (2006) and others, the growing freight and passenger loads are closely associated with the economic growth. Further, the economic growth of the city as well as the hinterland of the port drive the development of the port. For example, the increasing development of industries and international trade in the Shanghai, Shenzhen and Hong Kong has led to increasing needs for the ports in these cities, so as to facilitate the growth of these ports, providing logistics services and other shipping services. More particularly, there are different types of ports, which include hub ports, non-hub ports and feeder ports. These ports are categorized according to how they provide regional or international shipping services. To be specific, international shipping services are offered by the hub ports which are international shipping centers for cross-ocean transports, while the feeder ports are connected with hub ports and mainly offering trans-shipment, as they do not provide international services themselves. In addition, the non-hub ports provide limited international shipping services, with limited connections with feeder ports.

Chapter 3 The Construction of Hangzhou Bay Cross-sea Bridge

3.1 Background Information on Hangzhou Bay Cross-sea Bridge

3.1.1 General Introduction to the Bridge

The Hangzhou Bay Bridge , extending from Zhengjiali 6 Kms west away from Zha Pu Bay to Ci Xi Shui Lu Bay, crossing the south beach of Hang Zhou Bay, is 36 Km totally and the bridge is 35.673 Km in long and 33m in wide. The Hangzhou Bay Bridge is designed to have bidirectional 6 traffic lanes with a expected daily traffic flow 80, 000 vehicles and a speed of 100 Km per hour. The speed of the down-lead of the bridge is designed to be 120 Km per hour and the life-span of the bridge is designed to be 100 years.

The bridge has two sea-route ,one leading to south and the other one leading to north. The main span of the north spans 448 metres, diamond shaped with two towers and two steel ropes diagonally supporting it. It admits a largest pass of 35000 tons of steamship; the south sea-route spans 318 metres with a “A” shaped single tower and two steel ropes diagonally supporting it. It admits the highest limit of 3000 tons of steemship to pass. The rest leading bridges apply a structure of Fabricated prestressed concrete box beam, from 30 metres to 50 metres.

Using Su Causeway of Xihu as a reference, the Hangzhou Bay Bridge lies on the sea, like a beauty. The “S” shaped bridge fluctuates and winds, like a swimming dragon, which not only does good to the safety, but also make the bridge have the beauty of

rhythm. The characteristic diamond shaped tower in the south and “A” shaped tower in the north are stable enough to withstand the strong winds. The two towers stand up to the blue sky.

The Hangzhou Bay Bridge is not only a major route of transportation, but also will become a place of man-made landscape. It is unique in combining tourism with human culture. The bridge has an above-the-sea scenery-viewing platform of 10,000 square metres and a design of scene of night lighting on the body of the bridge. The scenery-viewing platform lies in the south of the bridge, on which it has scenery-viewing towers, hotels, entertainment places, filling stations and some other projects. After the completion of the platform on the bridge, it will be a good place for sight-seeing and entertainment. After finishing, the bridge will be decorated like a dazzling light beam by tens of thousands of spotlights at night.

3.1.2 Project Funding and Investment

Investors

The total investment for the body construction of the bridge is RMB11.8 billion, 35% of which will be used as capital and the rest RMB 7 billion will be borrowed from the bank: The National Development Bank promises to provide a loan of RMB 4 billion; The Industrial and Commercial Bank of China promises to loan RMB 2 billion; Bank of China and Bank of Pufa will loan 0.5 billion respectively.

Among the capital, investors from Ningbo will invest 90% and investors from Jiaying 10%, they together set up Ningbo Hangzhou Bay Bridge Investment and Development Corporation Ltd shareholders including Ningbo Transportation Investment and Development Company Ltd and Jiangxing Speedway Corporation Ltd (accounting for about 50% of the capital stock, state-owned). The rest of the capital comes from private investment, including Songcheng Group (17.3%), Cixi Bridge construction Investment Corporation Ltd (12.83%), Youngor (4.5%), Cixi Tianyi Investment Corporation Ltd and Cixi Xingxiao Corporation Ltd. Totally there are 17 private participants in this investment.

Right now Hangzhou Bay Bridge Investment and Development Corporation Ltd has registered capital 0.24 billion, all put into cash, among which 0.216 billion RMB is invested by Ningbo party, taking up a proportion of 90%, 0.024 billion RMB is invested by Jiaying Party, taking up a share of 10%. It is expected that the total capital will get to 3 billion RMB. The headquarters of the Hangzhou Bay Bridge also signed an insurance contract valued 9 billion RMB to claim for the possible loss caused by circumstances beyond control under the process of construction.

Investment Returns

Using vehicle class I as standard, it charges RMB 55 per vehicle. According to prediction, at 2008 year end on completion, the rate of internal return can be up to 8.03% and 10.1% before and after tax respectively. Investment return period is 11.9

years before tax and 14.2 years after tax .the charge period of the bridge can be as long as 30 years.

Of course, the yield of the bridge also has uncertainties. The most influential element that affecting decision-making are the competitions between bridges and competitions with speedways, which may lead to the decend of return.

3.2 Socioeconomic Performance of the Hangzhou Bay Cross-sea Bridge

3.2.1 Facilitating the Development of Enterprises

High investment return rate

The investment return rate can be as high as 12% to 15%. Other than the toll fee, big bridge economy will grow after the bridge opening to traffic, that is, oil filling, vehicle maintenance, restaurant and so on. And the connecting to Shanghai directly will bring a increcement estate, employment business opportunities for the neighboring areas, giving the investor a longer, more abundant return.

Brand effect

The Hangzhou Bay Bridge itself has great band effect and is important reason attracting numerous praiivate enterprises to invest. The private enterprises who participating in investment uphold a philosophy of everlasting enterprise and long term investment

3.2.2 Promoting the Development of Regional Economy

Effect on the economic development of Ningbo

Firstly, it will reduce the distance between Ningbo and Shanghai, between Ningbo and north flank of Yangtse River delta, further exerting the city function and boosting up the city vigor and then setting a solid foundation to develop Ningbo as the economic centre of south flank of Yangtse River delta. Secondly, it is good in making use of the foreign investment and intruducing technology, promoting the development of exporting and processing industry, manufacturing industry and commerce. Thirdly, it is good in expanding hinterland of Ningbo port, speed the development of the port economy and international container transportation, making contributions to buliding Shanghai international shipping center into a word-class "Northeast Asia shipping centre",

Effect on the construction of the shipping centre

Shanghai International Shipping Centre is made up of Yangshan harbor, ports coastally lying on Yangtse River , complementing each other in function. After the completion of the Hangzhou Bay Bridge, it will greatly shorten the terrestrial distance between Ningbo Harbor and Shanghai Harbor and Taicang Harbor,making the members of Shanghai international shipping centre more closely tied in shipping capacity, shipping ability, information, technology and management, which are

helpful to approach the aim and level of world-class shipping centre. At the same time, it helps Ningbo Harbor to break the bottleneck of the confined hinterland, becoming an important part of Shanghai International shipping centre and establishing the status of northeast Asian shipping centre ocean container hub port.

Effect on structure fitting

The construction of the Bridge gives birth to the "around the Hangzhou Bay" industry. Some related experts prove that Hangzhou Bay electronic industrial strip to be an IT industry foundation after Shanghai and Beijing. This is because right now, according to the statistics, Hangzhou Bay congregates more than 70% of the electronic enterprises of Zhejiang province, more than 80% of IT products manufacturing industries, more than 90% of software industry, microelectronics and almost all mobile communication industry. Besides, wooden industry in Jiashan, leather weaving industry in Haining, electrical appliances industry in Cixi, Ties in Shengzhou, plastics in Yuyao and wears in Ningbo are all in a nation wide or even world-wide advantageous position as industrial base.

3.3 Opportunities and Challenges for Ningbo

3.3.1 Opportunities: Positive effect on Ningbo development

Formation of the "two-hour city circle"

Ningbo lies in the southern fringe of the cities of Yangtse River Delta, drift off the main transportation lines of Yangtse River Delta Beijing to Shanghai Line and Zhejiang-Jiangxi line, the ability to receive the benefits radiated from Shanghai is far behind Suzhou, Wuxi, Changzhou, Hangzhou, cities that are mainly served by railways. Furthermore, owing to separation of the "∠" natural moat of Hangzhou Bay, leaving Ningbo for Shanghai, we have to detour Hangzhou towards north, very low in transportation efficiency. The construction of the bridge will quickly connect the transportation of Shanghai, Ningbo to promote the construction of the transportation net of the Yangtse River Delta and the construction of the main skeleton structure of "two-longitudinal, two vertical, five connected" highway net in Zhejiang province, thoroughly changing the highway terminal status quo of Ningbo. The prerequisite to build Ningbo into an economic centre of south flank of Yangtse River Delta and important port in southeast coast in our country — build Ningbo into transportation centre of south flank of Yangtse River Delta and important transportation hub of Zhejiang province first. Therefore, the construction of Hangzhou Bay Bridge has epoch-making significance in transportation development of Ningbo. For the Yangtse River Delta, according to the saying of Mr Chen Jianjun, director of Region and Urban Research Centre of Jianjiang University, it enters a new age of regional after the opening to traffic of Hangzhou Bay Bridge, the distance between Ningbo and Shanghai will be shortened about 120 Kms, forming a two-hour "gold circle" among

Shanghai, Hangzhou and Ningbo; the distance between Shanghai and Wentai and the distance between southern Jiandong and southern Suzhou also will be greatly reduced, which have positive meaning for enhancing the "intimacy" of the cities among Yangtse River Delta and propelling Shanghai centred "international city circle", making up of a new two-hour transportation circle between Ningbo and Shanghai, Hangzhou, Wuxi, Changzhou and making Ningbo melt into the core area of Yangtse River Delta. It also will make the hinterland of Ningbo port extend to the whole Yangtse River Delta, provide quick and excellent services for the import and export trade and modern logistic industry development of Yangtse River Delta.

Bringing new opportunities to high technology industry

Ningbo has strong industry foundation and abundant private capital but weak in big researching forces and rare in research and development institution of high level of science and technology. Improvement in transportation the preponderant port enable Ningbo to better receive the radiation of high- tech industry from Shanghai and other neighboring places, and better developing export-oriented economy and owning stronger attraction for foreign investment. It is already known that the New Zone has signed a agreement of physique project with the big part manufacturer TBS Group in India with a first phase investment of 12.5 million us dollars and it is announced to set up a new city equal one-hour ride to four cities of Hangzhou, Shanghai, Suzhou and Ningbo to nurture a new high- tech industry foundation oriented in delicate gauges, fine chemicals electronic information, posing a good opportunity for the industry structure adjustment in Ningbo area.

Expanding Human resources for Ningbo

The essence of the competition in current world is the competition of talents. The completion of the Hangzhou Bay Bridge make Shanghai's effect on Ningbo more obvious and will drive the talent exchange between Shanghai and Ningbo. Shanghai pool all sorts of excellent colleges and universities and after the completion of the Hangzhou Bay Bridge, Ningbo will become a good choice for the future graduates, enjoying competitive remuneration, refreshing working environment, convenient transportation. At the same time, it will expand the student resources for Ningbo Higher academy. Hangzhou Bay Developing Zone of Cixi in Ningbo has been finished, attracting many large groups to invest such as Dalian Shide. Cixi plough into RMB up to tens of billions to commence on full scale. The tens of billions big bridge economy will receive international shift to the largest extent, providing water, electricity, road support.

Enhancing the ability of transportation and transfer of Beilun Port

The completion of the Hangzhou Bay Bridge, by blending the regional resources , further exerting the effect of Yangtse River Delta group ports and having clear idea on the advantages of Beilun Port, can drive the development of Ningbo. Ningbo now is a multi-functional, comprehensive, big modern deep-water port with Neihe Port, Hekou port and harbor as a unit. Externally connected with Asian Pacific and internally

connected with Yangtse River, now Ningbo Port has become an important container main-line port of mainland China. The Hangzhou Bay Bridge expands economic hinterland of Ningbo Port to northern Zhengjiang and will lower the cost of logistics between Jiaying Port and Zhapu Port through cooperation between the two places. On the other hand, owing to Haiyan highway hub's (at the north coast of the bridge) connecting to southern areas of Suzhou through Zha Jia Su highway, the business of Ningbo Port has a big expanding space. According to the Eleventh Five-year Plan, Ningbo Port will be the transfer and store base of mainland China for iron ore, crude oil, liquefied products; coal transfer and store base for east China. The strategic status of Ningbo Port as a strategic materials transfer station will be greatly enhanced due to the planning of world-class petro-chemical base — Jinshan Beilun Zone Petro-chemical zone and the existing Nangjing Yangzi petro-chemical's huge demand for crude oil plus a lack of energy sources of Yangtse River Delta itself. And with the one-unit construction of Ningbo — Zhoushan Port and Hangzhou-Ningbo Canal renovation, Zhoushan connecting Islands Project and Yongjin railway reconstruction, the structure of Ningbo Port is changing and a big oriental port that is comparable to Shanghai Harbor is being built.

3.3.2 Challenges: Negative effect on Ningbo development

Possible damages to ecological environment

The construction of Hangzhou Bay Bridge may develop the southern area of Hangzhou Bay into new city zone, a large number of coastal neighboring industries settled in coastal areas. Under the process of construction of the new city zone, the centre of the city will be removed from the old city zone and a new centre of city will form at the coast of the estuary of Yongjiang (now the Zhenhai Chengguan Town and Beilun small port Developing zone), that is, a centre for government administration, economy, technology, culture and foreign affairs centre. After the formation of the new city centre at the estuary of Yongjiang, the old city zone must realize an intellectual transition and transformation. The development of the new city zone and the port-neighboring industry districts may lead to repeated constructions, causing huge ecological stress to Ningbo's eco-system, especially to the frail offshore transit areas.

The construction of developing zone also brings polluting problems. Haiyan and Cixi Developing Zone, constructed around the Bridge and close to Hangzhou Bay, introduce many heavy polluting chemical industries, the "overflowing" bonus and externality will to some extent worsen the ecological environment in Hangzhou Bay area. On the other hand, now the chemical industry of Ningbo mainly gather at northeastern area of Ningbo, opposite to Shanghai, emphasizing on the relationships with Shanghai, Kunshan's chemical industry and markets, which surely will become a developing trend. It also will bring damages to the air quality of Ningbo City and reduce the attraction as a trading, tourist and agreeable inhabitancy.

Hangzhou Bay Bridge is a Bridge crossing time and space and cultural differences, a

never-ending bridge of logistics, people, information stream, and capital flow. But the increasement of transportation adds the vehicle emission, lower the air quality of the city and make the heat island effect more obvious.

Causing social problems

With the improvement of transportation, the population living in Ningbo is constantly increasing, especially, the urban construction labour's streaming into the city brings big stress to the existing city construction. Public security must increase. Meanwhile, unemployment, especially, the re-employment of un-employed farmers will pose as a must-settled problem. Besides, these problems will may lead to the drop of quality of the living environment, not good for attracting high-tech talents for Ningbo.

Increasing traffic stress for Ningbo

According to regulation, Hangzhou Bay Bridge is national main-line highway, named "Shen Hai express highway and numbered G15. after the opening of the bridge, it will change the route of the vehicles going to Jiaxing, Shanghai and Suzhou. The vehicles originally taking the pass of Hu Hang Yong express highway now can change their way onto Hangzhou Bay Bridge, and then the vehicles from Wenzhou, Taizhou and Jinhua to Shanghai can borrow their ways of Tai Wen express highway in Ningbo. At the same time, vehicles from Ningbo to Zhoushan discharged leaving for northern Zhejiang also will make contribution to the traffic flow. Under the circumstance of uncompleted express highway crossroads in Cixi, at the south of the Hangzhou Bay Bridge, Ningbo will have a busy highway transportation temporarily. Down the bridge from south to north, vehicles can enter corresponding express highway at the biggest transportation hub—Haiyan Crossroads, Vehicles get to Suzhou direction by way of Zha Jia Su express highway; vehicles get to Shanghai by way of Hu Hang express highway or get to Pudong of Shanghai by way of Hang Yong express highway.

3.3.3 Counter-Measures for Ningbo to Handle the Opportunities and Challenges

When Hangzhou Bay Bridge is opened to traffic after completion, Ningbo should fully understand the comprehensive impact of the bridge on economic development of Ningbo port, based on the initiative, while seeking advantages and avoiding disadvantages, expand the positive effects of the completion of the bridge on economic development of Ningbo port to the maximum and promote rapid and sound economic development of Ningbo port.

To Accelerate the Integration Process of Ningbo - Zhoushan Port

Although Ningbo port has the advantages in economic strength, technical information, economic management, and other aspects, but there are still constraints such as unreasonable layout of port and coastline, limited space of deep-water development, etc., particularly its deep water coastline is difficult to meet the needs of long-term development, while coastline resources in Zhoushan port are rich, making up the shortage of resources Ningbo port coastline. Ningbo port can take the opportunity of the completion of Hangzhou Bay Bridge, actively promote the integration process of

Ningbo - Zhoushan Port and speed up the integration of coastal resources, to optimize the development and use of port resources, and enhance the competitiveness of ports in order to attract more the sources of supply, face competitive pressure from Shanghai Yangshan port after completion of the Hangzhou Bay Bridge and promote further economic development of Ningbo port.

To Accelerate Construction of Distribution and Transportation System Network

Based on constructing South Wing economic center in Yangtze River Delta and the needs to further exert collecting and distributing ability of Ningbo port, Ningbo should further develop internal and external collection and distribution network infrastructure, strive for construction of key projects such as Chuanshan Shugang Expressway and Beilun Container Terminal of the fifth phase; complete the integrated collecting and distributing network planning of Ningbo - Zhoushan Port as soon as possible; accelerate the implementation of "Opinions on Speeding up Traffic Development" examined and approved by Ningbo Municipal Government, making efforts to basically complete South Wing transport hub in the Yangtze River Delta by 2011 and form a fast, convenient, smooth, efficient and safe modern three-dimensional integrated transport network, led by the port and centered by cities in 2020 with the coordinated development of various modes of transport. The completion of Hangzhou Bay Bridge provides a more complete land-based channel for the transport of containers across the Hangzhou Bay and increases transit opportunities for shippers to choose Shanghai port and Ningbo port. Therefore, Ningbo port should also improve the roads in the port area, connect with the highway network and the convergence of urban expressway, promote construction of container terminals, develop international container transport vigorously, build multimodal transport system, conduct sea-rail transport, push building container depots of Ningbo railway, open inland container transportation, promote joint development of Ningbo port and the "golden waterway" of the Yangtze River, improve the capacity of the services to the hinterland and construct the Ningbo port into an important harbor of the Yangtze River and a major transport hub of rivers and sea combined transport.

To Expand the Scope of the Port Hinterland

The economic development of Ningbo port requires an adequate supply of goods as a guarantee, therefore, Ningbo should continue to strengthen the building of "dry port", consolidate traditional hinterland; establish and perfect the canvassing system of the cities along the Yangtze River; take the opportunity of the completion of Hangzhou Bay Bridge to focus on expanding cargo supplies in hinterland of northern Zhejiang and southern Jiangsu. Form a container transportation supporting system with large throughput capacity, high operating efficiency and strong competitiveness as soon as possible to attract more owners to choose Ningbo port for import and export by improving the conditions of collection and distribution as soon as possible. Meanwhile, take full use of deep-water of Ningbo port to open international shipping transit business, vigorously develop the sea hinterland, make efforts to increase the volume of international container transport and form scale effect, fostering new

growth points of port container transport.

To Speed up the Construction of the Port Logistics System

It should use thought of modern logistics systems to guide and plan logistics network system construction of Ningbo port. With the formation of distribution and transportation networks of the port and hinterland development, Ningbo should accelerate the establishment of integrated logistics economic circle, form of a fully furnished station's external radial of the highway, railway, water and air transport link network, eventually forming modern multi-faceted and main type of integrated transport network with a variety of modes of transport and coordinated development. In particular, build a modern logistics system centered by the port. Speed up start-up or construction of Logistics Park of Ningbo, Meishan Bonded Port Area and Ningbo (Zhenhai) sea-rail intermodal bulk logistics hub around the goal of building Ningbo into a sub-center of Shanghai international shipping, international logistics hub city in the Yangtze River Delta and major integrated logistics center in Zhejiang Province to promote the development of logistics industry and services near the port, pushing Ningbo to become an important regional center of logistics and resource allocation all over the country.

To Enhance Soft Power of the Port

To improve comprehensive services of the port, to constantly enhance the overall competitiveness of ports, and to promote the economic development of Ningbo port must have coordination of soft environment with good business and trade, finance, maritime, shipping services, etc. Therefore, Ningbo should continue to deepen the port customs clearance building, further optimize port service environment; make great efforts to cultivate shipping service market, creating a market environment for fair competition; actively develop the tertiary industry, providing effective support for the port and economic development of the port; enhance efforts to train and bring in professional, listing all kinds of professionals needed for economic development of the port into personnel project construction and planning of Ningbo city, creating intellectual supporting environment of economic development in the port; constantly update the concept of port management and operation, improve the technology and service levels and enhance economic competitiveness of the port.

To Improve the Impact of the Heavy Chemical Industry near Ningbo Port

Ningbo should take full advantage of the favorable opportunity that Hangzhou Bay Bridge is completed aiming at short industrial chain current heavy chemical industries near the port and little leading role it plays in promoting local enterprises. Promote industrial agglomeration by strengthening the implementation of the industrial plan, providing preferential policies and encouraging industry matching, for instance, establish industrial agglomeration area in the south bank of Hangzhou Bay Harbor, focusing on the introduction of projects with large-scale, high added value, leading role on the local industry and making great contributions to tax to build and extend the industrial chain, to improve the competitiveness and profitability of regional

industries, thus enhancing the overall competitiveness of heavy chemical industries in Ningbo port. Ningbo should complete matching capabilities fully, extend the industrial chain, to maximize the set of, form inter-related and supporting community-intensive advantages and promote the intensive development of port economy around the existing large projects.

To Actively Foster the Formation of Hangzhou Bay Industrial Belt

Hangzhou Bay industrial belt includes in Hangzhou, Ningbo, Shaoxing, Jiaxing, Huzhou and Zhoushan six cities which surround the Hangzhou Bay. The completion of Hangzhou Bay Bridge strengthens the links of Ningbo with other cities surrounding Hangzhou Bay. Ningbo should seize the opportunity of international industrial transfer and industrial structure adjustment of the Yangtze River Delta; make full use of the deep-water port conditions to accelerate the advanced manufacturing base building in Hangzhou Bay area and industrialization process focusing on the development of large port industries and logistics; give full play to the driving and service role it plays as economic center of southern wing in Yangtze River Delta, and gradually form a new pattern of regional cooperation in southeast Zhejiang with the basis of sharing of resources, assets link as tie and oriented by optimization of production factors.

Chapter 4 Influences of Hangzhou Bay Cross-sea Bridge on the Economy of the Areas of Shanghai and Ningbo Ports

4.1 Influences of Hangzhou Bay Cross-sea Bridge on Shanghai Port

Hangzhou Bay Cross-sea Bridge is a large scale project characterized by its "Double Cross" and "Double 100".The construction started in 13th November,2003,and planned to complete in 2008.This bridge is two-way six-lane design, the expected speed per hour is 100 km/h, and the expected service year is 100 years. The Hangzhou Bay Cross-sea Bridge has significant meaning for the development of Shanghai, Ningbo, Zhejiang and even the Yangtze River Delta.

4.1.1 The Bridge's General Impact on the Development of Shanghai

In general, because of the Hangzhou bay, the Yangtze River Delta had been divided into North and South including 15 prefecture level cities, now these area has an convenient passway due to the Hangzhou Bay Cross-sea Bridge .The construction of the bridge made the "two-hour traffic circle" between Ningbo-Shanghai-Hangzhou(now so called "Golden Triangle" city belt) became possible. And it also contributed to the "X-size" equidistance -"two-hour" city belt between Shanghai-Hangzhou-Ningbo-Jiangsu. It changed the project of ro-ro ferry which used in three line crossing Hangzhou Bay. Combining the built,building,and

will build projects like Hangzhou-Ningbo highway, Ningbo-Taizhou-Wenzhou highway, Ningbo-Jin highway, Xiaoshan-Ningbo double tracking railways' reform, Ningbo-Wenzhou railway, Zhoushan's "Continent to Island Project" and Cross-River Transportation Project in Nantong and Chongming, the whole transportation arrangement of Yangtze River Delta will be improved. Ningbo will be the hub city and the node city to connect Shanghai, South of Jiangsu, Wenzhou, Taizhou and even the South of Fujian. The change in this transportation structure will greatly enhance the grouping ability in South and North cities in Yangtze River Delta, strengthen Shanghai's radiant influence on inner cities and South of Yangtze River Delta, and then establish the world's sixth city agglomeration with Shanghai as the leading city. But on the other hand, the bridge would also bring pressure of competition to Shanghai's development: Pressure No.1: After the construction of the bridge, it's possible that some of the industry and production factors will flow to Ningbo, and the foreign investment will also likely to transfer to Ningbo. Pressure No.2: the Hangzhou Bay Cross-sea Bridge will promote the Ningbo-Zhoushan ports integration. This will benefit the formation of the Shanghai International Shipping Center, and also will bring some competition pressure to Yangshan port. Therefore, the Hangzhou Bay Cross-sea Bridge will be a double-edged sword which with two-way interaction to cities.

4.1.2 The Influence to Shanghai Port Brought by the Construction of the Bridge

The most important influence to Shanghai Port brought by the construction of the Hangzhou Bay Cross-sea Bridge is mainly reflected on the container transport. In the long term, the construction of the bridge will play a positive role in improving the overall competitiveness of the Shanghai International Shipping Center. In the short term, the construction of the Hangzhou Bay Cross-sea Bridge will greatly impact the development of Yangshan port. Something worth to mention here is that in order to compete with Yangshan port, Zhejiang province speeds up the management and island-connecting project of "Ningbo-Zhoushan ports integration", and also aims at improving the competitiveness of Ningbo port in attracting containers. All of these will facilitate the interior of Ningbo (South of Zhejiang) expanding to the North of Jiangsu which generates large quantity of containers. The island-connecting project between Zhoushan and Ningbo planned to finish by 2007 and so is the Hangzhou Bay Cross-sea Bridge's construction. Then new cross-sea bridges will be built to connect Zhoushan Island and Yangshan port. And the administrative division of Zhoushan city will be merged into the Ningbo city. This will be a intercept and surround situation to Yangshan' development.

4.1.3 The Influence to Shanghai Industry Development Brought by the Construction of the Bridge

It facilitates the double-flow of essential productive factors between Shanghai and the Hangzhou Bay area.

When Hangzhou Bay Cross-sea Bridge completed, the interflow of physical

distribution, stream of people and capital flow between Shanghai and Hangzhou Bay will be enlarged. On the one hand, some of the manufacturing enterprises in the East of Zhejiang will move their headquarters and R&D center to Shanghai. On the other hand, Shanghai's manufacturing enterprises will also get the opportunity to "go out", and even the opportunity of developing producer services. Some of the talents and techniques in Shanghai will flow out, thus it could be a great opportunity for the South of Hangzhou Bay carry on the industrial and technological transfer from Shanghai.

It greatly Influences on Shanghai Near-Port Industries Especially the Chemical Industry and the Equipment Manufacturing Industry.

This impact reflects two aspects-negative and positive. From the positive aspect, Hangzhou Bay Cross-sea Bridge will make the logistics of distribution in Shanghai chemical industry and equipment manufacturing industry more convenient. It benefits the product cost reduction. And meanwhile, it will be more convenient for the Shanghai chemical industry and equipment manufacturing industry market their products in East of Zhejiang and Fujian. The both banks of Hangzhou Bay will make their respective advantages complementary to each other and also become "the Chinese Largest" "the World Class" Jinshan-Ningbo petrochemical industry bases, then develop into the Chinese "Gulf of Mexico"

From the negative aspect, when the construction of the bridge finished, some of the harbor industries in Ningbo and South cities around Hangzhou Bay will be more easily to meet the huge energy demand of North cities in Yangtze River Delta, these elementary raw material include petrification, energy, steel, cement and paper etc. This will strengthen the cost superiority. The Shanghai chemical industry and equipment manufacturing industry will directly face the competition pressure brought by the fast development of Hangzhou Bay chemical industry and equipment manufacturing industry .The chemical industry and equipment manufacturing industry in Jinshan, Fengxian and area close to Hangzhou Bay will get the hardest hit.

It impacts on the modern logistics industry.

On the one hand, when the bridge established, it will build a triangle transport structure in Shanghai, Hangzhou and Ningbo. This will significantly increase the opportunity to exchange the physical distribution, human resources distribution and information distribution in these cities. On the other hand, the bridge will bring great opportunity to the development of the logistics industry in Ningbo. In the future Ningbo will become the synthetic logistics center in South of Yangtze Delta. And meanwhile, another entrance of the bridge is Jiaxing city, and this city will use this great advantage to develop its logistics industry. Then become the logistics hub in Yangtze Delta. This will decompose the function of Shanghai as the trading center and synthetic logistics center in some degrees.

It impacts on the tourism industry.

The impact on tourism of Shanghai and Yangtze Delta mainly reflect three aspects: First, the bridge will be the main tourism passway from South to North; this will be a positive impact on Ningbo tourism structure. Second, due to the bridge, Shanghai will be the center of Yangtze River Delta "two-hour tourism circle". This will combine and sublime the culture of Wu presented by Suzhou and Wuxi and the culture of Yue presented by Shaoxing, Ningbo, Jiaying. Thirdly, building of Hangzhou Bay Bridge is contributing to the connection of tourism and culture between Zhejiang Province and Shanghai, and it makes southern and northern tourism route which are Shanghai-centered in Yangtze Delta reach for the sky together.

4.1.4 The influence to Shanghai Foreign Investment Attraction Brought by the Construction of the Bridge

In recent years, the cost of doing business in Shanghai increased so fast that caused big challenge to attract foreign investment. As mentioned the biggest challenge will come from the South of Jiangsu. When the construction finished, the focus of the foreign investment will shift from South of Jiangsu to Hangzhou Bay circle. This will cause double-pronged attack to Shanghai in attracting foreign investment. The structure of attracting investment will further speed up the shift from manufacture to service.

4.1.5 The Influence to Shanghai City Development Brought by the Construction of the Bridge

Firstly, it's in favor of adjusting and balancing the city's space planning. The imbalance situation between North and South will be broke down. The city's space layout will get to balance. Secondly, the construction of the bridge will speed up the urbanization process of the South of Shanghai. When Hangzhou Bay Cross-sea Bridge finished, this region will be an important gathering zone for the migrant population. The population in Jinshan 、 Fengxian 、 Songjiang will be markedly increased, even possible to over fulfill the planning number.

As a whole, the function of Hangzhou Bay Cross-sea Bridge is double, it brings opportunity and challenge too both banks of the bridge. To any part of them, if the outflow is the mainstream, then the major impact of the bridge will be negative, and if the inflow is the mainstream, then the positive impact will be significantly increased.

4.2 Influences of Hangzhou Bay Cross-sea Bridge on Ningbo Port

4.2.1 Impact on the Hinterland Economy of Ningbo Port

Port is the most convenient connection point among sea transport, inland transport and inland river transport. Port's hinterland is the area which can connect the port by some transportation, supply goods and consume the import goods for the port.

The building of Hangzhou Bay Bridge will makes Ningbo receives Shanghai's radiation better. Hangzhou Bay Bridge could shorten the overland distance between Ningbo and Shanghai. Shanghai is a cosmopolitan city which is also the national economic center. Generally speaking, some economic actions between cities in Yangtze River delta and Shanghai shows an an inverse relationship. That is, the shorter distance, the less time and the closer economic relation with Shanghai, Naturally the effect is better; on the contrary, the further distance, the more time and the less Shanghai economic radiation, either the effect is worse. At present, land transportation from Shanghai to Suzhou and Wuxi needs about one hour, from Shanghai to Hangzhou needs about two hours, from Shanghai to Nanjing needs about two and a half hour and from Shanghai to Ningbo needs four hours. It is clear that the distance between Shanghai and the cities in Yangtze River delta, Ningbo is furthest and time-consumes longest, therefore the connection of economic technology is the loosest. After the Hangzhou Bay Bridge completed, the land distance from Ningbo to Shanghai, Suzhou and Wuxi will shorten in two hours traffic-circle which makes the connection between Ningbo and Shanghai convenient largely. This will bridge a fast channel for Ningbo to receive Shanghai's economic technology and wisdom as well as promoting a new leap for Ningbo's economic technology.

The building of Hangzhou Bay Bridge will do a favor to utilize foreign investment, introduce technology and promote the development of export processing industry, manufacturing and commercial & trade industry for Ningbo. Shanghai attracting the largest foreign investment nationwide due to its nice position, talent-advantage and loose invest circumstance. Taiwan-based business make use of Shanghai's convenient traffic and high-quality labors. They set enterprise's headquarters and administration departments in Shanghai, set manufacture enterprise and assemble plant in Suzhou and Wuxi etc. which have formed a develop trend of "front shop, backyard plant". Since reforming and opening-up policy in 1978, what Suzhou actually utilized investment is twice than Ningbo and the talent introduced is three times than Ningbo. Looking for the reason, besides Suzhou has a more looser and better policy & invest environment for attract foreign investment and introduce talents, the important reasons are nearer distance and it is easy to transport, cooperate and receive the support of Shanghai's technology. When the Hangzhou Bay Bridge completed, it will improve Ningbo's environment in Yangtze River delta and largely improve the attraction for foreign investment, technology and talent. As long as Ningbo grasp this advantage and exert itself potentials, characters and advantages. Ningbo will become an important manufacturing base and commercial & trade logistic center after Suzhou and Wuxi.

4.2.2 Influence on Transportation of Ningbo Port and its Hinderland

After Hangzhou Bay Bridge completed, Ningbo will become an import node in national road-net, change its long-term disadvantageous position in national traffic road-net and further broaden its develop space. In history, Ningbo's economic develop

and the flow of personnel and commodity are closely linked with Yangtze River delta. Because of the natural Yangtze River and Hangzhou bay, the railway and main road in Yangtze River delta (started with Shanghai) has been cut into east to west trend. Although there is a railway between Hangzhou and Ningbo, it is a branch only 160km long in national road-net, just like a "caecum" which capacity is small, run slow and fall behind economic's development and modern's requirement. That makes Ningbo plays a long-term ending city position. Although there are sea transportation and air transportation between Shanghai and Ningbo, it is only play a assistant role, could not instead of overland transportation. Of course, it can not change the reality that Ningbo is a ending city. The city development in world history shows that all the sea cities who has branch or "caecum" connect with large area road-net, its scale is small and has limit on area-radiation and impetus. Sea transportation and air transportation are not developed. Economic develop, personnel and logistic are slow. The building of Hangzhou Bay Bridge will open north door of Ningbo and change basically on road-net's layout of Yangtze River delta Z-shape which can form a new delta area from Ningbo to Shanghai and Hangzhou. The new delta will get through as the Hangzhou Bay Bridge complete and become an important channel (through south and north) for connecting Ningbo, Shanghai and Southern Suzhou. Yongjin highway and Ningbo Yizhoushan island traffic are under construction. The railway section of Ningbo-Taizhou-Wenzhou which belongs to Yong-Shenzhen along sea railway has planned and constructed, and integrated with Xiaoyong railway. That makes Ningbo's traffic road-net radiate around and expands deeply in hinterlands. Ningbo will becomes an area center cross-city from an ending city. Yangtze River delta economic area has natural ports, widely hinterlands, perfect cities' facilities, reasonable city's layout and has formed the largest city-group in China. Hangzhou Bay Bridge will connects tens good ports in Yangtze River delta closely, thus realize strategic target of "ports drive cities prosperity"

4.2.3 Direct influence on container transportation of Ningbo

When discussing the construction of the Hangzhou Bay Bridge, some argued that the bridge will influence the international container flow in Zhejiang Province, so as to generate negative impact on the container transport in the Port of Ningbo. Generally, major factors that influence the owners of goods to choose a port for transport include: the location of the port, the transport mode between the port and its hinterland, the extents of port's route, the frequency of sailings, the price of transportation, service level regards to the port checking as well as its popularity at home and abroad.

When the Hangzhou Bay Bridge is completed, the overland distance among northern part of Hangzhou bay and Hangzhou, Jinhua, Quzhou, Lishui and Shanghai port, Yangshan port as well as Shaoxin, Taizhou, Zhoushan, Wenzhou in southern part which far from Ningbo port will not changed. There is a river branch transport from Wenzhou and Zhoushan to Shanghai port, therefore river transport is more reasonable than land transport which can regards no influence. But there is a clear land-transport

change(See Table 3 and Table 4) from Ningbo, Shaoxin, Taizhou to Shanghai port and Yangshan port as well as representative node of Shanghai and Suzhou's southern part-Suzhou, representative node of Zhejiang-Jiaxing, so it will influence on these areas' international container import & export's flow and flow capacity.

Table 3: Changes in Distance between Hangzhou Bay North Shore to the Ports of Shanghai, Yangshan and Ningbo (Kilometer)

Starting Point	Arrival Harbor	Original Load Distance	Load Distance after Completion of Hangzhou Bay Bridge
Shanghai	Beilun Terminal of Ningbo Port	370	233
	Shanghai Container Terminal	143	143
Jiaxing	Shanghai Waigaoqiao Terminal	163	163
	Yangshan Port	140	140
	Beilun Terminal of Ningbo Port	265	141
	Shanghai Container Terminal	110	110
Suzhou	Shanghai Waigaoqiao Terminal	130	130
	Yangshan Port	210	210
	Beilun Terminal of Ningbo Port	343	219

Table 4: Changes in Distance between Hangzhou Bay South Shore to the Ports of Shanghai, Yangshan and Ningbo (Kilometer)

Starting Point	Arrival Harbor	Original Load Distance	Load Distance after Completion of Hangzhou Bay Bridge
Shaoxing	Shanghai Container Terminal	261	221
	Waigaoqiao	310	250
	Yangshan Port	273	213
Taizhou	Shanghai Container Terminal	523	333
	Waigaoqiao	543	353
	Yangshan Port	520	330
Ningbo	Shanghai Container Terminal	381	244
	Waigaoqiao	410	273
	Yangshan Port	373	236

Table 4 shows that when the Hangzhou Bay Bridge completed, the every standard container's charges from Shaoxin, Ningbo, Taizhou in southern bank to Shanghai container terminal, Outside high bridge, Yangshan port needs at least 1800RMB. Under the condition of not consider other factors, if Shanghai port's sea transportation price is 225USD lower than Ningbo port, it will increases the possibility that north of Shaoxing's international containers flow to Shanghai. At the same time, the distance from north bank area to Ningbo port and the distance from Jiaxing container to container terminal, outside high bridge, Yangshan port and Beilun terminal of Ningbo port are consistent after Hangzhou Bay Bridge is completed. The distances among Suzhou container, Yangshan port and Beilun terminal of Ningbo port are consistent, which will add a foreign trade port similar to Shanghai port. That is helpful for trade

development of Jiaxing and Suzhou area, and increase Ningbo's radiation ability to the areas mentioned above.

Port shipping line's layout, especially main route and density of shipping are one of the important factors for influence customer selection on international container transportation port. Till now, Ningbo port's far-sea shipping line and near-sea shipping line has covered Europe, America, Africa and main ports, while opened domestic branch and trade for main along-sea port of Yangtze river. Thus it basically formed an container transportation net of near-sea branch, domestic branch, domestic trade and main far-sea route.

The hinderland of Ningbo's import & export good mainly flow to Europe and North America. There are shipping containers to that area mentioned above everyday. This shipping line layout do not have a clear difference compare to Shanghai port, the shipping density maybe lower than Shanghai port,however, it could meet totally the requirement of import & export and will not influence Ningbo port's service for its hinderland.

The sea transportation price is directly influence the customer's selection on port and the sea transportation price is depends on sea transportation's competition and the balance degree of import & export containers. Generally speaking, when a far-sea shipping route of a certain port is rare, if the shipping market's competition is not enough and the port is not famous as well as goods is less, so these will cause unbalance of import & export goods, further more, cause the sea transportation price too high. However, when the port's TBU achieves a certain scale and become a area pivot port, its shipping price is similar to the neighbour port, even lower. At present,as the development of Ningbo port,the price of Ningbo port's containers is close to the Shanghai port gradually. Otherwise, with the ship scale is become larger quickly,in the future as the fifth generation and sixth generation ship (with exceed 5000TEU, 14 meters draft) put into operation, it will require higher for the port's water depth. At present, The Ningbo port's conditions could totally meet larger container ship's requirement, so the larger ship will exert advantage of Ningbo deep water port. With the deepening of China's reform and opening up and join WTO, more and more foreign investments and multinational corporations enter in our country, not only increase our country's export but also promote import extent and improve the unbalance of our country's import & export which will lower the sea transportation price. Plus the development of Ningbo port market, compare to the Shanghai port, its sea transportation price which has limit its goods supply could be solved gradually. Therefore, it is not only attract more containers in Zhejiang province which will transport out through Ningbo port, but also improve the attraction for common hinderlands due to the completed Hangzhou Bay Bridge has improved the transport links between Ningbo port and common hinderland.

Chapter 5 Contribution of Completion of Hangzhou Bay Cross-sea Bridge based on Theoretical Model Analysis: A Focus on Ningbo

5.1 Theoretical Model Analysis

Hangzhou Bay Bridge's contribution to the development of Ningbo is based mainly on the improvement of transportation environment in the Yangtze River Delta region. As a link between the regional economies, the level of development of traffic determines the depth and breadth of interaction between regional space, making it an important factor in influencing urban economic and social activities. The construction of Hangzhou Bay Bridge has changed the traffic pattern of Hangzhou Bay areas, from the original "V" shape into the current "A" shape, thus having had far-reaching impact on the traffic location of Ningbo City.

In theory, the impact of the improvement of transport conditions on regional economic development can be analyzed by means of the model of strength of economic ties. We compare the different strengths of economic ties between Ningbo and other neighboring cities and transportation center, Shanghai before and after the completion of Hangzhou Bay Bridge so as to illustrate the impact and contribution Hangzhou Bay Bridge has made to the development of Ningbo.

5.1.1 The Model of Strength of Economic Ties

The model of strength of economic ties between regions is evolved from the gravity model of Newtonian mechanics by geographers. According to the existing research results, taking the research objects into consideration, the following model is to be used:

$$R_{ij} = \left(\sqrt{P_i G_i} \times \sqrt{P_j G_j} \right) / D_{ij}^2$$

In which:

R_{ij} refers to strength of economic ties between two cities;

P_i and P_j refer to population sizes of two cities;

G_i and G_j refer to GDP of two cities;

D_{ij} refers to inter-city traffic distance between two cities.

This model uses such indexes as, population size, economic scale and inter-city traffic distance between two cities. This model does not take into consideration traveling

time and transportation costs, nor does it take into consideration the impact of the improvement of traffic conditions on passenger flow and freight flow.

5.1.2 The Comparison of Economic Ties between Cities

Table 5 is data collected by the author which will be used in the model:

Table 5: Basic Data of Shanghai and Major Cities of Zhenjiang Province

	Shanghai	Ningbo	Hangzhou	Jiaxing	Chaozhou	Shaoxing
GDP of 2008 (a billion)	1369.8	396.4	478.1	181.5	103.5	222.3
Population in 2008 (ten thousand)	1371	568.1	677.6	388.1	258.5	437.1
Distance from Shanghai before the completion of Hangzhou Bay Bridge (kilometer)	0	311	203	117	206	269
Distance from Shanghai after the completion of Hangzhou Bay Bridge (kilometer)	0	179	203	117	206	155

Note: The distance between Shanghai and major cities of Zhenjiang province before and after the completion of Hangzhou Bay Bridge refers to the travelling distance of highway transport.

Table 6 is gained by the calculating of model.

Table 6: Strength of Economic Ties between Shanghai and Ningbo, Other cities (1)

	Ningbo	Hangzhou	Jiaxing	Chaozhou	Shaoxing
Before the completion of Hangzhou Bay Bridge	6.7 (3)	18.9 (2)	26.6 (1)	5.3 (5)	5.9 (4)
after the completion of Hangzhou Bay Bridge	20.3 (2)	18.9 (3)	26.6 (1)	5.3 (5)	17.8 (4)

Note: the numbers in the bracket is the ranking for the strength of economic ties between Shanghai and Ningbo and other cities.

Form the **Table 6**, we can see that: after the completion of Hangzhou Bay Bridge, the strength of economic ties between Shanghai and Ningbo increases from 6.7 to 20.3. The strength of economic ties between Shanghai and Shaoxing increases from 5.9 to 17.8. However, Hangzhou, Jiaxing and Huzhou are not affected by the improvement of traffic conditions.

Table 6 also shows some changes of the ranking for the strength of economic ties between Shanghai and Ningbo, Hangzhou and other cities after the completion of Hangzhou Bay Bridge.

(1) Relative ranking of Ningbo has increased. Before the completion of Hangzhou Bay Bridge, the strength of economic ties between Ningbo and Shanghai ranked the three places, after that of Hangzhou and Jiaxing. After the completion of Hangzhou Bay Bridge, the strength of economic ties between Ningbo and Shanghai ranks to the second place before Jiaxing but after Hangzhou.

(2) Relative ranking of Hangzhou has declined. The ranking of the strength of economic ties between Hangzhou and Shanghai declines from the second place before the completion of Hangzhou Bay Bridge to the third place after the completion of Hangzhou Bay Bridge.

(3) Jiaxing still occupies the first place. The strength of economic ties between Jiaxing and Shanghai does not change, occupying the first place.

(4) The ranking of Shaoxing and Huzhou do not change, in the fourth and fifth place respectively.

It can be seen that the completion of Hangzhou Bay Bridge contributes the most to several cities in the northern part Zhenjiang province. The strength of economic ties between Shanghai, from the absolute point of view, has increased the most by 13.6; from the relative sort of view, it still enjoys the growth while other cities either increases or keep unchanged.

5.2 Analysis on Actual Effect

Concerning the actual effect in the first year when Hangzhou Bay Bridge was open, the author makes a brief analysis from the following four aspects: the change of location, the flow of factors, the development of industry and the conditions of port.

5.2.1 The opening of the bridge improves regional transportation and improves the status of Ningbo.

"A north-south bridge changes the natural moat into a plain thoroughfare." The opening of the bridge has shortened the distance of road transport between our city, the wider region of southeast Zhejiang and Shanghai, southern Jiangsu more than 120 kilometers. The road network of Hangzhou Bay area has changed from the "V" shape into "A" shape, forming a "two hours traffic circle" among Shanghai, Hangzhou and Ningbo. Used to be the twig of Yangtze River Delta, Ningbo now has become a regional transportation hub. From the time when the bridge opened to April 30 this year, there have been 8.67 million vehicles running on the bridge, an average of 23,800 per day; the traffic income has reached 674 million Yuan, an average of 1.8466 million Yuan per day, making a great contribution to the economical and social development of our city. According to the statistics of City Department of Transportation, Ningbo has 58 passenger lines which change their course to go the bridge and the average of passenger train crossing the bridge every day is 220.

The opening of the bridge has reduced travel costs and saved time. Take the line from Ningbo to Shanghai South Railway Station for example, if the car goes to Shanghai-Hangzhou-Ningbo highway it takes about 316 km. If it changes to the bridge line, the distance would decline to 225 kilometers, shorter than the previous trip by almost 100 kilometers, and time is less than nearly 1 hour. Bus fares have reduced from 100 yuan to 90 yuan. If we take a taxi to go to the bridge line, we will pay less taxi fees and tolls by 200 yuan.

5.2.2 The opening of the bridge has promoted the flow of elements, resulting in the effect of concentration elements resources

Erection of the bridge, opens the "North Gate" of Ningbo, promotes the flow of personnel, elements and products and strengthens contacts and cooperation between cities. For example, Jiaxing and Ningbo have cooperated in tourism, ports and other areas. They have become mutual "day trip" destination. And container feeder flights are also opened from Ningbo to Jiaxing .

The opening of the bridge also contributed to the formation industrial agglomeration of the relevant regions and the formation of a new specialized industrial area. Especially on the vast beach on both sides of the bridge, due to the erection of the bridge, the local geographic conditions have been changed and the local investment value has been improved, attracting more and more domestic and foreign business enterprises, capital owners and entrepreneurs to root here. For instance, in Cixi, a city on the south of the bridge, under the influence of the construction of the bridge, a new specialized industrial zone and new city - Hangzhou Bay New Zone is taking shape. Hangzhou Bay New District will cover by schedule 145 square kilometers where now an industrial block of 35 square kilometers has been developed and a total of 258 both domestic and foreign investment projects with the total investment of 42.6 billion yuan. North of the bridge, a Jiaxing Coastal New Town is rising. Coastal New Area will cover by schedule about 227 square kilometers with a population of 19.7 million.

5.2.3 The opening of the bridge has stimulated the development of industries with local characteristics, and also has enhanced industrial competitiveness

The most obvious improvement is that of the tourism industry. After the opening of the bridge, people in north bank of Hangzhou Bay can have easy access to the south bank of Hangzhou Bay, making a "back garden" of Shanghai. In particular, after the opening of Su Tong Bridge, people living in Nantong City and Jiangsu Province can be more convenient to Ningbo for touring. "three-day tour" has become a "two-day tour". "Holiday economy" phenomenon appears itself. Last year during the International Labor Day, for example, the number of tourists all over the country fell by three times while the number of tourists to our city increased by 45%. We received more than 160 million visitors during the three days, breaking the previous record.

There are more efforts to increase the export of agricultural products. After the

opening of the bridge, fresh vegetables, agricultural products and precious flowers in Ningbo can be more quickly transported to Shanghai and other places. According to the statistics of Municipal Bureau of Agriculture, our city has signed contracts of a total value of 86 million yuan on the Provincial Agricultural Fair of 2008 and Shanghai Green Expo. Other counties also become active in exhibition and sale of agricultural products in Shanghai. A number of leading agricultural enterprises such as Ningbo Zhenning animal husbandry, Jiangbei Shi Cuiying, Lu Long brothers are all set up monopoly stores in Shanghai.

5.2.4 The opening of the bridge has improved the conditions of Ningbo Port in the collection and distribution and also has enhanced the competitiveness of the port

The construction and opening of the bridge has promoted the formation of "a six-part radio" main framework of the basic highway network and the formation of modern traffic pattern, thus improving the city's comprehensive traffic network in collection and distribution and improving the conditions of Ningbo Port in the collection and distribution. Approved by the provincial government the bridge was opened in last October 11. From the distance, the distance from Suzhou, Wuxi, Changzhou, Jiaxing, Huzhou, Ningbo and other cities north of Hangzhou Bay through the bridge to Beilun port has been shortened 25-171 km than the original line crossing Hangzhou, of which Suzhou, Wuxi, Changzhou, Huzhou through the bridge to reach the Beilun port and Yangshan Port of Shanghai also have been shortened to 30km. the distance from Jiaxing through the bridge to Beilun has almost the same as that of Yangshan Port. Thus, these cities have become a shared hinterland of Shanghai and Ningbo. The opening of the bridge has enhanced the competitiveness of Ningbo Port. According to statistics of 2008, Ningbo completed the port cargo throughput of 360 million tons, up 4.8% over the previous year, ranking the second in China and the fourth in the world. Container throughput increased from 10 million standard containers to 10.846 million, growing by 16.0%, maintaining the fourth place of coastal ports in China and becoming the top ten in the world. The opening of the bridge has promoted the expansion of the hinterland of Ningbo port. Speaking of the hinterland to the sea, in 2008, the city has a net increase of 19 container lines with a total of 210, including 118 ocean Routes and 47 near Ocean Lines, 18 domestic branches and 27 domestic trading lines. Speaking of the hinterland to the land, the city has set up water-free ports in Shaoxing, Jinhua, Yiwu, Quzhou, Jiaxing, Shangrao, and Yingtian other areas.

5.3 Reflective Thinking and Recommendations

5.3.1 To strengthen the tracking of bridge economy

Compared with the research booming before the completion of the bridge, there is too little follow-up study after the completion of the bridge. In addition to some large coverage of media when the bridge was just opened, there has been no coverage of a

certain breadth and depth during the first year. I hope the relevant departments and research will conduct follow-up study after we enter the era of bridge economy. Although the author has made his best efforts, this essay is not profound enough, which can only be counted as a start for the discussion.

5.3.2 To specify the operation and management of the bridge

From the analysis of the development of and contribution made by the opening of the bridge towards Ningbo in the first year, we can only get the total number of various types of vehicles that are running on the bridge and the total amount of toll access revenues, but we cannot get such disaggregated data as the passage number of trucks, buses and so much. Without these basic data, it is impossible to measure the contribution made by the bridge on Regional Economic Development, such as cost-savings of transport, time- savings of passengers, contribution on logistics development of the port and so on. Therefore, most contents in this essay are only an indirect analysis. We propose Bridge Management Department to set identifying and counting device on the bridge, and call for provincial traffic management department to change the methods that toll revenue is calculated

5.3.3 To speed up regional economy integration

The analysis of contribution of the bridge should be set under the background of regional economic integration. In the first part of the analysis of theoretical model, we only analyzed the impact of the opening of the bridge without consideration of other changes in transportation conditions. We should see that the current changes in the traffic network around Hangzhou Bay is not only the construction of Hangzhou Bay Bridge, but also the planning and construction of Jiashao Cross River Bridge, the Shanghai-Hangzhou and Shanghai-Hangzhou maglev line. The emergence of high-speed transport modes will change the traffic conditions of all relevant cities around Hangzhou Bay, thus affecting the economic ties between these cities and Shanghai. Therefore, if we study and analyze the impact of Hangzhou Bay Bridge on Ningbo's development, it is not enough to analysis the impact Hangzhou Bay Bridge separately, but it is still necessary to expand the vision and to conduct the research based on the context of regional economic integration process. If we consider such factors as the opening of the Shanghai-Hangzhou passenger line, the strength of economic ties between the five cities in the south bank of Hangzhou Bay and Shanghai would change (see [Table 7](#)): (1) the strength of economic ties between Ningbo and Shanghai will be far behind in Hangzhou. the strength of economic ties between Hangzhou and Shanghai will be 30.5 and Ningbo will be only 20.3 with a difference of 10.2 ; (2) the strength of economic ties between Hangzhou and Shanghai will much more than that of between Jiaxing and Ningbo, thus becoming a city with the highest economic ties with Shanghai ; (3) the strength of economic ties between Shanghai and Jiaxing will fall from the first place down to the second place; (4) the strength of economic ties between Huzhou and Shanghai, and between Shaoxing and Shanghai have not changed.

Table 7: Strength of Economic Ties between Shanghai and Ningbo, Other cities (2)

	Ningbo	Hangzhou	Jiaxing	Huzhou	Shaoxing
Before the completion of Hangzhou Bay Bridge	6.7 (3)	18.9 (2)	26.6 (1)	5.3 (5)	5.9 (4)
After the completion of Hangzhou Bay Bridge	20.3 (2)	18.9 (3)	26.6 (1)	5.3 (5)	17.8 (4)
After the opening of maglev lines and passenger lines	20.3 (3)	30.5 (1)	26.6 (2)	5.3 (5)	17.8 (4)

Note: The numbers in the bracket is the ranking for the strength of economic ties between Shanghai and Ningbo and other cities.

It seems from the above results, the opening of Hangzhou Bay Bridge has produced effects on the development of Ningbo. But the effect in future will become less effective in inter-regional competition and it will not be compared with the impact of Shanghai-Hangzhou maglev lines and passenger lines on Hangzhou in a few years. Therefore, we can not be overestimated the impact of Hangzhou Bay Bridge on the development of Ningbo. Facing the changes of traffic conditions of Yangtze River Delta area, we need to analyze calmly and rationally with careful and thoughtful responses.

Chapter 6 Conclusion

This paper has focused on the construction and completion of the Hangzhou Bay Cross-sea Bridge, investigating its impact on the two important economic areas in China, the hinterlands of the ports of Ningbo and Shanghai along the Yangtze River. The Hangzhou Bay Bridge has brought various opportunities and challenges on various areas and aspects, including the transportation system, the logistics sector, as well as the industrial structure, so as to influence the economy. To be specific, the completion of the Hangzhou Bay Bridge has the most influence on the economic development of the hinterlands of the ports of Shanghai and Ningbo. According to the analysis, the Hangzhou Bay bridge has general impact on the overall development of Shanghai, as well as the industry development and foreign investment attraction of Shanghai. As a major project for improving the transportation system in the Hangzhou Bay area, the bridge has generated significant impact on the transportation status of the Port of Ningbo, such as the container transportation, in addition to the economy of its hinterland. Based on theoretical model analysis focusing on Ningbo, the economic ties between cities have been indicated. Moreover, the theoretical model analysis has

also figured out the actual effects of the Hangzhou Bay Bridge on the Ningbo port and its hinterland, which include: improving regional transportation and status of Ningbo; promoting the flow of elements and resources; stimulating the development of industries and enhancing industrial competitiveness; improving the conditions of the Ningbo port so as to enhance the competitiveness of the port. Accordingly, several recommendations have been developed in response to the research, which are: to strengthen the tracking of the bridge economy; to specify the operation and management of the bridge; and to speed up regional economy integration.

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