8-4-2007

The analysis and forecast of cargo throughput in inland waterway port of Baoshan District, Shanghai

Xiang Gu

WORLD MARITIME UNIVERSITY

Shanghai, China

The Analysis and Forecast of Cargo Throughput in Inland Waterway Port of Baoshan District, Shanghai

By

Gu Xiang

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)

2007

Declaration

I certify that all the material in this research paper 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 research paper reflect my own personal views, and are not necessarily endorsed by the University.

(Signature):

(Date):

Supervised by

Professor Shi Xin

Shanghai Maritime University

Assessor

Associate professor Gunnar Stefensson

Chalmers University, Sweden

Co-Assessor

Professor Liu Wei

Shanghai Maritime University

ACKNOWLEDGEMENT

First of all, I would like to owe my deepest appreciation to my supervisor, Professor Shi Xin. His guidance, support and encouragement throughout my dissertation writing are invaluable and critical. Without his insightful suggestions and continuous assistance, this dissertation would not have been completed. Also, his intelligence, wisdom, kindness and patience I have enjoyed during my study will benefit me for life.

I deeply thank Professor Liu Wei, and Professor Gu Weihong, for offering me some valuable advice in establishing the framework of my dissertation and some thought-provoking comments that improve the quality of this dissertation.

I am grateful to Ms. Zhou Yingchun, Ms. Qu Shanshan, and Mr. Zhu Minjian, who are in charge of this joint postgraduate program on behalf of Shanghai Maritime University, as well as many dear friends. It is their help and assistance that make my life in Shanghai Maritime University an enjoyable experience.

ABSTRACT

Title of Dissertation: **The Analysis and Forecast of Cargo Throughput in Inland Waterway Port of Baoshan District, Shanghai**

Degree: **Master of Science in International Transport and Logistics**

Along with the speedy increase of national economy and the construction of Shanghai international shipping center, the development of inland waterway network in Shanghai has faced many opportunities as well as challenges. Those phenomena bring the new requirements to the port designers to rethink the future planning and the development strategies of the inland ports. The layout, orientation, new construction or improvement of the infrastructure must base on the forecasting result of the cargo throughput in order to insure the work capacity and the financial return in a certain period. This research paper studies on the cargo categories analysis and the cargo throughput forecasting in inland port of Baoshan district in Shanghai. By using qualitative and quantitative analysis to make the researches on:

1. To find out the development process and successful experience of inland waterway transportation in foreign countries.
2. To analyze the demand and supply of inland waterway transportation in Baoshan district.
3. To forecast the cargo throughput of Baoshan in 2010, 2015, and 2020.
4. To introduce the comprehensive future planning of inland waterways network in Baoshan.

By doing the studies as mentioned above, the purpose of this dissertation should achieve:

1. To get the future trends of the cargo transportation in inland ports of Baoshan

district.

2. To introduce the comprehensive future planning and to make recommendation to the port designers.

Key words: inland waterway, cargo analysis, forecast.

Table of content

List of Tables

List of Figures

Chapter 1

Introduction

1.1 Background

Inland waterway transportation is a traditional transportation mode, which has demonstrated more and more advantages of environmental protection, sustainable development and the improvement of life quality. According to the experience of some foreign countries, inland water transportation plays an important role in the development of national and regional economy, such as the Mississippi valley in the United State, and the Rhine in West European countries. Compared with other transportation modes, water transportation has its comparative advantage of environment friendly, and it has comparatively lowest external costs. ("An external cost is a cost not included in the market price of the goods and services being produced, i.e. A cost not borne by those who create it.") (EEA Glossary, European Environment Agency)

China has ample water transport resources. Large rivers link from east to west, and north to south. These rivers provide favorable conditions for inland shipping. The major inland waterways which operated in China are the Yangtze River, the Pearl River, the Huaihe River and the Helongjiang River network. The inland waterway transportation has become a crucial part in China's integrated transportation system by the fast development of several decades. Especially, it is one of the main transportation modes in the Yangtze River Delta and the Pearl River Delta areas. The improvement of inland waterway transportation network plays an important role in releasing the pressure of other inland modes (road & railway), optimizing the rational layout of productive force in hinterlands and promoting the national economic and social development. (Huang, 2001) However, many problems exist during the development of inland waterways, such as some reasons of insufficient depth, inadequate river port infrastructure and poor inland transport connection. There are three key areas should be improved in the future planning—infrastructure, transport equipment, and transportation management and organization. (China-Inland Waterways Multipurpose Project, the World Bank) According to these drawbacks, the Chinese government has established future planning for the development of inland waterways.

1.2 Aims and Objective

Shanghai is located in the Yangtze River Delta with excellent hinterlands which include Shanghai, the south of Jiangsu province, and the north of Zhejiang province. The demand of traditional inland waterway transportation of domestic trade in Shanghai is general cargo and bulk cargo. To be a part of the whole river-sea-land logistics system, inland port in Shanghai still hamper it to provide the pivotal port with strong support, and the infrastructure, handling equipment, and management systems are need to be improved to achieve the nation's objectives. The construction of Shanghai international shipping center brings many opportunities and financial supports to the further improvement in inland waterway network. However, the layout, construction, and investment of the port require accurate forecasting on the cargo throughput. In other words, the analysis and forecasting of cargo throughput is the first job that must be done before the port design and the improvement process. This dissertation will conduct the studies on the cargo categories analysis and the forecasting of the cargo throughput in inland waterway network of Baoshan district in Shanghai.

The purpose of the research is to study and analyze the configuration of the inland transportation demand in Baoshan, by using economic forecasting model to predict the cargo throughput in 2010, 2015, and 2020, and to introduce the comprehensive future planning of inland waterway transportation network which is projected by Baoshan people's government.

The main contents of this dissertation include:

1) To introduce the experience of inland waterway network development in the European Union and the general situation in Baoshan district;
2) The marketing research and analysis focuses on the vessel supply, cargo categories and the cargo flow directions in the inland waterways network of Baoshan;
3) To find out the forecasting results of the cargo throughput in 2010, 2015, 2020;
4) The introduction of future planning on the aspect of inland waterways network in Baoshan district.

1.3 Literature review

According to the Chinese and foreign published literatures on the aspect of "inland waterway transportation" and "the cargo throughput forecasting model", the research scope covers five categories: Firstly, some articles talked about the law, regulation and policy, which is instructed by Chinese government on the development of inland waterway transportation. Secondly, to compare Chinese inland waterway transportation systems and those systems in some foreign countries in order to recommend the future construction plan. Thirdly, some analysis focuses on the relationship between the economic development of hinterland and the fluctuation of the cargo throughput of inland port. Fourthly, to analyze the influential factors on the freight flow volume, such as Gross Domestic Product (GDP). Fifthly, some economic forecasting models are established in the application of the cargo throughput prediction.

The research methodology of this dissertation focuses on two sections. The first section is the marketing research, which is conducted in Baoshan district. This section is going to collect the primary data from official statistics and questionnaire in order to process, calculate and analyze current situation of transport equipment, cargo categories, cargo flow directions and periodic fluctuation of cargo throughput. The second section is to predict the future trends of the cargo throughput in inland water transportation system in Baoshan. This section is going to establish economic forecasting models and then find out the forecasting results.

The marketing research process has four major steps. The first is to define the problems and research objectives; the second is to develop a research plan for data collection; the third is to collect and analyze the data; the last one is to interpret the finding results. (Kotler & Armsterong, 1996, p116) The most important part in this dissertation is cargo analysis. The primary data used in this part are collected from local maritime safety administration and questionnaires. The measurement of the primary data depends on the three major criteria—reliability, validity, and sensitivity. (Zikmund, 2003, p231) The questionnaire design focuses on the operational situation in 2005 & 2006 for each wharf in Baoshan district. Other parts with the information introduction and analysis will use secondary data collection. The forecasting model methodology will be stated in the Chapter 4.

Chapter 2

Inland waterway network in the European Union and Baoshan district of Shanghai

2.1 The introduction of inland waterway transportation in European Union

It is undoubted that the inland waterway transportation has offered great contribution to the development of economy and society. Nowadays, many developed countries have paid more attention to the shipping condition, the improvement of infrastructure, and they have taken a series of policies to encourage the development of the inland waterway transportation network due to its unique advantages of a great deal of transportation volume, lower costs, comparatively less investment, and environmental friendly compared with other inland modes. (Zhang, 2005) In this section, the discussion will focus on the inland waterway transportation network of Pan-European Union—25 countries instead of 15 countries, to examine its general situation, and the improvement of the infrastructure in the inland waterway network.

2.1.1 The inland waterway network

According to the research project of “Prospects for Inland Navigation within the enlarged Europe” in 2004, there are about 36,500 kilometers inland waterways estimated in Pan-European Union. The waterways can be classified as four categories based on the importance of the transportation infrastructure:

Trans-European capital waterways, International waterways, National waterways, and Waterways of regional importance. For the purpose of the commercial use, these inland waterways have been divided into seven classes. The Class I to III is National waterways and the waterways of regional importance. The Class IV to Ⅶ is for international importance. (Prospects for Inland Navigation within the Enlarged Europe （PINE）, 2004, p119)

The main corridors of the integrated river network in the European Union (EU) have four-- Rhine Corridor, Danube (South-East) Corridor, East-West Corridor, and North-South Corridor. In addition, there are some individual waterways in the remaining network as isolated subsystems, for example, the United Kingdom, Sweden, Finland, the Baltic countries (Latvia and Lithuania), Italy and the Iberian peninsula (Spain and Portugal). (PINE, 2004, p112)

In the whole network of the inland waterway in Pan-European Union, the Rhine plays a decisive role to offer the transport capacity, which carries two- third of all transport by inland waterways in Western Europe although the level of traffic may be influenced by the low water in some years. In 2004, the transportation demand remained constant compared with previous years, the total Rhine traffic could be divided into three parts: traditional Rhine traffic (only traffic using the German and French sections of the Rhine), national Dutch traffic and International traffic which only uses Dutch waterways. The total Rhine traffic (covers the transport over the entire length of the Rhine) was about 320 million tons, which has almost the same cargo throughput with 2000 and 2001, 10 million tons and 30 million tons increase more than 2002 and 2003 respectively. The traditional Rhine traffic accounted for over 60% in each year, which fluctuated slightly with the differences between the total Rhine traffic in each year. (Market observation for European inland navigation, Ⅰ-2005, p11&12) In 2005, the situation was almost the same, only 0.8% decrease in the total Rhine traffic and 1.5% decrease in the traditional Rhine traffic. (Market observation for European inland navigation, Ⅰ-2006, p17)

The cargo transportation in the Danube (South-East) Corridor was fluctuated in the past several years because the poor situation of water condition between Danube-Rhine route. For the cargo carriage in the East-West Corridor, and the North-South Corridor, container transportation has made large progress than other cargos transportation. (Market observation for European inland navigation, Ⅰ-2006, p19) For those countries are located in the isolated subsystems, the inland waterways are mainly used for direct inland to sea transportation and for some recreational purposes. (PINE, 2004, p125)

One of the prevailing manners in the network of the EU is direct river-sea transport (A vessel can sail on both inland waterways and coastal areas avoiding transshipment in the seaport), which are mainly developed between some ports in the Rhine corridor, the east coast of Britain, Sweden and Finland due to the advantages of time saving, cost saving, and pressure releasing for seaports. (PINE, 2004, p125) Moreover, many countries have improving their roles from intermodal nodal points to the trimodal (inland waterway, road and rail) transport center to decrease the dependency of traditional inland water transshipment in order to offset the limitation of the nautical capacity. (PINE, 2004, p164)

2.1.2 The improvement of the infrastructure

The capacity and quality is very important in the inland waterway network, which has decisive position to decide the volume of transportation, the cost of transaction, the work efficiency, and the technical and safety issues. The improvement of the infrastructure in the EU is mainly emphasis on two sections: the removal of missing links and bottlenecks and the utilization of small waterways.

The removal of missing links and bottlenecks are described in three cases in the market research paper of PINE 2004. The first case is Seine-Scheldt project. This project is a long term and large construction work within the framework of the Trans-European Transport Networks, and the canal is expected to be opened in 2010. (The Seine-Scheldt Project, 2005) The major benefit of this project is-- it will admit the ship and push-barge to sail in this area from 650 tons up to 4,400 tons. The project will bring extra opportunities for chemical and container transport, to improve the economic development in the north-south corridor, and the evolution of the logistic system. (PINE, 2004, p526-527) The second case is the upper Danube project. The main task of this project is to improve the inland navigability of the upper Danube due to the reason of low-water level. By solving this problem, the river may have further depth, by using 2.5m draught as a sufficient fairway conditions, the benefits of this improvement are: the cost saving on congestion, the reduction of investment on the road system, and the reduction of external costs on noise, CO_2-emissions, and landscape consumption. (PINE, 2004, p536) The third case is the Elbe River project. The purpose of improvement is also for the utilization of navigability as the same situation as the case two.

The other section of infrastructure improvement is the utilization of the small waterways. The small waterway is a common problem in the inland waterway network, which block the regional development and increase the total transportation costs from transshipment. The markets report of PINE 2004 concluded several characteristics for the small waterways.

First, the limitations of the small waterway itself have (PINE, 2004, p554-556):

a. Only limited types of ship can be used for the transportation in the small waterways.

b. The waterways cannot be used for commercial transportation without transshipment point, which increases the total costs.
c. Locks are needed in the small waterways area.
d. The situation of transportation is fluctuated by the seasonal condition.

Second, the distribution of the small waterways in the EU is directly connected with the high class waterways, or connected with the sea route, or the small waterways are isolated, but there is no connection with large waterways at all. Third, the characteristics of the current usages of the small waterways are cargo transportation and recreation. The conflicts of the usages have two aspects: one is the reinvestment on the maintenance and management of the infrastructure with the decreased utilization of the small waterways; the other is the conflict between the recreational navigation and the commercial navigation, which could lead to accident easily. However, although the small waterways have many drawbacks, the research also pointed out that the small waterway is an important part of the whole inland waterway network in the EU, some of them will contribute more to the economic development in the future with further improvement, which could include the modal shift potential. (PINE, 2004, p556-559)

The development of the inland waterways in the Pan-European Union is a favorable mode of transportation whether from the aspect of the legislation and policy or the economic and environmental points of view. (Inland Navigation Europe) The community and local authority has been improving the infrastructure and shipping condition to overcome the drawbacks and bottlenecks in the network in order to increase the utilization, to balance the economic development between different member countries, and establish the same standards for fair competition and safety issues. Moreover, the emphasis on the goods transportation is shifting from the dry bulk cargo to the high value cargo due to the higher benefits are generated from the evolution of containerization, the development of multimodal transportation, and the growing trend of integrated logistics system. (Chen, 2002) The inland waterway navigation faces the intensive competition with other inland modes as well as the closed cooperation between each other. The aim of the community is to expect a successful integration of the new members into the Union.

In the following section, this paper will focus on the analysis and comparison for the inland waterway network in the Baoshan district of Shanghai.

2.2 Inland waterway network in Baoshan district of Shanghai

Baoshan district of Shanghai is located in the intersection of the Yangtze Rive and the Huangpu River. As a riverside and coastal region, Baoshan has unique advantages in inland waterway transportation with good multi-modal transportation network and navigation system.

a. ferry transportation

There are five ferry wharfs in Baoshan district, two of those are along the Yangtze Rive, and three of those are along the Huangpu River. The total number of berths is 17 to deal with the ferry business between Chongming, Changsha, Hengsha inner Shanghai city, and the ferry transportation between Shanghai, Zhejiang and Jiangsu province. (Shanghai Baoshan People’s Government Office)

b. cargo transportation

The inland waterways in Baoshan district are about 108 kilometers, the new constructing and operating wharfs were 200, and the total number of berth is 475.

The Wenzaobang River in Baoshan is an important navigation section in the inland shipping line between Suzhou and Shanghai, which is also one of the major rivers in Shanghai. The wharfs in this section are 300, which accounts for 60% of the total wharfs in the district. (Shanghai Baoshan People's Government Office)

The integrated development of Baoshan District and Baosteel jointly forged the "Changjing River Delta" industrial hub, forming the fine steel industrial base of Shanghai. In addition, with convenient transportation, consummated infrastructure and ample supply of water, the development of micro-electronics industry, nanometer technology industry, biological and pharmaceutical industry, port machinery manufacturing, container manufacturing base and international logistics park has produced derived demand of inland waterways and multi-modal transportation. (Shanghai Baoshan People's Government Office) The following chapters will emphasis on the cargo and vessel analysis to find out the characteristics of demand and supply sides in using inland waterways in Baoshan.

Chapter 3

The analysis of the cargo turnover in inland port of Baoshan district, Shanghai

3.1 Data collection

The analysis and forecasting of the cargo turnover in inland port of Baoshan district is based on the historical data records of vessels and cargos discharging and loading registrations. Those data were collected from three sources. The first is the questionnaire. For this part of data, the sampling design and procedures depends on 200 wharfs (excluded new constructions) in Baoshan district, the feedback is 142--about 70% of total. The second is the vessel registrations which were collected from local maritime safety administration. The maritime safety administration of Baoshan district has five branches, and each branch provides the detailed vessel operational registration of August 2006 and January 2007. The third is the official statistics of the cargo throughput in inland port of Baoshan district from 2001 to 2006 by quarters. All these data are related to the information of vessel supply, cargo categories and cargo inflow/outflow directions.

3.2 Data analysis

3.2.1 The vessel analysis

For domestic cargo transportation, the vessel has been classified into five levels according to the gross registered tonnage by the local maritime safety administration (see table 1) for official statistics, this standard will be used for vessel analysis during this research procedure.

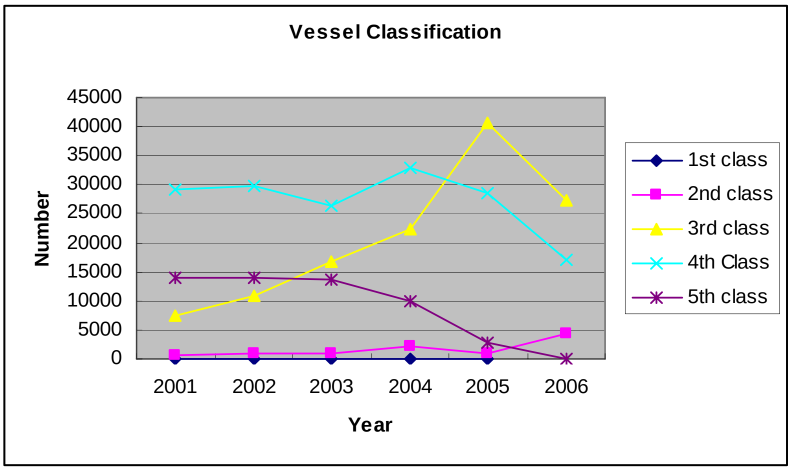
Table 1- Vessel Classification

Vessel Classification	
First Class	> 1600 tons
Second Class	600-1600 tons
Third Class	200-600 tons
Fourth Class	50-200 tons
Fifth Class	< 50 tons

1) The general information

According to the data records from 2001 to 2006, the total vessels supplied to the inland water transportation in Baoshan district with different classification as followed:

Figure 1- General information of the vessel supply from 2001-2006



As can be seen from the Figure 1, the third and the fourth class vessel dominated the supply of the inland water transportation market in Baoshan district although that total number of the voyages (inflow plus outflow) has declined. Moreover, the large decrease of the fifth class vessel was replaced by the slowly increase number of the second class vessel, which indicates that the average tonnages of the vessels were increasing. Those findings can be approved in the following analysis:

Figure 2- Vessel supply for cargo inflow from 2001-2006

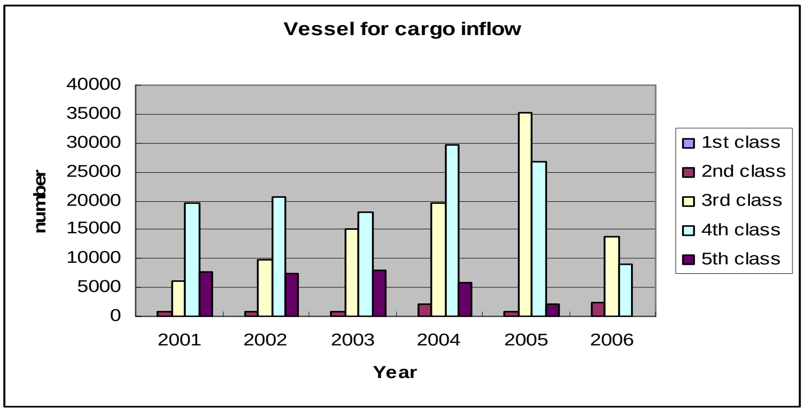
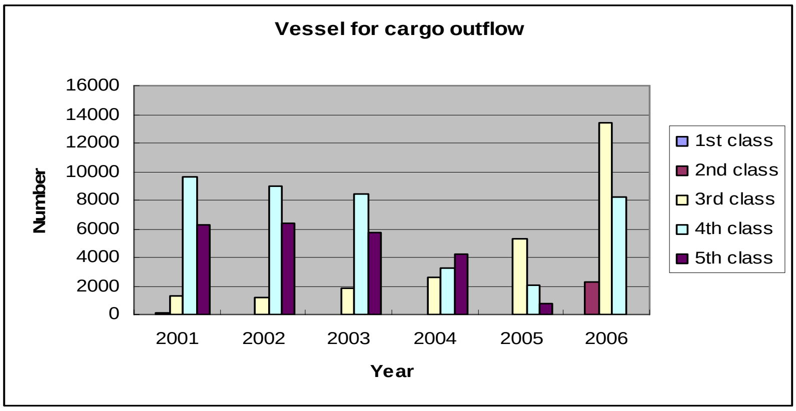


Figure 3- Vessel supply for cargo outflow from 2001-2006



According to those two Figures, the vessel supply for cargo inflow/outflow during the period of 2001-2006 has four characteristics. Firstly, the fourth class vessel took large number of voyage in the last 6 years both in the transportation of cargo inflow and outflow. Secondly, the fifth class vessel was clearly decreased from 2001 to 2006 for both cargo flow directions. Thirdly, the number of third class vessel increased for cargo outflow from Baoshan district, and it also took large number of cargo inflow transportation even exceeded the number of the fourth class vessel in 2005 and 2006. Finally, the first class vessel and the second class vessel were few used for the inland water transportation in Baoshan district.

2) The analysis of vessel supply tonnages

The Shanghai maritime safety administration has five branches in Baoshan district: Wusong, Jiwen, Wendong, Baosteel, and Luodian. Each branch provided two month vessel operational registrations for this marketing research program. August 2006 and January 2007 are selected as research sampling due to some considerations of weather condition and timing factor.

- **Baosteel branch**

Figure 4- Vessel supply in Baosteel branch

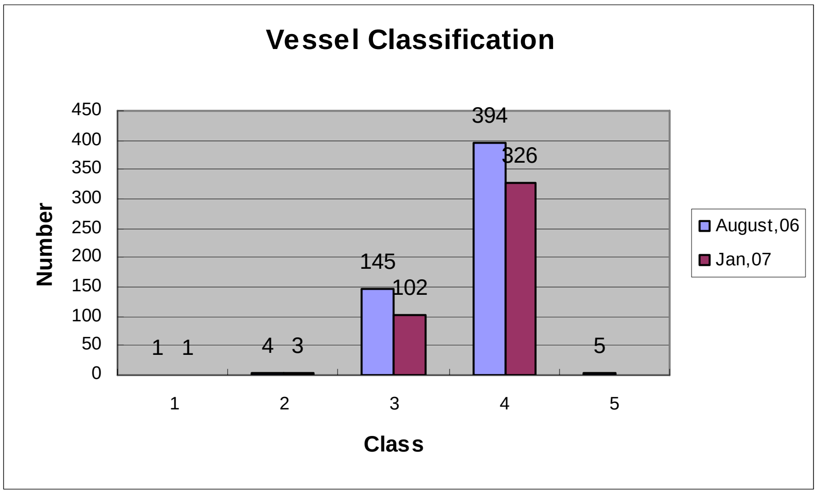


Figure 5- The transporting frequency distribution in Baosteel (August, 2006)

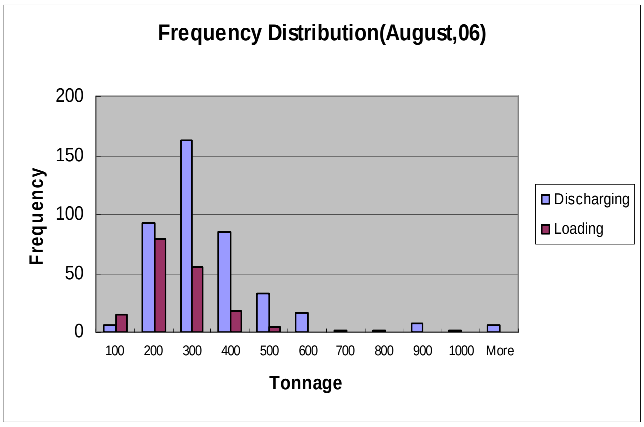
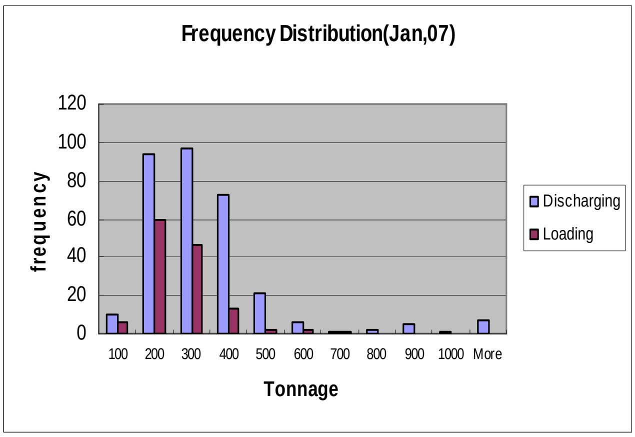


Figure 6- The transporting frequency distribution in Baosteel (January, 2007)



As can be seen from the Figure 4, 5 & 6, the total vessel number was 549 times in August 2006, and 435 times in January 2007. The fourth class vessel was to be used as 60%-70%, and the cargo inflows exceeded the cargo outflows.

- **Jiwen branch**

Figure 7- Vessel supply in Jiwen branch

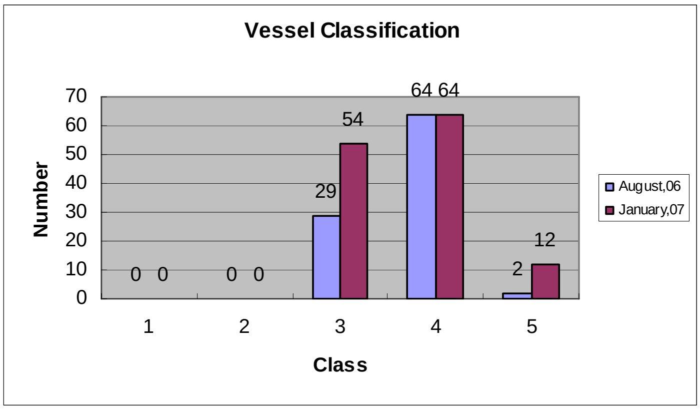


Figure 8- The transporting frequency distribution in Jiwen branch (August, 2006)

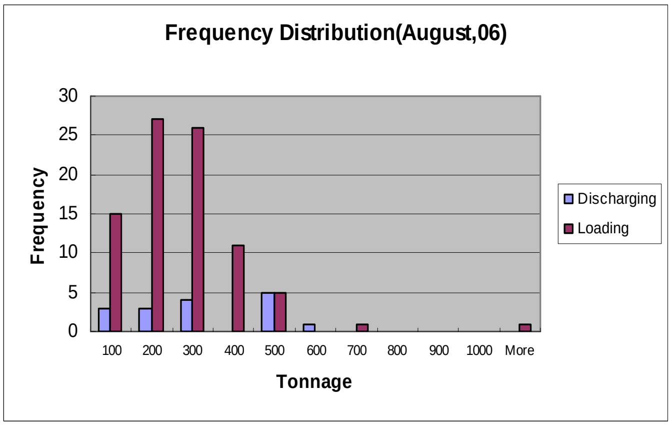
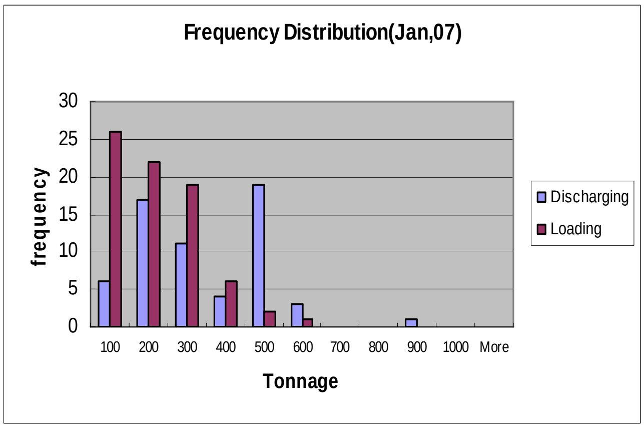


Figure 9- The transporting frequency distribution in Jiwen branch (January, 2007)



The Jiwen branch dealt with 95 vessel operational registrations in August 2006 and 130 vessel operational registrations in January 2007. The third class and the fourth class vessel were mostly to be used for cargo transportation. The frequency distributions of cargo movement in these two month (see Figure 8 & 9) show the number of loading cargo had much higher frequency than the number of discharging cargo from 100 tons to 400 tons per voyage. The discharging cargo was mostly moved by 500 tons per voyage in August 2006, 200 tons and 500 tons per voyage in January 2007.

- **Luodian branch**

Figure 10- Vessel supply in Luodian branch

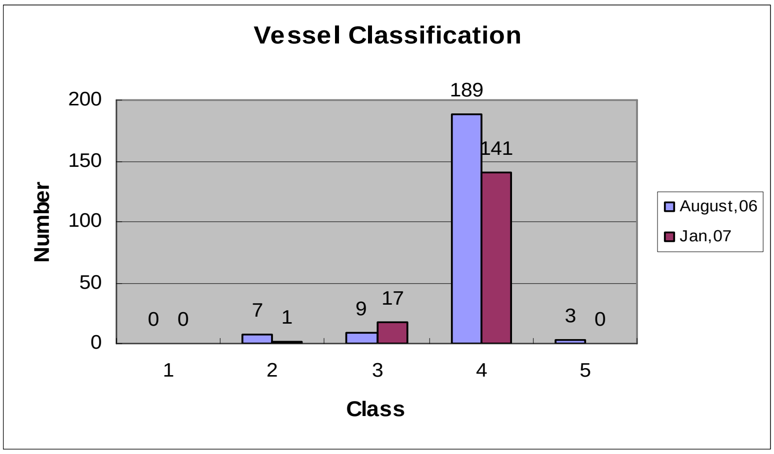


Figure 11- The transporting frequency distribution in Luodian (August, 2006)

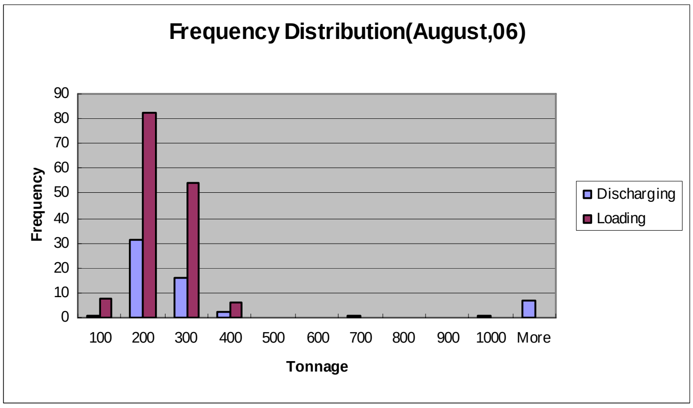
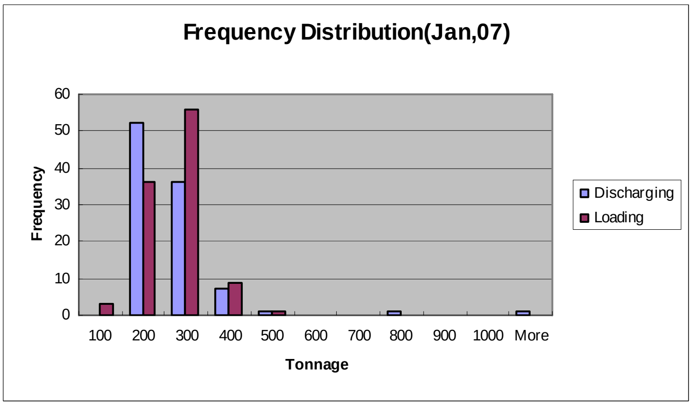


Figure 12- The transporting frequency distribution in Luodian (January, 2007)



The Luodian branch dealt with 208 voyages in August 2006 and 159 voyages in January 2007. There was 20% decrease. The cargo was transported by the fourth class vessel as around 90% of the total. The frequency distribution of cargo transport in Luodian was quite different from other areas. (See Figure 11 & 12) Although the cargo was mostly transported by 200-300 tons per voyage in both months, the cargo discharging movement used more large vessels in August 2006 than in January 2007. That is to say, in comparison with January 2007, August 2006 had fewer number of discharging voyage with the similar tonnages of total inflow cargo transportation.

- **Wendong branch**

Figure 13- Vessel supply in Wendong branch

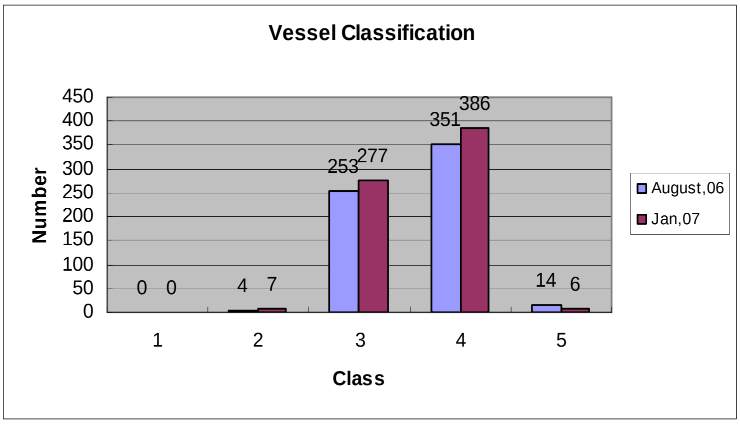


Figure 14- The transporting frequency distribution in Wendong (August, 2006)

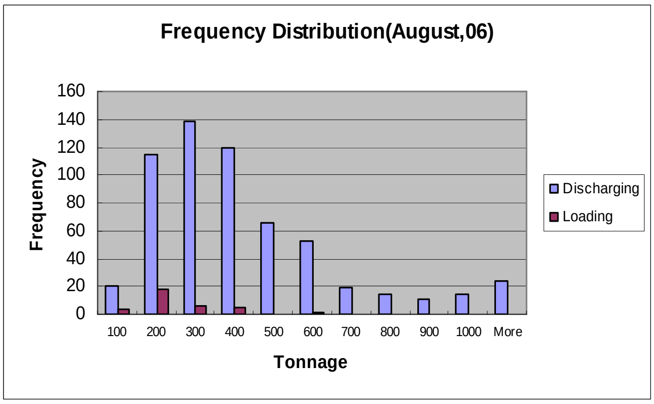
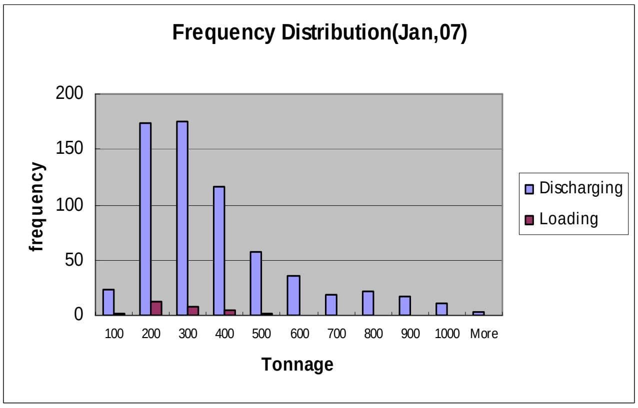


Figure 15- The transporting frequency distribution in Wendong (January, 2007)



In August 2006, Wendong maritime safety administration dealt with 622 voyages of vessel operational registrations, and this number increase to 677 voyages in January 2007. The third class and the fourth class vessels were still the highest frequency used for cargo movement. The Figure 14 & 15 shows the unbalance of the cargo inflows and outflows. In addition, these bar charts illustrate that 200 tons to 400 tons cargo movement had higher frequency of each single voyage, especially for cargo discharging in both months.

- **Wusong branch**

The Figure 16 exhibits that the 55%-56% cargo transportations in Wusong were finished by the third class vessel, which were followed by the fourth class vessels -- 40% of total voyages. The Figure 17 & 18 illustrates the unbalanced cargo flow frequency distribution of discharging and loading in August 2006 and January 2007, which points out the cargo inflows and outflows were mainly between 200-600 tons per voyage. It is also testified the statistics in the Figure 16 of vessel classification—the third class and the fourth class vessel were mostly used in cargo transportation in Wusong branch.

Figure 16- Vessel supply in Wusong branch

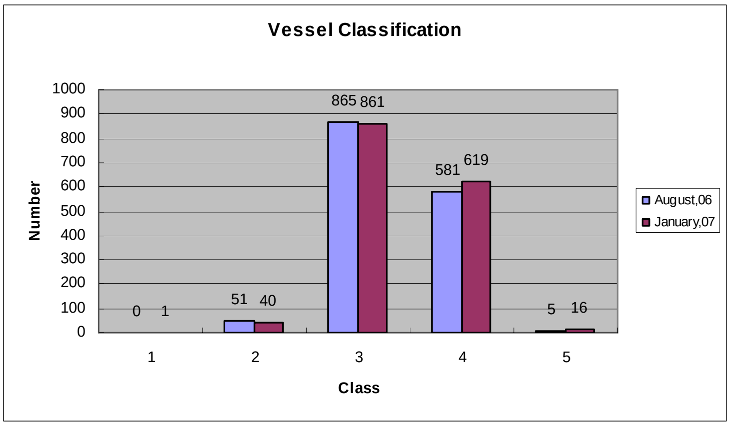


Figure 17- The transporting frequency distribution in Wusong (August, 2006)

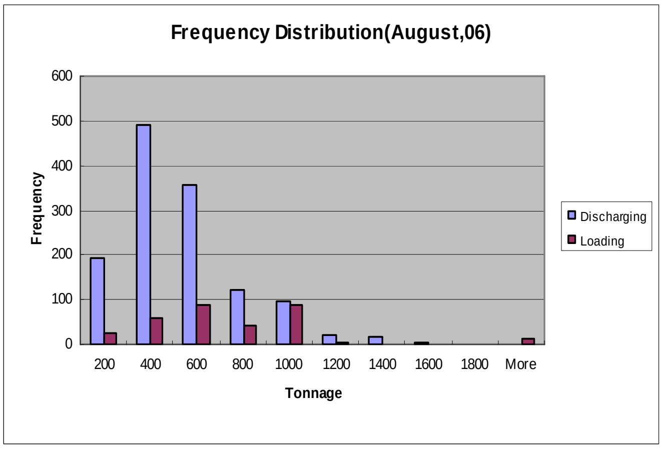
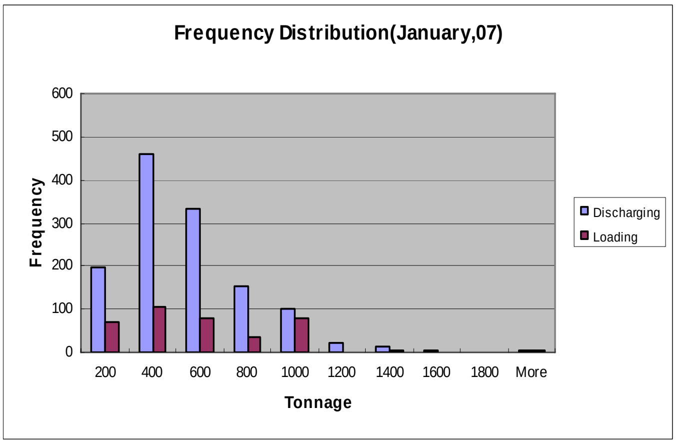


Figure 18- The transporting frequency distribution in Wusong (January, 2007)



3.2.2 The analysis of the cargo flow directions

According to the vessel registrations of August 2006 and January 2007, the total vessels supplied for cargo inflow were 2,531 voyages and 2,424 voyages respectively. The total vessels supplied for cargo outflow were 2,414 voyages in August 2006 and 717 voyages in January 2007. The vessels discharged in Baoshan district had more voyages than the vessels loaded from Baoshan obviously. Moreover, the cargo flow directions were mostly involved with Zhejiang, Jiangsu province and inner Shanghai city. The detailed information analysis depends on the vessel registrations of five branches as followed:

- **Baosteel branch**

The discharging cargos in Baosteel were mainly from Zhejiang, Jiangsu provinces and other inland ports of Shanghai. These three directions accounted for over 90% cargo inflows in August 2006 and about 87% cargo inflows in January 2007. The cargo tonnages exported from Zhejiang province did not have much difference in these two months, the Huzhou area was the major export place. However, in Jiangsu and other inland ports of Shanghai, the cargo transported in January 2007 was decreased 50% compared with the transporting tonnages in August 2006. For loading cargo, the Jiangsu province was the leading place where imported over 50% cargo from Baosteel area. (See Table 2)

Table 2- The statistics of cargo flow directions in Baosteel branch

Province	**Vessel arrival (August 2006/ January 2007)**			**Vessel departure (August 2006/ January 2007)**		
	Voyage	**Tonnage**	**% of Total**	**Voyage**	**Tonnage**	**% of Total**
Shanghai	112 / 52	33,772 / 16,261	25.71% / 16.70%	20 / 11	3,815 / 1,716	10.39% / 5.86%
Jiangsu	167 / 108	55,415 / 32,069	42.18% / 32.93%	104 / 73	22,021 / 16,190	59.96% / 55.27%
Zhejiang	124 / 123	39,158 / 37,396	29.81% / 38.40%	46 / 39	9,882 / 8,806	26.91% / 30.06%
Anhui	7 / 28	2,405 / 9,440	1.83% / 9.69%	3 / 7	910 / 2,580	2.48% / 8.81%
Hubei	0 / 1	0 / 340	0 / 0.35%			
Hunan						
Jiangxi	2 / 5	620 / 1,870	0.47% / 1.92%	1 / 0	100 / 0	0.27% / 0
Fujian						
Henan						
Shandong						
Total	412 / 317	131,370 / 97,376		174 / 130	36,728 / 29,292	

- **Jiwen branch**

Table 3- The statistics of cargo flow directions in Jiwen branch

Province	**Vessel arrival (August 2006/ January 2007)**			**Vessel departure (August 2006/ January 2007)**		
	Voyage	**Tonnage**	**% of Total**	**Voyage**	**Tonnage**	**% of Total**
Shanghai	1 / 3	60 / 695	1.36% / 3.72%	12 / 12	1,615 / 952	8.68% / 6.75%
Jiangsu	6 / 38	1,350 / 9,493	30.52% / 50.80%	30 / 28	5,816 / 3,982	31.27% / 28.23%
Zhejiang	7 / 16	2,764 / 7,640	62.48% / 40.88%	25 / 15	6,029 / 3,925	32.41% / 27.82%
Anhui	0 / 1	0 / 300	0 / 1.61%	2 / 7	460 / 1,255	2.47% / 8.90%
Hubei	0 / 1	0 / 110	0 / 0.59%	3 / 4	1,040 / 1,400	5.59% / 9.92%
Hunan				1 / 2	400 / 520	2.15% / 3.69%
Jiangxi	1 / 2	250 / 450	5.65% / 2.41	11 / 8	3,240 / 2,074	17.42% / 14.70
Fujian						
Henan						
Shandong						
Total	15 / 61	4,424 / 18,688		84 / 76	18,600 / 14,108	

The Table 3 shows that there was more cargo discharging in January 2007 than the cargo discharging in August 2006. Zhejiang and Jiangsu provinces were the main cargo export areas in both months. All cargos exported in Jiangsu province were from Nantong, Suzhou and Taizhou, which accounted for 31% of total amount in August 2006. The cargos came from Zhejiang province that accounted for 62% of the total. In January 2007, these two provinces occupied 90% of total discharging tonnages as well. The Table 3 also illustrates the loading cargos which mainly went to Zhejiang, Jiangsu and Jiangxi province. There was more cargo loading tonnages in August 2006 than the cargo loading in January 2007.

- **Luodian branch**

Table 4- The statistics of cargo flow directions in Luodian branch

Province	Vessel arrival (August 2006/ January 2007)			Vessel departure (August 2006/ January 2007)		
	Voyage	Tonnage	% of Total	Tonnage	Voyage	% of Total
Shanghai	2 / 0	470 / 0	2.31% / 0	8 / 11	1,940 / 2,320	6.58% / 9.75%
Jiangsu	15 / 28	4,010 / 6,740	19.72% / 29.23%	86 / 37	16,410 / 8,510	55.69% / 35.76%
Zhejiang	39 / 66	15,184 / 15,110	74.67% / 65.52%	49 / 49	10,075 / 11,180	34.19% / 46.97%
Anhui	3 / 4	670 / 1,210	3.29% / 5.25%	7 / 8	1,040 / 1,790	3.53% / 7.52%
Hubei						
Hunan						
Jiangxi						
Fujian						
Henan						
Shandong						
Total	59 / 98	20,334 / 23,060		150 / 105	29,465 / 23,800	

The cargo flow directions involved with 3 provinces except the cargo movement from and to inner Shanghai city. (See Table 4) The discharging cargos did not changed a lot in these two months, Zhejiang province (Huzhou & Jiaxing) exported 65%-75% of the total tonnages to Luodian area, the cargo inflow came from other inland ports of Shanghai only happened in August 2006. For cargo outflow, Zhejiang and Jiangsu were the main cargo import places-90% in August 2006, and 81% in January 2007.

- **Wendong branch**

The Table 5 shows the cargo inflows to Wendong were mainly from Zhejiang, Jiangsu, and Jiangxi provinces (85% of total), and the cargo outflows mostly went to Jiangsu province (over 65% of total). The flow directions and cargo tonnages was similar in both months. In Zhejiang province, Hangzhou, Huzhou and Jiaxing were the main export areas. In Jiangxi province, the cargo mostly came from Jiujiang to Wendong. In Jiangsu province, Changzhou and Suzhou were the main export areas, and the import cargo went to Nantong and Wuxi areas.

Table 5- The statistics of cargo flow directions in Wendong branch

Province	**Vessel arrival (August 2006/ January 2007)**			**Vessel departure (August 2006/ January 2007)**		
	Voyage	**Tonnage**	**% of Total**	**Voyage**	**Tonnage**	**% of Total**
Shanghai	86 / 53	28,475 / 17,363	12.01% / 7.91%	3 / 2	350 / 390	4.91% / 5.81%
Jiangsu	254 / 188	59,245 / 57,154	24.99% / 26.04%	24 / 19	4,803 / 4,400	67.33% / 65.57%
Zhejiang	245 / 329	83,033 / 93,828	35.02% / 42.75%	2 / 1	410 / 240	5.75% / 3.58%
Anhui	14 / 18	4,930 / 7,210	2.08% / 3.29%	3 / 4	630 / 980	8.83% / 14.61%
Hubei	9 / 2	3,300 / 1,280	1.39% / 0.58%	3 / 2	940 / 700	13.18% / 10.43%
Hunan						
Jiangxi	67 / 62	58,096 / 42,537	24.50% / 19.38%			
Fujian						
Henan	0 / 1	0 / 100	0 / 0.05%			
Shandong						
Total	675 / 653	237,079 / 219,472		35 / 28	7,133 / 6,710	

- **Wusong branch**

The statistics of the cargo flow directions in Wusong branch is in the following table:

Table 6- The statistics of cargo flow directions in Wusong branch

Province	Vessel arrival (August 2006/ January 2007)			Vessel departure (August 2006/ January 2007)		
	Voyage	Tonnage	% of Total	Voyage	Tonnage	% of Total
Shanghai	64 / 112	23,018 / 39,244	3.86% / 6.70%	12 / 39	2,860 / 9,400	1.37% / 4.66%
Jiangsu	437 / 449	147,700 / 173,225	24.78% / 29.58%	37 / 91	18,659 / 43,374	8.93% / 21.48%
Zhejiang	547 / 509	228,307 / 233,833	38.30% / 39.93%	223 / 208	162,199 / 132,254	77.63% / 65.52%
Anhui	129 / 96	59,999 / 51,074	10.07% / 8.72%	6 / 8	1,605 / 2,045	0.77% / 1.01%
Hubei	115 / 77	77,569 / 60,990	13.01% / 10.41%	28 / 20	15,760 / 9,790	7.54% / 4.85%
Hunan	12 / 6	6,550 / 3,551	1.10% / 0.61%	7 / 3	2,900 / 1,840	1.39% / 0.91%
Jiangxi	53 / 31	45,865 / 20,655	7.69% / 3.53%	3 / 9	1,050 / 3,160	0.50% / 1.57%
Fujian	11 / 4	5,894 / 2,790	0.99% / 0.48%			
Henan	0 / 1	0 / 320	0 / 0.05%	1 / 0	600 / 0	0.29% / 0
Shandong	2 / 0	1,200 / 0	0.20% / 0	4 / 0	3,300 / 0	1.58% / 0
Total	1,370 / 1,285	596,102 / 585,662		321 / 378	208,933 / 201,863	

The Table 6 shows the general information of cargo inflow/outflow in Wusong of these two months. The cargos came from nine provinces expect the inner movement in Shanghai city. Zhejiang was the first leading province for cargo inflows in Wusong, which was followed by Jiangsu, Hubei, Anhui, Jiangxi, and Shanghai. These six directions accounted for over 90% of cargo inflows to Wusong. For the first two leading province—Zhejiang and Jiangsu: Huzhou and Ningbo occupied 60% of cargo movement from Zhejiang province; Nanjing and Wuxi occupied 55% of cargo movement from Jiangsu province. Moreover, the cargo outflow directions were extremely the same as the cargo inflows although the volumes were difference. Zhejiang was the first leading province for cargo importing from Wusong, which accounted for 65%-77% of the total amount – thereof 90% cargo transportation activities were from Ningbo and Wenzhou city.

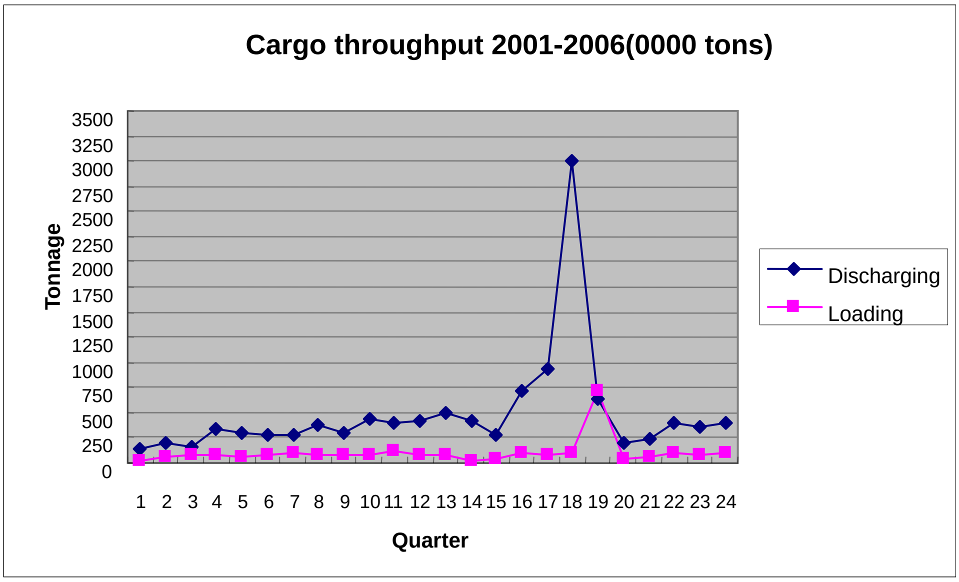
3.2.3 The analysis of cargo configuration

1) General information

- **Cargo throughput**

The local maritime safety administration provided the annual statistics of cargo throughput in Baoshan district as well by quarterly analysis from 2001 to 2006. The Figure 18 shows the trend of the cargo throughput in these 6 years.

Figure 18- Cargo throughput from 2001 to 2006 in Baoshan district



The tonnage amount of cargo inflows to Baoshan district fluctuated between 2,000,000 tons to 5,000,000 tons from 2001 to the third quarter of 2004. The cargo discharged in Baoshan increased rapidly from the fourth quarter of 2004 to 2005, it reached the peak at the second quarter of 2005, and then the amount of the cargo inflows went back to 2,000,000 tons in the fourth quarter of 2005. In 2006, the transportation amount of these four quarters did not change too much, and the cargo inflow followed the previous trend before the fourth quarter of 2004. The trend line of cargo outflow amount from Baoshan was quite steady, except the huge increased in 2005. The highest point of cargo outflow was in the third quarter of 2005-nearly 7,500,000 tons.

- **Cargo categories**

Figure 19- The discharging cargo categories in Baoshan district (2005)

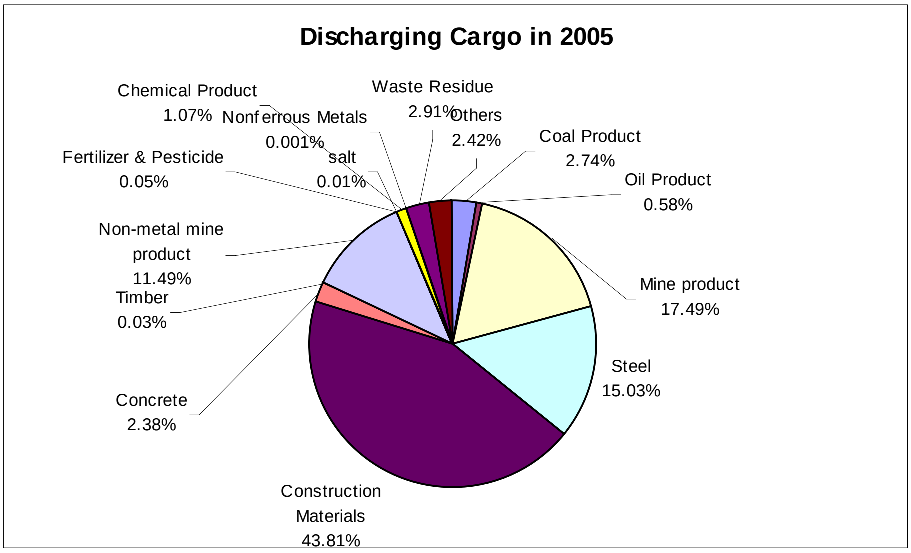


Figure 20- The discharging cargo categories in Baoshan district (2006)

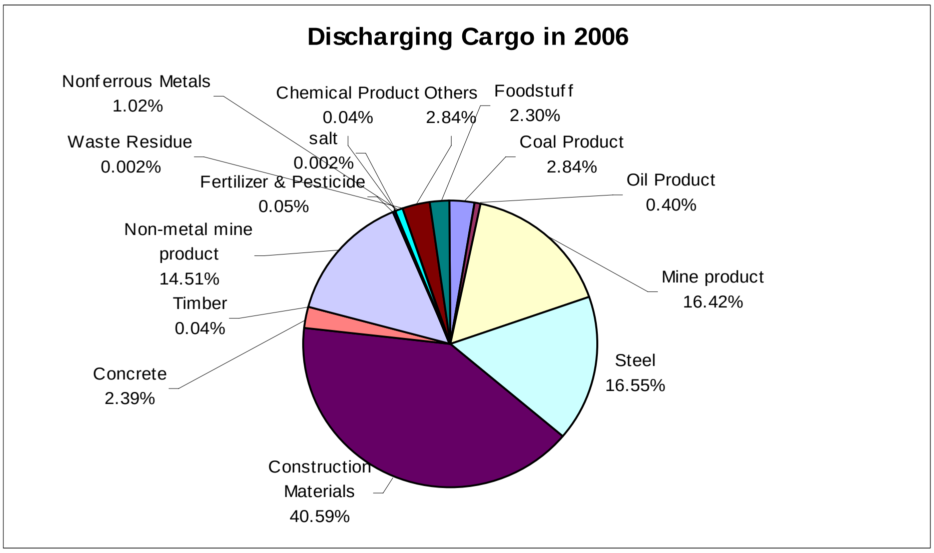


Figure19 & 20 shows the proportion of discharging cargo categories in the last two years in Baoshan. There were only slight changes between 2005 and 2006 although the figures were various, the construction materials, steel and mine product was the three leading discharging cargos.

Figure21 & 22 shows the proportion of loading cargo categories in the last two years. There were only slight changes between 2005 and 2006 although the figures were various, the construction materials, non-metal mine product, and steel were the three leading loading cargos.

Figure 21- The loading cargo categories in Baoshan district (2005)

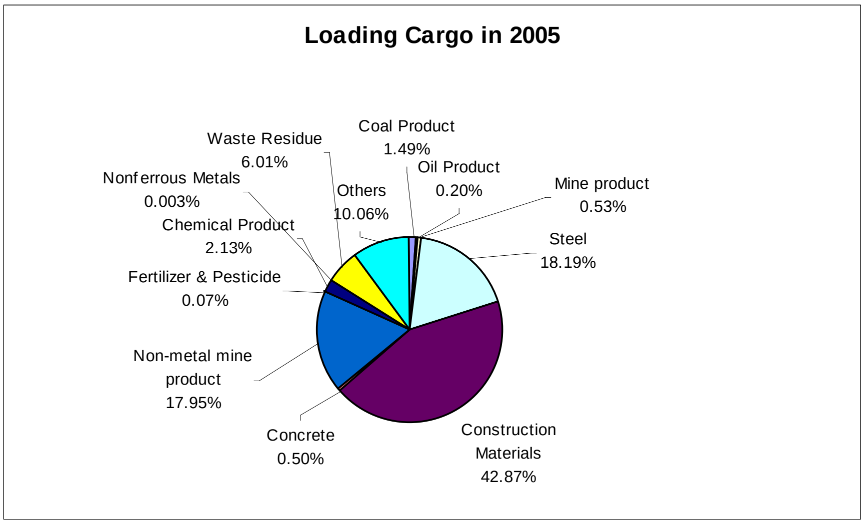
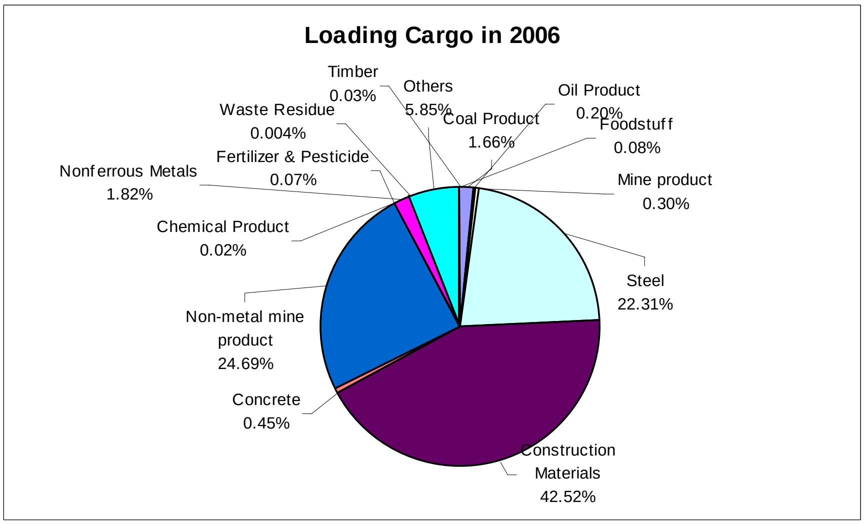


Figure 22- The loading cargo categories in Baoshan district (2006)



◆ Cargo flow direction

Most of the cargo transportations to Baoshan district dealt with the construction materials, steel, and mine product. Those three cargos can account for 80% of the total tonnages through last six years. The flow directions are from Zhejiang, Jiangsu province and other inland ports of Shanghai.

2) The detailed analysis of cargo configuration

The questionnaire has 142 feedbacks of total 200 wharfs which have plotted into six parts by water areas: the Panjing, Lianqi and Yangsheng area; the west bank of Beisitang area; the Meipu River; the Wusong Bridge to Xisitang; Xisitang to Wendong Lock, and the west part of Wendong Lock.

- **The Panjing, Lianqi and Yangsheng area**

Table 7- Cargo categories and flows in 2005 & 2006- the Panjing, Lianqi and Yangsheng area

	2005/2006 Discharging Cargo (0000 tons)						2005/2006 Loading cargo (0000 tons)				
	Shanghai	**Zhejiang**	**Jiangsu**	**Anhui**	**Shandong**	**Total**	**Shanghai**	**Zhejiang**	**Jiangsu**	**Anhui**	**Total**
Coal Product	11.2 / 11.2		0 / 2.9993			**11.2 / 14.1993**	1.2 / 1.2				**1.2 / 1.2**
Oil Product	1.1331 / 1.9396		1 / 0			**2.1331 / 1.9396**	1.2098 / 1.31				**1.2098 / 1.31**
Steel	17.9375 / 15.0365	14.734/ 15.0101	40 / 38			**72.6715 / 68.0466**	1.5 / 2.5	2 / 2.276	3.3167 / 8.517	1.5 / 1	**8.3167/ 14.293**
Construction Material	14 / 8	100 / 108.3	10 / 10	10 / 10		**134 / 136.3**	231.2 / 231.78		0/ 0.45		**231.2 / 232.23**
Concrete		0.02 / 0.03	2 / 2			**2.02 / 2.03**					**0 / 0**
Mine Product	200 / 300	19.3 / 21.69	12.5 / 13.5			**231.8 / 335.19**					**0 / 0**
Fertilizer & Pesticide	0.8 / 0.8					**0.8 / 0.8**		0.4 / 0.4	4.4 / 0.4		**4.8 / 0.8**
Chemical Product			8.05 / 8.75	0.8 / 0.45	0.25 / 0.3	**9.1 / 9.5**	7 / 8	0 / 0.1	0.2 / 0.1		**7.2 / 8.2**
Others						**0 / 0**	4.3 / 2	3 / 2.2	2.5 / 6		**9.8 / 10.2**
Total	**245.071 / 336.976**	**134.054 / 145.03**	**73.55 / 75.2493**	**10.8 / 10.45**	**0.25 / 0.3**	**463.725 / 568.006**	**246.41 / 246.79**	**5.4 / 4.976**	**10.4167 / 15.467**	**1.5 / 1**	**263.727 / 268.233**

The feedbacks of the operational enterprises are 33. The cargo inflow and outflow in this area was mainly focus on nine categories: coal product, oil product, steel, construction materials, concrete, mine product, fertilizer & pesticide, chemical product and others. The cargo configuration and the flow directions are in the Table 7. As can be seen from the tables, steel, construction materials and mine products were the most transacted cargos in this water area. The cargo inflows were mainly from other inland ports of Shanghai and Zhejiang province, but the cargo outflows were mostly moved to inner Shanghai city. The amount of loading cargos was nearly a half of discharging cargos amount. The cargo categories and flow directions were almost the same in these two years.

- **The West part of Wendong Lock**

The transportation volume of cargo categories and flow directions in 2005 and 2006 are as followed:

Table 8- Cargo categories and flows in 2005 & 2006- the West part of Wendong Lock

	2005/2006 Discharging Cargo (0000 tons)								2005/2006 Loading cargo (0000 tons)		
	Shanghai	**Zhejiang**	**Jiangsu**	**Anhui**	**Shandong**	**Jiangxi**	**Hubei**	**Total**	**Shanghai**	**Jiangsu**	**Total**
Coal Product	10 / 10			7.5 / 9	9.5 / 12			**27 / 31**	15 / 1.2		**15 / 1.2**
Steel			2 / 2					**2 / 2**	0 / 2.5	4.15 / 3.217	**4.15 /5.717**
Construction Material	10.5 / 11.5	92 / 105.93	9.8 / 7.55	55 / 57.8		26.5 / 25	0.5 / 0.4	**194.3/ 208.18**	5 / 0	0 / 0.45	**5 / 0.45**
Concrete			11.2 / 12.8	3.3 / 4.18				**14.5/ 16.98**			
Timber				0.25 / 0.35	0.25 / 0.35			**0.5 / 0.7**			
Mine Product		11 / 8						**11 / 8**			
Fertilizer & Pesticide										0 / 0.4	**0 / 0.4**
Foodstuff			0 / 1	0.12 / 0			0 / 0.06	**0.12 / 1.06**			
Chemical Product			0.586 / 0.4		0 / 0.418			**0.586 / 0.818**	0 / 8	0 / 0.1	**0 / 8.1**
Others		0.27 / 0.04	0.25 / 0					**0.52 / 0.04**	2.5 / 5	2.975 / 6	**5.475 / 11**
Total	**20.5 / 21.5**	**103.27 / 113.97**	**23.836/ 23.75**	**66.17/ 71.33**	**9.75/ 12.748**	**26.5 / 25**	**0.5 / 0.46**	**250.526 / 268.778**	**22.5 / 16.7**	**7.125 / 10.167**	**29.625/ 26.876**

In this water area, the feedbacks from the operational enterprises are 40. The cargo transportation in 2005 & 2006 involved 9-10 categories and the construction materials took the main part of the discharging cargos that mostly came from Zhejiang and Anhui province. On the other hand, the volume of loading cargos was only about one of tenth compared to discharging cargo in the same year, and the cargo outflows were only two directions.

- **The West bank of Beisitang area**

The feedbacks from the west bank of Beisitang area are 10 enterprises. The operational wharfs are few in this area. Thus, the volume of cargo transportation is comparatively less. The waste residue was the most transported cargo in last two years, which was from and to other parts of Shanghai city for recycling or destroys by burning or burying. (See Table 9)

Table 9- Cargo categories and flows in 2005 & 2006- the West Bank of Beisitang area

	2005/2006 Discharging Cargo (0000 tons)					**2005/2006 Loading cargo (0000 tons)**			
	Shanghai	**Zhejiang**	**Jiangsu**	**Anhui**	**Total**	**Shanghai**	**Zhejiang**	**Jiangsu**	**Total**
Coal Product			3.3 / 4.8		**3.3 / 4.8**				
Oil Product	1 / 1.2				**1 / 1.2**	1 / 1.2			**1 / 1.2**
Mine Product					**0 / 0**	6 / 0			**6 / 0**
Steel	0.7 / 0.7	4 / 3	9.3855 / 11.2589	1 / 1	**15.0855 / 15.9589**	11.0855 / 11.9589	1.5 / 1.35	1.5 / 3.35	**14.0855/ 16.6589**
Chemical Product	0.5 / 0.8				**0.5 / 0.8**	0.5 / 0.8			**0.5 / 0.8**
Nonferrous Metals	0.03 / 0.05				**0.03 / 0.05**	0.03 / 0.05			**0.03 / 0.05**
Waste Residue	28 / 31.8				**28 / 31.8**	28 / 31.8			**28 / 31.8**
Others	4.47 / 3.27				**4.47 / 3.27**	4.47 / 3.28			**4.47 / 3.28**
Total	34.7 / 37.82	4 / 3	12.6855 / 16.0589	1 / 1	**52.3855 / 57.8789**	51.0855/ 49.0889	1.5 / 1.35	1.5 / 3.35	**54.0855/ 53.7889**

◆ **The Meipu River area**

The Meipu River area has 7 enterprises provided their operational information about last two years. This area has the least operational wharfs in the total of six areas.

Table 10- Cargo categories and flows in 2005 & 2006- the Meipu River

	2005/2006 Discharging Cargo (0000 tons)					2005/2006 Loading cargo (0000 tons)			
	Shanghai	Zhejiang	Jiangsu	Jiangxi	Total	Shanghai	Zhejiang	Jiangsu	Total
Steel		11.49 / 14.637			**11.49 / 14.637**	0 / 14.637			**0 / 14.637**
Construction Materials		30.955 / 22.955	3 / 3	0.955 / 0.955	**34.91 / 26.91**	1.91 / 1.91	25 / 30		**26.91 / 31.91**
Nonferrous Metals	3 / 3.06				**3 / 3.06**		1.5 / 1.56	1.5 / 1.5	**3 / 3.06**
Others					**0 / 0**	0.2 / 0.3			**0.2 / 0.3**
Total	**3 / 3.06**	**42.445 / 37.592**	**3 / 3**	**0.955 / 0.955**	**49.4 / 44.607**	**2.11 / 16.847**	**26.5 / 31.56**	**1.5 / 1.5**	**30.11 / 49.907**

Those information shows that the volume of cargo transportation in 2005 and 2006 did not have much difference. The structure of cargo categories were the same—steel, construction materials, nonferrous metal and others. For cargo inflow and outflow, the most transportation dealt with construction materials that came from and went to Zhejiang Province.

◆ **The Wusong Bridge to Xisitang area**

The Wusong Bridge to Xisitang area has 23 feedbacks, the main cargo categories were related to oil product, steel, construction materials, concrete, chemical product and others. There was only 2,000 tons of timber discharged in 2005. The construction materials and steel occupied nearly 90% of the total transportation amount in the last two years. About 70% cargo inflows came from Zhejiang and Jiangsu province; 65% cargo outflows went to the other inland ports of Shanghai.

The Cargo categories and flow directions in this water area are referred to the following table:

Table 11- Cargo categories and flows in 2005 & 2006-the Wusong Bridge to Xisitang

	2005/2006 Discharging Cargo (0000 tons)								**2005/2006 Loading cargo (0000 tons)**					
	Shanghai	**Zhejiang**	**Jiangsu**	**Anhui**	**Shandong**	**Jiangxi**	**Hubei**	**Total**	**Shanghai**	**Zhejiang**	**Jiangsu**	**Anhui**	**Hubei**	**Total**
Oil Product	9.6 / 5.5		0.81 / 1.55					**10.41 / 7.05**						
Steel	44.7 / 30	30.63 / 37	54 / 67.15				15.1 / 27.5	**144.43 / 161.65**	41.8 / 62.5	50.63 / 58	13.3 / 34	3.1 / 5	2 / 4	**110.83 / 163.6**
Construction Materials		167.4 / 168.9	75 / 90	40 / 30		4.4 / 2.6	40 / 30	**326.8 / 321.5**	120 / 150					**120 / 150**
Concrete		1.2 / 1.2	20.2 / 20.7	2.45 / 1.85	0.7534 / 0.65			**24.6034 / 24.4**						**0 / 0**
Timber							0.2 / 0	**0.2 / 0**						**0 / 0**
Chemical Product			6.7636 / 5.4441					**6.7636 / 5.4441**	9.4126 / 5.2879					**9.4126 / 5.2879**
Others								**0 / 0**	0.6 / 0.6	12.5 / 10.5			12.5 / 10.5	**25.6 / 21.6**
Total	**54.3 / 35.5**	**199.23 / 207.1**	**156.7736 / 184.8441**	**42.45 / 31.85**	**0.7534 / 0.65**	**4.4 / 2.6**	**55.3 / 57.5**	**513.207 / 520**	**171.8126 / 218.4879**	**63.13 / 68.5**	**13.3 / 34**	**3.1 / 5**	**14.5 / 14.5**	**265.8426 / 340.4879**

- **Xisitang to Wendong Lock area**

This area has 29 feedbacks of the questionnaire. There were nine cargo categories involved in cargo movement. The mine product, and construction materials were still the major inflow cargos, which came from inner Shanghai city and Zhejiang province respectively. The cargo outflows mostly went to other inland ports of Shanghai for the movement of construction materials.

Table 12- Cargo categories and flows in 2005 & 2006- Xisitang to Wendong Lock

	2005/2006 Discharging Cargo (0000 tons)								2005/2006 Loading cargo (0000 tons)						
	Shanghai	**Zhejiang**	**Jiangsu**	**Anhui**	**Shandong**	**Jiangxi**	**Hubei**	**Total**	**Shanghai**	**Zhejiang**	**Jiangsu**	**Hubei**	**Fujian**	**Japan**	**Total**
Coal Product	11/ 5.5		5 / 5					**16 / 10.5**							
Mine Product	408 / 415							**408 / 415**							
Steel	25.9 / 22.5	6 / 6.43	13.25 / 22.0394				52.2 / 60.4	**97.35 / 111.3694**	5.3 / 10.5	5 / 24.4	5 / 4.4	8 / 12	4 / 4		**27.3 / 55.3**
Construction Materials	3 / 1	165.33 / 161.09	10.65 / 3	75 / 80		45.75 / 57.5	0 / 9	**299.73 / 311.59**	54.2 / 56	14 / 13.21	3.55 / 2				**71.75 / 71.21**
Concrete		0.6 / 7.5	3.7 / 3	4.6 / 1.9	0.75 / 1.24			**9.65 / 13.64**	5.2 / 5.5						**5.2 / 5.5**
Non-metal Mine product				11 / 10.5		11 / 10.5		**22 / 21**							
Chemical Product								**0 / 0**						8 / 8	**8 / 8**
Waste Residue	40 / 40							**40 / 40**	40 / 40						**40 / 40**
Others	10.108 / 12.0206	4.39 / 6.85	13.41 / 10.41					**27.908 / 29.2806**	22.41 / 22.41	18.3 / 18.21	18.71 / 22.21	0/6			**59.42 / 68.83**
Total	**498.008 / 496.0206**	**176.32 / 181.87**	**46.01 / 43.4494**	**90.6 / 92.4**	**0.75 / 1.24**	**56.75 / 68**	**52.2 / 69.4**	**920.638 / 952.38**	**127.11 / 134.41**	**37.3 / 55.82**	**27.26 / 28.61**	**8 / 18**	**4 / 4**	**8 / 8**	**211.67 / 248.84**

3) The detailed analysis of cargo configuration by vessel registrations

- **The Baosteel branch**

The discharging cargos in Baosteel involved with 5-6 cargo categories, and 4-5 categories for loading cargos. The steel and construction materials were the major discharging cargos, which accounted for over 90% of the total amount. For the loading cargos of these two months, although the cargo categories and tonnages had slight difference, the steel and construction materials were the major transported cargos as well, they still had more than 90% proportion of the total amount. (See the Figure 23 & 24)

Figure 23- Cargo discharging in August 2006 (Baosteel branch)

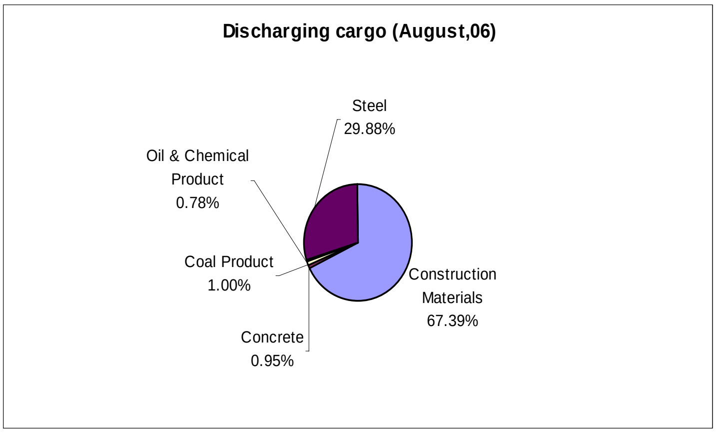


Figure 24- Cargo discharging in January 2007 (Baosteel branch)

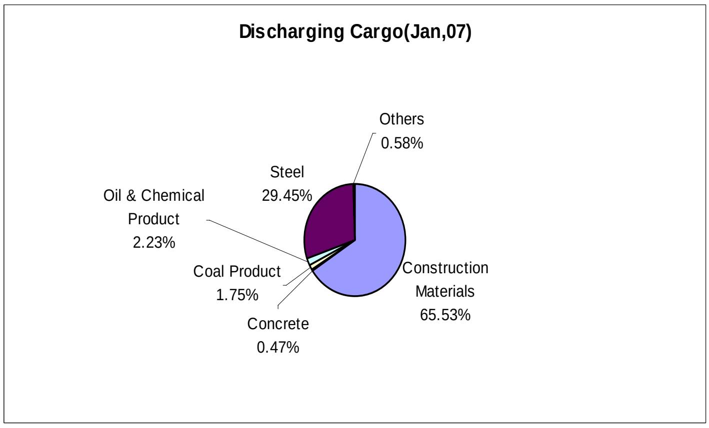


Figure 25- Cargo loading in August 2006 (Baosteel branch)

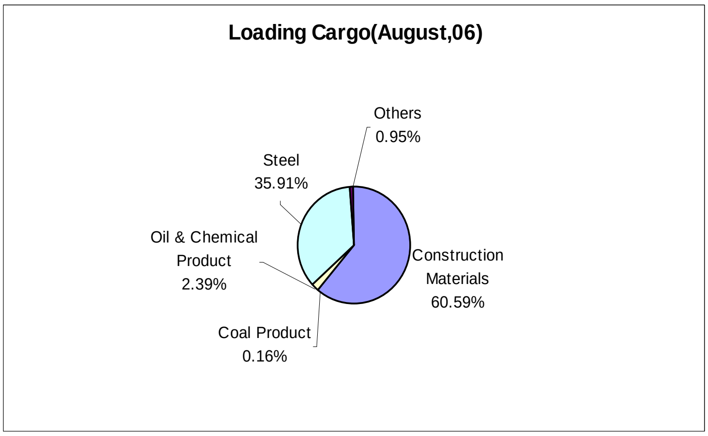
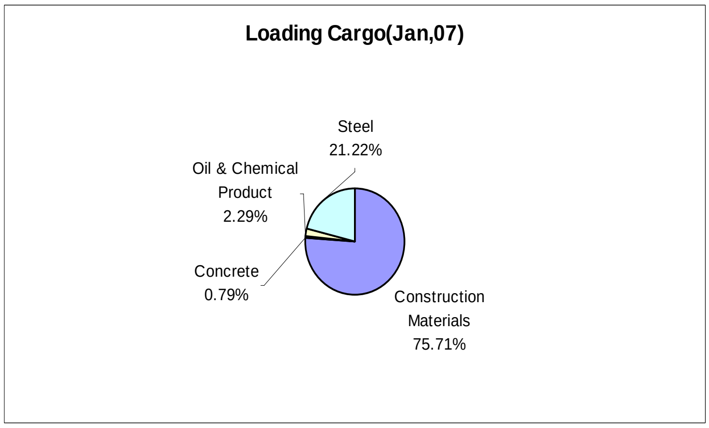


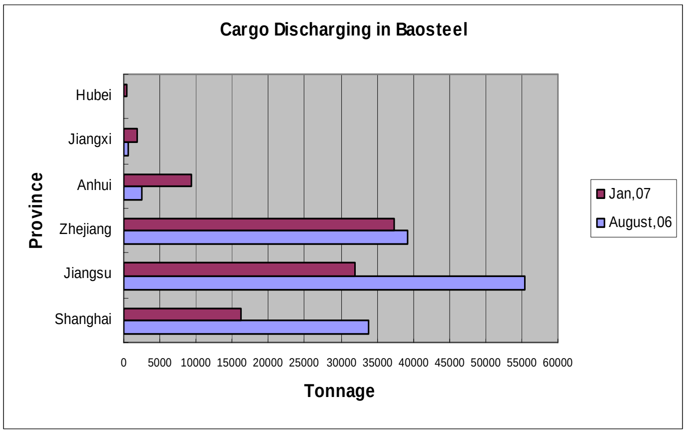
Figure 26- Cargo loading in January 2007 (Baosteel branch)

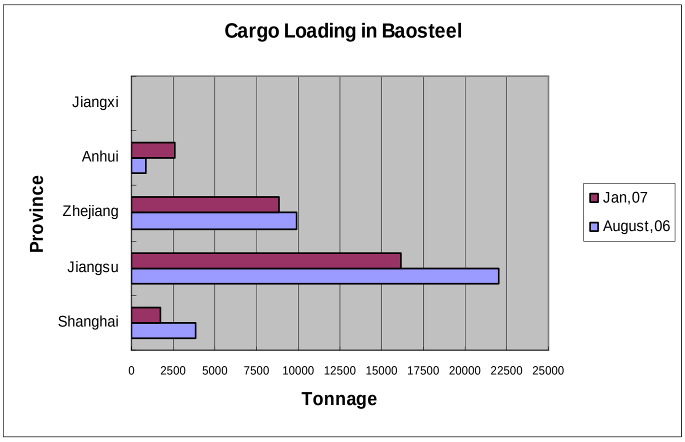


The discharging cargo in Baosteel was mainly from Zhejiang, Jiangsu provinces and other inland ports of Shanghai. These three directions accounted for 90% and 87% of the cargo inflow in August 2006 and January 2007 repectively. The loading cargo mostly went to Jiangsu province, which accounted for 50% of the total cargo outflows.

Figure 27- Cargo inflow to Baosteel branch

Figure 28- Cargo outflow from Baosteel branch

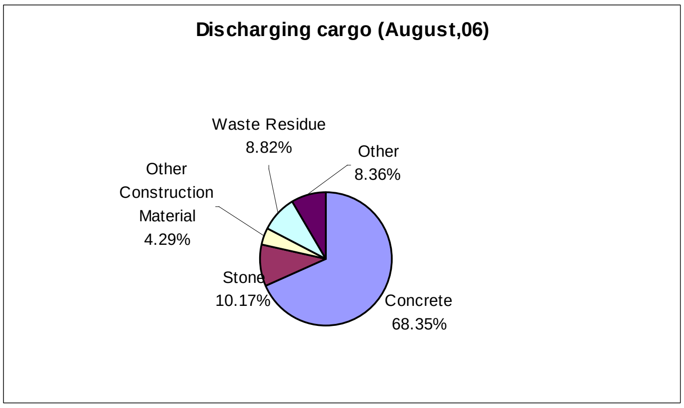


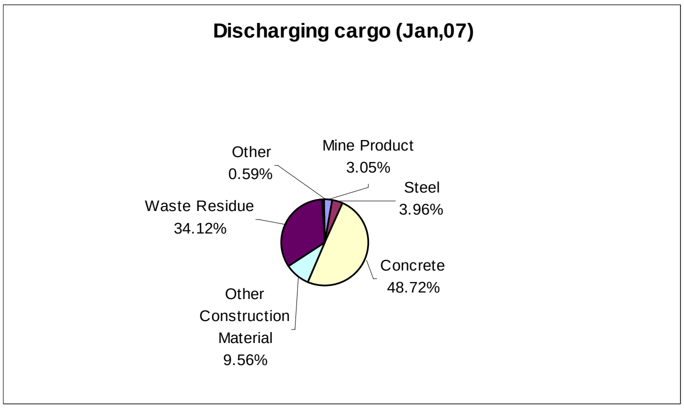


- **Jiwen branch**

Figure 29- Cargo discharging in August 2006 (Jiwen branch)

Figure 30- Cargo discharging in January 2007 (Jiwen branch)





As can be seen from the Figure 29 & 30, the structure and number of the discharging cargo categories were quite different in these two months. The number of cargo categories increased from 5 to 6 species in January 2007. There was no stone cargo discharged in January instead of steel and mine product inflows. Although the concrete still occupied the large percentage of cargo discharging in January, the proportion decreased nearly 20%. The cargo category of "others" was also decreased from 8.36% to 0.59%. On the contrary, the proportion of waste residue and other construction materials increased 3 times, 1.5 times respectively compared to the number of August 2006.

Figure 31- Cargo loading in August 2006 (Jiwen branch)

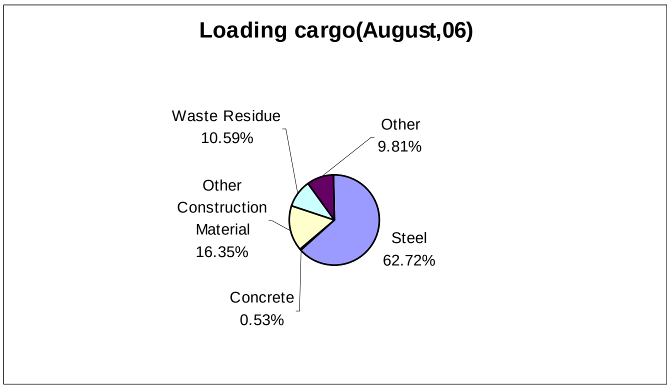
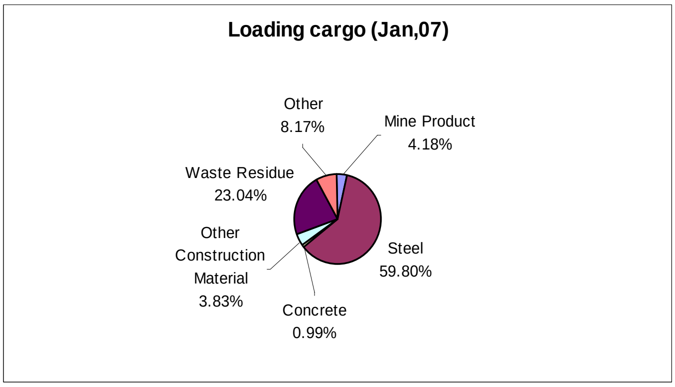


Figure 32- Cargo loading in January 2007 (Jiwen branch)



The Figure 31 & 32 shows the loading cargo situation in these two months. In January 2007, the loading cargo increased mine product transportation. Steel was the main outflow cargo in Jiwen branch.

Figure 33- Cargo inflow to Jiwen branch

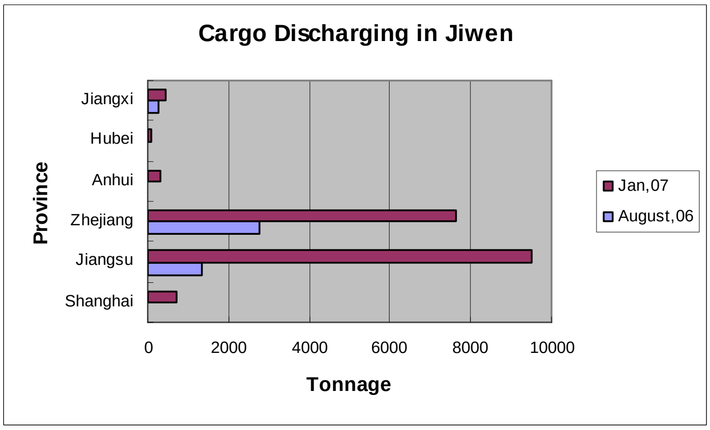
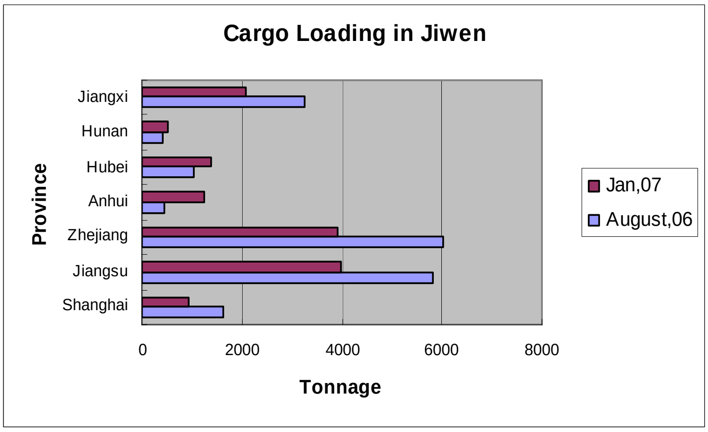


Figure 34- Cargo outflow from Jiwen branch



The Figure 33 shows the cargo inflows were mostly from Zhejiang and Jiangsu provinces, these two provinces occupied 93% of the total cargo inflows to Jiwen branch. Most of the cargo outflows from Jiwen branch (see Figure 34) went to Zhejiang, Jiangsu and Jiangxi province.

- **Luodian branch**

The steel and construction materials were the main discharging cargos and the construction materials was the major loading cargo in Luodian branch. The cargo configuration is in the following figures:

Figure 35- Cargo discharging in August 2006 (Luodian branch)

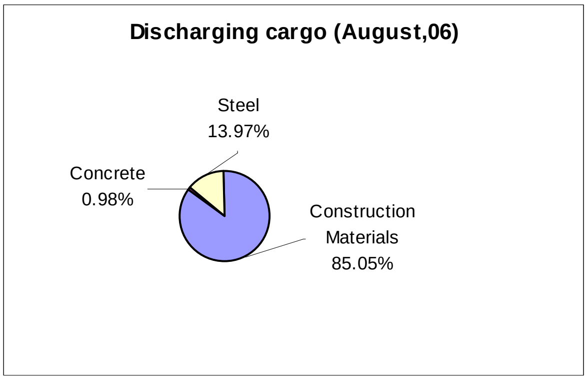


Figure 36- Cargo discharging in January 2007 (Luodian branch)

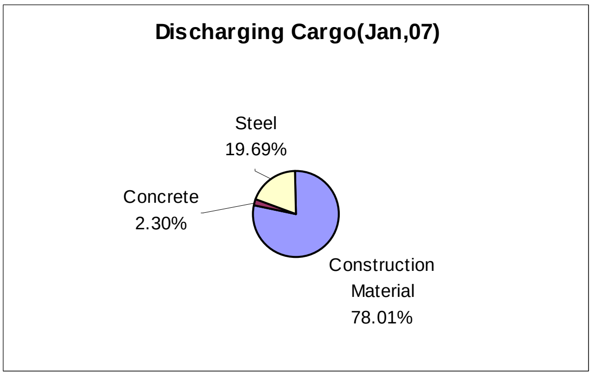


Figure 37- Cargo loading in August 2006 (Luodian branch)

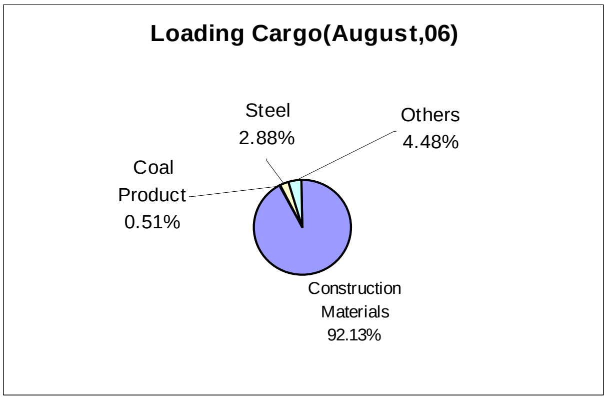
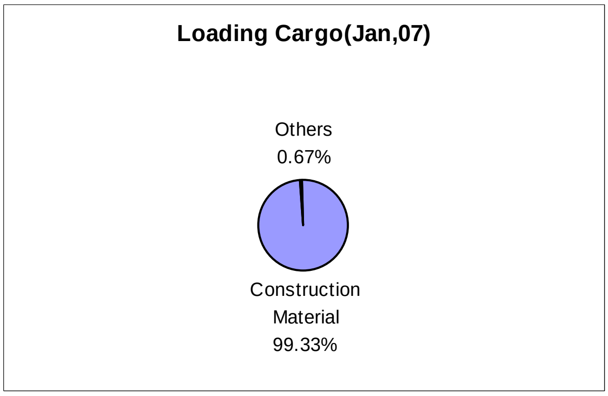


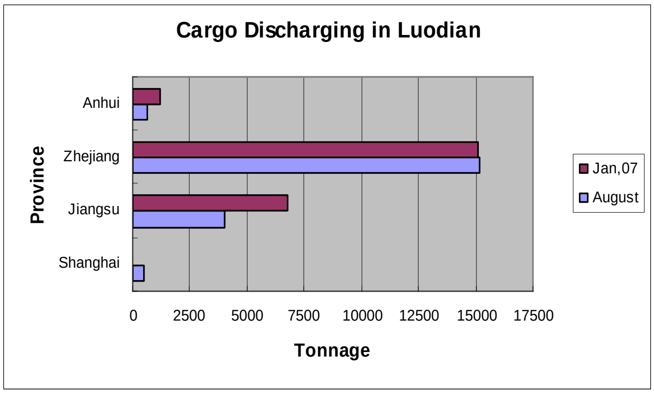
Figure 38- Cargo loading in January 2007 (Luodian branch)

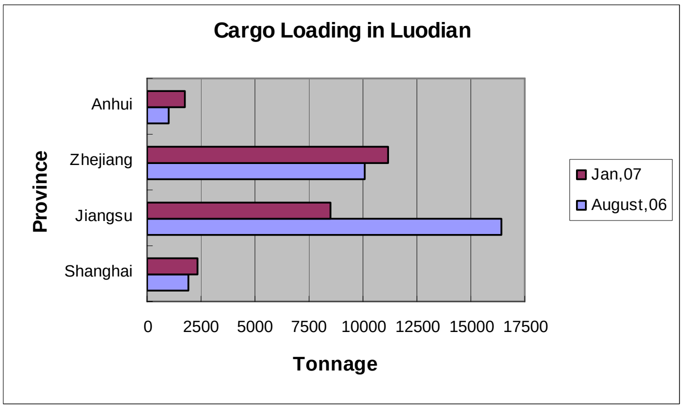


The discharging cargos did not changed a lot in these two months, Zhejiang province (Huzhou & Jiaxing) export 65%-75% of the total to Luodian area. For cargo outflow, Zhejiang and Jiangsu were the main cargo import places-90% in August 2006, and 81% in January 2007. (See Figure 39 & 40)

Figure 39- Cargo inflow to Luodian branch

Figure 40- Cargo outflow from Luodian branch



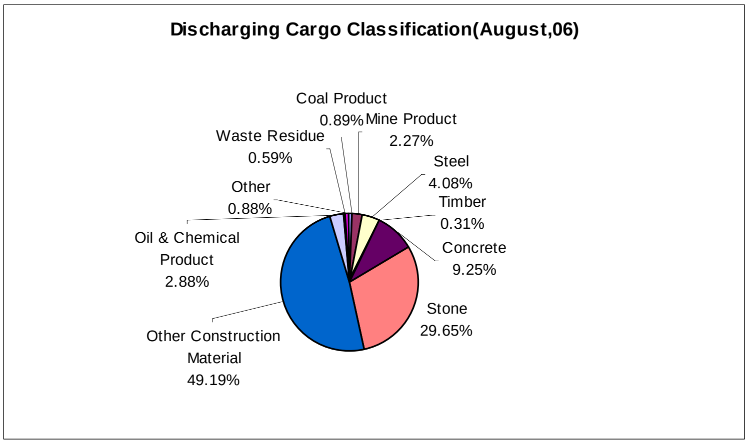


- **Wendong branch**

The situation of cargo flow directions and configuration is as followed:

Figure 41- Cargo discharging in August 2006 (Wendong branch)

Figure 42- Cargo discharging in January 2007 (Wendong branch)



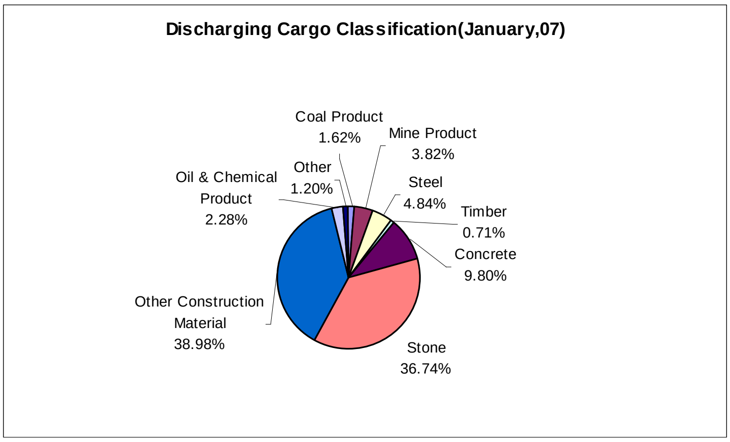


Figure 43- Cargo loading in August 2006 (Wendong branch)

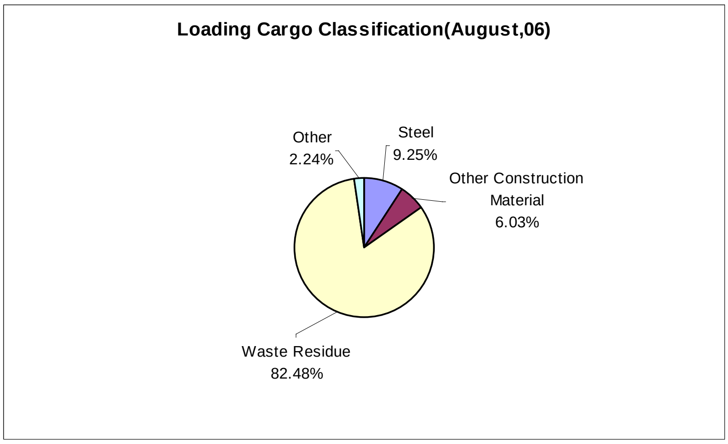


Figure 44- Cargo loading in January 2007 (Wendong branch)

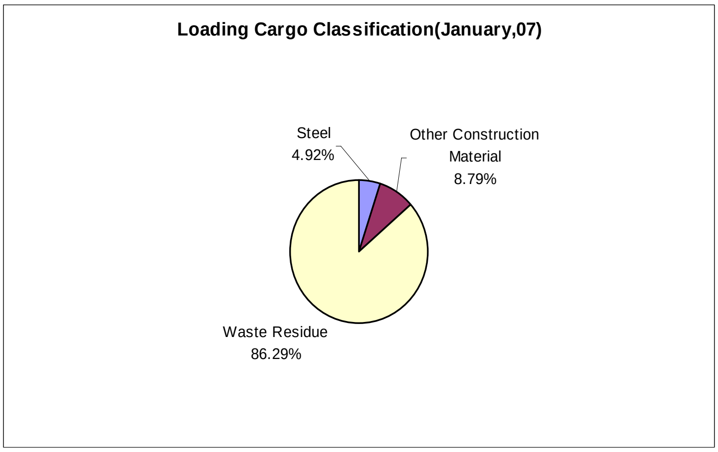


Figure 45- Cargo inflow to Wendong branch

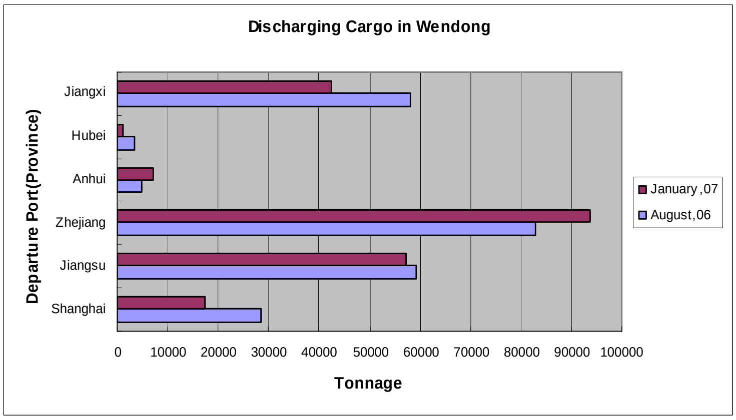
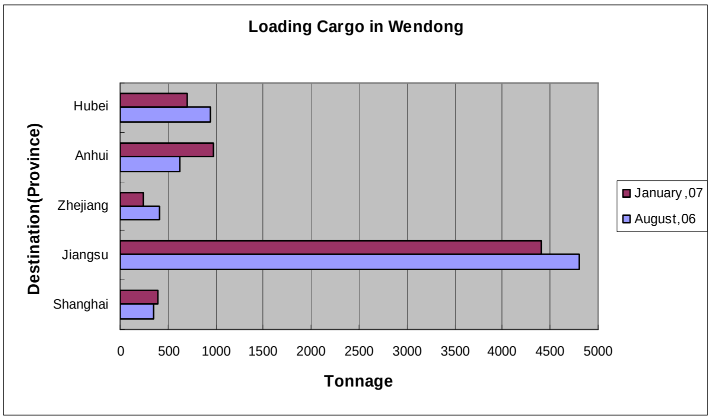


Figure 46- Cargo outflow from Wendong branch



The cargos were discharged in Wendong which almost included all the cargo categories expect there was no waste residue discharged in January 2007. (See Figure 41 & 42) The stone and other construction materials (sand, glass, brick and so on) occupied over 75% of the total tonnage in both months. The concrete was in the third place by nearly 10%. That is to say, the discharging cargo tonnage of total construction materials in Wendong was close to 85% of the total amount. The cargo categories of the loading cargos were quite few, only 3-4 species, the waste residue was the largest transported tonnage of cargo outflow in these two moths, which accounted for 82%-86% of the total amount. (See Figure 43 & 44) The Figure 45 shows the cargo inflows to Wendong were mainly from Zhejiang, Jiangsu, and Jiangxi provinces (85% of total). The Figure 46 shows the cargo outflows mostly went to Jiangsu province (65% of total). The flow directions and cargo tonnages was similar in both months.

- **Wusong branch**

The cargo discharging and loading in Wusong is related to 40-50 different cargos, which were divided into six large categories, and ranged to ten sorts of main cargo transaction—mine (mine product & coal product), steel, construction materials (timber, concrete, stone and other construction materials), oil and chemical product, waste residue, and others. The Figure 47 & 48 shows the discharging cargo in August 2006 and in January 2007 in Wusong branch, the configurations of the cargo categories were almost the same. Steel and construction materials were the highest frequency transported cargos, and the stone product occupied two third of the total amount of the construction materials.

Figure 47- Cargo discharging in August 2006 (Wusong branch)

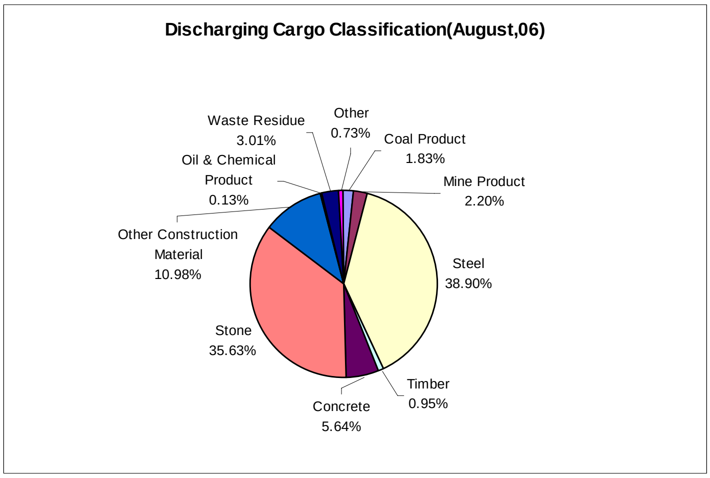
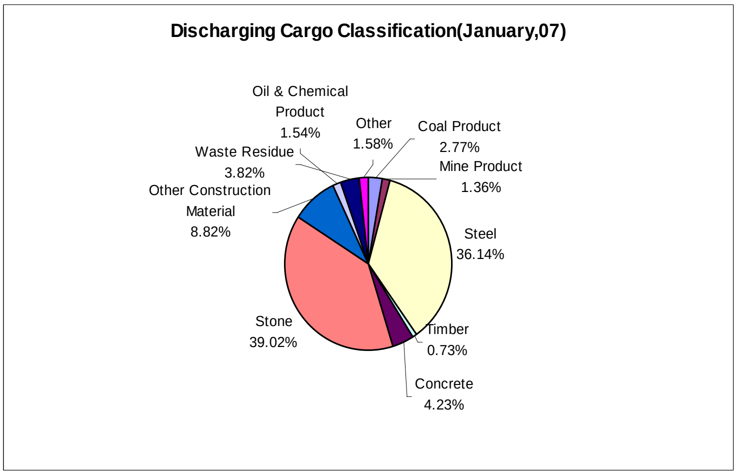


Figure 48- Cargo discharging in January 2007 (Wusong branch)



The Figure 49 & 50 illustrates the loading cargos in August 2006 and in January 2007. The structure of loading cargo categories were the same in these two month, which did not contain coal product, timber and stone compared to the discharging. Thus, the steel was the dominant cargo for cargo outflows.

Figure 49- Cargo loading in August 2006 (Wusong branch)

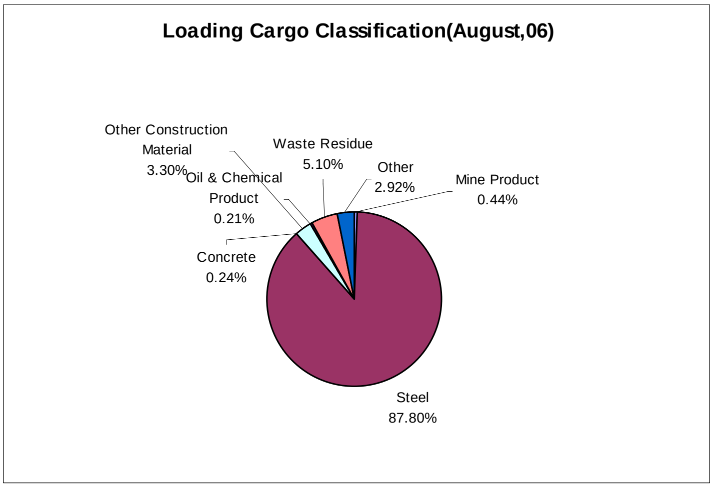


Figure 50- Cargo loading in January 2007 (Wusong branch)

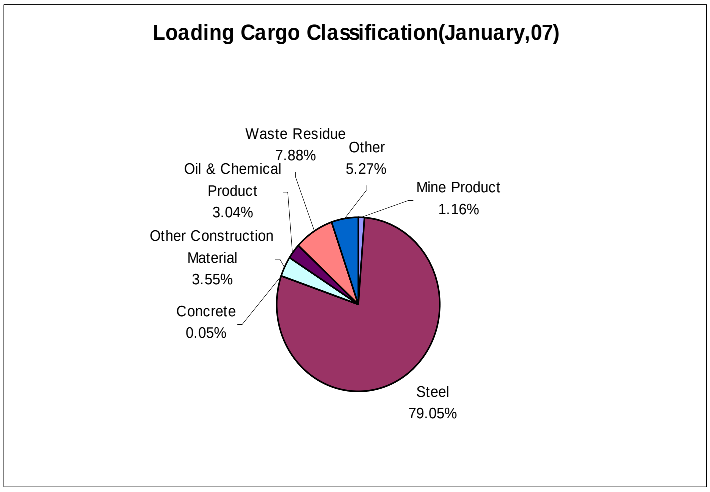
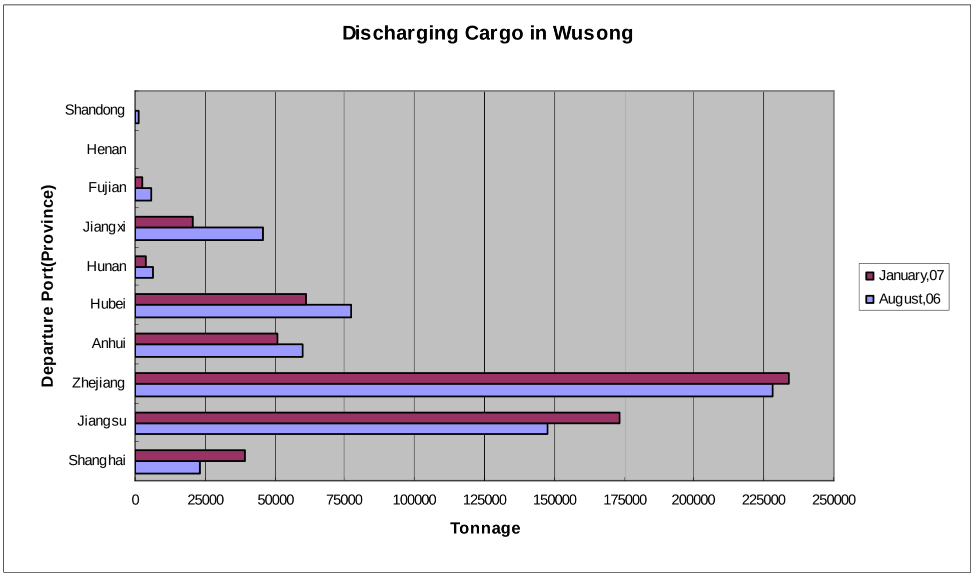
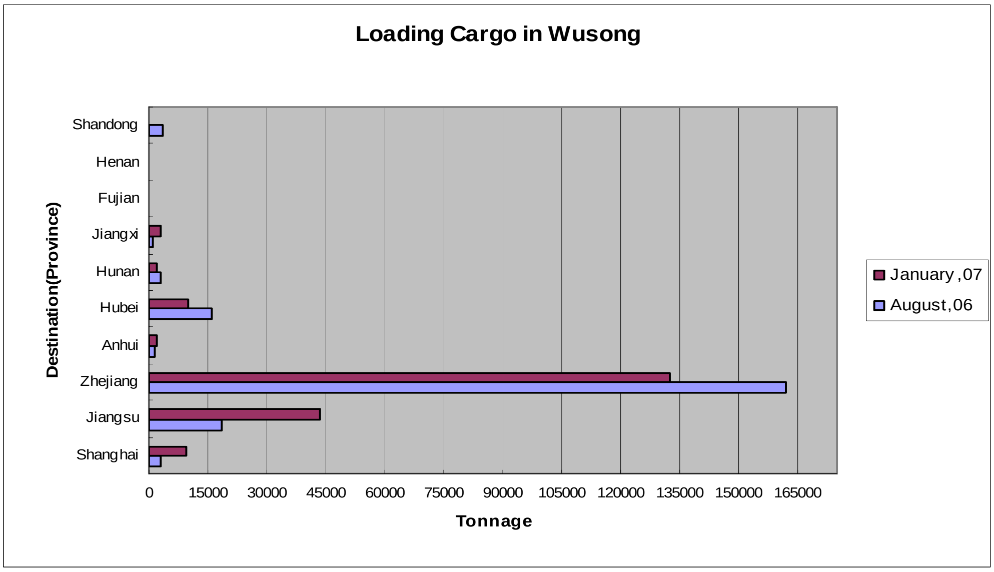


Figure 51- Cargo inflow to Wusong branch



Zhejiang was the first leading province for cargo inflows to Wusong, which was followed by Jiangsu, Hubei, Anhui, Jiangxi, and Shanghai. These six directions accounted for over 90% of cargo inflows to Wusong. For the first two leading province—Zhejiang and Jiangsu, each province was selected 7 areas for detailed calculation. Huzhou and Ningbo occupied 60% of the cargo export amount from Zhejiang province. The main cargo category was construction materials. Moreover, Nanjing and Wuxi occupied 55% of the cargo export amount from Jiangsu province. The main cargo categories were construction materials and steel.

Figure 52- Cargo outflow from Wusong branch



The cargo outflow directions were extremely the same as the cargo inflows although the volume was difference. Zhejiang was the first leading province for cargo import from Wusong, which accounted for 65%-77% of the total amount. In Zhejiang province, Ningbo and Wenzhou took 90% of the total cargo transportation activities.

3.3 Results finding

Owing to the primary data collection are from three different sources, the error information could exist due to the different concept of statistics, the maintenance of database, and the accuracy of data entry. The calculation and the statistics result cannot be exactly the same for these three parts of data analysis. However, those statistics results can be concluded some tendencies: Firstly, the Wenzaobang River is the major corridor for cargo transportation in the inland water transportation system of Baoshan district. The cargo inflows to Wusong branch and Wendong branch in this corridor accounted for 80%-90% of the total amount. Secondly, the third and the fourth class vessel dominates the supply of the inland water transportation market in Baoshan district although that total number of the voyages (inflow plus outflow) have declined, but the average tonnages have increased. The large decrease of the fifth class vessels is replacing by the slowly increased number of the second class vessels. Thirdly, the transportation demand for the cargo inflow exceeded the demand of the cargo outflow because of the large amount of construction materials import in Baoshan. Fourthly, the total cargo movement involved nine provinces and Shanghai city. Most of the cargo inflow transportations to Baoshan district dealt with the construction materials, steel, and mine product. Those three cargos could account for 80% of the total discharging tonnages through last six years. The flow directions were from Zhejiang, Jiangsu province and other inland ports of Shanghai. The outflow cargos from Baoshan almost went to Zhejiang and Jiangsu province by carrying construction materials and steel. In addition, according to the calculation of the seven areas in each province of Jiangsu and Zhejiang, the cargo flows mostly came from and went to the south of Jiangsu province, and the north of Zhejiang province. That is to say, the demand of the transportation is mainly from those hinterlands of the Yangtze River Delta.

The general distribution of the cargo and vessel flow is illustrated in the Flow Chart 1 & 2 in the Appendix.

Chapter 4

The forecasting and future planning of Baoshan District

The regional economy of Baoshan district has been developing rapidly with the establishment of the Shanghai international shipping center. That progress brings new opportunities to the inland ports, and which put forward the new requirement of the future strategic layout as well. According to the analysis results in chapter 3, the mine and construction materials are the main cargo categories by using inland waterways, the cargo flows are almost to and from Jiangsu and Zhejiang province. This chapter will focus on two sections depends on those results finding: the cargo forecasting for 2010, 2015 and 2020; and the comprehensive future planning of Baoshan district.

4.1 The forecasting of the cargo throughput

The prediction of cargo throughput belongs to economic forecasting. The forecasting model is to describe and analyze the past and current economic situation objectively, to calculate and predict the future trend in a certain period by using technological support. (Maurice & Thomas, 2003, p281) The accuracy of the economic forecasting is not only decided by the research and understanding level of economic situation, and the scientific economic forecasting method, but also influenced by the judgment of past experience. To estimate the inland port turnover is depending on the development of regional economic situation, the condition of transportation infrastructure, the port historical statistics data and the future designs of the port and hinterland that are planned by the related authorities. In reality, the forecasting of the throughput is always to combine the qualitative analysis and quantitative analysis together.

The objectives of the forecasting are:

a) The purpose is to forecast the future cargo throughput in 2010, 2015 and 2020.
b) The forecasting is divided into two sections: mine & construction materials and other cargos.

4.1.1 The forecasting of mine & construction materials

The analysis shows the throughput of mine & construction materials have strong correlation coefficient with the index of the Investment on fixed assets of Shanghai, which is greater than 0.8. （Shanghai statistics 2001-2006）So, the forecasting model selects the Investment on fixed assets of Shanghai as a coefficient. The formula is as followed:

$$\hat{T_i} = \hat{G_i} \times \hat{\theta_i}$$

θ_i = The throughput of mine & construction materials which are generated from the Investment on fixed assets of Shanghai (ton / a hundred million) in year *i*.

T_i = The throughput of mine & construction materials (tons) in year *i*.

G_i = The Investment on fixed assets of Shanghai (a hundred million) in year *i*.

To take the adjustment of the industry structure in Shanghai into account, the coefficient θ_i will decline, and the results can be concluded from the trend projection analyses:

Table 13- The coefficient of the mine & construction materials forecasting

Year	2010	2015	2020
Coefficient	2764.195	1724.946	1076.422

According to the tenth "five-year" plan and the eleventh "five-year" plan of Shanghai, the investment on the fixed assets will continue to grow up. (Shanghai's 11th Five-year Plan -- Shanghai Municipality) This forecast is going to use 9% as the annual increase rate. The analysis and forecasting of cargo throughput is based on the figures which from 2001-2004 and 2006 because the throughput in 2005 is very difference from the situation of other years. (See figure 18) The finding results are as following table:

Table 14- Forecasting result of mine & construction materials

Year	**2010**	**2015**	**2020**
The throughput of mine & construction materials (Tons)	15,315,256	14,704,955	14,118,975

4.1.2 The forecasting of other cargos

In this part, the forecasting methods use the time series notation, and the regression analysis, then to combine these two methods for detailed forecasting on the throughput of other cargos. The detailed calculation is conducted by SPSS software, and the detailed analysis is illustrated in Appendix 2.

a. The time series notation

The time series notation is one of the extrapolation methods, which is used to forecast future trend of a time series by using past values of the series. For example, if a port designer needs to forecast future cargo throughput, he/she can use one of several extrapolation methods to base future cargo throughput on past statistics. When using an extrapolation forecasting method, the past patterns and future trend in cargo throughput will be continue in future in month and year should be assumed. So, the past data of cargo throughput are used to generate the forecasting of the cargo throughput during future months and years. (Winston & Albright, 2003, p730)

The explanation of time series notation is as followed: let x_1, x_2,…..x_t,…be observed values of a time series, where x_t is the value of the time series observed during period *t*. The Y_t can be defined as the forecasting result for period *t* made after observing x_{t-h}. This is called the h-period-ahead forecast, which stand in period *t-h*, it forecasts *h* periods into the future. For example, $Y_4 = (x_1+x_2+x_3)/3$. In addition, the accuracy of a forecasting method must be judged by the forecast errors it makes. For many consecutive time periods *t*, after observing x_{t-1}, we make the forecasting result Y_t of x_t, the value of the series one period from now. After one period, the actual x_t is observed. The difference between the forecasting value in period *t* and the observing value in period *t* is called the forecast error and is denoted by e_t. One particular measure in this method is the mean absolute deviation, or MAD. (Winston & Albright, 2003, p731) It is simply the average of the absolute forecast errors. The formula is given by:

$$MAD = \frac{\sum |e_t|}{T}$$

b. The regression analysis

The regression model is to use dependent variable and independent variable to analyze the causal interrelationship between different influential factors in order to find out the forecasting result and estimate the future trend. (Zhang & Sun, 2005) For example, the development of port construction and the development of national economy has causal interrelationship. This research uses simple liner regression model to analyze the forecasting process by using the Investment on fixed assets of Baoshan as an independent variable.

Y= ax + b

Y= dependent variable – forecasting result (the throughput of other cargos)

x = independent variable- related factor (the Investment on fixed assets of Baoshan)

c. The combined forecasting optimal model

Different forecasting models can be used for solving the same problem, because each model has its own merits and limits, and each model use different conditions to make the prediction, which generate various forecasting results. (Huang, Chen, & Pan, 2003) By combining different forecasting methods is better to increase the accuracy. The combined forecasting optimal model is to use two or even more than two single forecasting method to predict the same problem, then weight average the different results to get only one optimal conclusion. This dissertation is going to use the time series notation and the simple linear regression model as single forecasting method, then combine those prediction results. To "minimize the sum of the squares error" is the principle of setting up the combined forecasting optimal model. (Zhao, Zhu & Feng, 2005)

The analysis and forecasting of other cargos is based on the figures which from 2001-2004 and 2006 because the throughput in 2005 is very difference from the situation of others. (See Figure 18)

Table 15–Forecasting value of other cargos (Tons)

Year	The true value	The time series notation	The simple linear regression	Combined forecasting method
2001	2,116,950	2,132,425	2,804,125	2,132,413
2002	3,926,299	3,636,130	3,330,894	3,636,140
2003	4,369,185	4,968,367	4,215,392	4,968,388
2004	6,464,425	6,200,191	6,305,976	6,200,195
2006	7,507,409	7,362,359	8,723,632	7,362,338

By using the combined forecasting model, the throughput of other cargos in 2010, 2015 and 2020 is as followed:

Table 16- Forecasting result of other cargos (Tons)

Year	2010	2015	2020
The throughput of other cargos (Tons)	12,554,001	17,153,617	21,406,652

4.2 The comprehensive planning of inland waterway transportation in Baoshan district

Generally speaking, the purpose/ mission is to set up a comprehensive planning for instructing the long-term development of a specified region, for confirming the scope, orientation, and the character of the program in order to optimize the allocation of resources and give a guideline of regional construction . For establishing the plan, the planner is going to achieve the sustaining development and the harmonization between the development of society, economy, population, the utilization of natural resources, and environment. (Shanghai Baoshan Planning Administration Bureau, 2006) Due to the specified aspect of research, the introduction of the comprehensive planning of Baoshan district will focus on inland waterway transportation.

4.2.1 Strategic target

The strategic target is to cooperate with the integrated network of the Yangtze Rive delta and the general objectives of the Shanghai urban transportation system; to establish a modern traffic system with high standard quality, reasonable configuration, multi-function, quick respond, and convenience; to improve logistics system with closed linkage between roads, railways and inland waterways. (Shanghai Baoshan Planning Administration Bureau, 2006)

4.2.2 Port planning

The objective is to found the Baoshan district as an important part of Shanghai international shipping center, and to optimize the configuration of cargo categories. The relocation of ferry function from Shiliupu to Wusong should be adapted as quick as possible in order to perfect operational system of the Wusong ferry center of Shanghai. The major functions have two sections: one is in the riversides of Huangpu River—to complete the function adjustment by relying on the hinterlands of Huangpu River, and be responsible for the cargo and ferry transportation between the ports of the Yangtze River, other costal cities and inner Shanghai city; the other is in the riversides between the Yangtze Rive and Baoshan district—integrated the resources of the riversides, to enlarge the construction of Luojing port. (Shanghai Baoshan Planning Administration Bureau, 2006)

4.2.3 Inland waterways planning

The comprehensive planning of inland waterways focuses on the improvement of navigability capacity, and optimizes the configuration of inland port and inland waterway network.

a) To encourage the inland container transportation and improve the ecological scenery along the riversides;
b) By optimizing the construction of cargo handling task, to improve the integrated system of inland waterways network with the characteristics of freight function, environmental friendly, ecological scenery and multi-functional.
c) To be a platform of the logistics center in north of Shanghai, and to accelerate the construction of information system in order to build a modern network of inland infrastructure and handling system. (Shanghai Baoshan Planning Administration Bureau, 2006)

Chapter 5

Conclusion

In conclusion, the planning of the Baoshan inland waterway system development should integrate with the establishment of the Shanghai international shipping center and the regional economic development of "the Yangtze River Delta". The infrastructure improvement of Baoshan inland waterway system should work in with the strategic development of Shanghai inland waterway system, the technological improvement of inland vessels, and the reasonable distribution of the inland berths in order to make the inland waterway network in Baoshan district to achieve the purpose of intensive utility, economic of scale, high efficiency and specialization.

5.1 The recommendation of the functional planning for the inland waterway network

According to the general development strategies as mentioned above, the recommendation of the functional planning for inland waterway network of Baoshan is as followed:

1) To encourage the development of integrated logistic system and service by relying on sufficient support of the hinterlands.

In 2020, Baoshan district will be a world-class base of fine steel production and its derived products, and a centralized location of the second industry and the tertiary industry in north Shanghai. Due to these objectives, the inland waterway system in Baoshan should be improved to complete the port function, and the relative construction of logistic system in port side for providing a series service of warehousing, loading/discharging, packaging, distribution, information exchange and so on to the enterprise. Meanwhile, the inland ports should enhance its characteristic of centralized traffic control to build up the industry belt along the riverside, and to drive the further economic development.

2) To construct the ecological scenery and landscaping inland ports in Baoshan to meet the requirement of the downtown development.

During the improvement process of the inland port construction, the local government should pay attention to the exploitation of the ecological scenery function for the purpose of recreation. Some parts of the riverside should be conducted landscape design and construction for inland river sightseeing. This new program will be an important part of the downtown development.

3) To maintain the essential function of cargo transportation in the inland waterway system

In a certain period, Shanghai will still conduct the large-scale city construction. As an important mine & construction material distributing center in north Shanghai, the inland waterway transportation in Baoshan will keep on busy. At the same time, the living garbage will increase year after year with the population increase although the burning and pipeline will be used for the disposal method. The movement of this kind of cargo amount by inland waterways will keep increase.

4) Container transportation system is an indispensable part of the Shanghai international shipping center

The inland waterway network of Baoshan will undertake the inland container transportation as a part of the whole system of the Shanghai international shipping center. On one hand, it will decrease the congestion pressure on road; on the other hand, it will provide the transshipment serive. For achieving this purpose, the utilization of the specified vessel should combine with the improvement of the infrastructure in order to set up rational outlay for constructing specified container wharfs in Baoshan district.

5.2 The fundamental principle of the future planning for the inland waterway system

1) The port layout

According to the functional planning as mentioned above, and to integrate the current situation and the potential demand of inland waterway transportation, the future layout of the port should as followed:

- Wendong port area (the main port area): this port area should use the Wenzaobang River as "golden waterway" to provide services to Wusong industrial park and several logistic centers in this area. By improving the infrastructure and river-route condition, to develop the container and general cargo transportation and to give attention to the dry bulk cargo and oil product transportation.

- North Yangsheng port area (complementary port area): this port is using the Yangsheng River (north part connects with the Yangtze River) to provide services to the Baosteel industrial park, Yueyang industrial park, international steel logistic center, and international automobile logistic center. The mine product and steel product will be the major transportation cargo, and container transportation will not be much.

- North Panjing port area (complementary port area): this port is using the Panjing River (north part connects with the Yangtze River), the major service objective should be south area of the Baoshan industrial park. The container and general cargo will be the major transporting cargo.

- Wenxi port area (transitional port area): this port area provides the transportation service of construction materials to Shanghai with the dry bulk vessels. There will not be much further improvement and construction for the existing wharfs, because most of this part will change to ecological scenery and landscaping inland ports step by step with the end of the Shanghai city construction. Few wharfs will rebuild as container wharfs for providing service to the south area of the Baoshan industrial park.

2) Inland waterway improvement

The inland waterway network in Baoshan district will follow the requirement of high-class waterway planning in the Yangtze River Delta, to increase the navigability and switch the waterway functions to freight type, ecotype and multifunction type.

a) The Wenzaobang River, the Panjing River, the Lianqi River and the Meipu River are the freight type waterways, and the Yangsheng River is the multifunction type waterway.
b) The waterways in the Wenzaobang River will be the third class, the capacity will reach to 1,000 tons for a single vessel, and the depth will be above 3.5 meters.
c) The Panjing River, the Yangsheng River is the freight type waterway with the fifth class at recently. These will reach to the third class in the future, the capacity will be 500-1,000 tons for a single vessel, and the depth will be

2-2.5 meters.

d) The Lianqi River, the Meipu River and the Xinchuan River are the freight type waterways, which will reach to the fifth class. The capacity will be 300-500 tons for a single vessel, and the depth will be 2-2.5 meters.

e) The Dijing River, Beisitang and the south bank of the Wenzaobang River will develop to the ecotype waterways.

Reference

1. Chen, Hong. Enlightenment from Europe Inland Navigation to Development to China inland Navigation. *Port & Waterway Engineering. 2002-10*, p39.

2. European Environment Agency. *EEA Glossary*. Retrieved April 15, 2007, from the World Wide Web: http://glossary.eea.europa.eu/EEAGlossary/E/external_cost

3. European Commission. *Market observation for European inland navigation, Ⅰ-2005*. Retrieved April 20, 2007, from the World Wide Web: http://ec.europa.eu/transport/iw/observatory/doc/2005_01_marketobs_en.pdf

4. European Commission. *Market observation for European inland navigation, Ⅰ-2006*. Retrieved April 20, 2007, from the World Wide Web: http://ec.europa.eu/transport/iw/observatory/doc/2006_01_marketobs_en.pdf

5. European Commission. *Prospects for Inland Navigation within the Enlarged Europe. 2004.* Retrieved April 20, 2007, from the World Wide Web: http://ec.europa.eu/transport/iw/studies/index_en.htm

6. Huang, Rongfu., Chen, Yadong., & Pan,jian. Research on the application of composite prediction technology for forecasting of port throughput. *Port & Waterway Engineering. 2003-5*, p25-27.

7. Huang, Zhendong. (2001). *Vitalizing Inland Waterway Transport, Promoting Sustainable Development of Economy and Society*. The Ministry of Communications of the People's Republic of China. Retrieved May 3, 2007, from the World Wide Web: http://www.moc.gov.cn/05zhuzhi/guojihzs/guojisildjh/t20031118_17071.htm

8. Inland Navigation Europe. Retrieved April 10, 2007, from the World Wide Web: http://www.inlandnavigation.org/en/waterways.html

9. Kotler, P., & Armsterong, G. (1996). *Principles of Marketing*. Prentice Hall: London.

10. Shanghai Baoshan Planning Administration Bureau. (2006, December, 16). *The comprehensive planning of Baoshan district from 2005 to 2010, 2005*. Retrieved April 25, 2007, from the World Wide Web: http://www.shbsgh.gov.cn/info_cont.asp?infoid=90

11. Shanghai Baoshan People's Government Office. *The general situation of Baoshan district-- Regional transportation system*. Retrieved April 13, 2007, from the World Wide Web: http://bsq.sh.gov.cn/bscd/bsgk/bsgk_44.htm

12. Shanghai Statistics Yearbook 2001-2006.

13. Shanghai Municipality. (2006, February, 8). *Shanghai's 11th Five-year Plan*. Retrieved April 30, 2007, from the World Wide Web: http://www.shanghai.gov.cn/shanghai/node2314/node15822/node15823/node15897/userobject21ai144564.html

14. The World Bank. (1995, July). *China-Inland Waterways Multipurpose Project*. Retrieved May 3, 2007, from the World Wide Web: http://www.worldbank.org.cn/chinese/content/631b1159297.shtml

15. The Seine-Scheldt Project. 2005. Retrieved April 21, 2007, from the World Wide Web: http://www.seine-escaut.org/en/project.html

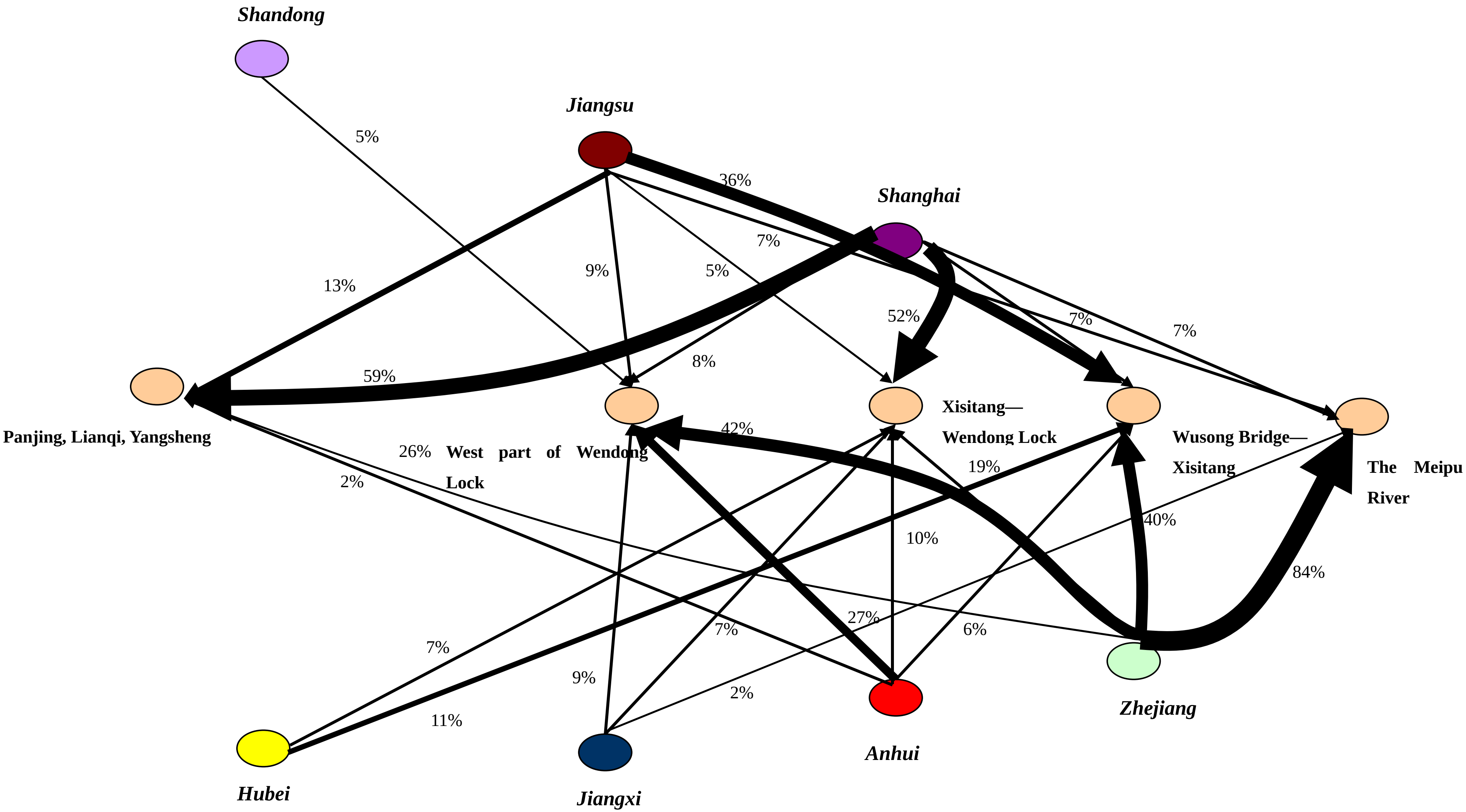
16. Winston, W. L., & Albright, S.C. (1997). *Practical Management Science: Spreadsheet Modeling and Applications*. Thomson.

17. Zhang, Rongzhong. The development of inland waterways in Europe. *Multi-model Transportation*. *2005-3*.

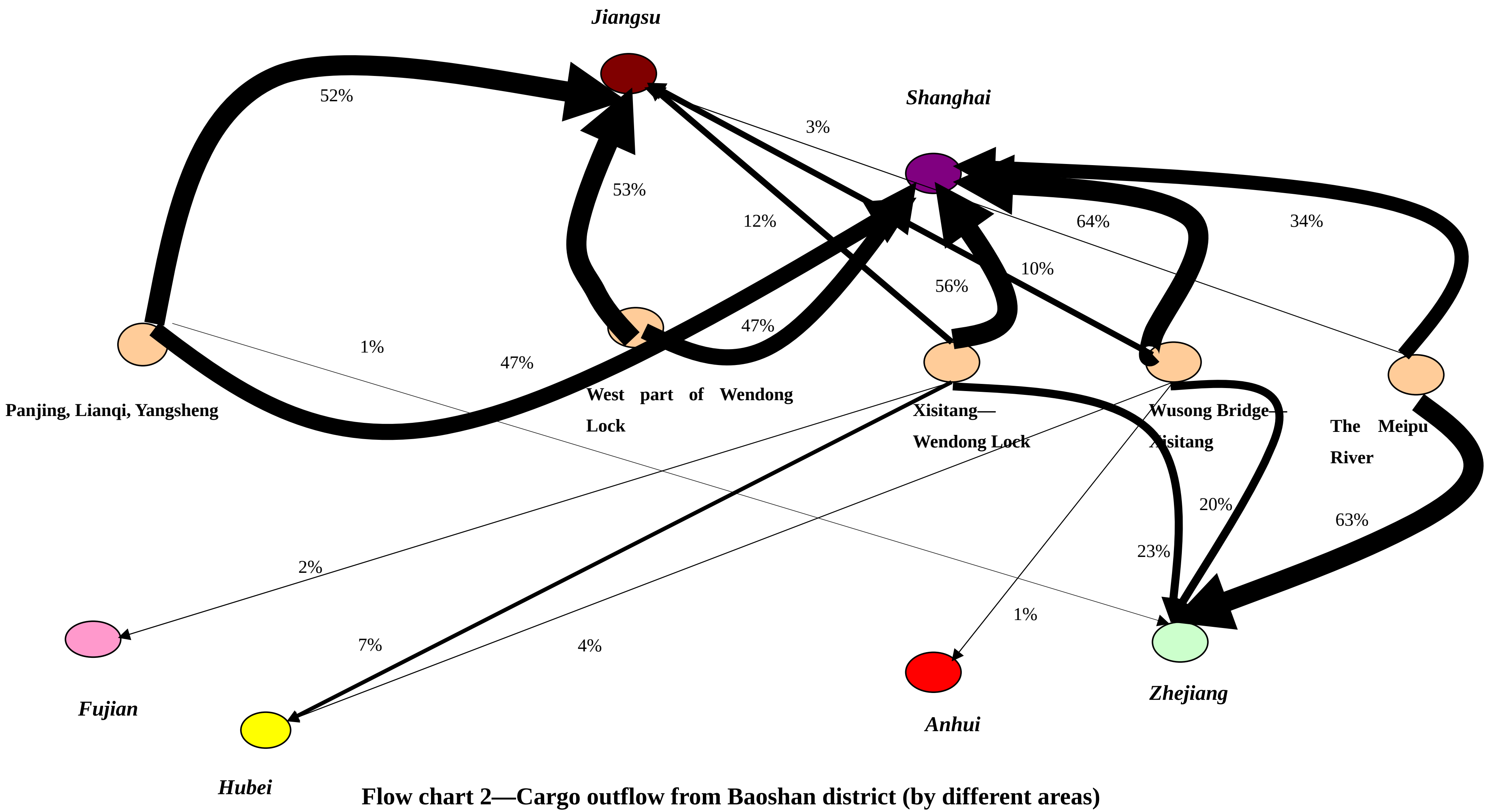
18. Zikmund, W.G. (2003). *Essentials of Marketing Research*. Thomson Learning.

19. Zhao, Gang., Zhu, Chao., & Feng, Xuejun. Application of combined forecasting for port throughput prediction. *Port & Waterway Engineering*. *2005-3*, p34-36 &52.

20. Zhang, Jiantong, & Sun, Changyan. 2005. *Practical Management Science by using Excel and SPSS*. Beijing: Tsinghua University.



Flow chart 1—Cargo inflow to Baoshan district (by different areas)



Flow chart 2—Cargo outflow from Baoshan district (by different areas)

Appendix 2 -- The forecasting analysis

1. The forecasting of mine & construction materials

Year	T_i	G_i	θ_i	θ_i	Forecsting results
	(tons)	(a hundered million RMB)	(ton/a hundred million RMB)	(ton/a hundred million RMB)	
2001	8,072,879	1994.730000	4047.103618		
2002	11,475,375	2187.060000	5246.941099		
2003	14,919,909	2452.110000	6084.518639		
2004	15,015,078	3084.660000	4867.660617		
2006	9,579,636	3925.090000	2440.615629		
2007		4278.348100		3668.127879	**15,693,528**
2008		4663.399429			
2009		5083.105378			
2010		5540.584862		2764.194794	**15,315,256**
2011		6039.237499			
2012		6582.768874			
2013		7175.218073			
2014		7820.987699			
2015		8524.876592		1724.946407	**14,704,955**
2016		9292.115486			
2017		10128.405879			
2018		11039.962408			
2019		12033.559025			
2020		13116.579337		1076.422006	**14,118,975**

Source: Shanghai statistics 2001-2006

Shanghai's 11th Five-year Plan -- Shanghai Municipality

The formula is:

$$\hat{T}_i = \hat{G}_i \times \hat{\theta}_i$$

θ_i = The throughput of mine & construction materials which are generated from the Investment on fixed assets of Shanghai (ton / a hundred million) in year *i*.

T_i = The throughput of mine & construction materials (tons) in year *i*.

G_i = The Investment on fixed assets of Shanghai (a hundred million) in year *i*.

The θ_i will decline due to the adjustment of the industry structure in Shanghai. The G_i will increase with 9% for the future investment. Thus, the forecasting results are:

Year	2010	2015	2020
The throughput of mine & construction materials (Tons)	15,315,256	14,704,955	14,118,975

2. The forecasting of other cargos

The throughput of other cargos (tons)

Year	2001	2002	2003	2004	2006
Throughput (tons)	2,116,950	3,926,299	4,369,185	6,464,425	7,507,409

a. The time series notation

I. Model set up

$y = b * X^a$

From the following table：

$y = 2132424.628587 * X^{0.769909}$

Y= the throughput of other cargos

X= Year（2001 is 1）

II. Correlation Test ：

R^2 = 0.97494

R= 0 .98739

R>0.8 – High correlation

The time series notation forecasting result by SPSS

```
MODEL:  MOD_8.
Dependent variable.. Other cargos            Method.. POWER
Listwise Deletion of Missing Data
Multiple R          .98739
R Square            .97494
Adjusted R Square   .96659
Standard Error      .09058
            Analysis of Variance:
              DF   Sum of Squares      Mean Square
Regression     1         .95759654        .95759654
Residuals      3         .02461508        .00820503
F =     116.70852       Signif F =  .0017

-------------------- Variables in the Equation --------------------
Variable         B         SE B        Beta          T   Sig T
Time              .769909      .071267     .987390     10.803   .0017
(Constant)    2132424.628587 169221.3590
12.601  .0011
```

III. t-Test:

Test variable a:

t(0.0017,3)=10.803

$\because\ \alpha = 0.0017 < 0.05$

Test variable b：

$t(0.0011,2)$=12.601

∵ $\alpha =$ 0.0176<0.05

∴ t-Test passed—the forecasting results are believable

IV. f-Test：

$n_1 = 1, n_2 = n - 2 = 3$

F(1,3)= 116.70852

∵ $\alpha = 0.0017$ <0.05

∴ f-Test passed—the hypothesis of this model is believable

V. Results:

Year	2010	2015	2020
Throughput (tons)	12,554,016	17,153,665	21,406,634

b. The regression analysis

The throughput of other cargos & the investment on fixed asset of Baoshan Tons/hundred million RMB

Year	2001	2002	2003	2004	2006
The investment on Fixed asset of Baoshan	608,768	745,841	976,000	1,520,000	1,890,000
The throughput of other cargos (tons)	2,116,950	3,926,299	4,369,185	6,464,425	7,507,409

Source: Shanghai statistics 2001-2006

The regression analysis forecasting results by SPSS

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.974(a)	.949	.932	555002.10813

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17294471978789.960	1	17294471978789.960	56.146	.005(a)
	Residual	924082020077.241	3	308027340025.747		
	Total	18218553998867.200	4			

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	461581.267	638708.132		.723	.522
	investment	3.844	.513	.974	7.499	.005

I.model set up：

$$y = ax + b$$

From above tables

y= 3.844*x* +461581.267

y= the throughput of other cargos

x= the investment on fixed assets of Baoshan

II.Correlation Test：

$R^2 = 0.949$

R= 0.974

R>0.8 – High correlation

III. t-Test：

Test variable a：

t(0.005 ,3)=7.499

∵ $\alpha = 0.005$<0.05

Test variable b:

α =0.522>0.05

(This result may due to fewer samplings of the cargo throughput)

∴suppose the t-Test passed—the forecasting results are believable

IV. f-Test：

$n_1 = 1, n_2 = n - 2 = 3$

F(1,3)= 56.146

∵ $\alpha = 0.005$ <0.05

∴ f-Test passed—the hypothesis of this model is believable

V. Results:

Year	2010	2015	2020
Other cargos throughput (tons)	13,852,669	20,263,966	21,546,225

c. The combined forecasting optimal model

First, the following table gives the comparison between the true value and the forecasting results by using the time series notation and linear regression from 2001-2006.

Year	True value (tons)	Time series notation (tons)	Simple linear regression (tons)
2001	2,116,950	2,132,425	2,804,125
2002	3,926,299	3,636,130	3,330,894
2003	4,369,185	4,968,367	4,215,392
2004	6,464,425	6,200,191	6,305,976
2006	7,507,409	7,362,359	8,723,632

According to above table, the combined forecasting optimal value can be assumed as following formula:

$$\begin{cases} (1.35851E+14)W_1+(1.4236E+14)W_2+\lambda/2=1.35851E+14 \\ (1.4236E+14)W_1+(1.43688E+14)W_2+\lambda/2=1.43688E+14 \\ W_1+W_2=1 \end{cases}$$

w_1 = the weight factor of the forecasting result by time series notation

w_2 = the weight factor of the forecasting result by simple linear regression

The results from above formula are:

$$\begin{cases} w_1=1.000021874 \\ w_2=\text{-}2.08741E\text{-}05 \end{cases}$$

From these results, the combined forecasting optimal values are:

Year	True value (tons)	Time series notation (tons)	Simple linear regression (tons)	combined forecasting optimal values (tons)
2001	2,116,950	2,132,425	2,804,125	2,132,413
2002	3,926,299	3,636,130	3,330,894	3,636,140
2003	4,369,185	4,968,367	4,215,392	4,968,388
2004	6,464,425	6,200,191	6,305,976	6,200,195
2006	7,507,409	7,362,359	8,723,632	7,362,338

The forecasting results by using combined forecasting optimal model are as following:

Year	2010	2015	2020
The throughput of other cargos (Tons)	12,554,001	17,153,617	21,406,652