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Study on the Combined Transport of Container Ports in Shandong Province

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Abstract. In the new type of multimodal transport, especially in Shandong province, which has developed railways, there must be railways to participate in container port group transport and improve multimodal transport. Considering the economic and industrial layout of the hinterland of Shandong province, the transportation structure is adjusted scientifically and the distribution of transportation resources is optimized. Firstly, container demand between hinterland and port is analyzed. Then the capacity of the combined transportation of iron and iron is analyzed. Finally, the improvement measures of container ports in Shandong province are put forward.

1. Introduction

Container multimodal transport in Shandong refers to taking Qingdao port and Yantai port as hub ports, surrounding coastal ports as auxiliary ports, Jinan, Zibo, Weifang, Qingdao, Yantai, Weihai, Linyi, Rizhao, Jining and other cities as inland container transport hubs. Through the highly developed highway hub of Shandong province and the four vertical and four horizontal railway lines, intersecting with the inland river routes of Shandong province, the whole container port group collection and distribution system of Shandong province is effectively connected in series, forming a collection and distribution system that radiates the whole Shandong province and is equipped with high container multimodal transport. Container multimodal transport takes container port group as the center. Multimodal transport is a combination of railway, highway and waterway. Multimodal transport enables hub ports to make up for the developed but independent transport system in Shandong province through different ports such as feeder lines, inland ports and freight stations such as railway and highway container handling stations.

2. Analysis of container demand between hinterland and port

The hinterland of this study is the port group under Yantai city. In collecting and distributing transportation system, economic hinterland is the demand place of goods transportation. The development of container gathering and distribution system will further improve the flow of container cargo in the economic hinterland and extend to the deeper inland economic hinterland. The demand for goods between the hinterland and the port has an extremely important impact on the whole distribution process. The throughput of major ports in Shandong province is shown in **table 1**.



Table.1 Throughput of Main Port in Shandong

Unit: 10,000 tons

Port name/year	1990	1995	2000	2005	2010	2012	2013	2014	2015	2016
Total	5445	10594	16025	38401	86421	106655	118137	128593	134218	142856
Qingdao Port	3034	5103	9661	18679	35012	41466	45783	47701	49749	51463
Yantai Port	668	1361	1964	4506	15033	24345	28680	31971	33027	35407
Rizhao Port	925	1452	2674	8421	22597	28387	31809	35324	36082	38286
Weihai Port	100	379	658	1532	2407	6200	7001	7110	7324	7554

2.1 Analysis of container production in hinterland

The container production volume refers to the container terminal throughput statistics of major ports in Shandong province in February 2018.

(1) Longkou port container company: the throughput in February was 58006/TEU, and the throughput from January to February was 89390/TEU, up by 20.83%.

(2) Yantai international container terminal co., LTD. : throughput in February 32001/TEU, throughput in January to February 77054/TEU, up 5.6%.

(3) Yantai port container terminal co., LTD. : throughput in February: 135028/TEU, throughput in January to February: 2753231/TEU, up 1.2%.

(4) Rizhao port container development co., LTD. : throughput in February: 280322/TEU, throughput in January to February: 591518.75/TEU, an increase of 22.56%

According to current statistical method and statistic data, hinterland and haven are different in the measure index of foreign trade respect. Hinterland's foreign trade volume is measured by the total volume of foreign trade import and export, while port trade volume is measured by cargo throughput and container throughput. So, we have to unify the dimensions, which is an important part of computing before we start.

This study takes a 20-foot container as the research object. The container generation coefficient is introduced here, as shown in formula (1).

Container generation factor = container throughput / total foreign trade value (1)

The calculation method of hinterland container production is to collect the following data through relevant statistical yearbooks and other statistical sources: The total volume of foreign trade import and export of Shandong province, the total volume of container throughput of all ports in Shandong province and the total volume of foreign trade import and export of all prefecture-level cities in Shandong province. According to the total volume of foreign trade in Shandong province and the total volume of container throughput of all ports, the container generation coefficient is calculated by using formula (1). Based on the total volume of import and export of local cities in Shandong province, the total volume of container production of cities at all levels was calculated. Container production as the hinterland of this study.

2.2 Distribution of hinterland container production among ports

Shandong port group is a typical Shared hinterland port group, which has a complex relationship of mutual supplement and competition. Therefore, a reasonable distribution method must be adopted. According to the trade gravity model established by Tingbergen (1962), the bilateral trade volume between two countries or two places is directly proportional to the economic aggregate of two countries and inversely proportional to the distance between them. This trade gravity model is substituted into the research background of container port group distribution and transportation in Shandong province, and the hinterland attraction index P of the port is introduced accordingly, as shown in formula (2).

$$P = \frac{T}{D^2} \quad (2)$$

Where, T is the container throughput of the preset port during the hypothesis period; D is the distance between hinterland and port, Floyd algorithm is adopted to obtain the shortest circuit of its distribution network in Shandong province, and the shortest circuit length is used as the distance between hinterland and port.

3. Capacity analysis of multimodal transport

3.1 Road traffic analysis

Theoretically, the capacity of highway refers to the capacity under ideal traffic conditions, which is the actual maximum capacity of highway. The calculation method is as follows formula (3).

$$C = \frac{1000vl}{d + \frac{vt}{3.6}} \quad (3)$$

Where, C is road safety capacity (pcu/h); V is the speed of the vehicle (km/h); D is the safe distance; T is operator response time (s); L is the number of lanes on the expressway. Formula (4) is for the car. The transport object of this study is a 20-foot container, which we need to convert. The standard 20-foot container truck is 5.899×2.352×2.386. All container trucks are trailers with a conversion coefficient of 3.0. Thus, we can get its capacity calculation method as follows:

$$C = \frac{1000vl}{3 \left(d + \frac{vt}{3.6} \right)} \quad (4)$$

3.2 Channel capacity analysis

Channel traffic capacity is the maximum transport volume under reasonable conditions, with the maximum design vessel type and full load, the minimum continuous travel between ships and the continuous travel through the channel or part of the channel in unit time. Formula (5) is as follows:

$$C = \frac{QtW}{10000} = \frac{VtW}{10r} \quad (5)$$

Let V be the average sailing speed of the ship (km/h); T is the daily navigation time, W is the ship's standard load (ton), r is the length of the long axis in the collision avoidance field. The capacity of formula (5) is obtained under hypothetical theoretical conditions, while the actual channel capacity will be affected by the size, performance, speed and other factors of the sailing ship, so it needs to be modified. Formula (6) is as follows:

$$C_p = CB_1B_2B_3B_4 \quad (6)$$

Among them, B₁ is channel navigation guarantee rate, according to "inland river navigation standards" to determine; B₂ is the ship speed correction coefficient, generally between 0.8 ~ 0.9; B₃ is the operating correction coefficient of ships on the Hong Kong and Macao routes, generally between 0.9~1.0, and B₄ is the operating non-standard coefficient of ships.

4. Measures to improve multimodal transport in container ports group

4.1 Strengthen the construction of waterless port

Container multimodal transport has a far-reaching impact on the economic hinterland. Container trade and transportation and logistics industry can greatly promote the economic development of this region, and the development of the economic hinterland will correspondingly promote the improvement of container collection and distribution and multimodal transport, which are mutually supporting and promoting each other. At the same time, Shandong province has vigorously strengthened the construction of waterless ports and newly developed transportation hubs, which have brought the Shandong peninsula with developed transportation to a higher level and played a leading role in the development of container transportation in the Beijing-tianjin-hebei region and the central and western regions. The construction of railways and highways around Shandong province and the transportation

of goods from the whole southwest China can be transported to the economic hinterland, making the connection more perfect.

4.2 Strengthen cooperation in road, rail and water transportation

We will strengthen cooperation in road, rail and water transportation around the bohai bay and along the east China sea, and improve the container multimodal transport channel. The railways and highways of Shandong province play an important role in connecting the economy with that of other countries; Shandong province must make great efforts to develop the system of collecting and distributing transportation, and form a unique multimodal transportation by combining the road, iron and water transportation, so as to better promote the transportation service by the diversion of the whole economic hinterland. The development of container multimodal transport can promote the rational allocation of various transportation resources and accelerate the comprehensive development of the comprehensive logistics transport system. With the rapid development of the demand for various containers, the reasonable construction of distribution and distribution network and the multi-modal transport as the development mode will strive to increase the total supply of social transport capacity while reducing the total consumption of social labor.

4.3 Introduce market mechanism

Introducing market mechanism to stimulate can accelerate the reasonable development of container transportation in Shandong province. The distribution and distribution system is not of a large scale, and the multi-modal transport enterprises are not unified. The market mechanism is the internal driving force for the development of container multimodal transport, which ensures that the market mechanism can play a role in Shandong province.

4.4 Strengthen the construction of coastal container handling stations

In order to develop multimodal container transportation and build the container port cluster distribution system in Shandong province, a large number of container handling stations should be set up in the whole province. At each container logistics node, the container handling station is related to the seamless connection during the transformation of various modes of transport. There is usually only one person responsible for multimodal transport, and the presence of container handling stations is undoubtedly more suitable for the development of container gathering and distribution system.

5. Conclusion

The construction of modern comprehensive transportation system takes multimodal transportation as the key content. Practice has proved that multimodal transport has developed rapidly in developed countries. Multimodal transport refers to the use of at least two different modes of transport to goods or products from the origin to the destination of a new type of composite mode of transport. Intermodal transport involves the docking of various modes of transport, the location of transfer center and the planning and construction of transportation facilities, etc. In the new era, both China and Shandong will face the upgrading of logistics industry. What can be met is that China will be the most attractive and potential logistics market in the world. The global economic center of gravity will shift to China and the Asia-Pacific region, and China will soon become the largest market. Container multimodal transport is a transport organization form aiming at improving the maximum benefit in the whole process of cargo transportation. It needs the joint efforts of the government and enterprises to realize the multimodal transport and realize the seamless connection within the province.

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