Analysis and Research of Port Gathering and Transportation System in Tokyo Port

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Abstract. Port industry belongs to the basic industry of national economy, is the most advanced window of a country's opening to the outside world, and is an important hub for communication of economic and trade exchanges. The unimpeded collection and distribution energy directly affects the development of port throughput and the development of integrated port area. Therefore, it is one of the key factors to control the efficiency and benefit of port logistics service. This paper analyzes the existing problems of the Tokyo port distribution system and proposes corresponding countermeasures.

1. Introduction
In recent years, international trade has developed rapidly and port development, which poses a great challenge to the distribution system. As the main junction of international trade, the port is an important strategic part of the economic prosperity and development of the city and the hinterland region, and the hub of the comprehensive transportation network[1]. The port collection and distribution system is the interconnected channel between the port and the vast hinterland, which provides external conditions for the survival and development of the port. Any modern port must have a perfect and smooth collection and transportation system to become an important land and water transportation hub in the comprehensive transportation network. This paper mainly provide the countermeasures by analyzing the current system and existing problems.

2. Current Status of Tokyo Port Gathering and Distribution System
Tokyo Port is a harbor located in Tokyo Capital, Japan, which is the transportation node between the capital circle and domestic and overseas regions. Tokyo port is one of the international strategic harbor designated by the province of land and three super center of Japan, since 1998 (flat into 10 years), foreign trade container throughput has been ranked first in Japan, is on behalf of Japan's international trade port, is also one of the three passenger ports in Japan, usually known as Yokohama port "Yokohama port"[2]. The throughput of Beijing-Binhai Port in the past two years is shown in Figure 1. Affected by the epidemic, Japan's exports have declined sharply continuously, and the container throughput of Tokyo Port has dropped significantly.
Fig. 1. Container throughput and ranking in 2018 and 2019

The port area is distributed between Mokawa and Domachuan in the southeast of the city, with inside and outer ports. The inner port is close to the city, and the outer port is located along the Tokyo Bay Highway. The most notable Tokyo port is the traffic network with the hinterland, where the noteworthy Tokyo Linhai road connects the Qinghai container terminal through the central brekty and the new surface treatment site. Due to the opening of this coastal highway, a new choice is more compared with the Tokyo Port Tunnel or Hongqiao that was only used to collect and distribute containers for Qinghai Terminal[3]. The distribution of the main docks in Tokyo Port is shown in Figure 2 and Figure 3.

![Distribution Map of Main Terminal of Tokyo Port](image)

Fig. 2. Distribution Map of Main Terminal of Tokyo Port
Fig. 3. Distribution and Traffic Line of Port Tokyo

(1) Urban Road: Japan is a mountainous island country, so the road transportation industry has always occupied a dominant position in various modes of transportation, especially with the adjustment of industrialization, industrial structure and the establishment and improvement of the comprehensive transportation system, Japan's road transportation industry has occupied an absolute dominant position[4]. Over time, the road cargo transport has increased and decreased. Due to the large and small land in Tokyo, the city roads are generally compact, most main roads are 2 lanes, 4-6 lanes, and the roadway is 12-19 meters wide.

(2) Highway: The Tokyo Linhai Highway connects the Qinghai container terminal with the Dajing terminal through the central breakty and the new sea treatment yard. Due to the opening of this coastal highway, a new choice is more compared with the Tokyo Port Tunnel or Hongqiao that was only used to collect and distribute containers for Qinghai Terminal. The construction and opening of the port bridge has played an important role in the efficient operation of the port collection and distribution system. For example, after the opening of "Dinosaur Bridge" in 2012, it is part of the Linhai Highway in Port Tokyo, and the ultimate purpose is to dredge the land transportation on Port Tokyo. For example, in June 2020, Tokyo announced the opening of the north and south lines and connecting roads (Tokyo Port Hutchison Tunnel and Hutchison Bridge), expanding and strengthening the smooth and efficient Shugang road network of Tokyo Port. The tunnel and bridge locations are shown in Figure 4.

Fig. 4. Location Map of Haisen Tunnel and Bridge
(3) Railway: Japan’s railway transportation industry has developed to a certain extent during the great development of heavy chemical industry, but it has been developed since the 1970s. The transportation guidance policy of Japan has changed, and the railway transportation capacity is more shifted to passenger transportation, which has led to the gradual decline of the status of railway transportation in the integrated transportation system, mainly because the JR freight company undertakes cargo transportation services. Tokyo Railway Freight Terminal is located in the southern part of Tokyo, adjacent to Tokyo Bay, connected to the East China Sea Freight Dedicated Line, close to the Heiwa Island logistics base, Tokyo Port, and Haneda International Airport. It is a multimodal transportation hub for Tokyo Railway and has the advantage of agglomeration of transportation resources[5]. All cargo in the Tokyo port area and outside ports can be collected and transported directly or indirectly through the port railway.

(4) Inland river branch line: Japan is mountainous, the rivers are short and small, the flow rate is large, the width is large, the height of the bridge is low, only bulk carriers can be passed, which is not conducive to shipping, and the inland water transportation is not developed.

3. Existing problems
As one of the important ports in Japan, Tokyo Port plays a crucial role in the national economic development, but due to the unbalanced collection and distribution system, the Tokyo Port collection and distribution system has the following problems.

(1) Insufficient special lanes for large freight vehicles. In the Tokyo urban area, large trucks generally carry out a large range of materials. In order to achieve the barrier-free passage of vehicles, there are many problems such as the lack of special roads for large freight vehicles and the deterioration of the urban environment.

(2) Limitation of truck drivers and labor time. Especially in the face of the progress of the global supply chain, the shortage of truck drivers and labor time restrictions, the demand for large trucks is getting higher and higher. The construction of a trunk logistics network that can make the accessibility of large trucks is one of the important factors to promote the development of Tokyo Port and its hinterland.

(3) Freight railway capacity was transferred to passenger transport. Japanese railway is in all directions and plays an important role in national development, but due to the change of Japanese transportation policy, most of the railway capacity will be transferred to passenger transport, thus increasing the pressure of the road transportation.

(4) Make full use of air transport. Haneda Airport is located at the southern end of Tokyo Port, close to Dakai and Qinghai areas. There are expressways connecting the docks of Tokyo Port, which can be dispersed conveniently and quickly and plan according to the nature and quantity of goods.

4. Countermeasures to the Existing Problems of Tokyo Port Gathering and Distribution System
(1) Replace large freight vehicles with small trucks. Due to the large and small people, there are only a few lanes for large freight vehicles in Tokyo, so you can consider multiple transportation through small and medium-sized freight vehicles, in order to reduce the environmental and noise pollution caused to the city by a large number of trucks, electric vehicles can be used.

(2) Targeting the shortage of freight drivers, transport companies can attract employment by increasing benefits. Regular professional training and schedule for staggered shifts to ensure freight continuity. In order to link driving fatigue, you can use more than two or three people take turns driving method, the specific number of people is determined according to the length of the distance.

(3) Using the developed rail network for railway collection and distribution. The railway transport volume is large and low, less affected by natural conditions, and can relieve the pressure of road freight and reduce a variety of pollution to the city.

(4) We will develop multimodal transport. Japan has many rivers, but the overall river is short and has a large flow rate, which is not conducive to shipping. The river reach suitable for shipping can be selected and carry out urban multimodal transport combined with land transport.
5. Conclusion

Any modern port must have a smooth collection and distribution system, in order to become an important land and water transportation hub in the comprehensive transportation network. Although road transport occupies the main position, the railway collection and distribution of goods in Tokyo Port is not backward, greatly making use of the developed railway network in Japan for cargo collection and distribution, and alleviating the port congestion. Due to the mountainous terrain of Japan and many rivers but short factors, the problems faced by the use of inland river transportation to share the pressure of other collection and distribution modes have yet to be solved. Tokyo Port Area can make full use of airport resources to develop sea, air, sea and air and other forms of multimodal transportation. As the actual situation of the port is very complex, from the perspective of development, multi-channels, multi-directions and various modes of transportation should be developed.

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