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RESEARCH PAPER

Fundamental Analyses for Constructing Road-rail Intermodal Freight Transport System

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Abstract: Intermodal transport generally concerns a few of fundamental elements such as freight's characteristics, shippers' and forwarder evaluations, etc.. The freight's characteristics decide the relevant potential demands and the possibility to combine different transport means into intermodalism. The evaluations of shippers and forwarders always have an important impact on the selections of transport. This paper comparatively analyzes the critical elements of freight's characteristics, shippers' and forwarder evaluations. Moreover, the possibilities and relevant issues to form the road-rail intermodal freight transport are discussed, and some suggestions are proposed to improve the railway freight services.

Keywords: integrated transportation; road-rail intermodal transport, potential demand, comparative evaluations, shipper, forwarder

1 Introduction

In the recent decades, several developed countries have promoted or considered the policy of freight modal shift from road to railway as a solution of the social problems such as global warming, road congestion and low efficiency of freight transport. However, transport means are generally chosen by the shippers or suggested by forwarders according to their actual situations. Therefore, the analyses of the shippers' situations are the first step to find whether the surface freights are available for rail container transport or if the railway transport and road haulage can be combined to form an intermodal freight transport.

In a certain meaning, to the rail container freights such as manufacturing products, the modal shift policy shall mainly be defined as how to construct road-rail intermodal transport because rail container transport cannot be separated from freight collection and delivery with trucks or trailers. In intermodal transport, there are many actors, such as railway operators, forwarders, shippers, etc.

Recently, there are many relevant studies with academic values and actual meanings for rail freight transport, according to the different situations in freight transport market. The Organization for Economic Co-operation and Development (OECD) had given a conception to construct intermodal freight transport in institutional aspects^[1]. Li detailed an intermodal freight transport system with the competitiveness

power through unifying rail & truck transport, as one of measures for improving the railway services^[2-6]. Hino, et al. described the importance of rail freight transport in Japan by one case study between Hokkaido and Honshu^[7]. Bontekoning and Priemus pointed out that it is necessary to make the breakthrough innovations for rail freight transport, whether technological, organizational or both^[8]. Furthermore, Bärthel and Woxenius indicated to develop the intermodal transport for small flows over short distances, for perishable and high-value commodities, for small consignments, and for flows that demand speed, reliability and flexibility, and explored some innovative concepts through a case study of the Swedish development project Light-combi with some special references to the competitiveness in markets^[9].

This paper focuses on the inter-regional surface freights of manufacturing industry in Japan. Firstly, the actual freights' situations are investigated. Then, as potential freights of rail containers with the most possibility, the current freights among rail container transport and road haulage including charter trucks and trailers are comparatively analyzed in shipper's output or sales' scale, freight lot size and weight, and shipment time zone, respectively. Meanwhile, the concentration rates of freight contents and destinations transported by rail containers and charter trucks and trailers are also considered as to explain these freights' likeness. Furthermore, with the questionnaires to the real shippers in manufacturing industry, the shippers' evaluations for rail

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container transport comparing to road haulage are found as to understand the advantages of railway transport. Because forwarders own double characters that to the operator of railway freight transport, they appears with the character of shippers, and to the real shippers such as manufacturers, they have the roles like transport companies to supply the relevant services. Actually, forwarder is one of the main organizers for rail container transport. The recognitions of forwarders to different transport means are very important not only to grasp situations of freight transport market, but also to construct road-rail intermodal transport. The current transport condition of rail corridor in the railway network is one of key factors to construct road-rail intermodal freight transport. This study also uses actual results of railway freight transport to discuss the railway freight conditions in rail corridors of network. With all of the previous descriptions, this study makes clear the fundamental elements of intermodal freight transport for

providing the well-founded materials for promoting railway freights.

2 Conceptual description for freight intermodalism

Intermodal freight transport is defined as that two or more than two different transport means or relevant operators are integrally combined into a new transport system for door-to-door freight transport. The purpose of the intermodal transport system is not only for shifting freight from road to railway or ship, but also for improving the actual situations of freight transport. Rail container transport is a typical kind of intermodal freight transport because it must or has to simultaneously use road's collection/delivery and on-rail transport in order to accomplish the door-to-door movement of goods.



Fig. 1 Conceptual model of road-rail intermodal freight transport

The majority of Japanese inter-regional railway freights are currently transported by rail containers. As shown in Fig. 1, the basic procedure of rail container transport is as follows.

- (1) Road haulage for collecting relevant containers or freights from sending shippers to the departure freight station;
- (2) Transshipments of containers or freights from truck onto freight train;
- (3) On-rail transport across a number of rail corridors in the railway network, or possibly with some necessary train's operations on the way, to the arrival freight station;
- (4) Retransshipments of containers or freights from freight train to truck;
- (5) Delivering containers or freights to the receiving shippers by road haulage.

In reality, the rail container transport can be described as a kind of road-rail intermodal freight transport with the simultaneous use of on-rail transport and road haulage for the pick-up and delivery of containers or freights. Relevant actors concerning the procedure include real shipper, forwarder, railway operator, relevant loading and unloading operator in some cases, and so on.

The forwarders take an important roles in the Japanese rail container transport, because the forwarders work as the practical freight organizers to supply the door-to-door services for rail container freights, with the use of railway transport

and road haulage. They shoulder the consistent responsibility to real freight shippers. Thus, the forwarders can be also seen as to the main organizers of an intermodal freight transport.

Therefore, according to the concept's discussions of road-rail intermodal freight transport, it is necessary to fundamentally analyze the elements such as freight characteristics to find the potential freights of rail containers by comparing the current rail container transport to road haulage, evaluations to rail container transport from real shippers and forwarders through the comparison with road haulage, and actual situations of rail corridors in the network as the indispensable conditions of railway freight transport, and so forth.

3 Potential demands of intermodal freight transport

3.1 Transport situation of inter-regional freight

Based on the regional Freight Flow Survey (<http://www.mlit.go.jp>)^[10], we can find that the totally domestic freight tonnages decreased from 6.96 billion tons in the early 1990s to 5.56 billion tons in 2007. On the other hand, the inter-regional freights grew from 1.62 billion tons to 1.86 billion tons during the same period.

In addition, the situation of railway freight can be investigated through the comparison between railway

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