

Prospects of the TKR-TSR Market

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Abstract : Nowadays, road transportation which has played a key role in the market of both passenger and freight transportation is facing with a serious problem, the traffic congestion causing a delay of transportation. Therefore, railroad transportation is considered as an attractive alternative mode of inland transportation due to its inherent merits in mass transportation such as relatively low cost compared with road transportations, less air pollution and noise than other mode etc.

In this paper, therefore, we examine the current situation of railroad transportation markets including TKR(Trans- Korean Railway), TSR(Trans-Siberian Railway) and prospects for the connection of TKR-TSR. And then we examine the structure of the container transportation market by railroad in Korea with a brief analysis of the traffic volume of TKR-TSR.

Key words : TKR, TSR, Railroad transportation, Conversion rate, Demand forecasting

1. Introduction

Nowadays, road transportation which has played a key role in the market of both passenger and freight transportation is facing with a serious problem, the traffic congestion causing a delay of transportation. Therefore, railroad transportation is considered as an attractive alternative mode of inland transportation due to its inherent merits in mass transportation such as relatively low cost compared with road transportations, less air pollution and noise than other mode etc.

Recently, the Korean Railroad Authority has launched a lot of projects to expand railroad transport market such as expanding railroad container yards, extending a railway to ports and making container depots in railroad station. More recently, the need for connecting South and North Korean railroad so called as TKR (Trans- Korean Railway) and furthermore connecting TSR(Trans-Siberian Railway) seems to be matured in accordance with the increasing business cooperate between South and North Korea.

Accordingly, the structure of the railroad transport market with respect to Korean import and export cargoes has been drawn more attention than ever before. One of the key market would be the Korea-Europe one in which the deep sea shipping service via the Suez Canal has been dominant. In that market, however, the railroad systems such as TKR and TSR is likely to play a role as an alternative mode of maritime transportation.

Therefore, this paper aims to examine the current situation of railroad transportation markets including TKR(Trans- Korean Railway), TSR(Trans-Siberian Railway) and prospects for the connection of TKR-TSR. And then we examine the structure of the container transportation market through railroad in Korea with a brief analysis of the traffic volume of TKR-TSR.

2. Current Situation of TKR and TSR

2.1 TKR

TKR can be divided into 3 routes: TKR1, TKR2 and TKR3 as shown in Fig. 1. These routes can be connected with TSR, TCR (Trans-China Railway), TMGR (Trans-Mongolian Railway) and TMR (Trans-Manchurian Railway) when these are renovated and restored. In order to connect these lines with the existing transcontinental railways and fully activate the connection of TKR-TSR, three corridors (Gyeong-ui, Gyeong-won and Dong-hae lines) should be renovated and restored as soon as possible.

One of the major problems to connect TKR with TSR is that the Korea peninsula has been divided by ideological dispute. Recently, however, these lines are partly under construction by several mutual agreements between North Korea and South Korea, and further ententes for additional development plans are in progress. Russia and Japan are also keen to mediate the agreements of TKR between

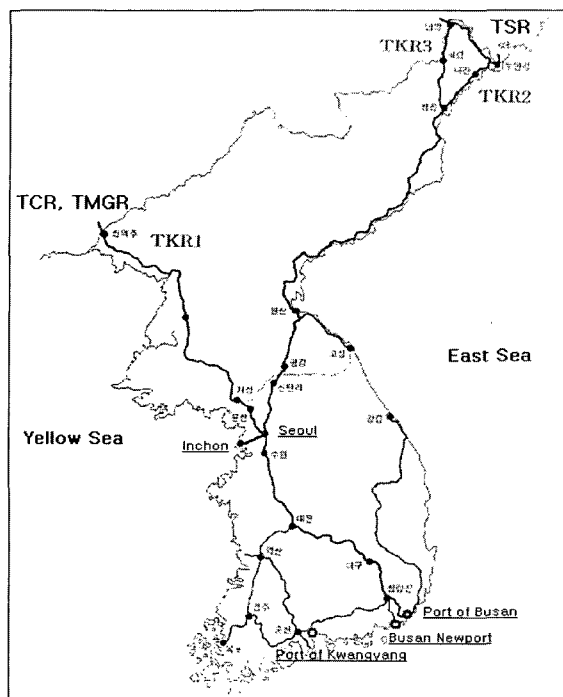
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North Korea and South Korea. Fortunately, all of the countries, especially North Korea, seem to start to realize the potential economic impacts of the interconnection of TKR-TSR. Therefore, the connection of TKR and TSR does not seem impossible.

amount of cargos transported via the railways is small. Moreover, it is difficult to obtain the accurate data about their throughput. Therefore, in this paper, these railways will not be dealt with.



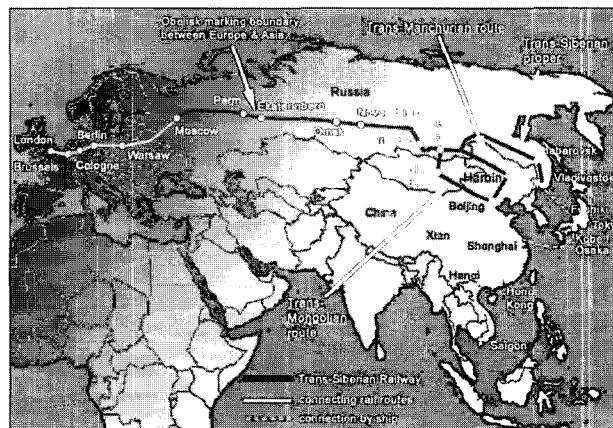
Source: Korea Transport Institute(2003)
Fig. 1 Locations of TKR1, TKR2 and TKR3

2.2 TSR

TSR is a transcontinental railway service route between Vostochny (and Nakhodka) and Moscow. All sections are double tracks and renovated for electric locomotives. This railway has been utilized for trades between several regions of Europe and Asia but its transit time, freight rate, reliability and tracking & tracing services have many disadvantages compared with the marine transport via Suez Canal.

Through TCR, TMGR and TMR, cargos can be also transported from Asia to Europe or vice versa. However, in order to connect the two regions, these routes have to utilize the TSR and cross more borders than TSR. Therefore, it can be noticed that the TSR has better efficiency in terms of transit time and freight rate, although its freight distance is a bit longer than others.

Generally speaking, the trade between Europe and Northeast Asia commonly depends on the marine transport via the Suez Canal. However, some parts of the trade utilize the railway transports: i.e. TCR, TMGR, TMR and mainly TSR. In the cases of TMGR, TMR and TCR, the



Source: www.seat61.com
Fig. 2 Trans-Siberian Railway

In order to figure out the importance of the TSR in the trade, the amount of cargos transported by ships between the two regions is compared to the throughput of the TSR as shown in Table 1.

Table 1 Market share of maritime transport and railway transport (TSR) on container market between Europe and South Korea

Year	Throughput(TEU)		Rate	
	Shipping	TSR	Shipping	TSR
1992	309,804	30,769	91.0%	9.0%
1993	354,711	37,958	90.3%	9.7%
1994	400,200	42,320	90.4%	9.6%
1995	447,793	50,269	89.9%	10.1%
1996	475,335	61,076	88.6%	11.4%
1997	561,028	58,062	90.6%	9.4%
1998	588,128	52,466	91.8%	8.2%
1999	623,258	44,280	93.4%	6.6%
2000	710,689	68,523	91.2%	8.8%
2001	734,927	82,827	89.9%	10.1%
2002	873,594	102,892	89.5%	10.5%

Source : Korea Container Terminal Authority, Donghae Shipping, 2004

Note : 1. Throughput of maritime transport quoted from 'The change of container flows between South Korea and Europe', Korea Container Terminal Authority, 1992-2002.

2. Throughput of railway transport (TSR) is data of Donghae Shipping.

Table 2 Korean cargo volume on TSR

Year	1991	1992	1993	1994	1995	1996
Import	16,798	22,555	23,784	24,469	30,205	37,458
Export	9,806	8,214	14,174	17,824	20,064	23,618
Total	26,604	30,769	37,958	42,320	50,269	61,076
Year	1997	1998	1999	2000	2001	2002
Import	38,243	35,580	29,706	46,265	57,756	69,060
Export	19,819	16,886	14,574	22,258	25,071	33,332
Total	58,062	52,466	44,280	68,523	82,827	102,392

Source : Busan Development Institute, 2004, Plans for revitalization of Busan port and construction of Asian rail network

As can be seen from Table 1, in South Korea, the average share rate of TSR just took about 9% out of the whole throughput. Although figures are not available for China and Japan, it is generally known that the market share of the railway transport (TSR) would reflect a similar picture. Moreover, in the case of South Korea, only about twenty integrated transport companies utilize TSR and their transport range are limited to a few territories such as Finland, Moscow and some central Asian territories. In other words, this railway transport is only utilized for the cargos which are needed to be transported to those four regions, where the marine transport is not available. Consequently, it can be said that the international trades between Northeast Asia and Europe generally depend on marine transport.

Actually, the transport distance of the route through the TSR is shorter than the marine transport. Nevertheless, the marine transport has two assets which make itself more popular. One is that its transit time is shorter than TSR. The other one is that its freight rate is lower than the freight rate of transport through the TSR.

Table 3 Comparison between marine transport and the railway transport (TSR) from Busan port to the major ports in Europe

Ports in Europe	Transport distance (km)		Transit time (day)		Freight rate (US\$/TEU)	
	Shipping	TSR	Shipping	TSR	Shipping	TSR
Le Havre	19,330	12,600	24	34-37	1,550	3,100
Rotterdam	19,790	12,230	24	34-37	1,550	3,100
Hamburg	20,360	11,900	26	34-37	1,550	3,100

Source : Korea Transport Institute, 2004, Analysis and Forecast of Pan-Asia Transportation system, Seoul

In order to transport cargos through TSR from South Korea, firstly, the cargos should be transported by short sea shipping from ports in Korea (Busan) to ports in Northeast Russia (Vostochny). When the cargos arrive at the ports in Russia, they should be transshipped to the TSR. The higher freight rate and longer transit time of the routes are mainly caused by these additional handling.

Furthermore, a freight rate is more directly proportional to freight distance. What makes it worse is that, in reality, shipping companies tend to apply lower freight rates than the declared freight rates. The deployment of ever-larger container ships also makes the rate even lower.

Therefore, at the moment, the TSR does not threaten the existing sea transport because this railway transport does not have any competitive power against the sea transport. Moreover it does not seem that the railway transport is an alternative between Northeast Asia and Europe because most trades are still dependent on the sea transport and this railway transport is only utilized for the cargos which are needed to be transported to several specific regions where the marine transport is not available.

3. The Future of Railway Transportation Market

Railway transport market in Korea can be divided into three such as the Import-Export container market, the South and North Korean trade market and the TKR-TSR market.

3.1 Import-Export Container Market

There are lots of remarkable changes in the import-export container market. First, transport by railway will be started in the Busan New Port around 2007; second, transport capacity in Gyeongbu railroad line will be increased by opening of Deagu-Busan express railroad in 2010; and third, double tracks and electric locomotive project in Jeolla line is under construction.

Nowadays, exclusive trains for import-export container cargo are servicing 61 times a day over the weekdays and 45 times a day during the weekends. After opening the second phase of the express train in 2010, the freight transport capacity will be sharply increased by using of existing Gyeongbu line and Jeolla line. Moreover, Jeolla line's transport capacity is going to be increased by the double tracks and electric locomotive project by 2008.

When Busan New Port opens with more than 20 berths in the year of 2011 it is forecasted that additional demand, more than existing container volume in Gyeongbu line, will be created. Moreover, when the interconnection of TKR

with TSR, becomes in reality it is expected to derive dramatical growth of railroad freight demand.

3.2 Trade between South and North Korea

The trade market between South and North Korea, on short term view point, is the trade with Keasong industrial park which is in operation in North Korea. And middle-long term point of view, we can consider a new market by revitalization of industrial park with special economic zones in North Korea. One of middle-long term projects is Najin-Sunbong economic special zone development project which seems to be visible.

In 1995, the three countries, China, Russia and North Korea, concluded an agreement for joint development of Duman river area but anything had not progressed yet. Recently, however, Honchun city in China and North Korea concluded an agreement for investment in Najin port on condition that Honchun city got the port operating power for the period of 50 years in return to the providing the infrastructure of port. So rapid progress of the project in Najin Port is expected (Maritime Press, 2005). The cargoes originated from such developing area in North Korea and destined to America and Europe is much more likely to use maritime feeder service between Najin and Busan Port and when TKR is in operation some of these cargoes will turn to TKR.

3.3 TSR Market

In general, TSR market is considered as maritime feeder service market from Busan port via Far East Russia ports to TSR. In such aspect TSR market is unlikely to be a competitor for maritime transport mode in the route between Busan port and European ports. Therefore, it seems to be more realistic to consider this market as Asian market including Russia and Commonwealth of Independent States (CIS).

Table 4 shows the TSR market's structure. Both Chinese and Korean cargoes destined to Russia are moved through the route from Busan port via port of Vladibostok or Vostochny by maritime feeder service to TSR. When TKR becomes in reality, it is expected that TKR will be a competitor with the maritime feeder service and will occupy some amount of cargoes in this route.

From the long term view point, the route of 'TKR-TSR-Europe' can gain some market shares against maritime transport in this route. However, TSR would be an alternative way of seaborne transportation rather than a direct competitor considering the transportation capacity of the two modes.

Table 4 Structural changes in TSR container transport market

Period	Change of Route	Change of Carrier	Transport market
Present	① North Chinese ports-Busan port-Far East Russian ports-TSR	Maritime carrier and intermodal carrier together	Focus on Maritime Feeder service
	② Busan port- Far East Russian ports-TSR		
Future	① North Chinese ports-Busan port-Far East Russian ports - TSR	Enlargement of intermodal carrier field	Some competition between maritime transport and railroad transport
	①-1 North Chinese ports-Busan port-TKR-TSR		
	② Busan port-TKR-TSR		
	②-2 Busan port-Far East Russian ports-TSR		

4. Prospect of Railroad Container Transport Market

4.1 Import-Export Container Volume

The estimated total import and export container volume of both Busan and Gwangyang port will be 7,291,000TEU and 3,317,000TEU in 2011 according to the amendment of traffic volume which made by the Ministry of Maritime Affairs and Fisheries in February of 2005.

As shown in the Table 5, based on the modal split of railroad in each port in 2003 (Busan : 10.5%, Gwangyang : 20.2%), the railroad traffic for the both ports are estimated as 766,000TEU and 670,000TEU in 2011.

Table 5 The estimated container transport volume by railroad in Busan and Gwangyang port

Year	Import-Export volume			Transport volume by railroad		
	2003	2006	2011	2003	2006	2011
Busan	6,035	6,655	7,291	636	699	766
Gyang Yang	853	1,321	3,317	172	267	670
Total	6,888	7,976	10,608	903	966	1,436

Note : 1. Based on the paper 'Forecasting national port traffic volume' in the Ministry of Maritime Affairs and Fisheries 2005. 2. Transshipment cargo and coastal cargo are excluded.

4.2 Container Traffic Between South and North Korea

The cargo volume between South and North Korea in the future has been estimated based on the annual average growth rate and the hypothesis of modal split rate. In 2001

Korean Transport Institute(KOTI, 2001) forecasted trade volume between South and North Korea based on the 30% of annual average growth rate of trade volume between the two countries. In 2002 the Institute applied 5.0% of annual average growth rate of traffic volume between the two countries.

The Korean Railroad Authority expected that they would transport 652,000tons of general cargoes and 65,000TEU of container cargo annually from 2005 when reconnecting railroad between South and North Korea. Furthermore, it was predicted that when connecting Korean railroad to the continental railway networks in Russia and China the cargo volume on the railroad would be 315,000tons for general cargoes and 315,000TEU for container(Baik, 2004).

4.3 Container Volume on TSR

4.3.1 Existing Market of TSR

The volume of Korean container cargo on TSR is predicted as shown in Table 6 using the Exponential smoothing method with the past traffic from 1991 to 2002(Table 2). In 2006 the volume will be 105,601TEU and in 2011 the figure seems to reach 132,000TEU.

A literature expected that Korean container cargo using TSR would be 204,650TEU in 2011(Sung, 2005).

Table 6 Forecasting the Korean cargo volume by TSR

Year	Export	Import	Total
2005	68,447	31,806	100,253
2006	72,265	33,335	105,601
2007	76,083	34,865	110,948
2008	79,902	36,395	116,296
2009	83,720	37,924	121,644
2010	87,538	39,454	126,992
2011	91,356	40,984	132,340

4.3.2 European Market

European transport market is defined as the transport market between Busan port and European ports. The shipping has been the main transport mode in the route, but TSR is expected to take more share in this route in the near future.

As shown in Table 7 we derived the estimated traffic volume between Busan port and European ports by using

both Regression and Exponential smoothing method with data of container traffic volume in the route from 1992 to 2002 (Busan Development Institute, 2004).

To derive the traffic volume on TKR-TSR from the total volume between Busan port and European ports we applied conversion rate, 12.6%, reflecting the cost and transit time difference between the two modes¹⁾. With applying it to the total traffic volume the traffic volume on TKR-TSR is obtained as shown in Table 7. The traffic volume in 2011 seems to be in the range between 162,000TEU and 259,000TEU.

Table 7 Forecasting the Korean cargo volume by TSR

Year	Traffic volume between Busan and European ports		Traffic volume on TKR-TSR	
	Regression	Exponential smoothing	Regression	Exponential smoothing
2005	969,764	1,147,641	122,190	144,603
2006	1,021,900	1,264,794	128,759	159,364
2007	1,074,036	1,393,905	135,329	175,632
2008	1,126,172	1,536,196	141,898	193,561
2009	1,178,308	1,693,012	148,467	213,319
2010	1,230,444	1,865,835	155,036	235,095
2011	1,282,580	2,056,301	161,605	259,094

4.4 Container Volume on TKR

One of major cargo origins of TKR in the future would be from Korean container cargo through TSR which is transported by maritime feeder service from Busan to Far Russian ports at present.

To grasp the outline of the scale of the market, we assume the transit time for the maritime feeder mode and the TKR connecting Busan and Vostochny Port as 3 days and 1.5 days respectively. The freight fare for the feeder mode is assumed as 400 USD per 20 feet container. but for the TKR mode, as there is no chance to offer cheaper fare than shipping fare, we assume two kind of railway freight rate; the first one is 70% out of shipping freight rate and second is the same rate as shipping freight rate.

To derive the conversion traffic volume on TKR out of the feeder volume we applied conversion rates, 40% and 25%, reflecting the cost and transit time difference between the two modes²⁾.

1) The cost and transit time for the shipping mode are 2,280USD and 29days, and for the TKR-TSR mode 2,020USD and 25 days. The conversion rate of 12.6% is the average rate of the cost differential weight, 11.4% (260USD/2,280USD), and time differential weight, 13.8% (4days/29days).

2) The cost and transit time for the feeder mode are 370USD and 3days, and for the TKR mode 259USD(70%) and 370USD(100%) and 1.5 days. The conversion rate of 40% is the average rate of the cost differential weight, 30% (111USD/ 370USD), and time differential weight, 50%(1.5days/3days).

By applying these conversion rates to the forecasted traffic volume in table 6, the traffic volume of TKR can be derived as 33,000TEU-53,000TEU in 2011 as shown in table 8.

Table 8 The conversion container volume on TKR out of TSR

Year	Traffic volume	Conversion volume on TKR	
		Conversion rate : 40%	Conversion rate : 25%
2008	116,296	46,518	29,074
2009	121,644	48,658	30,411
2010	126,992	50,797	31,748
2011	132,340	52,936	33,085

5. Conclusion

In this paper, we have examined current situation of TKR, TSR, and the market structure of railroad transport. Then the estimated market volume of railroad transport was examined briefly.

The connection of TSR and TKR is likely to secure trade routes for the regions accessible to the railroad systems. Moreover, the international trades between Northeast Asia and Europe seems to be accelerated by establishing the railroad connection, TKR-TSR. Furthermore, the demand for the connection of TKR-TSR seems to be accelerated through the increasing economic cooperation between South-North Korea with enlarging trade volume between in this region.

In such situation it might be the key issue to understand the potential and scale of the railroad freight transport market. This seems to put more emphasis on the forecast of the transport market. However, through the study we discovered a number of limitations on the study of demand forecasting. One of these is the limited data available on the freight movement on the railroad, resulting in the insufficient forecasting results.

With this in mind we can suggest directions for further studies on this issue. As to the methodology for the forecasting market share, in addition to the simple method such as comparing cost and transit time, we need to find out the main factors on transport mode choice such as cost, time, frequency etc., and then we have to analyze the preference of decision makers such as shippers and freight forwarders. Particularly, for such mode as TKR which is not existing now, we have to find out another way to analyze demand characteristic for new transport system.

This is one of alternative ways to use a 'stated preference data' obtained from survey to find out the preference, opinion and idea of individual decision makers(Ha, 1996).

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