

Perspectives on Linking the Trans-Siberian and Trans-Korean Railways

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1. Introduction

The Trans-Siberian Railway (TSR) is Russia's main East-West artery, running 9,297km from Vladivostok to Moscow. The line is linked to lines running further west to such European countries as Finland and Poland. In addition, it is connected by means of numerous branch lines to Northeastern China, the DPRK, Mongolia, Kazakhstan and Uzbekistan. Furthermore, via marine routes starting from ports such as Vladivostok and Vostochny, it is linked to such places as the ROK, Japan, the coastal areas of China, and Vietnam. In the first part of this paper, I will provide an overall picture of existing links between the TSR and East Asia.

Since the historic North-South summit meeting held in June 2000, the reconnection and revival of the Trans-Korean Railway (TKR) has been the focus of attention. The purpose of reconnecting the TKR is to establish a new transportation network that covers not just the Korean Peninsula but the whole of Northeast Asia, creating a new Silk Road in the form of a railway linking Asia to Europe. More specifically, the idea currently being promoted is to connect the TKR and the TSR to replace the maritime shipments between the ROK and the Russian Far East that are currently necessary, thereby permitting cargo to be transported by rail all the way from the ROK to Europe. The possibility of connecting the TKR and the TSR and using the link for through transportation will be discussed in the latter part of this paper.

2. Current Use of the Trans Siberian Railway to/from East Asian Countries

The four types of route via the TSR that are currently used as international transportation routes to/from East Asia are as follows:

- i) European Transit: Cargo can be transported from East Asia to Europe (Finland) via ports in the Russian Far East and the TSR in 16 to 22 days. Usually, cargo is stored temporarily in Finnish bonded warehouses and is ultimately exported to Russia. At present, this route is hardly ever used to reach any other European countries, which use standard gauge rails, as it is not competitive in terms of cost or time.
- ii) Central Asian: Cargo can be transported from East Asia to Kazakhstan / Uzbekistan via ports in the Russian Far East and the TSR in about 20 days. In addition, a block train began operating between Vostochny and Almaty in February 2003, reducing the journey time by about one week.
- iii) Afghan Transit: Cargo can be transported from East Asia to Afghanistan via ports in the Russian Far East, the TSR and Central Asian railways in about 30 days.
- iv) Russian Domestic: Cargo can be transported from East

Asia via ports in the Russian Far East and the TSR in about 17 days, in the case of Moscow.

Each of these routes has competitor routes; consignors make decisions about which routes to use depending on their relative competitiveness in terms of cost, journey time, frequency of service and trustworthiness.

European Transit's biggest competitor is the All Water route. The latter takes about a month to transport cargo from ports in Japan and the ROK to Finland, which is considerably longer than the 16 days that the TSR takes, but its low-cost service, made possible by its investment in vast ships that can carry more than 6,000TEU, is its major weapon. The marine freight rate between Japan and Europe is particularly low, so the TSR route is consequently unable to compete with the All Water route. However, as the marine freight rate between the ROK / China and Europe is much higher than this, the TSR route is competitive compared to the All Water route. Since the marine freight rate between East Asia and Europe rose in 2003, the TSR route has maintained its relative advantage in freight transport between the ROK / China and Europe.

The Trans-China Railway (TCR), running between Lianyungan Port (China) and Kazakhstan via the Alashankou-Druzhba border crossing, is a competitor to the Central Asian route. Container block trains run between Lianyungan Port and Alashankou three times a week. Both routes can apparently match each other in terms of cost and journey time, but block trains began to run between Vostochny and Almaty in 2003, reducing the journey time between these points by a week, so we can infer from this that the TSR has the edge at present. However, for cargo originating in Japan, there are around three shipping services per week to Chinese ports, which is more convenient than the two services per month to the TSR, so many consignors apparently use the TCR. On the other hand, for cargo originating in the ROK, there is a higher frequency of sailings to ports in the Russian Far East, making the route more convenient, so use of the TSR is higher. The downside of the TCR is the fact that border-crossing procedures on the Kazakhstan side take several days.

A route via Iran is the main competitor of the Afghan Transit route. The Iran route is cheaper than the TSR, using marine transport as far as Bandar Abbas and then running overland to western Afghanistan. However, transit via the Iran route has been interrupted on occasion due to the political situation, so it lacks trustworthiness.

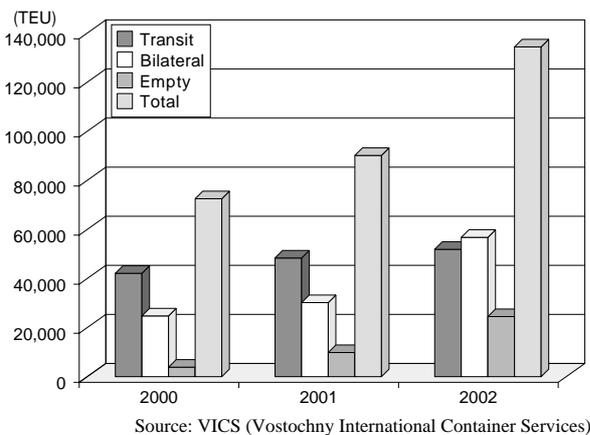
Cargo on the Russian Domestic route is often sent via Finland. From East Asia it is transported as transit cargo to Finland via All Water or the TSR, with cargo being exported to Russia, such as household electrical goods, being held temporarily in bonded warehouses near the

Finnish border. After it has been confirmed that the purchaser has paid, a truck is sent from Russia and the cargo is handed over. The main reason for choosing this route is that a lower customs duty is charged on goods entering Russia this way than those entering the country via ports in the Russian Far East, so it is competitive in terms of cost.¹ Other advantages of this route include the existence of easy-to-use Finnish bonded warehouses and transit railway charges that have been set far lower than those for bilateral cargo.

The total volume of cargo on the TSR using the aforementioned routes has continued to grow steadily over the last few years, increasing from about 70,000TEU in 2000, to 90,000TEU in 2001 and about 130,000TEU in 2002, according to statistics released by VICS (Vostochny International Container Services). In 2003, cargo volumes rose by as much as 50% on the previous year and the total volume for the year is anticipated to reach 180,000TEU.

Factors behind this increase include 1) the cut in journey times and the increase in the TSR's trustworthiness among ROK and Chinese consignors; 2) the spring 2003 price rise on the All Water route, the TSR's competitor in transit transport to Finland²; and 3) the boom in the Russian economy and active demand for ROK-produced household electrical goods and China-produced miscellaneous everyday goods. What could be a matter for concern is the fact that if this rise continues, transport capacity will be exceeded and delays will result.³

Figure 1. Growing Container Volumes



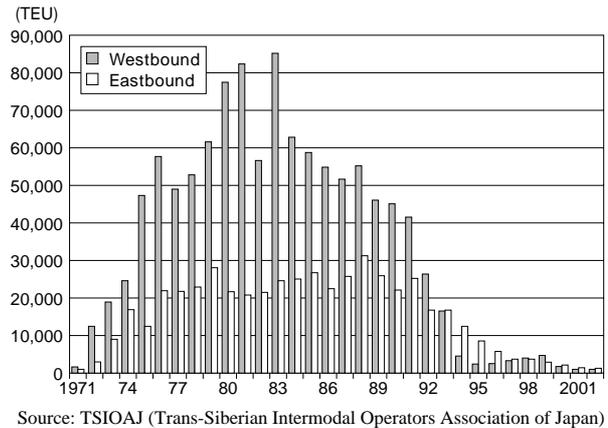
Several trends have been visible in TSR container transportation in recent years.

1) A rapid increase in Chinese cargo and a decline in Japanese cargo

It was Japan that blazed a trail in TSR transit transport in the latter half of the 1970s. However, cargo declined in

the 1990s, due to lower prices on the competing All Water route, the deterioration in the route's image due to the chaos arising from the collapse of the Soviet Union, and the tendency of Japanese companies to transfer their manufacturing hubs overseas, with efforts to check this fall in cargo volume ultimately proving unsuccessful.

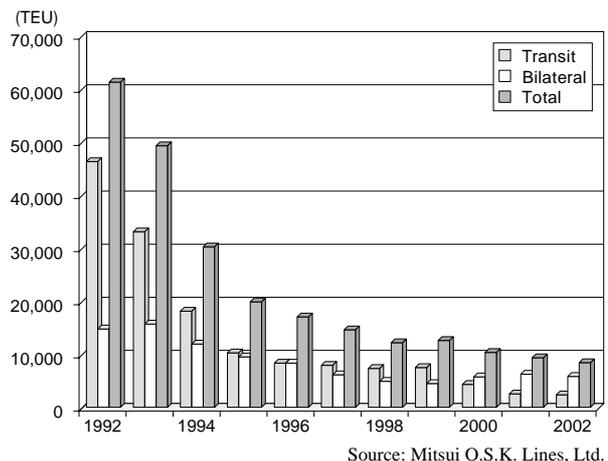
Figure 2. TSR Transit Cargo to/from Japan



According to the TSIOAJ (Trans-Siberian Intermodal Operators Association of Japan), the transit volume has been declining since reaching the 110,683 TEU mark in 1983; the volume in 2002 was only 1.8% of the peak year. According to Mitsui O.S.K. Lines, Ltd., TSR cargo originating in or destined for Japan continued to decline, totaling about 8,500 TEU (down 8% on the previous year), with transit cargo accounting for 30%, and bilateral for 70%.

Japanese forwarders are pessimistic about the return of Japanese cargo to the TSR route. As mentioned previously,

Figure 3. TSR Cargo Volume to/from Japan



¹ Piecing together remarks made by those involved in the business, it seems that, in the case of goods carried from Finland to Russia by Russian transportation companies, the invoices are fiddled and discounts on customs duty are granted.

² The TSR went ahead with a 30% rise in rail transit charges to Finland from 1st January 2003, but the All Water route also increased its prices, so there was hardly any effect on the TSR.

³ There is no accepted figure for the transport capacity of the TSR, as it is partly related to domestic transportation, but according to experts from the Russian Ministry of Railways, it is around 200,000TEU.

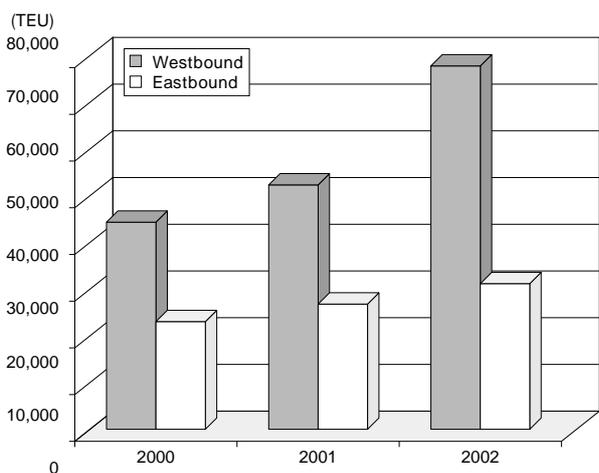
fares on the All Water route between East Asia and Europe vary greatly depending on the country. The rate between Japan and Europe is much lower than that between the ROK and Europe, or between China and Europe. The key reason for the low usage of the TSR by Japanese cargo lies in this cost difference. Unless there is no change in this cost structure, the TSR route will remain unattractive to Japanese consignors.

Meanwhile, the ROK made a great leap forward to become a major exporter in the 1990s, surging ahead as the main player in exports of household electrical equipment to Russia, in particular. According to shipping companies in the ROK, TSR cargo increased 3.3 times on 1991 levels in the 10 years to 2001.

Furthermore, China has emerged as a major exporter to Russia in recent years. Due to the momentum created by the establishment in the autumn of 2000 of a container route linking Shanghai and Ningbo in China with Vostochny, exports to Russia using the TSR have continued to climb sharply. At present, services are also operating on the Hong Kong - Vostochny shipping route. In addition, cargo is carried from a number of Chinese ports to Busan, where it is transhipped and sent to Russia. Cargo from China includes clothing, everyday items and household electrical items produced in Korean companies' factories in China; these are exported to Russia either directly or via Finland.

Looking at cargo by countries of origin and destination, in 2001, 77% originated in or was destined for the ROK, while the figures for China and Japan were 12% and 11%, respectively; however, the figures for ROK cargo include Chinese cargo transhipped at Busan. Currently, it seems that China's share is growing significantly while the shares of Japan and the ROK are declining.

Figure 4. Westbound Versus Eastbound Cargo



Source: VICS

2) An imbalance between westbound and eastbound cargo and an increase in empty containers

The ratio of westbound to eastbound cargo is imbalanced, having grown to 71 : 29 from 66 : 34 in 2001. In connection with this, the volume of empty containers is on the increase. Empty containers accounted for 18.4% of all cargo in 2002. The increase in empty containers does not only have repercussions for the cost of using containers, but also has an effect on the efficiency of work at Vostochny Port. This phenomenon is believed to be caused by the increase in Chinese cargo, which tends to be headed in one direction only.

3) A rapid rise in bilateral cargo

Although we can see a slight increase in transit cargo, we can also see that bilateral cargo is growing rapidly. The ratio of transit to bilateral cargo has become almost evenly divided, shifting from 61 : 39 in 2001 to 48 : 52 in 2002. In particular, the increase in westbound bilateral cargo signifies an increase in ROK cargo destined for Central Asia and Chinese cargo destined for the domestic market in Russia.

4) An active approach on the part of the ROK forwarders

The active approach on the part of forwarders in the ROK has played a significant part in the increase in TSR container cargo. Forwarders in the ROK have been creating a business environment that has strengthened the competitiveness of the TSR route. For example, the attempt by multiple shipping companies to become involved in the Busan-Vostochny shipping route succeeded in reducing⁴ marine transport fares by encouraging competition. In addition, the forwarders themselves own containers and reduce the burden on consignors by allowing them to use them. In contrast, Japanese forwarders do not have their own containers, so consignors have to lease containers, which in turn pushes costs up. Furthermore, major forwarders receive bulk discounts on rail transport fees. The ROK's forwarders have been picking up Chinese cargo at such places as Dalian, Tianjin and Hong Kong, transshipping it at Busan and then sending it via the TSR route.

There are several issues that must be dealt with in the future with regard to the ROK's and China's use of the TSR, which at present appears to be going smoothly.

1) Transfer of manufacturing sites overseas

Most of the ROK's exporting companies have domestic production bases, but it is likely that in future there will be an increasing trend towards shifting production bases overseas to countries where labor costs are low, as has been the case in Japan. In this case, the volume of export cargo originating in the ROK will decrease and the country may well go down the same path

⁴ Originally, Transorient Shipping Co., Ltd. (a joint venture between FESCO and Hyundai Merchant Marine) had a monopoly on the Busan - Vostochny route, but in 2001, other shipping companies were given permission to run services on the route and around five companies decided to take advantage of this. As a result, the marine transport fares for transit cargo fell by 30-35%. In contrast, the joint service run by FESCO and Mitsui O.S.K. Lines still has a monopoly on the Japan - Vostochny route.

as Japan.

2) Tariff competition versus All Water

The All Water route, which is the main competitor of the European Transit route, is moving towards the introduction of gargantuan ships, so it is possible that they will go on a further low-price offensive. On the other hand, Russian Railways has increased its rates occasionally in the past. For example, it increased transit fares by about 30% in January 2003. It announced a further increase in charges in October 2003, citing security reasons, but ended up having to back out of this move due to strong objections among users. Such fare increases may reduce cost competitiveness.

3) Improvement of the TCR route

The TCR route, which is the main competitor of the Central Asian route, could well embark upon efforts to speed up its transport times and improve its level of service. For instance, China Railways has a plan to increase the double-track and electrified sections of the railway between Lianyungang and Alashankou⁵. It is also looking into the possibility of running a container block train between Tianjin and Alashankou, with some cargo already being transported directly from Tianjin to Alashankou, without transshipment at Lianyungang Port.

4) Possible challenge from Mongolia

The Mongolian route could become a competitor to the TSR. Chinese exports to Russia and Finland will increase further and, if a new Tianjin ~ Ulaanbaatar ~ Ulan-Ude ~ TSR ~ Europe route were developed, this route might have an advantage in terms of time, compared with the existing option of transit to the TSR via Busan.

3. Possible TKR Routes and Plans for Reconnection

Since the historic North-South summit held in 2000, when the reconnection and revival of the TKR became the focus of attention, both Koreas have been involved in joint efforts to bring the project to fruition. The TKR reconnection project has an important political significance as a symbol of North-South cooperation. In addition, the idea of connecting the TKR and the TSR is being promoted.

Four Trans-Korean railway lines were constructed during the Japanese colonial period: the Gyungui Line (Seoul ~ Sinuiju), the Gyeongwon Line (Seoul ~ Wonsan), the Mt. Kumkang Line (Seoul ~ Mt. Kumkang) and the Donghae North Line (Samcheok ~ Anpyun). Unfortunately, these lines were severed following the division of the peninsula.

In April 2002, the ROK and DPRK governments agreed to make the reconnection of the Gyungui Line along the west coast the highest priority, with the Donghae North Line along the east coast as the second priority. No agreements have so far been concluded between the ROK and the DPRK regarding the reconnection of Gyeongwon Line and Mt. Kumkang Line. The factors considered in setting priorities appear to have been the ease and cost of construction, usefulness after completion and military

constraints.

I would now like to discuss current status of each line in terms of their disconnected sections, the progress of construction work and plans for the future.

1) Gyungui Line

The Gyungui Line is a route that runs to the DPRK from Busan in the ROK via Seoul, traveling north along the west coast to Sinuiju and then on to China. Before the Second World War, this corridor was an important transport route linking Japan and Northeastern China, but it had to be severed when the Korean Peninsula was divided in two. However, since the North-South Summit in June 2000, the momentum for reconstructing the Gyungui Line between north and south has increased and railway construction work has taken place on the ROK side. In September 2002, work to clear mines began on the DPRK side, with reconstruction of the lines continuing throughout 2003.

Of the 486km stretch between Seoul and Sinuiju, the 12km between Moonsan and the MDL (Military Demarcation Line) was disconnected before the reconnection project commenced. In 2002, the Gyungui Line was extended northwards from Moonsan to Dorasan on the ROK side. All that remains to be done in the ROK is construct 1.8km of track in the DMZ (demilitarized zone). The agreement of the Ministers of Defense of both countries will be needed before this can take place. The total cost of construction on the ROK side is estimated at 90.3 billion won.

Mine clearance work on the DPRK side has been completed, with construction of the 15.3km stretch between Gaesung and the MDL scheduled for completion in 2004. In addition, four-lane 20 meter-wide highway is due to be constructed in parallel with the Gyungui Line, running between the unification bridge and the MDL (5.1km) on the ROK side.

The completion of work on the railway and the road on both sides of the divide should make trade quicker and easier, with cargo traveling overland, rather than using marine transportation, as is the case at present. North-South trade was worth \$402.957 million in 2001, rising to \$641.730 million in 2002. Trade between the two countries takes place on four regular and irregular shipping routes, including Incheon ~ Nampo and Busan ~ Rajin. The cost of marine transport between Incheon and Nampo is about \$720/TEU, but it is estimated that this would fall to \$200/TEU if the Gyungui Line were used, and the journey time is also expected to decrease considerably. The most immediate use for the Gyungui Line could be the transport of industrial materials between the ROK and the planned Gaesung Industrial Park.

Furthermore, there is potential for the Gyungui Line to be used for trade between the ROK and Northeastern China, providing an alternative to the marine transport on which the ROK is currently dependent.

2) Gyeongwon Line

There are a number of possible options for a route

⁵ 76.6% of the TCR (4,100km between Lianyungang and Alashankou) is double-track, but only 28.8% is electrified.

Disconnected Sections of the TKR

Route	Disconnected sections	Distance (km)	Progress
Gyungui Line (Seoul~Sinuiju)	ROK: Dorasan~MDL	1.8	Completed
	DPRK: Gaesung~MDL	15.3	Under construction
Gyeongwon Line (Seoul~Wonsan)	ROK: Shintanri~MDL	16.2	
	DPRK: Pyonggang~MDL	14.8	
Mt. Kumkang Line (Seoul~Mt. Kumkang)	ROK: Chulwon~MDL	32.5	
	DPRK: Nekumkang~MDL	84.1	
Donghae North Line (Samcheok~Anpyun)	ROK: Cheojin~MDL	9.0	Under construction
	ROK: Cheojin~Gangnung	127.0	Planned
	DPRK: Onjungri~MDL	18.5	Planned
Donghae Central Line (Samcheok~Pohang)	ROK: Samcheok~Pohang	171.0	Planned

running up the east coast of the Korean Peninsula to Rajin via Wonsan in the DPRK and Khasan in Russia. Initially, several routes linking Seoul and Wonsan were proposed. These included the reconstruction of the Gyeongwon Line, the use of the Gyungui and the Pyongra (Pyongyang ~ Rajin) lines, and a line branching off from the Gyungui Line. Russian experts have carried out field studies into some of these options,⁶ but it was agreed in April 2002 that the reconnection of the Gyeongwon Line would be assigned a low priority, mainly due to the presence of military facilities along the Gyeongwon Line on the DPRK side. Instead, it was agreed in April 2002 that the Donghae Line between north and south should be connected.

31km of the 222km Gyeongwon Line between Seoul and Wonsan is disconnected: 16.2km between Shintanri and the MDL on the ROK side, and 14.8km between Pyonggang to the MDL on the DPRK side. The construction plan was drawn up in the ROK, with the cost of the work estimated to reach 86.8 billion won.

3) Mt. Kumkang Line

On the Mt. Kumkang Line, the sections between Chulwon and the MDL (32.5km) on the ROK side, and Nekumkang and the MDL (84.1km) on the DPRK side are disconnected. The ROK side has drawn up a plan for construction work, but there are no plans to reconnect this line at present.

4) Donghae North Line

As mentioned above, it was agreed in April 2002 that the Donghae Line between north and south should be connected. In September 2002, a ceremony was held simultaneously on both sides of the border to commemorate the commencement of work on the Gyungui and Donghae lines.

The line is disconnected between Cheojin and the MDL (9.0km) on the ROK side, and between Onjungri and the MDL on the DPRK side. The ROK is planning to construct a single-track line on its own side, at an estimated cost of 74.8 billion won.

The DPRK side appeared to have finished clearing mines by the end of 2003, and construction work is expected to continue on both sides in 2004. Furthermore, the ROK is planning to extend the line southward as far as Busan. More specifically, the Donghae North Line will be extended from Cheojin to Gangnung (127km), with the Donghae Central Line being constructed between Samcheok and Pohang (171km) by 2010. Along with the existing sections, these new sections of track will permit direct rail transportation from Busan to Russia via Gangnung and Wonsan. The total cost of construction is estimated at 2,441.2 billion won.

Even assuming that the entire Donghae Line is completed, it is thought unlikely that it will carry many passengers or much cargo between North and South, due to the geographical conditions. It could, however, be used for international transportation.

Firstly, a route linking the ROK with China's Jilin Province, via Chongjin and Rajin in the DPRK section of the Tumen River area, is conceivable. Yanbian Prefecture, in the east of Jilin Province, is home to many ethnic Koreans and many ROK companies have established bases there. At present, a marine route is used for transporting cargo between the ROK and Yanbian, but it would be possible to transport it overland if this route were completed.

The second possibility is that of connecting the ROK with Russia's Primorsky Territory. There is potential for the connection of the Donghae Line with the TSR. This will be discussed later.

4. Linking the TKR and the TSR

Now let us consider the potential for and profitability of linking the TKR, upon which work has already started, and the TSR.

There are four possible routes. The first three use the Gyungui Line and China's railways, while the fourth uses the Donghae Line.

⁶ According to a media source in the ROK (JoonAng Ilbo, April 8, 2002), Russia and the DPRK conducted a joint study of the 700km between Tumangang, Wonsan and Pyonggang, concluding that 130 tunnels and 742 bridges require immediate repair work and estimating the total cost for repair work at \$2.2 billion.

Possible Routes Linking the TKR and the TSR

Name	Route	Distance (km)	Transshipment point
Manzhouli/ Zabaikalsk	Sinuiju ~ Dandong ~ Shenyang ~ Harbin ~ Manzhouli ~ Zabaikalsk ~ Chita ~ TSR	8,437(Dandong~ Moscow)	Manzhouli/ Zabaikalsk
Mongolia	Sinuiju ~ Dandong ~ Shenyang ~ Beijing ~ Erenhot ~ Zamyn-Uud ~ Ulaanbaatar ~ Naushki ~ Ulan-Ude ~ TSR	9,007(Dandong~ Moscow)	Erenhot/ Zamyn-Uud
TCR	Sinuiju ~ Dandong ~ Shenyang ~ Beijing ~ Zhenzhou ~ Alashankou ~ Druzhba ~ Kazakhstan ~ Russia ~ TSR	9,735(Dandong~ Moscow)	Alashankou/ Druzhba
Tumangang/ Khasan	Wonsan ~ Rajin ~ Tumangang ~ Khasan ~ Ussuriysk ~ TSR	9,437(Khasan~ Moscow)	Tumangang/ Khasan

1) Manzhouli/ Zabaikalsk route

This route acts as an extension to the Gyungui Line, connecting the Korean Peninsula and the TSR via Northeast China. Starting from Sinuiju, the northern end of Gyungui Line, and passing through Dandong, Shenyang, Harbin and Manzhouli, before crossing the border to Russia, the route meets the TSR at Chita. The distance is 8,437km from Dandong to Moscow or 9,382km from Busan to Moscow. This route is the shortest of the four options, but has the following drawbacks:

- i) Transshipment is required at the Manzhouli / Zabaikalsk border crossing due to the gauge difference between China and Russia. The existing transshipment station can be used, but the border station is often crowded and it takes more than 2 days to cross the border.
- ii) The route uses the Chinese railway for about 1,800km. Some sections are crowded, such as Shenyang ~ Harbin, and it will be necessary to obtain the cooperation of Chinese Railways before container block trains can be run.
- iii) The route crosses two national borders - DPRK/China and China/Russia - as well as the frontier between the two Koreas.

2) Mongolia route

This route runs through China and Mongolia, from Sinuiju to Ulan-Ude, passing through Dandong, Shenyang, Beijing, Erenhot, Zamyn-Uud, Ulaanbaatar and Naushki. The total distance is 9,007km between Dandong and Moscow, or 9,952km between Busan and Moscow. This route is about 500km longer than the Manzhouli / Zabaikalsk route, and the following factors should be taken into consideration:

- i) Transshipment is required at the Erenhot / Zamyn-Uud border crossing, due to the gauge difference between China and Mongolia. There is a modern transshipment station at the border, which is used for the container block trains that run between Tianjin and Ulaanbaatar.
- ii) This route passes through one of the most crowded sections of the Chinese railway, between Beijing and Shenyang. It will be necessary to obtain the cooperation of Chinese Railways before container block trains can be run.
- iii) Mongolia has only single-track railway lines.
- iv) The route crosses three national borders, as well the

frontier between the two Koreas.

3) TCR route

This route runs from Sinuiju to the TSR via Dandong, Shenyang, Beijing, Zhenzhou, Alashankou, Druzhba, and either Lokot or Petropavlovsk. The estimated total distance is 9,735km between Dandong and Moscow, or 10,680km from Busan to Moscow. The total distance will depend on the specific routes taken in Kazakhstan and China. This route is the longest of the three that use the Gyungui Line and has many drawbacks:

- i) Transshipment is required between Alashankou and Druzhba due to the gauge difference between China and Kazakhstan. This border crossing is notorious for time-consuming CIQ procedures.
- ii) The route uses the Chinese railway for about 6,000km, so it will be necessary to obtain the cooperation of Chinese Railways before container block trains can be run. There is concern that railway tariffs may rise due to the long distance involved.
- iii) The route crosses three national borders, raising concerns about efficiency in border-crossing procedures.

4) Tumangang/ Khasan route

This route connects the east coast of the Korean Peninsula with the Russian Far East via Rajin, Tumangang, Khasan and Ussuriysk by rail, without once requiring cargo to be loaded onto a ship. The total distance is 9,437km from Khasan to Moscow, or 10,737km from Busan to Moscow. Although the total length is longer than the three routes that use the Gyungui Line, the route may have the edge on them, in that it does not transit China or Mongolia. In fact, Russian Railways have great expectations for this route because, if cargo could be sent from the ROK by rail via the DPRK, marine transport fees would not be required and it would be possible to make it more price competitive than the current route, which combines marine and TSR elements. However, many problems are likely to be encountered in developing this route:

- i) Transshipment is required at Tumangang / Khasan border due to the gauge difference between the DPRK and Russia and a transshipment station would have to be constructed for this purpose.
- ii) The DPRK's domestic railways, especially the Pyongra Line, which passes along the east coast, are

extremely dilapidated single-track lines, so a vast amount of investment would be required before block trains could run on them. The Pyongra Line contains many tunnels, bridges and steep curves.

- iii) About 800km of this route runs through the DPRK, so cargo from the ROK would have to pay transit fees to the relevant authority in the DPRK. In addition, the trains would have to travel some 500km within the ROK from Busan, thereby pushing up rail transport costs.
- iv) It would be necessary to construct new railway facilities on the ROK side, as mentioned before.
- v) Reconnection work on the Donghae North and Central lines has already been delayed, reflecting their lower priority compared with the Gyungui Line. Consequently, it is difficult to predict when the Donghae Line will be reconnected.

5. Obstacles to Continental Linkage

Let us now look at common problems affecting the possible routes.

1) Railway conditions and power shortages in the DPRK

One potential obstacle to all four routes is the fact that North Korea's railways are beset by technical problems that could prevent container block trains being run.

The DPRK's railway system lags far behind that of the ROK in terms of double-track rails and automatic signaling systems, although a greater proportion of the railways in the DPRK is electrified than in its southern neighbor. The DPRK uses an electric traction system (DC3kv), while the ROK combines a different type of electric system (AC25kv) with diesel locomotives, so some means of switching between these two systems will be required when connecting the railways of the two countries.

Furthermore, the DPRK's domestic rail network consists of extremely dilapidated single-track lines, so a vast amount of investment would be required before block trains could run on them. The question is, who will provide the financial assistance that the DPRK requires in order to upgrade its railways?

Furthermore, although the railway is electrified, the DPRK's trains often come to a standstill due to power shortages. This fundamental stumbling block must be solved before block trains can run through the DPRK.

2) Different gauges

Two different types of gauge are used for railways in the region, making transshipment necessary wherever these two types meet. Formerly Soviet countries (Russia, Central Asian states, etc.), Mongolia and Finland use broad gauge

(1,520mm) rails, while China, the Korean Peninsula and Europe (other than Finland) use standard gauge (1,435mm). Therefore, transshipment occurs at the borders between China and Russia, China and Kazakhstan, and the DPRK and Russia. Transshipment is time-consuming as well as costly in most cases.

3) Border crossing

With regard to the soft aspects of border crossing as well, there are many borders that are inefficient in terms of procedures (Customs, Immigration and Quarantine) and the time required to complete them. In particular, in Russia and Kazakhstan, there are problems with the efficiency of border-crossing and customs inspection procedures.

Generally speaking, the greater the number of discontinuous points, the lower the efficiency of multi-modal transportation.

4) Cooperation with neighboring countries

International cooperation is necessary in linking the railways of adjacent countries. China's cooperation is particularly important in the three possible routes using the Gyungui Line, since busy sections of its railways would need to be used. Furthermore, collaboration with Mongolia is necessary in the Mongolia route, while Kazakhstan's cooperation is key in the TCR route.

5) Economic competitiveness

The success of these four overland routes connecting the TKR and TSR will depend on whether the new routes would be economically competitive with such existing routes as All Water or the combined marine and TSR route.

Some people assume that, if cargo could be sent from the ROK by rail without once loading it onto a ship, marine transport fees would not be required and the route could be made more price competitive than the current combined marine and TSR transport system. However, the overland routes have to cover long distances. In particular, the TCR route will run along Chinese Railway's track for 6,000km. What kind of fee will have to be paid to China Railway? Similarly, the railway authorities of Kazakhstan, Mongolia and the DPRK could charge fees for the transit of block trains. The higher these fees, the less competitive the route will be.

Another question is how much would Russian Railways charge for using the shorter section of the TSR in the cases of the three routes that use the Gyungui Line? Unless their charges are much lower than the current transit fee applied from Vostochny, the three routes will not be competitive.

In order to obtain a realistic idea of through rates, a

Comparison of the Railway Systems of the ROK and the DPRK (2002)

	ROK	DPRK
Total length of track	3,129	5,214
% Double-track	32.1	3
% Electrified	21.4	79
% Automatic signal system	27.4	1.2
Traction method	Electric (AC25kv) or Diesel	Electric (DC3kv)

Source: Korea Railroad Research Institute

consultative team incorporating representatives of each railway authority should be established.

6) Opposition from the maritime industry

In the combined marine and TSR route used at present, maritime industries such as shipping companies and ports have important roles, both in the ROK and the Russian Far East. In other words, the existing route generates many jobs as well as high profits in East Asia, including the Russian Far East. Were the marine section of inter-modal transportation to be replaced by rail transport, profits in the maritime industry would be slashed, resulting in massive job losses. Vostochny Port, for instance, might lose its major container business. It is highly likely that these industries, as well as the governments of the areas in which they are based, including Primorsky Territory, will take political action to defend their livelihoods. It is unlikely that Moscow will be able to ignore the anguished appeals of even the more far-flung regions of the country.

6. Conclusions

1) The proposed overland routes connecting the TKR and the TSR pose many problems. It is necessary to conduct thorough studies of the technical and economic difficulties. The highest priority has to be assigned to a survey of the condition of railway infrastructure in the DPRK; this should be conducted by a multilateral team of experts.

2) International cooperation with China, Mongolia and Kazakhstan is necessary in order to make plans for the overland routes that function as an extension of the Gyungui Line.

3) An improvement in the political and economic environment of the DPRK is a prerequisite for connecting the TKR and the TSR, especially via the east coast route. This will be the key to obtaining international financial support for improving railway infrastructure in the DPRK.

4) Russia and the ROK cannot ignore the impact that improved cross-border rail links would have on maritime industries.

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