PROBABILITY OF CONTAINER TRANSPORT THROUGH EURASIAN CONTINENT BASED ON ON-SITE SURVEY

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Abstract: The present paper reports the current situation of the Transport Corridors in Eurasian Continent connecting with Far East Asia and Europe. The on-site survey was conducted from 1998 to 2000. The survey includes the current situation of the container transport by railways and roads connecting with East Coast of Eurasian continent and West European countries. The paper also discusses on the probability conditions of container transport through the Corridors.

Key Words: Container transport corridors, Eurasian continent, Siberian Land Bridge, North East Asia

1. INTRODUCTION

The world trade has rapidly grown since 1900's, and this tendency is anticipated to continue in the 21st century. Particularly, the rapid growth of economy in East Asia is often spotlighted and discussions are focused on the maritime container transport between those countries. In fact, the rapid growth of economy in NIES and ASEAN countries and China is extending the world trade among East Asia, North America and Europe. This has resulted in the rapid growth of international commodity flow. As already well known, the international commodity flow almost depends on the maritime transportation. In fact, it was 4 billion tons in 1990, but became 4.9 billion tons in 1997, 68% of which is bulk cargo such as oil, ore and grain and etc., and the remaining 32 % is the general cargo. 50% of the general cargo is containerized (Jose, 2000). Still, containerization will be expected to become more and more from the viewpoint of transport efficiency. Thus, container transport becomes very important for the world economy.

In Figure 1 is shown the container movement among Three Poles in 1998 (MOL, 1999). This figure shows the main container movement is between East Asia and North America, and between East Asia and Europe. Almost of these container is transported via maritime routes, which, in this context, is called as trunk sea routes.

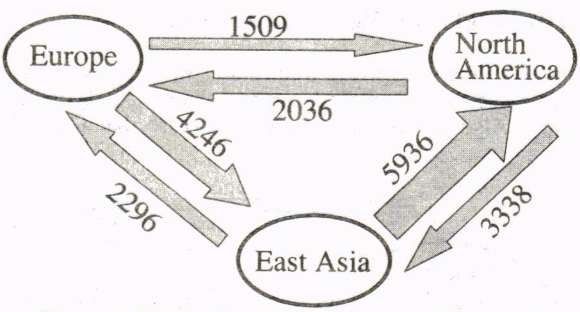

Figure 1 World Container Movement in 1998 (1000TEU)

Figure 2 shows the annual change of container cargo volume between East Asia and Europe, which is spotlighted in the present paper (International Transport Handbook, 1992-2000). As shown in Figure 2, the container movement between Europe and Far East countries has rapidly increased since 1990's.

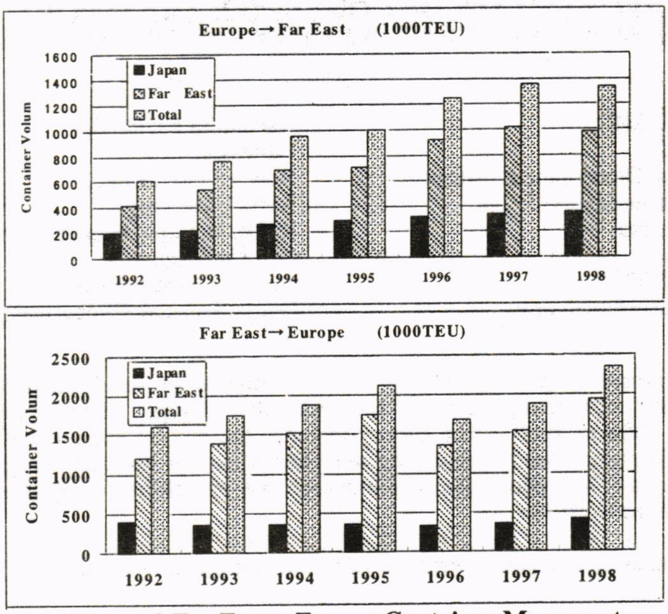

Figure 2 Far East～Europe Container Movement

Well, Most of Asian and European countries are connected with through the Eurasian Continent where so called as the Silk Roads were historically the main trade route between the East Asia and the Europe via the Middle East. In the Eurasian Continent, there are many countries and populations, and, the international trade has become vigorous, particularly after the end of the Cold War in 1991 with exception of North Korea. Nevertheless, the obstacle exists in the undeveloped transport infrastructures in this area. In fact, the container movement through the Eurasian Continent is still in the very low level, although the container volume is increased between the Far East and the Europe as shown in Figure 2. However, the transport route through the Eurasian Continent (hereafter called as Land bridge route) has advantage in travel time comparing with the Suez route. Therefore, if appropriate conditions are given to the Land bridge routes, more containers may be invited on these routes.

2. CURRENT STATUS OF EURASIAN LAND BRIDGE TRADE CORRIDORS

2.1 Trade Flows in Eurasian Continent

Figure 3 shows the world trade status in 1997, which is estimated by K. Shomodi(2000). As can be seen in this figure, approximately 20 % of East Asian trade is between Europe and Asia. Also, it can be seen in the figure that Central Asian trade is relatively so much as

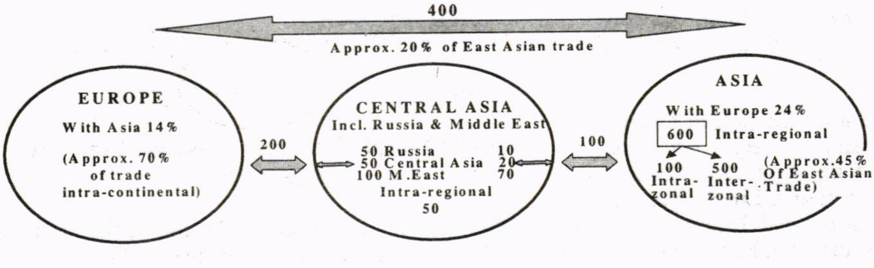

Figure 3 Trade Flows in 1997 by K. Shomodi (in bln US$)

can not be neglected. This means Eurasian Land Bridge trade takes an important role in the world trade. Here is the spotlighted issue in the present paper. Now let us take at a glance at this trade corridor.

2.2 Trade Corridors

In the Northeast region of the Eurasian continent, there can be considered seven trade corridors (Mitsuhashi, 2000); the first is called as the Siberian Land Bridge trade corridor (hereafter called as S.L.B.), which uses the Siberian railway starting from Vostochny port, the second is the Vanino-Tayshet trade corridor, which uses the Baikal-Amur railway starting from Vanino port, the third is the Heilungjiang Province-Ports of Primorsky Krai corridor, the fourth is Jilin Province-Tumen River corridor, the fifth is the Harbin-Darlian trade corridor, the sixth is the Mongolia-Tianjin trade corridor, and the seventh is the Lianyungang-Kazakhstan trade corridor. These trade corridors are shown in Figure 4.

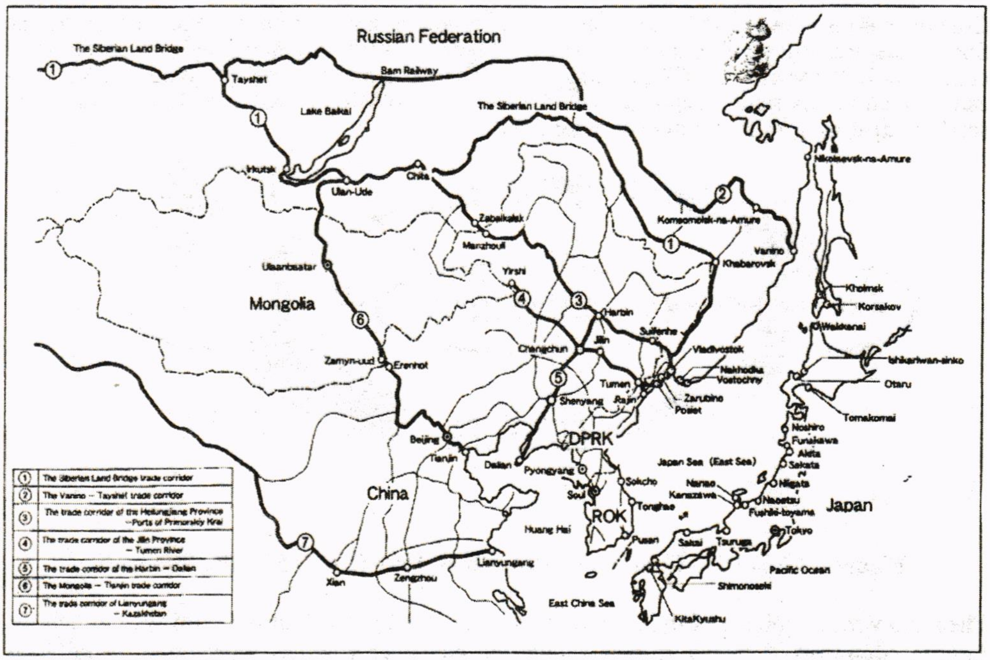

Figure 4 Trade Corridors in the Eurasian Continent

Based on the on-site surveys, the current state of railway transport conditions of the above corridors is shown in Table 1. In the above corridors, the first corridor, S.L.B. may take an important role for the container transport for Far East countries including Japan. Nowadays, almost of container cargos between Europe and Far East Asian countries are depending on the maritime transportation via the Suez route. However, we estimated that, for example, from Tokyo to Hamburg, it takes about 31.5 days on the Suez route and costs about 1886US$ per TEU while using the S.L.B., it takes about 29.4 days and costs 2151US$ per TEU as mentioned below. Therefore, if the S.L.B. is reliable and has enough capacity, it may be competitive to the Suez route.

Table 1 Physical Conditions of Corridors (observed in 2000)

Country	Route	Distance(km)	Travel Time (days)	Cargo[A)] (mil.ton)	Capacity[B)] (mil.ton)	Observed Site of A) and B)
Europe~Russia	Brest~Vostchny	10,541	13	70	140	Vladivostok~Khabarovsk
Russia	Tayshet~Vanino	4,300	8	6	18	Komsomolskna~Amur~Vanino
China~Russia	Harbin~Vladivostok	778	3	1.3	1.6	Suifenhe(Transshipped)
China~Russia	Changchun~Zarubino	675	3	irregular	small	Hunchun(Transshipped)
China	Harbin~Dalian	944	2	120	100	Shenyang~Dalian
Mongolia~China	Ulaanbaatar~Tianjin	1,689	7~10	0.3	1	Zamynuud(Transhipped)
Kazakhstan~China	Druzhba~Lianyungang	4,171	7~10	3.5	3.5	Druzhba(Transshipped)

2.3 Container Transportations

Container transportations between East Asian countries and Europe depend mainly on the Suez route, but still slightly on the railway. Figure 5 shows the maritime transportation of containers in the world in 1999 focusing on the East Asia and Europe (Shomodi, 2000). As can be seen in this figure, container volume from and to Middle East and South Asia is still small comparing with the volume of other regions.

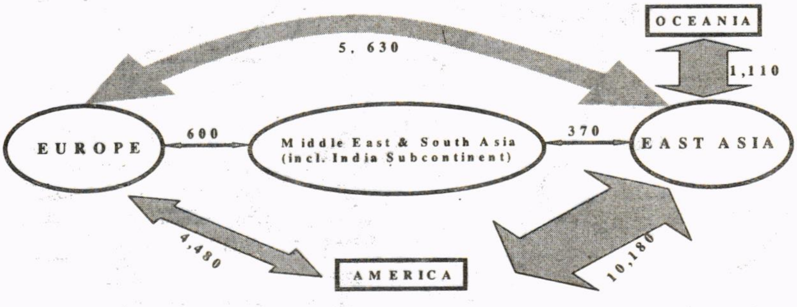

Figure 5 World Sea Container Turnover in 1999 (1000TEU) (K. Shomodi)

Then, How much volume of the containers is transported by each of the railways through the Eurasia continent? In Figure 6 is shown the container volumes transported by railways through the Eurasian continent in 1997 estimated by K. Shomodi (2000). According to Shomodi's estimation, containers via S.L.B. route are quite small up to now.

One reason is in the developing situation of economy of the countries along the S.L.B. route, but another is its low service level of transportations. Thus, questions may occur. Is there any possibility that containers are transported if the service level of the S.L.B. route is improved? In the next chapter, the possibility of container transportation from the Far East countries and Europe via the S.L.B. route is discussed.

3. POSSIBILITY STUDY OF SIBELIAN LANDBRIDGE TRANSPORTATION

3.1 Present Problems of the S.L.B. Route

One of the problems in stagnation of container transportation via S.L.B. is in the chaotic

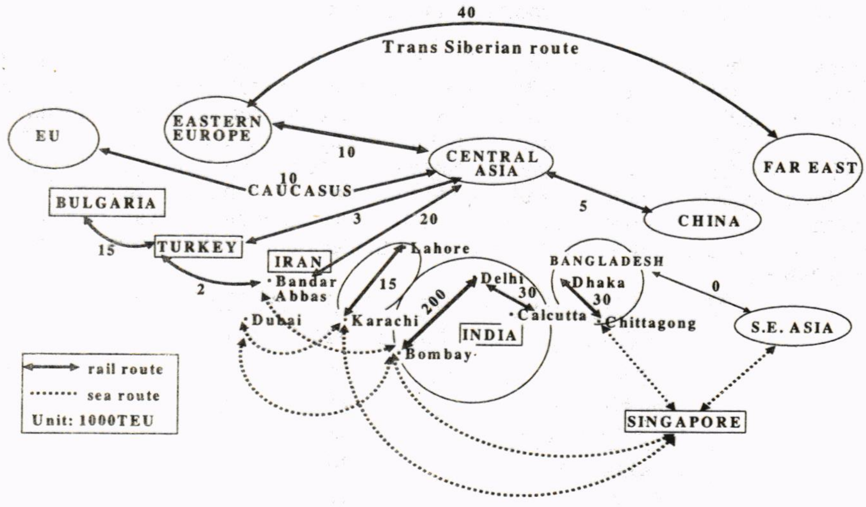

Figure 6 Estimation of Railway Container Transportation in 1997 (by K. Shomodi)

situation of economy of Central Asia including Russia and Eastern Europe since the collapse of Soviet Union in 1991. Before 1991, container transportation via S.L.B. is, in fact, more than the present. ERINA (1999) surveyed the historical change of container flows via S.L.B from Japan which is shown in Figure 7. As can be in this figure, 110 thousand containers were transported on the S.L.B. route at the peak period, however, after 1991 it has been rapidly decreased. Although the total containers for Europe are increasing, nowadays, only about seven thousand Japanese containers use the S.L.B. This means that Japanese shippers avoid using the S.L.B. to transport containers and shifted to the Suez route.

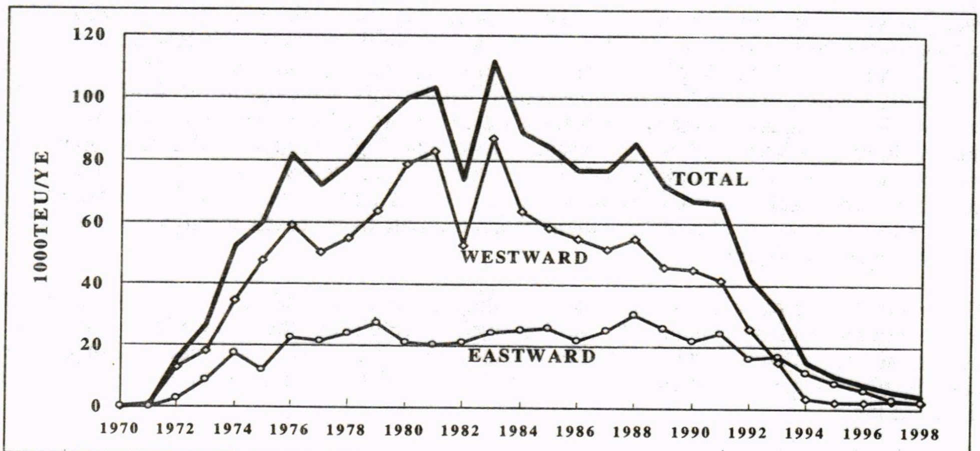

Figure 7 Changes of Containers From Japan via S.L.B.

Second problem is decline of function, in particular, decreasing regular exclusive-use container trains called a block train for transit transport. As already shown in Table 1, the capacity of Trans Siberian Railway is estimated about 140 million tons per year, and, in 2000, the container cargo volume transported via the S.L.B. route is estimated about one million tons, which is approximately same volume as the converted number of containers shown in

Figure 6. This directly means too small cargo volume to function enough as a transit route for Eurasia Land Bridge from the viewpoint of management.

Third problem is the transportation time. The S.L.B. route transportation is constituted of maritime transportations to the Port of Vostochny, inland transportation through CIS countries from Vostochny, and transportation beyond CIS. At the container yards of Vostochny port, VICS gives cargo-handling service, and it has the railway siding and yards. According to the interview to VICS, the average time for customs is one day for transshipped containers, two days for containers imported to Russia, and three days for containers imported to other CIS countries. From Vostochny port to inland, Trans Siberian Railway transports the containers. Again according to VICS, the railway transportation time to each destination is as listed in Table 2.

Table 2 Transportation Time From Vostochny Port

DESTINATION	TRAVEL TIME (day)
to Finland	16
from Finland	14
North East Europe	22
Uzbekistan	20
Tajikistan	21
Afghanistan	24
Kazakhstan	19
Moscow area	16

Based on Table 2, the travel time of the S.L.B. route, for example from Tokyo to Hamburg, is estimated about 29.4 days, which is almost same as the transportation time of 31.5 days on the Suez route as described below. This means it is shorter to East Europe than the Suez route. Therefore, it is probable that if high service conditions of the S.L.B. route including reliability are provided, the S.L.B. route can become well competitive to the Suez route.

3.2 Case Study of Possibility of the S.L.B. Transport

Nowadays, marine transportation market is seriously competitive since non-union ship companies entered into market. They are competing in the market with low price strategy and partially with the backup from their mother country as the national flag carrier. In the borderless society, bi-lateral production system has broadly achieved in the worldwide. In such world, trading among many countries is much important for economic development. In the worldwide bi-lateral production system, low cost, high frequent and certain maritime transportation service is indispensable. Responding to these requirements, liner ship companies are making various efforts for cost down to make alliances and/or consortiums, while port operators are also making their efforts to invite liner vessels through many kinds of port management systems.

Under these circumstances, what kind of strategies can be considered for the S.L.B. route transportation to invite containers? In this section, we discuss the service level with some numerical case studies focusing on the transportation time and cost because shippers are considered to make a route choice based on the generalized cost constituted of total travel time and fee.

Generalized Cost

In the case studies, the generalized cost of container transportations of both routes of the S.L.B. route and Suez route is computed supposing the case of container transportation between Tokyo in Japan and Hamburg in Europe. The generalized cost function for the Suez route is given by

$$GC_{SUEZ} = CL + CM_{SUEZ} + CTV_{SUEZ} \quad (1)$$

where

CL: the land transport fee per TEU from factory to Port of Tokyo
CM_{SUEZ}: marine transportation tariff from Port of Tokyo to Hamburg
CTVsuez: time value loss of container cargo due to total transportation time, which is given by

$$CTV_{SUEZ} = V(1 + r/365)^{TL+TMS} \cong V\{1 + r(TL + TMS)/365\} \quad (2)$$

where

V: cargo value
r: interest ratio per year
TL: travel time from factory to Port of Tokyo
TMS: travel time from Port of Tokyo to Port of Hamburg via the Suez route

The generalized cost for the S.L.B. route is given by

$$GC_{SLB} = CL + CM_{SLB} + CR_{SLB} + CTV_{SLB} \quad (3)$$

where

CM_{SLB}: marine tariff from Port of Tokyo to Port of Vostochny
CR_{SLB}: railway tariff from Vostochny to Hamburg transshipped at Brest
CTV_{SLB}: time value loss of container cargo due to total transport time, which is given by

$$CTV_{SLB} = V(1 + r/365)^{TL+TMV+TRV} \cong V\{1 + r(TL + TMV + TRV)/365\} \quad (4)$$

where

TMV: travel time from Port of Tokyo to Port of Vostochny.
TRV: travel time from Vostochny to Hamburg via Trans Siberian Railway

Data for Case Study

In case study computations, data listed in Table 3 is used.

Table 3 Data for Case Study

Item	SUEZ	S.L.B.	Reference
CL(US$/TEU)	124	124	Estimation
Charge in Tokyo Port (US$/TEU)	259	296	Shipping Gazette 2000
CM (US$/TEU)	1365	735	Int. Transp. Hundbook,2000
Charge in Humburg Port (US$/TEU	138	*	Hearing
Charge in Vostochny Port (US$/TE	*	118	Hearing
CR(US$/TEU)	*	878	Russian Railway Agency
TL (days)	1	1	
TMS (days)	2.5+25	*	Tokyo Port (2.5days)
TMV (days)	*	2+2.4+1	Tokyo 2days, Vostochny 1da
TRV (days)	*	23	

In computation, the cargo value and interest ratio are parametrically changed, and in order to find the equilibrium between both of routes, general cost is computed for various travel time of Trans Siberian Railway from Vostochny Port to Hamburg Port. The computed cases are listed in Table 4.

Table 4 Computed Cases

r (per year)	0.05			0.1			0.15			0.2		
V 1000$/TEU	50	100	150	50	100	150	50	100	150	50	100	150
Case	1	2	3	4	5	6	7	8	9	10	11	12

In Table 4, cargo volume of one TEU is assumed as 18.5 ton, which is the average value of the present containers on the Suez route (Kuroda et al., 2000). The cargo value transported by container is spread in wide range, so, in the case study, above values are assumed. The estimation method of time value of cargo is proposed by many researchers, but, in this case study, the time value factor in Eqns. (2) and (4) is based on the Assessment Manual of Port Investment of Japan (MOTJ, 1999). In order to investigate the sensitivity of the time value factor, in the case study, four kinds of time value factor (r=0.05, 0.1, 0.15, 0.20) are assumed.

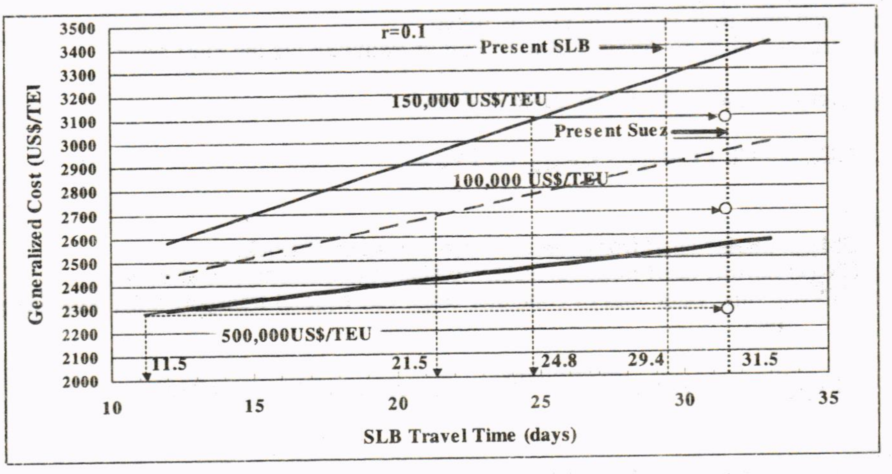

Figure 8 SLB Travel Time Competitive to Suez Route

An example of case studies is shown in Figure 8. In the figure, each straight line means the relation between the total travel time and the generalized cost of one TEU of 50 thousand, 100 thousand and 150 thousand US$ valued container via the SLB route, and each of vertical dotted lines show the present travel time of SLB route and Suez route, respectively. The circle symbols on the travel time line of Suez route means the equivalent generalized cost in case of the Suez route. Then, for example, 24.8 days of SLB route gives the equivalent travel time for a container valued of 150 thousand US$/TEU, which gives the same generalized cost of the Suez route. As this consequence, we obtained the required travel time of the SLB route equivalent to the Suez route as shown in Figure 9.

In figure 9, taking into consideration of 29.4 days of the present travel time of the SLB route, containers valued higher than 100 thousand US $/TEU is really probable to be transported via SLB. Thus, in order to realize the container transportation through SLB, the Trans Siberian Railway speed should be upped. This means the total travel time should be shortened about 8 days. Again consider the travel time related to the SLB route listed in Table3. It says the railway travel time of SLB takes 23days with average speed of 35km/hour. Comparing with the operation speed of North American Land Bridge (50 km/hour on the average), it may be possible to up the speed more than 20 km/hour which leads the travel time of railway be 15 days and the total travel time be 21.5 days. This may be possible to be realized. Another strategy to invite containers to SLB is to reduce the cost. The present cost of SLB is about 114 % of the Suez route as shown in Table 3. In the cost terms of the SLB route, maritime transportation tariff between Tokyo Port and Vostochny is particularly high. This may be reduced if cargo volume is much more increased. Railway tariff and port charges could be

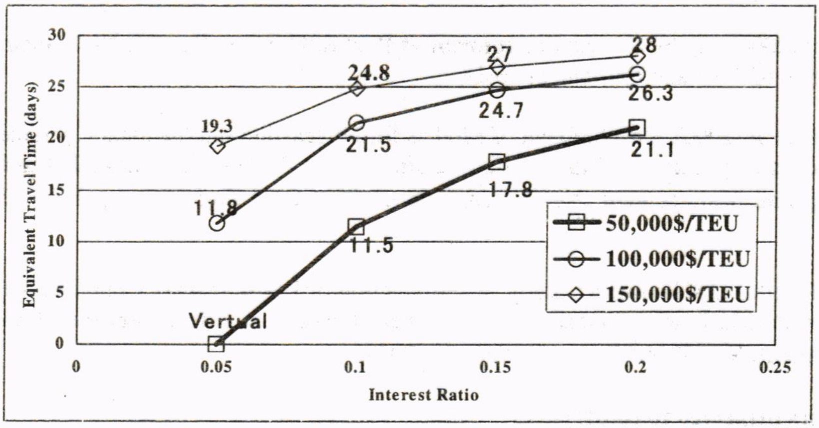

Figure 9 Required Travel Time of SLB Route

also reduced by introducing EDI (Electric Data Information) system, and cooperation of ship company or forwarders, railway operator and port operators. In addition, the railway system also should be improved, for example, by introduction of double stack trains.

4. CONCLUDING REMARKS

The present paper discusses the future possibility to promote the container transportation through the Siberian Land Bridge such as North American Land Bridge Transportation. One of the authors surveyed several times the present situation of Eurasian Continent transportation since 1998. The present paper reports one of the results of this on-site survey, and discusses the future possibility of SLB transportation through some numerical case studies.

The numerical case studies show that high valued cargo may be possible to use the SLB route. However, other commodity of lower value is difficult to be transported through the SLB route because they are not competitive to the transportation cost of the Suez route. Nevertheless, it should be emphasized that the Siberian Land Bridge transportation is largely attractive for the shippers of Far East countries and, particularly, for those of North Coast of Japan, because they are very close to Vostochny Port in Russia.

In case studies of the present paper, competitive situation of marine transportation market is not analyzes in detail. Thus, the results of simple analysis in case studies conducted in the present paper can not be directly applicable, for instance, it does not consider the market equilibrium constituted of the players; shippers, liner shipping companies, railway operators, and port operators. In order to analyze detail performance of those players, market equilibrium analysis such as those by Kuroda et al. (2000,2001) is necessary. We are now conducting a detail network equilibrium analysis of marine transportation market including the SLB route. Then, in the near future, those analytical approach and the results will be published.

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