

CONCEPTION OF PAN-ASIAN TRUNK RAILWAY NETWORK AND DEVELOPMENT OF CHINESE RAILWAY

Liu Ning(刘宁) Ye Baoming(叶宝明)

Northeast Normal University, Changchun 130024, P. R. China

(Received 10 May 1996)

ABSTRACT: This paper focuses on the formation of Pan-Asian trunk railway network. Pan-Asian trunk railways will be composed of two railway systems; one is the railway system linking up railways of 19 countries in Middle East, South Asia and Southeast Asia; the other is the cooperative railways system between countries. To realize Chinese railway network connecting with the railway networks of Eurasian countries is the prerequisite and guarantee for developing socialist market economy. The present transport capacity and the overall network level are too low to connect with Pan-Asian railway network, for example, the density of railway networks is low, the structure of railway networks is backward, the distribution of railway networks is unbalanced, etc. In order to match Pan-Asian trunk railway network, China must speed up railway construction, open some new ports, construct railway thoroughfare passing through China and neighboring countries

KEY WORDS: Pan-Asian railway, railway network, railway construction, Chinese railway

In the 1960s, the Asia-Pacific Economic and Social Council of the United Nations proposed a conception of constructing Pan-Asian trunk railway network as a preferential development plan of the 1960s to the 1990s. This plan's realization would depend on the support of economic and investment organization in Asia (Asian Development Bank) and local economic and investment organization in technology and finance, as well as materials and finance from countries in Middle East, South Asia, Southeast Asia and other countries concerned.

I. COMPOSITION OF PAN-ASIAN TRUNK RAILWAYS

Pan-Asian trunk railways will be composed of two railway system; one is the railway system linking up railways of 19 countries in Middle East, South Asia and Southeast Asia; the other is the cooperative railway system between countries.

(1) The railways system linking up railways of 19 countries in Middle East, South Asia

and Southeast Asia(Yao, 1991). Railway connection lines between these countries: Iran – Iraq, Iran – Pakistan, India – Burma – Tailand and the railways linking up the main railways of Pan-Asian trunk railways: (Turkey – Iraq, Pakistan – Afghanistan, India – Nepal, India – Bhutan, Tailand – Laos – Vietnam) were planned to construct, so that the Pan-Asian trunk railways consisting of several connected railway sections (Turkey – Bangladesh – India – Burma – Tailand – Malaysia – Laos – Vietnam railways; Singapore – Indonesia (Java) railway ferry; Jakarta – Bamyuwangi railway) can be formed. The total length of Pan-Asian trunk railway can exceed 23 000 km, if it includes present feeder railway and linking railway lines: Bangkok – Nongkhai-Viangchan, Bangkok – Phnom Penth – Ho Chi Minh City – Hanoi, Mosul – Aleppo – Damascus, Mosul – Kayseri, among which about 10 000 km of railways are in Southeast Asia.

(2) The cooperative railway system between countries. This system includes Hanoi (Vietnam) – Hekou(China) railway, Hanoi – Pingxiang (China), Erzurum(Turkey) – Leninakan (the commonwealth of Independent states-Nakhichevan (the Commonwealth of Independent States) – Tabriz(Iran), the railways along Turkey, Iraq and Syria, and the railways along Russia, China, Mongolia and Korea (Seberia Railway, Baykal – Amur, Druzhba – Ayaguz – Youyi – Uzhou – Lianyungang, Seberia Railway – Ulainbaatar – Jining – Beijing, Seberia Railway – Manzhouli – Harbin – Suifenhe and other connected artery railways and train ferries.

In fact, Pan-Asian trunk railways are part of the trans-continental railway system which connects all Asian countries with Europe (through the Commonwealth of Independent States, Turkey and Syria) and Africa (through Iraq, Syria and Palestine).

II. HARMONIZATION AND CO-DEVELOPMENT OF CHINESE RAILWAY AND PAN-ASIAN RAILWAY

To realize Chinese railway network connecting with the railway networks of Eurasian countries is the prerequisite and guarantee for developing socialist market economy, undertaking opening to the outside world, bring our country's economy into world economic system. The present transport capacity and the overall network level are too low to connect with Pan-Asian railway network. It needs a process of overall transformation and sustainable construction, so as to meet the requirments of Pan-Asian railway network(Qiqikin, 1992).

1. The Present Characteristics and Overall Level of Chinese Railway

1.1 *Low density of railway networks*

The railway kilometer opened to traffic in China is 53 000 km. The railway density is much lower than that of most Eurasian countries. At present 117 countries and regions with railways in the world have totally 1.2 million km of railways, among which, Asian countries have 0.21 million km, making up 17.5% of the total, the density of railway networks is 0.42 km/100 km². European countries have 0.41 million km of railways, making up 34.2% ,

the railway density is 4.04 km/100 km². China has 53 000 km of railways, the railway density is 0.55 km/100 km². The differences of railways between China and other countries can be seen from Table 1(Ye, 1990).

Table 1 Comparison of railway indexes between China and other countries

	USA	USSR	Japan	German	UK	France	India	China	
Kilometer opened to traffic (km)	205280	147359	20341	27045	16588	34322	61985	53000	
Density of railways	km/10000person	8.25	5.15	1.65	4.36	2.9	6.11	0.76	0.44
	km/100 km ²	2.19	66	5.38	10.9	7.98	6.22	2.04	0.55
Kilometer of elec-railways	1667	53862	11586	11688	4546	12430	8880	5830	
Kilometer of double track railways	22581	53600	8002	12384	11633	15685	13997	11660	

1.2 Backward structure of the railway network

The North American railway operation model represented by the American railway which is mainly freight is typical heavy-load railway network characterized by heavy train, heavy axles (27), heavy rails (56.6 kg/m), low density and low electric railway percentage (11%).

The development of the railways in the former Soviet Union was more advanced, where passenger and freight transport was characterized by heavy trains, higher density, and high percentage of electrified, double track and automatic blocked kilometer. The rail with a weight of 65 kg/m and 75 kg/m takes about 68% of its whole kilometer. Its average rail weight is 62 kg/m. It is the most powerful railway transport system in the world(Ye, 1990).

West European countries and Japanese railway operations are characterized by short kilometer, light train, high speed and heavy train density (10 – 20 trains/24 hours). They have a higher percentage of electrified double track and automatic block kilometer. In the heavy traffic area, they have built some special high-speed lines.

To increase the transport capacity, some important measures have been adopted by Indian state railways: to operate some group trains of 4500 tons along the present lines, to increase the number of through goods trains and to automatically block between sections. Now, over 90% of Indian coal, oil and ore are transported by through goods trains.

Chinese railway takes 60% of passenger transport, 70% of freight transport, 53.7% of passenger turnover and 42.2% of freight turnover of the whole state. The transport density is 24.7×10^6 t·km/km, which takes the second of the world. The annual transport of some heavy double lines can reach to 70 million tons, which can be ranked among the top level of the world. The use rate of trunk lines has been reached to 90% owing to heavy transportation and low density of railway network, but the transport capacity can only meet 60% – 70% of the

needs of the whole country. Chinese railway system has long been in the state of simple facility and high rate of utilization. Double track takes only 22% , rails of 60 kg/m takes 20% , electrified railway takes 11% and auto-block takes 17% . Steam locomotive takes 40% of the motive power. The annual amount of transport by locomotive is 8×10^7 t/km, which is about twice of that of USA and 6 times of that of France and Japan.

1.3 Unbalanced distribution of railway networks and obvious difference in transport capacity

The east part of China borders on the sea, where there are many cities and a large population, with developed economy, high railway density and large transport capacity. In the west frontier regions, the railway density is low, the transport capacity is small, the west of Beijing - Guangzhou railway covers 60% of the whole country's area, there are only railways of 24 000 km, making up 45.3% , the railway density is 0.24 km/100 km². Particularly vast south west and northwest regions cover an area of 5.46 million km², only has 13 000 km of railways making up 24.9% of the total railways. In order to connect Chinese railway networks with Eurasian railway networks, the railways in the above-mentioned regions must be developed greatly.

III. MAIN WAYS TO INCREASE TRANSPORT CAPACITY OF CHINESE RAILWAYS

In order to connect with Pan-Asian railways, Chinese railway networks should be taken as the subnetworks of Pan-Asian railway networks, the key is to increase railway kilometer and railway network density, to form a railway transport system which has unified structure, capacity harmonious and function consistence.

1. How Long Railways Be Needed in China

Reviewed the plans of railway construction by every government since the revolution of 1911, it is found that Dr. Sun Yat-sen (Sun Zhongshan) drew a blue print of constructing 160 000 km of railways in his State Plan in 1912; in the 1950s there was a conception of constructing 100 000 km of railways. According to the present situation of Chinese railways, in order to solve heavy railway transport pressure, to form a railway transport system whose capacity is coordinated with Pan-Asian railways, China should have 200 000 km of railways objectively. The passenger and freight transport volume and turnover volume have exceeded the United States, taking the second, after the former Soviet Union. Now the United States has railways of 200 000 km, the former Soviet Union has railways of 140 000 km.

It is estimated that by the year 2000, Chinese railway will take billion tons of freight transport, 1.8 billion person.time/a, it is twice as much as that at present. According to present over-saturated transport, railways of 100 000 km should have. By the twenties to thirties

of next century, the passenger and freight transport volumes will be doubled and redoubled on the basis of the year 2000, it is necessary to have railways of 200 000 km.

In India which is similar to China in national conditions, the railway density has reached 204 km/100 km², 4 times as much as that of our country. That is to say, only when our country has 20 000 km of railways, the transport capacity of the railways can be equal to that of India.

2. The Construction Speed of Chinese Railway

If we want to achieve the goal of 200 000 km of railways, we need to take the following two steps. First, we'll strive for making railways length reach to 100 000 km by the end of 2015; second, we'll make railway length reach to 200 000 km by the end of 2025.

The First Five-Year Plan period was the best period of railway construction, if we construct railways at the speed of 1950 - 1957, it is possible to have constructed 100 000 km of railways by the end of 2015. In the first five-year plan period, the state invested 5.017 billion yuan for constructing railways, making up 9.12% of the total state investment, the newly-constructed railways were 4860 km. Capital construction investment was 100 million yuan per year, and we had layed a railway track of 927 km per year and the investment growth rate was 25% per year, If the railway length was increased by 9% every year, by 1994, the railways should be increased as follows:

$$S_n = \frac{a_1(q^n - 1)}{q - 1}$$

$$S_{35} = \frac{927(1.09^{35} - 1)}{1.09 - 1} \approx 200\ 000\ \text{km}$$

where n is the number of year, S_n is accumulated railway length, q is common proportion, a_1 is the original railway length.

But in fact, the railway investment decreased greatly year by year. The investment for railway construction in the First Five-Year Plan period was 9.12% of the total investment of China, that in the Second Five-Year Plan period 9.0%, the Third Five-Year Plan period 12.3%, the Fourth Five-Year Plan period 10.5%, the Fifth Five-Year Plan period 6.4%, the Sixth Five-Year Plan period 7%, the first three years of the Seventh Five-Year Plan period 5.5%, 5.1% and 4.2% respectively. In addition, the price of raw materials had gone up gradually, in the Second Five-Year Plan period, 972 km of railways were constructed each year, 500 km each year in the Fifth Five-Year Plan period, 300 km each year in the Sixth Five-Year Plan period. If the railways were constructed at the above-mentioned speed, the railway construction goal would not be achieved. If the railway construction investment increasing are as the same as those of the First Five-Year Plan period, from 1994 to 2015, the newly-constructed railway will be accumulated to(Fang,1991):

$$S_n = a_1(q^n - 1)/(q - 1)$$

$$S_{20} = 972(1.09^{20} - 1)/(1.09 - 1) = 49\,723 \text{ km}$$

To 2015 year capacity of newly-built railway:

$$a_n = a_1 q^{n-1}$$

$$a_{20} = 972(1.09)^{19} = 4997.7 \text{ km}$$

If adding the original railways of 5300 km, by the end of 2015, China will have more than 100 000 km of railways. At such a speed, the newly-constructed railways from 2015 to 2025 will be as follows:

$$S_n = a_1(q^n - 1)/(q - 1)$$

$$S_{10} = 4997.7(1.09^{10} - 1)/(1.09 - 1) = 76\,000 \text{ km}$$

The newly - constructed railways of the first stage (100 000 km) and the second stage (76 000 km) will be 176 000. So that the goal of constructing new railways will be basically realized.

IV. WAYS TO CONNECT CHINESE RAILWAY WITH PAN-ASIAN RAILWAY NETWORK

In order to connect Chinese railways with Pan-Asian railway network, the present railway ports must be transformed to increase their capacities, to fit the main network facilities of Pan-Asian railways and harmonize capacity, besides, new ports and integrated railways should be opened, so that Chinese railways can be connected with Pan-Asian railway networks more closely, to form a huge Pan-Asian railway transport system with strong network functions, and optimized structure.

1. Railway Ports of China and Neighboring Countries

Now there are 8 railway ports of China and the neighboring countries (Table 2), among which, 6 railway ports are distributed on the borders between China and Kazakhstan, China and Russia, China and Mongolia, China and Korea, the other two link up Vietnam railways. The railways connecting with India Peninsula and Middle Asia are seriously short. In northeast and northwest regions, due to large passenger and freight of both sides transport volume, the port transport capacity seems to be overload.

2. Open New Ports to Increase Opening Degree of Chinese Railway Networks

The railway network in northeast region is most developed. Now there are 5 railway ports available. Dandong and Tumen ports' capacities still have surplus because the volume of trade between China and Korea is not large. Since the reform and opening to the outside world,

Table 2 The railway ports of China and its neighboring countries

Port	Railway line	Opposite countries	Corresponding Cities and towns	connecting railways
Manzhouli	Harbin - Manzhouli	Russia	Zabaykal'sk	Siberia feeder railway
Suifenhe	Harbin - Suifenhe	Russia	Pogranichnyy	Siberia railway
Tumen	Changchun - Tumen	Korea	Nanyang	
Dandong	Shenyang - Dandong	Korea	Sinuiju	
Erliaohot	Jining - Erliaohot	Mongolia	Zhamenwude	
Alataw Pass	Longhai - Lanxin	Kazakhstan		Tuxi railway
Hekou	Kunming - Hekou	Vietnam	Lao Cai	
Pingxiang	Nanyang - Pingxiang	Vietnam	Lang Son	

with the rapid increase in volume of trade between China and Russia, China and Mongolia, the original railway ports can't satisfy the needs, new railway ports must open to connect with railways of Russia, Mongolia overall, so as to meet the needs of foreign trade transport. The railway ports which plan to be constructed are as follows:

(1) Heihe railway port. The longest local railway of our country is Bei'an - Heihe railway (241 km). Its terminal station is Heihe, which is a first-class port in northeast region opening to Russia approved by the State Council, Heihe's opposite is Blagoveshchensk. Heihe has become an important window through which the goods can be exchanged between China and Russia. If the Heilongjiang River Bridge is constructed, Bei'an - Heihe railway can be connected with Siberia railway passing through Blagoveshchensk.

(2) As the growing point of international regional economic cooperation, the Tumen River delta region has become the focus of the world attention. In order to meet the needs of the trade of north part of northeast region and Jilin Province with Russia, Tumen - Hunchun railway of 68 km has been constructed, if it stretches to Mahalinnuo, it can connect with Russian railway to join Zhalubinnuo port in Russia, which is of significance to opening the mouth of going to the sea in the lower reaches of the Tumen River.

(3) Dongning railway in Heilongjiang Province (160 km) has been reconstructed. According to the agreement signed by China and Russia, Russian railway will connect with Chinese railway at Sanchakou of Dongning, to form another railway port between Suifenhe, Hunchun and Changlingzi, which can solve the problem that import and export goods has been overstocked, so as to promote the trade exchange between China and Russia.

(4) There is a railway hub taking Qiaobashan as its center in east Mongolia, its eastern end is Tamuchagebulake. There is an end breaking railway of 200 km between Tamuchagebulake and Yiershi which is the terminal of Bai'a railway in China. If this end breaking railway is connected, another joining port between Chinese and Mongolian railways will be formed after Ertran port, which will provide a strait and short port for going to the sea for Mongolia.

In northwest region, Beijiing railway links up with Tuxi railway of Kazakhstan through Ala Mountain pass. It will be built southward, pass Kunjirap pass to link up Jirjit of Pakistan, thus forming the railway passage-way to countries of Middle Asia.

In southwest China, Kunming – Hekou railway, Nanping – Pingxiang railway link up the railways of Vietnam. To build the railway from Kunming to Mizhina of Burma will make Chinese railway connect with railways of Burma and other neighboring countries.

V. CONSTRUCTING RAILWAY THOROUGHFARES LINKING UP NEIGHBORING COUNTRIES

(1) Railway transport thoroughfare in northeast China is from Dalian Port, through Harbin – Dalian railway, Manzhouli, to link up Siberia railway of Russia. Its transport distance on land is 166 km shorter than that of passing Tianjin New Port. From Nakhodka Port which is the beginning of land bridge to Chita of Siberia railway is 3057 km, and from Dalian through Manzhouli to China is only 2881 km, so the transport distance shortens 776 km. Because the transport of Dalian Port, Harbin – Dalian railway is busy, we may take the transport strategy of multi-port (Yingkou, Dandong, Jinzhou ports), multi-railway (Dahushan – Zhengjiatun, Siping – Baicheng, Siping – Qiqihar railways), multi – exit (Manzhouli, Heihe), to make a good use of the transport capacities of existing ports and railways, so as to relax the transport pressure of Dalian – Manzhouli railway system.

(2) Fangchuan Port to be built in the Tumen River delta region will be an important port through which we come into the sea of Japan and participate in international regional economic cooperation. Its rear railway line of Tumen – Hunchun, Changchun – Tumen, Changchun – Baicheng, Baicheng – Arxan, can link up Mongolian railway, to form another transport thoroughfare passing through the northern part of northeast region, which has an important effect on developing the economy along the railway line and the trade with Mongolia and Russia.

(3) Lianyungang – Lanzhou – Urumqi railway is called the second Eurasia land bridge, which is through Bortala Mongolian Autonomous Prefecture of Xinjiang to enter Kazakhstan, passing Poland, German to Rotterdam Port, the total distance is 10 000 km. It connects Asian and Europe directly. From Korla of Xinjiang to Kashi, over Hongqiapu-pass to link up Jirjit of Pakistan, is the south line of Lianyungang – Lanzhou – Xinjiang. Through Jirjit, it can go to such important cities and ports as Islandbad, Karachi, Lahore and North Hedam, which is a convenient and quick railway connecting the west region of China with South Asia, West Asia and Middle East, and even the Arab Sea, India Ocean, Bosi Bay.

(4) Railway thoroughfare in south region is through Kunming – Hanoi railway, Nanping railway to connect with Vietnam railways, even join the railways of Southeast Asian countries such as Laos, Thailand, Cambodia and Malaysia. In Kunming, through new-built railway, passing Xiaguan to Burma to connect with Mizhina railway, Dacca of Bangladash can be connected with Calcutta of India, to form the railway network passing through southwest China,

REFERENCES

- Fang Ju, 1991. Preliminary study of railway development strategy during "Eight Five-Year' Plan". *China Railway*, (10):44 - 47. (in Chinese)
- Qiqikin V A, 1992. Pan-Asian trunk railway-the road to Asia unitization. *Review of World Economic*, (5):34 - 40. (in Chinese)
- Yao Deming, 1991. Current situation and tendency of abroad railway development. *World Railway*, (1):72 - 76 (in Chinese)
- Ye Baoming, 1990. The position and effect of northeast port and railway in transportation of Eurasia Land Bridge. *Economic Geography*, (10):68 - 74 (in Chinese)