Country	: People's Republic of China
Project	: (1) Lianyungang Port Expansion Project (I)-(VI) (2) Zhengzhou-Baoji Railway Electrification Project (I)-(V) (3) Baoji-Zhongwei Railway Construction Project (I)-(IV)
Borrower	: Ministry of Foreign Trade and Economic Cooperation
Executing Agency	: (1) Ministry of Communications (2) Ministry of Railway (3) Ministry of Railway
Date of Loan Agreement	: (1) October 1984 (I) - May 1989 (VI) (2) October 1984 (I) - August 1988 (V) (3) March 1991 (I) - August 1993 (IV)
Loan Amount	: (1) ¥ 47,000 million (2) ¥ 76,000 million (3) ¥ 32,179 million
Local Currency	: Yuan
Report Date	: March 1998 (Field Survey: November 1997)

Overview of Project Site in Lianyungang Port
The yellow pipes crossing the center of the photo are the pipes connecting Cereal berth and silos.

[Reference]

1. Terminology

Berth: Specific mooring location in a port where loading, unloading, etc. are performed.

Longhai Railway: One of China's main east-west railways running from Lianyungang Port in Jiangsu Province in the east to Lanzhou in Gansu Province in the west.

DWT (Dead Weight Ton): Indicates the quantity of cargo that can be loaded.

TEU (Twenty Equivalent of Unit): Indicates the number of containers converted to 20-feet containers (8x8x20 feet)

E/L: Electric Locomotive

P/C: Passenger Car

D/L: Diesel Locomotive

Introduction

New Eurasia Land Bridge (New Eurasia Intercontinental Railway)

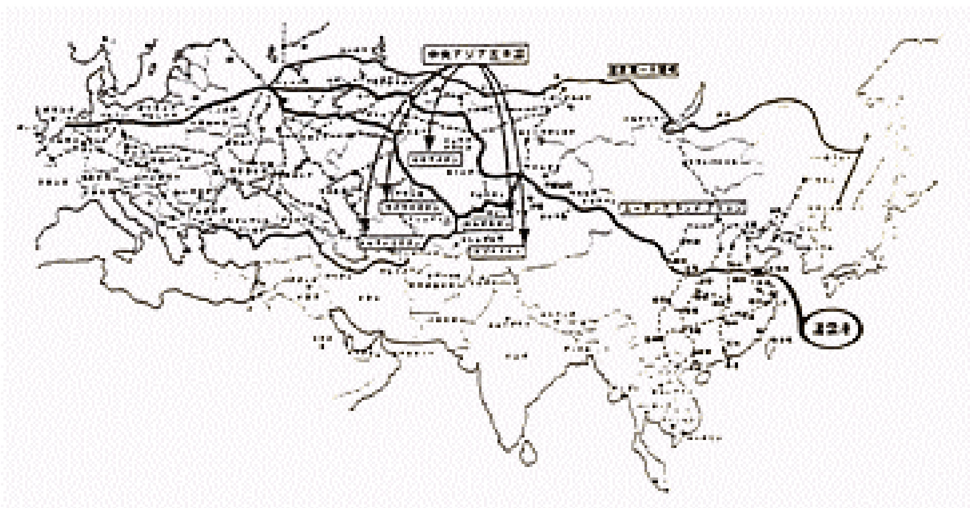
In September 1990, construction of the link between Chinese Railway and the Soviet Railway (present Kazafustan) in Alataw Shankou, Xinjiang in China was completed, creating a physical link between the port of Lianyungang Port in China and the port of Rotterdam in Holland.

This line is called the New Eurasia Land Bridge (or alternatively, the Silk Road Railway), and marks the birth of New Eurasia Intercontinental Railway extended by 10,900 km. Originally, the Eurasia Intercontinental Railway designated the Siberia Railway originating from Vladivostok. The New Eurasia Land Bridge is 2,500 km shorter (one-way trip duration about 1 week shorter) and is now the shortest railway that links the Pacific Ocean and the Atlantic Ocean.

Relationship between this project and the New Eurasia Land Bridge

The Lianyungang Port Expansion Project, Zhengzhou-Baoji Railway Electrification Project, and the Baoji-Zhongwei Railway Construction Project evaluated this time have all played an important role in the New Eurasia Land Bridge. In other words, the Lianyungang Port Expansion Project is an expansion project of the Lianyungang Port, which is the eastern starting point of the New Eurasia Land Bridge, the Zhengzhou-Baoji Railway Electrification Project is a project designed to electrify the section of the New Eurasia Land Bridge's Chinese part that carries the most freight and passengers the area with the most valuable tourism resources, and the Baoji-Zhongwei Railway Construction Project is a project to build a bypass line for the section of the New Eurasia Land Bridge that is a bottleneck due to the mountainous nature of the area.

In addition to performing the evaluation of these three projects, this evaluation also examines various problems that affect how intensively and effectively the New Eurasia Land Bridge can be used, and their possible solutions.

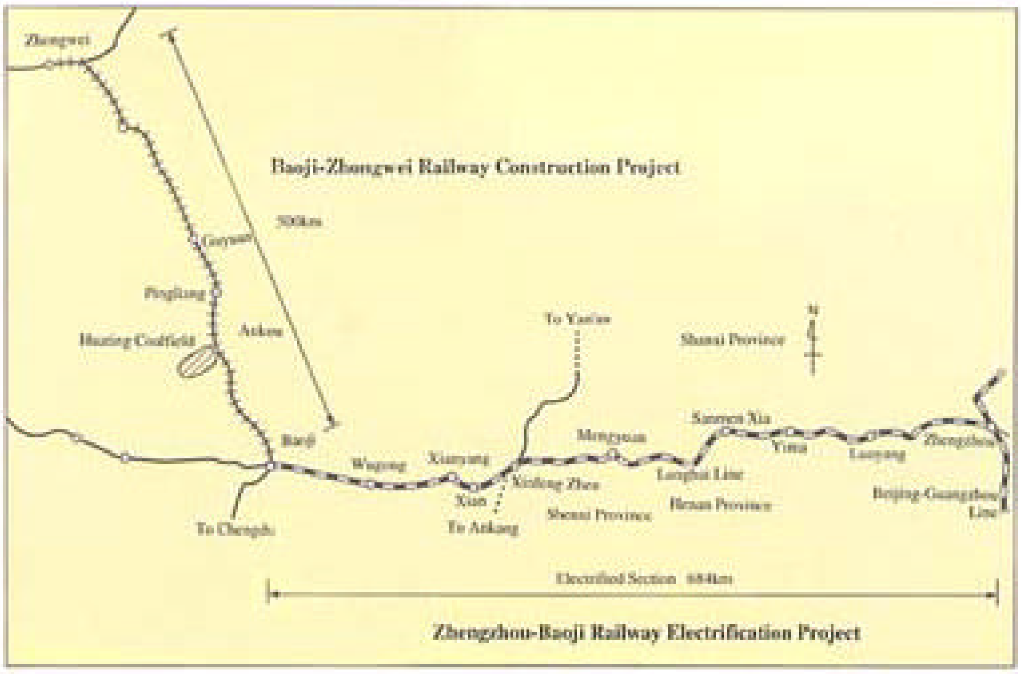


1. Project Summary and Comparison of Original Plan and Actual Result

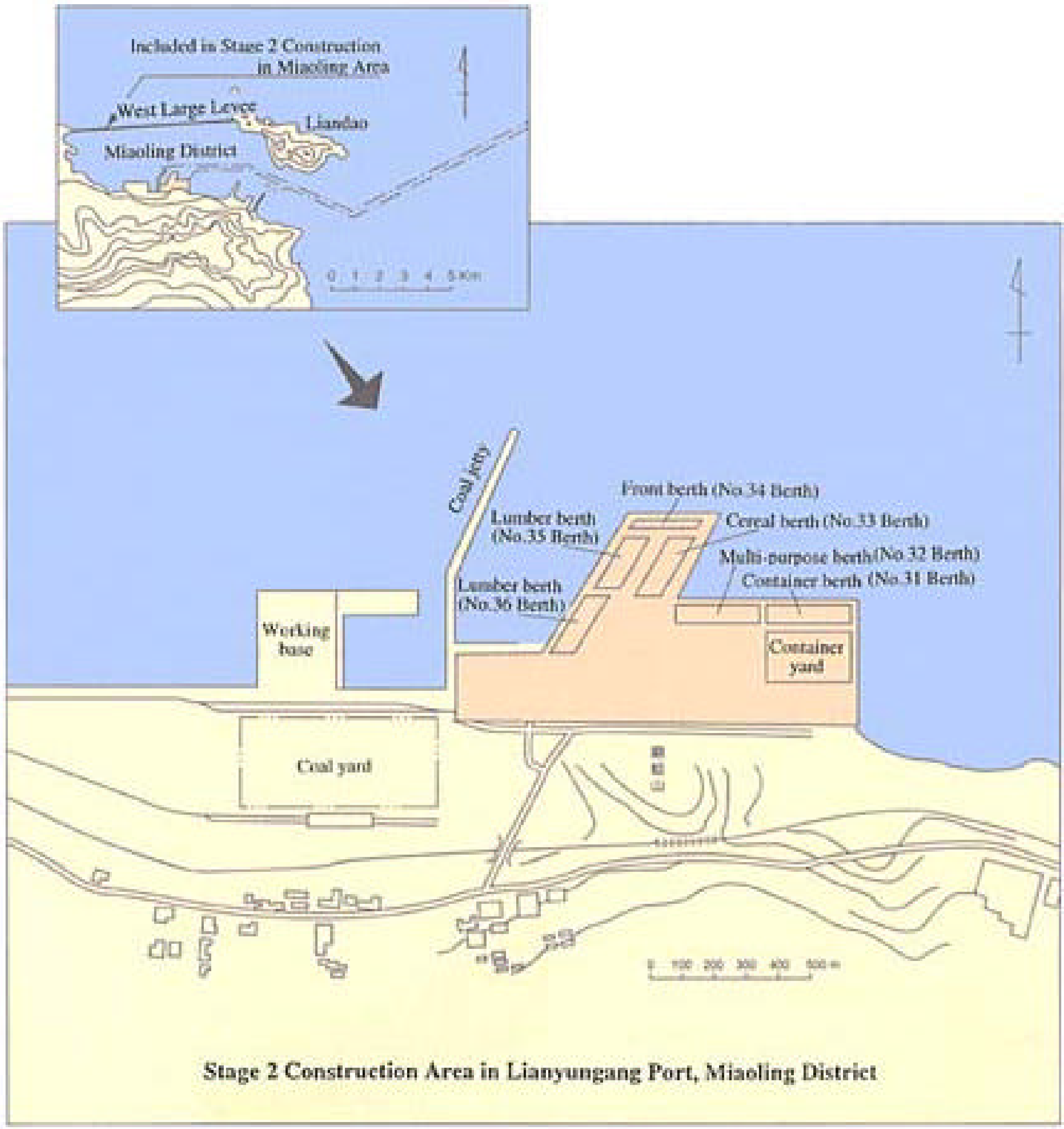
1.1 Project Location

Railway and port-related OECF projects in China, including area subject to this evaluation

Location Map of Baoji-Zhongwei Railway Construction Project and Zhengzhou-Baoji Railway Electrification Project



Stage 2 Construction Area in Lianyungang Port, Miaoling District



1.2 Project Summary and ODA Loan Portion

Lianyungang Port Expansion Project (I) ~ (VI)
To build five berths (plus another one berth for waiting), including lumber, cereal, and container berths, and breakwaters in the Miaoling district of Lianyungang Port in Jiangsu Province as Stage 2 Construction in Miaoling district, and handle the increase in freight shipments at the Lianyungang Port.
Zhengzhou-Baoji Railway Electrification Project (I) ~ (V)
To electrify the 684km of railway between Zhengzhou in Henan Province and Baoji in Shenxi Province and enhance the transport capacity of the railway.
Baoji-Zhongwei Railway Construction Project (I) ~ (IV)
To construct 500km of railway of electrified single track between Baoji in Shenxi Province and Zhongwei in Ningxia and enhance the transport capacity in northwest China.

The ODA loans were used to pay for the foreign currency portion of project cost.

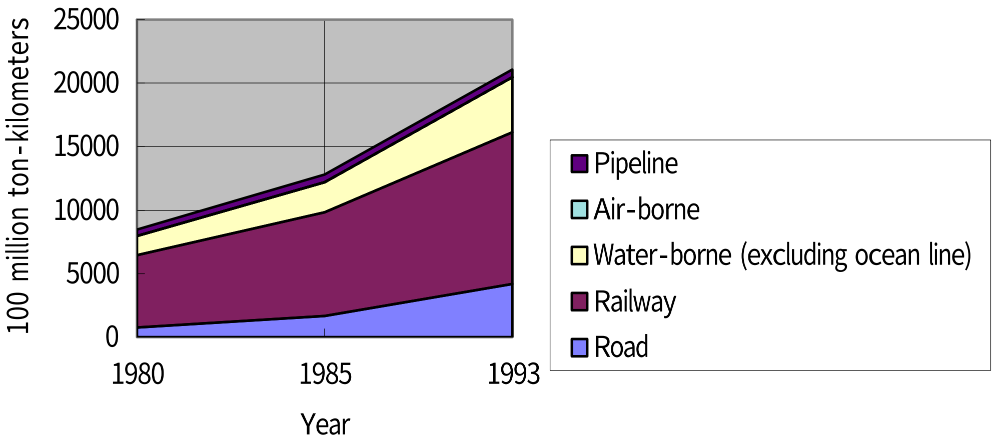
1.3 Background

1.3.1 State of Ports and Railways

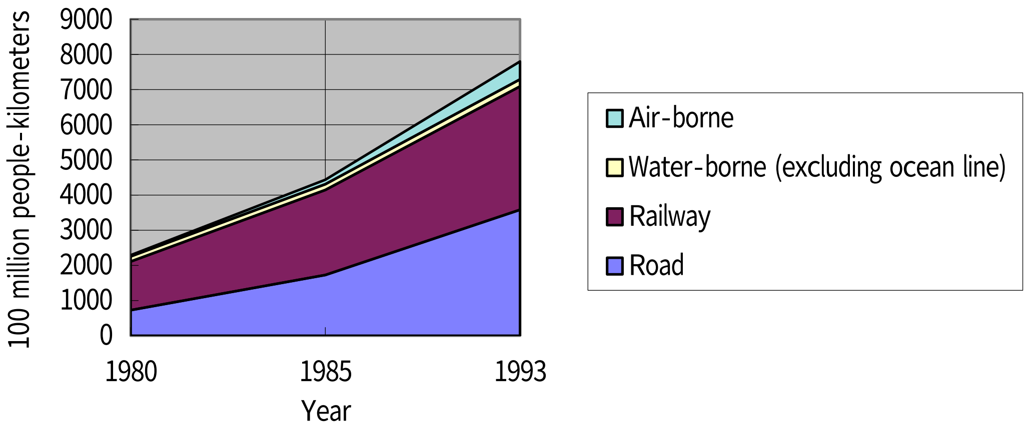
(1) State of freight and passenger transport in China

The figures below are the state of freight and passenger transport in China from 1980. As indicated by the data, the percentage of freight and passenger transport on roads (automobile) has been rising.

However, the importance of railway transport and transportation by water remains high in China, especially for freight.



【Figure 1.1 State of Freight Transport in China】



【Figure 1.2 State of Passenger Transport in China】

(2) State of ports

China's ports are divided into river ports that handle inland waterway transport on rivers and canals, and coastal ports that handle domestic transport and international shipping on oceans.

River ports

As China is a continental region blessed with numerous large and small rivers, including the Yangzi Jiang and the Huang He, inland waterway transport on rivers and canals has developed to an extremely high degree historically, and represents a major mode of transport. As a result, there are some 2,000 river ports, large and small, distributed throughout China.

Among these, some 300 are of relatively large size, and 25 located on the Yangzi Jiang, one of the major river systems of China, are under the direct control of the Ministry of Communications of the Central Government.

Coastal ports

China has a total of 18,400 km of coastline, which includes 58 relatively large ports. Out of these, the 15 major ones are directly under the control of the Ministry of Communications. Of these, the eight ports of Dalian, Qinhuangdao, Tianjin, Qingdao, Lianyungang, Shanghai, Huangpu (Guangzhou), and Zhanjiang are designated as large-scale major ports (8 major Chinese ports).

The carrying capacity of China's port and water carriage industry has greatly expanded during the period of a little less than 40 years since the establishment of the People's Republic of China. Passenger-kilometers have grown 1,000 times, while freight ton-kilometers have grown 100 times, and their share of total transportation in 1984 was 4.3% and 43.7%, respectively. Over 90% of the overseas trade freight capacity goes through ports, and the total handled freight amount at the 15 major coastal ports of China in 1984 was 275 million tons. However, China's open-up policy of the time suddenly brought clearly to view the insufficient capacity of its ports, and record demurrage occurred in China's major ports. In 1984, China had only 141 large-scale (docking) berths (10,000 DWT-class or higher). Demurrage in major ports was on average 3.7 days, and as high as 10.4 days for foreign ships, constituting a serious bottleneck for the development of China.

Therefore, China's Sixth 5-year Plan (1981-1985) aimed to expand the freight handling capacity of China's coastal ports from 217 million tons in 1980 to 317 million tons in 1985, and 650 million tons by the year 2000. In order to achieve these targets, China had to build more large-scale berths, modernize its port facilities, and establish container systems to make the management of its ports more efficient.

(3) State of China's railways

Railway transport in China occupies an extremely important position in the nation's inland transport arterial system. In 1984, the share of railway transport declined as the road and pipeline network was gradually developed, but it still represents a high two-thirds share of total inland transport.

In 1983, China ranked fifth in the world in terms of working kilometers with 52,000 kilometers, after the U.S. (310,000), the former Soviet Union (140,000 km), Canada, and India. Its traffic volume for that year was 177.3 billion passenger kilometers and 663.9 billion freight kilometer, and China thus ranked particular high for freight traffic, placing third after the U.S. and the Soviet

Union.

Next, comparing railway density versus population and area to determine the maturity of China's railways reveals that there were 0.51 working kilometers per 10,000 persons, less than India's 0.85 working kilometers per 10,000. Compared with industrialized countries, this ratio is one fourth that of Japan, one tenth that of the Soviet Union, and one twenty-eighth that of the U.S. China's ratio of 53.7 km per 10,000 square kilometers was the lowest in the world. On the other hand, China's ratio of electrification, at 4.5%, was about one tenth that of Japan, one half that of India, and one seventh that of the Soviet Union, while China's double-track ratio, at 18%, was about one half that of Japan. Thus while large in scale, China's railway network was still underdeveloped.

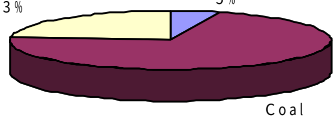
At the time, China's traffic volume was steadily expanding as the nation's economy developed, and railway transport had always played the leading role. However, China always suffered a chronic lack in carrying capacity, and in order to achieve rapid economic growth in the future, it had to rapidly build up its infrastructure and strengthen its carrying capacity. In response to this situation, China embarked on a plan to expand its freight carrying capacity to about 1.2 billion tons and its passenger carrying capacity to about 1.5 billion passengers by the end of 1985 under its Sixth 5-Year Plan, and then to further expand its freight carrying capacity to more than 2.5 billion tons and its passenger carrying capacity to between 2.0 and 2.5 billion passengers by the end of the year 2000.

The main types of freight carried by railway during 1983 were, by category, coal (40%) and cement and other construction materials (14%). These two categories accounted for more than half of China's total carried freight volume. Livestock, vegetables, and fruits were additional major categories. Thus, the largest problem concerning China's insufficient freight carrying capacity was coal transport, which represented 10% of total carried freight in China, and particularly the need to raise the coal carrying capacity in the SSI region, which will be discussed later.

1.3.2 Coal Production and Transport in China

All three projects evaluated in this report relate to coal transport. Thus, coal production and transport in China are studied below.

Coal is China's principal energy resource. Its share was as high as 72% in 1983 (see figure below). China's confirmed coal reserves, at 640 billion tons, were the world's most important, and it was estimated that supply would last for over 300 years. That coal is the main energy source in China is beyond discussion, and its share, if anything, is expected to increase in the future. Naturally, China is the world's largest producing and consuming nation in the world. In 1988, the nation's coal production was about 1 billion tons, and China planned to increase coal production to 1.4 billion tons by the year 2000.



【Figure 1.3 Composition of China's Energy Sources (1983) 】

Already in the early 1980's, the largest bottleneck in China's economy was its limited capacity to transport coal. About 65% of China's total coal transport was done by train as the nation's road network was undeveloped, and as a result, coal transport represented the major percentage, about 40%, of China's railway freight carriage.

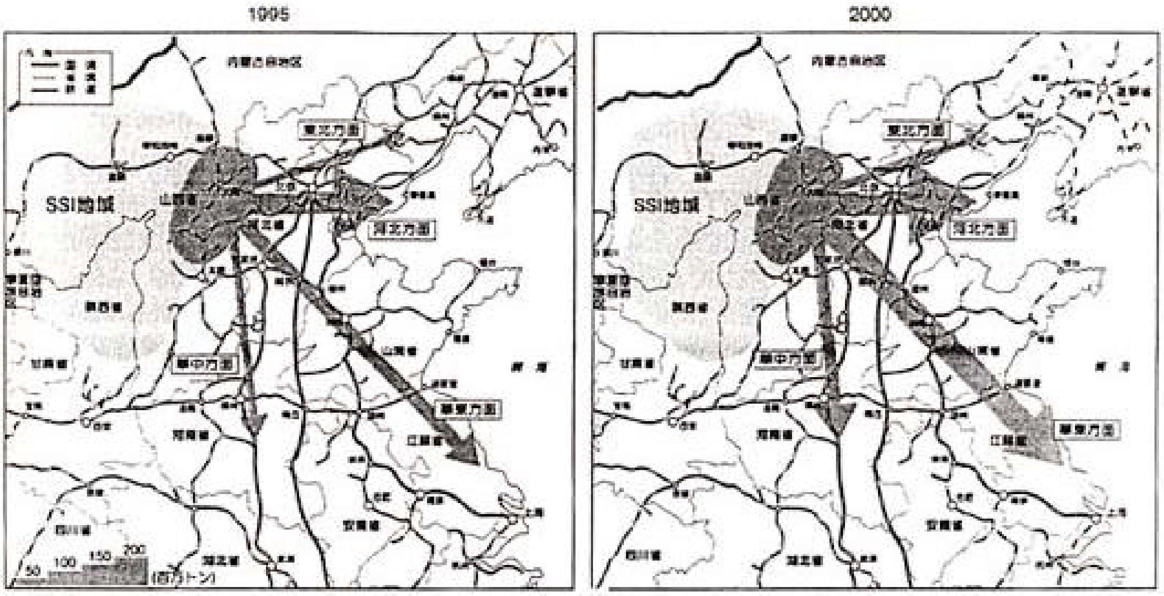
A look at the distribution of China's coal resources shows marked regional disparities and the fact that production and consumption areas are very distant from one another. China's coal producing region (abbreviated as SSI), which consists of two provinces, Shanxi Province and Shenxi Province, as well as one constituency, Inner Mongolia, is designated as an "energy production base" by the Chinese government. The SSI region's coal output in 1988 was 310 million tons (of which 250 million tons were produced by the Shanxi Province) and accounted for 32% of China's total production. Some 170 million tons of the SSI region's coal production was distributed to other areas. Thus the SSI region's coal had to be transported over long distances to the south and the east, but as mentioned above, the railway carrying capacity at the time was limited, and delays in coal transport was a grave problem.

Ministry of Railways of the P.R.C. submitted a long-term coal transport plan to OECF in 1990 (see Table 1-1.) According to this plan, the SSI region would ship 290 million tons of coal to other areas in 1995, and this figure would grow to 430 million tons in the year 2000. Moreover, coal shipping and supply routes from the SSI region is divided into four directions (see Figure 1.4).

【Table 1.1 Coal Production and SSI Region's Coal Shipping Amount and Destinations (Actual and Predicted Figures) 】

(Unit: 1 million tons)

	1988 (Actual)	1995 (Predicted)	2000 (predicted)	2000/1988
National production amount	980.0	1,200.0	1,400.0	143%
SSI region production amount	312.8	413.5	568.0	182%
Portion of SSI production shipped to other areas	167.0	292.0	431.5	258%
Breakdown				
Huabei bound(3 northeastern provinces including Liaoning	78.9	137.4	168.5	214%
Hebei bound(including Peking,Tianjin and Qinhuangdao shipping)	23.7	38.0	51.0	215%
Huadong bond(Shangdong, Jiangsu,Shanghai etc.)	44.7	68.6	132.0	295%
Huazhong bound(Henan,Hubei etc.)	19.7	48.0	80.0	406%
Total traffic volume to other areas	167.0	292.0	431.5	258%

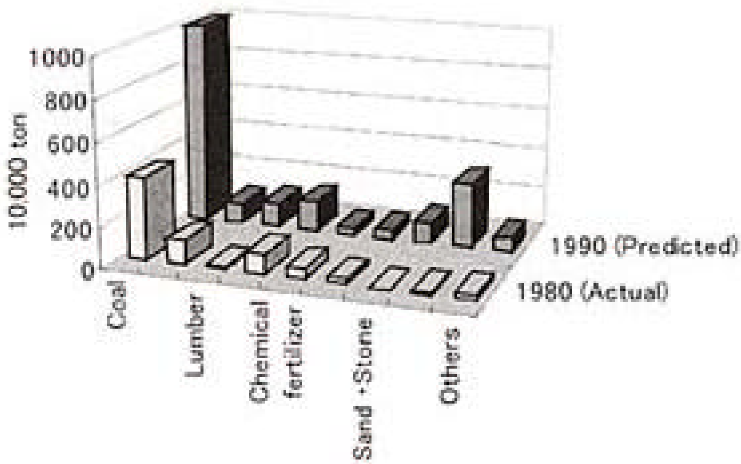


【Figure 1.4　 Coal Shipment Volume and Routes in Shanxi Province】

1.3.3 Background of Each Project

1.3.3.1 Lianyungang Port Expansion Project

The Lianyungang Port, a major foreign trade port located between the Huang Hai and Chinese coastal ports, is one of the 8 major ports of China. It is also the starting point of the Longhai Railway that extends west all the way to Lanzhou in Gansu Province, and is also the starting point of the New Eurasia Land Bridge, which goes all the way to Rotterdam in Holland. In 1980, the carrying capacity of the Lianyungang Port was 7.2 million tons, the bulk of which coal, but by the end of the 1980s, the share of lumber and cereals rose, so that the total handling volume was predicted to reach 19.4 million tons a year. Therefore, expanding the port capacity became an urgent priority, and the Lianyungang Port Expansion Project (Stage 2 Construction in Miaoling Area) thus came into being.



【Figure 1.5 Predictions of Freight Handling Capacity at the Time of Appraisal in Lianyungang Port】

1.3.3.2 Two Railway Projects

(1) Zhengzhou-Baoji Railway Electrification Project

The Longhai Railway (extension of approximately 1,760 km, start point (east): Lianyungang Port in Jiangsu Province, end point (West): Lanzhou in Gansu Province) which crosses the five provinces of Jiangsu, Anhui, Hunan, Shenxi, and Gansu, and goes through the cities of Xuzhou, Kaifeng, Zhengzhou, Luoyang, Xian, Lanzhou, etc., is the longest railway linking the eastern and western reaches of the Chinese continent. The Zhengzhou-Baoji Railway is a double-track line in the Longhai Railway between Zhengzhou in Henan Province and Baoji in Shenxi Province, a 684-km section. The Zhengzhou-Baoji Railway crosses Beijing-Gwangju Line, a main north-south artery in Zhengzhou, and Baoji-Chengdu Line branches to the south at Baoji. The ancient cities of Xian and Luoyang border this section, and since coal mines also line this Railway, this section of the Longhai Railway is particularly heavily trafficked in terms of traffic and freight volume.

In 1980, the Zhengzhou-Baoji Railway could be traveled by about 70 trains a day (one way), and the section between Zhengzhau and Luoyang by 65 trains, and between Xian and Xianyang by 67 trains daily, which were actually very close to full capacity. The electrification of the Zhengzhou-Baoji Railway increased the number of trains that could travel the line, and thus represented a necessary measure to handle the rapid increase in transport demand.

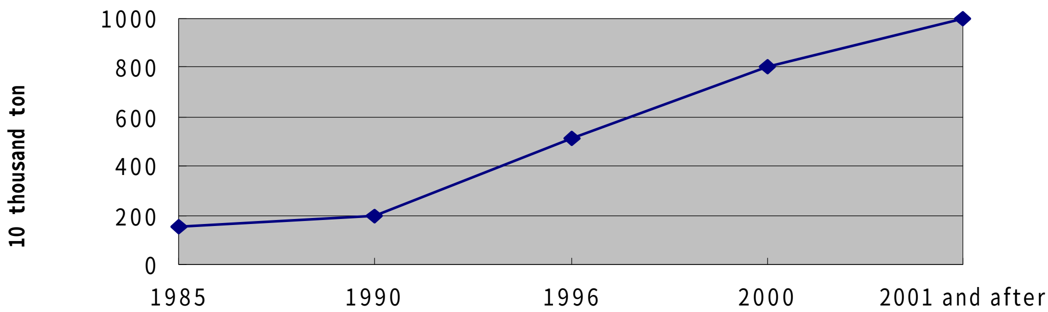
(2) Baoji-Zhongwei Railway Construction Project

This project was necessary on two points: To increase the coal transport capacity and to function as a bypass of the Baoji-Lanzhou Section (Longhai Line).

(i) Increase in coal transport capacity

There are some 3.27 billion tons of coal reserves (Huating Coal Field) centered around Ankou on the Baoji-Zhongwei Railway, which are under exploitation.

In 1988, transport of coal from this coal field was performed using road transport. However, there were limits in the road transportation capacity due to plans to massively expand coal production, which made additional railway construction indispensable.



Source: Ministry of Railways of the P.R.C.

【Figure 1.6 Coal Production Plan in Huating Area at the Time of Appraisal (1988) 】

(ii) Baoji-Lanzhou (Longhai Line) bypass function

Increases in transport demand between Baoji and Longhai on the Longhai Line were predicted due to petroleum production increases in the Xinjiang area and the coal production increases in the SSI region, and also as the result the completion of the New Eurasia Land Bridge through connection of the Longhai Line to the Russian railway (see Table 1.2).

This projected increase in transport demand required the creation of double tracks between Wuwei and Wulumuqi, as well as increasing the carrying capacity between Baoji and Wuwei. However, this section of electrified single track was characterized by steep gradients and sharp curves which made the construction of double tracks very difficult, so that the construction of bypass route in the direction of Zhongwei was demanded. However, the Baoji-Lanzhou Line was deteriorated and moreover the irregular topography of the terrain along the railway made the rapid construction of double tracks difficult, and thus the construction of electrified single track from Baoji to Zhongwei as a bypass railway between Baoji, Lanzhou, and Wuwei was urgently required.

【Table 1.2　Predicted Demand between Baoji and Lanzhou at the Time of Appraisal】

(Units: 10,000 ton)

	1988		1996 (Estimate)	
	Transport capacity	Transport volume (for coal)	Transport capacity	Transport volume (for coal)
Baoji-Lanzhou	1,300	1,316	1,300	1,243
Baoji-Zhongwei Railway (This Project)	-	-	1,400	1,082 (360)
Total between Baoji and Lanzhou	1,300	1,316	2,700	2,325 (360)

Source: Ministry of Railways of P.R.C.

1.4 Major Comparison of Original Plan and Actual Result

1.4.1 Project Scope

(1) Lianyungang Port Expansion Project (I) ~ (VI)

Item	Plan	Actual	Difference
1. Breakwater	6,700m		
2. Wharf			
1) Lumber berth	25,000 DWT class (Depth of water 11m, length 225m) 2 berths		
2) Cereal berth	One 35,000 DWT class (Depth of water 12m, length 280m) 1 berth		
3) Container berth	1,200 TEU class (Depth of water 11m, length 280m) 2 berths	Same as left	None
4) Front berth	(Depth of water 11m, length 270m) 1 berth		
5) Operation boat wharf	(Depth of water 4m, length 247m)		
3. Sea route/anchorage			
1) Foreign route	(Depth of water 8m, width 160m, length 8km)		
2) Domestic route	(Depth of water 8m, width 100m, length 6.5km)		
3) Anchorage	(Depth of water 9m, radius 400m and 450m)		
4. Shore protection	480m		
5. Cargo-handling machine	Crane, forklift, trailer etc.	Basically same as left	However, there are some changes in specifications and quantity.
6. Others	Port roads, water supply and waste water treatment facility etc.	Same as left	

(2) Zhengzhou-Baoji Railway Electrification Project (I) ~ (V)

Item	① Plan (1) At the time appraisal	② Plan (4) At the time appraisal	Difference ①-②	③ Actual	Difference ②-③
1. Electrification					
1) Distance	684 km	Same as left	None	684 km	
2) Railway line	2,374.6 km	2,375km	+ 0.4km	2,375km	
3) Transformer station	19 stations	Same as left	None	19 stations	
2. Civil engineering work					
1) Roadbed	2,283,300m^3	3,474,000m^3	+ 1,190,700m^3	3,474,000m^3	
2) Track	81.4 km	Same as left	None	Same as left	
3) Bridge	9 stations, 203.5m	305m	+ 101.5m	305m	
4) Culvert	27 stations, 869m	1,544m	+ 675m	1,544m	
3. Electricity					
1) New distribution station	5 stations			5 stations	
2) Reconstructed distribution station	10 stations			10 stations	
3) Electric wire	684km			684km	None
4. Communications					
1) Small-sized coaxial cable	294km	Same as left	None	294km	
2) Telephone wire	684km			684km	
3) Automatic telephone switchboard	12			12	
5. Signal					
1) Signal wire	684km			684km	
2) Automatic signal system	684km			684km	
6. Building	188,300m^2	200,800m^2	+ 12,500m^2	200,800m^2	
7. Repair base					
1) Locomotive District	4 bases			4 bases	
2) Rolling Stock District	1 base	Same as left	None	1 base	
3) Supplying Power District	3 bases			3 bases	
8. Vehicle					
1) E/L (Electric Locomotive)	80 vehicles	130 vehicles	+50 vehicles	160 vehicles	+30
2) P/C (Passenger car)	none	100 vehicles	+100 vehicles	100 vehicles	vehicles
9. Consultant	3 items	0 item	- 3 items	0 item	None None

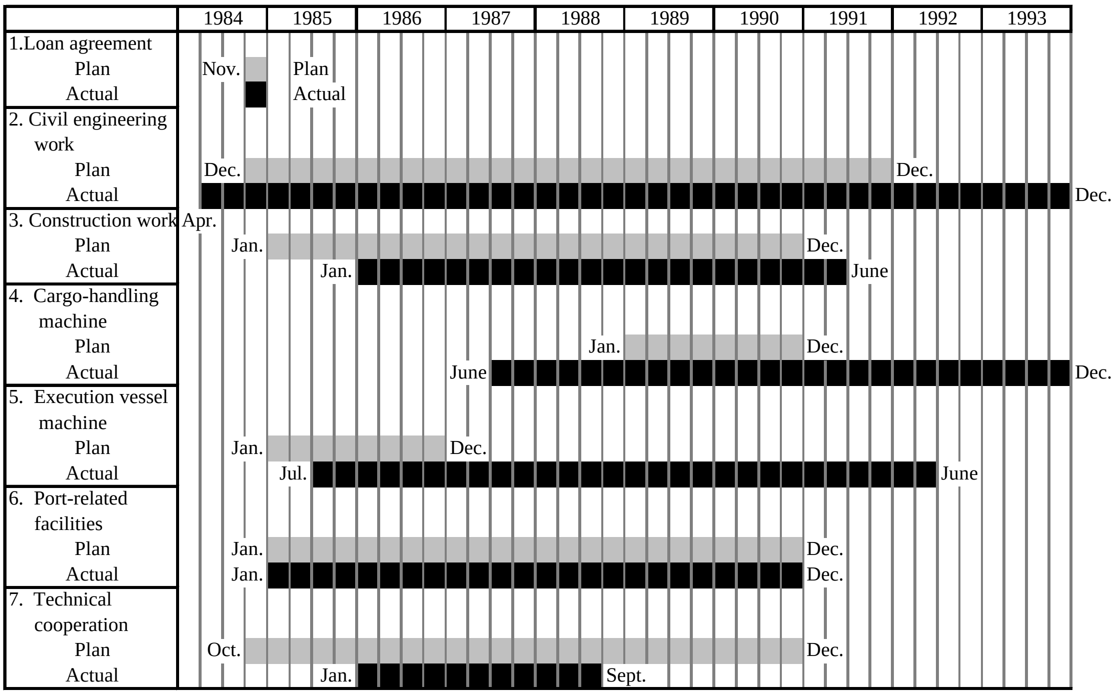
Note : Plan (1) At the time of Appraisal means to plan in1984, Plan (4) after time of Appraisal, the plan reviewed in 1987.

(3) Baoji-Zhongwei Railway Construction Project (I) ~ (IV)

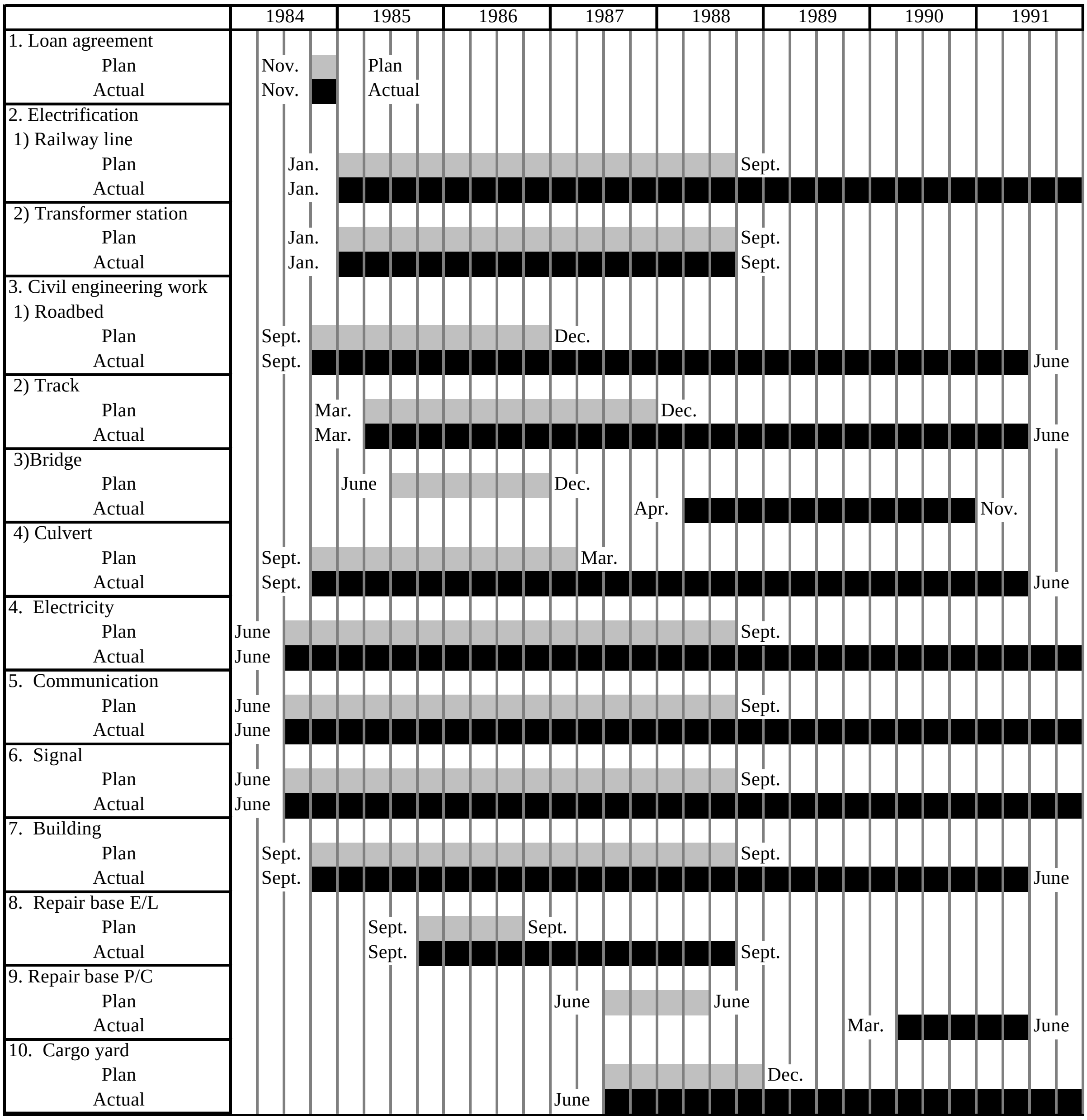
Item	Plan	Actual	Difference
1. Civil engineering work			
1) Roadbed	33,250,000m³	35,040,000m³ (Including ballast 1,270,000m³)	+ 1,790,000m³
2) Track	508km	508.6km	+ 0.6km
3) Bridge	426 places 33,151m	313 places 36,527m	- 113 + 3,376m
4) Culvert	909 places 19,573m	1,388 places 28,795m	+ 479 + 9,222m
5) Tunnel	67 places 56,673m	68 places 59,335.5m	+ 1 2,662.5m
2. Communications signal	508km	Same as left	None
3. Electrified facility	500km	Same as left	None
4. Station	42 stations	45 stations	+ 3

1.4.2 Implementation Schedule

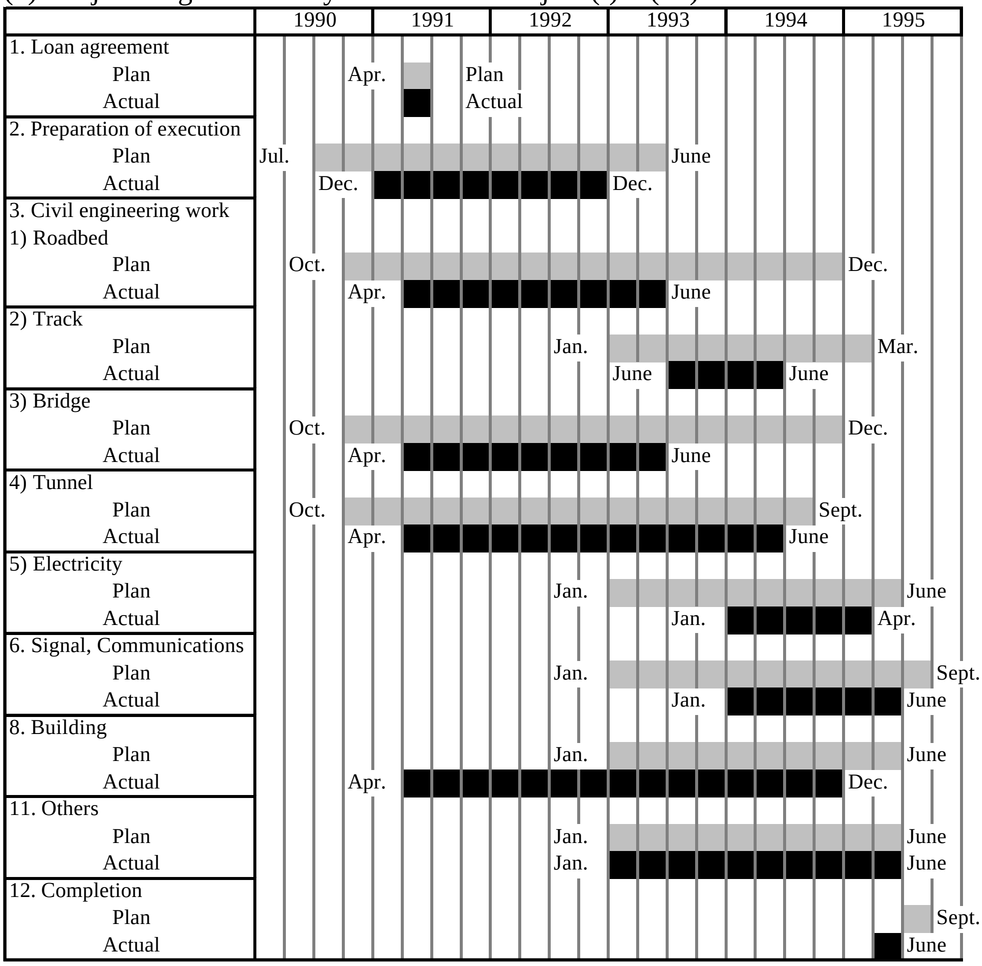
(1) Lianyungang Port Expansion Project (I) ~ (VI)



(2) Zhengzhou-Baoji Railway Electrification Project (I) ~ (V)



(3) Baoji-Zhongwei Railway Construction Project (I) ~ (IV)



1.4.3 Project Cost

(1) Lianyungang Port Expansion Project (I) ~ (VI)

Item	Plan		Actual		Difference	
	Foreign currency (1 million yen)	Local currency (1 thousand yuan)	Foreign currency (1 million yen)	Local currency (1 thousand yuan)	Foreign currency (1 million yen)	Local currency (1 thousand yuan)
Civil engineering work	8,288	435,780	5,609	387,530	-2,679	-48,250
Construction work	2,497	29,030	798	76,030	-1,699	47,000
Cargo-handling machine	8,636	17,130	9,534	14,110	898	-3,020
Execution vessel machine	7,027	520	16,335	1,890	9,308	1,370
Port-related facility	8,341	251,740	5,322	1,140	-3,019	-250,600
Technical cooperation	861	200	193	0	-668	-200
Reserve cost	11,350	133,630	1,378	0	-9,972	-133,630
Total	47,001	868,031	39,170	480,701	-7,831	-387,330

(2) Zhengzhou-Baoji Railway Electrification Project (I) ~ (V)

Item	Plan		Actual		Difference	
	Foreign currency (1 million yen)	Local currency (1 thousand yuan)	Foreign currency (1 million yen)	Local currency (1 thousand yuan)	Foreign currency (1 million yen)	Local currency (1 thousand yuan)
Electrification	16,447	52,710	9,155	206,775	- 7,292	+ 154,065
Civil engineering work						
1) Preparation of execution	4,864	83,730	2,706	122,797	- 2,158	+ 39,067
2) Roadbed	12	4,630	6	6,945	- 6	+ 2,315
3) Track	1,845	4,290	3,656	10,725	+ 1,811	+ 6,435
4) Bridge	80	1,340	45	2,680	- 35	+ 1,340
5) Culvert	120	2,090	67	5,180	- 53	+ 3,090
Electricity	1,536	8,840	855	36,825	- 681	+ 27,985
Communications	5,478	36,170	3,048	140,425	- 2,430	+ 104,255
Signal	4,063	42,260	2,262	155,650	- 1,801	+ 113,390
Building	775	34,680	431	76,296	- 344	+ 41,616
Repair base	613	14,860	342	32,692	- 271	+ 17,832
Survey and design / technical cooperation	1,323	0	736	0	- 587	0
E/L	24,000	0	38,930	3,415	+ 14,930	+ 3,415
P/C	3,490	75,890	4,279	0	+ 789	- 75,890
Base cost total	64,647	361,491	66,519	800,406	+1,873	+ 438,915
Others	11,354	36,910	0	0	- 11,354	- 36,910
Total	76,000	398,400	66,518	800,405	- 9,482	+ 402,005

(3) Baoji-Zhongwei Railway Construction Project (I) ~ (IV)

Item	Plan		Actual		Difference	
	Foreign currency (1 million yen)	Local currency (1 housand yuan)	Foreign currency (1 million yen)	Local currency (1 housand yuan)	Foreign currency (1 million yen)	Local currency (1thousand uan)
Civil engineering work						
1) Preparation of execution	2,479	220,610	1,656	406,950	- 823	+ 186,340
2) Roadbed	474	147,380	365	280,020	- 109	+ 132,640
3) Track	7,911	114,930	8,243	236,450	+ 332	+ 121,520
4) Bridge/culvert	3,867	238,630	4,865	453,860	+ 998	+ 215,230
5) Tunnel	4,634	342,950	4,967	654,780	+ 333	+ 311,830
Communications/electricity etc.	9,293	88,090	7,455	194,800	- 1,838	+106,710
Building	1,975	149,450	2,036	295,680	+ 61	+ 146,230
Vehicle base	14	2,960	226	8,690	+ 212	+ 5,730
Appurtenant work etc	0	247,610	0	407,560	0	+159,950
Price escalation	0	603,420	0	1,249,830	0	+ 646,410
Others (excluding expropriation of land)	1,532	85,320	0	0	- 1,532	- 85,320
Expropriation of land	0	153,820	0	187,900	0	+ 34,080
Total	32,180	2,395,171	29,814	4,376,521	1	+1,981,350

2. Analysis and Evaluation

2.1 Evaluation of Project Implementation (Project scope/implementation schedule/project cost/implementation scheme)

2.1.1 Project Scope

Contrastive analyses of plans related to the scope of each project and results are described below.

(1) Lianyungang Port Expansion Project

As indicated in section 1.4.1 Comparison of Original Plan and Actual Result—Project Scope, the berths and the West Large Levee were completed according to plan. The analyses of the design and implementation method for each item are described below.

Lianyungang Port Expansion Project ("Miaoling Area 2nd Stage Construction", which is the concrete project content of this section) was implemented by the Ministry of Communications' Third Water Transport Engineering Bureau, Design Institute, and the Lianyungang Port Bureau did not directly participate in this project. Thus plans and design materials could not be obtained from the Lianyungang Port Bureau.

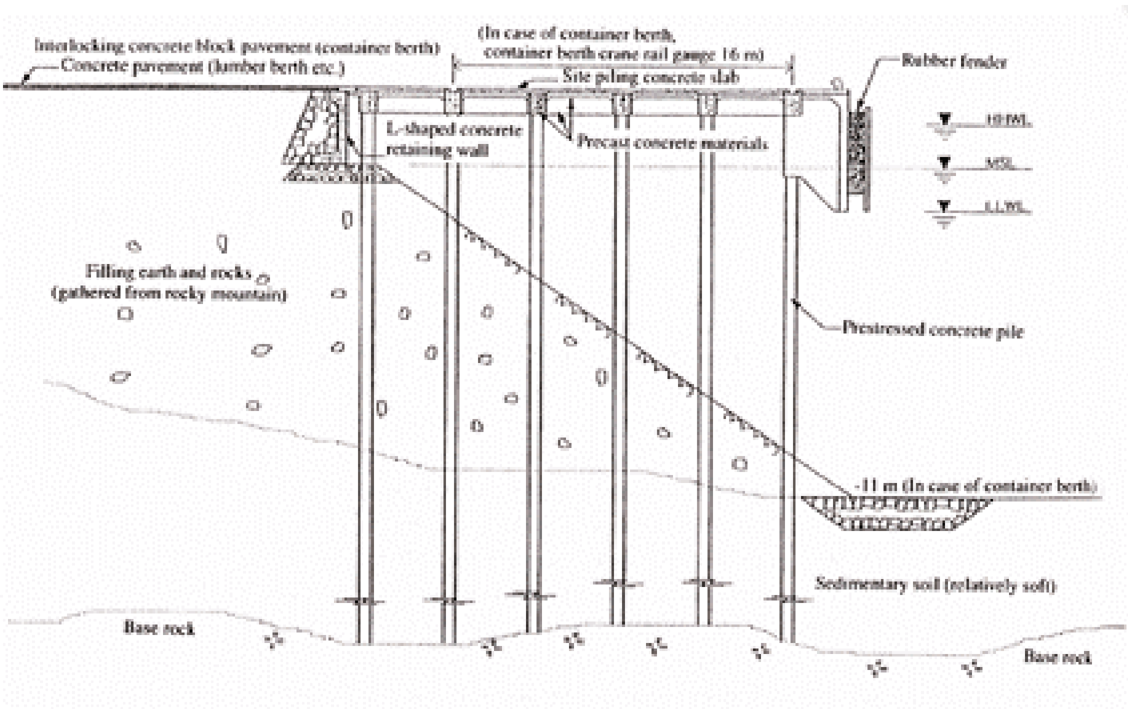
The following is a description based on descriptions obtained from the Lianyungang Port Construction Authority.

As indicated in section 1.1 Project Location, the Miaoling Area 2nd Stage Construction built a total of 6 berths: a container berth (No. 31), multi-purpose berth (No. 32), cereal berth (No. 33), mooring berth (No. 34), and two lumber berths (No. 35 and No. 36). Of these, the mooring berth (No. 34) was built to serve as a mooring berth for ships waiting for their berth to clear, based on consideration of the fact that the port was to see many incoming and exiting ships. All the berths constructed in this project were of the horizontal wharf type (Figure 2.1), with the pier foundation formed of prestressed concrete piles (concrete piles that have been reinforced through the application of pressure), and the upper portion of the pier formed of concrete beams using many precast elements (manufactured beforehand, and simply needing to be assembled on the site to be completed) and concrete slabs. The yard consists of land reclaimed using earth and rocks obtained from the Mountain right behind the port, and the end dam between the berths and the yard consists of an L-shaped retaining wall made of concrete.

For the reader's reference, a conceptual drawing prepared based on an interview of the Port Construction Authority is shown in Figure 1.7.

A relatively soft soil layer is accumulated up to the rock-bed, which is the pile support layer, and thus building the berth as a horizontal wharf type was reasonable. The reason concrete piles were used instead of steel piles for the pile foundation is thought to be for economic (foreign currency saving) purposes.

1. Interlocking concrete block pavement (container berth)
   Concrete pavement (lumber berth etc.)
2. (In case of container berth, container berth crane rail gauge 16 m)
   Site piling concrete slab
3. Rubber fender
4. L-shaped concrete retaining wall
5. Precast concrete materials
6. Filling earth and rocks (gathered from rocky mountain)
7. Prestressed concrete pile
8. -11 m (In case of container berth)
9. Sedimentary soil (relatively soft)
10. Base rock
11. Base rock



【Figure 2.1 Conceptual Drawing of Berth Structure (Horizontal Wharf Type) 】

① Container berth (No. 31 berth) and multi-purpose berth (No. 32 berth)

One of the most important factors related to berth design conditions in port construction that deals with containers, including multi-purpose berths, has to do with the design of the ships for which the berths will be made. In the Miaoling Area 2nd Stage Construction, the berths were designed for second-generation container ships (ships with a container capacity of 1,500 TEU to 3,000 TEU), and therefore it was decided during the planning stage to make the ship path depth minus 8 meters. Based on this decision, the depth in front of the berths was set at minus 11 meters (in the case of third-generation container ships (ships with a container capacity of 3,000 TEU or more), a depth of 12 meters is required.) The berth extension was set at 2x230 m = 460 m, and the container berth crane rail gauge width at 16 m (the initial standard container berth crane rail gauge was 16 m, which makes it easy to procure second-hand cranes).

For the container yard loading and unloading, tire-type transfer cranes (cranes for loading and unloading containers that move on tires on the travel track) were used. It is efficient to use tire-type transfer cranes or straddle carriers (a method whereby the crane is mounted on a car) for container terminals of this type, with a berth extension of 230 m and a yard depth of about 400 m, and such systems are easy to maintain. Since, in addition, the first type offers the possibility of being automated, it is currently the type that is most used, and thus it can be said that the loading/unloading type was an appropriate choice. (Incidentally, these cranes were supplied by Japanese company, and according to persons related to the Lianyugang Port, despite the fact that they were procured for a low price, they had very few problems, and offered a fully satisfactory level of performance.)

Interlocking concrete blocks (a pavement method whereby concave and convex complementary concrete pieces are assembled) were used for yard pavement.

This type of pavement is relatively easy to repair, and is frequently used in reclaimed locations where subsidence is predicted. Also, the fact that this pavement method is also labor intensive makes it suitable for China, where labor costs are low.

② Cereal berth (No. 33 berth)

The greatest feature of the Lianyungang Port's cereal berth is that cereal loading and unloading are done using the same system. In other words, a single system is used that can perform both functions by exchanging the attachments of the loader/unloader installed on the berth. It was decided to employ this system based on consideration of the fact that the port would handle both wheat imports and corn exports. The fact that the port handles both imports and exports of cereals is attributed to the fact that cereal import and export volumes are dictated by the Chinese government for each port.

The berth is intended for 35,000 DWT-class bulk carriers, and has been planned and designed for a depth of 12 meters and an extension of 280 meters. In the case of a channel dredge of minus 8 meters, the channel depth is only 12.5 meters at high tide, so that even if ships enter and exit the port at high tide, the full draft of the bulk carrier must be 11.5 meters maximum. Since the full draft of a 35,000 DWT-class bulk carrier is 11.5 meters, and its length about 200 meters, making the berth depth minus 12 meters and the berth length 280 meters was appropriate. Also, as mentioned previously, the berth structure is although considered to be appropriate.

③ Front berth (No. 34 berth)

The front berth is of the horizontal wharf type, with a quay structure. The front berth was originally planned as a temporary mooring station for ships entering the port, and thus handles extremely small cargo volume. Currently, the area in front of the front berth is being reclaimed as part of a facility expansion plan for the Miaoling Area, and construction of an offshore berth for 100,000 DWT ships is now being considered. Considering the original purpose of this front berth and the fact that it will be filled in the future, planners could as well have elected not to give the wharf a berth structure (strong structure), but instead a bulkhead structure (simple structure). However, if demand for freight handling exceeds predictions, effective use of the front berth will probably be sought. The front berth was designed and built to be 270 meters in extension with a depth of minus 11 meters.

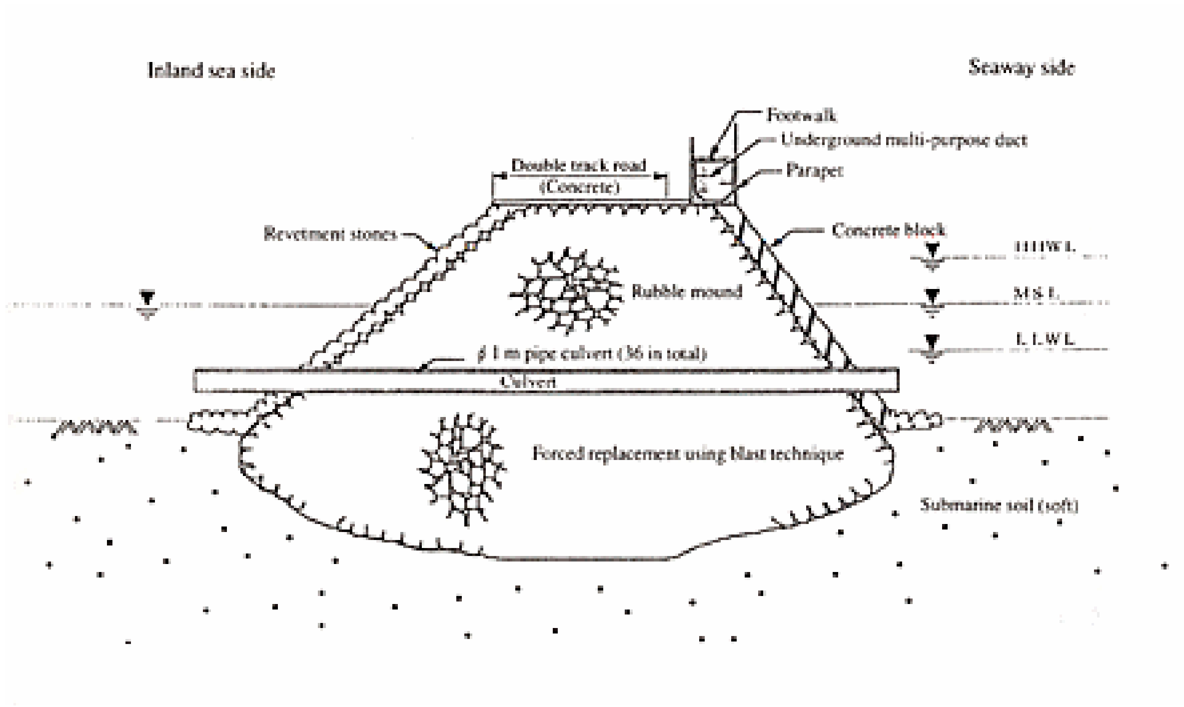
④ Lumber berths (No. 35 and No. 36 berths)

The Lianyungang Port's lumber berths were planned and designed for 25,000 DWT-class cargo ships, based on results prior to 1984. Since it is not predicted that giant lumber carriers will ever emerge, designing for 25,000 DWT-class cargo ships was an appropriate choice. The port's lumber berths were planned and designed with an extension of 2 x 225 meters = 450 meters and a depth of minus 11 meters.

As mentioned earlier, the berths are of the horizontal wharf type with concrete pile foundations. The yard pavement consists of concrete pavement, an appropriate choice since sturdy pavement is required for handling raw wood. The lumber berths currently handle metallic and non-metallic ore as well, for which concrete pavement is also suited.

⑤ West Large Levee

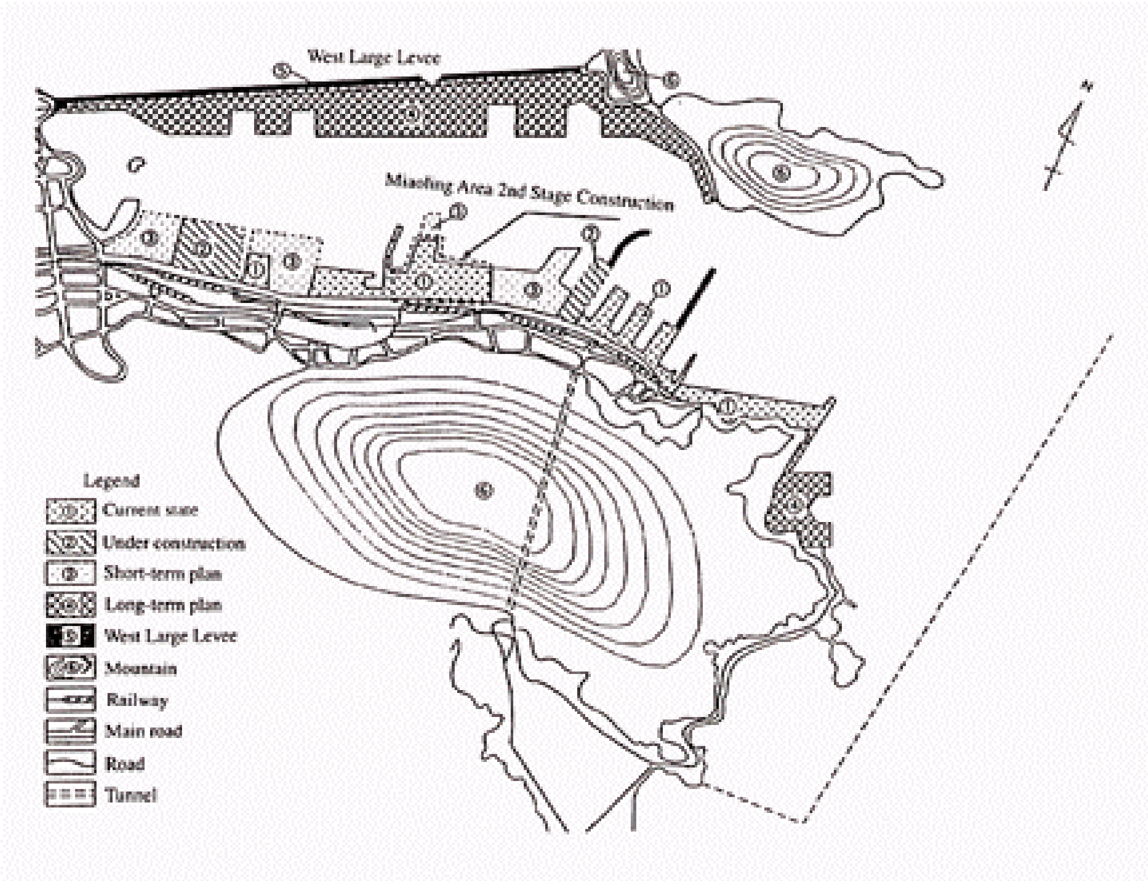
We were not able to obtain the engineering drawings of the West Large Levee, which is a breakwater, and a sectional drawing based on a hearing with the Lianyungang Port Construction Authority is shown in Figure 2.2.



【Figure 2.2 Conceptual Diagram of West Large Levee】

As shown in the sectional drawing, the foundation of the West Large Levee consists of a rubble mound. The stone used for the rubble mound is granolith taken from Liandao Island. This rubble mound is topped by a concrete superstructure that includes a driveway, footwalk, and underground multi-purpose duct. The underground multi-purpose duct serves also as a parapet. The rubble mound on the seaway side is covered with a breakwater formed of concrete blocks.

The function of the West Large Levee is not merely to calm waters inside the port. The West Large Levee was designed with a greater purpose in mind, that is, to provide a driveway, water line, power lines, and telephone lines linking the Liandao to the mainland. The West Large Levee thus functions as a lifeline for the Liandao, and the port expansion plan includes the entire waters encompassed by the mainland and the West Large Levee as illustrated by the plan view of the future Lianyungang Port. (Figure 2.3 shows the image of the future Lianyungang Port expansion plan.)



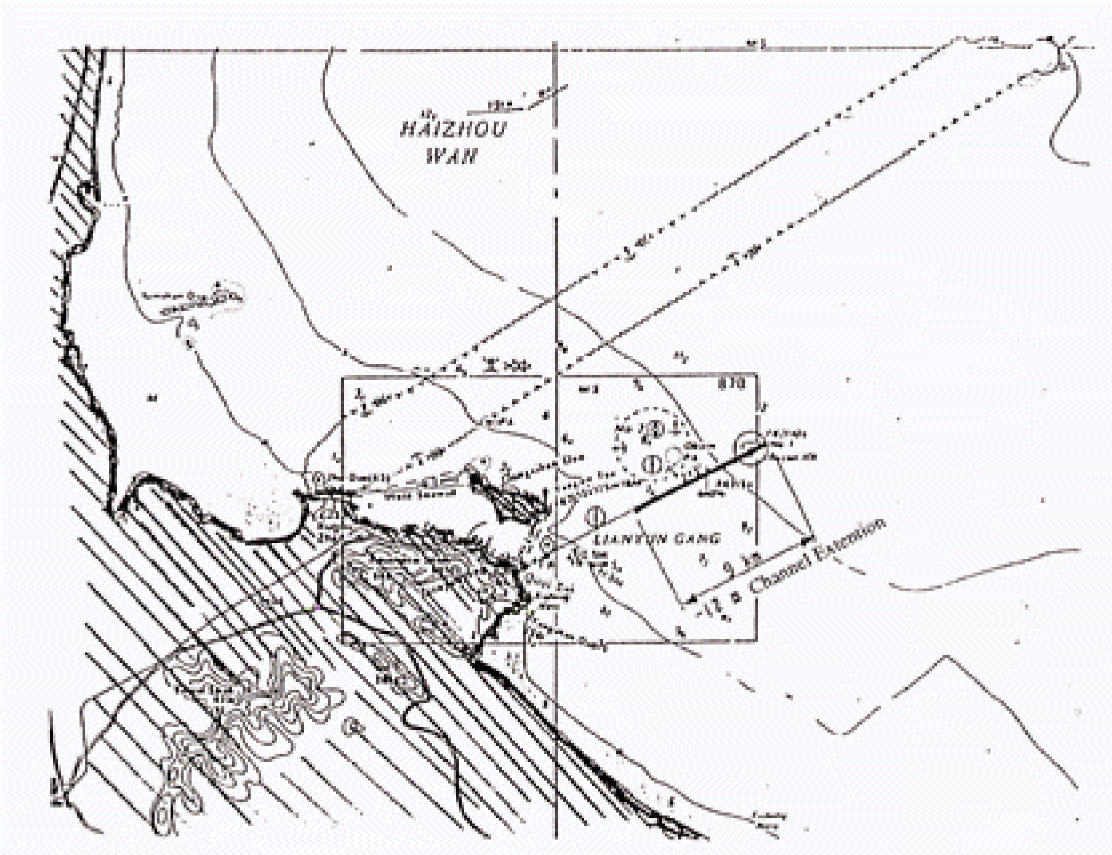
【Figure 2.3 Future Expansion Plan of Lianyungang Port】

A distinguishing feature of the West Large Levee's design is the way concrete wave-breaking blocks are used. Unlike Japanese breakwaters, which are either honeycombed or layered, the concrete wave-breaking blocks of the West Large Levee are joined so as to leave no interstices between them, and as a result, the size of the each block has been kept small. According to our information, the Chinese Design Bureau designed the West Large Levee based on a model test. In our view, confirmation of the West Large Levee's stability against actual ocean waves is needed.

⑥ Channel

The reason why the channel depth was designed to be minus 8 meters is that "The channel depth should be set at minus 12.5 meters or more to match the size of the largest ships for which the project is designed. However, the average sea level at this port is a high 2.94 meters (height between depth of 0 meters to sea floor), and thus a depth of even only minus 8 meters means that a depth of minus 12 meters to minus 13 meters can be obtained at least once a day (the average low tide/high tide difference is +4.17 meters, and the average spring high tide level is 4.93 meters). While a channel depth of minus 8 meters cannot be said to be a safe comfortable depth, the fact that the number of port entries is about five a day, and that making the channel deeper would require significant expenses dictated the use of a provisional depth of minus 8 meters." For the above reasons, although a depth of minus 12 meters is required for the periodic entry of large container ships, a provisional depth of minus 8 meters was settled upon for second-generation container ships.

According to the Lianyungang Port Bureau, the annual channel maintenance dredging amount is 2,600,000 m^3. If the channel depth is minus 12 meters, this means that the current channel will be extended an additional 9 km conjecturing from the hydrographic chart (see Figure 2.4). In this case, assuming that the dredging amount rises in relation to the channel extension, maintenance dredging of approximately 4,300,000 m^3 is required annually. Currently, considering that the majority of container ships entering the port are first- and second-generation ships, in order to keep maintenance dredging costs down, setting the channel depth to minus 8 meters is considered to be appropriate. (The Lianyungang Port Bureau is performing maintenance dredging to a depth of minus 9 meters, and as indicated by 1994 hydrographic charts, the channel depth was maintained at minus 9 meters.) However, container ships are becoming increasingly large, and considering the competitive relations with other ports including Shanghai and Qingdao, the fact that a decision regarding the channel depth will have to be made in the future remains unchanged.



Channel Extention

【Figure 2.4 Hydrographic Chart】

⑦ Cargo handling equipment

A comparison of equipment procurement plans and an equipment list obtained from the Lianyungang Port Bureau is shown in the table below. The Plan column shows quantities of initial plan in 1984 and the revised plan quantities in 1989, while the results column indicates quantities from 1992 to 1996. Container berths and multi-purpose berths are operated by Lianyungang Port container companies, and cargo handling equipments on both berths are used mutually to some degree. For the sake of convenience, they have been divided into two berth categories. On the other hand, the front berth yard and the lumber berth yard can be used only indivisibly, and considering the conditions at the three cargo handling companies of the Lianyungang Port, we decided to compare the cargo handling equipment of the two berths as a whole.

【Table 2.1　Cargo Handling Equipment Procurement Plan/Results】

	Plan		Results	
	Item	Qty.	Item	Qty.
Container terminal	Container crane (30.5t)	2	Container crane (40.5t)	2
	Transfer crane (30.5t)	5	Transfer crane (30.5t)	5
	Transfer crane (30.5t)	2	Transfer crane (30.5t)	0
	Other forklifts		Other forklifts	
Multi-purpose terminal	Tire crane (8t〜30t)	10	Tire crane (8t〜50t)	8
	Trailer	60	Trailer	13
	Others		Others	
Cereal	Forklifts	8	Forklifts	15
	Loader/unloader	2	Loader/unloader	2
	Others		Others	
Front/lumber berths	Log loader	32	Log loader	12
	Other trucks etc.		Other trucks etc.	

A comparison of the planned cargo handling equipment procurement quantity and the actual procurement quantity for the container terminal shows that equipment was procured almost exactly according to plan. As an exception, a transfer crane with a lifting capacity of 5 tons was not procured as planned. Cancellation of the procurement of this transfer crane, which is thought to have been originally earmarked for handling empty containers, is thought to have been a logical decision since it could be replaced by normal transfer cranes.

Two remarkable aspects of the multi-purpose terminal are that many of the cranes that were actually procured have a performance exceeding that which was planned, and also that the number of trailers is considerably lower than originally planned. The reason for the first item is that large cranes can be used for a wider range of purposes, and the second item is explained by the fact that as the percentage of general cargo containers increases, conventional general cargo transported by trailers is decreasing. Thus, disparities between planned procurement and actual procurement figures are considered to be the result of rational reasons. The Lianyungang Port Bureau procured second-hand 30.5 ton container berth cranes for the multi-purpose terminal, which are being used for loading and unloading container cargo and general cargo.

The fact that the number and types of procured forklifts greatly exceeded the planned figures for the cereal berth also deserves pointing out. This is explained by the fact that the proportion of cereals shipped bagged instead of in bulk exceeded expectations.

With regard to the cargo handling equipment for the front berth and the lumber berths, the number of log loaders was remarkably lower than the planned procurement number. Considering the fact that from the 1980s all the way to the 1990s, lumber exporting countries started prohibiting the export of raw lumber, the decision to reduce the number of log loaders to be procured is thought to have been rational. Moreover, while it is indicated that six berth cranes that did not figure in procurement plans were procured, they are thought to have been procured for handling a variety of general cargo such as steel products, machines, etc.

As a whole, many general-purpose units such as large, medium, and small forklifts and tire cranes were procured, while few log loaders, truck-mounted log loaders, and other special-purpose units were procured. This signifies that material procurements were performed while monitoring demand, with the aim to make efficient use of the ODA loan.

(2) Zhengzhou-Baoji Railway Electrification Project

Basically, there were no changes from the original plan. However, with regard to each item of the original plan during the period from the original plan (time of Zhengzhou-Baoji Railway Electrification Project (I) appraisal) to the final plan (time of Zhengzhou -Baoji Railway Electrification Project (V) appraisal), the following partial changes were made (see 1.4.1 Comparison of Original Plan and Actual Result).

Description of changes

(i) Increase in civil engineering work (roadbeds, bridges, culverts)
(ii) Addition of related facilities
(iii) Increase in number of cars procured
(iv) Non hiring of external consultants

Reasons for changes

(i) Increase in civil engineering work (roadbeds, bridges, culverts)
The following reasons can be given for increasing civil engineering work.

(a) Increase in capacity of Xinfeng Zhen yard
As part of this project a yard (switchyard) was constructed at Xinfeng Zhen, but during the implementation of the construction, it was decided to build a new railway line from Xian to Yan'an. Consequently, it became necessary to raise the cargo handling quantity for the yard compared to the initial plan, and as a result civil engineering work increased. Concretely, this included the construction of a station building, the construction of more than 70 km of tracks, the construction of a bridge with a total extension in excess of 300 meters, and the construction of more than 1,200 culverts.

(b) Increase in land-filling and grading work
During the implementation of the project, the local residents of an area where construction of a railway was planned excavated soil for making bricks, which had to be returned to its original location and graded, causing an increase in civil engineering work.

(c) Consideration of farm land
A proposed railway was to cut across farm land, and in order to prevent this, it was necessary to do digging work for culverts (small bypass tunnel) that had not been planned for.

(ii) Addition of related facilities
The original plan called only for wagon warehouse and other facilities actually necessary for trains. However, during the implementation of the project, the need to also build

facilities for the benefit and welfare of employees, including dormitories for railway employees was recognized, so that the construction of such facilities was added to the project.

(iii) Increase in number of cars procured

The F/S performed by JICA pointed out the fact that the Ministry of Railways ownership of rolling stock was insufficient, and the procurement of 80 E/L (electric locomotives) was included in this project. However, while the project was being implemented, it was decided to further increase the number of rolling stock by 180 units due to the severe shortage. The new procurement figure broke down as follows: 80 E/L (electric locomotives) and 100 P/C (passenger cars).

In addition to the above, 210 other P/C were procured using Ministry of Railways budget, most of which were allocated to the railway worked on by this project.

(iv) Non hiring of external consultants

The original plan was to hire consultants due to the fact that the Ministry of Railways lacked experience concerning train radio communications, remote control of substations, and signal information management systems. However, following the start of the project, it was decided on the Chinese side (Ministry of Railways) that these areas could be supported independently, and thus consultants were not hired. While the impact of not hiring external consultants on the project is not known, no major hitches were observed, at least in the construction stage.

(3) Baoji-Zhongwei Railway Construction Project

Basically, there were no changes in the original project. However, partial changes were implemented with regard to the items listed below (see section 1.4.1 Comparison of Original Plan and Actual Result).

Description of changes

(i) Increase in civil engineering work (roadbed, culverts)/decrease in number of bridges built

(ii) Increase in number of stations built

Reasons for changes

(i) Increase in civil engineering work (roadbed, culverts)/decrease in number of bridges built

Following the start of railway construction for this project, it was decided to implement an irrigation project that would use water from the Huang He in the area where construction of the railway was planned. In order to keep the railway construction project from hindering the irrigation project, it became necessary to increase civil engineering works for culverts and roadbeds. On the other hand, many of these culverts serving as replacements for planned bridges, the number of bridges built as part of the project was reduced from the originally planned figure.

(ii) Increase in number of stations built

The reason why a greater number of stations was built than originally planned is that, according to railway specialists, the proposed railway could support the increased number of stations, a fact that was not brought to light during the field survey.

2.1.2 Implementation schedule

A comparative analysis of the plan and results for each item of the implementation schedule is done below (see section 1.5.2 Comparison of Original Plan and Actual Result).

(1) Lianyungang Port Expansion Project
Completion two years behind schedule

Although the implementation schedule for the Lianyungang Port fixed its completion for December 1991, the project was completed two years late, in December 1993. The reason for this delay is that completion of the West Large Levee, which was part of the project scope, was two years late. This delay originated from the fact that it was decided to employ a new construction method[1] as the result of studies regarding soft foundation processing techniques performed by the Oversea Coastal Area Development Institution of Japan (OCDI) in cooperation with the Chinese side. These studies took time, resulting in unavoidable delays.

According to the Lianyungang Port Bureau, use of this new technology is reported to have resulted in a shorter construction period and lower construction costs.

While the delay in the project's completion was not desirable, this delay is considered to have been unavoidable considering the fact that this time was spent on studies of a new technology, combined with the fact that the application of the new technology was successful, plus the fact that the use of this technology was the result of technical cooperation between China and Japan.

(2) Zhengzhou-Baoji Railway Electrification Project
Completion three years behind schedule

Although completion of the electrification of the Zhengzhou-Baoji Railway was planned for December 1988, the project was completed three years behind, in December 1991. The main reason for this delay was that the construction of the Xinfeng Zhen Yard was completed three years behind schedule. The reason for this delay was that, as mentioned above in the project scope section, there was an increase in the construction items compared to the original plan. Other contributing factors were delays resulting from the failure of procured potential transformers, which impeding the proper operation of substations, and the fact that yuan-denominated procurements took a long time.

On the other hand, the department in charge of managing the implementation of the project (the Zhengzhou Railway Bureau) sped up the construction of facilities and raised the work efficiency by introducing new technologies related to materials, equipment, and construction techniques, thereby minimizing implementation delays. While the project, including the construction of the Xinfeng Zhen Yard was completed in December 1991, the electrification of

[1] This method consisted in blasting and removing the weak portion of the foundation in the bottom of the sea. The conventional method would have gradually removed the weak portion using dredging ships. Compared to the conventional method, the new method was particularly effective in lowering construction costs.

the Zhengzhou-Baoji Railway itself was completed earlier, so that the railway started operating from December 1988, almost per the original plan, and thus the delay in the completion of the entire project does not deserve to be pointed out as a particular problem.

(3) Baoji-Zhongwei Railway Construction Project

Completion three months ahead of schedule

The construction of the Baoji-Zhongwei Railway, which was planned to be completed in September 1995, was actually finished three months early, in June 1995, and the railway started being used from July 1995[2]. The reason for this early completion was that the Chinese government directed the Ministry of Railways to speed up the project's completion on account of the rapid economic development of Northwestern China, and that the Ministry of Railways responded with hard work to meet the government's request. (Ministry of Railways plans to perform additional procurements of large equipment and materials required for the maintenance of the railway by March 1998.)

The fact that this project was completed ahead of schedule can be attributed to the efforts of the Chinese side. However, the attention must be paid later whether the fact that completion was sped up may result in the emergence of problems due to construction inadequacies.

2.1.3 Project Cost

The comparative analyses of the planned and actual costs of each project are detailed below. (See section 1.4.3 Comparison of Original Plan and Actual Result.)

(1) Lianyungang Port Expansion Project

Cost underruns both for foreign currency and local currency

While the original plan envisioned foreign currency cost of ¥47,000 million and local currency cost of 868 million yuan, the actual foreign currency cost was ¥39,169 million and the local currency cost was 481 million yuan. Thus, compared to total project costs of ¥148,560 million, the project ended up costing ¥57,692 million less. Broken down by currency, the project's foreign currency cost underrun was ¥7,831 million (16.7% of the planned amount), and the project's local currency cost underrun was 384 million yuan (44.2% of the planned amount).

The foreign currency cost underrun is explained by the fact that the procurement unit cost of equipment and material was lower than planned. Taking steel products for example, in 1984, the price of one ton of steel was predicted to be ¥80,000, whereas it actually was as low as ¥50,000 (as of 1989 during implementation of the project). The reason that the yen-based unit price of equipment and materials was so low was due to the efficiency of international competitive bidding, as well as the strength of the yen during the project, which made yen-converted prices lower. However, the foreign currency portion allocated for the ships and equipment used in implementing the project cost ¥16,335 million compared to the planned figure of ¥7,027 million, or ¥9,300 million more. The main reason for this overrun is that under the original plan (1984),

[2] In the case of China, new railways are operated on a trial basis for one year before the start of commercial operation. Therefore, in the case of the Baoji-Zhongwei Railway, which started service in July 1995, the official start of operation was one year later.

only one dredging ship was to be purchased, a figure that was later revised (in 1989) and expanded to 6 ships. Now that the project is completed, these dredging ships are being used for expanding the Lianyungang Port.

On the other hand, with regard to the local currency cost of the project, the actual amount expended for port-related facilities was merely 1 million yuan compared to the 252 million yuan planned, or 251 million yuan less than planned. This reduction accounts for almost all the entire reduction in the local currency cost of the project. The planned amount was based entirely on calculations done by the Chinese side, and the details of these calculations are not necessarily clear. Although during the last field survey we inquired to the Lianyungang Port Bureau about the calculation details and the reasons for the cost reduction, we were told that these data were not known. Since the local currency portion of the project costs is outside the scope of the ODA loan, it was decided that further analyses would not be performed.

(2) Zhengzhou-Baoji Railway Electrification Project

Foreign currency cost underrun, local currency cost overrun

While the original plan set the foreign currency cost at ¥76,000 million and the local currency cost at 398 million yuan, the actual cost figures were ¥66,518 million and 800 million yuan, respectively. Thus, while the total project cost was set at ¥122,613 million, the actual project cost was ¥99,902 million, which means a cost underrun. Specifically, the foreign currency cost underrun was ¥9,482 million (12.5% underrun), and the local currency cost overrun was 402 million yuan (101.0% overrun).

The difference between the planned and actual foreign currency cost figures was due to the fact that the procurement unit cost of equipment and materials was lower than planned, in the same way as for the Lianyungang Port Expansion Project. On the other hand, the local currency cost overrun was due to inflation in China and the fact that civil engineering work was added as discussed in the section on the project scope. While a foreign currency cost underrun was achieved, the foreign currency amount spent for the procurement of electric locomotives (E/L) was actually ¥14,930 million higher than planned, due to the additional purchase of 80 electric locomotives. Conversely, purchase cost of passenger cars (P/C) was 76 million yuan lower than planned because, despite the fact that a local currency budget had been allocated for the purchase of 210 passenger cars as part of the plan, the Ministry of Railways allocated funds for the purchase of passenger cars from outside the project's budget, so that the actual purchase cost of these passenger cars is not reflected in the project's cost figures.

(3) Baoji-Zhongwei Railway Construction Project

Foreign currency cost underrun, local currency cost overrun

While the project's foreign currency budget was set at ¥32,179 million and the local currency budget at 2,395 milion yuan, the actual foreign currency cost was ¥29,813 million[3] and the local currency cost was 4,377 million yuan.This means that the total project cost, originally tagged at ¥114,573 million, turned out to be lower, or ¥106,965 million. Broken down by currency, there was a foreign currency cost underrun of ¥2,366 million (7.1% underrun), and the local currency cost overrun was 1,981 million yuan (82.7% overrun).

The difference between the planned and actual foreign cost figures is due to the fact that the procurement unit cost of equipment and materials was lower than planned, in the same way as for the Lianyungang Port Expansion Project. With regard to the local currency cost overrun, the inflation in the Chinese economy had a considerable impact. Other factors include the additional civil engineering work that had to be performed due to the emergence of an irrigation project during the construction period, as described in section 2.1.1 Project Scope, (3) Baoji-Zhongwei Railway Construction Project (I).

With regard to the breakdown of the local currency component of the project costs, the 1,250 million yuan entered under "Price escalation" represent the amount of increase in the procurement cost of equipment and materials paid for with local currency, and normally would have been absorbed within the respective procurement categories, such as civil engineering work.

(4) Common trends among three projects

A detailed item-by-item examination of the projects' costs reveals both increases and decreases, but on the whole, all three projects show a decrease in the foreign currency portion (ODA loan) due to the efficiency of international competitive bidding and also the fact that the unit cost of materials and equipment fell during the project implementation period on account of the rising yen. On the other hand, all three projects show an increase tendency in the local currency portion due to inflation in the Chinese economy. These cost decreases and increases are considered to have been unavoidable during the respective projects' implementation period.

As a matter of fact, estimation of price increases, both for foreign and local currency, were factored in the total project cost calculations at the time of the appraisal. As for local currency, a price increase rate of 12.2% was projected during the implementation period of the Baoji-Zhongwei Railway Construction Project started in 1991 and the actual annual rate of increase was 11.6%, while in the case of the Lianyungang Port Expansion Project and the Zhengzhou-Baoji Railway Electrification Project, which started in 1984, the actual annual rate of increase was 9.0% as opposed to the projected rate of 2%. Predicting inflation is not a simple task, and while there is not much meaning in debating the validity of the 2% annual rate figure, this projection nevertheless seems rather low when the final result is examined.

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[3] The ODA loan implementation deadline for the Baoji-Zhongwei Railway Construction Project (Baoji-Zhongwei Railway Construction Project (IV)) was September 1998. With regard to the project cost data obtained during the latest field survey (November 1997), the procurement estimate (¥1,250 million) for large equipment and materials to be used in the maintenance of the railway, which are to be purchased by September 1998, is included in the actual foreign currency cost figure for communications and power.

2.1.4 Project Implementation Scheme

The implementation scheme of each project is shown in the following table.

【Table 2.2 Implementation Scheme of Each Project】

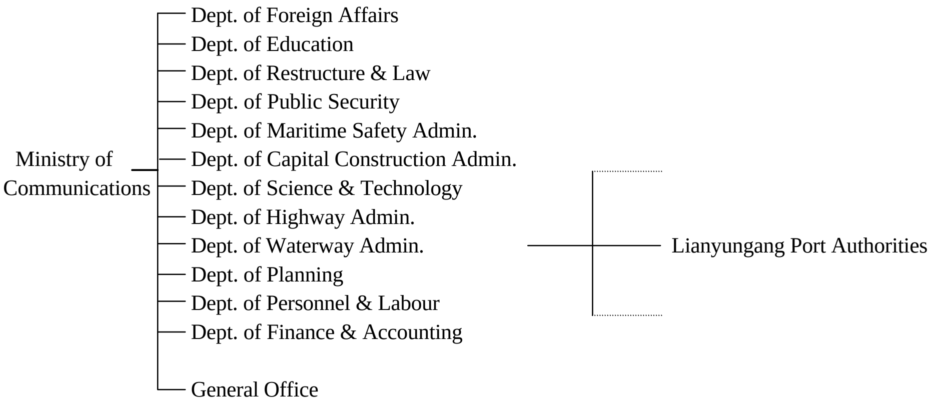
	Lianyungang Port Expansion Project	**Zhengzhou-Baoji Railway Electrification Project**	**Baoji-Zhongwei Railway Construction Project**
Executing Agency	Ministry of Communications	Ministry of Railways	
Procurement	China National Technical Import and Export Co.		
Design	The Third Water Transport Engineering Bureau, Design Institute	Xi'an Investigation and Design Institute, of Zhengzhou Railway Bureau	The First Investigation and Design Institute of Railway Engineering
Implementation	The Third Water Transport Engineering Bureau, No. 1 Company, No. 5 Company	Xi'an Project Co., of Zhengzhou Railway Bureau	The Engineering Company The Construction Company
Implementation and maintenance	The Command Post of Lianyungang Harbour Construction	Zhengzhou Railway Sub-bureau Luo Yang Railway Sub-bureau Xian Railway Sub-bureau	Yinchua Railway Sub-bureau Xian Railway Sub-bureau
Management, operations and maintenance	Lianyungang Port Authorities	Zhengzhou Railway Bureau	Lanzhou Railway Bureau Zhengzhou Railway Bureau
Consultant	Japanese foundational person	Non-hiring	

(1) Ministry of Communications

Ministry of Communications ("Department" in Chinese means the same as "Ministry") is the organization that controls China's ports, administration of transportation by water, and administration of transportation by road. Ministry of Communications employs approximately 300,000 workers. Figure 2.5 shows the organization chart for the port and transportation by water portion of the Ministry of Communications. Transportation by road is overseen by the Dept. of Highway Admin., Ministry of Communications, but it actually manages only the construction planning of national highways and enactment of laws, while the construction and maintenance of national highways, as well as the planning, construction, and maintenance of roads in provinces and prefecture is the responsibility of local governments.

Similarly, with regard to the administration of ports and transportation by water, control of coastal ports is divided between the state and local governments, depending on the size and importance of the port. The 14 major ports, including Shanghai, Dalian, and Lianyungang Port are directly under the control of the state, and each has Port Authorities, but other small- and medium-sized ports are under the control of local governments.

With regard to the administration of ports and transportation by water, the Dept. of Planning, Dept. of Capital Construction Admin., Dept. of Waterway Admin., etc., are in charge of planning, construction, control, and operations of ports. The internal organization of the Dept. of Waterway Admin. includes Port Section, Freight Planning Section, Ship Allocation Section, and General Affairs Section, which are mainly in charge of control, operations, and guidance of ports. The major 26 ports of the Yangzi Jiang and transportation by rivers including the water transport of Yangzi Jiang are the responsibility of the Dept. of Inland Water Transportation, and maritime safety is the responsibility of the Dept. of Maritime Safety Admin. Each Port Authority is in charge of operations, navigation control, environment preservation, etc., according to the investment plans and budget approved by the central government, and of implementing daily tasks such as the allocation of materials handling and berth allocations. However, the allocation of ships coming into and leaving port, freight planning, etc., are under the control of the Ministry of Communications. Also, port bureau personnel affairs, finances, and other basic functions are under the control of the Ministry of Communications, and thus Port Authorities do not enjoy a large degree of freedom. Ports under local governments belong under the local government's *Department of Communications*, and receive guidance and orders from the central government through the *Department of Communications*.



Source: Ministry of Communications etc.

【Figure 2.5 Organization Chart of Ministry of Communications of P.R.C. 】

(2) Ministry of Railways

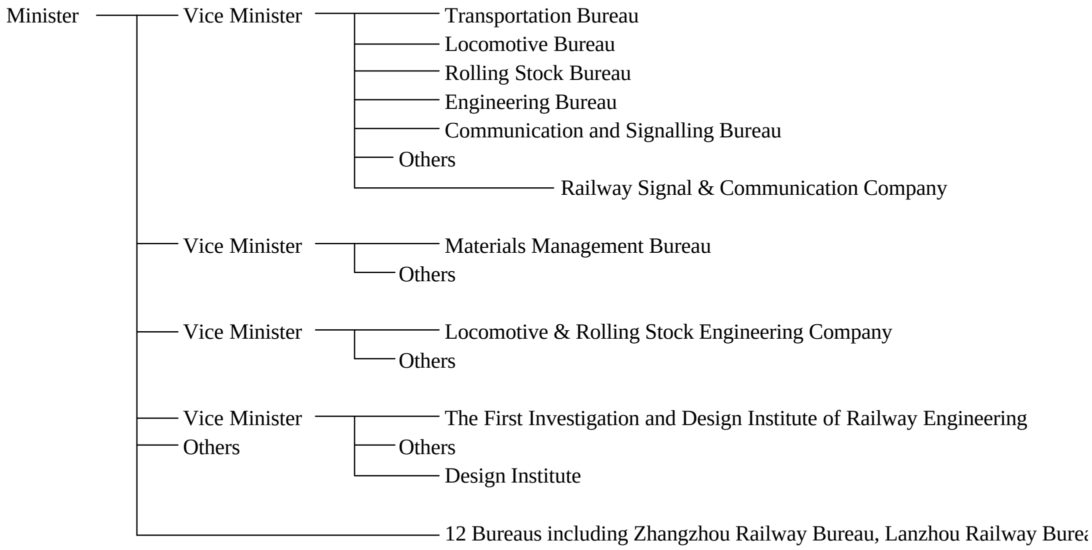
Ministry of Railways is one of the organizations of the Chinese government that administers China's railways. However, the power to take important decisions such as raising fares or fixing the number of employees lies with the State Council. In this sense, there are similarities with a government owned corporation. (Japan's former national railway).

The organization of the Ministry of Railways is divided among Bureaus, Admin. Bureaus, and Railway Bureaus.

Bureaus' railway-related bureaus are, in charge of managing and operating passenger and freight as Transportation Bureau, operations and locomotives and power are the charge of the Locomotive Bureau, passenger cars and freight that of the Rolling Stock Bureau, railways that of the Engineering Bureau, and signal communications that of the Communication and Signalling Bureau.

In Admin. Bureaus, there are locomotive & Rolling Stock Engineering company who is responsible for production of passenger/freight/engineering car and repairment of passenger/freight car, coap of engineering who is in charge of railway and electrification and Procurement Bureau who takes care of procurement of materials. Each of the Railway Bureau is divided into 12 sections.

Of the 3.4 million workers of the Ministry of Railways, 700,000 work for the Engineering Companies (including direct control division of construction), and approximately 100,000 construction-related workers belong to the Railway Bureaus.



【Figure 2.6 Organization Chart of Ministry of Railways of P.R.C. 】

(3) Project implementation scheme

① Lianyungang Port Expansion Project

The executing agency was the Ministry of Communications of P.R.C. The actual design, execution, etc. were handled by the sub-organizations shown in Table 2.2, as per the plan. International competitive bidding was used for equipment and materials only (however, for contract sums of less than ¥100 million, direct contractings were also allowed.)

Consultants were to be hired for some of the advanced technology, and were actually contracted with a Japanese foundational person to work in the areas of weak ground processing methods and the preparation of tender documents.

② Zhengzhou-Baoji Railway Electrification Project

The executing agency was the Ministry of Railways P.R.C. The fact that the China National Technical Import and Export Co. was put in charge of the procurement of equipment and materials, and that the Xian Railway Bureau was incorporated in the Zhengzhou Railway Bureau, were the points of difference from the original plan. Other than that, the sub-organizations of the Ministry of Railways were in charge of each of the various aspects, as shown in Table 2.2. Moreover, international competitive bidding was performed only for equipment and materials by the China National Technical Import and Export Co. (however, for contract sums of less than ¥100 million, direct contractings were also allowed.)

Originally, consultants were to be hired for transmission signals and remote control of substations, two areas in which the Ministry of Railways had little experience, but later it was decided not to hire consultants as the Chinese side declared that it would be able to manage these two areas unassisted. The impact of not hiring consultants on this project is not known. Based on interviews during the last field survey, the technological level of each company under the Ministry of Railways in the general area of electricity still leaves a lot of room for improvement. One reason is that the best electrical engineers tend to go to organizations other than the Ministry of Railways. In the case of this project, the fact that the Japanese manufacturers who supplied electrical-related facilities gave strong technical support is considered to have strongly contributed to the smooth implementation and operation of the project.

③ **Baoji-Zhongwei Railway Construction Project**

The executing agency was the Ministry Railways of P.R.C. Similarly to the Zhengzhou-Baoji Railway Electrification Project, the China National Technical Import and Export Co. was in charge of the procurement of equipment and materials. Other than that, the sub-organizations of the Ministry of Railways were in charge of each of the various aspects, as shown in Table 2.2.
Moreover, international competitive bidding was performed only for equipment and materials by the China National Technical Import and Export Co. (however, for contract sums of less than ¥100 million, direct contractings were also allowed.)

From the beginning, there were no plans to hire consultants.

(4) Evaluation of implementation scheme

With regard to the implementation scheme, the central government (Ministry of Communications, Ministry of Railways) entrusted management to regional organizations (Lianyungang Port Authorities, each of Railway Bureaus), and the actual execution of the project was carried out by companies under the jurisdiction of the respective ministries. Apart from that, the procurement of equipment and materials was performed by China National Technical Import and Export Co. Basically, consultants were not hired and the project's construction management was performed using Chinese technology.

With regard to the project implementation contents, although there was room for improvement for part of the Lianyungang Port Expansion Project, as described below, this kind of implementation scheme was extremely common in the case of ODA loans to China, and it is evaluated as having functioned to achieve the desired results. However, with regard to the lumber berths of the Lianyungang Port Expansion Project, the projected lumber imports were marked by a series of lumber export prohibitions in lumber-exporting countries due to environmental protection considerations, and currently these berths are not used as lumber berths. Regarding this point, had the plans been revised while the berths were being constructed, they could probably have been converted to berths of a different type.

Such revision of plans is considered to be necessary when performing public work projects, and this remark is not limited to China. In the case of this project, regardless of whether such plan revision under the Chinese system then in place and the required procedures would have been possible, it is thought that plan revisions would have been possible by hiring external consultants and receiving advice during construction. On the part of the OECF, it is thought to be necessary to pay care in order to have a flexible implementation scheme that allows plan modifications as soon as changes occur in the surrounding environment during the implementation of projects, both for future ODA-loan projects and for ODA-loan projects currently under implementation.

The Baoji-Zhongwei Railway Construction Project required the expropriation of land. According to the Ministry of Railways, during execution of the project, although some complained about unfairness, almost all residents accepted the land expropriations smoothly, and currently there are no problems related to the land expropriations, which ended in December 1992. The land expropriation details are shown below.

【Table 2.3　Status of Land Expropriations in the Baoji-Zhongwei Railway Construction Project 】

Item	Plan	Implementation
Land area (For purchasing leased land)	3,719,232m^2 (2,831,202 m^2 888,030 m^2)	Same as left
Number of expropriated houses	37,568	Same as left
Number of people applied	About 9,000 people	Same as left

Source: Ministry of Railways of P.R.C.

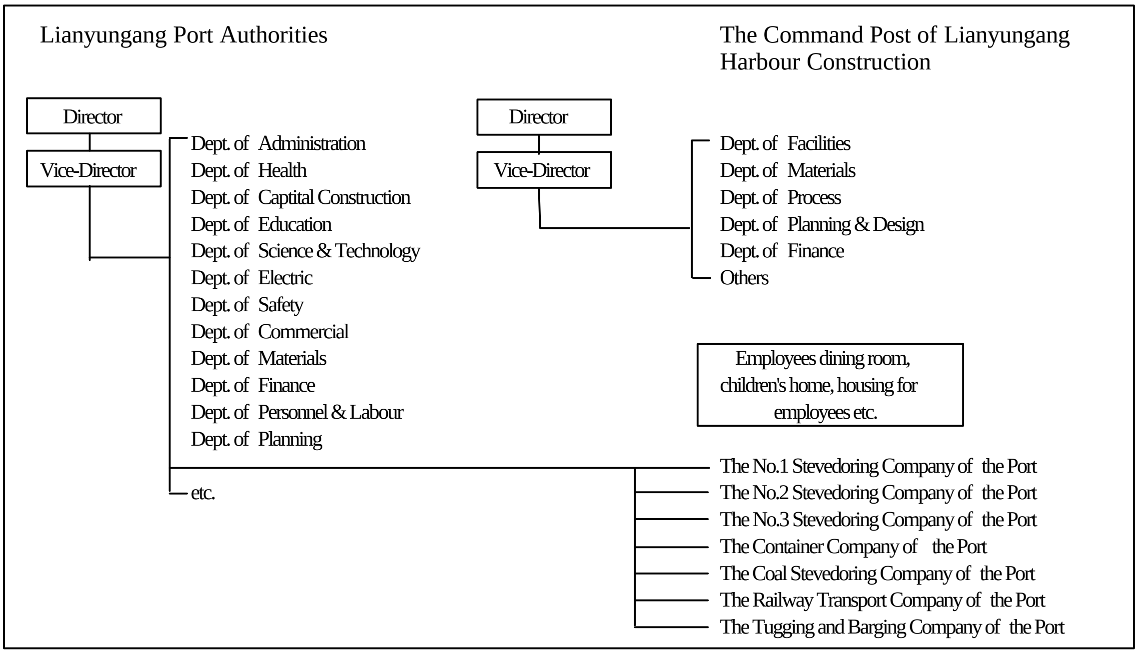
2.2 Evaluation of Operations and Maintenance

2.2.1 Operations and maintenance scheme

The operations and maintenance scheme of each project is detailed below.

(1) Lianyungang Port Expansion Project (Lianyungang Port Authorities and each of the Companies)

The operations and maintenance of port facilities including railway, tag boats, and buoy at the Lianyungang Port are performed by the seven companies under the Lianyungang Port Authorities as shown in Figure 2.7.



【Figure 2.7 Organization Chart of Lianyungang Port Authorities】

Among these companies, the No. 1 Stevedoring Company of the Port is in charge of operations and maintenance for the First Jetty and Second Jetty located in the old port, while the No. 2 Stevedoring Company of the Port is in charge of the Third Jetty also located in the old port as well as the coal berth. The operations and maintenance of the lumber berths and cereal berth, which form the subject of the present survey[4], are the responsibility of the No. 3 Stevedoring Company of the Port, while the operations and maintenance of the container berth and the multi-purpose berth are the responsibility of the Container Company of the Port.

[4] There are four berths for 25,000 DWT class freight and two berths for 5,000 DWT class freight at the First and Second Jetties which are in charge of operations and maintenance by No. 1 Stevedoring Company of the Lianyungang Port.
One berth for 30,000 DWT class freight, three berths for 20,000 DWT class freight, two berths for 10,000 DWT class freight and one berth for 5,000 DWT class freight at the Third Jetty which are in charge of operations and maintenance by No. 2 Stevedoring Company of the Port. Coal berth is for 10,000 DWT class bulk freight.

(2) Zhengzhou-Baoji Railway Electrification Project, Baoji-Zhongwei Railway Construction Project (railway sub-bureau)

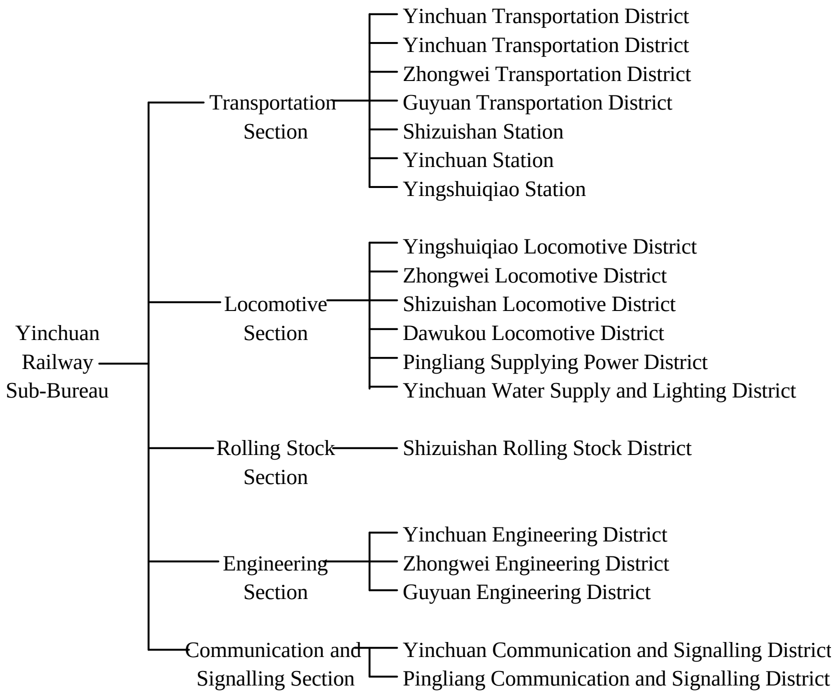
The Ministry of Railways comprises 12 railway bureaus (corresponding to Japan's branches) that manage railway operations, and below them are 2 to 10 railway sub-bureaus depending on the size of each bureau, which function as railway operations offices.

Operations and maintenance of the Baoji-Zhongwei Railway are performed by the Lanzhou Railway Bureau's Yinchuan Railway Sub-bureau and Zhengzhou Railway Bureau’s Xian Sub-bureau, and the operations and maintenance of the Zhengzhou-Baoji Railway are performed by the Zhengzhou Railway Bureau's Zhengzhou, Luoyang, Xian Sub-bureau.

The organizational structure of railway sub-bureaus is described below, using the example of the Baoji-Zhongwei Railway, Yinchuau Sub-bureau. (The organization of other railway sub-bureaus, though the place names differ, is basically the same.) The Yinchuan Railway Sub-bureau has 18,000 railway employees, and is in charge of 853 km of railway tracks. Figure 2.8 shows the sub-bureau's organization chart.

The administrative departments of the Yinchuan Railway Sub-bureau consist of the Transportation Section (corresponding to Japan’s department), which is in charge of passenger and freight operations, the Locomotive Section, which is in charge of operations and power, the Rolling Stock Section, which is in charge of the rolling stock, the Engineering Section, which is in charge of railway tracks, and the Communication and Signalling Section, which is in charge of signal transmission. Each section has as its operating organs the following: The Transportation Section has a station (passenger stations, freight stations, and switching yards), Transportation District (small station control and management), and Transportation District (conductor space), the Administrative Section (Locomotive District) has Rolling Stock District (machinery space), Supplying Power District (power space), Water Supply and Lighting District (water supply and general lighting maintenance), and the Rolling Stock Section (Rolling Stock District) has a Transportation District (passenger car space, freight car space), the Engineering Section (Engineering Section) has Engineering District (track maintenance space), and the Communication and Signalling Section has Communication and Signalling District (signal transmission space).

The reason why the Locomotive District includes Supplying Power District is thought to be a remainder of the fuel supply system that existed when steam locomotives used to run. In Japan, the Supplying Power District would be in charge of electric power, and be located together with the Communication and Signalling District in the Communication and Signalling Section.



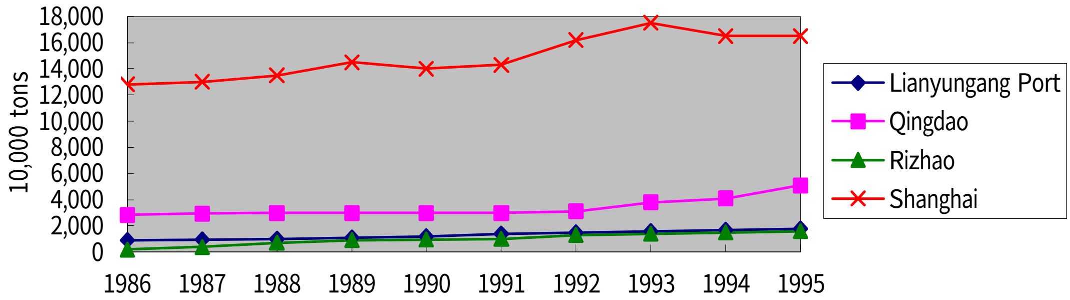
【Figure 2.8 Organization Chart of Yinchuan Railway Sub-Bureau】

2.2.2 Operational performance and operations and maintenance

(1) Lianyungang Port Expansion Project

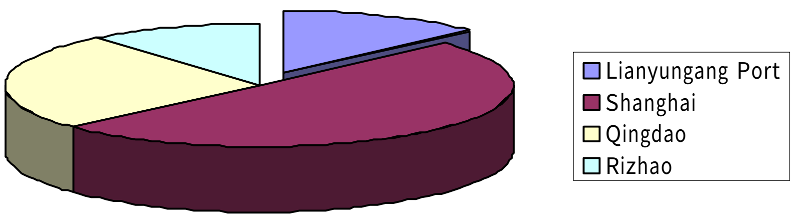
① Freight handling trends

Figure 2.9 shows the freight handling volume at the major ports of China that are all close together, including the Lianyungang Port, Shanghai, and Qingdao, etc., from 1986 to 1995. The total freight handling volume of the Lianyungang Port up to 1995 was approximately 1/10 that of Shanghai, and that of Qingdao approximately 1/3, but if one looks only at freight handling volume related to foreign trade, the Lianyungang Port handled approximately 1/4 of Shanghai, and handled about 1/2 of Qingdao (Figure 2.10).



Source: China Communications Yearbook and Statistics Yearbook

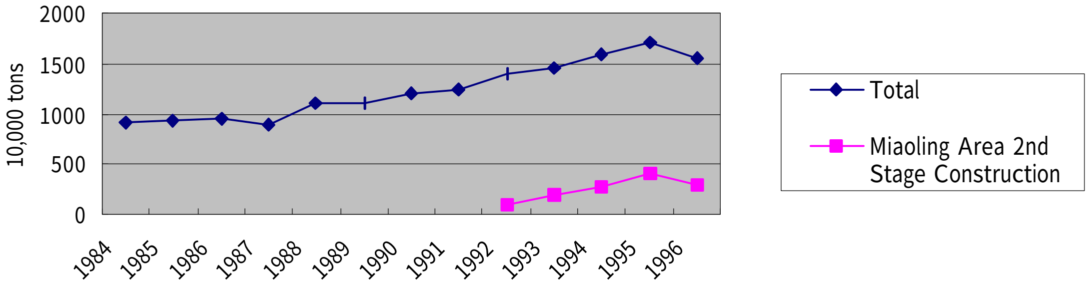
【Figure 2.9 Trends in Freight Handling Volume of Lianyungang Port and Near By Ports】



Source: China Communications Yearbook

【Figure 2.10 Percentage of Freight Handling Volume of Lianyungang Port and Near-By Ports In Terms of Foreign Trade (1995) 】

Next, the changes in the freight handling volume of the Lianyungang Port, including the Miaoling Area 2nd Stage Implementation Schedule (1984 to 1993), is shown in Figure 2.11. According to this data, the handled freight of the No. 31 berth to the No. 36 berth completed through the Miaoling Area 2nd Stage Construction accounted for about 20% of the total freight handled in 1995 and 1996, and thus had this construction not been done, the Chinese coastal freight handling would have been impeded according to our estimations. The future freight handling volume will, per the planning of the central government, reach 28 million tons in the year 2000, and then 35 million tons, 41 million tons, and 54 million tons are predicated for the year 2005, 2010, and 2020, respectively, but the Lianyungang Port Authorities reckon that 22 million tons will be reached by the year 2000, and the modification of the overall plan was requested of the Chinese Central Government.



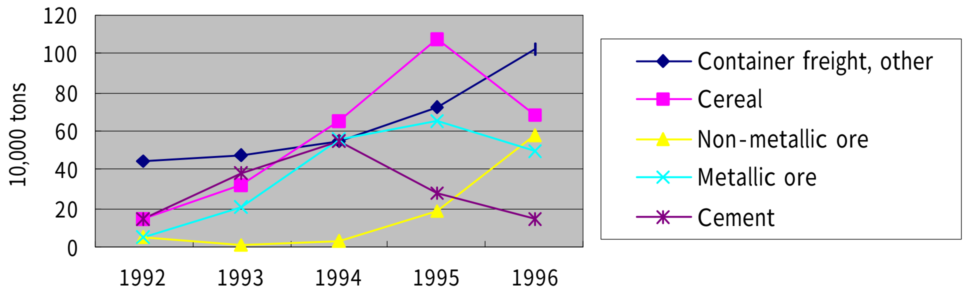
Source: China Communications Yearbook, Statistics Yearbook and materials from Ministry of Communications

【Figure 2.11 Changes in the Freight Handling Volume of the Lianyungang Port】

② Operational status of each berth

(i) All berths

The five freight categories handled in the greatest volume by the No. 31 berth to the No. 36 berth for 5 years from 1992 to 1996, completed through the Miaoling Area 2nd Stage Construction, are



shown in Figure 2.12.

Source: China Communications Yearbook, Statistics Yearbook

【Figure 2.12 Changes in the Freight Handling Volume of Five Top Items】

The freight category handled in the greatest volume by all the berth was container freight etc., followed by cereals, non-metallic ore, metallic ore, and cement. All together, these five freight categories accounted for about 91% of the total freight volume handled. Figure 2.8 shows that among these leading freight categories, in recent years, the freight handling volume of cement has been decreasing, and that the freight handling volume of non-metallic ore has been increasing.

Table 2.4 shows the size of the ships that have been using, from 1992, the No. 31 berth to the No. 36 berth. In 1993, the No. 31 berth (container berth) had container ships with a length of 255 meters moor at it, while the No. 31 berth and No. 32 berth (multi-purpose berths) had ships whose length did not reach 200 meters moor. These figures seem to suggest that these berths are used by first-generation and by second-generation container ships.

The No. 33 berth (cereal berth), in the five year period from 1992 to 1996, was used by vessels measuring between 60 meters and 225 meters. The No. 35 berth and the No. 36 berth (both lumber berths) were used by vessels measuring between 60 meters to 254 meters, but by using the No. 35 berth and the No. 36 berth linked together, it is thought that two large and small ships can use them at the same time with no problem.

【Table 2.4　Actual Result for Size of Ships Using Lianyungang Port (1992 ~ 1996) 】

(Unit: m)

	Allowable length (design)	Minimum length (actual)	Maximum length (actual)
Container berth (No.31 berth)	230	40	255
Multi-purpose berth (No.32 berth)	230	45	199
Cereal berth (No.33 berth)	280	60	225
Front berth (No.34 berth)	230	60	199.5
Lumber berth (No.35 berth)	225	60	254
Lumber berth (No.36 berth)	225	60	254

Source : Lianyungang Port Authorities

(ii) Container terminal (No. 31 berth) and multi-purpose terminal (No. 32 berth)

The trend in the freight volume handled by the container berth and the multi-purpose berth over the past five-year period is shown in Table 2.5 and in Table 2.6, respectively. The data in Table 2.5 indicates that container freight and other freight rose from 130,000 tons in 1992 to 830,000 tons in 1996, a marked increase over five years. Among this container freight and other freight, the share of container freight rose from 69% in 1992 to 85% in 1996, and the growth in the freight volume handled by the container berth is due in large part to the growth in the volume of container freight.

【Table 2.5　Changes of Freight Handling Volume in Container Berth】

(Unit: 10,000 tons)

	1992	1993	1994	1995	1996
Container, others	13	20	46	62	83
Non metallic ore	0	0	0	6	12
Agricultural products	0	0	0	1	1
Chemical fertilizer	3	0	0	0	0
Machine	0	0	0	1	0
Steel materials	0	6	0	6	0
Chemical industrial products	0	0	1	1	0
Lumber	0	0	0	0	0
Cereal	1	0	0	0	0
Light industry products and pharmaceuticals	0	0	0	0	0
Nonferrous metals	0	0	0	1	0
Cement	0	7	4	2	0
Metallic ore	1	0	0	0	0
Annual Total	19	34	52	80	97

【Table 2.6　Changes of Freight Handling Volume in Multi-purpose Berth】

(Unit: 10,000 tons)

	1992	1993	1994	1995	1996
Container freight, others	4	8	5	6	8
Cement	3	15	36	18	5
Non metallic ore	0	0	0	0	5
Agricultural products	1	1	1	2	3
Steel materials	0	7	1	4	2
Chemical industrial products	0	1	2	3	1
Chemical fertilizer	3	0	1	1	1
Light industry products and pharmaceuticals	0	0	0	0	1
Cereals	0	2	2	3	0
Construction materials	0	0	0	0	0
Machine	0	0	0	0	0
Oil	0	0	0	2	0
Lumber	0	0	0	0	0
Nonferrous metals	0	0	0	0	0
Coal	0	0	0	0	0
Annual Total	12	36	48	40	25

Source : Lianyungang Port Authorities

On the other hand, as can be seen in Table 2.6, the freight handling volume of the multi-purpose berth, after rising from 120,000 tons in 1992 to 480,000 tons in 1994, declined in 1995 and in 1996, falling to 254,000 tons in 1996. Since this decline is due almost entirely to the decline in cement freight handling volume, this is thought to be due to the decline in the cement import volume, which is greatly influenced by domestic consumption trends.

Container freight handled by the container berth and the multi-purpose berth, on TEU base, grew from 15,534 TEU in 1992 to 89,558 TEU in 1996, and this rising trend is predicted to continue in the future. The berth extension of the multi-purpose berth and the container berth is 230 meters, but by using both continuously, it would be possible to increase the handled freight volume from 150,000 TEU during a normal year to approximately 200,000 TEU. Therefore, vis-a-vis the increase in container freight, switching to a container base using multi-purpose berth with a 230 meter extension, and realizing a container terminal with an extension of 460 meters is thought to be necessary. Furthermore, during the latest field survey, containers in the yard were piled four layers high instead of 3 layer high as before, which seems to indicate that carrying out containers is not being performed efficiently. Achieving higher efficiency yard arrangement and terminal management by adapting the multi-purpose berth to a container base, is thought to be necessary.

(iii) Cereal berth (No. 33 berth)

The changes in the freight handled by the cereal berth is shown in Table 2.7. As a matter of course, more than 98% of the freight volume handled by this berth (in 1996) consists of cereals. Cereal freight handling, which began in 1993, has grown from over 220,000 tons in that year to approximately 970,000 tons in 1995. The following year, in 1996, the cereal freight handling volume fell to a little more than 650,000 tons, due to the fact that China had bumper cereal crops that year.

【Table 2.7　Changes of Freight Handling Volume in Cereal Berth】

(Unit: 10,000 tons)

	1993	1994	1995	1996
Cereal	22	50	97	66
Non metallic ore	0	0	0	0
Agricultural products	0	0	1	0
Cement	1	1	0	0
Others	1	1	0	0
Machine	0	0	0	0
Steel materials	0	0	0	0
Annual Total	25	52	99	67

Source : Lianyungang Port Authorities

The cereal freight handling system employs two loader/unloader units (which can be used for both loading and unloading simply by changing the extremity attachments), one carry-in belt conveyor, and one carry-out belt conveyor, as well as cereal silos, etc. The cereal freight handling system, which is automated, is smoothly operated by the No.3 Stevedoring Company of the Port.

The unloader is a power-efficient continuous type equipment that generates little noise and suffers few failures.

The reason for using dual-purpose cereal freight handling machines is based on consideration of the fact that China both imports wheat and exports corn.
Since China is currently a food importer, the handling equipment is exclusively used for its unloading function to process wheat imports.[5]

[5] This was also the first time for Japanese manufacturers to fabricate and install dual-function cargo handling equipment. In order to ensure smooth installation of the units, Japanese engineers stayed at the Lianyuangang Port to perform the installation work.

(iv) Front berth (No. 34 berth)

The changes in the freight handled by the front berth are shown in Table 2.8. Until the cereal berth started fully operating in 1993, cereal freight represented approximately one third of the total freight handling volume.

Moreover, until 1994, the front berth handled a large volume of cement, but in 1995 and in 1996, the handled volume of cement fell sharply. The total freight volume handled by the front berth fell from less than 130,000 tons in 1992 to a little over 40,000 tons in 1996, which means that it handles only about 7% of the freight volume handled by the adjacent lumber berth (No. 35 berth). Since the lumber berth and the front berth share the same yard (in the back), in order to raise the freight handling percentage of the lumber berth inevitably requires reducing the freight handling volume of the front berth.

【Table 2.8 Changes of Freight Handling Volume in Front Berth 】

(Unit: 10,000 tons)

	1992	1993	1994	1995	1996
Others	4	4	2	1	2
Cement	3	2	3	2	1
Non metallic ore	0	0	0	0	0
Chemical industrial products	0	0	1	1	0
Machine	0	1	1	0	0
Cereal	4	4	1	2	0
Oil	0	0	0	0	0
Agricultural products	0	0	0	0	0
Metallic ore	0	0	3	0	0
Nonferrous metals	0	0	0	0	0
Steel materials	0	0	0	0	0
Lumber	0	0	0	0	0
Total	13	12	10	6	4

Source : Lianyungang Port Authorities

(v) Lumber berths (No. 35 berth and No. 36 berth)

The changes in the freight handling volume of the lumber berths (No. 35 berth and No. 36 berth) are shown in Table 2.9. As the No. 35 berth and the No. 36 berth actually function as a single berth, the figures listed in the table are the combined figures of the two berths. According to the data listed in Table 2.9, the annual freight handling volume doubled from about 660,000 tons in 1992 to about 1,290,000 tons in 1996. However, the lumber handling volume was 33,000 tons in 1993, short of 4,000 tons in 1994, and zero in both 1995 and 1996. Instead, the handling volume of metallic ore, non-metallic ore, and coal rose, and the combined handling volume for these three freight handling categories exceeded 1,030,000 tons in 1996, representing about 80% of the total freight handling volume, which was just under 1,290,000.

Thus, the lumber berths are actually functioning as bulk berths at present.

【Table 2.9　Changes of Freight Handling Volume in Lumber Berth】

(Unit: 10,000 tons)

	1992	1993	1994	1995	1996
Metallic ore	4	22	52	67	51
Non metallic ore	5	0	3	13	40
Coal	0	0	2	19	12
Others	23	14	3	3	10
Cement	7	11	12	6	7
Steel materials	6	22	12	9	3
Chemical fertilizer	12	1	1	2	1
Machine	0	0	3	1	1
Chemical industrial products	0	4	10	2	1
Cereal	10	5	12	7	1
Agricultural products	0	0	0	1	1
Light industry products and pharmaceuticals	0	1	0	1	0
Nonferrous metals	0	0	2	0	0
Lumber	0	3	0	0	0
Total	66	84	114	129	129

Source : Lianyungang Port Authorities

The cargo handling equipment that was procured was done so based on the assumption that it would be used to handle lumber (log loaders, etc.), but by changing the attachments of log loaders, this equipment can be used for handling bulk freight such as metallic ore.

(vi) West Large Levee

The West Large Levee does not only function as a breakwater for the Lianyungang Port, but also as a passageway to the Liandao as previously explained, and further, as a lifeline including a water line, power cables, and telephone cables for the inhabitants of the Riandao. Moreover, the future expansions plan for the Lianyungang Port envisions the construction of large-scale port facilities on the inside of the West Large Levee.

(vii) Channels

According to a hydrographic chart based on measurements done in 1994, the channels are dredged to a depth of minus 9 meters. The hydrographic chart contains a caution to the effect that "Channels are dredged every year, but since the water depth inside the port changes frequently, cautious navigation is required." Based on this fact, silting of the port area is thought to be considerable.

(2) Zhengzhou-Baoji Railway Electrification Project, Baoji-Zhongwei Railway Construction Project

① Railway operations status

(i) Freight cars

Freight cars are divided into three types: A-type (connected and disconnected at major switching yards), B-type (connected and disconnected at major freight stations), and C-type (connected and disconnected at each station). In the case of the Longhai Railway, 80% of all are of the A-type and 20% are of the B-type, while only two trains are of the C-type. The down line (Baoji-bound) has six trains (320 cars) consisting of gondola cars (box type cars with no roof) for transporting coal that are dead-head cars. Although it seems in the case of oil transportation, only the locomotives are replaced at switching yards due to the fact that oil cars are special types of cars, in the case of coal transport, if there is sufficient traction power, other types of cars are also connected.

The operation of freight cars is the responsibility of the Transport Department, Ministry of Railways.

The number of cars per train is between 40 to 50 cars on the Baoji-Zhongwei Railway and 50 to 60 cars on the Longhai Railway, and these numbers are believed to be the maximum number of cars that can be drawn over the effective length of track.

A look at the train operation speed on the Zhengzhou-Baoji Railway shows that in the case of passenger cars (limited express), the speed, at 68.5 km/h, is about 10% lower than eight years before. On the other hand, in the case of freight cars, we could not obtain railway timetables, and thus we calculated the speed based on the time required to travel the same railway section minus the time spent stopped at intermediate stations.

First, the travel time in the same railway section is between 17 hours and 18 hours, thus we used the average figure of 17.5 hours. Next, concerning the stopping time at intermediate stations, the disconnection and connection time at the Longhai Railway's Xinfeng Zhen Yard is 100 minutes, and in the case of the Baoji-Zhongwei Railway, based on the figures of a stopping time between 40 minutes and 90 minutes per major station, and 10 minutes to 20 minutes at other smaller stations, the total stopping time of freight trains was calculated to be 340 minutes, as shown below.

100 (Xinfeng Zhen) + 65 × 3 (major stations - Luoyang, Yima, and Xianyang) + 15 × 3 (other intermediate stations - Sanmen Xia West, Hua Shan, and Xian) = 340 minutes

The travel time of freight trains in the same section thus obtained (710 minutes) was then used to calculate the average travel speed, which turned out to be 57.3 km/h, unchanged from eight years earlier.

【Table 2.10 Operation Time of Trains (Zhengzhou-Baoji / 684km) 】

Category	Type	FY	Operating time (Minutes)	Stopping time (Minutes)	Arriving time (Minutes)	Average speed (km/h)	Standard speed (km/h)
Passenger car	Special train (Limited super express)	1989	528	-	-	77.1	-
	Special train (Limited super express)	1997	594	33 (5 stations)	627	68.5	64.1
Freight car	B-type train	1989	708	-	-	57.5	-
	B-type train	1997	710	340 (7 stations)	1,050	57.3	38.8

Source: materials of Ministry of Railways and calculated from oral search
Note: 1989 is the following year of electrification.

The fall in the average travel speed of passenger trains is that the distance between trains has diminished as the number of freight trains has been increased, resulting in narrower time spans available for the operation of passenger trains.

② Status of railway use

(i) Freight trains

First, we decided to examine the freight train use status by comparing the number of freight trains, and the traffic volume with the transport capacity. As we could not obtain a railway timetable, our figures for the number of trains depended on information from the Chinese Ministry of Railways. Table 2.11 shows the number of trains available for operation and actual numbers obtained from the operation time, and Table 2.12 shows the carrying capacity and traffic volume based on the number of trains available for operation.

【Table 2.11 Comparison of Number of Trains Available for Operation and Actual Number of Trains (One Way, One Day) 】

Baoji-Zhongwei Railway				Zhengzhou-Baoji Railway (part of Longhai Line)			
Maximum number of trains for operation	Actual (1997)			Maximum number of trains for operation	Actual (1997)		
	Total	Freight	Passenger		Total	Freight	Passenger
35	18	16	2	120	106	76	30

Source: Obtained orally from Ministry of Railways of P.R.C.
Note : Figures for the Zhengzhou-Baoji Railway are for the Xian direction of Zhengzhou.

【Table 2.12 Comparison of Traffic Volume (One way) with Designed Transport Capacity of Freight】

(Unit: 10,000 tons)

Line	Route	Item	1988	1996	2000
Baoji-Zhongwei Railway	Baoji-Zhongwei Xian bound	Designed transport capacity	-	1,800	1,800
		Projected traffic volume	-	(750)	1,100
		Actual traffic volume	-	800	-
Zhengzhou-Baoji Railway (Zhengzhou-Baoji)	Longhai Line	Designed transport capacity	4,000	Unknown	5,000
		Projected traffic volume	-	(4,000)	6,200
	Zhengzhou bound	Actual traffic volume	4,100	(4,800) 5,500	-

Source:Ministry of Railways
Note 1: Transport capacity of Baoji-Zhongwei Railway for target year is unknown.
Note 2: Figures between parentheses for Baoji-Zhongwei Railway are for 1995.
Note 3: Figures between parentheses for Zhengzhou-Baoji Railway figures are for 1994.
Note 4: Zhengzhou-Baoji Railway was not electrified in 1988, and traffic volume was for Zhengzhou environs.

Zhengzhou-Baoji Railway

The maximum number of trains that could be operated on the Zhengzhou-Baoji Railway was a total of 120 trains, while 106 trains were actually in operation in 1997, which is a number close to the limit. Until 1988, the Zhengzhou-Baoji Railway was not electrified, and until then the transport capacity and the actual freight volume were the same, but later, the Zhengzhou-Baoji Railway was electrified, and in 1994 the projected freight volume exceeded the actual freight volume for that year. The projections for the year 2000 put the predicted freight volume well above the carrying capacity.

Baoji-Zhongwei Railway

The maximum number of trains that could be operated on the Baoji-Zhongwei Railway was a total of 35 trains combining both passenger and freight trains, while only 18 trains, mostly freight trains, were actually in operation, which represents a usage rate of about one half. The traffic volume projections for freight in 1996 and actual figures match almost exactly, and the actual freight traffic volume was one half (8 million t/18 million t) of the total carrying capacity.

Baoji-bound freight trains on the Baoji-Zhongwei Railway are mainly special oil transport trains from the Wulumuqi direction, a region that has been developed as China's second oil producing region in Western China (Wulumuqi), and coal carriers from the Yinchuan direction, while in the Zhongwei direction, construction materials and foodstuffs are mostly presumed to be sent bound for Western China.

Currently, the traffic volume is only about one half that of the total carrying capacity, but the railway is positioned as a development railway for Western China, and as mentioned in section 2.3.3 Project Effects and Impacts, there is a project of a large-scale coal-fired thermal power generation plant at Ankou, and coal shipment volume is predicted to grow.

(ii) Passenger trains

This section describes the passenger riding rate for the Baoji-Zhongwei Railway.

Since freight transport is a higher priority than passenger transport on the Baoji-Zhongwei Railway, the number of operating passenger trains is only about one third to one fourth the number of freight trains. The trains in operation on the Baoji-Zhongwei Railway consist of 18 limited express cars (1 freight car, 1 postal car, 7 second-class cars, 1 diner, 1 first class sleeper, and 7 second class sleepers (including one sleeper for railway employees)). While the nominal riding capacity is 1,218 passengers, the actual rate is 110% of that figure, and the figure for second class sleepers is 120%. However, according to the Ministry of Railways, the passenger riding rate is normally 80%. Since passenger transport demand is high on the Baoji-Zhongwei Railway, the use of extra trains is being considered.

③ Operations and maintenance

The operations and maintenance of the railway projects is described taking as examples the Zhengzhou-Baoji Railway's Xinfeng Zhen Yard and the Baoji-Zhongwei Railway's Guyuan Engineering District and Pingling Supplying Power District. While other railway sub-bureaus all differ in scale, their function is basically the same.

(i) Zhengzhou-Baoji Railway-Xinfeng Zhen Yard

The Xinfeng Zhen Yard, which is under the control of the Zhengzhou Railway Bureau, is responsible for the connection and disconnection of the direct trains to Zhengzhou-Baoji Railway and Baoji-Zhongwei Railway and the C-type trains and the coal trains from Xian to Houma on the Yan'an Railway.

The actual number of cars handled per day in 1996 by the Xinfeng Zhen Yard was 4,000 cars taken apart and reassembled, 60 trains, and the switching yard's handling capacity being 4,600 cars, this means that the yard was operating close to full capacity. A handling volume of some 9,900 cars is projected for the year 2000, but this will require that the handling capacity of the switching yard be expanded. One hundred workers are required for the inspection and connection/disconnection of cars, and another 100 workers are required for handling signals.

The waiting time on the arrival track for one train is one hour, the disconnection and connection time on the sorting line 30 minutes, and the waiting time on the departure track 10 minutes, thus a total waiting time of 100 minutes.

(ii) Zhengzhou-Baoji Railway--Xinfeng Zhen Locomotive District

The Xinfeng Zhen Locomotive District is responsible for the inspection and repair of 47 D/L (Diesel locomotives: East Wind 4 type) and 2 replacement D/L (East Wind 7 type) in the Yan'an and Houma directions. It will also be responsible in the future for E/L (electric locomotives: Zhaoshan 1 type) on the Longhai Railway. The required number of personnel is 1,100 workers (650 locomotive technicians, 150 repair technicians, and 300 fuel supply workers). Locomotive District also has 460 workers in addition to the above (including workers such as cement workers who are not related to railway operations), but their position within the direct chain of command is not clear.

The maintenance and repair cycles are shown in Table 2.13. Major inspections for D/L are not performed at this locomotive district, and are the responsibility of the Locomotive District in the Yan'an direction (corresponds to Japanese plant).

【Table 2.13 Maintenance Cycles by Locomotive Type】

(Unit: km)

Type	Major inspection	Medium inspection	Periodical inspection	Daily inspection
E/L	1.6 ~ 2.0 million	0.4 ~ 0.5 million	0.08 ~ 0.1 million	Daily check
D/L	0.8 ~ 0.9 million	0.2 ~ 0.25 million	0.025 million	Daily check

Source: Materials of Ministry of Railways

(iii) Zhengzhou-Baoji Railway--Xinfeng Zhen Rolling Stock District (for Cargo Car)

The Xinfeng Zhen Rolling Stock District has responsible for inspection and repairs of cars entering the Xinfeng Zhen switching yard. The number of employees is 57. There is a two shift system that can handle 24 cars a day.

The repair method employed is major repair (every year) and repair (every six months), with the chassis and the platform separated and repaired, but axle inspection (every three months) and visual inspection are performed.

Since cars are registered to the Railway Department, Ministry of Railways, repairs (third major repair) are performed at the Rolling Stock Bureau, Ministry of Railways.

(iv) Zhengzhou-Baoji Railway—Rolling Stock District (for Passenger Car)

Passenger cars are registered to each Rolling Stock District.

The repair methods employed for passenger cars consist of major repair (every 1.5 to 2 years), repair (every six months), and repair (every third major repair), and they are performed at the Rolling Stock Bureau, Ministry of Railways.

(v) Baoji-Zhongwei Railway--Guyuan Engineering District

The Guyuan Engineering District is responsible for the Baoji-Zhongwei Railway's Zhongwei-Ankou section, which measures 356 km. The railway territory under its supervision is estimated to measure about 300 km (about double if double tracks are counted).

The number of employees is 1,000, and their responsibilities include inspection and repair of tracks, inspection and repairs of civil engineering structures, and inspection and repairs of buildings. In order to repair tracks, few areas are located.

Daily track inspections are inspections during travel, done visually and with measuring cars; maintenance is performed both by track maintenance cars (multiple tie tamper) and by using manual tie tampers. The replacement of track materials is done all at once every two years, and large machines are employed for this work.

Almost all repair work is performed by railway workers (employees of the railway sub-bureau Engineering District) (most repair work is performed by outside contractors employed in the case of Japan). However, external workers are hired to perform work that is purely manual and does not use manual tie tampers (temporary workers hired mainly among farmers).

(vi) Baoji-Zhongwei Railway--Pingliang Supplying Power District

The Pingling Supplying Power District is in charge of monitoring supplies and the maintenance and repairs for the Baoji-Zhongwei Railway power (locomotives, signals) and for the train line (power lines supplying power current for electric locomotives), and the total track distance under its charge is 356 km, while the number of workers is about 1,000 persons.

Daily inspections are performed using train inspection cars, and repairs are done throughout the year on a as-needed basis for topical wear. The change of wide range train line is performed synchronously.

(vii) Zhengzhou-Baoji Railway--Xian Communication and Signalling District

The entire status of signal transmission monitoring console of the Xian Railway Bureau is located in Xian. For the purpose of maintenance and repairs, stations with personnel, equipment, and lumber are available.

④ Environmental measures for railways

(i) Environmental preservation system

A Sanitation and Environment Bureau has been established in the Railway Department, and environmental control specialists placed in the railway bureaus, sub-bureaus, and stations. An environment measurement section has been established at each railway sub-bureau, and periodic and occasional measurements are performed (noise, vibration, air pollution, etc.). Each is linked with regional administrative organs, and environmental preservation measures are promoted.

(ii) Environmental impact evaluation

(ii)-1 During construction

With regard to the Baoji-Zhongwei Railway track selection, consideration was paid to minimizing thrown soil and debris. With regard to the land on which construction was to take place, precious land and farmland was avoided, and if their use could not be prevented, after their use, they were returned to their former state.

(ii)-2 Following completion

In the Zhengzhou-Baoji Railway Electrification Project, the comparison of the state before and after the electrification work was carried out and was reported by the Ministry of Railways. According to this report, the environmental measurement values have been improved (however, since the environmental protection standard values have not been made known, absolute evaluations with regard to the environment are unknown.) Moreover, with regard to the Baoji-Zhongwei Railway Construction Project, impact measures for the environment have been measured by the Ministry of Railways and submitted to the Chinese Environmental Preservation

Bureau, and the result has been approved by the Environmental Preservation Bureau. Therefore, with regard to the Baoji-Zhongwei Railway, basically the impact on the environment is considered to be within allowable range.

Concerning air pollution, boilers meeting the nation's emission standards have been placed rationally (in the apartment of employees, in station buildings, etc.), and in the case of the Longhai Railway, automatic measurement are performed. With regard to water pollution, sewage treatment plants have been established, and following treatment, the water is released into rivers.

The water used to wash oil off locomotives, after the oil has been separated, is mixed with the sewage water of employee facilities and railway hospital sewage to be treated at sewage treatment plants. In the case of the Longhai Railway, the quality of water that has been treated is automatically measured and local employees are posted to take care of this aspect.

With regard to noise and vibration, noise and vibration measures have been put in place. In the case of the Longhai Railway, the impact on the Xian's rampart is reported as being insignificant.

Tree planting and other measures are implemented for the railway administrative facilities and employee housing areas on the Baoji-Zhongwei Railway, in order to embellish the surroundings.

Since the Longhai Railway crosses heavily populated areas around Xian, the impact on televisions and wireless appliances (radio interference) is also measured.

2.2.3 Overall evaluation regarding operations and maintenance

(1) Lianyungang Port Expansion Project

① Container terminal (No. 31 berth) and multi-purpose terminal (No. 32 berth)

At present, double tracks for container transport and single tracks for general mixed cargo have both been laid to the multi-purpose terminal (behind the No. 32 berth). Container overland transport by railway is currently done by railway west of Zhengzhou, but up to Zhengzhou, it is done 60% by railway, and 40% by road. If the share of railway transport for container transport up to Zhengzhou is to be increased, coping for the increased volume is thought to be difficult using only the existing tracks laid to the multi-purpose terminal. Therefore, it is thought that the establishment of a new container terminal inside the port will become necessary. Therefore, in the future, the construction of a railway terminal in coordination with the Mioling's Area 3rd Stage Construction should be considered, and the plan combining a new container terminal, existing container terminals, and the multi-purpose terminal should be reviewed, in order to ensure the efficient transport of containers to the Chinese hinterland.

② Cereal berth (No. 33 berth)

The operations and maintenance of the cereal berth do not have any problems in particular.

③ Front berth (No. 34 berth)

As explained previously, in order to achieve efficient operations for lumber berth (especially the No.35 berth) and for the Lianyungang Port as a whole, it is thought that it will be inevitable to keep the volume handled by the Front berth at a relatively low level. As long as this premise does not change, the operations and maintenance of the front berth will not be affected by any problem in particular.

④ Lumber berths (No. 35 and No. 36 berths)

As mentioned previously, lumber imports have stopped, and thus the lumber berths now handle metallic ore, non-metallic ore, cement, coal, and other bulk freight. Since it is feared that these freight categories generate large amounts of dust, it is necessary to minimize the impact of these dust to the cereal berth that lies right behind the lumber berths. For this purpose, it is thought necessary to prepare standards for water sprinkling and bans on work under strong wind conditions, and to implement operations control based on these standards.

⑤ West Large Levee

The West Large Levee actually divides the port water and the ocean water. Despite the fact that 36 pipe culverts have been set along the 7-km extension of the levee, the current between the port water and the water outside the port takes a long time to circulate. Moreover, due to the fact that the port side from the West Large Levee represents a highly calm water mass, sea mosses farming are growing rampant. In this way, implementing measures in order to preserve the quality of this water mass is extremely important. At the present, water quality has not yet become a problem, but nevertheless the promotion of wastewater conduit facilities by the Lianyuangang Port City is thought to be highly important, as well as the establishment of regulations against the release of polluted waters from port facilities by the Lianyungang Port Bureau , for the sake of preserving the environment inside the port.

⑥ Channels

As mentioned previously, maintenance dredging of existing channels moves approximately 2.6 million m^3 every year, and if the depth of the channels is increased to -12 meters, it is estimated that this volume will have to be increased to approximately 4.3 million m^3 every year. On the other hand, container ships are growing increasingly large, and thus the depth of the port's channels will sooner or later have to be increased.

Therefore, with regard to planning this increase in depth, future demand for container transportation should be calculated, as should the cost of initial and maintenance dredging, and economic and financial analyses should be performed, in order to determine the most appropriate depth of the channel.

(2) Zhengzhou-Baoji Railway, Baoji-Zhongwei Railway Projects

① Structure of Chinese Railway sector

The organization of the Ministry of Railways, including railway sub-bureaus and work organs, is essentially the same as that of the Japan's JR. However, unlike JR in Japan, complementary industries to the railway business (hotels, rolling stock cleaning, general contracting, systems) are directly managed. Moreover, another decisive point of difference with Japan's JR is that under the present system in China, the Ministry of Railways directly manages employee welfare (such as the operation of elementary schools, junior high schools, and cultural facilities). Under the Japanese system, the former is placing an order outside, in other words, being managed by related companies, the latter, of course, being governmental or local government functions.

Taking the Xinfeng Zhen Locomotive District as an example, the Locomotive District organization includes functions that completely differ from railway operations, such as a cement plant (employing approximately 30% of all the employees).

In this way, the fact that operations that have no relation to the business of the organization are run within the organization is not considered to be necessarily desirable from the viewpoint of efficient management.

② Number of employees

Table 2.14 shows the number of employees per kilometer by railway sub-bureau.

【Table 2.14 Number of Employees per Kilometer by Railway Sub-bureau】

Railway Sub-bureau Name	Working kilometers	Number of employees (10,000)		Number of railway employees per km
		Railway operations	Others	
Yinchuan	853	1.8	0.2	21.1
Xian	1,300	5.7	2.3	43.8
JR companies	20,100	16.7	-	8.3 (3.6 ~ 10.8)

Source: Ministry of Railways answers (oral)

Note: Figures in parentheses are 1994 figures for all JR companies, from Annual Railway Statistics Report.

As shown in Table 2.14, the number of employees of Chinese railway sub-bureaus per kilometer was between 20 and 40, or two to four times Japan's JR figures of 10 persons / km. As mentioned previously, this is due to the fact that operations, which are contracted out to different companies (for example, diners, security personnel, rolling stock cleaning, locomotive lubrication) in the case of Japan, are directly managed in China. Furthermore, manual labor is extensively used as mechanization is not enough. The conductors assigned to every car and the workers assigned to simple repairs of the tracks are examples of this situation.

Next, Table 2.15 shows the number of employees per kilometer under the supervision of the Maintenance Division.

【Table 2.15 Productivity of Maintenance Division】

Type	Implementation organ name	Working kilometers	Number of employees	Number of employees per kilometer
Track maintenance	Guyuan track maintenance area	356	1,000	2.8
	JR companies	30,919	18,600	0.6 (0.4 ~ 0.7)
Electrical	Pingliang electricity area	356	1,000	2.8
	JR companies	11,837	9,000	0.8 (0.6 ~ 0.9)

Source: Ministry of Railways answers (oral)

Note: Track maintenance: track kilometers, electrical: train line kilometers.

As can be seen from this data, the number of employees of Chinese implementation organs is 2.8 persons/km, which is remarkably high compared to Japan's JR's 0.7 to 0.9 persons / km. Since the Chinese Railway and Japan's maintenance methods can be thought as being essentially the same, this difference in productivity is due to the insufficient number of equipments and to greater number of workers who operate equipment.

To improve productivity, subcontracting is now done on a limited basis (to farmers, etc.), and mechanization should be further promoted, as should a revision of the labor breakdown. Subcontracting greatly reduces labor costs, while mechanization is also effective in cutting labor costs (related divisions that are separated from the Ministry of Railways are considered for subcontracting).

③ Maintenance investments

The Ministry of Railways does not have the authority to raise fares or decide the number of workers, and therefore, has not been able to secure fare revenues in keeping with the rise in labor cost, materials cost, and fuel costs in recent years. As a result, its business revenues have eroded.

In consequence, the Ministry of Railways has become unable to finance the construction of new railways with its own funds, and it has to execute construction projects decided by the Chinese government with overseas loans.

On the other hand, the investments necessary for maintenance are the charge of local railway sub-bureaus, and due to the worsening of the revenues of railway sub-bureaus, there is a risk that the required investments are difficult to be secured. For example, in the Zhengzhou-Baoji Railway, even when high-priced equipment broke down, it is predicted that it cannot be replaced by the local railway sub-bureau. As a result, the railway transportation as a whole is threatened to fall in a bad state, and it is feared that the future transportation efficiency will decline.

This situation is illustrated by taking as an example the electrical implementation organ.

When new equipment was introduced, the procurement contract included technical guidance by the Japanese manufacturers, and as a result there were no problems, but after the warranty period for the procured equipment expired, the Chinese side, due to insufficient funds, became unable to pay for having the Japanese manufacturer perform on-site maintenance and perform replacements. This is because that as the maintenance expenses following procurement were to be the charge of the local railway sub-bureau, the local railway sub-bureau is unable to raise the required funds.

The Chinese side has limited ability to cope with failures in electrical facilities, and it seems that they have difficulties in continuous using of such facilities. Under the current conditions, it is feared that the equipment's rate of operation will decline.

④ Train operation

As can be seen in Table 2.10, the average speed of freight trains (speed excluding stop time), compared to that in 1989, had not declined in 1997, but the average speed of passenger cars had declined. The reason for this decline in the speed of passenger cars is thought to be that in China, freight trains are given the priority over passenger cars, and furthermore the number of freight trains that are run is also increasing, so that the time band in which passenger cars can be operated are decreasing. In the future, the number of passenger cars will also be increased along with the number of freight cars, and this is predicted to further exacerbate the current situation.

Therefore, raising the operating speed of freight trains is required in order to cope with the increase in the number of trains. For this purpose, the power of locomotives must be increased, and electrification is required in order to permit the use of E/L that have high traction power.
The current handling should be to provide more leeway in the traction power of freight trains.

⑤ Freight trains operation

Of the total of 430,000 freight cars owned by the Ministry of Railways (as of 1995), gondola cars (box type cars with no roof) represented 64%, and transportation of coal is performed with such gondola cars. Therefore considerable time is thought to be required to load and unload the coal from such cars. Gondola cars are used for a variety of purposes, and thus offer high convenience, but for loose materials such as coal that contain powder materials, as cleaning of the gondola cars is required, such cars are thought to be used mostly just for coal. Actually, on the Longhai Railway, gondola cars for coal are also being returned empty. In principle, coal transport should be done using special freight cars (hopper cars, a type of gondola car in which the freight materials are loaded from the top, and released from a port located at the bottom of the car), but in China, such cars are not used except for ballast (gravel placed below the cross ties on tracks). In the future, gondola cars should be replaced with hopper cars, in order to raise the volume of coal transport by shortening the unloading time, and by raising the usage rate of cars.

⑥ Baoji-Zhongwei Railway's future plan

In the future, if the Wuwei-Wulumuqi section is double tracked, the Baoji-Zhongwei Railway also should be double tracked. However, since the Baoji-Zhongwei Railway, which has less steep inclines than the Baoji-Langzhou-Wuwei section, has a heavy traffic of oil and coal, which are heavy materials, simulated double track operation could be achieved by using only as the upward Zhengzhou-bound track, and the Baoji-Zhongwei Railway as the downward Wulumuqi-bound track. In case there is large uncertainty about future trends in demand, this method allows coping with demand with minimal investments.

In this case, the currently existing network of transportation lines that forms a bottleneck could be improved, and the Zhongwei-Wuwei section is thought to be in need of electrification.

2.3 Project effects and impacts

2.3.1 Lianyungang Port Expansion Project

(1) Handling capacity

As shown in Table 2.16, currently, the handling capacity of all the berth of this project (Miaoling Area 2nd Stage Construction) is still lower than the figures planned. The cause for this is the slump in the cereal berth.

【Table 2.16 Comparison of Planned and Actual Handling Capacity】

Berth	Plan		1996 (Actual)	
	Handling items	Handling volume (thousand ton)	Handling items	Handling volume (thousand ton)
Lumber 2 berth	Lumber	1,100	Metal, non metallic ore, coal	1,290
Cereal berth	Cereal	2,000	Cereal	670
Container and multi-purpose berth	Miscellaneous goods 1,000 (including containers)		Container	910[Note 1]
			Miscellaneous goods	
				310
Total		4,100		3,180

Source : Liangugang Port Authorities

For detailed handling figures and items, see in Table 2.4.

Note 1: The container handling volume was tabulated at 90,000 TEU.

(2) Operational performance of each berth

① Container berth, multi-purpose berth

It reached the handling volume of 90,000 TEU in 1996, and in 1997, will reach the handling volume of 110,000 TEU, exceeding the 100,000 TEU capacity of the initial plan. The increase in the volume of container handling volume is thought to be due to the following reasons.

- Economic activity stimulation due to inland development priority policy

  The hinterland behind the Lianyungang Port, includes Henan Province, Shenxi Province, Gansu Province, etc. except for the northern part of Jiangsu Province. It was the main subject of debates to reduce economic disparities between the coastal region and the inland region in China's ninth 5-Year Plan which started in 1996. Based on this policy, the central government, in a mark of considerably strong will, distributed an infrastructure budget and overseas loans to inland regions. As a result, the hinterland region saw an increase in large-scale investments, and this was linked to an increase in the volume of freight transport, particularly containers. This trend is expected to continue in the future.

- Increase in transfer containers

  A point that deserves special mention is the fact that of the containers currently handled, 30,000 TEU/year goes through the Lianyungang Port en route to countries in Central Asia. In this sense, the containers berth of the Lianyungang Port exceed the concept of domestic-oriented, but represent an indispensable element for the Eurasian Land Bridge transport that is currently the focus of attention.

② Lumber berth, cereal berth

Compared to the smooth progress of the Container berth, the actual usage of Lumber and Cereal berth does not reach the plan. The reasons may be explained as below.

- About lumber berth

  Due to the declining strength of the domestic economy and measures prohibiting exports of raw lumber in exporting countries, a sharp drop in the handling volume of lumber was experienced. Original projections can be said to be completely off. The Lianyungang Port Authorities have implemented measures to handle general cargo at lumber berth as a countermeasure for the drop in lumber handling volume, but although the handling volume in tons reached the target amount of 1 million tons, the cargo charge for the lumber substitutes, namely metallic ore and non-metallic ore, is lower, compared to lumber(about 80% of that for lumber), and thus profitability is lower.

- About cereal berth

  The original plan aimed for a total volume of 2 million tons for the cereal berth including silos, consisting of 1 million tons of exports, and 1 million tons of imports.

  Thereafter, China turned into a net importer of foods, and the nation's exports of food have sharply dropped. Furthermore, in 1995 and 1996, China enjoyed bumper crops, which resulted in lowering imports to just 670 thousand tons. Moreover, since the cereal berth cannot be used for other substitute cargo, its handling volume is kept stagnating.

  However, from a long-term point of view, among the hinterlands of the Lianyungang Port, with the exception of Henan Province, all provinces are net importers (receiver) of foodstuffs. The Lianyungang Port plays an important role from the viewpoint of securing stable food supply during bad harvest years.

(3) Economic analysis and financial analysis

Table 2.17 shows the economic internal rate of return (EIRR) and the financial internal rate of return (FIRR) of the F/S survey results, and based on the results of the latest field survey, the recalculated results. The benefits in EIRR include benefit derived from quicker movement of cargo by diminishing demmurage, benefit by shortening time and increased cost that may be resulted if inland transportation continues, etc.

【Table 2.17 EIRR and FIRR Comparison】

Lianyungang Port Expansion Project

	EIRR	FIRR
F/S stage	14%	1%
Revision	7%	Minus

Compared with the figures during the planning stage. EIRR remains within the range of satisfaction, while the FIRR has considerably worsened. The cause for this has been determined to be as follows based on the data collected during the field survey.

① Suppression of port freight handling charges

The revision of freight handling charges of ports in China is done through a system based entirely on petitions to the Chinese government and its authorizations. From 1992, in order to lower the rapidly increasing inflation rate (which exceeded 20% in 1994), the government first took the policy of suppressing the prices of public services. As a result, in the last few years, although labor costs and other fixed expenses are rising every year, port freight handling charges, railway freight charges and other public service charges have been kept at 1992 levels, and in the same way as the management situation of railways, which will be described later, the majority of ports suffer losses.

② Rise in operations cost

According to each stevedoring companies, the rise in freight operations costs is remarkable.

Excluding equipments and energy price increases, the rapid increase in the expense for the labor is a major cause.

(4) Other economic impacts

The implementation of the Lianyungang Port Expansion Project has produced many social and economic benefits (not accounted for in the EIRR calculations).

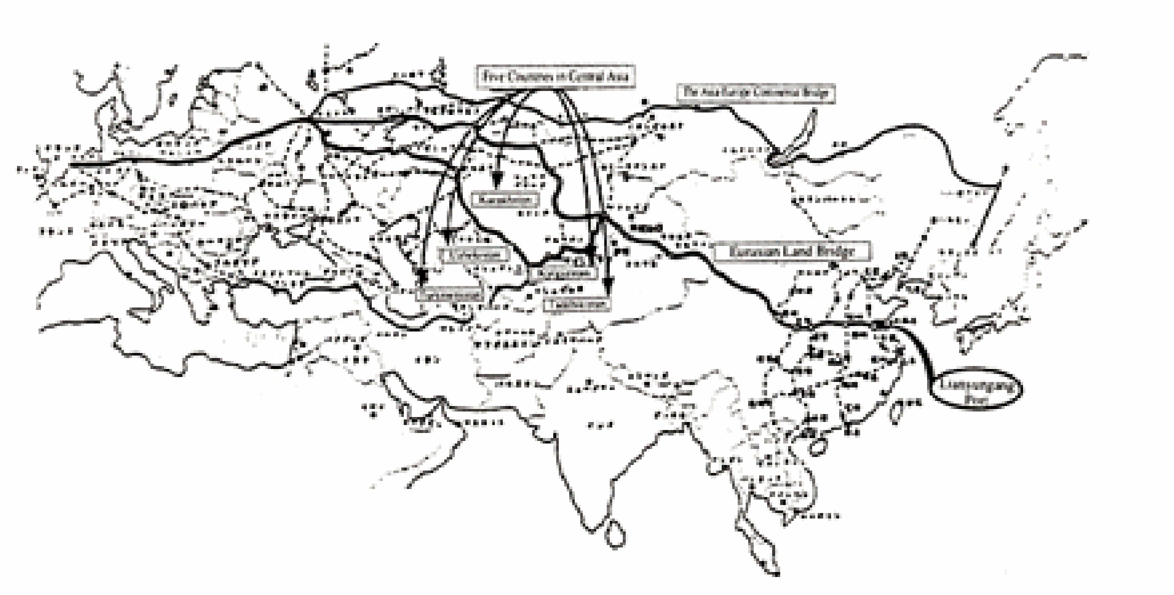
① Lianyungang Port as starting point of New Eurasian Land Bridge

In September 1990, when the Lianyungang Port Expansion Project was underway, the construction of the link connecting the Chinese railway at Alataw Shankou, Xianjiang in China, and the ex-Soviet railway was completed. Through this, the Lianyungang Port became physically connected wit the port of Rotterdam in Holland through the New Eurasian Bridge (distance of 11,000 km). (See Figure 2.13).

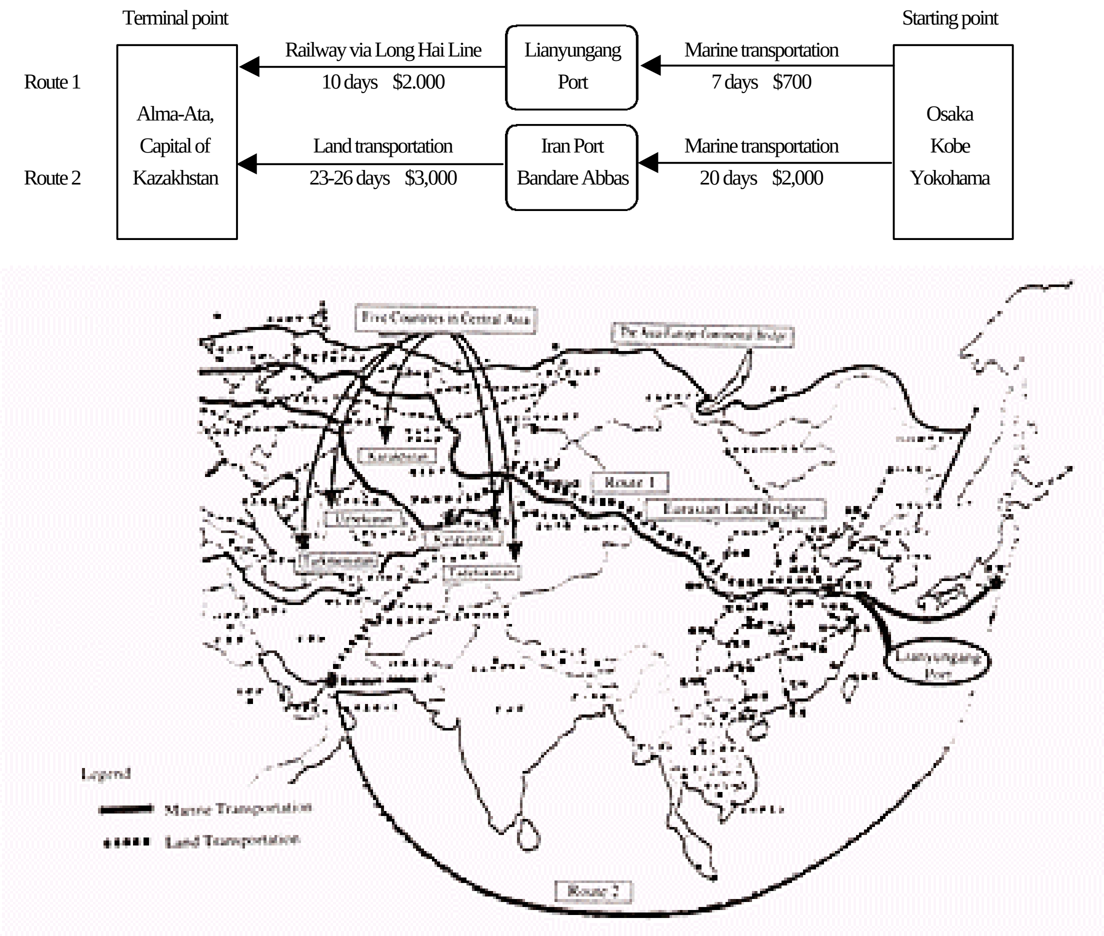
This passageway has drawn the attention of countries around the world, including Japan, and many research and test projects have been implemented in relation to this new land bridge. As a result, various issues related to multinational transportation agreements and transportation technology have emerged. However, although these issues are being addressed, actually transfer containers from the Lianyungang Port to five Central Asian countries are rapidly increasing. In 1996, containers transported from the Lianyungang

Port to Central Asian countries via the Longhai Railway totaled 30,000 TEU. Most of the containers were from Japan, Korea, and Southeast Asia and bound to Central Asia.

With regard to the significance of the New Eurasian Land Bridge with respect to costs, the following data, shown in Figure 2.14, was obtained through interviews with the maritime transport companies of Japan and China.



【Figure 2.13 Eurasian Land Bridge】



【Figure 2.14　Comparison of Japan-Central Asia Transport Route】

However, the PR activity is considered to be important issues for the Lianyungang Port in the future.

Namely, the Lianyungang Port's position is that of a feeder port in relation to mother ports such as Hong Kong and Dalian, and in order to increase the number of transfer containers, actively promoting the fact that it is the starting point of the New Eurasian Land Bridge to the maritime transport companies of Japan, Korea, Southeast Asia, etc., is expected to be effective.

② Liandao development impact

With regard to the breakwater of the Lianyungang Port (West Louge Levee), a totally unforeseen impact has emerged.

This impact is that the living environment of the residents of Liandao has greatly improved and the development of tourism. Currently, tourism development in Liandao is proceeding at a rapid rate, and in addition to beaches and an aquarem, a number of tourism development projects are in progress. For the residents of the Lianyungang Port city, whose sources of entertainment are extremely scarce, Liandao is becoming a precious leisure and entertainment center.

2.3.2 Zhengzhou-Baoji Railway Electrification Project

(1) Utilization status

The main aim of the Zhengzhou-Baoji Railway Electrification Project was to raise the transport capacity of the railway from 24 million tons/year in 1983 to 70 million tons/year by the year 2000.

Table 2.18 summarizes the transportation status of the Zhengzhou-Baoji Railway prior to the project implementation in 1982, immediately after the project in 1992, and in 1996. There figures show that, as of 1996, the Zhengzhou-Luoyang section of the railway, which was its busiest section (119 km) achieved a transport volume of 85 million tons/year, thus exceeding the project's target.

【Table 2.18 Comparison of Zhengzhou-Baoji Railway Transportation Volume 】

Section	Baoji-Xianyang			Xianyang-Xian			Xian-Xinfeng Zhen			Xinfeng Zhen-Mengyuan			Mengyuan-Shanmen Xia			Shanmen Xia-Yima			Yima-Luoyang			Luoyang-Zhengzhou		
	150km			27 km			31 km			88 km			119 km			90 km			60 km			119 km		
FY	Up	Down	Total	Up	Down	Total	Up	Down	Total	Up	Down	Total	Up	Down	Total	Up	Down	Total	Up	Down	Total	Up	Down	Total
1982	586	882	1468	1198	725	1923	826	911	1737	1135	1000	2135	1218	930	2148	1310	997	2307	2008	1038	3046	2603	1344	3947
1992	1859	1753	3612	3146	1477	4623	2886	1791	4677	2779	1821	4600	2829	1713	4542	2975	177	3152	3931	1829	5760	4641	2590	7231
1996	1981	1836	3817	3384	1625	5009	3157	1944	5101	3086	1966	5052	3254	2001	5255	3437	2030	5467	4619	2063	6682	5472	3084	8556

Source : Ministry of Railway

(2) Economic analysis and financial analysis

Table 2.19 shows the economic internal rate of return (EIRR) and the financial internal rate of return (FIRR) of F/S, and the result of recalculations based on the data collected during the latest field survey.

The benefits used to calculate EIRR include effect of reduced operation and maintenance repairment cost when compared with “without electrification” and effect of shortening time.

【Table 2.19 Comparison of EIRR and FIRR】

Zhengzhou-Baoji Railway Electrification Project

	EIRR	FIRR
F/S stage	48%	19.7%
Review	45%	25%

The EIRR and FIRR were almost as expected. However, financial status of Ministry of Railway is not so good, as explained as follows.

① Chronic loss structure

In the same way as for the Lianyungang Port's port freight handling charges described earlier, railway transportation fares can only be changed by petitioning the government and receiving its approval.

Based on the Chinese government's macro-economic policy to suppress inflation, public charges are kept low. This problem is compounded by the excessive number of employees and inefficient management system. As a result, almost all railway bureaus throughout China have been in the loss since 1994. (See Table 2.20.)

【Table 2.20 Profits and Losses (Net Profits) and Freight Transport Charges in the Ministry of Railways 】

FY	Ministry of Railways(thousand yuan)	Zhengzhou Railway Bureau	Lanzhou Railway Bureau	Average freight transp transport charges (Yuan/t・km)
1988	6,710,000	-	-	0.0176
1989	5,460,000	-	-	0.0176
1990	11,300,000	-	-	***0.0386***
1991	9,860,000	1,629,450	289,020	0.0386
1992	5,920,000	1,333,830	242,420	0.0386
1993	1,266,440	232,490	69,660	0.0386
1994	-2,910,000	-	-	0.0386
1995	-6,412,760	-1,221,140	-508,400	***0.0586***

* - is unknown.
Source: Chinese Communications Statistics Yearbook.

Moreover, with regard to the Zhengzhou-Baoji Railway, the original plan was to set charges higher than those of existing railways, but this could not be accomplished.

② Inefficient management of state-owned enterprises

At present, the Ministry of Railways manages tracks totaling 60,000 kilometers and a workforce of some 3.5 million employees. In actual terms, it is the largest Chinese state-owned enterprise. However, from the viewpoint of management, management of each railway line and each local railway bureau on the basis of financial data is insufficient, and it will not be easy to improve management efficiency.

(3) Other economic effects

The Longhai Railway crosses China from east to west and provides wayside line's inland areas access to ports (Lianyungang Port). Therefore, the rise in transport capacity resulting from the electrification of the Zhengzhou-Baoji section, which is an important section of the Longhai Railway has yielded considerable social and economic benefits.

① New Eurasian Land Bridge

As described previously, containers transported to Central Asia via the Lianyungang Port using the Longhai Railway reach 30,000 TEU/year, and currently a container train is operated every day that loads 100 TEU.

② Environmental impact

According to a survey on the environmental impact conducted by the Ministry of Railways, environmental improvements resulting from the electrification of the railways were considerable. Table 2.21 shows the amount of pollutants along the railway before and after the project was completed.

【Table 2.21 Reduction Rate of Pollutants Along the Railway】

Item	Soot (dust)	SO2	CO	Nox	Waste water
Reduction rate	95%	95%	94%	85%	72%

Source: Ministry of Railways of P.R.C.

Moreover, on the basis of materials obtained during the field survey, experimental results show that some 340,000 tons of coal per one year were economized through the electrification of the railway.

【Table 2.22 Reduction in Coal Consumption Resulting from Electrification Project】

Locomotive type	Fuel efficiency a	Passenger transport volume (10,000 passengers•km)	Freight transport volume (10,000 t•km)	Freight transport volume conversion * b	Energy consumption amount c=a•b	Coal conversion** (t)
S/L	0.1374 t/10,000t•km	1,480,000	3,660,000	3,808,000	523,220 (t)	523,220
Electricity	109.4kw•h/10,000t•km				416,600,000 (kwh)	183,300
Coal consumption decrease through use of E/Ls						339,920

* Passenger transport volume was converted to freight transport volume, to which freight transport volume was then added, using the conversion rate of 100,000 persons-km against 10,000 ton-km.

** When the power consumption was converted to coal consumption volume, the Chinese standard thermal power generation combustion factor of 0.44 kg/kWh was used. The power transmission loss was not factored in.

*** Other data was obtained from the China Communications Annual Handbook 1995.

③ Important reduction of energy cost

According to the Ministry of Railways, the improvement in energy efficiency derived from electrification resulted in a cost reduction of 40%.

2.3.3 Baoji-Zhongwei Railway Construction Project

(1) Operational performance

At present, there are two passenger trains and 16 freight trains per day. With regard to the transportation quantity, the railway transported about 8 million tons of freight in 1996, compared to the design capacity of 18 million tons/year.

Coal represented approximately 60% of the total freight, while petrochemicals represented the greatest portion of freight from Xinjiang to Henan Province. Moreover, with regard to carrying volume projections, while details are not known at the present stage, there is a plan to construct a large-scale coal-fired thermal power plant near the Ankou Station, and if this plant is realized, the total carrying volume of coal is expected to rise considerably.

(2) Economic and financial analysis

The economic and financial analyses performed based on the results of the F/S survey conducted by the First Investigation and Design Institute directly controlled by Ministry of Railways yielded an EIRR of 34.5% and an FIRR of 8.0%.

However, as only one year has passed since the start of operations, there is a great lack of data and information required for post-evaluation, the EIRR and FIRR values have not been recalculated in this evaluation.

(3) Additional impacts

The aim of the Baoji-Zhongwei Railway, in addition to forming a bypass of the Zhengzhou-Baoji section, was also very strongly as an anti-poverty measure.

The Ningxia ethnic group constituency that the Baoji-Zhongwei Railway traverses (Islam) (286 km) and Gansu (96 km) are the poorest regions in China. The completion of the Baoji-Zhongwei Railway is expected to stimulate the transport of agricultural products, livestock and ores along the railway, and to generate employment growth.

2.3.4 Contribution of Two Railway Projects Toward Strengthening of Coal Transport Capacity

The latest field survey did not go as far as verifying the overall situation regarding coal with regard to the coal transportation plan submitted to the OECF by the Ministry of Railways in 1990. However, according to the materials that were obtained, the coal that was transported from the SSI region in 1995 was 230 million tons, or slightly lower than the planned figure of 290 million tons.

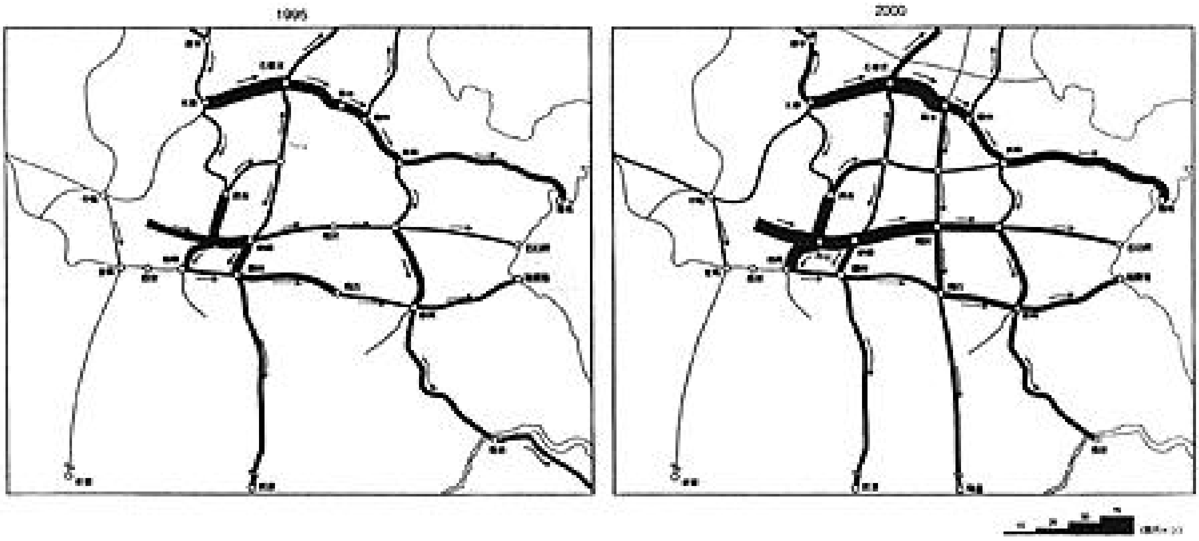
In particular, in the 1990 coal transportation plan, in relation to the projects evaluated in this report, there are two routes, the Huadong route and the Huazhong route. With regard to coal transportation volume on both routes, the 1995 results (see Table 2.23) and the year 2000 projections obtained from the Chinese Transportation Yearbook and interviews of Ministry of Railways officials are shown in Figure 2.15.

【Table 2.23 Coal Transport Volume in the Shanxi Province (Huadong Route, Huazhong Route) 】

1995 (Unit: 10,000 tons)

From Shanxi Province	Huadong Route				Huazhong Route			
	Jiangu	Anhui	Shangdong	Shanghai	Henan	Hubei	Hunan	Guangdong
	1474	392	2204	67	648	768	259	129

Source : Chinese Transportation Yearbook 1995



【Figure 2.15 Coal Transport Volume by Railway from Shanxi Province】

Through this, in the future too, the Zhengzhou-Baoji Railway Electrification Project is expected to make great contributions to coal transportation of Shanxi Province, and the Baoji-Zhongwei Railway Construction Project is expected to make great contributions to the coal transport of Gansu Province and Ningxia.

Manual Maintenance work of the Tracks
(between Xian-Baoji)

Electric Locomotive on the Longhai Railway - Zhaoshan 1 type

(the station of Xian)