Technological Scheme of Transshipment Bulky Cargo

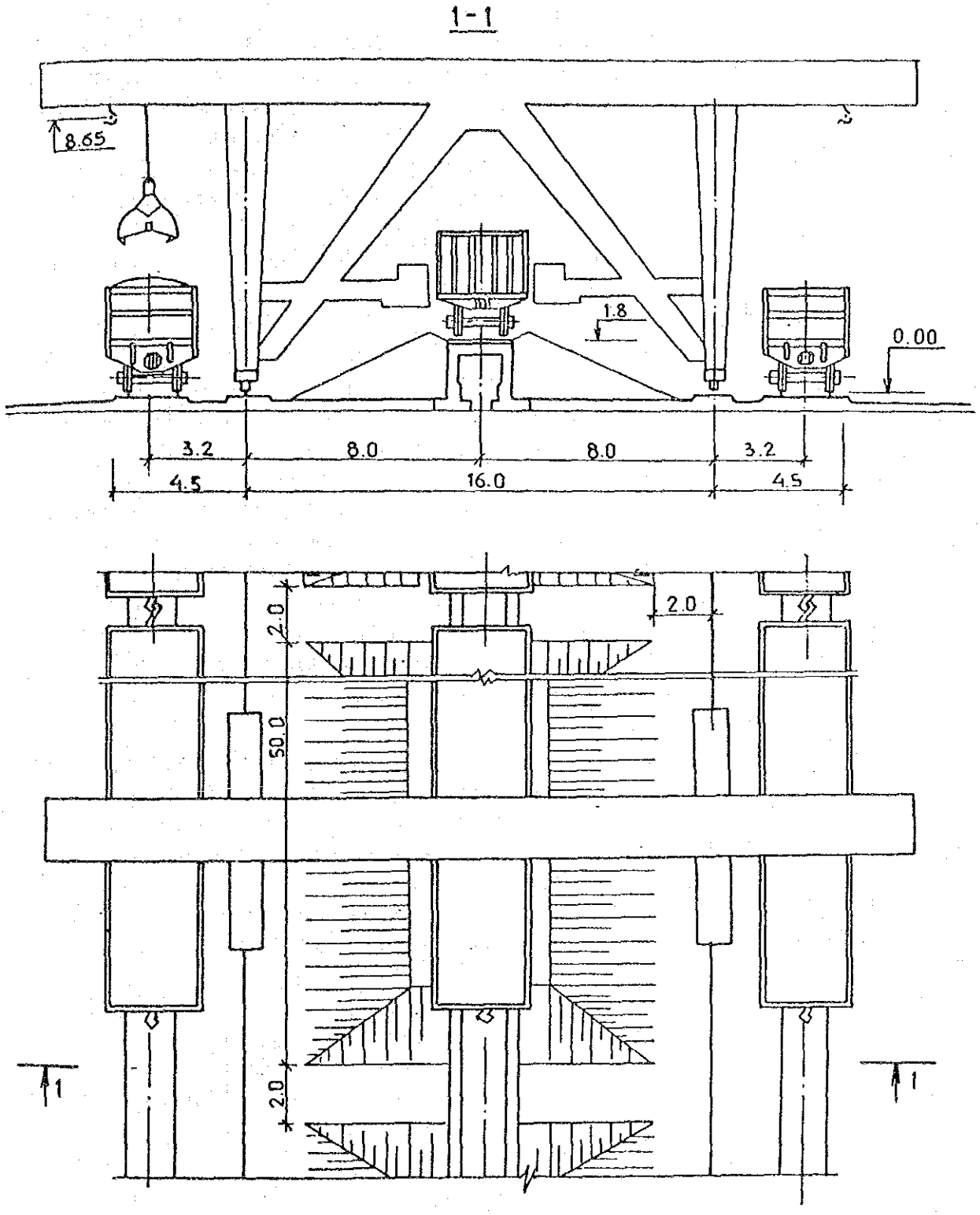


Fig. 2-3-5 Bulky Cargo

2-3-5 Electrical Equipment

1) Signal equipment

* According to the feasibility study, the semi-automatic block system was planned for the 1,520 and 1,435mm gauge tracks between Zamyn-Uud and Erenhot, and also for the section between Zamyn-Uud and P52, both equipped with the tablet system at present.
* The 1,435mm gauge track between Zamyn-Uud and Erenhot is already in operation with Chinese type 64 semi-automatic relay block system. The system to be introduced for the 1,520mm gauge track in this section should be negotiated with China.
* The DSP-13 type A track relay at 25 Hz was planned for the track circuit. Since there are no electrical facilities near the track that would be affected by the induction current, the frequency should be reviewed accordingly.
* The study planned to adopt the relay interlock system that is widely used in Mongolian Railway.
* Semi-automatic barriers were planned in the feasibility study report. Adoption of the system should be reviewed when the road network plan has been clarified in the future.

2) Telecommunication equipment

* The feasibility study report planned to introduce a telephone network for the communications between the signal operation cabin and engineers and other staff in the yard, which should be constructed as planned.
* The report planned to build a new telecommunication center and install a cross bar exchange to replace the existing step-by-step exchange. However, this plan should be reconsidered, since cross bar exchanges are no longer manufactured.
* The report planned introduction of six sets of teletypes and additional multiplex equipment with 12CH bare wire transmission lines between Zamyn-Uud and Shain-shand. In introducing new equipment, however, it is desirable to discuss the possibility of replacement of existing equipment on a large scale.

3) Power supply equipment

The report describes only that Zamyn-Uud station has a power generating plant with an inadequate capacity. There are three generators, one with a capacity of 800KW and two with a capacity 630KW each. However, the two generators of 630KW are not working at present. Though Mongolian Railway plans to repair one of these defective generators, the power supply system is extremely unreliable.

Under the circumstance, the power supply system must be reviewed to prepare for the construction of cargo transshipment facilities.

2-4 Agreement Between Mongolia and China

Mongolian Railway has an agreement with China on the cargo transshipping work currently undertaken at the border station in China, based on which both countries are having a meeting every year to discuss related procedures including train operation, communication, operation of wagons and so forth. After the commissioning of cargo transshipment facilities at Zamyn-Uud station, the existing agreement is to be amended accordingly.

2-5 MR Management and Operation

2-5-1 Financial Status of Mongolian Railway

Financial status of Mongolian Railway seems to be so far sound. Operation of the Railway has been managed on profit basis. As a result, the Railway does not have received from the government any subsidy to be extended to loss-incurring state-owned enterprises. Currently the Railway has its own funds enough for their payment and has not borrowed money from the government or banks. However, under the severe economic situation of Mongolian Republic in recent years, its financial position is now worsening and further deterioration is anticipated in near future.

Table 2-5-1 shows the revenue and expenditure of Mongolian Railway's Transport Division. The results for the year 1991 and the first half of 1992 seem to be respectively better than the preceding year, but if the high inflation rate of Mongolia since 1991 is taken into consideration, it should be said that the amount of both revenue and profit in real terms are going down year by year from the peak in 1988.

Table 2-5-1 Profit and Loss Statement of Mongolian Railway's Transport Division

(Unit: Thousand Tugrik)

Year	1987	1988	1989	1990	1991	Jan./June 19922
Revenue						
Freight	363,803	375,072	352,972	304,210	375,564	-
Passenger	51,418	54,181	55,470	53,730	199,587	-
Others	20,122	19,078	19,824	16,719	27,519	-
Total revenue	435,343	448,331	428,266	374,659	602,670	478,028
Expenditure						
Personnel cost	55,717	55,110	53,864	54,149	109,153	-
Fuel	69,302	72,154	69,526	64,111	78,089	-
Materials	28,040	28,294	28,448	27,816	37,478	-
Withholding tax	5,095	5,115	5,058	5,230	14,371	-
Electric power	2,974	3,091	4,876	3,232	3,562	-
Others	154,145	157,791	155,896	150,339	198,193	-
Total expenditure	315,273	321,555	317,668	304,877	440,846	376,098
Profit & loss	120,070	126,776	110,598	69,782	161,824	101,930

In accordance with the so-called price reform in January 1991 in which retail prices fixed by the government were doubled, the freight and passenger fare of the Railway was also raised. In addition, the passenger fare was put up again for 100-300% in February 1992 and as from June 1992 the new rate increased by 50% was applied for some categories of the cargo. Though the volume of both freight and passenger decreased significantly, these revisions of the tariff prevented the transport revenues of the Railway from going down. However the Railway seems to have already fallen in the process in which the frequent and sharp increase of the fare is sure to result in further decline of the traffic volume and thus to force the Railway to resort to the succeeding hike.

As for the expenditure side, the increase of personnel cost is the most remarkable. As inflation goes on, the salary of the workers must be reviewed at short intervals. The Railway has worked hard to cut the number of the staff, but the total amount paid as salary in 1991 almost doubled from the previous year. In April 1992 an equal increase of the wage for monthly 400 Tugrik was given to all employees. The salary jumped up again by 50% as from September. The management and the workers agreed that the new scale would be only provisional and the wage for the next year left for further negotiation at the end of the year. This means that the Railway is under pressure of further increase of personnel cost in the coming year.

On the other hand, payment for fuel, electric power and other various materials has increased rather moderate because the price of these substantial items stayed at relatively low level even after the price reform and consumption has gone down due to decline of the traffic volume. However, as price of oil was raised drastically in May 1992, cost of fuel and electric power will have an adverse effect on the financial status of Mongolian Railway as much as personnel cost.

Mongolian Railway has Non-Transport Division gaining revenue almost equal to that of Transport Division, but also incurring loss amounting to the half of the profit earned by Transport Division. Table 2-5-2 shows the consolidated revenue and expenditure of both Transport and Non-Transport Divisions, for 1990, 1991 and the first half of 1992. Non-Transport Division includes some Departments running business relative to Transport Division. For example, the plant manufacturing wooden sleepers for Railway's own use belongs to Non-Transport Division. However, the most of the loss of Non-Transport Division comes from other Section. It handless housing, education, medical care, entertainment, distribution of commodities and so on for people working in Mongolian Railway and their family. This means that Mongolian Railway is distributing considerable part of the profit obtained from Transport Division to its employees for their welfare.

Table 2-5-2 Consolidated Profit and Loss Statement of Mongolian Railway

(Unit: Thousand Tugrik)

Year	1990	1991	Jan./June 1992
Revenue			
Transport division	374,659	602,670	478,028
Manufacturing section	63,752	82,611	-
Non-Manufacturing section	61,837	92,451	-
Other section	205,796	356,756	-
Non-Transport division	331,385	531,818	407,449
Total revenue	706,044	1,134,488	885,477
Expenditure			
Transport division	304,877	440,846	376,098
Manufacturing section	58,276	84,427	-
Non-Manufacturing section	51,900	84,288	-
Other section	257,289	443,499	-
Non-Transport division	367,465	612,214	460,415
Total expenditure	672,342	1,053,060	836,513
Profit & loss			
Transport division	69,782	161,824	101,930
Non-Transport division	-36,080	-80,396	-52,966
Consolidated profit & loss	33,702	81,428	48,964

2-5-2 MR Organization and the Number of Employees

Figure 2-5-1 is the Organization Chart of Mongolian Railway. Except three Departments under direct control of General Director, the management of all other operations are shared by three Deputy Directors and Chief Engineer. The role and the function of some of the Departments are as follows.

Locomotive Facilities Department is responsible for operation, maintenance and rehabilitation of locomotives and for administration of locomotive crew.

United Power Supply Section is responsible for water supply as well as electricity.

Traffic Management Department is responsible for overall management of Mongolian Railway and consists of following four Divisions: Freight Traffic Division, Passenger Traffic Division, Traffic Movement Division and Technology Division.

Car Facilities Department responsible for operation, maintenance and rehabilitation of freight and passenger cars and for administration of passenger train crew.

Track Facilities Department is responsible for maintenance and rehabilitation of tracks and other permanent structures.

Civil Engineering Department handles housing of the employees for their welfare as well as civil work of Mongolian Railway.

Trade Department is responsible for public catering and supply of food and other consumer goods.

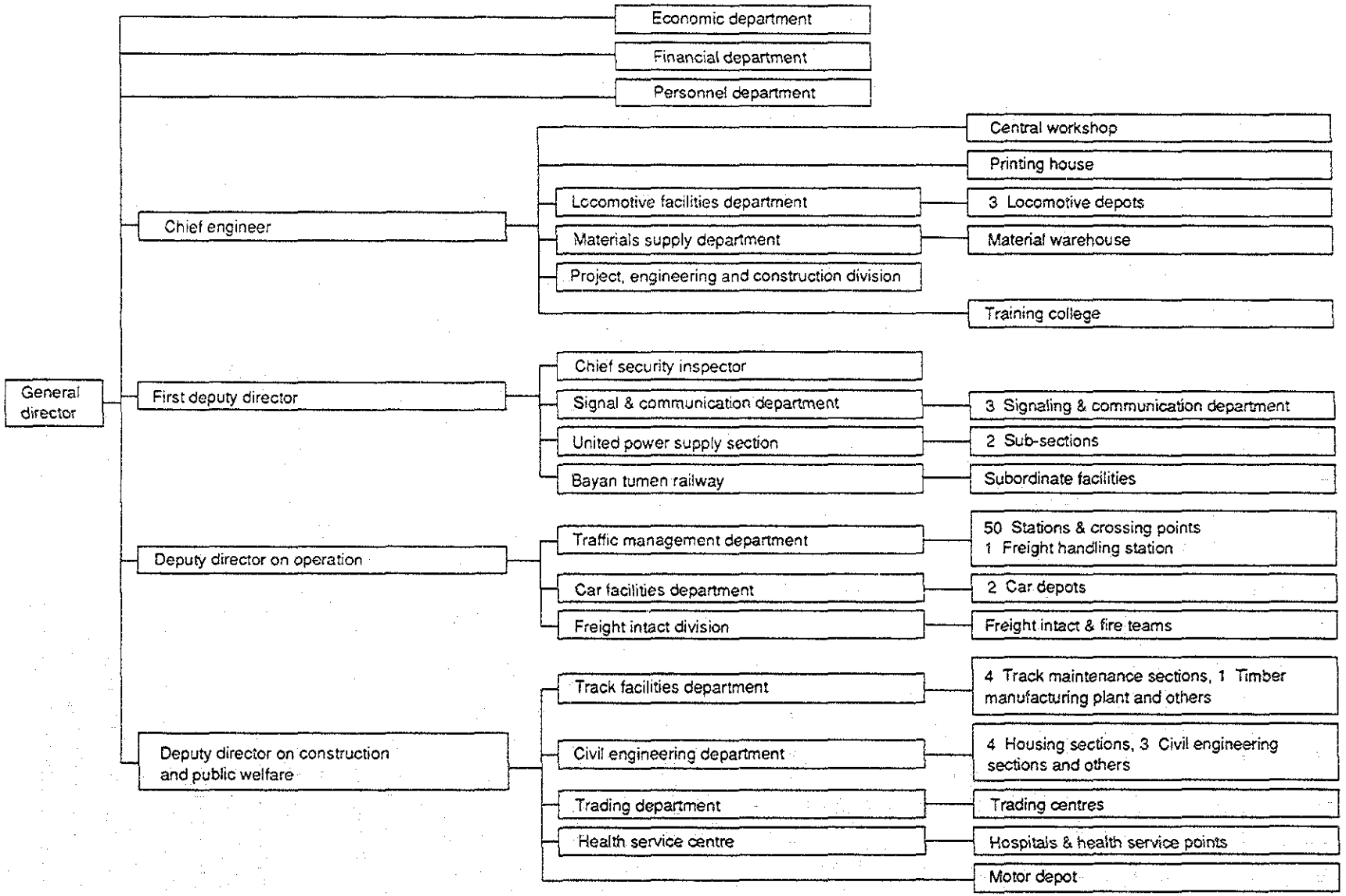


Fig. 2-5-1 Organization Chart of Mongolian Railway

Table 2-5-3 shows the number of MR employees classified by Departments. In all Departments the number of staff members has decreased remarkably in the past few years.

Table 2-5-3 The Number of MR Employees Classified by Departments

Department	Number of Employees			Diff.
	in 1990 (of which engineers)		in Jan. 1992	
Traffic management	1,821	(552)	1,577	-244
Locomotive facilities	1,803	(133)	1,551	-252
Car facilities	1,674	(103)	1,460	-214
Track facilities	3,959	(95)	2,856	-1,103
Signaling & telecommunication	627	(61)	561	-66
Power supply	358	(319)	350	-8
Civil engineering	2,366	(161)	2,210	-156
Health service centre	1,259	(0)	1,130	-129
Trading	960	(62)	941	-19
Others	1,884	(183)	1,470	-414
Total	16,711	(1,669)	14,106	-2,605

2-6 Facilities and Assets of Mongolian Railway

2-6-1 Route Profile

Ulaanbaatar is located at the river side of Tuur which runs in the Hentei mountains, one of the largest mountain ranges in Mongolia.

Starting at the boundary with Russia, about 600m high from the sea level, the railway climbs along the Orkhon river up to the height of 1,410m at the 372km point (372km from the boundary station of Naushki in Russia), then descends along the Tuur river toward Ulaanbaatar, the altitude about 1,300m. Around the 372km point, there are sections of steep gradient, 18/1,000, and curves with radius 290m, which is a design to avoid construction of tunnels.

After Ulaanbaatar, the line passes a number of gradients, 9/1,000 and small curves, radius 290m, embankment and cuttings, to ascend up to 1,702m at the 471km point, the maximum height of the Mongolian Railway lines, and descends again to Airag and further to Sain-shand in the Gobi desert, before it reaches the boundary station of Zamyn-Uud which is 962m high from the sea level.

2-6-2 Major Specifications of Mongolian Railway

Below given are major specifications of Mongolian Railway.

Route length		
Total	:	1,813km
Sukhe-Baatar – Zamyn-Uud	:	1,111km
Salhit – Erdenet	:	164km
Length of double track line	:	5km
Track gauge	:	1,520mm
Construction gauge		
Width	:	4,900mm
Height	:	5,550mm
Rolling stock gauge		
Width	:	3,600mm
Height	:	5,300mm
Minimum radius of curve	:	290mm (Main lines)
Maximum gradient	:	18/1,000
Maximum axle load	:	24ton
Maximum speed	:	80km/h
Width of right-of-way	:	140m
Effective length of track	:	850m

2-6-3 Specifications of Track

Below given are major track specifications.

Rail	:	USSR standard P43 rail (44.7kg/m) USSR standard P50 rail (51.5kg/m)
Sleeper	:	Treated wooden sleeper 30 × 25 × 275cm
Fastening device	:	Tie plate fastened with spike and anti-creeper at 1/20 inclination
Track bed		
0 – 604km point section	:	Mixture of sand and gravel
604 – 1,111km point section	:	Crushed-stone ballast
Turnout		
No. 9 R = 200m	:	Turnout side maximum allowable speed 25km/h
No. 11R = 300m	:	Turnout side maximum allowable speed 40km/h

2-6-4 Stations

Major stations of Mongolian Railways are as follows.

(1) Sukhe-Baatar (23km point)
Sukhe-Baatar is the northern-most station with 12 stabling tracks.

(2) Darkhan-1 (122km point)
Darkhan-1 station is located at Darkhan City with a population of about 80,000, as the controlling center of the neighbouring sections. It unloads the materials sent to a nearby steel manufacturing plant now under construction.

(3) Erdenet (164km point)
Located at Erdenet City, population about 60,000, this station loads the products of Erdenet copper mine, one of the largest of its kind in the world. It has six stabilizing tracks, a locomotive repairing depot, cargo handling facilities and a track connecting the station with a refinery in the mine.

(4) Tolgoit (395km)
Since the Ulaanbaatar station is at the center of the capital, it is virtually impossible to scale up its cargo handling facilities that would worsen noises and other problems of environmental pollution. It was planned therefore to shift the industrial and railway facilities around the Ulaanbaatar station to the Tolgoit area which is to the northwest of the capital, and the expansion work of the Tolgoit station had already been implemented for this purpose including construction of humps. However, the work was suspended after civil work had mostly been completed.

(5) Ulaanbaatar (402km point)
Ulaanbaatar station is the largest station in Mongolian railway, equipped with 18 stabling tracks in the complex, cargo handling facilities and a rolling stock repairing shop to the north and a locomotive depot to the south.

(6) Zamyn-Uud (1,111km)

Zamyn-Uud station in the Gobi desert is the southernmost station of the Mongolian Railway, facing the Erenhot station in China across the border. An area of about 500m × 3,000m to the northeast of the station has been planned by the former USSR as the site for cargo transshipment, but the construction work was abandoned after some civil work had been completed. A track of Chinese gauge connects the station with Erenhot, which is currently used for cross-border tank car train operation to transport petroleum from China to Mongolia. Transshipment of petroleum alone is in operation at present with a small scale facility as a temporary measure. A power plant is supplying power to the station and the community of the area.

2-6-5 Power Supply Equipment

(1) Power Source

Power is being supplied to Mongolian Railway from power plants in Ulaanbaatar and Darkhan, and also from its own power plants at Sain-shand and Zamyn-Uud.

(2) Power Generation and Transmission

The power plant of Zamyn-Uud station has three generators driven by diesel engine. The generator No.3, capacity 800KW, is currently in continuous operation. A maximum load of 740KW was recorded at this plant in 1991. Two sets of diesel engine generators, capacity 630KW each, are also in operation at Sain-shand station. These plants generate power of 3-phase 400V and boost it up to 10,000V for transmission. The Zamyn-Uud and Sain-shand power plants supply power each up to the midpoint in between, a 962km point from the border with Russia, where a normally-open section switch is installed. When the Zamyn-Uud power plant fails, the section switch at the midpoint is closed to supply power from the Sain-shand plant on a priority basis to Zamyn-Uud station, hospitals, signal and telecommunication systems and other important facilities in the district.

(3) Transmission Equipment

Transmission poles, installed at the intervals of 50m, are made of raw wooden poles sandwiched by iron rails or square concrete bars up to the height of 2 to 3m from the ground. These components are wound with iron wire, 4.0mm in diameter, 5 to 6 turns at two separate places.

Power is supplied at 3-phase 10,000V through 70mm^2 bare aluminum wires connected to the poles with insulators of 10,000V capacity.

Vinyl-covered copper wires are used for low voltage power supply.

2-6-6 Signalling Equipment

(1) Signal

All stations of Mongolian Railway adopt the multiple color light signal system, with the aspects of R, Y, G as the basic signals, and Y-flash, YY, GG and W. The white signal is used as the calling-on signal when the entry signal is defective. All equipment are made in USSR. Two lamps consist of a unit signal display device, to make a four-aspect display when two units are combined. A small number of three-aspect signals also exist.

There are two different methods of installing signal devices. One is to set them directly on the ground and the other on a pole made of steel pipe or concrete. In both cases, the foundation is made of concrete. To the side of the signal pole, a junction box is attached to accommodate a transformer which drops the supplied voltage from 220V to 12V to feed the signal display system. Table 2-6-1 gives the voltage and wattage used for each category of signal. Figure 2-6-1 shows aspects and categories of signal.

Table 2-6-1 Voltage and Wattage Used in the Signalling System

Category	Voltage Used (V)	Wattage (W)	Voltage Supplied (V)
Entry signal and calling-on signal	12	25	220
Departure signal	12	15	220
Shunting signal	12	15	220

(2) Interlock System

The relay interlock system is adopted at all stations except for the section between Zamyn-Uud station and P52 signal station, with the USSR's NMSH and KMSH 24V type equipment. The display panel is incorporated in the control panel at small stations, while they are separated at large stations. Relays and other parts are all made in Russia. The relays are all large-sized so that they are repairable. Except for the section between Zamyn-Uud station and P52 signal station, all sections are covered by a semi-automatic block system with the USSR's GTSS type equipment. Figure 2-6-2 shows the interlock diagram of a small station.

(3) Track Circuit

Power of 30V 50Hz is supplied to the track circuits after the voltage is dropped from the source voltage 220V by the track circuit transformers. The track circuit relay transformers drop the voltage of the current picked out to 24V to operate the track relays.

(4) Points

All stations under the relay interlock system except for Zamyn-Uud station are equipped with power-operated points. There are some side tracks installed with hand-operated points. The power-operated points are the MCP-0.25 type that works with the power of 160V, maximum current 20A, and operating current 2 to 3A, and switches the routes with operating force of 600kg. A transformer in the junction box attached to the point drops the voltage from 220V to 160V. The points are placed on two L-shape steel bars that make gauge ties and are tightened to a base rail with

bolts. As auxiliary devices, a point has an operating lever and two locking levers, one for the open position and the other for closed position.

2-6-7 Telecommunication Equipment

(1) Wire Telecommunication

Telecommunication lines consist of eight pairs of 4mm bare wires, i.e., two pairs of steel copper wires and six pairs of steel wires. Steel copper wires are used for 3CH and 12CH frequency division multiplex transmission. See Table 2-6-2.

Table 2-6-2 Types of Frequency Division Multiplex Transmission

Number of Channels	Frequency	Type
3	33kHz or lower	B-3-3
3 to 12	33 to 150kHz	B-12-3

Steel wires are used to send train operation commands and signals, and for the communication between stations and other purposes. See Table 2-6-3 for the detail of the applications. Two 3- to 12-channel transmission lines are used in the section between Darkhan and Sain-shand, and one 3- to 12-channel and one 3-channel transmission lines are used in the sections between Sain-shand and Zamyn-Uud, and between Sukhe-baatar and Darkhan. Figure 2-6-3 shows the present drawing of telecommunication equipment.

Transmission poles, installed at the intervals of 50m, are made of a wooden pole, with the lower part being sandwiched with iron rails or square concrete bars.

The transmission equipment in use are USSR-mmade STA, RTA-80 and German E-2000. Ulaanbaatar telecommunication center divides the Mongolian Railway into three zones, for each of which a GCT-2-61 type equipment is in operation.

Table 2-6-3 Applications of Transmission Wires

Category	Application
Steel copper wire	1. 3- to 12-channel frequency division multiplex transmission 2. 3-channel frequency division multiplex transmission
Steel wire	3. Train operation commands 4. Signals 5. Communications between stations 6. Communications between unit control regions 7. Telegraph 8. Communication between maintenance staff

(2) Telephone

Twelve major stations are equipped with automatic telephone exchanges, mostly Russian crossbar switches and step-by-step switches, accommodating 50 to 2,000 lines each. Ulaanbaatar telecommunication center uses an ATCK-2000/50 type equipment.

(3) Radio Communication

Radio communication is adopted between train locomotives and major stations in 2130 to 2150kHz, with the 42-PTM type equipment on the locomotives and the 43-PTC type equipment on the ground. Radio communication is also in use between shunting locomotives and ground staff in 150 to 156MHz, with the equipment listed in Table 2-6-4. The portable equipment are made in Bulgaria and others are all made in Russia. The train dispatcher can communicate with the locomotives and stations in the section between Sukhe-baatar and Bagahangai, but not with the locomotives in the section between Bagahangai and Zamyn-Uud due to the shortage of transmission line capacity. Drivers of odd and even number train locomotives are exchanging the information on the route when they cross at a station via radio communication.

Table 2-6-4 Telecommunication Equipment for Shunting

Place of Installation	Type	Output (W)	Frequency (MHz)	Voltage (V)
Locomotive	72PTMA-24M	8	150	48
Ground (station)	79RTMA-24M	8	to	24
Portable	Transport-4	1.2	156	24

(4) Train Operation Control

The section between Sukhe-Baatar and Zamyn-Uud is divided into the following three zones.

Zone 1 (Northern district)	Sukhe-Baatar	~	Zuun-Hara
Zone 2 (Central district)	Zuun-Hara	~	Bagahangai
Zone 3 (Southern district)	Bagahangai	~	Zamyn-Uud

The train operation in each zone is controlled by a train dispatcher in the head office of Mongolian Railway. The train dispatcher can call each station and signal station in these zones directly by pushing a button to connect him to the intended place. To communicate with a locomotive, the train dispatcher calls a station near the locomotive and the radio communication equipment of the station is switched to directly connect him to the locomotive. The communication in the opposite direction is also possible in the same way. Figure 2-6-4 shows the communication network between the train dispatcher, station and locomotives.

2-6-8 Rolling Stock

(1) Locomotive

Mongolian Railway has four types of locomotives, 122 numbers in total, all diesel electric, including the strongest 2M62, with output 4000 HP, hauling capacity 17 passenger cars or 38 freight cars, or tractive load 4,000 to 5,000 tons on level sections and 1,500 tons at 18/1,000 gradients.

Table 2-6-5 gives major specifications of the locomotives.

Table 2-6-5 Major Specifications of the Locomotives

Type		2M62	TEM2	TE2	M62
Output (HP)		4,000	1,200	2,000	2,000
Maximum speed (km/h)		100	100	93	100
Number		64	28	213	17
Wheel diameter (mm)		1,050	1,050	1,050	1,050
Weight (ton)		240	120	170	120
Axle load (ton)		20	20	21.25	20
Wheel arrangement		2 × Co-Co	Co-Co	2 × Bo-Bo	Co-Co
Year of manufacture		1980 ~	1974 ~	1948 ~ 1955	1965 ~
Power transmission		Electric	Electric	Electric	Electric
Dimensions (mm)	Height	4,615	4,915	4,689	4,615
	Width	2,950	3,080	3,267	2,950
	Length	34,800	16,970	23,895	17,400

(2) Passenger Cars

Mongolian Railway has 200 passenger cars including sleeping cars and dining cars as given in Table 2-6-6.

Table 2-6-6 Passenger Cars

Type	Sleeping cars Hard type	Sleeping cars Soft type	Dining cars	Others
Number	89	84	9	7

Specifications of soft type sleeping cars are as follows.

Dimensions	:	Length 27,560mm
		Width 3,020mm
		Height 4,350mm
Maximum speed mm	:	160km/h
Seating capacity	:	36
Weight	:	59 ton
Manufacturer	:	Former East Germany

(3) Freight Cars

Table 2-6-7 gives the number and major specifications of the freight cars of Mongolian Railway.

(4) Rolling Stock Station

Table 2-6-8 gives the rolling stock stations and the number of rolling stock assigned.

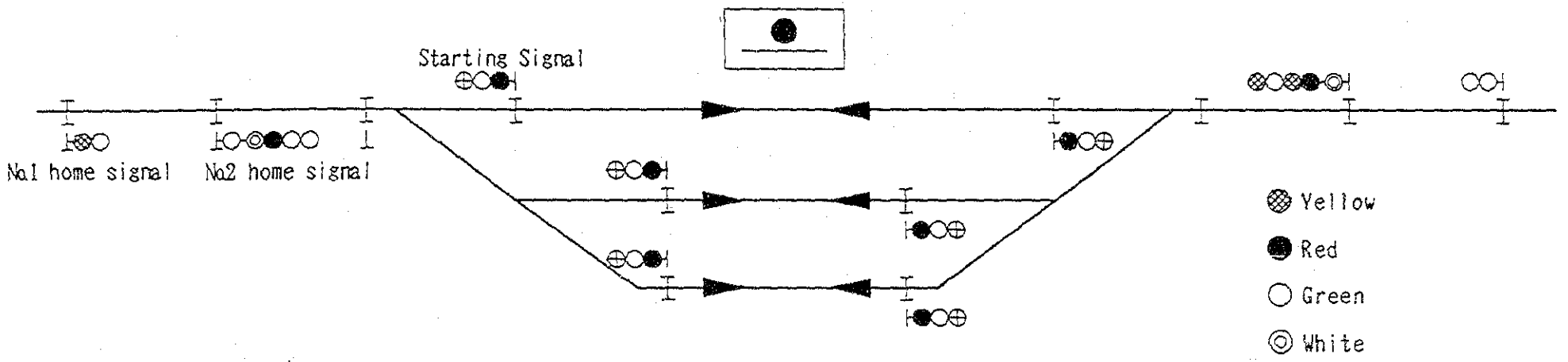
Table 2-6-7 Freight Cars

Type	Open wagon	Open wagon	Box wagon	Hopper car	Tank car
Number	104	1,124	246	(230)	(21)
Length (mm)	14,620	13,920 13,920	14,370 14,730	10,870	
Width (mm)	3,150	3,130 3,134	3,228 3,249	3,200	
Height (mm)	1,820	3,485 3,495	4,650 4,668	3,210	
Weight (ton)	21.4	22 22.5	22.8 24.7		
Pay load (ton)	71	69 69	6 68		
Maximum speed (km/h)	120	120	120		

Table 2-6-8 Rolling Stock Stations

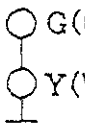
Station		Sukhe-Baatar	Zuun-Hara	Ulaanbaatar	Sain-Shand	Bayan-Tumen
Loco	2M62	20		33	11	
	TE2	5		3	2	3
	TEM2	5		14	7	2
	M62	3		8	2	4
Passenger car				200		
Freight car			1,500			

Fig. 2-6-1 Standard Layout of Signals and Track Circuits at Station



◎ Classification of railway signals and signal aspects

1. No.1 home signal

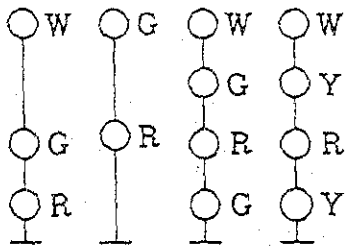


Y: Always ON.
G: The next signal is the main line (straight side) route.
Y flash: The next signal is the sub-main (branched side) route.

2. No.2 home signal

R: The arrival line is closed.
G: The main line (straight side) is open and it is possible to pass the station.
Y: The main line (straight side) of the train which is stop at the station is open.
YY: The sub-main line (branched side) of the train which is stop at th station is open.
W: Used for guiding a train to a station.

3. Starting signal

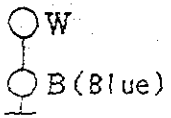


1. The aspect 3 is used when there is a shunting signal.
2. The aspect 4 is used when there is a branch line.
3. The aspect YY is used when a train starts from an unfixed.

(a) R is displayed when the departure is not permitted.
(b) G is displayed when a train passes a station. GG and YY also have the same meaning.
(c) W is displayed when shunting is permitted.

4. Repeating signal

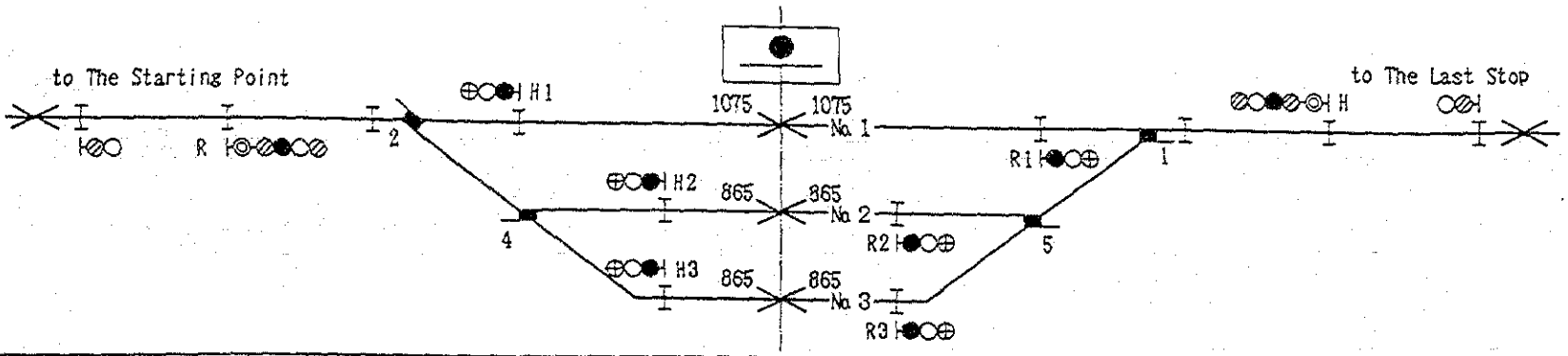
5. Shunting signal



B: Stop
W: Shunting is permitted.

Fig. 2-6-2

Interlocking System of Station



Course		Truck No	Route	Signal	Signal aspect	Point No	Route 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	13/5	14/6			1/9	2/10			Point 2	4				5	1
Side of The Starting Point	Arrival Line	Arrival 1	1	R	◍	2	●	×	×		×	×	×						×					×	×			○	×			—						
		Arrival 2	2	R	◍◍	4	×	●	×		×	×	×							×				×	×			×	○			+	+					
		Arrival 3	3	R		4	×	×	●		×	×	×								×			×	×			×	×			+	—					
			4							○																												
	Departure Line	Departure 1	5	H1	○	2	×	×	×		●	×	×											○	×			×	×			—						
		Departure 2	6	H2	○	2	×	×	×		×	●	×											×	○			×	×			+	+					
		Departure 3	7	H3	○	2	×	×	×		×	×	●											×	×			×	×			+	—					
			8											○																								
Side of The Last Stop	Departure Line	Departure 1	9	R1	○	1									●	×	×		×	×	×			×	×			○	×								—	+
		Departure 2	10	R2	○	1									×	●	×		×	×	×			×	×			×	○								—	+
		Departure 3	11	R3	○	1									×	×	●		×	×	×			×	×			×	×								—	+
			12															○																				
	Arrival Line	Arrival 1	13	H	◍	1	×								×	×	×		●	×	×			○	×			×	×								—	+
		Arrival 2	14	H	◍◍	5		×							×	×	×		×	●	×			×	○			×	×								—	+
		Arrival 3	15	H	◍◍	5			×						×	×	×		×	×	●			×	×			×	×								—	+
			16																			○																
Trough Signal		StartSide 1	13/5	H,H1	○○	1,2	×	×	×		○	×	×		×	×	×		○	×	×			●	×			×	×			—						+
		StartSide 2	14/6	H,H2	◍○	5,2	×	×	×		×	○	×		×	×	×		×	○	×			×	●			×	×			+	+					+
																										○											
																											○										
		Stop Side 1	1/9	R,R1	○○	2,1	○	×	×		×	×	×		○	×	×		×	×	×			×	×			●	×			—						+
		Stop Side 2	2/10	R,R2	◍○	4,1	×	○	×		×	×	×		×	○	×		×	×	×			×	×			×	●			+	+					+
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Fig. 2-6-3

TELECOMMUNICATION FACILITIES

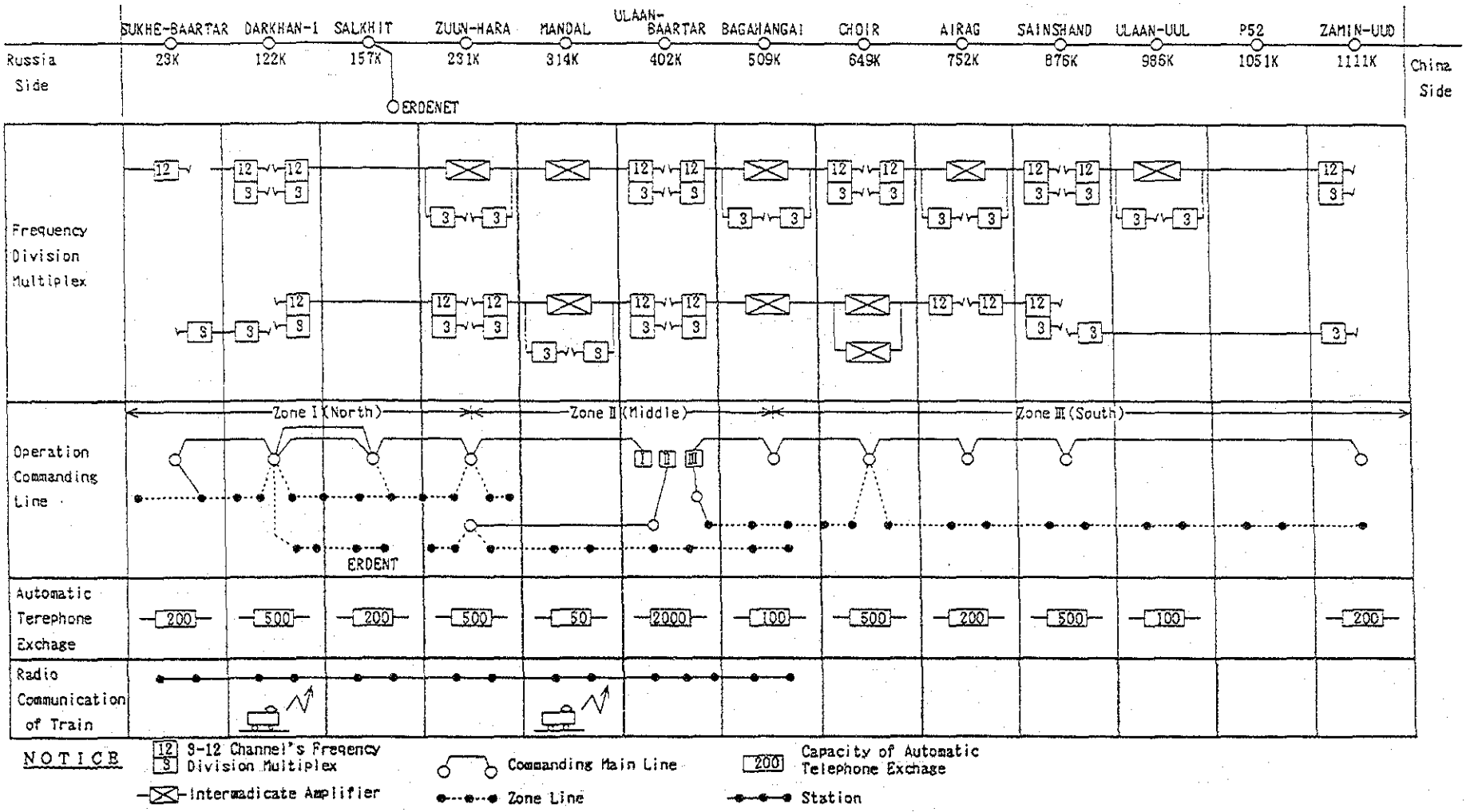
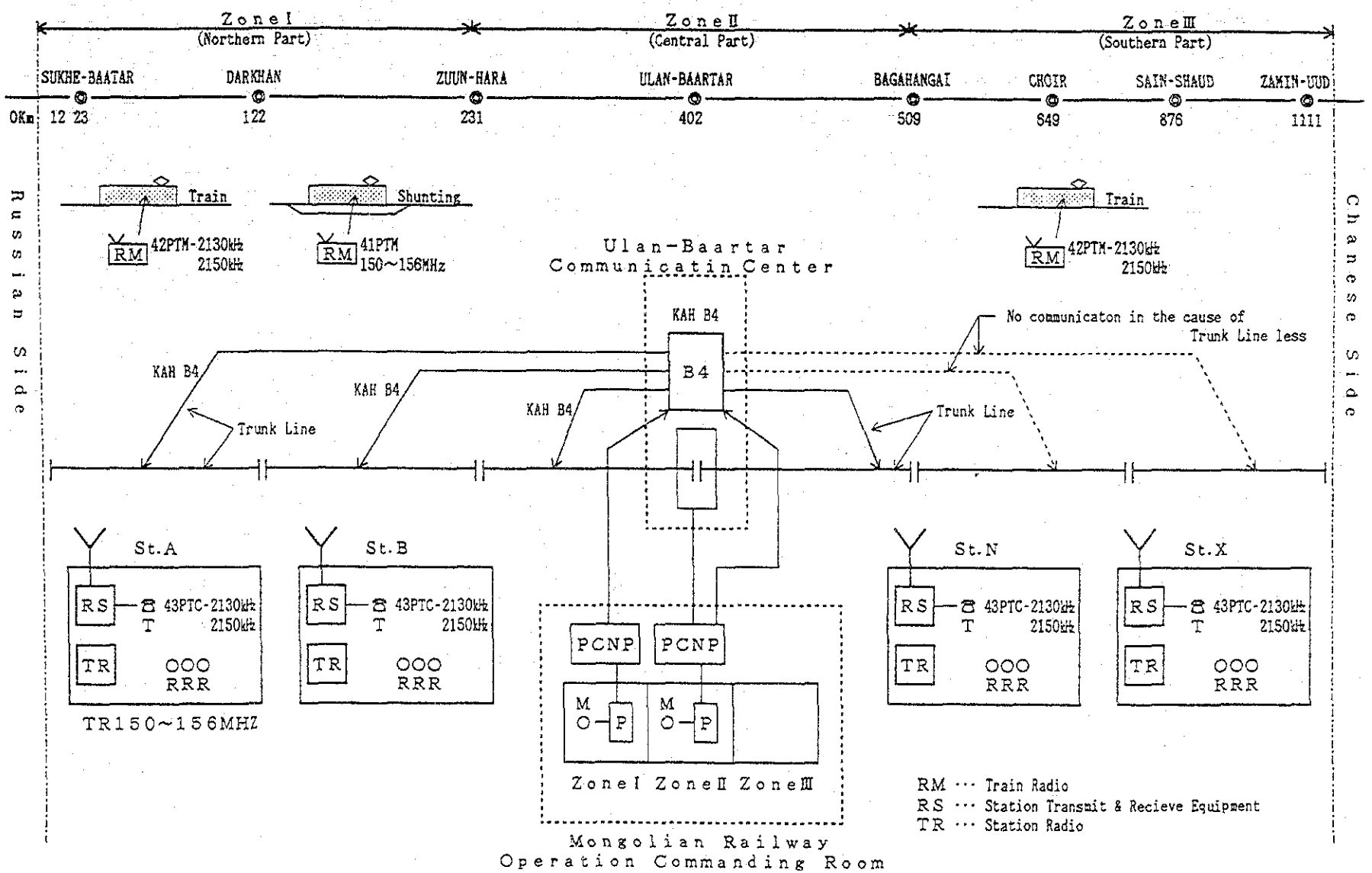


Fig. 2-6-4 Organization of Operation Commanding, Station, Train Communication Facilities



2-7 Natural Conditions at Zamyn-Uud Station

2-7-1 Topography and River Surveys

Zamyn-Uud Station is situated in the region known as the Gobi Desert (the East Gobi Plain) in the south of Mongolia. The area ranges from 900m to 1,000m above sea level. This undulating terrain gives differences in altitude of 5 ~ 15m, and occasionally 30 ~ 50m. The East Gobi Plain is characterized by the many large land depressions which hold water.

Against this plain topography, there is a very rocky plain area which rises slightly and has a muddy, uneven surface rising to 1100 ~ 1200m above sea level. Hillocks and land-rises with a height of 5 ~ 10m alternate with drainage basins.

There are no rivers in this region. A network of waterways is made up of dry river beds which become seasonally active, and the occasional small lake. Seasonal water flow, especially in heavy rain, is torrential and voluminous. The erosion basins of the seasonal water flow are formed in depressions from which there is no way for water to flow out. The water either stagnates in these depressions or evaporates.

The dark brown earth of the Gobi is distributed throughout this region. As a result of fine soil being transported by the wind, the surface of this earth is covered with gravel to a thickness of 2 ~ 3cm. The loam content in the soil is only 0.3 ~ 1%, but there is an abundance of mineral substances.

Vegetation in this region is scanty, covering a mere 20 ~ 30% of the desert surface.

2-7-2 Climate

The characteristics of Mongolia's climate derive from its great distance from seas or oceans. The climate of this region is continental, characterized by extremely dry air and a scarcity of atmospheric precipitation. The climatic characteristics are based on data from metrological stations in Ulan Bator and Sain Shaud.

The average annual temperature is +3.4°C. The coldest month is January, when the average temperature is -18.7°C. Normally it is between the latter part of March and the early part of April that the average daily temperature reaches 0°C. The average monthly temperature in April is 5.9°C, and the warmest month is July, when the average montly temperature reaches 23.1°C. The absolute maximum and minimum temperatures are 40.7°C and -37.2°C, respectively. The greatest variation in temperature in one day is usually in the autumn.

In terms of the amount of atmospheric precipitation, this region belongs to the low humidity zone. The region's average annual precipitation is 120 ~ 160mm. The distribution of precipitation throughout the year is rather uneven. The majority of it (more than 85%) is concentrated in the summer, while some of it falls in the short period of concentrated heavy rains in the autumn. Precipitation in winter is meagre, amounting to no more than 1 ~ 3% of the annual precipitation. Snow rarely settles, and the surface is never completely covered with snow. Normally, at the end of winter, snow only lingers in low-lying areas. The average snowfall over the ten days in winter when it is at its greatest in the year is 2 ~ 4cm. In this region winds blow constantly, mostly these are westerly or north-westerly winds.

Wind velocity varies, depending on the season. The annual average wind velocity is 4.9m/sec. The number of hours of wind in one day also varies with a maximum of 13 hours, but the wind dies down gradually as night falls. Apart from this, the greatest wind velocity is seen in spring (April, May) and in

autumn (September). At these times, the maximum annual wind velocity reaches 26 ~ 34m/sec. In spring particularly, the wind sometimes reaches storm proportions, producing sand and snowstorms.

The annual variation in absolute humidity parallels the annual variation in temperature. The maximum figure is 10 ~ 12.6mb, observed in July, while it reaches a minimum of 0.6 ~ 1.1mb in January. The maximum relative humidity reaches 60 ~ 72% in winter and 44 ~ 60% in summer. The minimum figure of 28 ~ 40% comes in April/May. The average annual relative humidity is between 43% and 56%.

Squall-like summer rainfall is sometimes accompanied by thunderstorms and hailstones. According to data from the metrological stations, the highest number of thunderstorms in one year is 26. Due to the severe, drawn-out winter and the fact that snow rarely settles, seasonal freezing of the earth goes down quite a considerable depth. The following data is taken as the standard for seasonal freezing of the earth in the region.

Clay, loam	2.08m
Red-brown loam, fine sand	2.54m
Coarse sand	3.04m
Gravelly soil	3.7m

The average magnitude of earthquakes is 6 bar.

2-7-3 Geological Composition

The geological composition of this region includes strata from the Mesozoic and Cenozoic periods.

Here, the Mesozoic/Cenozoic strata take the form of sedimentary rocks from the Cretaceous period. Various grades of sandy soil, sandy clay, clay-like shale, red clay, conglomerate rock, weathered formations of these (loam, clay), and others are distributed over a wide area in the region. The Quaternary period strata, in terms of evolutionary theory, are of aeolian formation. These strata comprise sandy soil which forms small hills and ranges as well as the ground surface but are not normally grass covered. The thickness of this sandy soil stratum is in the range of 0.5 ~ 2.5m.

2-7-4 Natural Geological Phenomena

This region lends itself to geological engineering. That is to say, there is a complete lack of natural geographical phenomena in this region which could have an adverse effect on the strength of the facilities. The special characteristics of this region are that its soil has a high salt content and that liquefaction of sandy soil occurs. Conditions for the accumulation of salinity are produced by the fact that there is intense evaporation under continental climatic conditions and because there is no way for water to flow out of this region. Temporary drainage into land depressions captures all liquescent salinity together with fine-particle soil, so that upon evaporation the salinity is concentrated in the residue. This saline soil is desiccated to an extremely high density, and the salinity has the effect of binding it together. When humidity rises, the soil loses this composition and changes to a fluid state.

The soil in the vicinity of Zamyn-Uud Station contains more than 1% water-soluble salinity. This soil can be used as material for building up the track bed. Aeolian sand is affected by wind-weathering. While the railway was in operation, sand used to be drift-blown onto the tracks and station facilities. In the process of the project, it is vital that protective countermeasures are devised against this drift-blown sand.

2-7-5 Hydro-geological Conditions

The sedimentary Mesozoic/Cenozoic sedimentary strata located in this region have an extremely low hydrosity. Hydrous horizontallying soil of any practical value lies scattered sporadically at a depth of 70 ~ 80m. This stratum corresponds to a thin intermediate stratum with hardly any fractures in the thick mixed-clay stratum. In terms of its chemical composition, this subterranean water is sodium chloride water, which overall has a fairly high mineralizing effect (M, less than 3000mg/l) and hardness (less than 14mg.eqv/l). According to data from the excavation of the Zamyn-Uud Station well, as the well goes deeper the mineralizing and hardening effect on the water increases. The rate of emission per unit hour of wells bored in hydrous sandstone is 0.88 ~ 2.7m^3/hr, varying according to the degree of fracture and the thickness of the hydrous soil. The hydraulic pressure of the subterranean water is extremely weak, and the static water level in the working well at Zamyn-Uud Station is at a depth of 52.0 ~ 58.0m.

2-7-6 Construction Materials

In this region, there is an abundance of different grades of sand (from powdery to gravelly). This sand, with its low water content and roughly intermediate density, can be used for making the track bed and preparing land for construction sites.

There is no ballast material in this region. We recommend that railway track ballast is transported in from other regions.

When the UlaanBaatar railway was constructed, rubble was quarried for use in making gravel. Although there is no clay in the region of Zamyn-Uud Station, these materials can be obtained in the vicinity of Ulan-Uul Station, which is located immediately to the northwest.

2-8 Status of Major Freight Handling Stations

2-8-1 Freight Handling Work

Mongolian Railway has 40 freight handling stations as shown in Figure 2-8-1. They include loading stations such as Sharyngol and Baganuur for coal, Erdenet for copper concentrate and Borondor for fluorspar. Table 2-8-1 gives the situation of freight handling work at major freight stations. Similar handling work is conducted at different stations for the same categories of freight. The handling work of each category of freight is as follows.

(1) General Freight (foodstuff, clothes and consumer commodities)

At Darkhan and Erdenet stations, the unloading time is three to five hours per car by the manual work of three workers (a freight clerk and two unloaders). Ulaanbaatar unloads 70% of the freight manually and 30% by forklift in about 1.5 hours.

The loading time for a 5-ton truck is about thirty minutes by manual work and about fifteen minutes when a forklift is used.

(2) Containers (foodstuff, clothes, furniture, house-moving goods and consumer commodities)

1) Freight handling equipment
   a) Darkhan : A 10-ton crane
   b) Ulaanbaatar : A 20-ton crane, a 12-ton crane and a 10-ton crane
   c) Erdenet : A 10-ton crane
2) Number of workers and unloading time

   The unloading work is carried out by 4 to 9 workers (one to three freight clerks, two to four slingers and one to two crane operators). A 10-ton crane requires 15 to 40 minutes to unload a car.

(3) Heavy Freight

1) Freight handling equipment
   a) Darkhan and Erdenet use the cranes used for container handling.
   b) Ulaanbaatar uses a 12-ton crane.
2) Number of workers and unloading time

   Ulaanbaatar employs five workers (a freight clerk, three slingers and a crane operator).

   The unloading time per car is 30 to 40 minutes at every station.

(4) Woods

1) Freight handling equipment

   Ulaanbaatar has a 10-ton crane and two 30-ton cranes.
2) Number of workers and unloading time

   The unloading time per car is about 45 minutes by five workers (a freight clerk and three slingers and a crane operator).

(5) Coal

1) Freight handling equipment

Shovel cars are used at Sukhebaatar, Darkhan and Ulaanbaatar. Ulaanbaatar's unloading lines are elevated to facilitate the unloading work.

2) Number of workers and unloading time

Six to nine workers (a freight clerk, 4 to 8 unloaders and a shovel car operator) are engaged in the unloading work. The loading time differs to a large extent in summer and winter. This is because coal freezes in winter to make unloading difficult. The unloading time for a 60- to 65-ton car is given below.

* Summer : About 10 minutes
* Winter : About 120 minutes

Coal is transported by wagons of special structure in which the floor can open downward on both sides.

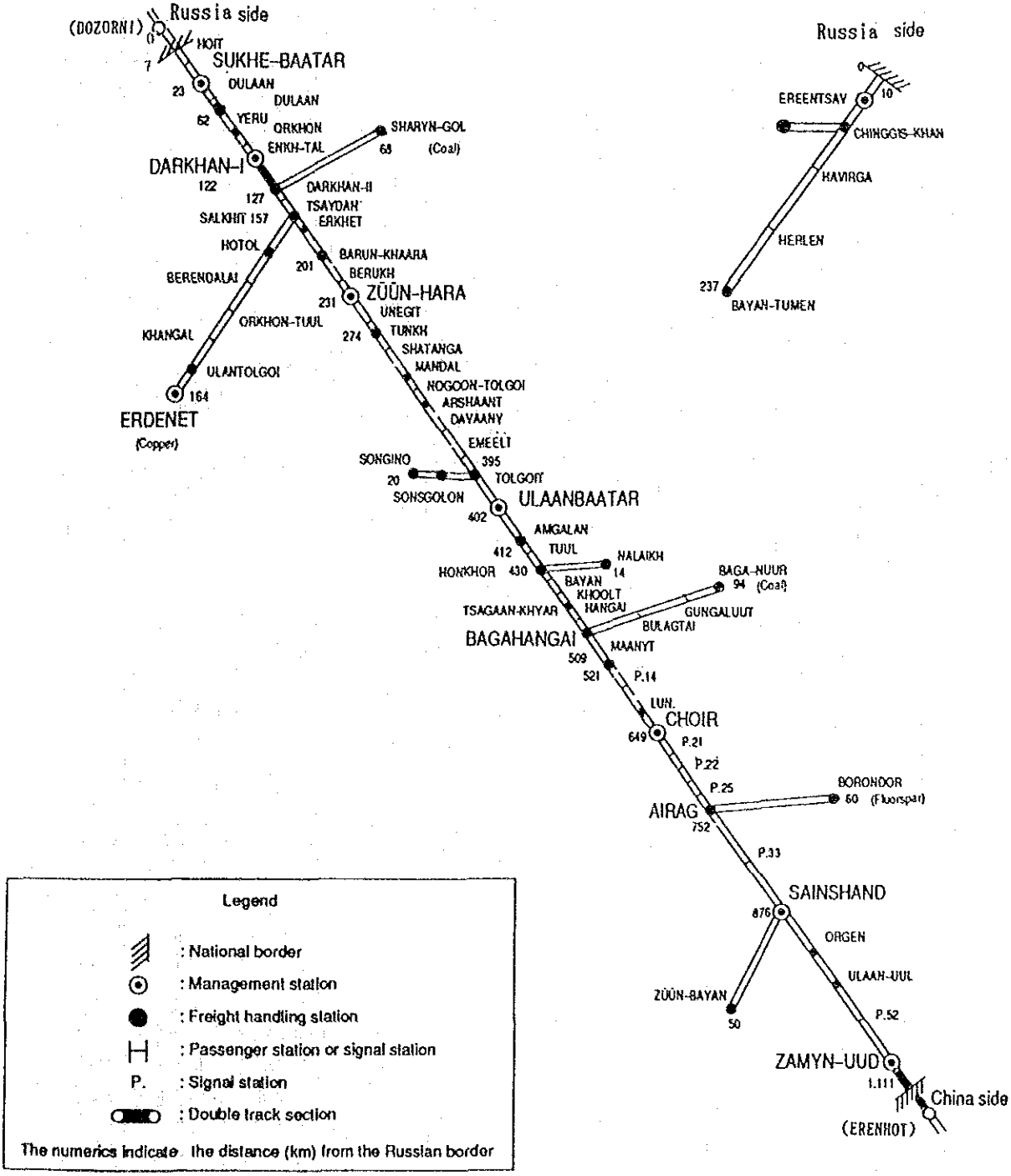


Fig. 2-8-1 **Layout of Stations and Signal Stations**

Table 2-8-1 Present Situation of Loading and Unloading Work at Main Stations

Station / Item	Sukhe-Baatar	Darkhan	Ulaan-Baatar	Erdenet
General freight	—	(1) 3 persons (Manual work): Freight clerk 1, unloading workers 2. (2) 3 ~ 5 hours/wagon (3) 30 minutes/car by 2 persons.	(1) 9 persons (Manual work 70%, forklift 30%): Freight clerks 3, unloading workers 6. (2) Manual work: 90 minutes/wagon (3) Manual work: 30 minutes/car Forklift: 15 minutes/car (4) Two 2.5ton forklifts.	(1) 3 persons (Manual work): Freight clerk 1, unloading workers 2. (2) 3 ~ 5 hours/wagon (3) 30 minutes/car by 2 persons.
Container	—	(1) 5 persons (including persons for weight freight): Freight clerk 1, slinging workers 3, crane operator 1 (2) 20 ft: 20~30 minutes/wagon 3 or 5ton: 25~30 minutes/wagon (3) 3 or 5ton container, 3 minutes/car (4) One 10ton crane	(1) 9 persons: Freight clerks 3, slinging workers 4, crane operator 2. (2) 20ft: 15~20 minutes/wagon 3 or 5ton: 30 minutes/wagon (3) 3 minutes/car (4) One 10ton crane, one 12ton crane, one 20ton crane.	(1) 4 persons (including persons for weight freight): Freight clerk 1, slinging workers 2, crane operator 1. (2) 3 or 5ton: 30~40 minutes/wagon (3) 3~5 minutes/car (4) One 10ton crane
Weighty freight	—	(1) Same persons as those for containers: (Freight clerk 1, slinging workers 3, crane operator 1) (2) 30~40 minutes/wagon (3) 3~5 minutes/car (4) (One 10ton crane)	(1) 5 persons: Freight clerks 1, slinging workers 3, crane operator 1. (2) 30 minutes/wagon. (3) 15 minutes/wagon. (4) One 12.5ton crane.	(1) Same persons as those for containers: (Freight clerk 1, slinging workers 2, crane operator 1.) (2) 30~40 minutes/wagon (3) 3~5 minutes/car (4) (One 10ton crane.)
Wood	—	—	(1) 5 persons: Freight clerks 1, slinging workers 3, crane operator 1. (2) 45 minutes/wagon. (3) 90 minutes/car. (4) Two 30ton cranes, one 10ton crane.	—
Coal	(1) 6 persons: Freight clerk 1, unloading workers 4, shovel car operator 1. (2) 10 minutes/wagon in summer, 120 minutes/wagon in winter (November~March) (3) 10 minutes/car by power shovel (4) 1 power shovel with a bucket capacity of 1.4 m^3	(1) 8 persons: Freight clerk 1, unloading workers 6, shovelcar operator 1 (2) 10 minutes/wagon in summer 120 minutes/wagon in winter (November~March) (3) 5 minutes/car by power shovel (4) 1 power shovel (unrotatable) with a bucket capacity of 1.4m^3	(1) 10 persons: Freight clerks 1, unloading workers 8, shovel car operator 1. (2) 10 minutes/wagon in summer 120 minutes/wagon in winter (November~March) (3) 3~5 minutes/car power shovel (4) 3 power shovel, 2 bulldozers, 1 excavator.	—

Note1: Based on Mongolian Railways materials.
Note 2: (1) Number of persons assigned. (2) TTime required for unloading.
(3) Time required for loading (5ton trucks).
(4) Machines owned.

2-8-2 Cargo Handling Equipment Including Cranes and Forklift Now Used by the Mongolian Railway

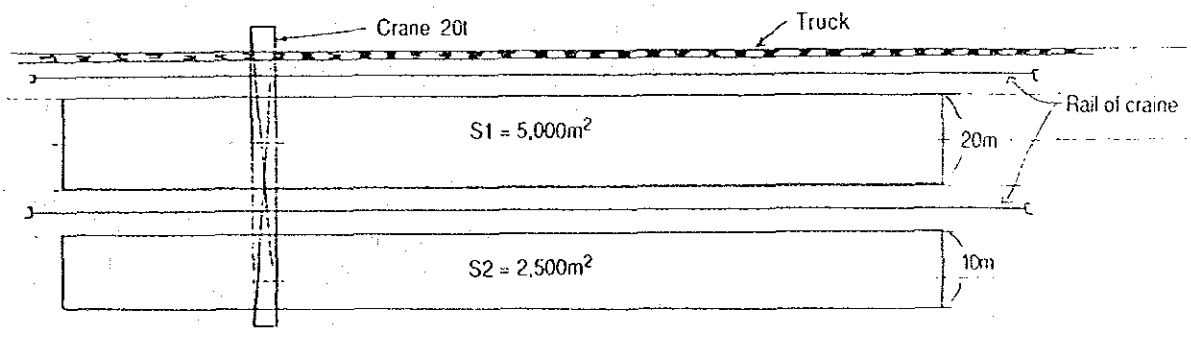
The UBRW Subsidiary Terminal Loading and Unloading Functioning

Name of terminal	Container		Coal		Small deliveries		Heavy cargo		Timber and wood material	
	①loading unloading	②transpor-tation	①	②	①	②	①	②	①	②
Ulaanbaatar	+	+	+	+	+	+	+	+	+	–
Darkhan	+	–	+	–	+	–	+	–	–	–
Sukhbaatar	–	–	+	–	–	–	–	–	–	–
Erdenet	+	–	–	–	+	–	+	–	–	–
Baganuur	+	–	–	–	+	–	+	–	–	–
Choir	+	–	–	–	–	–	+	–	–	–

+ – Transportation by UBRW

– – Transportation by receiver

(1) Ulaanbaatar Container Terminal

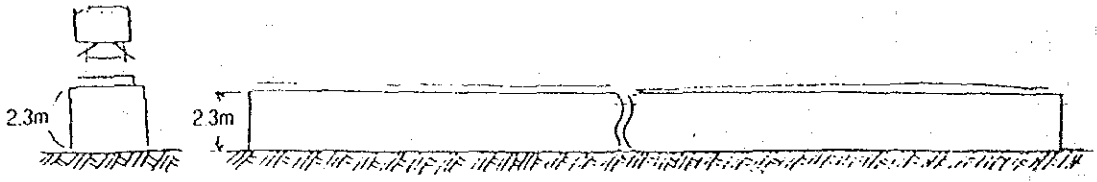


Equipment Being Used and Their Capacity

Name	Model	Quantity	Capacity per equipment	Capacity per year
Clane	KK-20	1	20t	70,000t
Trucks	MA3-504	2	20t	

1) Coal (Ulaanbaatar)

Length Truck I: 22 cars
" II: 14 cars



Coal Loading/Unloading Equipment

Name	Model	Quantity	Capacity per year
Power shovel		2	400t
Shovelloader		6	350t
Bulldozer		3	–
Truck		40	110t

2) Deliveries Facilities

Name	Quantity	Area (m^2)	Number of cars per loading unloading	Capacity per year
Closed warehouse	1	700	3	
Roofed warehouse	1	700	4	
Diesel forklift	2	–	–	16
	1	1,000	3	
Open area	1	1,000	1	
Hand handling	–	–	–	
Reloading parallel truck		–	11	

3) Heavy Cargo's Area

Facilities and equipment	Quantities	Dimensions	Capacity	Number of cars plased during one loading	Capacity per year
Area	1	4,000m^2	–	14	
Crane	1	–	10t	14	20,000t

4) Timber and Wooden Materials

Name of facilities	Dimensions capacity	Number of cars plased per shipment	Capacity per year
1st area	4,600m^2	12 cars	
Crane	10t	–	18,000t
2nd area	6,400m^2	14 cars	
Crane	30t	–	32,000t

Loading/unloading of timber and wooden materials executed on two areas equipped with 1 crane each.

(2) Darkhan Container Yard – Heavy Cargo –

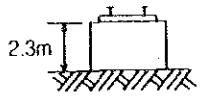
Area: 20m × 120m = 2,400m^2 Crane capacity: 10 tons

Containers and heavy cargoes handled on same area due to small volume of work.
If we use the area based on the capacity of simultaneous placement of cars it can be handled 62,000 tons of cargo.

Existing crane was installed in 1975, thus exploitation period is expiring.

1) Coal

Number of cars placed per 100 meters.
Simultaneously is 7 cars.
Loading traction – 1.
High of tracks – 2.3m



Capacity: 220,000 ton (220 thousand tons) per year.

2) Small Deliveries

Name	Quantity	Area	Number of cars placed simultaneously	Capacity per year
Closed warehouse	1	800m^2	2	–
Roofed warehouse	1	480m^2	2	–
Open area	1	480m^2	1	–
Hand handling	–	–	–	12,000 t

(3) Sukhebaatar – Coal –

Name	Quantity	Length or number of cars placed simultaneously	Capacity per year
Tracks with heightened cargo platform	1	7	
Loading tractor	1	–	45,000 t

(4) Erdenet – Container, Heavy Cargo

Due to Crane's Capacity of 10 tons and small volume of work, small containers of 3.5 tons and heavy cargoes are handled on the same area of 4,000m^2.

Warehouse area: 600m^2
Roofed storage area: 600m^2
Number of cars placed simultaneously: 4 cars

(5) Baganuur

1) Container, Heavy Cargo

Due to cranes capacity of 1.2 tons and small volume of work containers and heavy cargoes are handled on same area.

Size of area: 1,000m^2
Number of cars placed simultaneously: 5 cars

2) Small Deliveries
Warehouse area: 600m^2
Roofed storage area: 380m^2
Number of cars placed simultaneously: 3 cars

(6) Choir – Container and Heavy Cargo
Due to cranes capacity of 10 tons and small volumes of work containers and heavy cargoes are same area of 3,000m^2.

Capacities and Capacity Usage Level of UBRW's Cargo Handlings and Transportation Terms Subsidiary Units

Unit: 1,000 ton/year

Station	Function	Loading	Unloading	Transportation	Capacity	Current rate of capacity usage	
							(%)
Darkhan	Coal	100	110	–	220	120	54
	Container (3t,5t)	25	25	–	30	12	40
	Heavy cargo	6	6	–	12	1.2	10
	Small deliveries	31	31	–	62	12	20
Ulaanbaatar	Coal	430	430	100	960	800	83
	Container (3t,5t,20t)	82	82	21	185	70	37
	Timber	–	160	–	160	50	31
	Heavy cargo	35	35	–	70	20	28
	Small deliveries	51	51	13	115	10	10
Erdenet	Container (3t,5t)	25	25	–	50	5	10
	Heavy cargo	10	10	–	20	1	5
	Small deliveries	51	51	–	102	3	3
Baganuur	Container	25	25	–	50	4.5	9
	Heavy cargo	10	10	–	20	0.2	1
	Small deliveries	31	31	–	62	0	–
Choir	Container (3t,5t)	25	25	–	50	2.0	4
	Heavy cargo	10	10	–	20	2.0	4
Shukhbaatar	Coal	75	80	–	75	45	60
						1,157.0	

2-9 Status of Zamyn-Uud Station

2-9-1 Freight Transport a Zamyn-Uud Station

(1) Freight dispatched and received by the station

There are no industrial products in the Zamyn-Uud area, where only railway employees and their dependants live. In the station yard, a power generating plant is in operation. For these reasons, there is little freight dispatched from the station. The freight handled at the station is therefore mostly fuel, construction materials, foodstuff and consumer commodities that arrive at the station. The volume handled at the station increased from 14,000 tons in 1988 to 38,000 to 45,000 tons in 1990 and 1991. However, this increment was recorded largely by gravel. On an average, one to three freight cars are handled at the station in recent years.

Table 2-9-1 Freight Handled at Zamyn-Uud Station

No.	Item	1988			1989			1990			1991		
		(Ton)	Cars	Ton/car	(Ton)	Cars	Ton/car	(Ton)	Cars	Ton/car	(Ton)	Cars	Ton/car
1	Coal	2,765	43	64.3	3,826	59	64.9	2,902	45	64.5	3,164	48	65.9
2	Construction materials	3,337	53	63.0	9,199	146	63.0	10,568	189	55.9	6712	12	56.0
3	Railroad tie	390	9	43.3	375	8	46.9	150	3	50.0	300	9	50.0
4	Wood	1,658	33	50.2	1,023	21	48.7	700	14	50.0	1,175	24	49.0
5	Foodstuff	595	17	35.0	621	17	36.5	565	16	35.3	280	8	35.0
6	Iron scrap	211	4	52.8	784	16	49.0	304	6	50.7	350	7	50.0
7	Grass	12	1	12.0	12	1	12.0	12	1	12.0	33	3	11.0
8	Gravel	2,142	33	65.0	1,340	21	63.8	21,701	344	63.1	23,853	379	83.0
9	Line	130	7	18.6	–	–	–	–	–	–	60	3	20.0
10	Fuel (woods, oil)	1,728	38	45.5	439	10	43.9	50	1	50.0	215	5	43.0
11	Fragile article	79	2	39.5	143	14	35.8	89	2	44.5	80	2	40.0
12	Part of machines	328	16	20.5	128	11	19.8	115	3	38.3	152	4	38.0
13	Furniture	20	1	20.0	17	1	17.0	–	–	–	70	5	14.0
14	Diesel oil	61	1	61.0	568	10	56.8	678	12	58.5	58	1	58.0
15	Others	741	31	23.9	5,340	223	23.9	7,399	308	24.0	7,054	301	23.4
16	Total	14,197	289	49.0	23,905	548	44.0	45,236	944	48.0	35,518	808	46.0
17	Daily average	38.9	0.8		64.5	1.5		123.9	2.6		102.8	2.2	

Note 1: Based on Mongolian Railway's materials.

Note 2: Arrival traffic accounts for most of the freight handled by this station, and outgoing traffic is almost nil.

(2) Freight in Transit at Zamyn-Uud Station

Tables 2-9-2 and 2-9-3 give the categories and volumes of major international freight that was transported through the station.

From 1985 through 1989, the transit freight between Russia and China occupied 95% of the total volume of freight that passed the station. After that, the volume of transit freight substantially decreased to 14% in export and 4% in import from the level in 1985.

On the other hand, the volume of freight transported between Mongolia and China originating or terminating in Mongolia is steadily increasing, though the volume itself is not yet large. Compared with 1985, 1991 recovered a 303% level in export, mostly by fertilizer and copper concentrate, and a 788% level in import, mostly by cereals and fruits.

(3) Organization of Station

1) Organization and employees

Zamyn-Uud station consists of eleven divisions for train operation, rolling stock maintenance, power generating, track maintenance, signal maintenance, hospital, fire prevention and other business purposes.

Ninety-two employees belong to the train operation division of the station headed by a station master. There are three deputy station masters who assist the station master in the fields of train operation, freight transport and passenger transport. Zamyn-Uud station features the following.

i) Customs clearance procedures as a border station.
ii) Stationing staff at the Chinese border station of Erenhot to witness the freight transshipment.
iii) Locally operated points in the yard.

The station employs a worker who is in charge of customs clearance documents, eight interpreters and 36 freight clerks. Eleven employees (two interpreters and nine freight clerks) are dispatched to Erenhot. There are two freight clerks for containers, two for heavy goods, two for fragile goods (bottles and others) and two for general cargos, all working under a section chief. Points are switched by points men assigned at the site.

Table 2-9-2 Transport Volume of International Freight at Zamyn-Uud Station

	Ote.	1985		1986		1987		1988		1989		1990		1991	
		1000 ton	Cars	1000 ton	Cars	1000 ton	Cars	1000 ton	Cars	1000 ton	Cars	1000 ton	Cars	1000 ton	Cars
EX	Foodstuff	–	–	–	–	–	–	1.2	31	–	–	–	–	–	–
	Grain	–	–	–	–	–	–	–	–	–	–	–	–	4.4	88
	Grape	–	–	–	–	–	–	–	–	–	–	–	–	0.6	11
	Chemical Materials	–	–	–	–	–	–	5.6	124	5.0	111	24.1	536	2.2	59
	Wood	36.7	816	16.8	373	17.9	398	22.6	502	31.4	698	35.5	791	51.4	1,142
	Raw Materials	0.5	12	0.4	11	0.4	10	1.8	53	1.1	32	0.7	21	–	–
	Scrap	5.8	232	4.9	196	3.4	136	–	–	–	–	–	–	–	–
	Construction Materials	–	–	–	–	9.5	153	–	–	–	–	2.9	47	–	–
	Iron	–	–	–	–	–	–	4.5	69	6.0	92	5.9	95	12.2	407
	Metal	–	–	–	–	–	–	–	–	–	–	–	–	1.5	23
	Leather	–	–	–	–	–	–	–	–	–	–	–	–	0.3	10
	Fertilizer	–	–	–	–	–	–	–	–	–	–	–	–	35.8	551
	Copper Concentrate	–	–	–	–	–	–	–	–	–	–	–	–	20.1	309
	Others	4.0	91	3.8	85	2.4	55	6.6	150	6.8	131	25.1	483	13.8	315
	Total Ratio (%)	47.0	1,151	25.9	665	33.6	752	42.3	929	50.3	1,064	94.2	1,973	142.3	2,915
	Passing freight Ratio (%)	1,032.6	25,496	1,348.9	33,306	1,129.3	27,884	914.4	22,578	877.6	21,669	575.8	14,711	149.1	3,681
		100		127		108		89		85		56		14	
	Total Ratio (%)	1,079.6	26,647	1,374.8	33,971	1,162.9	28,636	956.7	23,507	927.9	22,733	670.0	16,684	291.4	
		100		127		108		89		86		62		17	
IM	Fresh food	1.4	40	1.8	51	1.1	31	1.7	49	1.8	51	2.1	59	2.2	59
	Foodstuff	0.8	20	–	–	1.7	43	0.9	23	1.1	28	1.6	41	4.1	108
	Grain	–	–	–	–	–	–	–	–	–	–	–	–	23.4	468
	Grape	–	–	–	–	–	–	–	–	–	–	–	–	29.8	542
	Rice	1.6	29	2.0	2.0	2.0	36	1.9	34	–	–	0.8	14	4.4	79
	Machine	0.1	2	–	–	–	–	–	–	–	–	–	–	–	–
	Chemical Materials	1.3	31	15	1.5	0.7	17	0.6	13	0.5	11	1.6	36	2.1	56
	Construction Materials	–	–	–	–	1.3	21	1.0	16	1.4	23	0.3	5	3.1	50
	Iron	–	–	–	–	–	–	–	–	–	–	–	–	1.5	50
	Others	5.1	116	6.5	6.5	7.1	161	5.8	132	14.0	320	12.9	474	10.6	246
	Total Ratio (%)	10.3	238	11.8	273	13.9	309	11.9	267	18.8	433	19.8	629	81.2	1,658
		100		115		139		116		183		192		788	
	Passing freight Ratio (%)	441.3	7,318	453.7	7,524	419.9	6,964	377.1	6,254	390.689	6,478	402.6	6,677	19.7	325
		100		103		95		85				91		4	
	Total Ratio (%)	451.6	7,556	465.5	7,797	433.8	7,273	389.0	6,521	409.4	6,911	422.4	7,306	100.9	1,983
		100		103		96		86		91		93		22	

Note 1: Based on Mongolian Railway's materials.
Note 2: The ratio to 1985 (assumed as 100) is given.
Note 3: EX means export, while IM means import.

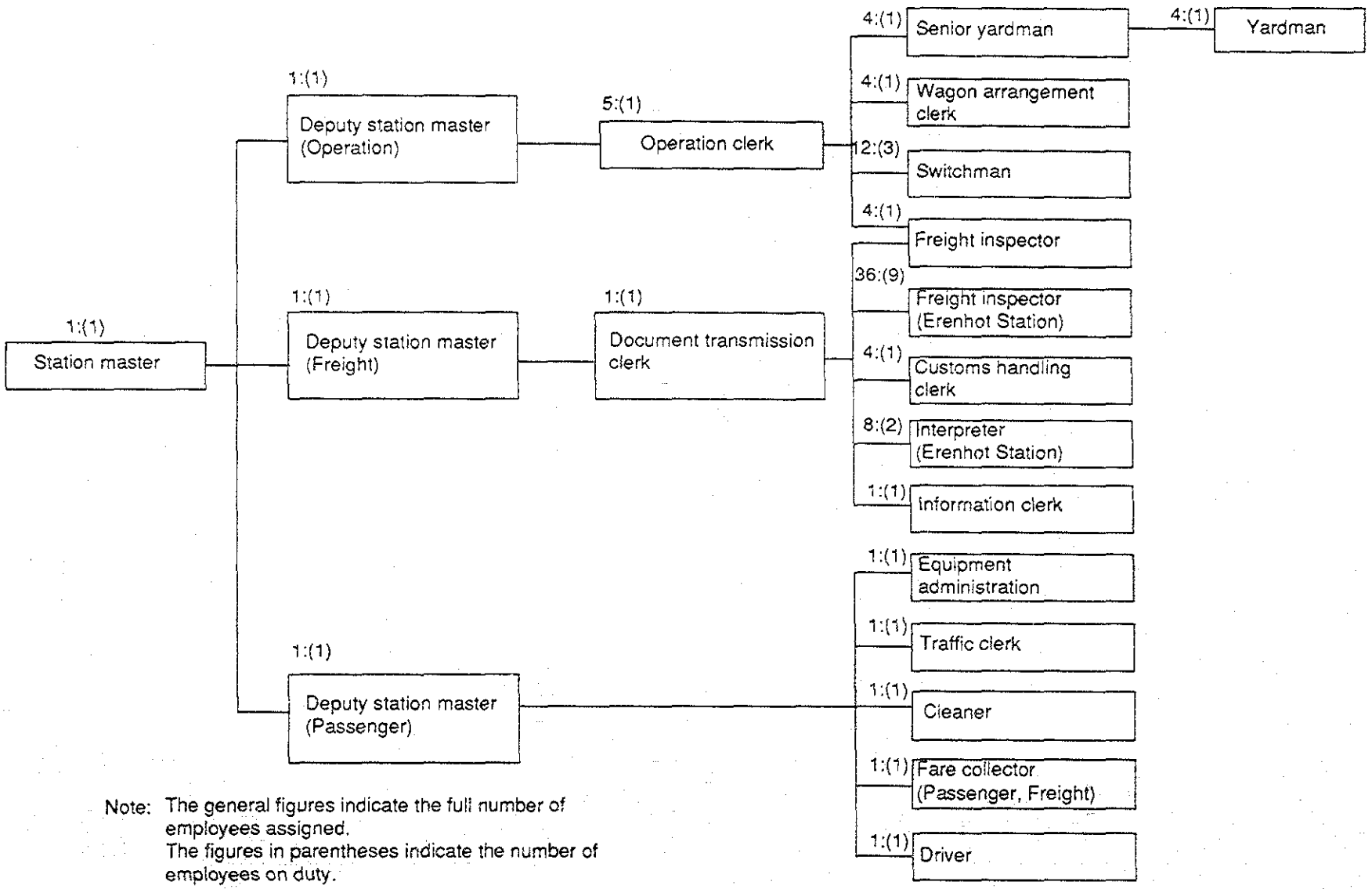
Table 2-9-3 Freight Transport Passing Mongolia

(1,000 tons)

		1985	1986	1987	1988	1989	1990	1991
Russia ↓ China	Wood	204.4	331.5	241.4	193.5	156.5	39.4	–
	Non-ferrous ore	33.4	45.2	45.6	43.4	52.0	17.3	8.8
	Chemical Materials	37.8	54.2	48.3	24.6	24.4	14.0	33.2
	Fertilizers	–	–	–	–	67.1	38.2	75.8
	Iron	556.3	709.3	769.5	615.0	54.7	433.3	10.9
	Cement	116.4	162.9	0.1	0.1	–	–	–
	Machine	9.0	10.1	2.9	2.1	–	18.8	–
	Others	75.3	38.7	21.5	35.7	28.9	575.8	20.4
	Total	1,032.6	1,348.9	1,129.3	914.4	877.6	575.8	149.1
	Growth rate	100	131	109	89	85	56	14
China ↓ Russia	Oil	–	9	–	–	0.3	–	–
	Construction Materials	–	–	–	–	1.4	–	–
	Fresh food	–	–	–	–	0.5	–	–
	Law Material	–	–	–	–	2.0	–	–
	Fluorspar	182.2	166.5	118.2	118.2	110.8	132.3	–
	Foodstuff	60.7	51.5	62.6	62.6	92.4	55.4	2.2
	Iron ore	0.1	0.2	6.6	6.6	9.9	8.3	–
	Chemical Material	49.8	37.4	44.6	44.6	75.3	52.6	2.7
	Iron	–	–	–	–	0.5	–	–
	Machine	–	–	–	–	–	2.7	–
	Fertilizer	–	–	–	–	–	–	0.9
	Tea	–	–	–	–	–	–	3.8
	Quarry	–	–	–	–	–	–	0.4
	Fruit, nuts	8.6	160	17.2	21.8	–	20.4	–
	Others	139.9	182.1	170.7	148.4	97.5	130.9	9.7
	Total	441.3	453.7	419.9	377.1	390.6	402.6	19.7
	Growth rate	100	103	95	85	89	91	4

Note 1: Based on Mongolian Railway's materials.

Note 2: The growth rate over 1985 (assumed as 100) is given.



Note: The general figures indicate the full number of employees assigned.
The figures in parentheses indicate the number of employees on duty.

Fig. 2-9-1 Organization Chart of Zamyn-Uud Station (Fiscal 1992)

2) Duty schedules

Except for the station master, deputy station masters and other workers in the daytime shift, employees are working in 4-, 8- and 12-hours shifts.

Table 2-9-4 Duty Schedules of Station Yard Personnel (Standard)

Day / Employee	1st	2nd	3rd	4th
	(8:00~20:00)	(20:00~0:00)	(0:00~8:00)	
A	12	4	8	–
B	4	8	–	12
C	8	–	12	4
D	–	12	4	8
Total	24	24	24	24

Note 1: Based on the Mongolian Railway's materials.

Note 2: The figures shown are working hours.

Figure 2-9-2 gives the duty schedules of the station yard personnel.

2-9-2 Track and Civil Structure

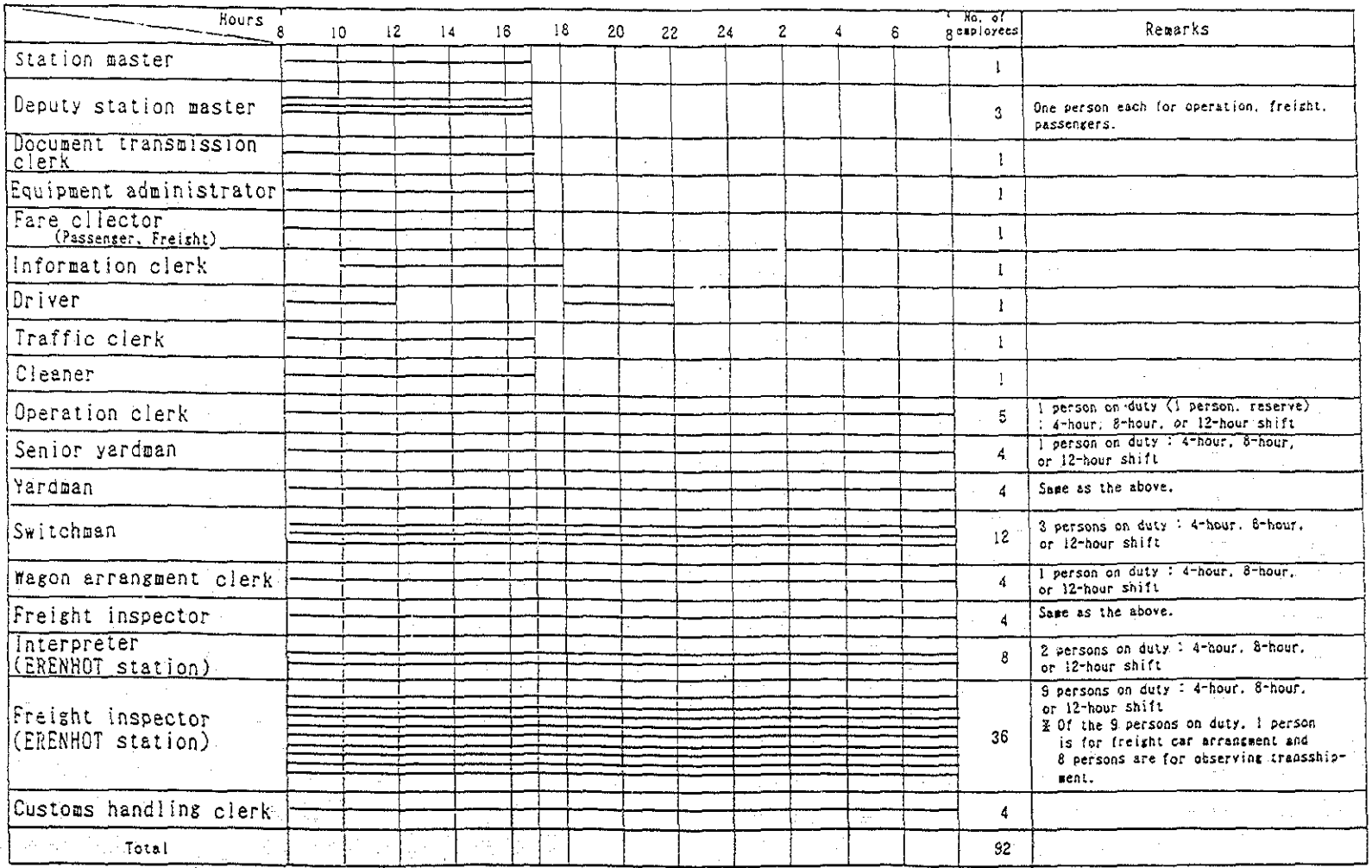
(1) Track

Zamyn-Uud station is located at the southern end of Mongolia, 4.5km from the border with China. Figure 2-9-1 shows the standard track section of the station and Table 2-9-5 lists major existing tracks.

Table 2-9-6 gives the 1,435mm gauge tracks constructed by the former Soviet Union, which are used for temporary petroleum transshipment facilities. Figure 2-9-2 shows the standard section of the track structure, P50 rails (51.5kg/m) and wooden sleepers. For the detail of track materials, see Chapter 4-3 "Track and Civil Structure." The 1,520mm gauge tracks generally require supplementary filling and tamping of ballasts.

Table 2-9-5 Existing 1,520mm Gauge Tracks

Purpose	Number of Track	Remarks
Main line track	1	
Departure/arrival line track	3	
Marshalling and storage line track	3	
Other side tracks		Draw-out, loco run-round and standing, maintenance Tentative
Petroleum loading	1	



	No. of employees	Remarks
Station master	1	
Deputy station master	3	One person each for operation, freight, passengers.
Document transmission clerk	1	
Equipment administrator	1	
Fare cllector (Passenger, Freight)	1	
Information clerk	1	
Driver	1	
Traffic clerk	1	
Cleaner	1	
Operation clerk	5	1 person on duty (1 person, reserve) : 4-hour, 8-hour, or 12-hour shift
Senior yardman	4	1 person on duty : 4-hour, 8-hour, or 12-hour shift
Yardman	4	Same as the above.
Switchman	12	3 persons on duty : 4-hour, 8-hour, or 12-hour shift
Wagon arrangment clerk	4	1 person on duty : 4-hour, 8-hour, or 12-hour shift
Freight inspector	4	Same as the above.
Interpreter (ERENHOT station)	8	2 persons on duty : 4-hour, 8-hour, or 12-hour shift
Freight inspector (ERENHOT station)	36	9 persons on duty : 4-hour, 8-hour, or 12-hour shift ※ Of the 9 persons on duty, 1 person is for freight car arrangment and 8 persons are for observing transshipment.
Customs handling clerk	4	
Total	92	

Note 1: Based on Mongolian Railway's materials.

Fig. 2-8-2 Duty Hours at ZAMYN-UUD Station (Fiscal 1992)

Table 2-9-6 Existing 1,435mm Gauge Tracks

Purpose	Number of Track	Remarks
Train operation between Zamyn-Uud and Erenhot	1	Single track
Departure/arrival track	4	Not completed
Loco run round for Petroleum loading	1	Tentative

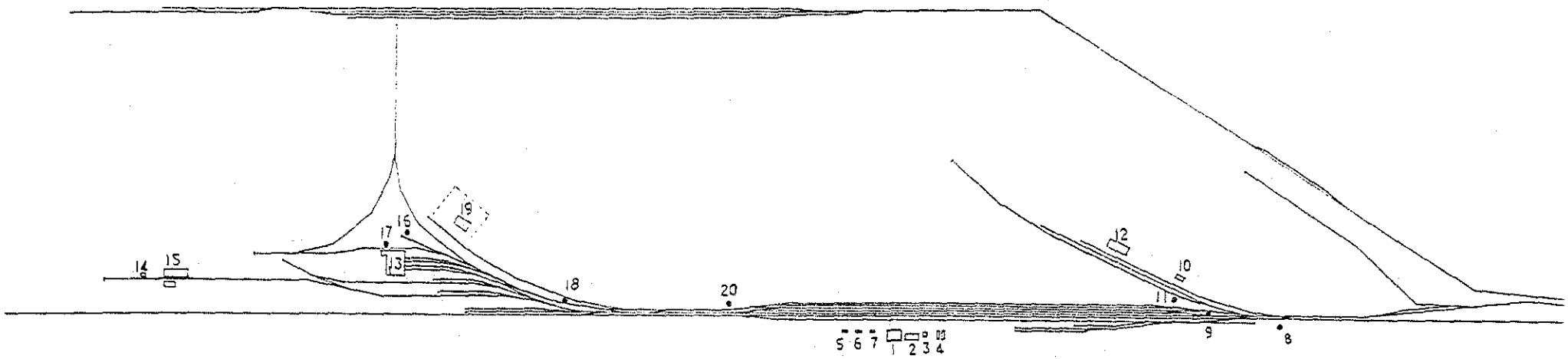
(2) Civil Structure

The track bed is made as a flat embankment made of soil with homogeneous properties, mainly sands of Gobi desert. Embankment has been completed for four departure and arrival tracks of 1,435mm gauge.

Construction of embankment is required at the transshipment site and other areas.

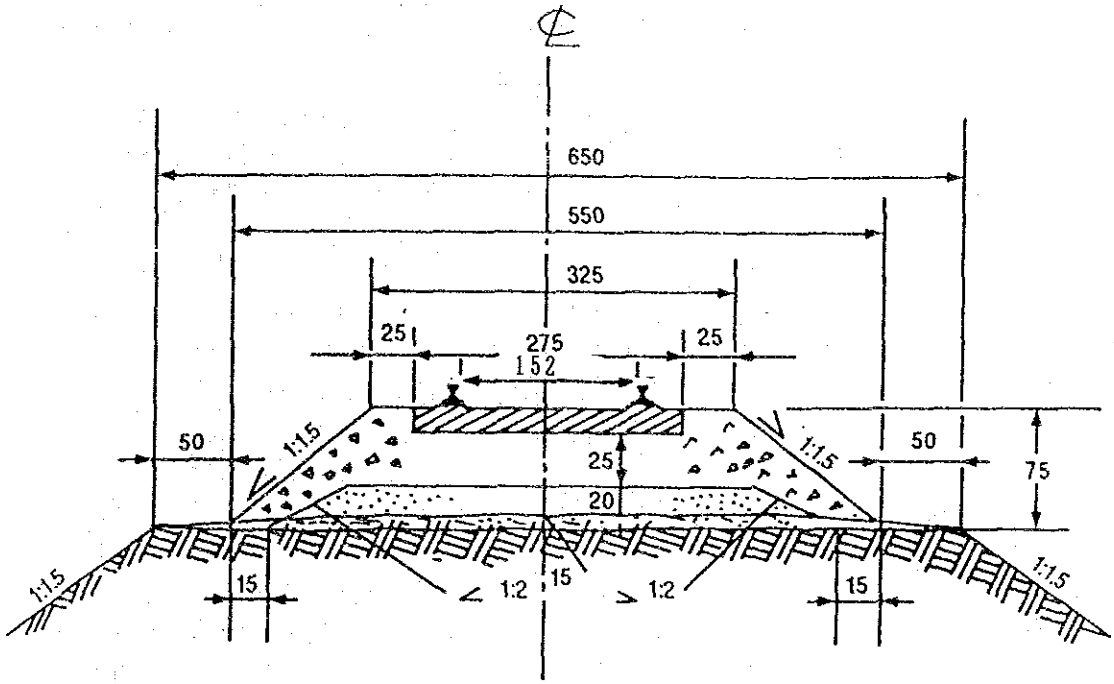
For the detail of the track bed structure, see Chapter 4-3 "Track and Civil Structure."

Fig. 2-9-3 Zamyn-uud station



Existing buildings

No	Name	Area (m^2)
1	Station main office	581
2	Customs office	276
3	Tower	69
4	Toilet	26
5	Customs warehouse	49
6	Baggage warehouse	93
7	Refrigerator room	5
8	Point operation center No.3	9
9	Point operation center No.1	9
10	Boiler room	122
11	Substation	18
12	Maintenance center	679
13	Locomotive shed	1,708
14	Oil storage house	23
15	Warehouse and roofed platform	750
16	Oil filling bridge	---
17	Diesel oil tank	---
18	Point operation center No.4	9
19	Power plant	437
20	Point operation	



unit : c m

Fig. 2-9-4 Standard track section
(1520^{mm})

(3) Architecture

Table 2-9-7 and Figure 2-9-1 show the existing architectures. Most of the existing facilities are deteriorated and require proper remodeling and repair.

Table 2-9-7

No.	Name	Area (m^2)	Material		Remarks
			Wall	Roof	
1	Passenger house	581	Brick	Iron plate	
2	Customs office	276	– do –	– do –	
3	Tower	69	– do –	– do –	
4	Toilet	26	– do –	– do –	
5	Customs warehouse	49	– do –	Slate	
6	Baggage warehouse	93	– do –	– do –	
7	Refrigerator room	5	– do –	– do –	
8	Point operation center No. 3	9	– do –	– do –	
9	Point operation center No. 1	7	– do –	– do –	
10	Boiler room	122	– do –	– do –	
11	Substation	18	– do –	Tar paper	
12	Maintenance center	679	– do –	Iron plate	
13	Locomotive shed	1,708	– do –	Concrete	Not used
14	Oil storage house	23	– do –	Tar paper	
15	Warehouse and roofed platform	750	– do –	– do –	
16	Oil filling bridge	—	—	—	
17	Diesel oil tank	—	Iron plate		Two tubs
18	Point operation center No. 4	9	Brick	Slate	
19	Power plant	437	– do –	Concrete	
20	Point operation center No. 2	9	– do –	Slate	

2-9-3 Signal, Telecommunication and Power Supply

(1) Signal

1) Signal equipment

For entry from Ulaanbaatar and Erenhot sides, Zamyn-Uud station is equipped with entry signals No. 1 and No. 2. The No. 1 signal has two aspects, while the No. 2 signal has four aspects with two signal units, in addition to a calling-on signal display. There are no departure signals. The entry signals are operated from the control board in the signal operation room of the station after the intended route has been composed. Figure 2-9-5 shows the signal book.

2) Interlocking System

The relay interlocking system is not adopted. The points are locked by the route locking lever at the station or the signal operating room after the locking lever and the route setting lever are set at the site signal operation center. Figure 2-9-6 shows the interlock diagram.

3) Block System

Trains are operated under the tablet block system between Zamyn-Uud and P52 signal station. Communication between the stations is made through telephone. The 1,435mm gauge track at the petroleum transshipment site is equipped with an entry signal and two departure signals. The track is protected by a semiautomatic relay block system, type 64, with 25-meter track circuits. The control board is accommodated in a house located to the side of the petroleum transshipment facilities. Distances between the stations are as follows.

Zamyn-Uud ~ P52 signal station : 65km
Zamyn-Uud ~ Erenhot : 9km

4) Points

Points are all hand-operated type with two keys for normal and reverse positions. Keys have registration numbers.

(2) Telecommunication

1) Wire Telecommunication

Telecommunication into the direction of Ulaanbaatar uses eight pairs of bare wires, of which two pairs are steel copper wires for 3-channels and 3- to 12-channel multiplex transmission and six pairs are steel wires for communications for different purposes. The station is connected with Erenhot with eight pairs of steel wires used for signaling, telephone and exchanging information on cargo movement.

There are two types of bare wire transmission equipment, B-12-3 for 3- to 12-channel and B-3-3 for 3-channel transmission. The section between Sukhe-Baatar and Sain-Shand is covered with two 12CH transmission systems, while the section between Sain-Shand and Zamyn-Uud has only one system of smaller capacity.

Multiplex transmission is not adopted between Zamyn-Uud and Erenhot. Zamyn-Uud telecommunication center is equipped with transmission equipment, an exchange stand, a step-by-step automatic exchange, alkali batteries and a cable room. The automatic exchange

manufactured in 1974 accommodates 200 lines. There are two sets of batteries, 2V × 12 pieces (24V) and 2V × 30 pieces (60V), with a capacity of 350VA. The operating currents are 10 to 20A for the 24V set and 5 to 10A for the 60V set.

2) Wireless Telecommunication

Wireless telecommunication is adopted between train locomotives and major stations in 2130 to 2150kHz. Wireless telecommunication is also in use between shunting locomotives and ground staff in 150 to 156MHz. Marshaling staff communicates with the point and signal operator in the operating center through a telephone at the nearest site signal operating center. Due to the shortage of line capacity, the train dispatcher can not communicate with locomotives in the section between Sain-Shand and Zamyn-Uud.

(3) Power

1) Powering equipment of Zamyn-Uud Station

Located near the border with China and 709km distant from Ulaanbaatar, the Zamyn-Uud district has no commercially available power source. For this reason, the station has a power generation plant in the compound equipped with diesel engine power generators, from which power is being supplied to the whole area. In case the power plant fails, a transmission line at 10kV connects Zamyn-Uud with Sain-Shand, 230km distant, to supply power to important facilities in the Zamyn-Uud district. Figure 2-9-7 shows the present electric power distribution system.

To implement cargo transshipment at Zamyn-Uud station, lighting equipment are required for the cargo handling work and shunting in the yard. This will bring about an increase in the load so that the capacities of generators, power distribution network, transformers and other electrical equipment must be reviewed.

2) Load

Table 2-9-8 gives the capacities and loads of major electrical equipment installed in the Zamyn-Uud district including the station.

Table 2-9-8 Capacity and Load of Equipment

Area	Category	Capacity of transformer (kVA)	Estimated load (kW)
In the town	Station	223	180
	Hospital, residence	400	180
	Boiler, telecommunication, residence	400	180
	Army	160	80
	Water pump	250	20
Outside the town	Facilities along the railway	1,074	100
Total		2,444	740

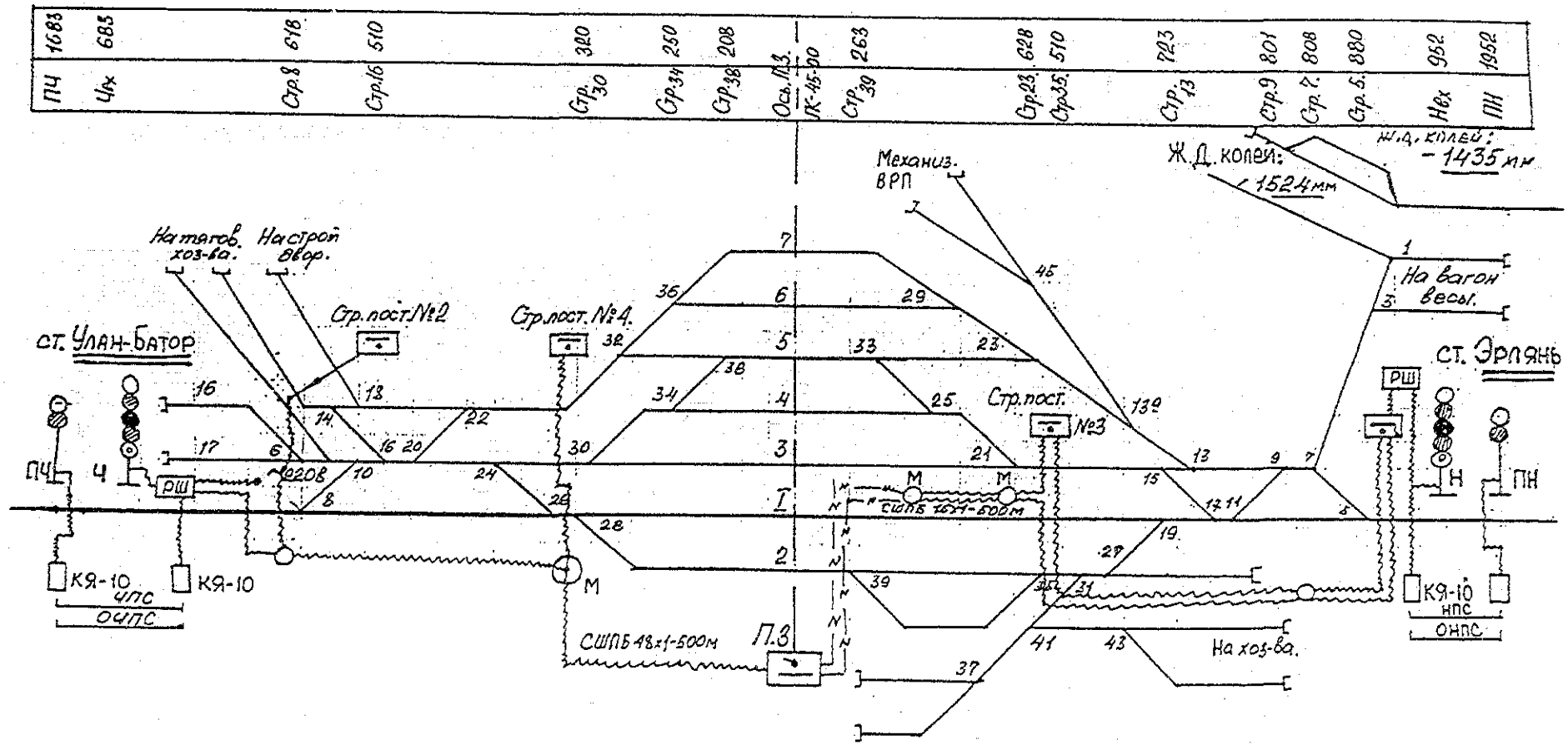
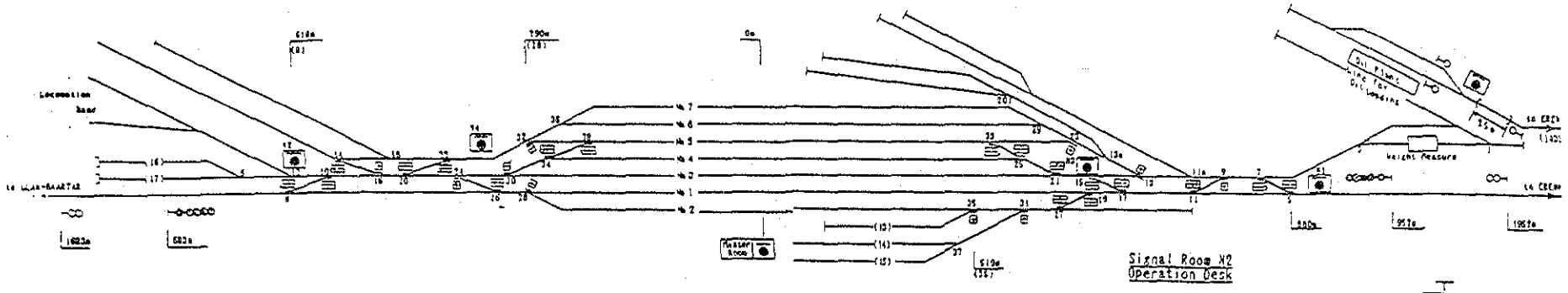
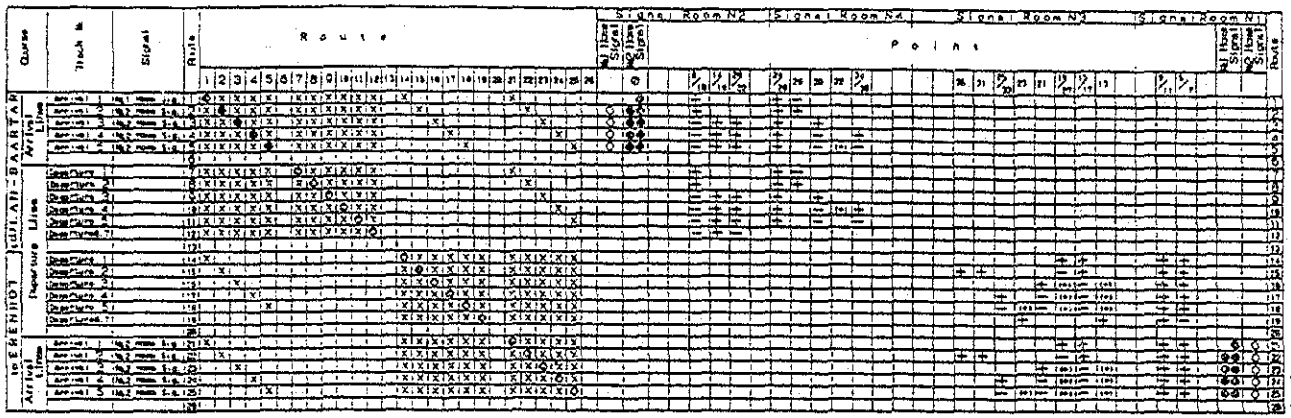


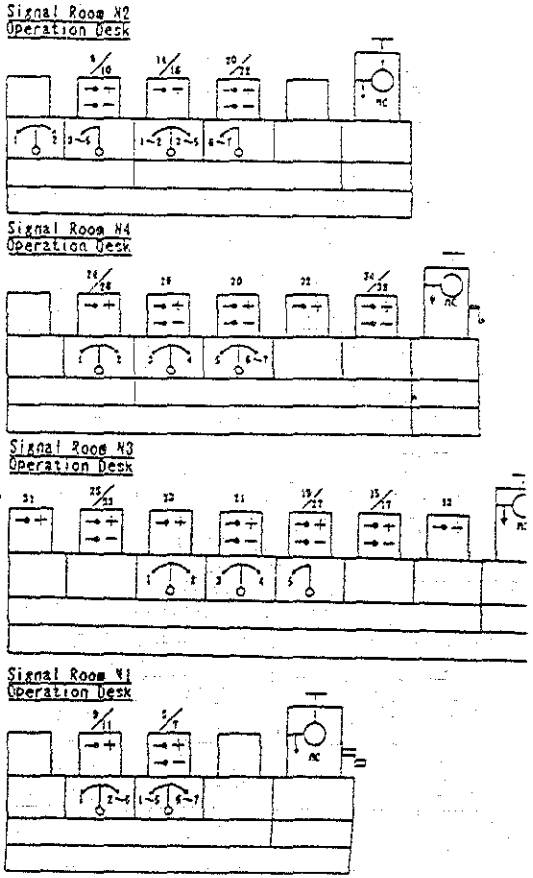
Fig. 2-9-5 Signal Book

Ст. Замын-Чад

Interlocking Facilities of ZAMIN-UUD Station







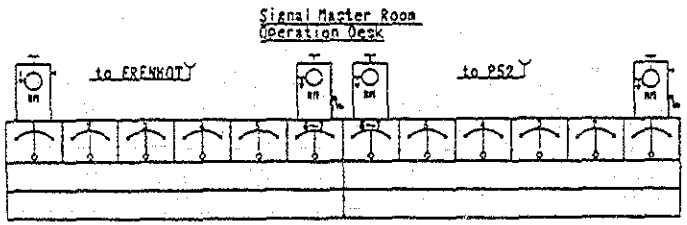


Fig. 2-9-6 Interlock diagram

3) Generator

Table 2-9-9 gives the generators installed at the power plant. Only the generator with the capacity of 800kW is in operation at present. Other two generators are defective.

Table 2-9-9 Generator

	Specification	Quantity
Diesel engine power generator	3-phase 400V 630kW	2
	3-phase 6kV 800kW	1

4) Transformer

Table 2-9-10 gives the step-up transformers to raise the voltage to 10kV for transmission from 400V or 6kV.

Table 2-9-10 Transformer

	Specification	Quantity
Oil-filled self-cooled transformer	3-phase 630kV 0.4/10kV	2
	3-phase 1,000kVA 6.0/10kV	1
	3-phase 250kVA 0.4/10kV	1

5) Distribution equipment

To supply power to the town, there are an overhead high voltage distribution line, 3-phase 10kV, and a standby line. Another transmission line connects the district with Sain-Shand. Hard aluminum wires, 70mm^2, are used for the distribution network. Low voltage power is supplied via 400V overhead distribution lines.

(1) Station circuit
(2) Station
(3) Wayside circuit
(4) Communication boiler, residence
(5) Hospital residence
(6) Pump
(7) Engine room
(8) Military

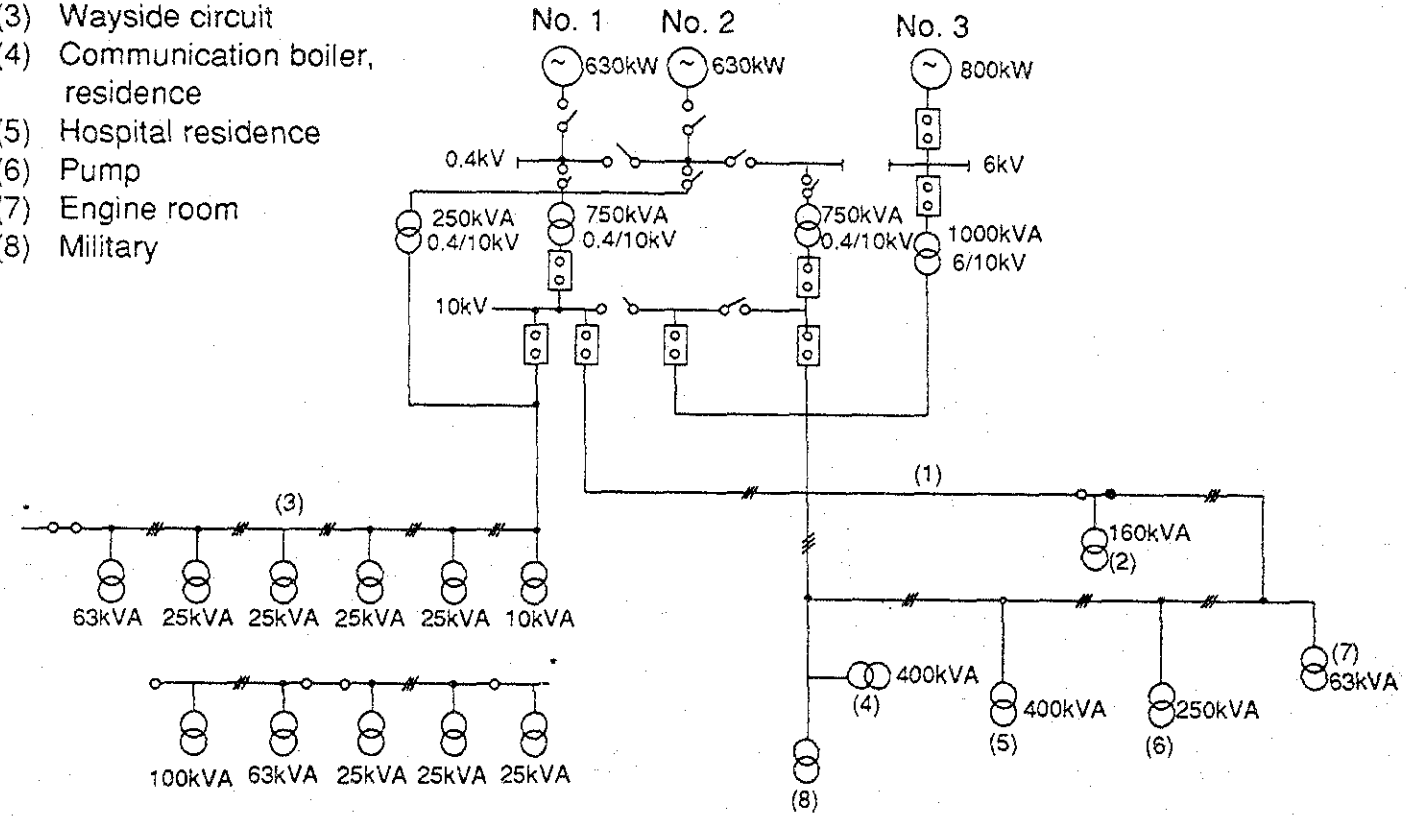


Fig. 2-9-7 Electric Power Distribution System (present)

2-9-4 Present State of Car Maintenance

(1) Maintenance Personnel

For maintenance of cars at Zamyn-Uud, presently 47 workers are working against the authorized number of 51.

The workers include those working only during the daytime and those working in shifts day and night. The workers working in day and night shifts include those working at Zamyn-Uud and those working at Erenhot in China. The working schedule is as follows:

Table 2-9-11 Working Schedule

Working personnel			No.	Mon. 1	Tue. 2	Wed. 3	Thu. 4	Fri. 5	Sat. 6	Sun. 7
Personnel working only during daytime			12	08:00~ 17:00 hrs.	08:00~ 17:00 hrs.	08:00~ 17:00 hrs.	08:00~ 17:00 hrs.	08:00~ 17:00 hrs.	08:00~ 14:00 hrs.	Holiday
Personnel working in shifts day and night	Working at Zamyn-Uud	A	6-7	08:00~ 20:00 hrs.	20:00~ 08:00 hrs.			08:00~ 20:00 hrs.	20:00~ 08:00 hrs.	
		B	6-7	20:00~ 08:00 hrs.			08:00~ 20:00 hrs.	20:00~ 08:00 hrs.		
		C	6-7		08:00~ 20:00 hrs.	20:00~ 08:00 hrs.			08:00~ 20:00 hrs.	20 hrs.
		D	6-7	8 hrs.		08:00~ 20:00 hrs.	20:00~ 08:00 hrs.			08:00~ 20:00 hrs.
	Working at Erenhot	A	2-3	08:00~ 20:00 hrs.	20:00~ 08:00 hrs.			08:00~ 20:00 hrs.	20:00~ 08:00 hrs.	
		B	2-3	20:00~ 08:00 hrs.			08:00~ 20:00 hrs.	20:00~ 08:00 hrs.		
		C	2-3		08:00~ 20:00 hrs.	20:00~ 08:00 hrs.			08:00~ 20:00 hrs.	20 hrs.
		D	2-3	8 hrs.		08:00~ 20:00 hrs.	20:00~ 08:00 hrs.			08:00~ 20:00 hrs.

Total : 47

Note 1. Workers working during the daytime have a noon recess of from 12:00 to 13:00 hours.
Note 2. The weekly working hours of the workers working in shifts day and night are average 40 hours.
Note 3. The workers assigned to Erenhot are changed at a cycle of 1 year.

(2) Details of Daytime Workers

Chief, 1; Foreman, 1; Car check/mechanical worker, 1; Welding foreman, 1; Welders, 3; Toilet/steam worker, 1; Boiler workers, 2; Electric worker, 1; Store keeper, 1.

(3) Car Inspection

At Zamyn-Uud, the car inspection is made in the inspection yard of a length of 310m and a width of 24m. The inspection yard has three inspection tracks laid. Having two units of movable inspection equipment provided, it is designed to inspect and repair 40 cars in 8 hours.

The works are mainly comprised of lubrication, welding and repairing.

2-10 Capacity for Construction Work and Relevant Laws

2-10-1 Present Status of the Construction Industry

In the days of the socialist regime, Mongolia tried to develop a planned economy along the lines of societies in the USSR and East Europe. But with the collapse of socialism, the fabric of this planned economy has also fallen apart with some speed. The collapse of this system has had repercussions on all fields of activity, the construction and operation of railways being no exception. That is to say, in the socialist era the construction and operation of the railways used to be carried out under the guidance of the Soviet Union, the work being divided such that rolling stock and rail materials were manufactured in East Europe and the USSR, repairs to rolling stock were undertaken by the latter, and operation/maintenance were jointly overseen by Mongolia and the USSR. Now that this system has collapsed, it is virtually impossible for all the stages from construction to operation and maintenance to be managed single-handedly by one country (i.e. Mongolia). It goes without saying that financial and technical support from abroad will be needed for the period until Mongolia can manage these operations independently.

Mongolia's construction industry has suffered a considerable set-back because of the collapse of the old system. Shortages of imported materials and financial aid mean that construction and repair works have either been postponed or stopped altogether. In Ulaanbaatar there are numerous examples of half-finished construction work for housing, factories, office buildings and the like. The state of road surfaces is deteriorating due to shortages or delays in imports of asphalt, and road surfacing work has been left unfinished. Only 10km has been completed so far this year, compared to 150km last year.

Since the majority of railway facilities were built in the 1940's and 50's, new lines constructed since then have largely involved small-scale freight shunting tracks. Although recently a freight transfer facility was under construction in Zamyn-Uud using Soviet technology, this work was halted before it could be finished.

2-10-2 Entities Undertaking Construction

Apart from Mongolia's state railway itself, there are no entities within the country which can undertake railway construction. Recently, road construction companies have occasionally been contracted to carry out civil engineering work including raising ground levels for the construction of freight shunting tracks, while track-laying work has been undertaken by the Mongolian National Railways. However, the capacity of the Mongolian National Railways as an undertaking entity is largely restricted to matters such as maintenance. Meanwhile, road works are currently being privatized, with a number of private companies already set up and operating. The history and present status of the road construction industry can be explained briefly as follows.

Before privatization, the road construction industry was just another state-owned organization, for example the government entity that went under the name of the Ulan Bator Road Trust. Two years ago this was split up into three construction concerns (Chandmani, Batzam, and Huch) and three maintenance divisions (government-controlled). However, at present they apparently receive no financial support from the government whatsoever. They are completely autonomous and independent. The situation is that road projects are planned and designed by the government (Roads Department), while construction is undertaken by these private sector companies and maintenance by the Roads Department. But road construction projects which require a high degree of technology are carried out directly from planning to construction by the Road Design Institute, which has the capacity to implement construction independently.

The private sector construction companies are scattered amongst the 18 provinces and three cities. There are six of these companies in Ulaanbaatar, but only one in most of the Provinces.

Meanwhile, although there used to be a strong Soviet influence on construction projects as well, with tree large Soviet construction companies active in Mongolia 2 ~ 3 years ago, today there is only one, a company called Sovinvest (3,000 employees). This company undertakes construction in a variety of fields (housing, factories, office buildings, roads, railways, and so on).

2-10-3 Procedures for the Execution of Construction Work

In the construction of new railway lines, the Ministry of Transport is sometimes involved at the planning stage, while, the Mongolian National Railways take care of track laying, and subsidiary civil engineering work is carried out by road construction companies. Although in these cases there is no special format for contracting civil engineering work, selection is made on the basis of the construction capacity (manpower, construction equipment/machinery, experience) of the construction companies, which are invited to submit price proposals. The final decision is then subject to negotiation.

2-10-4 Ability to Carry Out Work

It would be correct to say that Mongolia's ability to carry out work independently is "almost non-existent", in terms of the execution of large-scale projects under the new regime. For the time being the country is obliged to rely on foreign technology, construction materials, and machinery. The present situation can be given under the following headings.

(1) Manpower

In relation to its size (four times that of Japan), Mongolia's population of 2 million is small (compared to Japan's 120 million). But in spite of this there is apparently a high rate of unemployment. Nevertheless, when it comes to securing skilled labour, expectations should be minimal. To secure skilled labour, we have to look to recruitment abroad (Russia, China, others).

(2) Materials

The basic resources (earth, crushed stone, concrete, timber, and so on) are available. Ballast for the tracks is produced in a place 96km south of the Russian border (Sukhe Baatar), crushed stone for use in concrete can be produced near Ulan Bator at a rate of 200 ~ 300m^3/day, and wooden sleepers can also be manufactured domestically. As it is difficult to cast concrete on-site due to the extreme cold of the Mongolian winter, precast concrete material is often used. There is a factory in Ulaanbaatar which is active all year round, producing precast concrete for basic building materials such as posts, beams, walls, and drains. However, since these precast concrete products are inferior in terms of quality, very serious thought must be given to aspects such as quality control and process control if they are to be used. Apart from these, bricks, coal, logs, and other materials can be procured domestically. At present a Japanese company is building a steel plant reinforcement and other building products processed from scrap iron in Darkhan.

(3) Construction Machinery

Most of the construction machinery in use is of Soviet origin, much of it having been in use for 2 ~ 10 years. As the volume of construction works is low, there are not many machines.

The following is a list of the numbers of machines possessed by the main body of construction enterprises, for reference purposes.

Mongolian National Railways

Machine Name	No.	Year Produced
Track-laying cranes	4	1957 ~ 1989
Self-propelled motor flat cars	6	1982 ~ 1987
Leveling/tamping/profiling machine	1	1976
Track liner machine	1	1977
Snow removers	5	1958 ~ 1986
Track cranes	3	1985 ~ 1991
Ballast wagons ($40m^3$)	60	1968 ~ 1990
Ballast wagons ($26m^3$)	27	1983 ~ 1987
Flat cars	40	1985 ~ 1987
Hand tamping machines	200 ~ 300	New

Chandmani (the largest Mongolian private-sector road construction company; has 113 employees)

Excavators	3
Bulldozers	4
Motor graders	2
Asphalt finishers	2
Rollers (7 ~ 16 tons)	5
Cranes (8 ~ 16 tons)	2
Dump trucks (5.5 ~ 12 tons)	10
Asphalt finisher	1
Scrapers $8m^3$	2
Concrete mixers $4m^3$	2

50% of these machines are 2 ~ 5 years old, while the other 50% are 7 ~ 10 years old. 70 ~ 80% of the latter are apparently still usable. The remaining 20 ~ 30% are inactive owing to inadequate maintenance.

Sovinvest (Russian general construction company)

This is the only Russian-owned construction company undertaking construction work in Mongolia. It has 1,000 Mongolian and 2,000 Russian employees. This company owns 250 ~ 270 pump trucks, 50 types of construction machines (number of units unknown), a concrete plant, and others.

2-10-5 Points of Concern If Construction Work on the Zamyn-Uud Freight Transfer Facility is to be Undertaken

(1) Natural Conditions

Zamyn-Uud is about 960m above sea level, and the winter temperatures are said to be coldest in January when they go down to an average of about –18°C. From October to April the average temperature is below 0°C. For concrete casting, we have to consider installing a heater with which concrete hardening can be carried out properly. Or else we should consider making wholesale use of precast concrete material which can be manufactured indoors. As the work efficiency rate drops in the coldest season, all due consideration should be given to this when planning the work processes.

(2) Geographical Conditions

Zamyn-Uud is a land-locked island some 700km from Ulan Bator (where building materials, labour, and machinery are available for use). 10km away over the Mongolian – Chinese border to the south is the Chinese town of Erenhot, but owing to the intervening border considerable difficulties would be anticipated in obtaining construction materials or machinery from there. The railway is the only means of transport between Ulan Bator and Zamyn-Uud. We have to consider transporting both construction materials and machinery by rail from the Ulan Bator direction. To this end total co-operation by the Mongolian National Railways is essential.

In addition, because there are no rivers nearby, there is of course no drinking water or water for construction purposes on site. Therefore, although drinking water will be transported by rail, we have to consider drawing underground water for construction purposes. But although underground water is available at a depth of 6 ~ 8m, this is in short supply, so it would have to be drawn from a depth of 100 ~ 140m. (A well of 1,200mm in diameter has a supply probable capability of 7 ~ 10m^3 /hr.)

(3) Civil Engineering Materials

Sandy earth for use in raising ground levels is available in abundance 3km to the north of Zamyn - Uud. But track ballast will have to be transported by rail 1,015km from the north, crushed stone from 390km from the north, and cement materials, precast concrete products, and other building materials from the vicinity of Ulaanbaatar. If concrete is intended to be cast on site, a concrete mixing machine and concrete-making plant equipment will have to be transported from Ulan Bator and set up on site.

(4) Construction Machinery

All machinery needed for construction would have to be transported from Ulaanbaatar (700km to the north) by rail. However should there be a shortage of machines we would have to consider some way of procuring and bringing them in from China or Russia.

(5) Labour

Construction workers will probably also have to be brought in from the Ulaanbaatar direction. If there are not enough of them, it may be feasible to hire from China. The Chinese are also keen to co-operate positively in the supply of labour. However, we have to consider providing adequate

facilities, including accommodation for workers, in order to guarantee their subsistence during the coldest season.

(6) Structure for Implementation

In order to develop Mongolia's self-reliance, Mongolian construction undertaking entities and construction companies should preferably have priority in participating in the work. However, in order that adequate quality and process control may be carried out, we should also seek to bring in consultants with high-level capabilities in the management of work execution, and to have the joint participation of overseas construction companies which have a wealth of operational experience.

2-10-6 Construction Standards

Mongolia does not have any construction standards or regulations of its own; instead, Russian standards and regulations are applied throughout. However, though we have obtained and translated the regulations on track construction, we have been unable to obtain copies of regulations pertaining to other construction work. As regards the standards and regulations pertaining to track construction, these are referred to in Chapter 4, paragraph 4-3.

Chapter 3

CHAPTER 3 FREIGHT TRAFFIC DEMAND FORECAST

3-1 General Condition of Rail Freight Transport

Mongolia was achieving stable economic growth as a socialist state until the collapse of the Soviet Union in the second half of the 1980s. After the collapse of the Soviet Union, like other socialist countries, Mongolia plunged into economic confusion. The country is now in a period of transition in which it is attempting to overcome this economic dislocation by shifting to a market economy.

Mongolia's rail freight transport reflects its socio-economic conditions. Until 1988, Mongolia tended to enjoy stable economic growth, but after that, its imports, exports, transit and domestic transport have all tended to decline. The total transport volume by rail in 1991 decreased by about 32 percent over the level recorded in 1985. Mongolia's transit freight was directly hit by the collapse of the Soviet Union, resulting in a decline in 1991 of about 89 percent over the 1985 level.

Although Mongolia's rail freight transport has been reduced by its socio-economic dislocation, as described above, it is believed that rail freight transport will continue to be important to Mongolia's long-distance freight transport in the future. Reconstruction of Mongolia's economy should lead to an increase in transport volume.

3-2 Estimate of Rail Freight Transport Volume

3-2-1 Precondition of Demand Estimate

(1) The target year of the demand forecast will be the year 2000.

(2) After due consultation between the Mongolian Railways and the Ministry of Trade and Industry, the estimated values of freight volume by export, import and transit, as well as by commodity, will be regarded as preconditions for the estimates presented in this section. The estimates are shown in Table 3-2-1 and Table 3-2-2.

1) The Mongolian Railways needs to endeavor to make its various plans consistent with the basis of the estimated values presented here.

2) Estimated results are considered generally valid. Import and export traffic: It is believed that the present economic crisis will continue through 1992.
Domestic transport: As a result of foreign assistance, reconstruction of the economy, etc., Mongolia's economy should by 1995 be able to recover to the 1990 level.
Transit: The amount of freight in 1991 was far less than in other years, but prospects for recovery are good, due to the conclusion of an export contract for chemical fertilizer between China and Russia.

Table 3-2-1 Estimation on Railway Freight Transport Volume of Export and Import

(Thous. ton)

Commodity	Export				Import			
	1992	1993	1994	1995	1992	1993	1994	1995
Coal	100.0	300.0	300.0	400.0	50.0	50.0	50.0	50.0
	100.0	300.0	300.0	400.0	100.0	100.0	100.0	100.0
Oil	2.0	30.0	4.0	4.0	400.0	590.0	693.0	762.0
	100.0	150.0	200.0	200.0	100.0	147.5	173.3	190.5
Steel	10.0	12.0	13.0	20.0	30.0	170.0	180.0	250.0
	100.0	120.0	130.0	200.0	100.0	566.7	600.0	833.3
Machine facility	13.0	15.0	17.0	18.0	20.0	150.0	190.0	250.0
	100.0	115.4	130.8	138.5	100.0	750.0	950.0	1250.0
Construction materials	100.0	110.0	115.0	120.0	38.0	53.0	75.0	100.0
	100.0	110.0	115.0	120.0	100.0	139.5	197.4	263.2
Wheat and cereal	30.0	35.0	37.0	40.0	20.0	30.0	35.0	40.0
	100.0	116.7	123.3	133.3	100.0	150.0	175.0	200.0
Raw foods	20.0	25.0	26.0	30.0	15.0	18.0	20.0	23.0
	100.0	125.0	130.0	150.0	100.0	120.0	133.3	153.3
Livestock	9.0	10.0	11.0	12.0	0.0	0.0	0.0	0.0
	100.0	111.1	122.2	133.3				
Wool	3.0	5.0	6.0	10.0	0.3	0.5	0.7	1.0
	100.0	166.7	200.0	333.3	100.0	166.7	233.3	333.3
Fluorite	300.0	320.0	330.0	350.0	0.0	0.0	0.0	0.0
	100.0	106.7	110.0	116.7				
Chemical materials	3.0	5.0	6.0	7.0	10.0	40.0	50.0	60.0
	100.0	166.7	200.0	233.3	100.0	400.0	500.0	600.0
Fertilizer	30.0	35.0	38.0	39.0	30.0	35.0	40.0	50.0
	100.0	116.7	126.7	130.0	100.0	116.7	133.3	166.7
Foods	5.0	6.0	7.0	8.0	50.0	70.0	80.0	90.0
	100.0	120.0	140.0	160.0	100.0	140.0	160.0	180.0
Fuel	3.0	5.0	6.0	6.0	20.0	26.0	30.0	34.0
	100.0	166.7	200.0	200.0	100.0	130.0	150.0	170.0
Wood	60.0	65.0	68.0	70.0	10.0	14.0	17.0	20.0
	100.0	108.3	113.3	116.7	100.0	140.0	170.0	200.0
*Cupper concentration	400.0	425.0	450.0	460.0	0.0	0.0	0.0	0.0
	100.0	106.3	112.5	115.0				
Non-ferrous metal	3.0	4.0	5.0	5.0	0.3	1.5	2.0	2.0
	100.0	133.3	166.7	166.7	100.0	500.0	666.7	666.7
Others	209.0	220.0	245.0	261.0	130.4	202.0	224.3	198.0
	100.0	105.3	117.2	124.9	100.0	154.9	172.0	151.8
Total	1300.0	1600.0	1684.0	1860.0	824.0	1450.0	1687.0	1930.0
	100.0	123.1	129.5	143.1	100.0	176.0	204.7	234.2

Source: Mongolia Railway Statistics

Note 1: Upper column – Volume

Lower column – Index standardized 1985

Note 2: * This commodity changes 'iron ore' in export case

Table 3-2-2 Estimation on Railway Freight Transport Volume of Transit and Domestic

(Thous. ton)

Commodity	Transitt				Domestic			
	1992	1993	1994	1995	1992	1993	1994	1995
Coal					5000 100.0	5000 100.0	5200 104.0	5500 110.0
Oil					26 100.0	28 107.0	30 115.4	34 130.8
Steel	25.0 100.0	50.0 200.0	150.0 600.0	325.0 1300.0	20 100.0	25 125.0	30 150.0	35 175.0
Machine facility	25.0 100.0	30.0 120.0	35.0 140.0	40.0 160.0	8 100.0	14 175.0	18 225.0	20 250.0
Construction materials	1.0 100.0	1.5 150.0	2.0 200.0	2.5 250.0	1100 100.0	1200 109.1	1300 118.2	1500 136.4
Wheat and cereal					30.0 100.0	35 116.7	40 133.3	45 150.0
Raw foods					6 100.0	7 116.7	8.5 141.7	9 150.0
Livestock					7 100.0	8 114.3	9 128.6	9 128.6
Wool	1.0 100.0	1.3 130.0	1.5 150.0	2.0 200.0	4 100.0	5 125.0	5 125.0	6 150.0
Fluorite	50.0 100.0	60.0 120.0	80.0 160.0	90.0 180.0	100 100.0	105 105.0	110 110.0	115 115.0
Chemical materials	50.0 100.0	75.0 150.0	90.0 180.0	100.0 200.0	2 100.0	4 200.0	5 250.0	7 350.0
Fertilizer	123.0 100.0	379.0 308.1	700.0 569.1	1000.0 813.0	1 100.0	1 100.0	2 200.0	3 300.0
Foods	20.0 100.0	30.0 150.0	50.0 250.0	60.0 300.0	20 100.0	23 115.0	25 125.0	26 130.0
Fuel					80 100.0	83 103.8	85 106.3	88 110.0
Wood	35.0 100.0	45.0 128.6	100.0 285.7	160.0 457.1	200 100.0	212 106.0	220 110.0	225 112.5
*Cupper concentrate	5.0 100.0	7.7 154.0	11.0 220.0	15.0 300.0				
Non-ferrous metal	15.0 100.0	20.0 133.3	25.0 166.7	30.0 200.0	0.5 100.0	1 200.0	2 400.0	3 600.0
Others	50.0 100.0	110.5 221.0	155.5 311.0	175.5 351.0	121.5 100.0	149 122.6	260.5 214.4	375 308.6
Total	400.0 100.0	810.0 202.5	1400.0 350.0	2000.0 500.0	6726 100.0	6900 102.6	7350 109.3	8000 118.9

Source: Mongolia Railway Statistics

Note 1: Upper column – Volume

Lower column – Index standardized 1985

(3) Future economic indices: After due consultation between the State Department for National Development and the Ministry of Trade and Industry, the State Department for National Department's estimated values (GDP, population, amount of exports and amount imports) will be used. The future economic indices are shown in Table 3-2-3.

Reasons: 1) After transition from a planned to a market economy, Mongolia's economy has no target values.

2) Since the future economic indices are not based on a radical economic recovery plan, by and large, they are judged valid.

Table 3-2-3 Estimation of Economics Indices by State Department for National Development

Item	1990	1991	1992	1993	1994	1995	2000
GDP (Min. trg.)	10281.4	9330.7	8988.9	9050	10263	12459	15490
Export (Min. $)	660.8	300	400	528	658	829	
Import (Min. $)	923.9	339.3	535	628	758	879	
Population (thous. per.)	2075.5	2129.8	2182.8	2236.5	2291.2	2347.2	2613.3

Source: State Department for National Development

3-2-2 Demand Estimate

(1) Export and Import Freight

Demand estimates for export and import freight follow the flow chart presented in Figure. 3-2-1.

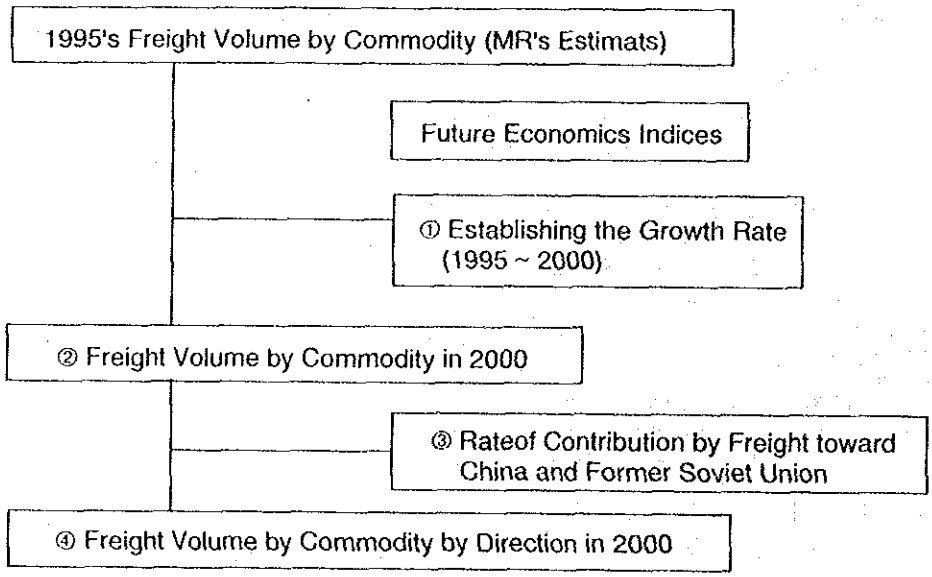


Fig. 3-2-1 Flow of Demand Estimates for Export and Import Freight Transport

1) Establishing the growth rate

The growth rate was considered by three methods.

a) The amount of import (export) in the year 2000 is estimated by multiplying the per capita amount of import (export) in 1995 by the population in the year 2000, and the ratio of the product to the 1995 value is regarded as the growth rate. (1.11-fold)

b) The growth rate is sought by treating the amount of import (export) from 1995 to 2000 as a simple trend. (2.31-fold)

c) The growth in GDP from 1995 to 2000 is applied. (1.24-fold)

Case 3 was selected for the following reason:

i) With regard to the outlook for Mongolia's economic condition, the Ministry of International Trade and Industry and MR, after due consultation, agreed that the period until 1995 should be regarded as an economic reconstruction period, and the period after that as a stable economic growth period.

ii) Thus, it is difficult to consider a growth rate as high as the growth presented by Case 2.

iii) Case 1 only considers growth based only on demographic growth factors. This will not be consistent with the premises of a stable growth.

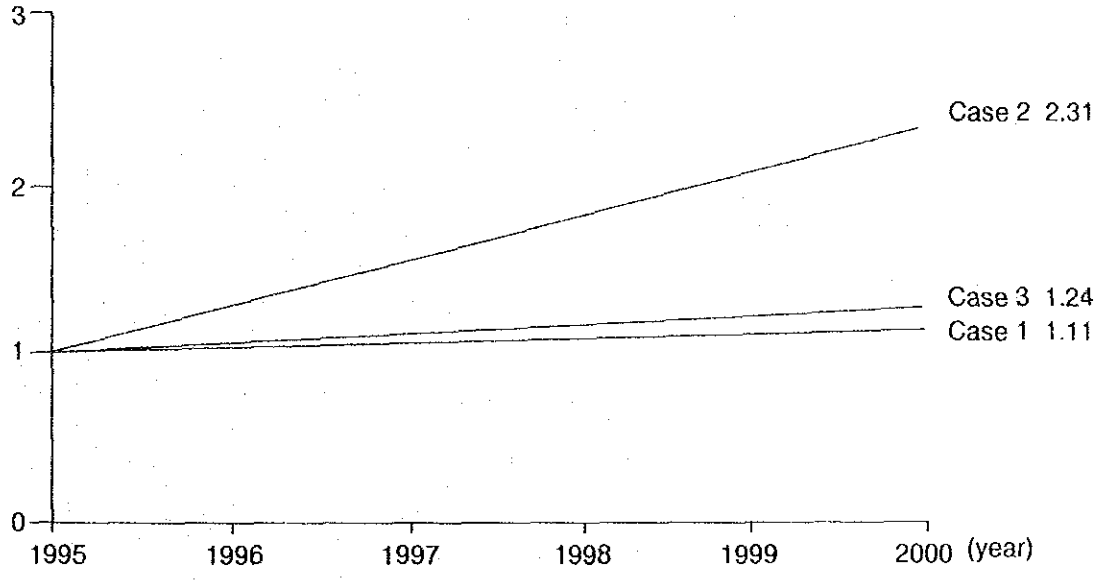


Fig. 3-2-2 Growth Rates by 3 Cases

2) Freight volume by commodity in 2000

Estimation results of freight volume by commodity in the year 2000 are shown in Appendix 3-2-1 and Appendix 3-2-2.

3) Rate of contribution by freight toward China and that towards the former Soviet Union

Two methods were considered: the method of seeking the rate of contribution from the total amount of import (export) derived from each direction covering the period from 1985 to 1991; and the method of applying the rate of contribution of recent years (1990 or 1991). But because the trade in the direction of China has increased since the collapse of the Soviet Union, a decision was made to adopt the second of these methods.

because the trade in the direction of China has increased since the collapse of the Soviet Union, a decision was made to adopt the second of these methods.

However, if it is decided that it is inappropriate to seek a rate of contribution with the trends of only the recent years on the grounds that the amount of trade considered would be too small, the rate of contribution will, after due consultation with the Ministry of International Trade and Industry and MR, be determined by another formula.

With regard to oil, after due consultation with the Petroleum Corporation, the following rate of contribution was established:

a) Although the ratio of trade with China to that with Russia is about 1:9, Mongolia intends to increase its trade with China.

b) For this reason, the amount of import from Russia will be allowed to increase by only 10 percent in 2000 from the present level. The rest of Mongolia's import will come from the direction of China. (Result 34:36)

The effect of establishing the rate of contribution as described above is shown in Table 3-2-4.

Table 3-2-4 Establishing Rate of Contribution in 2000

Commodity	Export		Import	
	Rate of Contribution (%)		Rate of Contribution (%)	
	To USSR	To China	From USSR	From China
Coal	1.00	0.00	1.00	0.00
Oil	1.00	0.00	0.66	0.34
Steel	0.86	0.14	0.97	0.03
Machine facility	0.90	0.10	1.00	0.00
Construction materials	0.84	0.16	0.94	0.06
Wheat and cereal	0.90	0.10	0.00	1.00
Raw foods	1.00	0.00	0.71	0.29
Livestock	1.00	0.00	0.00	1.00
Wool	0.50	0.50	0.83	0.17
Fluorite	1.00	0.00	0.00	1.00
Chemical materials	0.50	0.50	0.96	0.04
Fertilizer	0.00	1.00	1.00	0.00
Foods	1.00	0.00	0.94	0.06
Fuel	1.00	0.00	1.00	0.00
Wood	0.13	0.87	1.00	0.00
*Cupper concentration	0.93	0.07	0.00	1.00
Non-ferrous metal	0.90	0.10	1.00	0.00
Others	0.90	0.10	0.83	0.17
Total				

Note: * This commodity changes 'iron ore' in export case.

4) Freight volume by commodity by direction in 2000

Estimated results of freight volume by commodity by direction of export and import are presented in Table 3-2-5.

Table 3-2-5 Estimates of Freight Volume by Commodity by Direction of Export and Import at 2000

(Thous. ton)

Commodity	Export			Import		
	Volume Thous. ton	Direction		Volume Thous. ton	Direction	
		To USSR	To China		From USSR	From China
Coal	497.3	497.3	0.0	62.2	62.2	0.0
Oil	5.0	5.0	0.0	947.5	625.4	322.1
Steel	24.9	21.4	3.5	310.9	301.5	9.4
Machine facility	22.4	20.2	2.2	310.9	310.9	0.0
Construction materials	149.2	125.8	23.4	124.3	116.9	7.4
Wheat and cereal	49.7	44.7	5.0	49.7	0.0	49.7
Raw foods	37.3	37.3	0.0	28.6	20.3	8.3
Livestock	14.9	14.9	0.0	0.0	0.0	0.0
Wool	12.4	6.2	6.2	1.2	1.0	0.2
Fluorite	435.1	435.1	0.0	0.0	0.0	0.0
Chemical materials	8.7	4.4	4.3	74.6	71.6	3.0
Fertilizer	48.5	0.0	48.5	62.2	62.2	0.0
Foods	9.9	9.9	0.0	111.9	105.2	6.7
Fuel	7.5	7.5	0.0	42.3	42.3	0.0
Wood	87.0	11.3	75.7	24.9	24.9	0.0
*Cupper concentration	571.9	531.9	40.0	0.0	0.0	0.0
Non-ferrous metal	6.2	5.6	0.6	2.5	2.5	0.0
Others	324.5	292.1	32.4	246.2	204.3	41.9
Total	2312.4	2070.6	241.8	2399.9	1951.2	448.7

Note: * This commodity changes 'iron ore' in export case.

(2) Domestic Freight Transport

Demand estimates for domestic freight transport follow the flow chart shown in Figure 3-2-3.

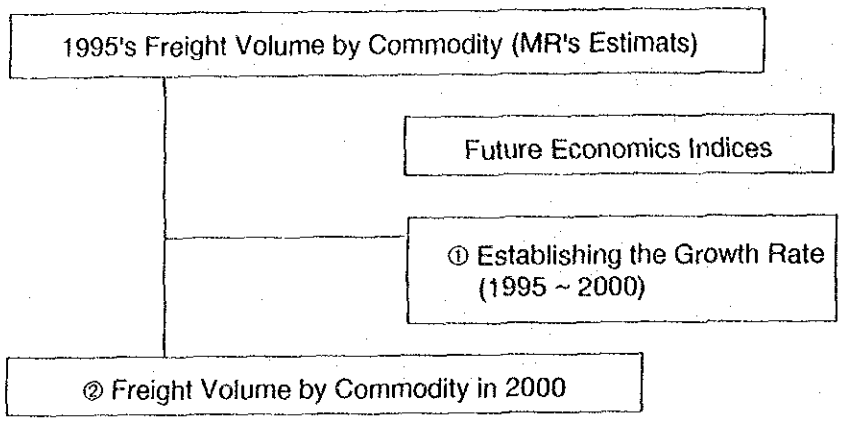


Fig. 3-2-3 Flow of Demand Estimates for Domestic Freight Transport

1) Establishing the growth rate

The growth rate is established according to Figure 3-2-2.

2) Freight volume by commodity in 2000

Estimation results by commodity in the year 2000 are shown in Appendix 3-2-3.

(3) Transit Freight

The trends in transit freight volume since 1952 are presented in Figure 3-2-4. Mongolia's transit freight volume has changed dramatically reflecting, among other things, developments in the relationship between China and the former Soviet Union. Therefore, estimates based on trends are deemed inappropriate.

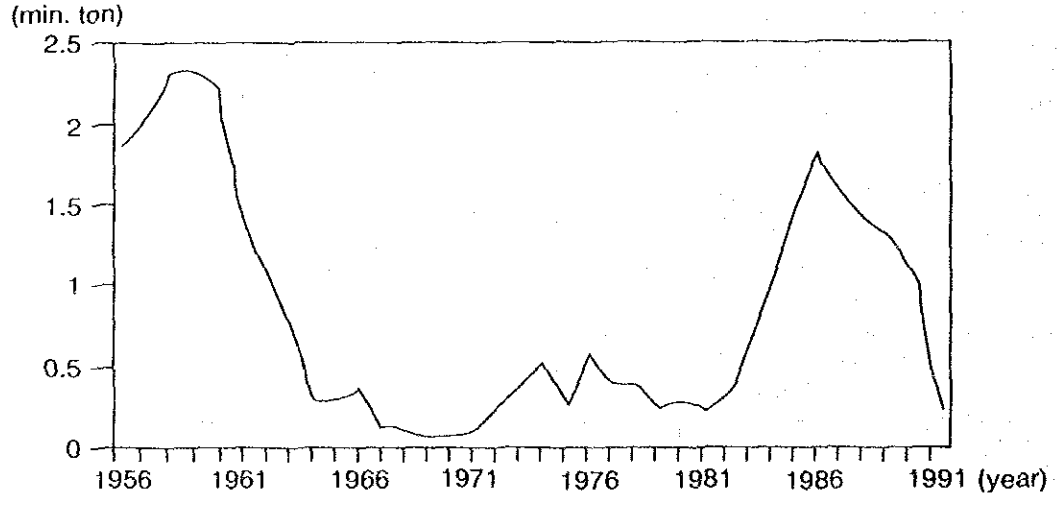


Fig. 3-2-4 Domestic Freight Transport Trends in Transit Freight Volume (1952 ~)

Also, the estimated value of 2 million tons per year by train is greater than Mongolia's past transit freight volume.

Thus, after due consultation between the Ministry of Trade and Industry and MR, the maximum transit freight volume that can be considered at present will be set at 314,000 tons, the level recorded in 1958. The transit freight volume for the year 2000 will be estimated by applying the estimated value for 1991 and afterwards to the logistic curve.

The logistic curve is expressed by the following equation. The transit freight volume at year 2000 is set at 2.312 million tons.

$$Y = 2313.9/(1 + e^{(-1.07826 * X + 2149.46)})$$

R = -.996259

Y : Transit freight volume

X : Year

R : Correlation coefficient

The rate of contribution of transit freight volume in the direction of China and that of Russia is applied to the rate of contribution in 1990 or in 1991. Estimated results by item, by direction, of the transit freight volume are shown in Table 3-2-6.

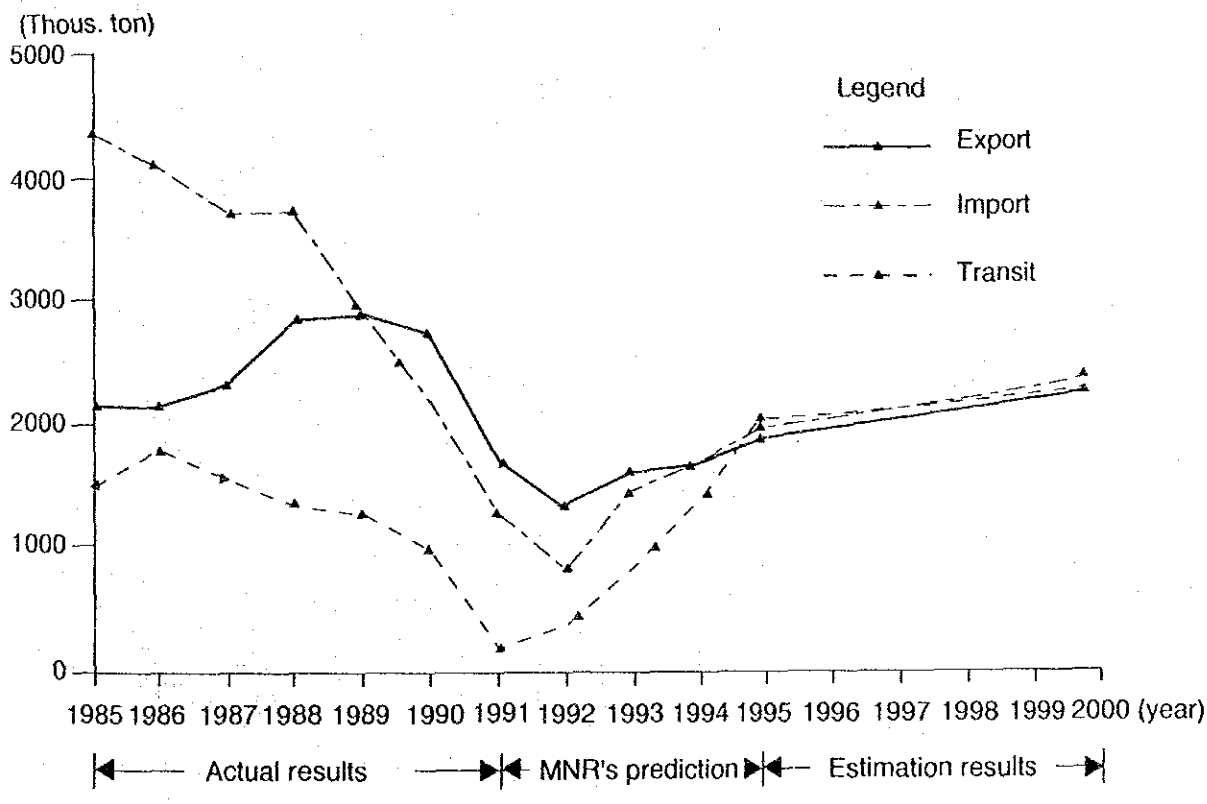


Fig. 3-2-5 Estimation of Transit Freight Volume

Table 3-2-6 Estimates of Transit Freight Volume at 2000

(Thous. ton)

Commodity	Volume at 2000	Rate of Contribution (%)		Freight Volume	
		To USSR	To China	To USSR	To China
Coal	0.0			0.0	0.0
Oil	0.0			0.0	0.0
Steel	375.7	0.0	1.0	0.0	375.7
Machine facility	46.2	0.0	1.0	0.0	46.2
Construction materials	2.9	1.0	0.0	2.9	0.0
Wheat and cereal	0.0			0.0	0.0
Raw foods	0.0			0.0	0.0
Livestock	0.0			0.0	0.0
Wool	2.3	1.0	0.0	2.3	0.0
Fluorite	104.0	1.0		104.0	0.0
Chemical materials	115.6	0.5	0.5	57.8	57.8
Fertilizer	1156.0	0.0	1.0	0.0	1156.0
Foods	69.4	1.0	0.0	69.4	0.0
Fuel	0.0			0.0	0.0
Wood	185.0	0.0	1.0	0.0	185.0
Cupper concentration	17.3	1.0	0.0	17.3	0.0
Non-ferrous metal	34.7	0.0	1.0	0.0	34.7
Others	202.9	0.5	0.5	101.5	101.5
Total	2312.0			355.2	1956.8

3-3 Transshipment Freight Volume at Zamyn-Uud

Transshipment freight at Zamyn-Uud will, in accordance with the principle governing acceptance, be the import freight from China and the transit freight from China towards Russia.

The transshipment freight volume by import and transit at Zamyn-Uud is shown in Table 3-2-7. Commodity by commodity breakdown is given in Table 3-2-8.

Table 3-3-1 Transshipment Volume at Zamyn-Uud

Import Volume from China	448.8
Transit Volume from China to USSR	355.2
Total	803.9

Table 3-3-2 Transshipment Volume at Zamyn-Uud

Commodity	Volume at 2000	Transit	Import
Coal	0.0	0.0	0.0
Oil	322.2	0.0	322.2
Steel	9.3	0.0	9.3
Machine facility	0.0	0.0	0.0
Construction materials	10.4	2.9	7.5
Wheat and cereal	49.7	0.0	49.7
Raw foods	8.3	0.0	8.3
Livestock	0.0	0.0	0.0
Wool	2.5	2.3	0.2
Fluorite	104.0	104.0	0.0
Chemical materials	60.8	57.8	3.0
Fertilizer	0.0	0.0	0.0
Foods	76.1	69.4	6.7
Fuel	0.0	0.0	0.0
Wood	0.0	0.0	0.0
Cupper concentrate	17.3	17.3	0.0
Non-ferrous metal	0.0	0.0	0.0
Others	143.3	101.4	41.9
Total	803.9	355.2	448.8

Appendix 3-2-1 Freight Volume of Export by Commodity in 2000 (Thous. ton)

Commodity	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	2000
Coal	226.6	301.6	602.5	1055.5	779.8	515.9	119.0	100.0	300	300.0	400.0	497.3
	100.0	133.1	265.9	465.8	344.1	227.7	52.5	44.1	132.4	132.4	176.5	219.5
Oil	5.9	5.0	2.6	5.4	55.0	65.0	2.4	2.0	3	4.0	4.0	5.0
	100.0	84.7	44.1	91.5	932.2	1101.7	40.7	33.9	50.8	67.8	67.8	84.7
Steel	59.9	91.8	83.9	80.4	92.7	80.6	25.5	10.0	12	13.0	20.0	24.9
	100.0	153.3	140.1	134.2	154.8	134.6	42.6	16.7	20.0	21.7	33.4	41.6
Machine facility	18.2	12.6	13.4	16.1	11.0	69.5	19.1	13.0	15	17.0	18.0	22.4
	100.0	69.2	73.6	88.5	60.4	381.9	104.9	71.4	82.4	93.4	98.9	123.1
Construction materials	74.8	120.3	151.4	125.9	118.4	106.7	131.3	100.0	110	115.0	120.0	149.2
	100.0	160.8	202.4	168.3	158.3	142.6	175.5	133.7	147.1	153.7	160.4	199.5
Wheat and cereal	46.6	178.4	75.3	169.0	69.3	52.0	30.0	30.0	35	37.0	40.0	49.7
	100.0	383.8	161.6	362.7	148.7	111.6	64.4	64.4	75.1	79.4	85.8	106.7
Raw foods	29.3	53.6	38.1	27.6	57.2	32.7	21.0	20.0	25	26.0	30.0	37.3
	100.0	182.9	130.0	94.2	195.2	111.6	71.7	68.3	85.3	88.7	102.4	127.3
Livestock	18.5	19.6	17.5	14.7	14.3	13.3	8.8	9.0	10	11.0	12.0	14.9
	100.0	105.9	94.6	79.5	77.3	71.9	47.6	48.6	54.1	59.5	64.9	80.5
Wool	17.8	15.8	14.1	15.7	18.2	10.2	2.6	3.0	5	6.0	10.0	12.4
	100.0	88.8	79.2	88.2	102.2	57.3	14.6	16.9	28.1	33.7	56.2	69.7
Fluorite	783.6	571.1	537.3	653.9	686.0	632.4	356.8	300.0	320	330.0	350.0	435.1
	100.0	72.9	68.6	83.4	87.5	80.7	45.5	38.3	40.8	42.1	44.7	55.5
Chemical materials	0.5	1.0	1.9	7.7	1.5	14.4	3.2	3.0	5	6.0	7.0	8.7
	100.0	200.0	380.0	1540.0	300.0	2880.0	640.0	600.0	1000.0	1200.0	1400.0	1740.0
Fertilizer	0.0	0.0	0.0	0.0	5.3	24.2	39.3	30.0	35	58.0	39.0	48.5
					100.0	456.6	741.5	566.0	660.4	717.0	735.8	915.1
Foods	13.8	5.3	10.1	12.7	12.4	6.5	1.6	5.0	6	7.0	8.0	9.9
	100.0	38.4	73.2	92.0	89.9	47.1	11.6	36.2	43.5	50.7	58.0	71.7
Fuel	12.1	8.4	3.8	2.2	6.5	9.1	2.5	3.0	5	6.0	6.0	7.5
	100.0	69.4	31.4	18.2	53.7	75.2	20.7	24.8	41.3	49.6	49.6	62.0
Wood	176.1	157.7	134.5	93.7	94.8	68.0	64.9	60.0	65	68.0	70.0	87.0
	100.0	89.6	76.4	53.2	53.8	38.6	36.9	34.1	36.9	38.6	39.8	49.4
Cupper concentration	408.0	397.1	398.7	406.7	517.7	557.1	450.7	400.0	425	450.0	460.0	571.9
	100.0	97.3	97.7	99.7	126.9	136.5	110.5	98.0	104.2	110.3	112.7	140.2
Non-ferrous metal	1.3	1.8	2.6	2.8	3.8	4.5	5.5	3.0	4	5.0	5.0	6.2
	100.0	138.5	200.0	215.4	292.3	346.2	423.1	230.8	307.7	384.6	384.6	476.9
Others	223.2	203.1	252.0	139.0	329.4	491.3	422.6	209.0	220	245.0	261.0	354.5
	100.0	91.0	112.9	62.3	147.6	220.1	189.3	93.6	98.6	109.8	116.9	158.8
Total	2116.2	2144.2	2339.7	2829.0	2873.3	2753.4	1706.8	1300.0	1600.0	1684.0	1860.0	2312.5
	100.0	101.3	110.6	133.7	135.8	130.1	80.7	61.4	75.6	79.6	87.9	109.3

Source: Mongolia Railway Statistics (1985 ~ 1991)
Note: Upper column ; Volume
Lower column ; Index standardized 1985

Appendix 3-2-2 Freight Volume of Import by Commodity in 2000 (Thous. ton)

Commodity	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	2000
Coal	333.2	496.6	398.5	349.9	287.1	180.1	198.2	50.0	50.0	50.0	50.0	62.2
	100.0	140.9	119.6	105.0	86.2	54.1	59.5	15.0	15.0	15.0	15.0	18.7
Oil	1160.7	1081.4	1149.2	1174.7	1034.1	817.2	634.2	400.0	590.0	693.0	762.0	947.5
	100.0	93.2	99.0	101.2	89.1	70.4	54.6	34.5	50.8	59.7	65.7	81.6
Steel	230.0	219.5	215.2	249.7	260.0	227.5	49.9	30.0	170.0	180.0	250.0	310.9
	100.0	95.4	93.6	108.6	113.0	98.9	21.7	13.0	73.9	78.3	108.7	135.2
Machine facility	137.2	123.7	132.3	140.4	123.4	106.6	23.1	20.0	150.0	190.0	250.0	310.9
	100.0	90.2	96.4	102.3	89.9	77.7	16.8	14.6	109.3	138.5	182.2	226.6
Construction materials	1455.6	1130.0	844.0	798.0	573.5	306.8	94.7	38.0	53.0	75.0	100.0	124.3
	100.0	77.6	58.0	54.8	39.4	21.1	6.5	2.6	3.6	5.2	6.9	8.5
Wheat and cereal	70.9	61.0	56.0	55.7	72.8	50.7	92.2	20.0	30.0	35.0	40.0	49.7
	100.0	86.0	79.0	78.6	102.7	71.5	130.0	28.2	42.3	49.4	56.4	70.2
Raw foods	55.1	66.1	54.6	62.8	49.7	34.0	12.4	15.0	18.0	20.0	23.0	28.6
	100.0	120.0	99.1	114.0	90.2	61.7	22.5	27.2	32.7	36.3	41.7	51.9
Livestock	0.4	0.2	0.5	1.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	100.0	50.0	125.0	300.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wool	1.0	0.6	4.2	1.6	2.5	1.0	0.2	0.3	0.5	0.7	1.0	1.2
	100.0	60.0	420.0	160.0	250.0	100.0	20.0	30.0	50.0	70.0	100.0	124.3
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chemical materials	109.8	98.5	109.2	120.7	91.8	64.8	23.1	10.0	40.0	50.0	60.0	74.6
	100.0	89.7	99.5	109.9	83.6	59.0	21.0	9.1	36.4	45.5	54.6	67.9
Fertilizer	0.0	0.0	0.0	1.5	9.6	53.7	35.5	30.0	35.0	40.0	50.0	62.2
				100.0	640.0	3580.0	2366.7	2000.0	2333.3	2666.7	3333.5	4144.9
Foods	116.6	114.1	114.5	121.3	117.0	108.2	45.1	50.0	70.0	80.0	90.0	111.9
	100.0	97.9	98.2	104.0	100.3	92.8	38.7	42.9	60.0	68.6	77.2	96.0
Fuel	20.5	30.1	17.5	12.1	12.2	8.3	4.1	20.0	26.0	30.0	34.0	42.3
	100.0	146.8	85.4	59.0	59.5	40.5	20.0	97.6	126.8	146.3	165.9	206.2
Wood	75.4	86.0	69.9	57.9	40.1	19.0	9.7	10.0	14.0	17.0	20.0	24.9
	100.0	114.1	92.7	76.8	53.2	25.2	12.9	13.3	18.6	22.5	26.5	33.0
Cupper concentration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non-ferrous metal	5.3	3.5	6.5	5.7	3.8	3.6	0.6	0.3	1.5	2.0	2.0	2.5
	100.0	66.0	122.6	107.5	71.7	67.9	11.3	5.7	28.3	37.7	37.7	46.9
Others	584.3	596.2	539.2	555.8	341.7	228.2	58.2	130.4	202.0	224.3	198.0	246.2
	100.0	102.0	92.3	95.1	58.5	39.1	10.0	22.3	34.6	38.4	33.9	42.1
Total	4356.0	4080.5	3711.3	3709.0	2959.7	2209.7	1281.2	824.0	1450.0	1687.0	1930.0	2399.9
	100.0	93.7	85.2	85.1	67.9	50.7	29.4	18.9	33.3	38.7	44.3	55.1

Source: Mongolia Railway Statistics (1985 ~ 1991)
Note: Upper column ; Volume
Lower column ; Index standardized 1985

Appendix 3-2-3 Demand Estimates for Domestic Freight Transport (Thous. ton)

Commodity	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	2000
Coal	4046.9	4533.3	5023.0	5342.2	5073.7	4830.0	4910.1	5000	5000	5200	5500	6838.0
	100.0	112.0	124.1	132.0	125.4	119.4	121.3	123.6	123.6	128.5	135.9	169.0
Oil	79.3	40.4	29.3	21.5	43.8	32.3	26.3	26	28	30	34	42.3
	100.0	50.9	36.9	27.1	55.2	40.7	33.2	32.8	35.3	37.8	42.9	53.3
Steel	34.9	70.8	73.8	85.3	55.9	25.3	23.1	20	25	30	35	43.5
	100.0	202.9	211.5	244.4	160.2	72.5	66.2	57.3	71.6	86.0	100.3	124.7
Machine facility	43.7	48.5	45.7	34.6	14.6	11.3	9.6	8	14	18	20	24.9
	100.0	111.0	104.6	79.2	33.4	25.9	22.0	18.3	32.0	41.2	45.8	56.9
Construction materials	1563.1	1831.1	2564.7	3148.5	3301.4	2693.9	1414.5	1100	1200	1300	1500	1864.9
	100.0	117.1	164.1	201.4	211.2	172.3	90.5	70.4	76.8	83.2	96.0	119.3
Wheat and cereal	81.6	82.7	67.1	89.4	91.5	66.0	45.5	30	35	40	45	55.9
	100.0	101.3	82.2	109.6	112.1	80.9	55.8	36.8	42.9	49.0	55.1	68.6
Raw foods	27.9	12.2	21.6	15.5	11.3	10.3	6.9	6	7	8.5	9	11.2
	100.0	43.7	77.4	55.6	40.5	36.9	24.7	21.5	25.1	30.5	32.3	40.1
Livestock	13.4	16.6	14.5	10.0	9.9	9.3	8.9	7	8	9	9	11.2
	100.0	123.9	108.2	74.6	73.9	69.4	66.4	52.2	59.7	67.2	67.2	83.5
Wool	8.4	9.9	10.2	10.0	9.0	7.4	5.1	4	5	5	6	7.5
	100.0	117.9	121.4	119.0	107.1	88.1	60.7	47.6	59.5	59.5	71.4	88.8
Fluorite	0.1	0.1	3.8	78.6	77.9	105.5	104.4	100	105	110	115	143.0
	100.0	100.0	3800.0	78600.0	77900.0	105500.0	104400.0	100000.0	105000.0	110000.0	115000.0	142977.0
Chemical materials	4.5	4.2	4.2	6.0	3.6	10.6	2.1	2	4	5	7	8.7
	100.0	93.3	93.3	133.3	80.0	235.6	46.7	44.4	88.9	111.1	155.6	193.4
Fertilizer	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1	1	2	3	3.7
							100.0	111.1	111.1	222.2	333.3	414.4
Foods	31.3	44.9	29.1	47.9	49.9	39.7	24.9	20	23	25	26	32.3
	100.0	143.5	93.0	153.0	159.4	126.8	79.6	63.9	73.5	79.9	83.1	103.3
Fuel	253.7	294.1	299.7	268.1	221.2	151.9	101.2	80	83	85	88	109.4
	100.0	115.9	118.1	105.7	87.2	59.9	39.9	31.5	32.7	33.5	34.7	43.1
Wood	523.8	570.8	599.6	474.2	441.0	375.9	258.5	200	212	220	225	279.7
	100.0	109.0	114.5	90.5	84.2	71.8	49.4	38.2	40.5	42.0	43.0	53.4
Cupper concentrate	0.0	0.0	0.0	0.0	0.0	0.0	0.0					0.0
Non-ferrous metal	0.0	0.0	0.4	1.3	0.6	0.3	0.7	0.5	1	2	3	3.7
			100.0	325.0	150.0	75.0	175.0	125.0	250.0	500.0	750.0	932.5
Others	371.0	342.5	365.9	325.3	285.8	205.9	170.5	121.5	149	260.5	375	466.2
	100.0	92.3	98.6	87.7	77.0	55.5	46.0	32.7	40.2	70.2	101.1	125.7
Total	7083.6	7902.1	9152.6	9958.4	9691.1	8575.6	7113.2	6726	6900	7350	8000	9946.2
	100.0	111.6	129.2	140.6	136.8	121.1	100.4	95.0	97.4	103.8	112.9	140.4

Source: Mongolia Railway Statistics (1985 – 1991)
Note: Upper column ; Volume
Lower column ; Index standardized 1985

Chapter 4

CHAPTER 4 PLANNING CARGO TRANSSHIPMENT FACILITIES AT ZAMYN-UUD STATION

4-1 Basic Policy for Planning Cargo Transshipment Facilities

4-1-1 Recipient's Responsibility for Cargo Transshipment

According to the minutes concluded between the Ministry of Trade and industry, Mongolia, and the study team on September 1, 1992, the team planned the cargo transshipment facilities to handle only the cargos arriving in Mongolia from China.

4-1-2 Priority of Construction Work

The team framed the cargo transshipment facilities implementation plan for Zamyn-Uud station in line with the following priority order of category-wise cargo transshipment facilities set forth in the said minutes.

1) Package cargos of food and consumer commodities
2) Containers
3) Petroleum
4) Others

4-1-3 Natural Conditions at Zamyn-Uud Station

The team studied the natural conditions (soil, topography, disasters in the past, rain, snow, wind speed and direction, etc.) that would affect the management, operation and maintenance of the cargo handling facilities. These are reflected in the short term cargo transshipment facilities improvement plan for Zamyn-Uud station.

4-1-4 Existing Facilities at Zamyn-Uud Station

To economize the construction of the new cargo transshipment facilities, the team considered utilization of the existing facilities and management system as far as possible. For this purpose, the team surveyed the track layout, signal and telecommunication facilities, power supply and lighting facilities, working hours and assignment of employees, organization, train operation and shunting methods, cargo handling equipment, land utilization plan, access from the outside, station crew houses and other conditions of Zamyn-Uud station.

4-1-5 Capacity for Construction Work and Relevant Laws

The team surveyed the conditions for construction work in Mongolia including the capabilities for construction, relevant laws and regulations, tariff systems for utilities, availability of materials, and unit work costs to make a reference in making the short term cargo transshipment facilities improvement plan and its implementation plan.

4-1-6 Economies and Statistics on the Inland Transportation in Mongolia That Would Affect the Cargo Transshipment Plan

The team estimated the volumes of the inland transportation of Mongolia that would affect the cargo transshipment plan, and the volume of cargo transported across the border with China. This estimate covers the years up to 2000, based on which the short term cargo transshipment facilities improvement plan is formulated.

4-1-7 Trend of the Volume of Cargo Handled at Zamyn-Uud Station

The team also estimated the volume, categories and packing styles of cargo that would be handled at Zamyn-Uud station up to the year of 2000. This forms the basis of the short term cargo transshipment facilities improvement plan.

4-1-8 Discussions on the Policy

In making the short term cargo transshipment facilities improvement plan, the team considered the policies of the Government of Mongolia and attempted to adapt the plan to the requirements of Mongolia as much as possible.

4-1-9 Cargo Transportation Plan

To reflect the cargo transportation plan in the short term cargo transshipment facilities improvement plan, the team discussed the plan from the following points of view.

- Rolling stock deployed
- Frequency of train operation
- Units of cargo transportation

4-1-10 Track Layout and Civil Structure Plan

(1) Track Layout Plan

In planning the track layout, the team aimed at efficient cargo transportation and manpower saving, fully utilizing the existing layout.

(2) Conditions for Planning

The team determined the most appropriate center to center distance of tracks, turnouts and other track conditions, in consideration of transportation plan, cargo handling facilities and rolling stock used in the cargo transportation.

(3) Track Construction Plan

1) The team determined the dimensions of track layout taking into consideration the transportation plan, site conditions and maintenance conditions at present and those envisaged in the existing plans.

2) Track materials

The team adopted the existing and available track materials into the plan.

(4) Civil Structure Plan

The team planned the civil structure required for the cargo handling equipment.

4-1-11 Planning the Cargo Handling Facilities

The team planned the cargo handling facilities in consideration of various factors including the following.

- Handling route, distance and time
- Available space and yard layout
- Working conditions
- Construction and running costs
- Natural conditions including climate, temperature, wind speed and direction
- Track layout
- Type of cargo to be handled, packing style and respective volume
- Weights and dimensions of cargo
- Cargo handling procedures, system and flow
- Lifting height
- Type of cargo handling equipment
- Train operation frequency
- Working hours
- Maintenance of the equipment
- Safety devices
- Power supply and Lighting system
- Necessary auxiliary equipment

4-1-12 Signal and Communication, and Power Supply Equipment

The team made plans the following.

(1) Signal

1) Operation and security equipment

Blocking system, interlocking system and track circuits

2) Organization and maintenance

Organization for operation and maintenance

(2) Communication

1) Communication network

Cable or wireless type communication system, telephone, exchange and other communication equipment

2) Organization and maintenance

Organization for operation and maintenance

(3) Power Supply System

Power generation, distribution and lighting systems.

4-1-13 Storage Plan

The cargo transportation plan was designed to attain the maximum efficiency and the minimum storage space. However, the team made a plan of storage facilities of appropriate sizes to prepare for train delay, accidents and constraints from bad weather.

4-1-14 Management Office and Crew Houses

The team discussed a plan of the station office and crew houses from the view point of efficient cargo handling and train operation.

4-2 Freight Transport Planning

4-2-1 Basic Principle

The transport planning is based on the precondition that, out of the freight traffic at Zamyn-Uud station by main commodity estimated for the year 2000, the freight arriving in Mongolia from China and that passing through from China to Russia is transshipped at this station. Therefore, the exports from Mongolia to China and the freight passing through from Russia to China are assumed to be transshipped at Erenhot station in the Chinese side.

As for oil transport, since construction of transshipment facilities is being planned, the yard work within the oil base at Zamyn-Uud station is taken up in the separae plan.

4-2-2 Preconditions

The preconditions of the transport planning are as follows.

(1) Incoming and Outgoing Transport Volume at Zamyn-Uud Station, by Commodity
The estimated transport volume is 2000 is applied.

(2) Traffic Fluctuation
The traffic fluctuation is assumed to be 120% of the monthly average, taking into consideration the monthly fluctuation in 1990 and 1991. [Refer (1) –3) of 2-2-2.]

(3) Packing Styles of Arriving Freight and Types of Cars Used (including containers)
The packing styles of arriving freight and types of cars used are assumed to be as follows, taking into consideration such factors as the past results in the Mongolian Railway.

Table 4-2-1 Styles of Packing and Types of Cars by Commodity

Item	Styles of Packing	Types of Cars
Oil	–	Tank car
Steel	Bulk	Gondola car
Construction materials	Bulk	Wagon and gondola car
Wheat and cereal	Sack	Container and wagon
Fresh foods	Corrugated carton	Container
Wool	Sack	Container
Fluorspar	Sack	Gondola car
Chemical materials	Bulk and cane	Container and wagon
Foods	Sack	Container and wagon
Iron ore	Sack	Gondola car
Other	Variety	Container, wagon and gondola car

Table 4-2-2 Packing Styles of Main Commodities and Cars Used in the Mongolian Railway

No.	Category	Styles of Packing	Country	Weight	Car	Type of Work
1	Vegetable	Corrugated carton, basket	China		W	Manual work
2	Candy food (fish)	Corrugated carton	Russia		W	"
3	Fruit	Corrugated carton	Russia China	25~30kg	W	"
4	Rice	Vinyl sack	China	50kg	W.C.	"
5	Wheat, Flour	Vinyl sack	China	25kg	W.C.	"
6	Grain	Vinyl sack, Hemp Sack	China		W.C.	"
7	Sugar	Vinyl sack, Corrugated carton	China	50kg	W.C.	"
8	Candy	Corrugated carton	China		W.C.	"
9	Liquors	Corrugated carton	China	20kg	W.	"
10	Machine	Bulk	China Russia		W.G.C.	Manual work•crane
11	Chemical materials	Can, Sack, Bulk	China Russia	50~200kg	W.G.C.	"
12	Construction materials	Box pallet, Bulk	China Russia		W.G.C.	"
13	Steel	Bulk	Russia		G	Crane
14	Furniture and Furniture to be moved	Bulk	China Russia		W.C.	Manual work
15	Soap	Corrugated Carton	China	10~20kg	W	"
16	Cotton	Sack	China	77kg	W	"
17	Hemp cloths	Sack	China	100kg	W	Manual work•fork lift
18	Hemp sacks	Sack	China			Manual work
19	Cloths	Sack	China	10kg	W.C.	"
20	Car tire	Bulk	China		W	"
21	Petroleum	Tank car, can	China Russia		T.W.	Machine•manual work
22	Glass	Crated	Russia		G	Manual work•fork lift
23	Canned food (meat)	Corrugated carton	Russia		W	"
24	Fertilizer	Sack	China		W.C.	"
25	Fluorspar	Sack	China Russia	800kg	G	Crane
26	Cupper concentrate	Sack (China) Container (Russia)	China Russia	2.5ton	G	"
27	Livestock	Bulk	Russia		W	Manual work
28	Hide, Furs	Sack	China Russia		W.C.	"
29	Iron ore	Sack	Russia China		G	Crane
30	Wood		China Russia		G	Crane
31	Cement		China		W.T.	Manual work•fork lift

Note: 1 W: Wagon, G: Gondola car, C: Container, T: Tank car

Table 4-2-3 Kinds of Containerized Commodities

		RUSSIA (20Ft, 5t, 3t)		CHINA (20Ft)	Ton/cont
EX	1	Furniture	1	Scrap (Copper and brass)	18
	2	Clothing (Leather goods, Sheep fur)	2	Furniture	3~4
	3	Woolens	3	Fertilizer	18
	4	Foodstuff (Livestock intestine products)	4	Carpet	10~11
	5	Animal food	5	Woolens	8~10
	6	Miscellaneous goods	6	Deer horn products	3~5
	7	Deer horn products	7	Leather goods (sheep, goat, cattle and horse)	14~16
	8	Canned food (Meat)	8	Clothing and clothes	2~3
	9	Copper concentrate	–		
IM	1	Furniture	1	Foodstuff	5
	2	Diplomatic goods	2	Miscellaneous goods	18
	3	Miscellaneous goods, equipment	3	Machines and machine parts for { cars / car parts } construction	2.5 1.5~15
	4	Clothing (Suits, etc.)	4	Clothing, Cloth. { Clothing / Cloth }	2 18
	5	Daily necessities (Soap etc.)	5	Daily necessities	18
	6	Office supplies (Stationery etc.)	6	Wheat, Rice and Sugar	18
	7	Foodstuff			
	8	Fertilizer			

Note: Based on Mongolian Railway's materials.

(4) Load of Freight per Car (including container) by Commodity

The load of freight per car by commodity is assumed to be as follows, taking into consideration such factors as the records of international freight for the 5 years (1985~1989) at Zamyn-Uud station and carrying capacity of freight cars owned by China.

Table 4-2-4 Average Load of Incoming Freight per Car by Commodity

Category	Type of Cars	Tare (ton)	Average Load per Car (ton/car)
Oil	Tank car	21	50
Steel	Gondola car	22	50
Construction materials	Wagon Gondola car	24 22	50 50
Wheat and Cereal	Wagon Container	24 2	30 15
Fresh foods	Container	2	5
Wool	Container	2	10
Fluorspar	Gondola car	22	50
Chemical materials	Wagon Container	24 2	40 15
Foods	Wagon Container	24 2	35 5
Iron ore	Gondola car	22	50
Others	Wagon Gondola car Container	24 22 2	40 40 10

Table 4-2-5 Length and Weight of Main Freight Cars in the Chinese Railway

Type of Cars		Length (m)	Tare (ton)	Load (ton)
Flat car	NJ4A	15.456	14.5	30 (40)
Gondola car	C62A	12.5	22.3	60
Gondola car	PD 5	17.3	17.3	50
Wagon	P 62	16.438	24.0	60
Tank car	G 19	14.542	21.0	60

Table 4-2-6 Average Load (Tonnage) per Car of International Freight by Commodity (Originating from or Terminating in Mongolia) – Zamyn-Uud Station

	EX			IM		
	1000 tons	Cars	Ton/car	1000 tons	Cars	Ton/car
Fresh food	–	–	–	7.8	222	35.1
Foodstuff	1.2	31	38.7	4.5	114	39.4
Machines	–	–	–	0.1	2	50.0
Chemical materials	10.6	235	45.1	4.6	108	42.6
Rice	–	–	–	7.5	135	55.5
Wood	125.4	2,187	45.0	–	–	–
Raw materials	4.2	118	35.6	–	–	–
Scrap	14.1	564	25.0	–	–	–
Construction materials	9.5	153	62.1	3.7	60	61.6
Iron	10.5	161	65.2	–	–	–
Others	23.6	512	46.1	38.5	879	43.8
Total	199.1	4,561	43.6	66.7	1,520	43.8

Note 1: EX means exports, while IM means imports.

Note 2: The tons and number of cars are the total for the five years from 1985 to 1989.

(5) Hauling Capacity per Freight Train

The hauling capacity per freight train is in accordance with the Mongolian Railway's regulations and the agreement between the Mongolian and Chinese Railways. [Refer (1) –2) of 2-2-2.]

Table 4-2-7 Load Hauled by Freight Trains Starting from or Arriving at Zamyn-Uud Station

Station	Hauling Capacity (ton)	Maximum Train Length
Sain-Shand	2,600	55 cars or 220 axles
Zamyn-Uud	2,000	49 cars
Erenhot		

(6) Time Required for Transshipment

The standard time required for freight transshipment and related work is calculated as follows for each type of freight car (including container) on the basis of the past results of traffic volume and working hours, and also taking into consideration the number of workers assigned, types of machines used, etc.

- Container ..... 4 ~ 5 minutes/container
- Gondola car..... 30 ~ 40 minutes/car
- Wagon ..... 2.5 hours/car

(7) Shunting Work for Freight Cars at Zamyn-Uud Station

It is estimated that shunting locomotives are used for the shunting of freight cars on both the 1,435mm tracks (Chinese side) and 1,520mm tracks (Mongolian side).

4-2-3 Transport Planning

A transport plan for the year 2000 was drawn up as follows, based on the preconditions described in 4-2-2.

(1) Freight Transport Volume per Day by Commodity

Based on the demand forecast, the transport volume per day and that with a 120% fluctuation were obtained as follows.

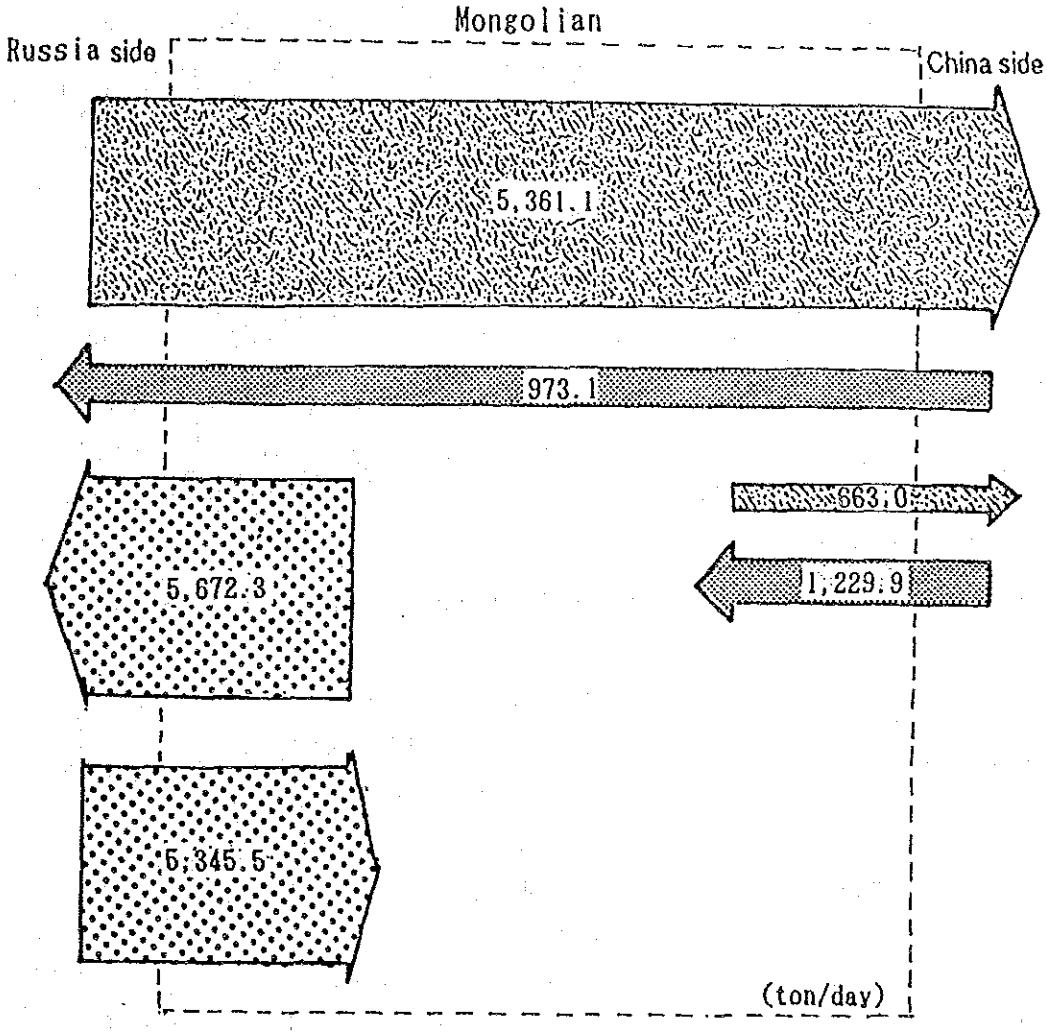


Fig. 4-2-1 Transport Volume of International Freight (2000)