JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF TRADE AND INDUSTRY MONGOLIA

THE STUDY ON THE IMPROVEMENT PLAN FOR TRANSSHIPMENT FACILITIES AT ZAMYN-UUD STATION IN MONGOLIA

URGENT PROJECT
FINAL REPORT
VOL. 3

MARCH, 1993

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PACIFIC CONSULTANTS INTERNATIONAL

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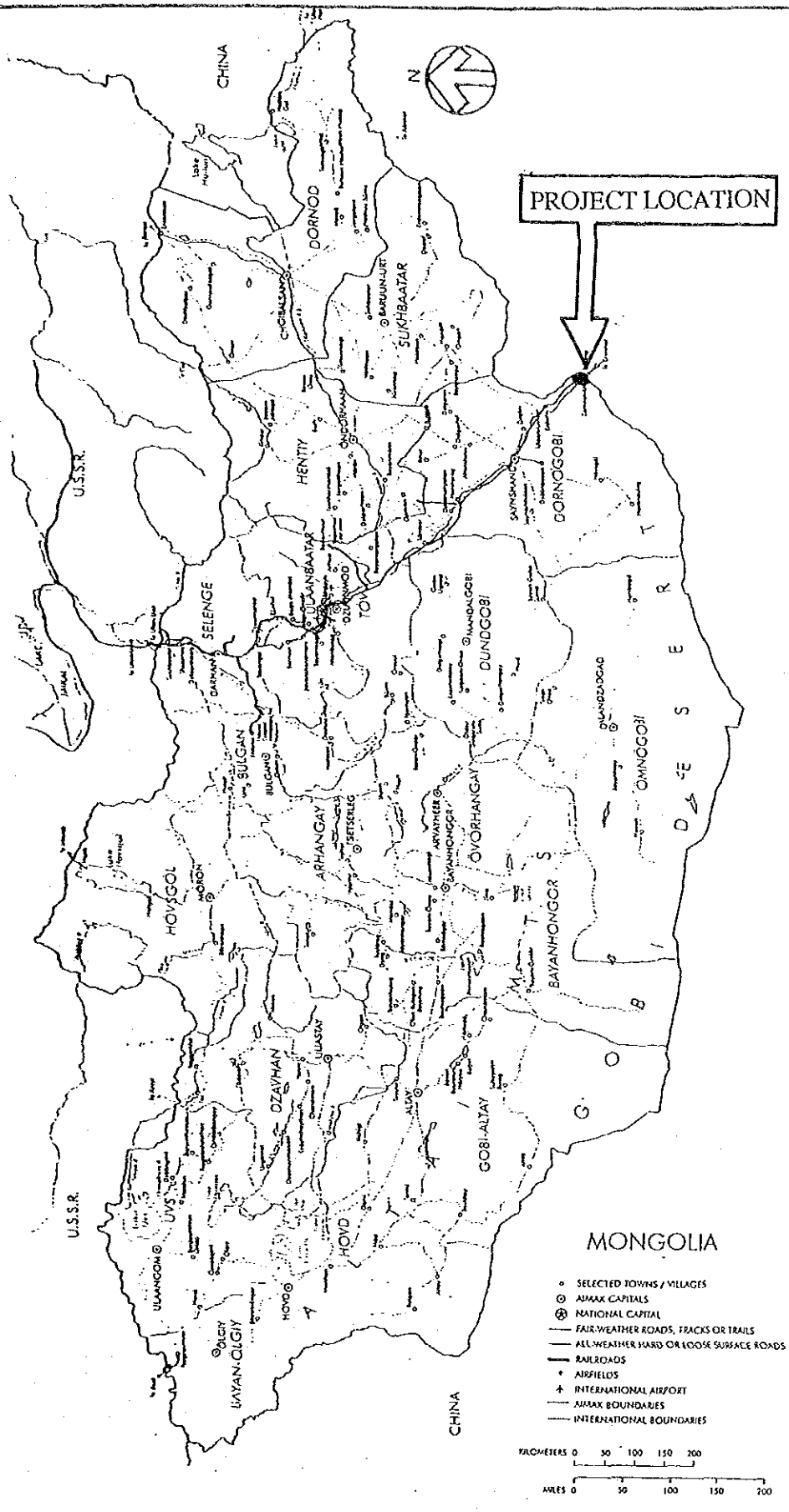


PROJECT LOCATION MAP

Table of Contents

Summary

Since it became independent in 1921, Mongolia pursued a course of economic development solely relying on the cooperation of the former Soviet Union. However, this socialism-oriented economic policy unexpectedly crumbled by the collapse of the former Soviet Union and poor performance by the economies of the COMECON countries. Under the circumstances, Mongolia has been trying to introduce market economics to restructure the economy of the country, while promoting democratization of politics. It is now important for Mongolia to shift foreign trade, erstwhile biased to the East European countries and the former USSR, to a multi-directional export and import with China, Korea, Japan and other Western countries. To do this, it is indispensable for the reborn Mogolia to improve the southbound trade routes towards China.

Mongolia has three major transport media, rail, road and air. The railway contribution was 70 % of the total transport demands in 1991 in terms of ton-kilometres, which manifests its dominance in the long-distance and international freight transport: When the volumes transported by Mongolian Railway are compared in O-D terms cargoes transported to and from Russia dropped from 400 million tons in 1990 to 220 million tons in 1991, while those to and from China doubled, from 11 million to 22 million tons, during the same period. According to the estimate made by JICA, the volume of cargo transported through the southern route will reach 300 million tons in the year 2000, almost 13 times larger than the present level.

Undertaking this passenger and freight transport with the 17,000 employees, with 3,500 rail cars, and 1,813 kilometres long in total, Mongolian Railway has an established plan to further reinforce its transport capacity, bearing in mind the importance of the role of rail transport for the country. In this context, it is a subject of utmost importance not only for Mongolian Railway but also for the nation as a whole to urgently solve the problems brought about by the difference in gauge at the border between Mongolia and China.

Since the track gauges are different between the two countries, cargos are now being transshipped from Chinese cars to Mongolian cars, and vice versa, at Erenhot, the border station inside China. It is said, however, that 700 to 900 Mongolian freight cars are always idle at the station due to the shortage of transshipping capacity. Despite the international rule that stipulates the recipient's responsibility for transshipment in such a situation, Mongolia can not but be totally reliant on China for cargo transshipment, since it has no transshipment facilities at its border station. To solve this bottleneck, the former Soviet Union designed

transshipment facilities at the border station of Zamyn-Uud based on a feasibility survey it made in 1986 and subsequently started large-scale construction work according to an agreement between the two countries. However, this plan was abruptly abandoned in 1990 as the result of the collapse of promoter's economy.

Under the circumstance, the Government of Mongolia requested the Government of Japan in November 1990 to conduct a survey of the cargo transshipment facilities improvement plan at Zamyn-Uud station. The Government of Japan sent a project formation team to Mongolia in 1991 July to study the requirements of Mongolia, before deciding on the implementation of a survey by the Japan International Cooperation Agency (JICA). JICA dispatched a team to discuss the scope of work in April 1992 and a full scale study team in August 1992 for a feasibility study for a short term cargo transshipment facilities improvement plan. In December 1992, the full scale study team presented the Interim Report to the Government of Mongolia. This was the result of the survey including the "Urgent Project". In February 1993, the full scale study team made a presentation of the Draft Final Report to the Government of Mongolia on the short term cargo transshipment facilities improvement plan. This covered the study on the urgent project, on which the Government of Mongolia and the team held discussions and eventually reached an agreement.

The Government of Mongolia had originally requested the Government of Japan to improve the existing facilities of Zamyn-Uud station, while constructing cargo transshipment facilities in the station compound. In the course of the study, however, both sides confirmed and agreed that a priority should be placed on the construction of facilities to transship cargos arriving in Mongolia from China, such as food, petroleum, steel and other construction materials. Regarding petroleum, there exists temporary transshipment facilities which are expected to be able to sufficiently cope with the transshipment demand for the time being, so that the petroleum transshipment facilities are excluded from the scope of the Urgent Project according to the agreement between the two sides.

On the condition that the existing facilities should be utilized as far as possible, the facilities and equipment to be constructed or introduced are summarized as follows.

(1) Track work

Construction of a Chinese gauge track to bring freight trains arriving from China to the transshipment site and a Mongolian gauge track to despatch freight trains into Mongolia.

(2) Cargo transshipment facilities and equipment

Construction of civil structures and introduction of transshipment facilities to unload cargoes from Chinese freight cars and load them on Mongolian freight cars, including:

1) a high platform and cargo handling equipment, such as belt conveyors and forklifts, for cargos transported in wagons, and

2) a low platform and a reach stacker for containers, construction materials and other cargoes transported in gondolas.

(3) Facilities for operation and management

Office buildings for operation and management, garages for maintenance and storage of transshipment machines, covered platforms for temporary cargo storage, telecommunications and lighting equipment for safe and efficient train operations and transshipment work.

The construction site is located in the Gobi desert, where only railway employees and frontier guards live under severe natural conditions in that the temperature is as low as -40 °C in winter, with little available food and drinking water. To do the construction work, it is necessary to bring machines and materials from other areas. Since embankment compaction and concrete work can be done only in the summer season, construction work will take longer than in other areas, more than two years in this case. This requires the implementation period to be divided into two phases as written below.

Category of work	1st phase	2nd phase
Tracks (Chinese and Mongolian gauges)	○	○
High platform (width 15 m x length 120 m)	○	
Forklift/conveyor	○	
Low platform (width 36 m x length 210m)		○
Reach stacker		○
Office	○	
Cargo warehouse	○	
Garage		○
Residential housing		○

Lighting and telecommunication equipment	O
Water supply equipment	O
Boiler (for heating)	O

It seems to take about two years for each phase to complete the above categories of work. The procedures required for the construction work will take several months in each season as given below.

Procedure	1st phase	2nd phase
Implementation planning	3.5 months	3.5 months
Tendering/contracting	2.5	2.5
Implementation	12	12
Test and Commissioning	4	4
Total	22	22

Completion of this project will strengthen the capacity of cargo transport to and from China to eliminate this Mongolian bottleneck. Mongolia will be able to abide by the international rule for the recipient's responsibility. Thus, Mongolia will acquire self-subsistence to stand on equal terms with China. In addition, the project has various advantages including shorter cargo delivery time, faster rotation of freight cars leased from Russia to cut the foreign exchange demurrage payment, creation of employment opportunities, smoother exports and imports, and accelerate development of various industries, all leading to the overall economic development of the nation.

The Mongolian economy fell sharply after the former Soviet Union stopped providing assistance. Mongolia is now making efforts to shift its economic structure from a planned economy to a market economy, aiming at fast economic recovery. Under the circumstances, it is urgently required to promote this project by introducing foreign assistance including grant loans.

CHAPTER 1 INTRODUCTION

1-1 Objectives of the Study

The objectives of the Study are as follows:

(1) to examine the effect of the Urgent Project (the Project) selected from the established short term improvement plan at Zamyn-uud and its appropriateness for the foreign Aid Program; and

(2) to conduct the Study to determine the most suitable content and scale of the Urgent Project.

This Final Report has been prepared by the study team, in order to explain the results of the design based on the mutual understanding regarding the main items of the Urgent Project and to confirm the components of the study.

1-2 Mission to Mongolia

In response to the request from the Government of Mongolia, the Government of Japan decided to conduct the Study on the Improvement Plan for Transshipment Facilities at Zamyn-uud Station in Mongolia including the Study of the urgent project selected from the above-mentioned short term plan, and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Mongolia the mission, which was headed by Mr. Masaaki FUJIMOTO, team leader of a full-scale study team, and stayed in the country from August 19 to September 23, 1992, from November 30 to December 16, 1992 and from February 9 to 21, 1993.

The team held discussions with the officials concerned of the Government of Mongolia and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed the main items of teh Urgent Project and the Minutes of Discussions as attached in Appendix-4 were agreed and signed.

1-3 Outline of the Study

The study on the short term improvement plan for transshipment facilities at Zamyn-uud station in Mongolia conducted by a full-scale study team under JICA is split into two studies, namely the Feasibility Study for the above plan (F/S) and the Study of the urgent project selected from the above plan.

The F/S Interim Report including the plan of urgent project was explained and submitted on December 3, 1992 and accepted by the Government of Mongolia. The Draft Final Report of F/S has been prepared as a separate volume from the Draft Final Report of the Study.

In the study, the Design is prepared based on the result of the Feasibility Study (F/S).

CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 Background of the Project

Since the railway track gauges of Mongolia and China are different, 1,524 mm in Mongolia and 1,435 mm in China, the Mongolian Railway necessitates cargo transshipment facilities near the border with China.

In this context, the Government of Mongolian requested the Government of Japan in November, 1990 to make a feasibility survey of the cargo transshipment facilities at the border station of Zamyn-uud. Thus, Japan sent a project formation survey team to the country, in July 1991, and a mission of Japan International Cooperation Agency (JICA) in April, 1992 to discuss the scope of work of full-scale survey. According to the results of these surveys, the Governments of Mongolia and Japan concluded an agreement on the Scope of Work for a full-scale survey to establish a short term cargo transshipment facilities improvement plan.

A full-scale survey team visited Mongolia on August 19, 1992 to make a field survey on the improvement plan and prepared an Interim Report on December 3, 1992 which includes the plan of the Subject Project (Urgent Project) selected from the above improvement plan.

The survey team conducted the study on the Urgent Project and prepared the Final Report herewith.

2-2 Outline of the Request

The contents of the request made by the Government of Mongolia are understood to be the following ones.

(1) Installation of new transshipment facilities
(2) Improvement of existing station facilities

The above request has been examined and discussed with the ministries concerned in Japan. The necessity to install the new transshipment facilities at Zamyn-uud in Mongolia has been recognized, and the priority was given to item (1). After discussion with a full-scale survey team during second field survey period, the following items for the Study were finally requested by the Mongolia side.

1) Track work (Material and installation)

1,435 mm gauge	(New installation)	approx. 3,600 m
	(Adjustment)	approx. 5,000 m
1,520 mm gauge	(New installation)	approx. 5,600 m

2) Civil work (Material and Construction)

Platform with roof for wagon 15 m x 120 m	approx. 1,800 m^2
Platform for container 36 m x 210 m	approx. 7,560 m^2
Earthwork for the above track and platform	
Maintenance road, gate, fence, drainage	
Pumping system (water supply) for transshipment facilities	

3) Building work (with heating, plumbing and lighting systems)

Cargo handling office 150 m^2 x 2F	approx. 300 m^2
Cargo storage house	approx. 300 m^2
Garage for reach stacker	approx. 210 m^2
Residential houses for 54 employees	approx. 1,620 m^2

4) Cargo handling equipment (with fueling and repairing equipment and spare parts)

Reach stacker	1 set
Forklift 1.5 ton	4 sets
Portable belt conveyor	4 sets

5) Telecommunication (Equipment and installation)

Fixed and portable radio communication equipment	28 sets
Talk-back equipment	21 sets

6) Power equipment (Material, equipment and installation)

Mercury flood lamps	(10 lux for container platform)
- do -	(100 lux for wagon platform)
- do -	(One lux for storage and locomotive turn-out track)

2-3 Outline of the Project Area

2-3-1 The Nation

Location

Mongolia (longitude 88 - 120 degrees east and latitude 42 - 52 degrees north) is landlocked between the former Soviet Union to the north and northwest and China to the south. Mongolia has a total land area of about 1.566 million square kilometers, or about four times that of Japan, about one-fifteenth that of the former Soviet Union, and about one-sixth that of China. Mongolia is on a large plateau with an average elevation of 1,580 meters. The northwest, a mountainous region with inland lakes and rivers,

has a maximum altitude of 4,374 meters above sea level. The south-east, a desert region and plain, is located at a relatively low altitude with a minimum elevation of 560 meters. Ulaanbaatar, the capital, is 1,351 meters above sea level.

Climate

Mongolia has a typical continental climate, with extremes of hot and cold weather spanning the year but with little precipitation.

The average temperature from July to August, Mongolia's summer, is 15 - 16 °C, while the average from November to February, Mongolia's winter, dips to -15 °C to -20 °C. January is the coldest month, with temperatures plunging to as low as -40 °C.

With the annual precipitation being only about 300 millimeters, the air is dry; precipitation occurs only from July through August.

Table 2-3-1 Temperature, Humidity and Precipitation on Ulaanbaatar

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average of Year
Temperature (℃)	-20.9	-17.1	-8.0	1.5	9.8	14.3	16.7	15.1	8.8	1.1	-11.6	-17.3	-0.6
Humidity (%)	81	77	66	52	52	58	65	70	65	64	72	81	67
Precipitation (㎜)	2.4	2.4	6.6	5.8	14.6	55.6	64.0	92.7	26.9	12.0	5.4	4.8	293.2

Source: Institute of Climate July 1991

Population

Mongolia's population, about 2.154 million in 1991, has been growing at a relatively high rate of 2.8 percent per year since 1985.

Although the population pyramid in 1991 clearly shows that the 0 - 9 age group was the biggest group in absolute terms, the growth rate declined to 1.0 percent in 1991 over the previous year's level. This happened because of the withdrawal of former Soviet troops (Mongolia's population figures include former Soviet troops).

Table 2-3-2 Growth of Population and Population Density

Item \ Year	1985	1986	1987	1988	1989	1990	1991
Population (1000)	1,900.6 (100)	1,940.2 (102)	1,992.1 (105)	2,044.0 (108)	2,095.6 (110)	2,149.3 (113)	2,154.6 (113)
Population Density (per km²)	1.21	1.24	1.27	1.30	1.34	1.35	1.37

Source, 1985~1990:Mongolia Railway Statistics
1991:Mougolia National Statistics
Note:value in ( ) is % value normalized to 1985 data

Table 2-3-3 Population by Ten-year Age Group and Sex

Years Old	Total (1000)	Male (1000)	Female (1000)
0 ~ 9	600.0	303.3	296.7
10~19	477.2	241.3	235.9
20~29	375.6	186.3	189.3
30~39	227.9	113.9	114.0
40~49	138.7	71.2	67.5
50~59	105.6	52.7	52.9
60~69	67.8	32.0	35.9
70 over	51.2	20.1	31.1

Source:Anniversary Statistical yearbook 1991

The population of Mongolia's three principal cities decreased in 1990. The population of the mining city Darkhan was 85,000, while that of Erdenet, the production center for copper and molybdenum, was 52,000. The population in Ulaanbaatar was about 562,000 in 1991, or one-fourth of Mongolia's total population. Mongolia's population is therefore concentrated around the city of Ulaanbaatar.

Socio-economic Situation

Democratization of Mongolian politics, triggered by the Mongolian version of perestroika, has been accelerating since the middle of the 1980s. Amid this change, reform of the Mongolian economy has also been taking place at an accelerated pace.

The program finalized in November 1990 calls for a shift to a market economy within the next three years. The three-year program entails: privatizing Mongolia's enterprises by recognizing the right of private ownership and distributing two-thirds of all national property among the Mongolian people; promoting international trade; and reforming the banking system.

As a result of these reforms, all trade shifted from a barter basis to foreign currency trade, triggering considerable confusion in the supply of parts and fuel. Mongolia today can be said to be in a period of transition from a planned to a market economy.

GNP

Gross National Product (GNP) of Mongolia is tabulated as follows.

Table 2-3-4 Gross National Product

	1985	1986	1987	1988	1989	1990	1991
GNP (Million Tugruk)	8,155	8,052	8,350	9,013	9,544	9,295	17,960
GNP percapita (Tugruk)	4,475	4,301	4,349	4,582	4,728	4,479	8,436

Source : Statistics of M of Trade & Industry

Trade

The amount of trade has been falling since 1989, and in 1991 plunged by almost 50 percent. Moreover, the balance of trade is constantly in the red.

As a result of a large decrease in economic assistance from the former Soviet Union, medical supplies and other daily necessities, fuel for industrial use, and the like are in short supply, thus severely affecting people's livelihood and restricting economic activities.

Table 2-3-5 Trend on Balance of Foreign Trade (1,000. mln Tg)

	1985	1986	1987	1988	1989	1990	1991
Exports	2.05	2.13	2.14	2.20	2.15	1.97	1.37
Imports	3.26	3.40	3.29	3.32	2.87	2.75	1.90
Balance	-1.21	-1.27	-1.15	-1.12	-0.72	-0.78	-0.53

Source,1985-1990:Mongolia Railway Statistics
1991:Statistics of M. of Trade & Industry

Export Commodities

The principal export commodities are coal, fluorite and other mineral products. But as a result of economic confusion and other factors, exports of such minerals as coal and fluorspar have declined sharply, and except for skin goods and goat down goods, exports of such products as wool and camel wool have also plummeted.

Import Commodities

The principal import commodities include machinery, vehicles, chemical fertilizers and consumer durables.

Although livestock is flourishing, Mongolia imports wheat, powdered milk and other products, and the amount of these imports is either increasingly slightly or leveling off. The lack of foreign currency is making it difficult to import these principal products.

Trading Partners

The ties with the former Soviet Union are so strong that about 80 percent of Mongolia's trade is with it, but trade decreased significantly in 1991. The reason is with the democratization of eastern European countries and the collapse of the former Soviet Union's economy. The democratization of Mongolia also caused a marked reduction in the amount of assistance it receives from these former communist states which used to provide indirect assistance. These developments have also led to a reduction in the amount of trade Mongolia has with the former COMECON nations.

The amount of trade with free nations was about US$80 million, or only 4.7 percent of Mongolia's total amount of trade.

Agriculture

From 1940 to 1990, when Mongolia was still under socialism, agriculture was the main industry employing 40 percent of all workers and gaining 45 percent of the country's foreign currency. But the ratio of its net material product is gradually decreasing.

Mongolia's urban population is increasing rapidly, and as a result of the 1990-1991 crisis, self-sufficiency in agriculture is decreasing. There are about 26 million domestic animals, but Mongolia has to import wheat, butter and other daily food items.

Growth in Mongolia's livestock sector cannot be expected because of its poor regional production facilities.

Industry

Most industries in Mongolia are joint undertakings involving the Government and the COMECON countries. Consequently, the private sector consists mainly of small retail-type manual industries.

Industrial production is stagnating due to such factors as obsolete technology, inadequate social capital and lack of modern management and professional skills.

Mining

Mongolia is rich in natural resources. The principal ones include coal, iron ore, tin, copper, molybdenum, gold, silver, tungsten, zinc, lead, potassium, fluorite, uranium, oil and semi precious stones. The output of Mongolia's mining industry accounts for about 20 percent of its GNP.

Fluorite is indispensable for iron manufacture and metallurgy. Mongolia is the world's biggest producer of fluorspar, producing about 15 percent of the world's total production.

Transportation

Mongolia has four means of transport: rail, road, air and water.

Rail transport is operated by the Mongolian National Railways (MNR). MNR has a route kilometer range of 1,813 kilometers, consisting of 1,111 kilometers of trunk line and a number of branch lines. The trunk line links Ulanbaatar, the nation's capital, with the Russian Chinese borders.

The total length of roads is 199,300 kilometers. But the road density is extremely low, providing service to only a fraction of Mongolia's vast 1.56 million square kilometers of land area. The length of paved roads is only 1,024 kilometers.

Mongolia has one international airport, at Ulaanbaatar, and 17 local airports.

Water transport is available on the lakes found in the northwestern district.

Railroads

MNR is linked to railroads in China and the Russian Federation.

The centers of Mongolia's key industries -- Ulaanbaatar, Darhan, Erdenet, Boronpor, etc. -- are all connected by rail.

Mongolia and the Russian Federation have the same railway broad gauge, so the routes between the two countries are operated directly. But since China's railways are standard gauge, passengers have to change train trucks and freight trains have to be transshipped at Erenhot Station, in China.

Except for one double track section (5 kilometers) all other lines are single track, and none are electrified.

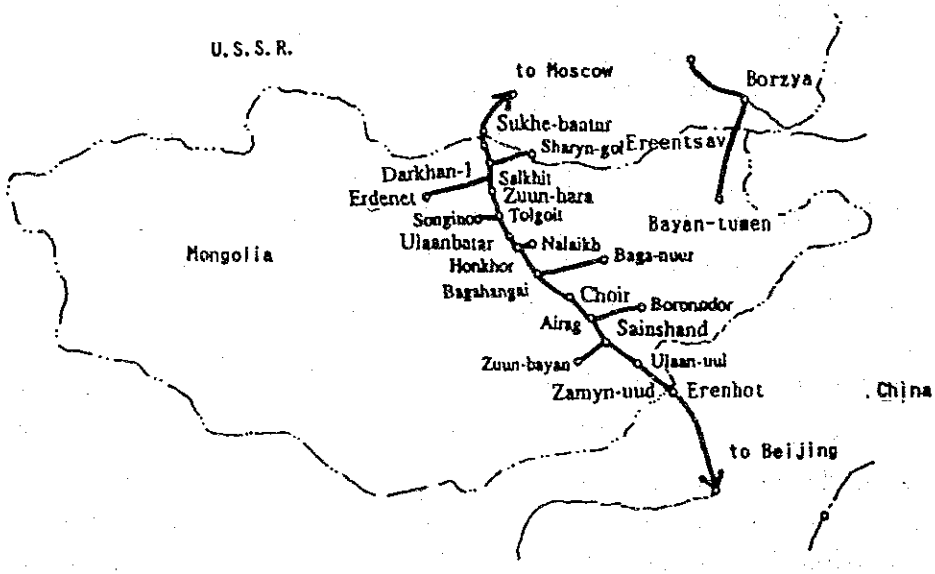


Fig. 2-3-1 Railway Map of MNR

Table 2-3-6 Section and Distance of MNR's Route

Section		Distance
Sukhe-baatar	～Zamyn-uud	1,111km
Darkhan-Ⅱ	～Sharyn-gol	63
Salkhit	～Erdenet	164
Tolgoit	～Songino	20
Honkhor	～Nalaikh	14
Bagahangai	～Baga-nuur	94
Airag	～Borondor	60
Sainshand	～Zuun-bayan	50
Ereen-tsav	～Bayan-tumen	237
Total		1,813

2-3-2 The Project Area

The Project Area is situated in the region known as the Gobi Desert (the East Gobi Plain) in the south of Mongolia. The area ranges from 900 m to 1,000 m above sea level. This undulating terrain gives differences in altitude of 5 - 15 m, and occasionally 30 - 50 m. 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 1,100 - 1,200 m above sea level. Hillocks and land-rises with a height of 5 - 10 m 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.

There are no industrial products in the Project area, where mostly railway employees and their dependents live. Population of the Zamyn-uud area is said to be given at about 1,000 in 1992 including about 357 of railway employees.

CHAPTER 3 OUTLINE OF THE PROJECT

3-1 Objectives of the Project

The objective of the Project is to install the cargo transshipment facilities and equipments at Zamyn-uud station to transport most of the international freight via China and to solve a serious problem for Mongolian economic development.

3-2 Study and Examination on the Request

3-2-1 The Scope of the Project

After discussions with the full-scale survey team during 2nd field survey period in December 1992, the Scope of the Project which will be urgently executed was finally confirmed as stated in clause 2-2.

3-2-2 The Appropriateness and Necessity of the Project

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, Mongolia plunged into economic confusion. 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 affected 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, 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 will lead to an increase in the transportation volume in the future.

Future Rail Freight Transport Volume at Zamyn-uud

Regarding the rate of contribution by freight toward China and that toward the former Soviet Union, the amount of imports from China will be allowed to increase much from the present level, because the trade in the direction of China has increased since the collapse of the Soviet Union. As a result of freight traffic demand forecast study, the volumes to be transshipped at Zamyn-uud station in the year 2000 were estimated as 448,800 tons of import from China, and 355,200 tons of transit from China.

The Appropriateness and Necessity of the Project

Regarding the transshipment of cross-border cargos, the Government of Mongolia stated that there exists an international agreement that prescribes the recipient's responsibility for the transshipment of incoming cargos transported between Mongolia and China.

At present the transshipment facilities except for petroleum are available only at the Erenhot station in China. It means that Mongolia has a large dependence on China in transport operations.

In addition, the installation of the transshipment facilities at Zamyn-uud is believed to contribute to the social and economic development in Mongolia.

In view of the above-mentioned effects, the implementation of the Project is indispensable to ensure the increase of the railway transport capacity from China to Mongolia.

3-3 Project Description

3-3-1 Executing Agency and Operational Structure

Ministry of Trade and Industry (MTI) and Mongolian Railway (MR) are responsible for the implementation of the Project.

The operational structures of the executing agency are shown in Figure 3-3-1 and 3-3-2, and the organization structure of Mongolian Government and Train Operation Division of Zamyn-uud station are attached in Figure 3-3-3 and 3-3-4 for reference.

3-3-2 Plan of Operation

Foreign Trade Department of Ministry of Trade and Industry (MTI) is responsible for all kinds of foreign Grant and Assistance.

Mongolian Railways (MR) is responsible for the implementation of the Project. The Chief Engineer will superintend and integrate implementation of the Project. The staff of the Engineering and Construction Division who manage the project overall will be expanded and supervise implementation of Project and assist the Chief Engineer. The Economic Department manages the budget, and the Financial Department manages the disbursement of the budget. Materials Supply Department is responsible for contracting and procuring rolling stock, equipment and materials.

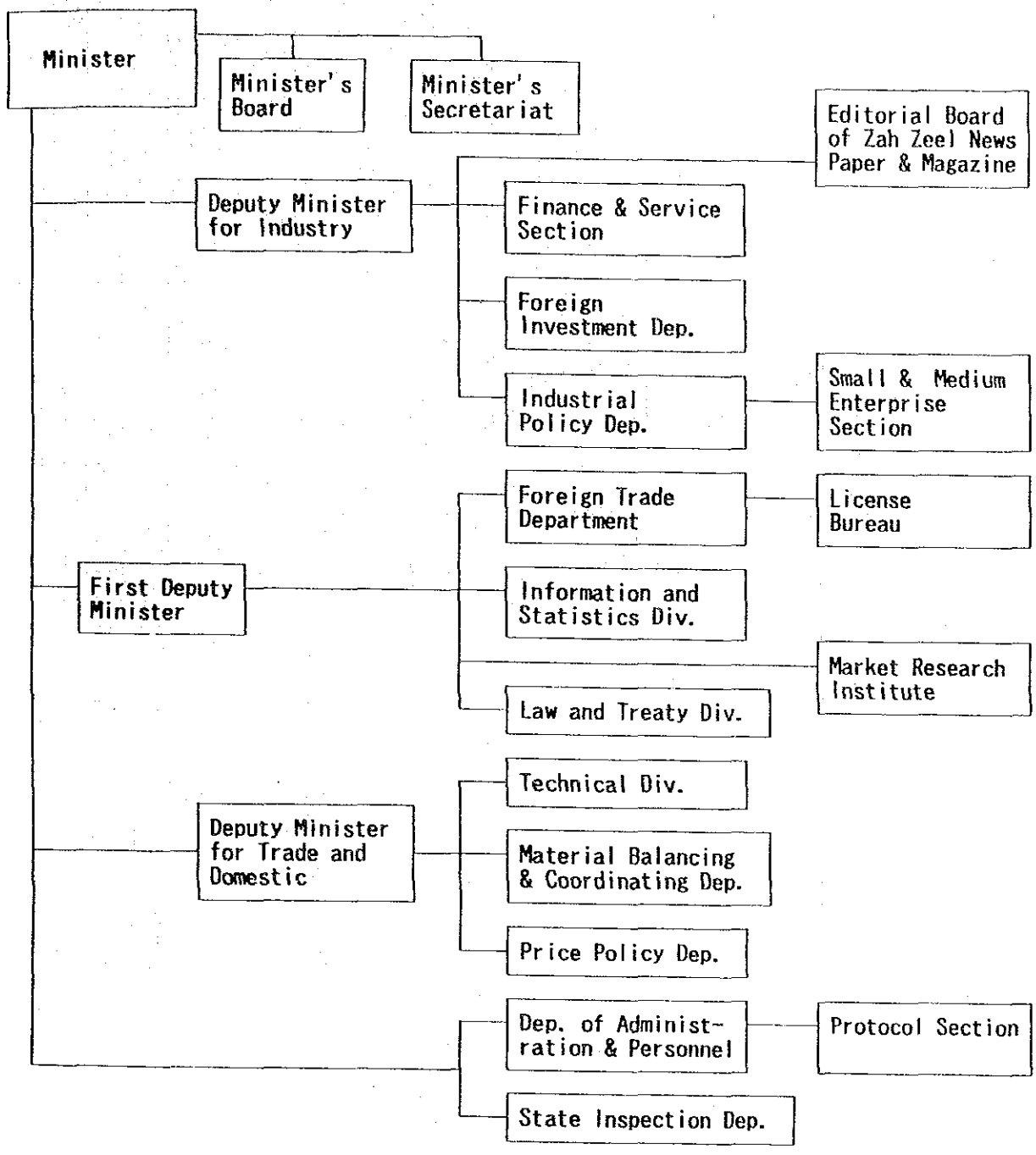


Fig. 3-3-1 Organization Chart of Ministry of Trade and Industry

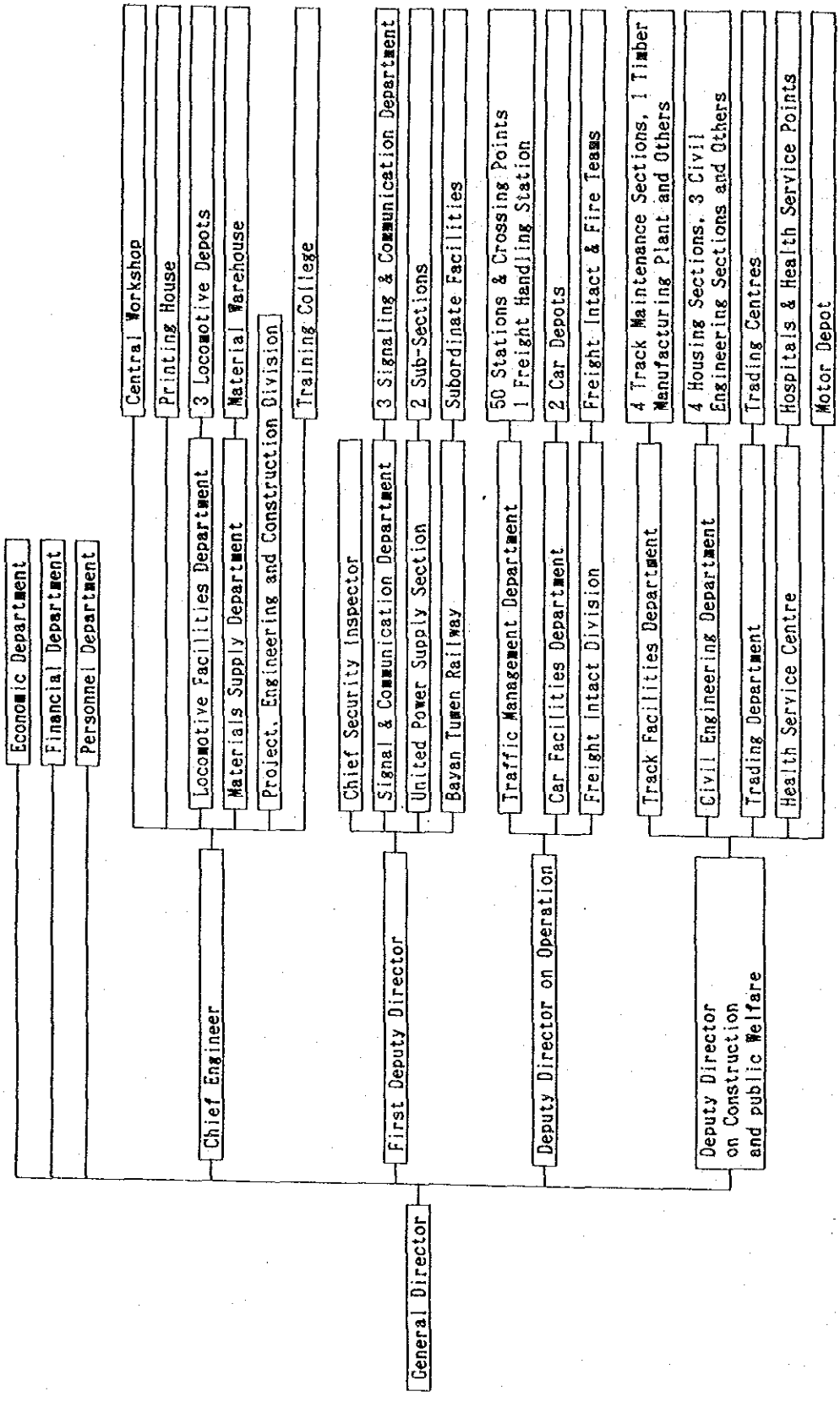


Fig. 3-3-2 Organization Chart of Mongolian Railway

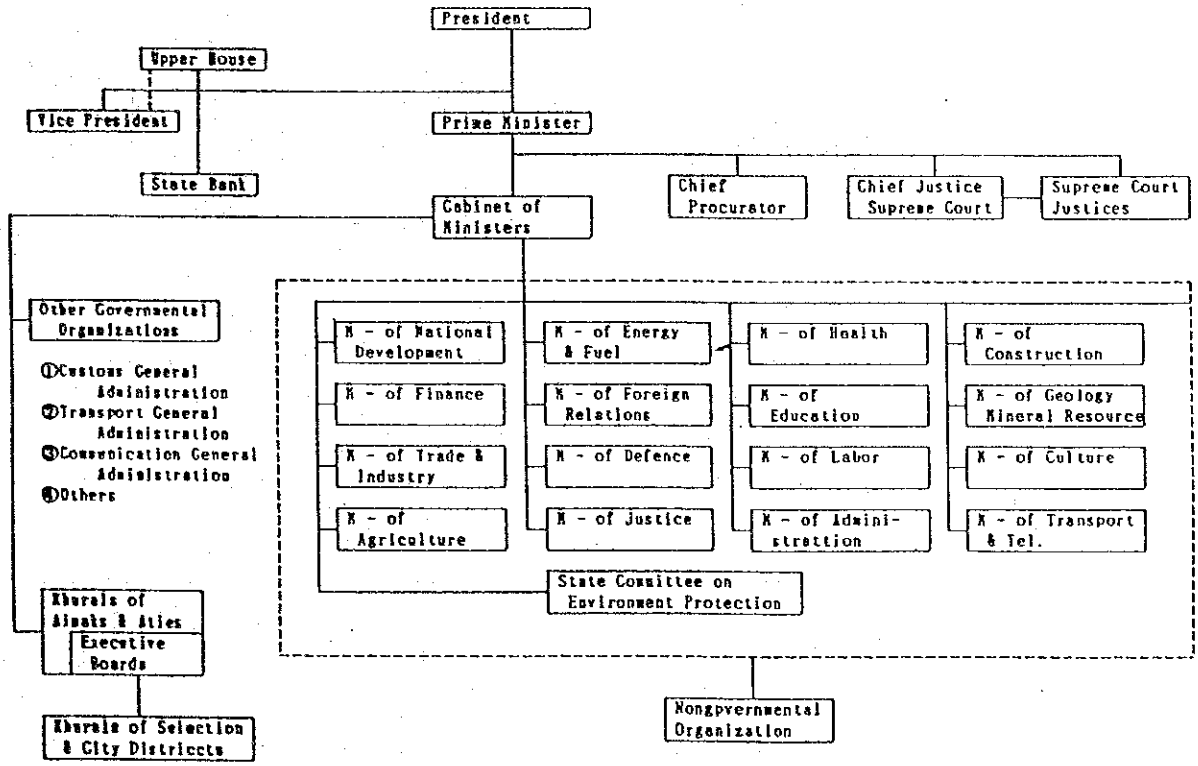


Fig. 3-3-3 Organization Chart of Mongolian Government

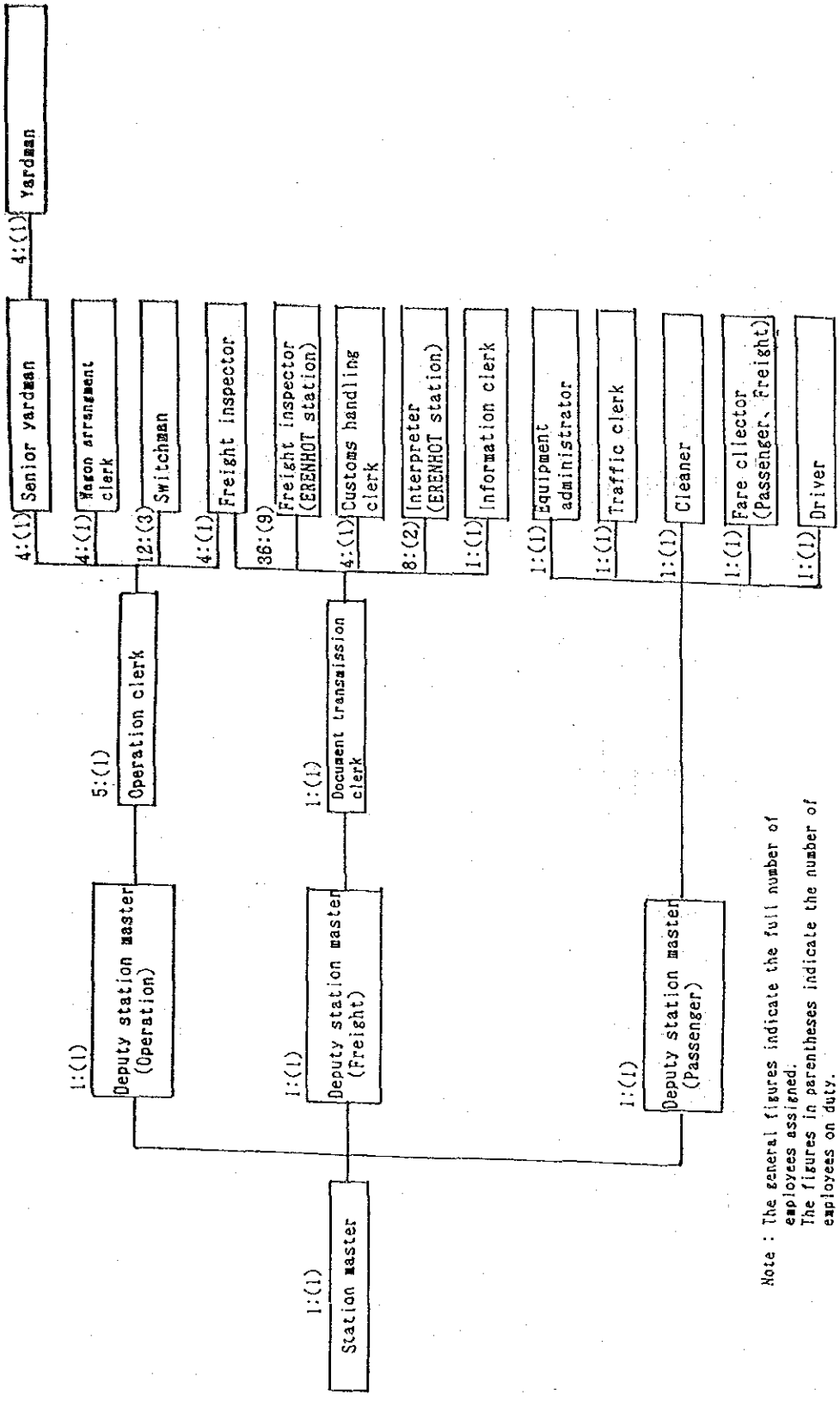


Fig. 3-3-4 Organization chart of Train Operation Division of ZAMYN-UUD Station (Fiscal 1992)

MR had 16,711 staff in 1990 including 1,669 engineers and 14,106 in 1991. The number of staff members has decreased remarkably in the past few years. The number of MR employees in January 1991 is classified as follows.

Table 3-3-1 Number of Staff, MR (1991)

1)	Traffic Management	1,557
2)	Locomotive Facilities	1,551
3)	Car Facilities	1,460
4)	Track Facilities	2,856
5)	Signaling and Telecommunication	561
6)	Power Supply	350
7)	Civil Engineering	2,210
8)	Health Service Centre	1,130
9)	Trading	941
10)	Others	1,470
	Total	14,106

Zamyn-uud station consists of eleven divisions for train operation, rolling stock maintenance, power generating, train 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 as shown in Fig 3-3-4, 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 pointsmen assigned at the site.

3-3-3 Location and Condition of Project Site

a) Location of Project Site

Project Site (Zamyn-uud Station) is located at the southern end of Mongolia, 4.5 km from the border with China or 709 km in railway route length far from the northern Mongolia capital, Ulaanbaatar.

b) Status of Zamyn-uud Station

There is a railway station in the Zamyn-uud area which is a district to receive, serve and dispatch goods and passenger trains, which are bound for China and back. The station has one railway carriage yard with 7 railway tracks, two sorting yards. There are locomotive depot, inspection and carriage repair office at the station.

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.

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 recorded a 303 % level in export, mostly by fertilizer and copper concentrate, and a 788 % level in import, mostly by cereals and fruits.

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 1,435 mm gauge.

Construction of embankment is required at the transshipment site and other areas. Most of the existing facilities are deteriorated and require proper remodeling and repair.

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 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.

Trains are operated under the tablet block system between Zamyn-uud and P52 signal station. Communication between the stations is made through telephone. The 1,435 mm gauge track at the petroleum transshipment site is equipped with an entry signal and two departure signals. The track is protected by a semi-automatic 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.

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

Telecommunication into the direction of Ulaanbaatar uses eight pairs of bare wires, of which two pairs are steel copper wires for 3-channel 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 signal, telephone and exchanging information on cargo movement.

Multiplex transmission is not adopted between Zamyn-uud and Erenhot. Wireless telecommunication is in use between train locomotives and major stations in the frequency band of 2,130 to 2,150 kHz. Wireless telecommunication is also in use between shunting locomotives and ground staff in the frequency band of 150 to 156 MHz. Marshaling staff communicates with the point and signal operator in the operating center through a telephone at the nearest site signal operating center.

Zamyn-uud 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 10 KV connects the area with Sain-shand, 230 km away, to supply power to important facilities in the Zamyn-uud district.

For the maintenance of rolling stock, 47 workers are now working at the station in the daytime and night shifts against the authorized number of 51.

c) Zamyn-uud Transshipment Facilities

At the present, there is no transshipment facility at Zamyn-uud excepting the temporary petroleum transshipment facility which was constructed by the Mongolian Government and is now under operation.

The former Soviet Union's feasibility study of cargo transshipment facilities at Zamyn-uud station was implemented by All USSR export and Import Corporation and Ural Transport Facilities Design Institute based on the contract between the said Corporation and Complex Import Corporation in Mongolia which was concluded according to the "Agreement on Economy, Science and Technology, 1986 to 1990" reached on January 15, 1986 between the Soviet Union and Mongolia.

This feasibility study covered transport demands, transport planning, facilities of track, cargo handling, telecommunication, signal and rolling stock maintenance, architecture and other various fields.

In this feasibility study, the volumes of cargos to be transshipped every year at Zamyn-uud in the 2000s are estimated to be 850,000 tons of import and 1,690,000 tons of export.

On the basis of this feasibility study, construction of 1,435 mm tracks had started. However, the construction work was suspended after four tracks had been completed in 1990 due to the changes in the political and economic situation in the Soviet Union.

Since the economic situation of Mongolia has undergone drastic changes after the feasibility study was implemented by the former soviet Union, most of the proposals made in the feasibility study report require modifications more or less under the present circumstances.

d) Natural Conditions at Zamyn-uud Station

Climates

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 following characteristics are based on data from meteorological stations in Ulaan-Baator and Sain Shaud.

Temperature

Annual average temperature	:	3.4 °C
Absolute maximum temperature	:	40.7 °C
Absolute minimum temperature	:	-37.2 °C
Monthly average temperature		
Jan. (coldest month)	:	-18.7 °C
March - April	:	0 °C
April	:	5.9 °C
July (warmest month)	:	23.1 °C

Precipitation

Annual average precipitation	:	120 - 160 mm
Distribution of precipitation		
in Summer	:	More than 85 % of precipitation
in Autumn	:	Short period heavy rains
in Winter	:	1 - 3 % of precipitation and over ten days snowfall (2 - 4 cm)

Wind

Annual average wind velocity	:	4.9 m/sec
Maximum wind velocity in April, May, September	:	26 - 34 m/sec
Sand storm and Snow storm occur in spring		

Humidity

Maximum relative humidity	:	60 - 72 % in winter
	:	44 - 60 % in summer
Minimum relative humidity	:	28 - 40 % in April/May
Annual average relative humidity	:	43 - 56 %

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 - 2.5 m.

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.

Field investigation had been carried out for this project by the former Soviet Union and completed in 1990. Having reviewed the soil investigation report, it seems that the standard penetration test had not been carried out. Fig. 3-3-5 shows the typical geological section at Project Site.

Hydro-geological conditions

The sedimentary Mesozoic/Cenozoic sedimentary strata located in this region have an extremely low hydrosity. Hydrous horizontal-lying soil of any practical value lies scattered sporadically at a depth of 70 - 80 m. 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 3000 mg/l) and hardness (less than 14 mg.eqv/l). According to data from the excavation of 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 - 2.7 m^3/hr, varying according to the degree of fracture and the thickness of the hydrous soil. The hydraulic pressure

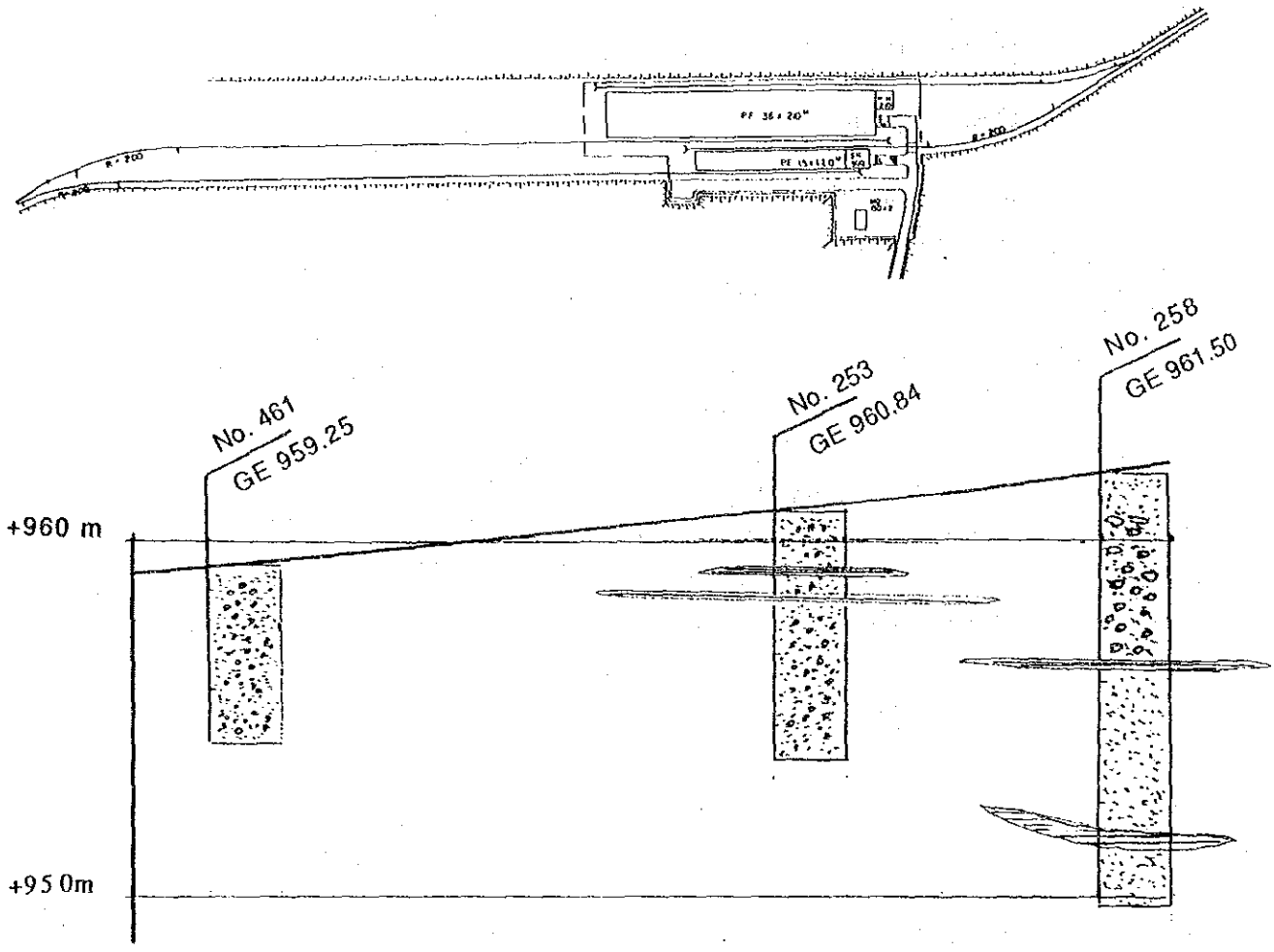
of the subterranean water is extremely weak, and the static water level in the working well at Zamyn-uud Station is at a depth of 52.0 - 58.0 m.

Construction materials

In this region, there is an abundance of different grades of sand (from powdery to gravely). 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 be transported in from other regions.

When the Ulan Bator 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.



SYMBOLS OF BORING LOG

SAND

CLAY

GRAVEL

Fig. 3-3-5 Geological Cross Section (H = 1/5,600, V = 1/200)

3-3-4 Outline of Facilities and Equipment

General

The Japanese full Scale Study Team (JICA) conducted the feasibility study on the shot term improvement plan for the transshipment facilities at Zamyn-uud station to enable to transfer the cargo from the Chinese to Mongolian freight cars. In this study, the Team established the transshipment facilities plan for the year 2000 and selected the Urgent Project (the Project) to be implemented immediately.

The project facilities and Equipment were selected based on the following preconditions.

(1) The project must realize facilities to transship cargos arriving by Chinese freight trains to Mongolian freight trains at Zamyn-uud station.

(2) The transshipment facilities must handle containers on gondola cars and flat cars as well as foodstuff, fertilizer and other cargos of different packing styles loaded on wagons.

(3) The project does not cover the transshipment facilities for construction materials, fluorite and other cargos transported in gondola cars. However, these cargos can be dealt with by the container handling facilities.

(4) To minimize the expenditure, the project does not include items that are not urgently required for the transshipment work. For this reason, facilities for car washing and locomotive maintenance and other auxiliary equipment will be considered in the whole layout for the year 2000.

(5) Not only in the urgent project but also in the whole plan for the year 2000, the track layout and related facilities must be designed to facilitate linkage with the petroleum transshipment site which will be constructed and operated by another entity (Mongolian Petroleum Import Corporation).

(6) For the budgetary reason, the project cannot necessarily cope with the whole transshipment demands forecast at the time of its completion.

(7) The project must be completed with as small an initial investment as possible.

Outline of Facilities and Equipment

The Project consists of the following facilities and equipment of which approximate volume is described in 2 - 2 of Chapter 2.

(1) Track

1) 1,435 mm gauge track

Departure and arrival track	:	3 (existing tracks)
Sorting track	:	3 (1 existing, 2 to be constructed)
Draw-out track	:	1 (to be constructed)
Cargo transshipment track	:	2 (1 each for wagon and gondola car/container car)

2) 1,520 mm gauge track

Departure and arrival track:	:	6 (existing tracks to be extended)
Sorting track	:	3 (1 existing, 2 to be constructed)
Draw-out track	:	2 (1 existing, 1 to be extended)
Cargo transshipment track	:	2 (1 each for wagon and gondola car/container car)

(2) Civil structure

Construction work of embankment and track bed for the above tracks, cargo transshipment platforms (for cargos in wagon and containers) and roads.

(3) Building

Cargo handling office	150 m^2 x 2 floors
Cargo storage house	300 m^2
Residential house	4,130 m^2 (for 54 family use)
Garage (for reach stacker)	210 m^2

(4) Cargo handling equipment

Four 1.5-ton forklifts and four belt conveyors will be used for cargos in wagon, and a reach stacker for containers.

(5) Signal and telecommunication equipment

To improve the efficiency of shunting, maintenance, inspection and other work in the yard, fixed and portable radio communication equipment and talk-back equipment will be introduced for communications between ground crews. If the budget allows, a digital telephone exchange will preferably be introduced to replace the existing exchange which often fails to connect intended subscribers.

(6) Power equipment

The team planned to install lighting equipment with mercury floodlamps to maintain an average illumination density of 10 lux on the low platform, 100 lux with lamps fixed at the ceiling of the house on the high platform, and one lux for the storage and locomotive turn-out tracks, with necessary transformers and power supply cables. The existing power generating plant can supply power for the lighting equipment, if the existing 630 Kw generator now defective is repaired.

3-3-5 Operation and Maintenance Plan

To efficiently operate freight trains between Mongolia and China, the appropriate organization with necessary employees, finance and training will be required to operate and maintain the transshipment facilities and equipment.

Organization

Since Zamyn-uud station is located near the border with China, a remote place from large towns, the increase of employees must be limited to a minimum, by utilizing the present work force as much as possible. For this reason, it is necessary to:

(1) Operate the station with the present organizational structure without organizing new divisions.

(2) Introduce efficient work procedures for the cargo transshipment work, and

(3) Cope with the increased workloads by improving the efficiency of the present work force.

Number of employees

To efficiently implement the international freight transport, we determine the number of employees taking into consideration transport demand, freight train operation plan, yard work plan and scales of various cargo handling equipment, in addition to the employment situation of Mongolian Railway as a whole.

(1) Operation of station

The employees to be newly adopted include cargo transshipment workers, inspectors of cargo transshipment work, interpreters for Chinese inspectors, yard men for shunting, signal men to handle signals and the relay interlock system, point men and guards for prevention of thefts. In case the workload increases in the future, train dispatchers, errand workers and customs document officers will be newly recruited.

(2) Shunting locomotive drivers

Zamyn-uud station will be assigned with two shunting locomotives, one each for the 1,435 mm gauge track and the 1,520 mm gauge track. With the aid of radio communication means, a locomotive can be operated by one driver. When the frequency of train operation between Zamyn-uud station and Erenhot increases in the future, drivers and assistant drivers will additionally be employed accordingly.

(3) Rolling stock maintenance

The rolling stock maintenance is being carried out by 47 workers at present. Their major assignments are inspection of locomotives and freight and passenger trains, mainly visually made without dismounting components from the cars. In case a locomotive or a car fails, however, they will do necessary repair work.

At present two freight trains and three passenger trains are inspected at Zamyn-uud station. In the year 2000, the number of trains and locomotives to be dealt with will increase to six freight trains and two locomotives besides the three passenger trains which is the same as at present.

Even though the workload is nine trains, the present work force seems to be able to cope with, since it takes only one hour or so to complete inspection of a train. In view of the new assignment of two shunting locomotives and the possibility of

increase of rolling stock maintenance as a result of the increase of cars to be handled, it is appropriate to add one worker to each shift, i.e., four workers in total in the four-shift working system.

(4) Maintenance of cargo handling equipment

The cargo handling equipment require an appropriate number of operating and maintenance staff. The cargo transshipment work consists of three categories, transshipment of containers, transshipment of cargos in gondolas and transshipment of cargo in wagons.

In this situation, the work force must be composed of:

a. A crane operator and an assistant for container,
b. A crane operator and two assistants for cargo in wagons, and
c. A forklift operator and six cargo carrying workers for cargos in gondola.

Cargos in gondola are wound with wires when to be lifted. This requires an assistant for unloading from the Chinese car and another for loading on the Mongolian car. Three to four forklifts and conveyors will be used in handling the cargos transported by wagon.

From the above, a team should have 11 workers. It is necessary therefore to employ 44 workers for the cargo transshipping in the four-shift working system.

The workload differs depending on the packing styles and volume of cargos transported by a train, so that the number of the workers in one shift should not be fixed. Adjustments should be made between different shifts flexibly by confirming the composition and contents of the arriving train.

(5) Track and building

In estimating the necessary number of track maintenance staff in the year 2000, we consider the present status of track maintenance work, severe natural conditions at the site, possibility of improvement of maintenance work and modernization of the facilities.

The present building maintenance team consists of a foreman, two painters and a carpenter, which will be strengthened in the year 2000 to a formation of a foreman, a plasterer, a worker for block maintenance and an iron work worker.

(6) Signaling and Telecommunication

When the numbers of the staff required for signal and telecommunication equipment are totaled, the necessary number becomes 21, which is the same as the number of the present staff.

(7) Power supply equipment

At present, 25 workers are assigned to the power generating plant of Zamyn-uud station, including four maintenance staff and engine operators, assistant operators and electricians who are working in two shifts.

In the year 2000, the operation of power generators and the auxiliary distribution board will have been automated so that the number of staff need not be increased for the operation of the system. However, one more member will be necessary as the maintenance staff to cope with the increase of the number of power generators and the length of transmission lines.

(8) Increase of the number of staff

Following Table summarizes the increase of the number of the station staff as of the year 2000.

Table 3-3-2 Expected Number of Staff at Zamyn-uud Station (2000)

Assignment	Increase	Remarks
Train operation	98	Increases of trains and cargos
Locomotive	12	Introduction of shunting locomotives and increase of shunting
Car maintenance	4	Introduction of shunting locomotives and increase of maintenance
Cargo handling equip't	44	Installation of cargo transshipment equipment
Track and building	6	Extension of tracks
Signal and Telecom. eq.	0	The present staff can cope with the increased equipment
Power supply eq.	1	Increase of maintenance work
Total	165	

The number of staff required for the operation and maintenance for the facilities and equipment provided by the Urgent Project is supposed to be about 54, taking into consideration of the scale of the transshipment facilities at Urgent Project. These increased staff will be selected and assigned among the present Mongol Railway Staff, 14,100 in total (1992). New organization Chart of Zamyn-Uud Station (2000) as shown in Fig. 3-3-6 is referred to this plan.

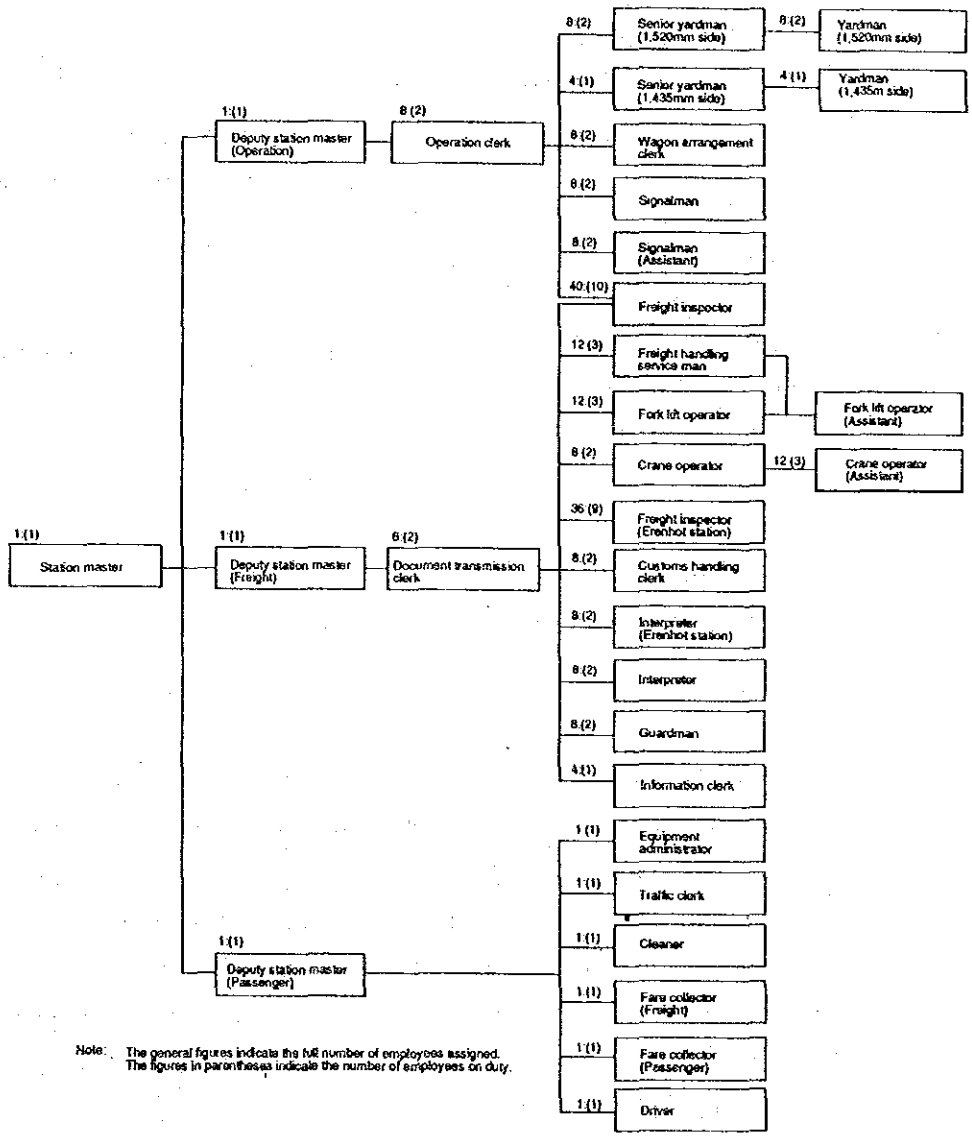


Fig. 3-3-6 Organization Chart of Zamyn-Uud Station (2000)

Training

For the operation of the cargo transshipment facilities, the following training is necessary.

(1) Before the commissioning

1) Contents of training

a) Cargo handling equipment
Structure, function, operation and maintenance

b) Maintenance of cargo handling equipment
Structure, function and maintenance

c) Operation of signal, switching and relay interlock equipment
Security system for train operation, equipment, operation and trouble shooting

d) Signal and point and their maintenance
Structure and maintenance

e) Radio communication equipment, digital exchange, communication equipment in the yard
Function and operation

f) Maintenance of radio communication equipment
Function and maintenance

g) Power supply equipment
Operation of generator and maintenance

2) Instructor

Prior to the training of the workers, instructors must be trained. Training of instructors are to be made abroad or in Mongolia depending on the situation. As for the training on the cargo handling equipment, however, the equipment can be brought into the construction site in advance, then the engineers from the manufacturers will be able to train the instructors and transfer the technologies for using the equipment. Similar approaches can be adopted for the training of signal, interlock and radio communication equipment, generator and digital exchange.

(2) After the commissioning

It may take nearly one year after commissioning the cargo transshipment facilities for the staff to be sufficiently experienced and acquire necessary skills in the

operation. The training schedules must be well prepared considering the severe natural conditions, the maximum temperature of 40 °C in summer, the minimum temperature of -40 °C in winter and the climate of the desert area.

Operation and Maintenance

According to the result of JICA Feasibility Study, the following annual cost is required for the operation and maintenance of the transshipment facilities and equipment at Zamyn-Uud Station in 2000 year.

Personnel cost	5,100,000 Tg/year
Energy cost	4,750,000 Tg/year
Maintenance cost	7,600,000 Tg/year
Total	17,450,000 Tg/year

The operation and maintenance cost for the facilities and equipment provided by the Urgent Project will require about 5,800,000 Tg/year which is a one-third of the cost at 2000 year. This cost may be found from the new source of transshipment operating revenue. (90,000,000 Tg/year x 1/3)

CHAPTER 4 DESIGN

4-1 Design Policy

Basic considerations made in developing the design are as summarized below;

(1) Careful examination of the proposed schemes and methods of execution in respects of their project time and cost implications.

(2) Practicability of the construction schemes within the project contexts where construction activities can not take place during winter season. (November to March)

(3) The importance of sandstorm and freezing resistance in the transshipment facilities and equipment structure since the project site is in a desert region where the absolute minimum temperature is -37 °C.

(4) Due attention is paid to the importance of maintenance costs saving considerations in public works design in Mongolia, particularly in selection of concrete structure type and transshipment equipment. Where concrete structures are involved, the use of cast-in-site concrete which does not require maintenance work is recommended, and

(5) Due attention is also paid to the necessity of maximizing the use of local manpower in selecting facility and equipment types, methods of construction and temporary works systems, with an aim to contribute in activation of local economic activities and practical technological transfer to local parties of interest through project implementation.

Based on the above principles, the designs have been developed with the following policies;

(1) To use the existing facilities as much as possible. Particularly to utilize most of the track and track bed facilities partially constructed by the former Soviet Union for the purpose to transfer the cargo at Zamyn-uud Station and suspended in 1990 due to the changes in the political and economical situation in the Soviet Union.

(2) To use the cast-in-site concrete structures for main concrete structures such as building foundations and its frame, cargo handling platform, precast concrete structures for minor concrete structure such as building wall, drainage ditch and fencing.

(3) To use the concrete wall fence to protect the main transshipment facilities and equipment from sandstorm and snowstorm.

(4) To level the heights of track in transshipment yard, as the freight train can be smoothly operated in yard and the transshipment facility can be expanded to cope with the future demand.

(5) To design the structures that have safety, ease of construction and maintenance and adequacy environment.

(6) To design the transshipment equipment with special attention for the specific site conditions such as the extreme low temperature, sand storm with fine sand dusts.

(7) To provide the sufficient maintenance facilities for the transshipment equipment including the engine start-up backup system.

(8) To provide the necessary cargo handling and lifting slings and pallets required for handling the various types of cargoes.

(9) To provide the necessary jig manufacturing facilities in order to fully utilize the transshipment equipment to handle the special type cargoes.

(10) Frequencies of train operation and point operation do not increase beyond the capacities of existing signal equipment. Therefore, the signal equipment is out of the scope of construction work under this project.

(11) As telecommunication equipment, talk-back equipment shall be introduced for the convenience of shunting work, maintenance work and communication between the sites and the station office.

(12) The telecommunication equipment shall be prepared for future system expansion.

(13) Based on the yard equipment arrangement diagram, two types of talk-back equipment, for general address and individual communication, shall be installed.

(14) The radio communications equipment shall include those fixed in the office, on the shunting locomotives and of the portable type.

(15) To use the existing two generators - the 630 kW and the 800 kW generators at Zamyn-uud Station.

(16) To use the lighting poles with mercury lamp projectors for transshipping facilities and equipment against sandstorm and snow storm.

(17) To use the mercury lamp projectors (HF400 W) for low-floored transshipment platform and station yard.

(18) To use the mercury lamps (HF200 W) for sheltered platform.

(19) To use the fluorescent lamps (FL40 W) for field office, warehouse, car barn and boiler room.

4-2 Study and Examination on Design Criteria

4-2-1 Natural Conditions

a. Ambient temperature

Maximum temperature	:	40.7°C
Minimum temperature	:	-37.2°C
Annual average temperature	:	3.4°C

b. Precipitation

Average annual precipitation : 120 - 160 mm

Distribution of precipitation

in Summer	:	More than 85 % of precipitation
in Autumn	:	Short period heavy rains
in Winter	:	1 ~ 3 %
Average Snowfall	:	over ten days (2 - 4 cm)

c. Wind

Maximum annual wind velocity : 26 - 34 m/sec.
in spring (April, May) and in Autumn (September)
Annual average wind velocity : 4.9 m/sec.
Sandstorm and Snowstorm occur in spring
Wind direction : W, NW

d. Humidity

Maximum relative humidity	:	60 - 72 % in winter
	:	44 - 60 % summer
Minimum relative humidity	:	28 - 40 % in April/May
Average annual relative humidity	:	43 - 56 %

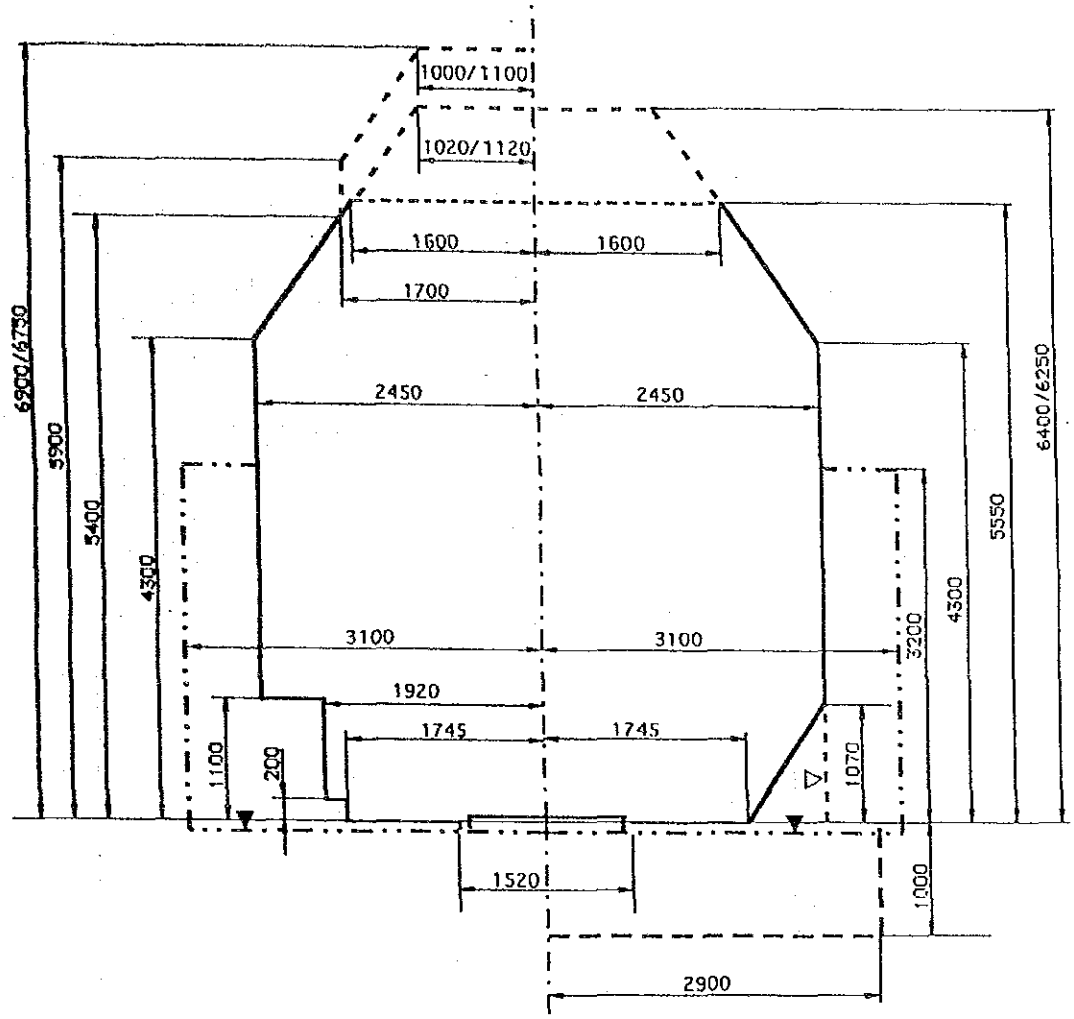
e. Seismic Loads

The observation records of earthquake in Mongolia are not enough to decide the seismic coefficient in the design. The minimum number of Kk (= 0.10) which is specified in the Japanese domestic structural design is adopted in the design. The vertical seismic coefficient is not considered in the design, because it is too small.

4-2-2 Design Criteria of Track and Track Bed Structure

Design criteria adopted for the track structure in this project are as follows, as agreed by the executing agencies, Ministry of Trade and Industry (MTI) and Mongolian Railway (MR).

(1)	Construction gauge (Fig. 4-2-1)	: 4.9 m in width, 5.4 m height
(2)	Rolling stock gauge (Fig. 4-2-2)	: 3.6 m in width, 5.3 m height
(3)	Minimum radius of curve	: 200 m
(4)	Gradient of track in the yard	: Less than 10/1000
(5)	Effective length of track	: 850 m
(6)	Center to center distance between tracks	: Main line 4.10 m, in the yard 5.30 m
(7)	Turn out point in the yard (Fig. 4-2-3)	: 1/9
(9)	Rail and fastenings (Fig. 4-2-4)	: 50 kg/m
(10)	Wooden Sleeper in the yard	: 150 mm (h) x 230 (w) x 2,750 (l)
(11)	Number of sleeper	: 1,600 unit/km for Dep./Arr Track yard
		: 1,440 unit/km for other yard
(12)	Rail bed structure (Fig. 4-2-5)	



Line of approaching the construction of bridges, tunnels, platforms and others.

Line of approaching all constructions and organizations.

Line of approaching constructions for the tracks, where is not electrified.

Line of approaching buildings, constructions and others from the external side of outward blocks.

Top of raising constructions and organizations.

Line of approaching foundation of buildings, underground cables, tubing and others.

Line of approaching constructive elements of tunnels, bridges, scaffolds and others.

Fig. 4-2-1 MR Construction Gauge (1520)

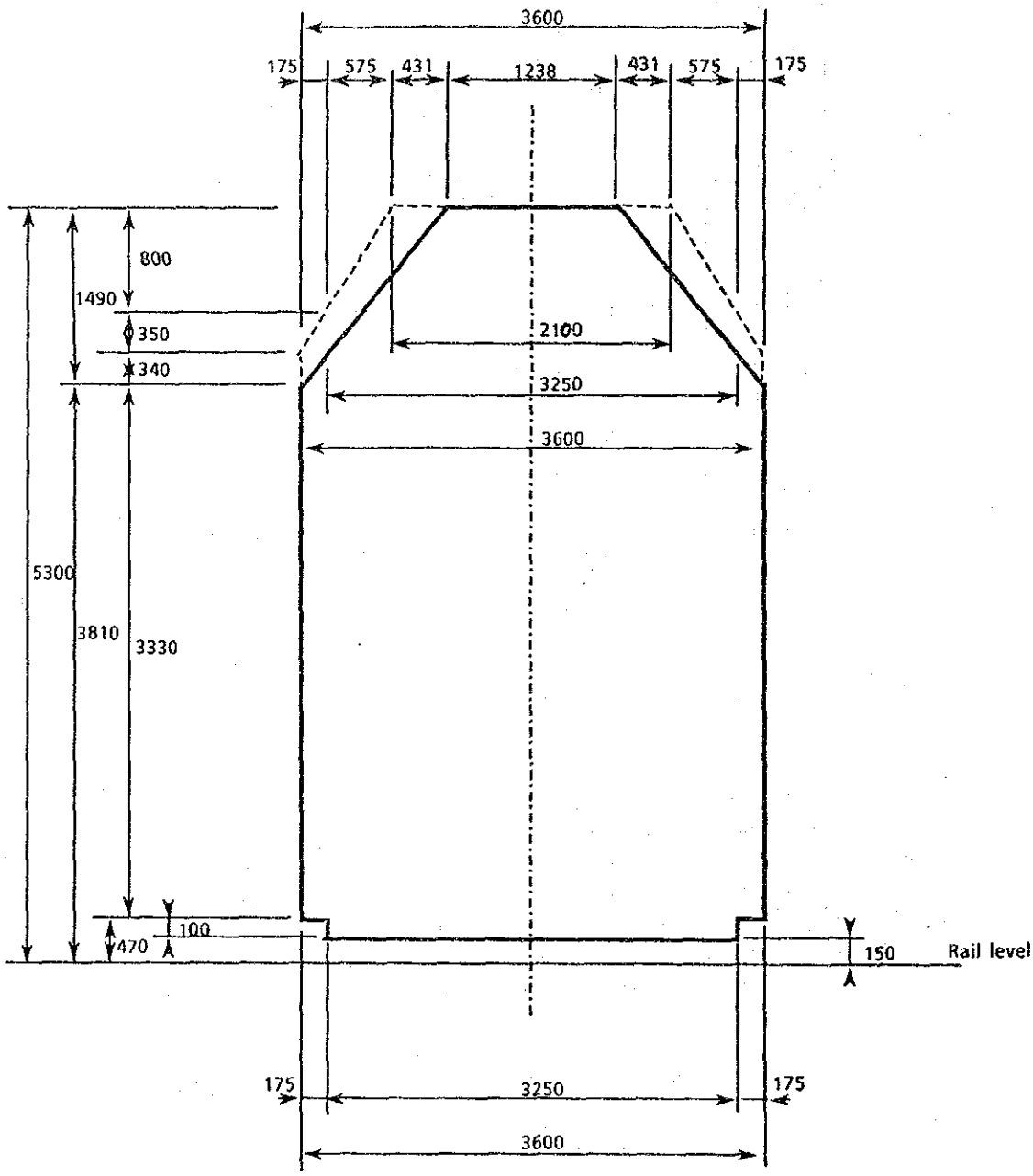
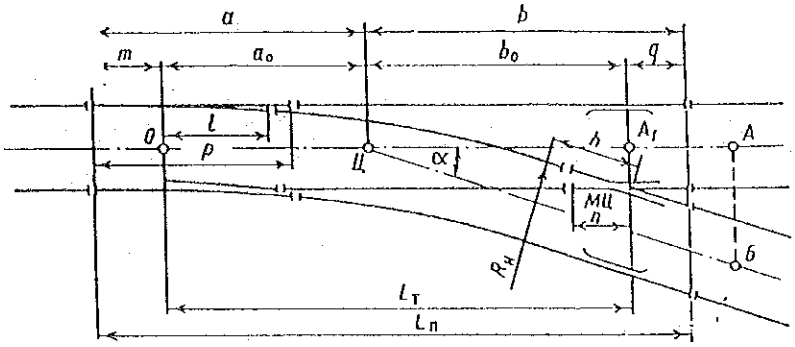


Fig. 4-2-2 MR Car Gauge



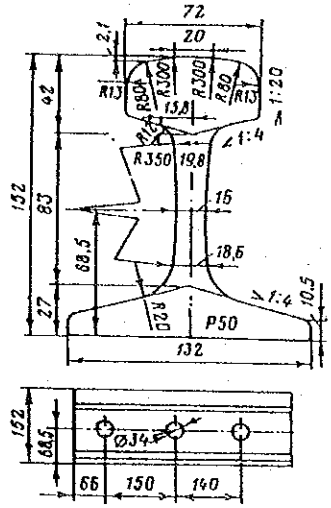
(unit m)

rail	size	l	p	m	α	n	q	a_o
simple								
P50	1/9	6.515	12.500	4.327	6° 20'25"	2.055	1.880	11.132
P50	1/11	6.515	12.500	4.327	5° 11'40"	2.650	2.300	10.148

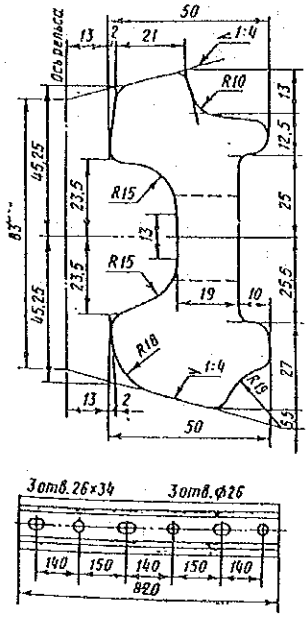
rail	size	b_o	h	$R_н$	$L_н$
simple					
P50	1/9	13.722	2.018	200.000	31.061
P50	1/11	16.754	3.537	297.259	33.529

Fig. 4-2-3 Turn out Skelton

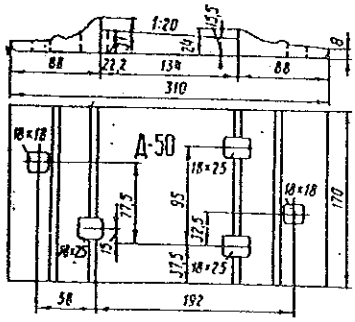
P 50 Rail



Rail joint plate



Tie-plate



Spike

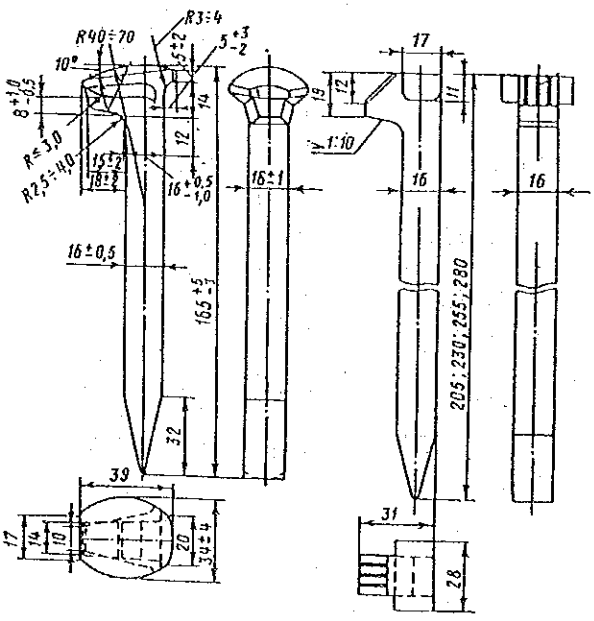
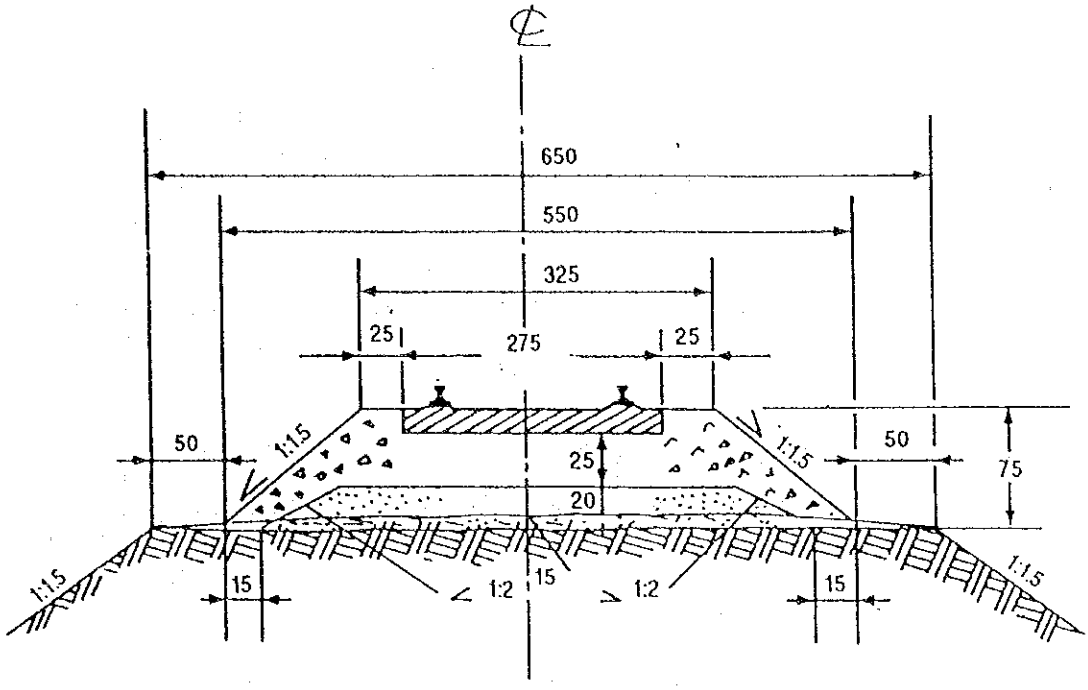


Fig. 4-2-4 Track Materials



unit : c m

Fig. 4-2-5 Standard Track Section

4-2-3 Design Criteria of Civil and Architect Structure

(1) General

a. Materials and Testing

Materials used in structures and foundations will conform to JIS or equivalent standards latest edition.

b. Design and Testing

Structures and foundations will be calculated and proportioned according to the following standards.

- Japanese Industrial Standards (JIS)
- Standard of the Architectural Institute of Japan (AIJ), Japanese Architectural Standard Specification (JASS) and Japan Society of Civil Engineers (JSCE)
- Standard of Mongolian Railway

(2) LOAD

a. Dead Loads

The unit weights as given in the following table are used for calculation of the dead load.

Table 4-2-1 Unit weight of materials by volume

Material	Unit Weight (ton/m^3)
Steel, cast steel and forged steel	7.85
Cast iron	7.25
Reinforced concrete	2.50
Concrete	2.35
Cement motor	2.15
Bituminous material (for water proofing)	1.10
Stone	2.60
Timber	0.80
Sand/Gravel/Crushed stone/Clay	1.60 - 2.00
Ballast (Gravel or Crsushed stone)	1.90
Snow	0.30
Coal, Coal slag	1.00
Track skeleton	0.45 ton/m

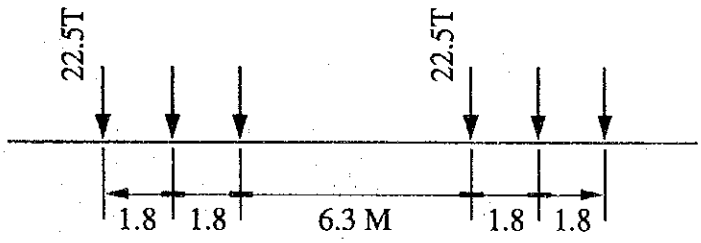
b. Live Loads

The train-loading and vehicle-loading, cargo handling-loading sidewalk-loading are adopted in the design of the track, platform, road and building. The details are described as below:

(i) Train-loading

The maximum axle load (26 ton used in Russia) shall be adopted in the design of the track and civil structure. Axle loads of Diesel locomotive operated in Mongolia are shown in the following figures.

Standard gauge (1,435 mm)



Mongol gauge (1,520 mm)

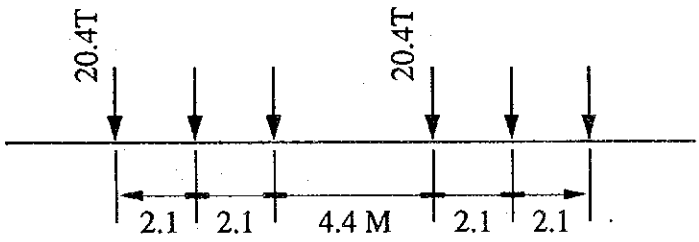
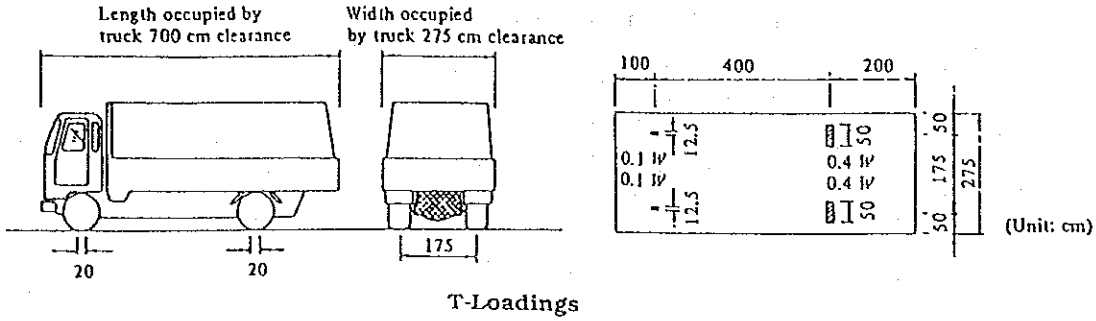


Fig. 4-2-6 Train loading

(ii) Vehicle-loading

T-20 is adopted in the design. T-20 loading is shown in Fig 4-2-7.



T-Loadings

Loading	Gross weight W(ton)	Weight of a front wheel 0.1W (kg)	Weight of a rear wheel 0.4W (kg)	Width of a front wheel b_1 (cm)	Width of a rear wheel b_2 (cm)	Length of contact area of a wheel on the road-surface a (cm)
T-20	20	2000	8000	12.5	50	20

Fig. 4-2-7 Vehicle loading

(iii) Cargo handling-loading (Container Platform)

The Maximum wheel pressure of Cargo handling machines on the Container Platform is 28 ton per wheel (107.7 kgf/cm²)

(iv) Cargo handling-loading (Wagon Platform)

The Maximum wheel pressure of Cargo handling machines on the Wagon Platform is 0.7 ton per wheel (1.8 kgf/cm^2)

(v) Sidewalk-loading

500 kg/m^2

c. Basic Wind Speed

The wind loads that are used for the design of the structure will be based on the maximum wind velocity of V = 34 m/sec.

$q = 24\sqrt{h}$

Where

h; height above around ground level in meters

q; wind pressure in kgf/m^2

0<h<15 m apply wind pressure = 93 kgf/m^2

15 m<h and higher apply wind pressure = $24\sqrt{h}$ kgf/m^2

d. Earth Pressure

(i) Normal State

The coefficients of active earth pressure and of passive earth pressure shall be determined by the following formula:

$$Ka = \cos^2(\phi - \psi) / \cos^2\psi \cos(\delta + \psi)\left[1 + \sqrt{\sin(\phi+\delta)\sin(\phi-\alpha)/\cos(\delta+\psi)\cos(\psi-\alpha)}\right]^2$$

$$Kp = \cos^2(\phi - \psi) / \cos^2\psi \cos(\delta + \psi)\left[1 - \sqrt{\sin(\phi-\delta)\sin(\phi+\alpha)/\cos(\delta+\psi)\cos(\psi-\alpha)}\right]^2$$

where

Ka : Coefficient of active earth pressure

Kp : Coefficient of passive earth pressure

ϕ : Angle of internal friction of soil at the back side of retaining wall (ϕ+35°)

δ : Angle of friction between the soil and the back face of wall, which may be regarded as the angle between the line perpendicular to the back face of wall and the line of application of earth pressure (d = ±15°)

α : Angle between the horizontal plane and the ground surface at the back side of the retaining wall

ψ : Angle between the back face of the wall and the vertical plane, which is positive if the back face inclines, in reference to the vertical plane, outwards from the backfill and is negative when it inclines inwards.

(ii) At earthquake

The coefficients of active earth pressure and of passive earth pressure shall be determined by the following formula:

The coefficient earth pressure at rest (Ko) shall be determined by the following equation.

$$Ko = 0.5 + \Delta Ka$$

where

$$\Delta Ka = Ka^2 - Ka^1$$

Ka^1 : Coefficient of active earth pressure in normal state

Ka^2 : Coefficient of active earth pressure at earthquake

$$Ka^2 = \cos^2(\phi - \psi - \theta) / \cos\theta \cos^2\psi \cos(\delta+\psi+\theta)\left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\alpha-\theta)}{\cos(\delta+\psi+\theta)\cos(\psi-\alpha)}}\right]^2$$

$$Kp^2 = \cos^2(\phi + \psi - \theta) / \cos\theta \cos^2\psi \cos(\delta+\psi-\theta)\left[1-\sqrt{\frac{\sin(\phi-\delta)\sin(\phi+\alpha-\theta)}{\cos(\delta+\psi-\theta)\cos(\psi-\alpha)}}\right]^2$$

$$(\theta = \tan^{-1}k)$$

where

k : horizontal earthquake coefficient

e. Load Combination

Load combinations to be used in calculations are as follows:
Apply the worst condition.

A) Dead Loads + Live Loads
B) Dead Loads + Live Loads + Wind Loads
C) Dead Loads + Live Loads + Seismic Loads

f. Bearing Capacity of Footing

The Zamyn-uud construction site is on an alluvial foundation composed of a light viscous soil layer (0.5 - 2 m thick) sandwiched between dominant layers of fine sand mixed with gravel. Though no measurement of the N-value has been made, since the void ratio is 0.6 - 0.7 (measured value), we estimate that the N-value could be about 10.

The bearing capacity of the soil which is specified by "N" value as N = 10 is considered as the allowable bearing capacity of soils.

The foundation bed for structures shall be considered below the depth of frost penetration as shown in Fig. 4-2-8 to prevent from damage caused by frozen soil.

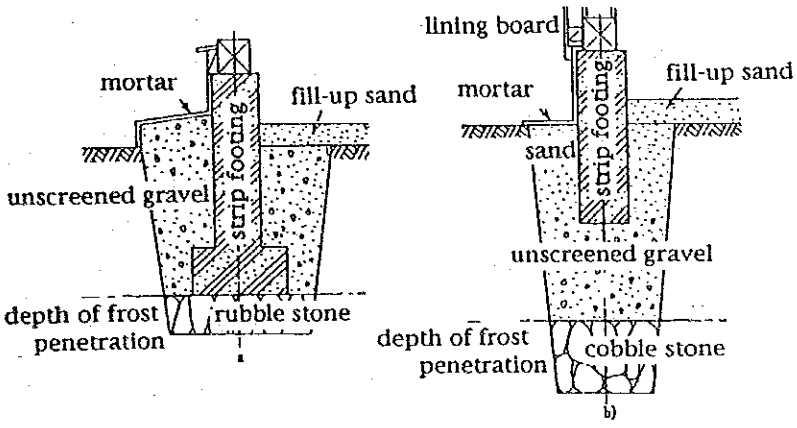


Fig. 4-2-8 Foundation bed for frozen soil

g. Quality and Allowable Strength of Materials

(i) Steel

Quality of structural materials, unless otherwise specified, will conform to JIS given in the following table.

Table 4-2-2 Quality of structural materials

Materials Title	JIS No.	Material (Shall be used)
Rails Fish-plates Track bolts Fish-nuts	E 1001	50 N
Rolled steel for general structure	G3101	SS 400
Steel bars for concrete reinforcement	G 3112	SD 295 SR 235

Allowable unit stress are show in the following table.

Table 4-2-3 Allowable unit stress (Steel)

Stress Unit: (t/cm^2)

Item	Description	Tension	Shear
Structural Stele	SS 400	1.4	0.8
Reinforcing	SD 295	1.8	2.0
Steel Bars	SR 235	1.4	1.6
Bolts	SS 400	1.2	0.9

(ii) Concrete

Ordinary Portland Cement shall be used for concrete works. The quality and allowable stress of concrete will be conform to the specified number in the following table.

Table 4-2-4 Allowable unit stress (Concrete)

Stress Unit: (t/cm^2)

Description	Compressive strength of concrete aged 28 days	Allowable stress
Leveling concrete	135	45
Plain concrete	180	60
Reinforced concrete	210	70
Paving concrete	315	105

(iii) Wooden Material

The allowable stressed of wooden material for general structure are as shown in the following table.

Table 4-2-5 Allowable unit stress (Wood)

Description	Allowable stress (kgf/cm^2)		
	Bending	Compression	Shearing
Red pine, Black pine, larch, Japanese cypress, Japanese hemlock, Oregon pine,	135	120	10.5
Japanese cedar, Fir, Silver fir, Red cedar, Western hemlock,	105	90	7.5
Oak	195	135	21.0
Japanese chestnut, Japanese Oak, Japanese beech, Zelkoua,	150	105	15.0

The quality of wooden sleepers shall be conformed to JIS E1001.

4-2-4 Design Criteria for Transshipment equipment

Basically, Japanese Industrial Standards (JIS) or the equivalent internationally recognized standards are applied for the design of equipment

Design criteria adopted for the transshipment equipment are as follows;

(1) Design criteria for reach stoker

a. Containers to be handled

Type : ISO 20FT and 40FT

Weight : 30.5 Ton

b. Stocking condition of containers

Row : minimum two raws

Stock Height : minimum three stacks

c. Cargo handling other than containers

Cargoes on gondola wagons and flat wagons shall be handled to the maximum extent.

(2) Design criteria for forklifts

a. Forklift shall be operable inside of box type wagons.

b. Cargoes on pallet and drums shall be handled.

(3) Design criteria for portable conveyors

a.	Cargoes to be handled	:	box type and bagged cargoes
b.	Maximum weight of cargo	:	100 kg each
c.	Power Supply	:	400 V, 50 Hz

4-2-5 Design Criteria of Electrical Facilities and Equipment

(1) Talk-Back

a. To protect them from flying sands and low temperatures in the desert, the talk-back equipment will be placed on a pole. The push button will be dusttight and antifreezing to endure severe operational conditions for long years.

b. A connection box will be placed near the talk-back installation pule as the cable relay terminal.

c. The talk-back installation pole and the connection box will be designed to the Mongolian Railway standards.

d. The signal operation cabin and the connection boxes will be connected with shielded multi-core cables with two to three pairs of spare cables in case the system is expanded in the future.

e. The cables will be laid underground.

f. The communication talk-back system and its operation panel will satisfy the following conditions.

* The operation panel gives a priority to the talk-back system, and sounds the ringing tone and the busy signal.
* The system will allow both single channel and simultaneous multi-channel communications.

* The speakers of the operation panel and the communication talk-back equipment will work also as a microphone.
* The operation panel will have lamps to indicate the operation status.

(2) Radio communications

a. To maintain good transmission conditions, antennas will be located on or near the signal operation cabin roof and on the shunting locomotives.

b. Portable equipment will be used by the staffs at the sites toward Ulaanbaatar and Erenhot in the yard and on or around the 1,435 mm gauge tracks.

c. To fully charge the batteries, always only half of the portable equipment will be in operation with other half being charged or kept as standby units.

d. The portable equipment will be:
* Compact and easy to carry,
* Highly reliable with good quality, and
* Structurally strong.

(3) Electric Power Facilities

a. Conforming to : JIS (Japanese Industrial Standard)
JEC (Japanese Electrical Commission)

b. According to : JR Rules on Design and Installation of Electric Power Facilities

c. High voltage distribution line : 3-phase 10kV aerial

d. Low voltage line : 3-phase 4 wires 380V

e. High voltage distribution wires : Bare hard copper wires, 38 mm squared, for high voltage distribution line

f. Low voltage wires : CV 14 - 38 mm squared
CVV 2 mm squares x 15 cores

g. Supporting pole : Reinforced concrete

h. Lamps : Mercury lamp HF400W (projector)
: Mercury lamp HF250W
Fluorescent lamp FL40W

i. Transformers : 10kV/380 - 220, 3-phase

j. Load switch : 10kV 200A

4-3 Design

4-3-1 Site Arrangement Plan

(1) Transshipment Facilities

The transshipment facilities have been installed in an intermediate position allowing them to be approached and used effectively without any obstruction to their operation from the existing facilities. They are also designed to enable efficient transshipment between Chinese-gauge and Mongolian-gauge freight trains, as well as securing sufficient space for future expansion.

(2) Cargo Handling Office

The office has been installed in a position which provides control of the transshipment work, where there is no obstruction to future expansion, and which is easily linked to the existing facilities.

(3) Cargo Warehouse and Garage/Repair Shed

The temporary cargo warehouse has been installed in a position where the temporary storage of cargo is simple and does not obstruct future expansion, whilst the garage and repair shed have been installed in a location where the storage and repair of transshipment equipment is easy at all times, without obstructing future expansion.

(4) Residential House

In conformity with the policies of the Zamyn Uud Development Plan by the Urban Planning Bureau of the Mongolian Construction Ministry, these have been located in a location near the work site, which is convenient for commuting, and where the surrounding environment is a residential area (in fact its location is specified in the urban plan).

(5) Auxiliary Facilities

A maintenance transshipment work and access road has been installed for the connections with ordinary roads, whilst a fence (to protect from shifting sand) has been installed around the periphery for the safety and security of the cargo and transshipment work. In addition, a roof is provided over the working

platform to prevent damage to small cargo from rain. The handling of small cargo is on a high-floor platform which involves a large degree of manual work.

4-3-2 Design of Track Layout

As a basic principle of layout design, effective use shall be made as far as possible of readily installable facilities. In addition, the layout shall be such that operations for train departure/arrival, engine run-round, and shunting shall not effect, conflict with, or cause inconvenience to the others.

(1) Departure and Arrival Tracks

a) Track for Departure and Arrival of Chinese Freight Trains (1,435 mm gauge)

Departure and Arrival Operations

Chinese freight trains will arrive at the arrival track hauled by Chinese locomotives. On arrival, only the locomotive will run-round. To avoid conflict between this locomotive and other yard shunting work, it will draw onto the petro base passage track, and after passing the departure and arrival tracks will wait on the Engine Waiting Track until it is due to depart for China.

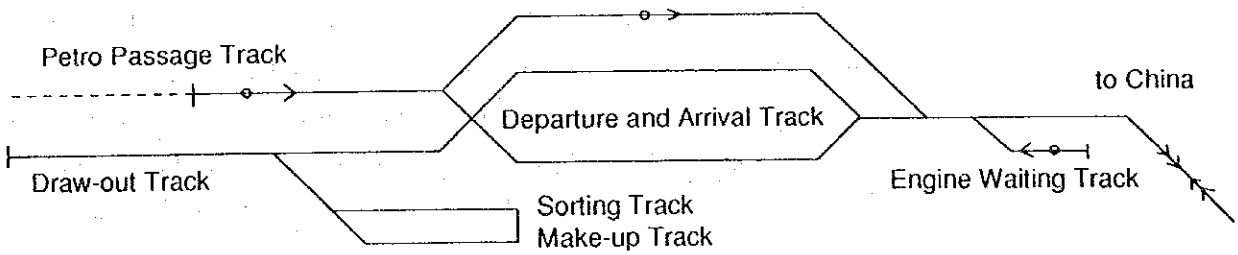


Fig. 4-3-1 Departure and Arrival Tracks (1,435 mm)

When the train of empties to be returned to China has been made up on a Departure track, the Chinese locomotive that has been waiting on the Engine Waiting Track will set back and be couple up. The train will then return to China via the China Departure track.

Layout of the departure and arrival tracks

The existing departure and arrival tracks (4 tracks) will be retained. The Draw-out Track and the Petro Base Link Track will be separated. The effective lengths of departure and arrival tracks for these cases will be as follows.

The departure and arrival tracks shall be numbered 1, 2, and 3 from the north.

Table 4-3-1 Effective Length of Dept/Arr Tracks (1,435 mm)

	Existing (m)	Planned (m)
Main Track	840	840
No. 1 Track	840	840
No. 2 Track	830	830
No. 3 Track	700	770*
East engine waiting track	-	50

* Use for sorting track in the beginning stage

b) Departure and Arrival Tracks for Mongolian Freight Trains

Departure and arrival operations

Mongolian loaded cars with export cargoes will arrive from locations within Mongolia at the Zamyn-Uud border town station. Here the trains will undergo train load adjustment from 2,600 tons to 2,000 tons. Trains depart for China pulled by Mongolian locomotives. Mongolian freight wagons which have been emptied at the Chinese transshipment stations will arrive hauled by Mongolian locomotives.

Empty Mongolian wagons from China as well as empty cars and tank cars returned from locations within Mongolia will be remarshalled, and these wagons which have been selected for transshipment will be shunted to the transshipment facility to which this plan relates. After loading, they will be made up into trains together with the remaining empty cars, and will depart for Mongolian destinations.

In other words, the main operations of the departure and arrival tracks will be engine run-round for Chinese trains to and from China, adjusting the train load of Mongolian trains bound for China, remarshalling Mongolian empty wagons from China, and from Mongolia, and making up trains departing for Mongolia.

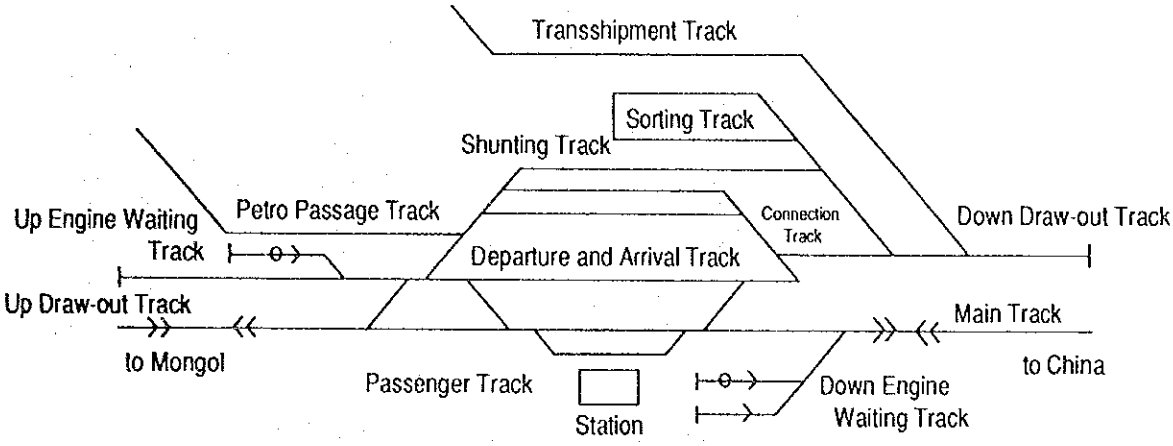


Fig. 4-3-2 Departure and Arrival Track (1,520 mm)

Layout of departure and arrival tracks

Since most of the existing departure and arrival tracks have an effective length of 850 m or less, the effective length will be extended by altering the track layout. The extension will take the form of improvements to the western part of the existing departure and arrival tracks. Since the Down Draw-out Track is extremely busy, an Up Draw-out Track will be laid out for auxiliary support. To this end, a Shunting Track (Make-up and Break-down) will be laid such that make-up and break-down of freight cars for up-trains can be carried out on the Up Draw-out Track. Train load adjustments to down trains and shunting of tank wagons (petroleum tank wagons) will as far as possible be carried out on the Up Draw-out Track. The Make-up and Break-down Track mentioned above can also be used effectively for tank wagons going in and out of the petroleum base.

Engine run-round for locomotives hauling trains arriving from China will in principle take place on departure and arrival track No. 1, and 'conflict' will be avoided between operations on up/down draw-out tracks and make-

up/break-down tracks, and on the down draw-out track and sorting/ connecting track.

The effective lengths of the departure and arrival tracks are as follows. Departure and arrival tracks are numbered 1, 2, 3, etc. from the south.

Table 4-3-2 Effective Length of Dept/Arr Tracks (1,520 mm)

	Existing (m)	Planned (m)
Main Track	761	761
No. 1 Track	891	891
No. 2 Track	868	900
No. 3 Track	769	890
No. 4 Track	767	870
No. 5 Track	714	845
No. 6 Track	714	714
Up engine waiting track	2 x 120	1 x 120
Down engine waiting track	2 x 120	2 x 120
Make-up/break-down track 1	-	650
Make-up/break-down track 2	-	620

(2) Draw-out Track/Make-up Tracks/Sorting Tracks

a) Chinese Freight Trains

A new draw-out track will be laid and will be divided from the engine run-round and petro-basc passage tracks. Although 3 sorting tracks and 2 ~ 3 make-up tracks will be needed, the total for both will be set at 3 since the sorting and make-up tracks can partly be used in combination. The effective lengths of each are as below.

Table 4-3-3 Effective Length of Shunting Yard Track (1,435 mm)

Draw-out Track	460 m
Sorting Track No. 1	440 m
Sorting Track No. 2	440 m
Sorting Track No. 3	770 m*

* Use for both dept/arrival track and sorting track in the beginning stage.

b) Mongolian Freight Trains

Mongolian freight trains returning from China will be completely remarshalled, those wagons which are suitable for transshipment will be spotted for loading. Fairly lengthy sorting tracks will be needed so that both these loaded wagons and the remaining empty wagons can be sorted according to destination. The number of sorting tracks and their respective effective lengths are as follows.

Table 4-3-4 Effective Length of Shunting Yard Track (1,520 mm)

Down Draw-out Track	500 m
Up Draw-out Track	450 m
Sorting Track No. 1	(650) m
Sorting Track No. 2	620 m

c) Layout of Transshipment Facility

Chinese freight wagons arriving from China will be brought up alongside platforms sorted according to Covered Wagons, Container Wagons, or Open Wagons (Covered Wagon Platform, Container Wagons Platform), and their cargoes will be transshipped to Mongolian freight wagons. If Mongolian freight wagons are already waiting on the platform at the time, transshipment will be performed directly, otherwise the cargo will be temporarily off-loaded onto the platform.

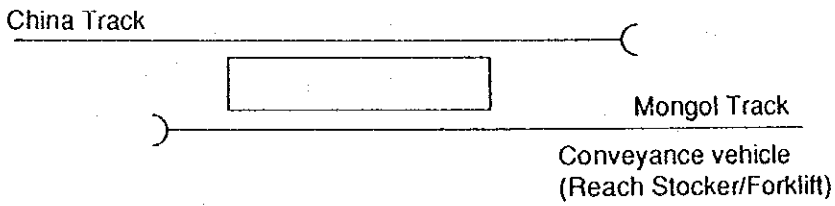


Fig. 4-3-3 Track Layout by Different Transshipment Equipment

4-3-3 Design of Civil Structures

The principal civil structures in this plan are a high level concrete platform with a steel-framed roof for covered-wagon cargo, and a low level concrete for container cargo. The scale of the main structures and the reasons for their calculation are as below.

(1) Platform for Covered-Wagon Cargoes

To facilitate the movement of transshipment equipment to ensure a smooth movement, and for ease of control, reinforced cost-in-situ concrete shall be used. Covered-wagon freight includes small items such as foodstuffs, grains, chemicals, and construction materials, the loading and unloading, conveyance, and storage of which is carried out manually, or by forklifts or belt conveyors. As well as being a working space, the platforms also provide space for temporary storage when there are no empty freight wagons. The size of the platform is designed so that forklifts (which takes up the greatest space) can be used to the fullest extent, as well as providing adequate space for the temporary storage of cargo.

The platform width will be such that a 3 m-wide working radius for 1.5 ton forklifts is required at each face, and a storage area in the middle. The storage width is derived from:

Av. 37 t/wagon ÷ 16.4 m/wagon ÷ 0.25 t/m^2 = approx. 9 m.

Therefore, the platform width will be 3 m x 2 + 9 m = 15 m.

The platform length will be 240 m, the length needed for a 12-wagon freight trains in the year 2000 plus an allowance of 20 %. But for the urgent project 120 m or half of this figure will be provided.

{16.4 m/wagon x 12 wagons x 1.2 (surplus)} ÷ 2 = say 120 m.

The platform height will be 1.10 m above the top of the rails, in line with the floor level of freight wagons.

The platform deck will be steel-reinforced structure with a thickness of 20 cm in view of the forklift axle weight of 0.7 t/axle.

(2) Platform Wall

Since the platform for covered-wagon cargoes is 1.1 m above rail level, the wall will be 30 cms thick to resist the forklift axial load as well as earth pressure.

The height of the wall will be 1.8 m, in view of the thickness of the track structure.

The dimensions of the foundations have been designed to resist sliding from side pressure, with a maximum bearing pressure of 10 t/m^2. The foundations are 150 cms wide and 40 cms thick.

(3) Concrete Deck for Container Platform

Although in future this platform will be used exclusively for containers, for the time being (under the urgent project) it will be used for loading, conveyance, and storage of both containers and open-wagon cargo (those which need to be hoisted by cranes and other equipment, such as bagged fluorite and mineral ores, iron, and construction materials), using transshipment equipment (the reach stacker).

The platform needs to have a width of 15 m on each face for the reach stacker to be able to carry out loading/unloading. In addition to this, a width of 6 m (equivalent to two container train loads) is needed as temporary storage space for when there are no freight wagons available. Thus a total width of 36 m is required.

The length of the platform will need to be equivalent to 53 container freight wagons in the year 2000. But for the urgent project it is considered that, since sufficient space for off loading can be ensured with a short transshipment time of 15 minutes, half of the container cargo and half of open-wagons can be handled with half of the platform length made available for loading and unloading by two rotating shifts per train. Each train is broken into 2 and each half takes turn to occupy the unloading facility i.e. 15.46 m/wagon x 53 ÷ 2 = say 410 m. But only half the facility is being built under the urgent project i.e. 410 ÷ 2 = say 210 m.

In view of the workability of the reach stacker and for cost reductions, it will be a low-level platform at rail level, to make a fully paved area in the future with inset tracks.

The platform deck will be a steel-reinforced concrete structure with a thickness of 25 cm, in view of the reach stacker axial load of 28 tons/axle.

(4) Steel-Framed Roof for the Freight Platform

This platform is a working area for handling cargo transported in covered wagons, such as foodstuff and grains, and thus these commodities will have to be protected from rain. Therefore, in order to provide shelter not only for the surface of the platform but also for the area which connects with the wagons, a roof is required to extend over to the center line of the wagons (1.92 m).

The roof will have a width of 18.84 m, corresponding to the platform width of 15 m plus 1.92 m x 2.

The pitched roof is designed so as not to cause any obstruction to forklift work or to the clearance of the freight wagons, and to allow for rainwater drainage.

As shown in attached Fig. 4-3-6, column height will be 4 m, and the roof slope 20 %. Lengthwise, the roof will cover the whole of the covered wagon platform length of 120 m. The roof will be steel-framed, in order to reduce construction time and ensure precision in erection.

Dead load:	steel-framed roof dead weight
Live load:	50 kgf/m^2
Wind load:	93 kg/m^2
Earthquake load:	earthquake coefficient Kt = 0.10

Therefore:

Columns	-	H-488 x 300 x 11/18
Roof Beans	-	H-488 x 300 x 11/18 (overhanging supports)
	-	H-488 x 300 x 11/18 (long central support)

Pairs of columns are arranged so as to cause no obstruction to the movement of forklifts or the temporary storage of cargo (8 m x 9.54 m centres). The foundation structure will be of direct foundation concrete (width 1.5 m x 1.2 m, 1.7 m thick).

(5) Other civil structures (fences, gates, drainage, level crossing blocks, etc.) will comply with standard design drawings.

Precast concrete blocks (height 1 m) will be installed underneath the sand fence, which will enclose the transshipment facility perimeter.

4-3-4 Design of Buildings

Building facilities included in this plan are the cargo handling office, cargo warehouse, garage and repair shed, residential house, and boiler room.

(1) Cargo Handling Office

a. Ground Plan

In the plan for the year 2000 the numbers of staff will increase by 165, but for the urgent project (the present plan) it is thought sufficient to increase staff by 54, or about one-third of that figure.

Of these, the staff employed by the cargo handling office (full time) will be:

Office manager	1
Assistant manager	1
Operation controller	1
Clerks	2
Cargo inspectors	12
Customs staff	2
Wagon controller	2
Interpreters	3
Cargo fee officer	1

25 x 6 m^2/person = 150 m^2

Apart from these, staff rooms for yardmen (3), cargo handling assistants (4), drivers (15), and guards (3):

23 x 3 m^2/person = 75 m^2

Others: WC, canteen, storage, stairways take up 75 m^2, making a total of 300 m^2.

It will be built on two floors, for the sake of ease in controlling transshipment work.

b. Structural Plan

Having studied aspects such as structural strength, durability, price, and construction time, and taking local natural conditions into consideration, a precast concrete slab prefabricated structure such as those in general use locally is considered suitable, also offering favorable product control.

The building will take the following form.

Structure: Columns and slabs of reinforced concrete, walls of precast concrete and brick

Roof: Reinforce concrete slabs

Forces acting on the structure are calculated on the basis of Japanese architectural structure design principles. The methods of calculating earthquake and wind load are as below. Apart from these, internationally applicable Japanese standards are adopted.

- Earthquake strength:

  Since there is not enough local data and earthquakes are few, the minimum conditions under Japanese standards are adopted, viz. $kh = 0.10$.

- Wind load:

  Since the maximum wind velocity is 34 m/sec, wind load is set at $q = 24\sqrt{h}$, based on Japanese standards. Here, taking 'h' as the height of the buildings, and 'q' as the wind pressure (kgf/m^2), we apply the following:

  if $0 < h < 15$ m, $q = 93$ kgf/m^2;
  if $15 < h < n$, $q = 24\sqrt{h}$.

- Ground resistance:

The safe bearing pressure of the site is about 10 t/m^2.

- General design load:

a. Dead loads

Steel-reinforced concrete:	2.40 t/m^3
Structural steel:	7.85 t/m^3
Concrete blocks:	1.90 t/m^3
Mortar:	2.00 t/m^3

b. Live loads

Roof:	50 kg/m^2
Office floor:	300 kg/m^2

- Structural materials:

The stress tolerance and quality of the structural materials are set as follows.

Steel-reinforced concrete	SD295, SR235
Concrete	210 kg/m^2
Cement	Ordinary Portland cement
Steel materials	SS400

c. Equipment plan

Since this is a cold zone, heating equipment will be made available inside the building. Heating will be from a coal-fired boiler, as commonly used in Mongolia, and will take a central heating format with fixed hot water pipes in the rooms. Therefore a coal fired boiler-room will be located adjacent to the office.

As for the supply of water, this will be provided either from pipes from the residential area to the west or by drilling a 100 - 150 m well. Water will be supplied to the boiler room, WCs, the canteen, and elsewhere. The local underground water has high salt and mineral contents, making it unsuitable for use as drinking water, as well as for the casting of concrete. Therefore the installation of desalination devices (water purifiers) is being considered.

For water drainage, although sewerage facilities have been installed in the residential area, the office is about 1 km away from this, and it would be difficult to form a water gradient, while construction costs would be high. Therefore local permeation drainage is being considered. The volume of drainage water from the office, warehouse, and elsewhere would not be great, and as the surrounding area is on a sandy soil foundation this would have only very small effect on the underground water level at 100 - 150 m. Thus this can be resolved by installing a simple reservoir.

Interior lighting equipment will be provided by FL40W fluorescent lighting provided for an area of 300 m^2.

d. Construction material plan

Materials that can be procured locally in Mongolia are more or less limited to concrete products and bricks, and most construction materials (roofing, flooring/wall finishing, waterproofing, window frames, pipes, lighting equipment materials, etc.) have to be imported.

(2) Cargo Warehouse

a. Ground Plan

A cargo warehouse will be needed for temporary storage of covered wagon cargoes when they are classified for processing by customs, or are returned goods, or when separated from other transshipment cargo. For this, a site will be selected in a location that is near the covered wagon cargo platform, is easy to control, and will not obstruct the future expansion of the platform. This will be located at the southern end of the platform and near the cargo handling office.

The scale of the temporary warehouse is taken to include space for storing one wagon load of cargo, space for storing forklifts, belt conveyors, etc., space for tools and others, and space for a staff room and corridors.

Cargo space	37 tons ÷ 0.25 tons/m^2	=	150 m^2
Machinery storage	2 m x 5 m x 4 units (forklifts)	=	40 m^2
Belt conveyor	1 x 10 m x 4 units ÷ 2	=	20 m^2

Engine generator space	3 m x 2 m	=	6 m^2
Staff room, WC		=	24 m^2
Corridors	30 m x 2 m	=	60 m^2
			300 m^2

b. Structural Plan

In order to make effective use of the space inside the warehouse, it will be structured with only few columns.

The foundation will be a reinforced concrete strip foundation.

For the structural frame of the walls, reinforced concrete or steel frames are being considered, using profiled steel sheets and insulation materials.

The roof will use profiled steel sheets on steel-frames.

c. Equipment Plan

Lighting equipment will be installed in the warehouse, whilst heating will be piped underground from the boiler room in the cargo handling office. Water supply will also be from the cargo handling office via underground pipes.

d. Construction Material Plan

Basically, this will follow the details stated in the section on the cargo handling office.

(3) Garage and Repair Shed

a. Ground Plan

These facilities will mainly involve arranging a storage house for reach stackers, but also as a repair shed for the reach stackers and forklifts.

These will be located at the southern end near the container platform as the northern end is the site for future expansion.

The scale of the facilities will allow repair space for one reach stacker.

Reach stacker space	7.5 m x 17 m x 1	=	125 m²
Repair space	5 m x 17 m	=	85 m²
			210 m²
Others: Lubricant storage 5 m x 2 m		=	10 m²

The height of the garage will be 10 m, in view of the fact that a chain hoist will be installed in the ceiling in order to repair the reach stacker.

Reach stacker height	6 m
Suspended work space (free space):	2 m
Hoist equipment height:	2 m
	10 m

b. Structural Plan

The foundation will be reinforced concrete direct foundation. For the walls, a steel structure frame with profiled steel sheets is being considered, and shutter doors will be installed. For the roof, as with the warehouse stated above, a steel frame and profiled sheet steel are being considered.

c. Equipment Plan

As with the warehouse, equipment for lighting, water supply, and heating is being considered, while repair machinery equipment will also be provided, as stated in section 4-3-5 Machinery and Equipment Plan.

d. Construction Material Plan

Basically, this will follow the details stated in the section on the cargo handling office.

(4) Residential House

a. Ground Plan

Accommodation and rest areas will be provided for the 54 employees needed for this project. In Mongolia it is normal for the whole family to move when employment is taken up in depopulated areas, and so in view of this fact married quarters will be provided for 54 employees.

The accommodation will be in a two-storey building located 200 m to the west of the present station building, in conformity with the Zamyn Uud urban plan.

Mongolian families normally comprise 3 - 7 members, and the required room area is said to be 30 - 70 m^2 per family (according to the Mongolian Railway). The average area will be 50 m^2 per family, or if common areas such as stairways are added, 75 m^2 per family.

b. Structural Plan

This shall be the same as for the office.

c. Equipment Plan

As stated in the section on the cargo handling office, each room will be provided with heating, plumbing, and lighting. Heating equipment will be installed in the coal boiler room already installed according to the Zamyn Uud urban plan (presently 100 m to the south-west of the accommodation). From here warm water will be led to the accommodation via underground pipes, providing heating for each room via pipes inside the building. This hot water can also be used in the kitchens and showers.

Similarly, a water supply for plumbing will be led via underground pipes from water mains already installed 60 m to the southwest of the accommodation. Water will be pumped up to the roof, from where it will be supplied to each room via pipes inside the building. The water will be purified by a desalination device at the pump inlet.

Drainage inside the building will be achieved by underground pipes connecting to sewerage mains already installed 70 m to the south of the accommodation.

d. Construction Material Plan

This will be the same as the details stated in the section on the cargo handling office.

(5) Boiler Room

a. Ground Plan

Boilers will be installed to provide hot water for the staff accommodation and the office/warehouse/garage, respectively. The fuel used will be coal, and water will be pumped to the buildings via underground pipes. The boiler will maintain the temperature of the water leaving the pump room at 65 °C (recorded figure in Mongolia).

The boiler room for the staff accommodation, as stated in section (4), will be constructed next to the existing boiler room site. The boiler for the office/warehouse/garage will be constructed next to the office.

Boiler room	27 m^2
Pump room	2 m^2
Parts/tools storage	9 m^2
Staff room/WC	10 m^2
	48 m^2

b. Structural Plan

Will follow the structure of the cargo storage house.

c. Equipment Plan

Boiler equipment, pumps, hot water pipes, and cold water pipes necessary for the operation of the heating facilities will be installed, as well as indoor lighting, plumbing, and drainage equipment.

Electricity, plumbing, and sewerage for drainage will be provided by connecting to the wiring and piping facilities in the vicinity.

d. Construction Material Plan

This will be the same as the details stated in the section on the cargo handing office.

4-3-5 Design of Transshipment Equipment

(1) Scope of design

Design of transshipment equipment includes basic design of transshipment equipment and maintenance equipment e.g.;

A) Transshipment Equipment

- Reach Stacker	1 unit
- Fork Lift	4 units
- Portable Belt Conveyor	4 units

B) Maintenance Equipment

- Portable Engine Generator	2 units
- Welding Machine	1 unit
- Portable Air Compressor	1 unit
- Overhead Chain Hoist	1 unit
- Bench Lathe	1 unit
- Bench Drill Press	1 unit
- Bench Saw	1 unit
- Oil Cleaner	1 unit
- Tool Box and Tool Kit	1 unit
- Diesel Fuel Station Equipment	1 unit

C) Spare Parts

(2) Technical Specification

A) Transshipment Equipment

1) Reach Stacker

I. Quantity : One (1) units

II. Technical Specification

a. Performance

- Lifting Capacity : Min. of 30.5 Ton at 2 m from front end of the wheel
- Container Stacking Capacity : Min. of two rows and three high stack

- Performance

Boom hoisting speed	: min. 2.14 m/s
Boom lowering speed	: min. 0.20 m/s
Travel speed	: min. 20 km/h
Gradability	: min. 15 %

- Minimum Turning Radius : Not more than 12 m

- Spreader Control

Spreader sideshift	: abt. ± 800 mm
Spreader slewing angle	: min. ± 90 degrees (at least 185 deg. for one way)
Spreader tilt angle	: ± 5 dgrees
Boom angle	: up to abt. 50 deg. or over

- Engine

Type	: Diesel Engine
Fuel	: Diesel Oil
Rated Horsepower	: min. 220 HP

- Type Arrangement

Front Wheel	: 4 wheels (2 wheels x 2 set)
Rear Wheel	: 2 wheels (1 wheel x 1 set)

- Brake System : Hydraulic brake or Hydro-Pneumatic brake system with air dryer

- Maximum Axle Load : Not more than 115 ton

- Maximum Wheel Pressure : Not more than 28 t/w

b. Special Provisions

- Electric heaters shall be provided for main engine oil pan and hydraulic tank.
- Plug-in cord back up shall be provided for heaters and main engine start up.
- Lifting lugs shall be provided for spreader to lift other heavy cargoes than container box.

c. Painting : As per manufacturer's standard

d. Tools and Accessories : As per manufacturer's standard

2) Fork Lift

I. Quantity : Four (4) units

II. Technical Specification

a. Performance

- Loadcapacity : 1,500 kg
- Lifting height : max. abt. 3 m
- Lifting speed (with load) : abt. 430 mm/sec.
- Traveling speed (No Load) : abt. 18 km/h
- Turning Radius : abt. 2 m
- Dimensions

  Overall height : abt. 3,100 mm
  Fork length : abt. 920 mm
  Overall width : abt. 1,100 mm
  Wheel base : abt. 1,350 mm
- Drive Power

  Rated flywheel horsepower : not less than 40 Hp
  Fuel : Diesel oil

b. Special Provisions

- Plug-in cord backup shall be provided at least for heaters and main engine start up.
- Oil pan heater and oil tank heater shall be provided.

c. Painting : As per manufacture's standard

d. Tools and Accessories : As per manufacture's standard

e. Attachment

- Standard size fork with push-pull cage
- Roll cramp

3) Portable Belt Conveyor

I. Quantity : Four (4) units

II. Technical Specification

a. Type : Horizontal conveyor

b. Performance

- Conveyor length : abt. 10 m
- Conveyor width : abt. 600 mm
- Conveyor speed : abt. 20 m/min.
- Drive Motor : abt. 1.5 kw
- Power Supply : 50 Hz, 400 V

c. Special Provisions

Grease system and electric system shall have provisions for minimum surrounding temperature of -40 °C.

d. Accessories and Tools : As per manufacture's standard

e. Painting : As per Manufacture's standard

B) Maintenance Equipment

1) Portable Engine Generator

I. Quantity : Two (2) units

II. Technical Specification

a. Type : Wheel mounted type
b. Capacity : min. 10 KVA
c. Output : 400 V, 50 Hz
d. Engine : Diesel Engine
e. Special Provisions
   - Electric heaters shall be provided for engine oil pan.
   - Plug-in cord back up shall be provided for heater and engine start up.

2) Welding Machine

I. Quantity : One (1) unit

II. Technical Specification

a. Type : Movable type A.C arc welder
b. Applicable welding rods : ϕ2 mm ~ ϕ6 mm

3) Portable Air Compressor

I. Quantity : One (1) unit

II. Technical Specification

a. Type : Wheel mounted single stage oil cooled unloader type

b. Actual Free Air : min. 300 l/min.

c. Operating Pressure : 7 kg/cm^2

4) Overhead Chain Hoist

I. Quantity : One (1) unit

II. Technical Specification

a. Type : Electric Chain Hoist

b. Lifting Capacity : min. 10 ton.

c. Lifting height : min. 6 m

5) Bench Lathe

I. Quantity : One (1) unit

II. Technical Specification

a. Type : Horizontal type

b. Center Distance : Approx. 550 mm.

c. Cutting tool : Standard bit set

6) Bench Drill Press

I. Quantity : One (1) unit

II. Technical Specification

a. Type : Vertical type

b. Boring Capacity : ϕ23 mm (steel)

c. Tools and Accessories : Standard set

7) Bench Saw

I. Quantity : One (1) unit

II. Technical Specification

a. Type : Horizontal type
b. Cutting Capacity : min. 30 mm thick

8) Oil Cleaner

I. Quantity : One (1) unit
II. Technical Specification

a. Type : Portable type
b. Capacity : min. 1,000 l/hr
c. Filtration : min. NAS Class 12 ~ NAS Class 9

9) Tool Box and Tool Kit

- Portable Oscilloscope : 1 set
- Garage Jack (10 t) : 1 set
- Portable Hydraulic Jack (50 t) : 2 sets
- D.C. Volt Ampere Meter : 1 set
- Torque Wrench : 1 set
- Puller Set : 1 set
- Solder less Terminal Kit : 1 set
- Electric Soldering Iron : 1 set
- Thread Type Solder Containing Paste Flux : 1 set
- Iron Anvil : 1 set
- Machinists Vise : 1 set
- Parts Cleaner : 1 set
- Cleaning Pan : 3 sets
- High Pressure Grease Pump : 1 set
- Oil Drain : 1 set
- Drum Pump : 2 sets
- Portable Fuel Can : 5 pc
- Work Bench (Locker type) : 2 sets
- Bolt Clipper : 2 sets
- Ratcheting Chain Wrench : 1 set
- Socket Wrench Set : 1 set
- Mechanic Tool set for Construction Equipment (Metric & Inch Size) : 2 sets
- Type Pressure Gauge : 1 set
- Air Chuck : 3 sets
- Tire Repair Tool Set : 1 set

- Welding Rod (for work shop) : 500 kg
- West Cloth : 1,000 kg
- Steel Materials : 2,000 kg
- Pallets : 50 set

10) Diesel Fuel Station Equipment

I. Quantity : One (1) set

II. Technical Specification

a. Type : Horizontal tank with fueling unit
b. Tank Capacity : min. 10 m^3
c. Handling Fuel : Diesel Fuel

4-3-6 Design of Communication and Power Supply

(1) Talk-back

1) The central unit (operation division and operation panel) shall be installed in the signal operation cabin. The talk-back terminals shall be installed near the points according to the equipment arrangement diagram.

2) The quantities are as follows.

* Central unit (operation division and operation panel) for 60 channels : 1 set
* Wiring box (for 60 pairs) with arrestor : 1 set
* Speaker (double sided) for general address : 3 sets
* Speaker for communication (with push button) : 20 sets

3) Power source of signal operation cabin : AC 200 V, 50 Hz

4) Output of speaker : 25 W for general address
5 W for communication

5) Bush button shall be sandtight, dusttiight and antifreezing.

6) Specifications of cable are as follows.

* The size of the cable for remote transmission (to the 1,435 mm gauge track area) shall be 1.2 mm^2 to cope with the direct current resistance and 0.9 mm^2 for other areas.

* To prevent noise, insulation shielded cables shall be used between the communication talk-back equipment and the connection box. The shielded cable shall be grounded.

(2) Radio communications

1) The frequency band for the radio communications shall be 150 MHz to match the frequencies, 150 to 156 MHz, now used for shunting by Mongolian Railway.

2) Quantities and output of radio communications equipment are as follows.

* In the station office	:	1 set, 10 W
* On shunting locomotive	:	7 sets with spares, 10 W
* Portable	:	20 sets, 1 W

3) Power source:

* Signal operation cabin	:	AC 220V, 50 Hz
* Shunting locomotive	:	DC 24V

4) A charger shall be prepared to charge the butteries of portable equipment.

(3) Power Supply

To supply power into the station, there is an overhead high voltage distribution line, 3-phase 10 kV.

Power distribution lines shall be provided for signal stations, field offices, freight car washing points and residences where loads are heavy, and transformers for power distribution near major loading points. Transformers shall be installed at poles.

Illumination shall be provided at platforms for open freight cars and containers, and covered freight cars. For open freight car and containers tracks, lighting poles shall be placed around both platform, with mercury lamp projectors. The sheltered platform for covered freight cars shall be illuminated from the ceiling with mercury lamp projectors.

4-3-7 Design Drawings

Design drawings for Transshipment Facilities at Zamyn-uud station are presented as follows:

Civil/Track Structure

1) Fig 4-3 - 4 General Plan
2) Fig 4-3 - 5 Layout of Transshipment Facilities
3) Fig 4-3 - 6 Base Concrete and Steel Structure of Roofing Support for Wagon Platform
4) Fig 4-3 - 7 Retaining wall and Concrete Pavement for Wagon Platform
5) Fig 4-3 - 8 Foundation and Concrete Pavement for Container Platform
6) Fig 4-3 - 9 Fence
7) Fig 4-3-10 Entrance Gate
8) Fig 4-3-11 Level Crossing
9) Fig 4-3-12 Water Supply Tower
10) Fig 4-3-13 Buffer Stop

Architect

11) Fig 4-3-14 Front/Side View of Buildings (Storage, Office, Residential house)
12) Fig 4-3-15 Layout/Cross Section of Buildings
13) Fig 4-3-16 Boiler Building
14) Fig 4-3-17 Garage for Reach Stacker

Equipment

15) Fig 4-3-18 Typical Arrangement of Reach Stacker
16) Fig 4-3-19 Typical Forklift and Portable Conveyor

Telecommunication

17) Fig 4-3-20 Out Line of Talk-Back System
18) Fig 4-3-21 Schematic Drawing of Talk-Back System
19) Fig 4-3-22 Layout of Talk-Back System

Power Supply

20) Fig 4-3-23 Power Distribution Line System
21) Fig 4-3-24 Electric Power Facilities, Zamyn-uud Station Yard
22) Fig 4-3-25 Transformer-Mounted Standard Pole
23) Fig 4-3-26 Standard Pole for General Yard Illumination
24) Fig 4-3-27 Standard Pole for Container Platform Illumination

PETRO TRANSSHIPMENT BASE

Draw-out track

Departure and arrival track
1,435 mm gauge (Adjustment)

Wagon cleaning shed

Sorting track

1,435 mm gauge (New installation)

Cargo transshipment track

Platform with roof for wagon

Cargo stora

Cargo hand

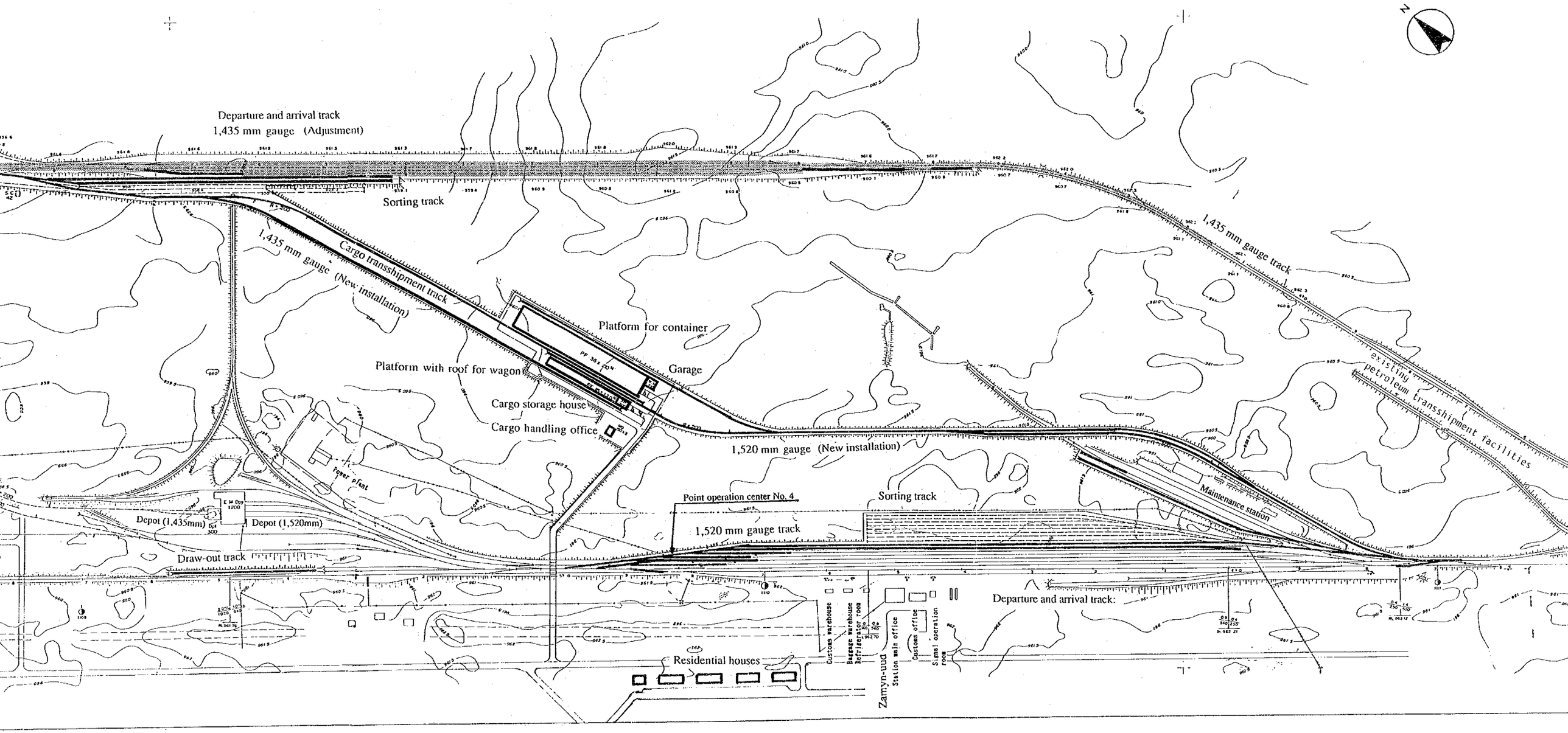
Power plant

Depot (1,435mm)

Depot (1,520mm)

Draw-out track

Ulaanbaatar


Departure and arrival track
1,435 mm gauge (Adjustment)
Sorting track
1,435 mm gauge track
Cargo transshipment track
1,435 mm gauge (New installation)
Platform for container
Platform with roof for wagon
Garage
Cargo storage house
Cargo handling office
existing petroleum transshipment facilities
1,520 mm gauge (New installation)
Power plant
Point operation center No. 4
Sorting track
Maintenance station
Depot (1,435mm)
Depot (1,520mm)
1,520 mm gauge track
Draw-out track
Departure and arrival track
Customs warehouse
Baggage Warehouse
Refrigerator room
Customs office
Signal operation room
Residential houses
Zamyn-uud
Station main office

MINISTRY OF TRADE AND INDUSTRY
AND
MONGOLIAN RAILWAY, MONGOLIA

THE IMPROVEMENT PLAN FOR TRANSSHIPMENT FACILI FACILI TIES AT ZAMYN-UUD STATION IN MONGOLIA

GENERAL PLAN – Urgent Project

PROJECT MANAGER	DESIGNED BY		DRAWING NO.
	DATE		
	SCALE	1: 2000	

JAPAN RAILWAY TECHNICAL SERVICE
PACIFIC CONSULTANTS INTERNATIONAL, JAPAN

- Urgent Project
- Track to be adjusted, 1520 to 1435mm (Urgent Project)
- 2000 Year Plan
- Existing Facility
- Petro Track Line to be done by others

S.C : Signal Cable (47m)
M.Dept: Locomotive Maintenance Depot (300m² or 1700m²)
R.O : Rain Administration Office (150m²×2F)
S.H : Storage House (300m²)
P.F : Platform

N

1,435 mm gauge track

existing petroleum transshipment facilities

Platform for container

Garage

1,520 mm gauge (New installation)

Point operation center No. 4

Sorting track

1,520 mm gauge track

Maintenance station

Draw-out track

China

Departure and arrival track:

Residential houses

Customs warehouse
Baggage warehouse
Refrigerator room
Zamyn-uud Station main office
Customs office
Signal operation room

Fig. 4-3-4 General Plan

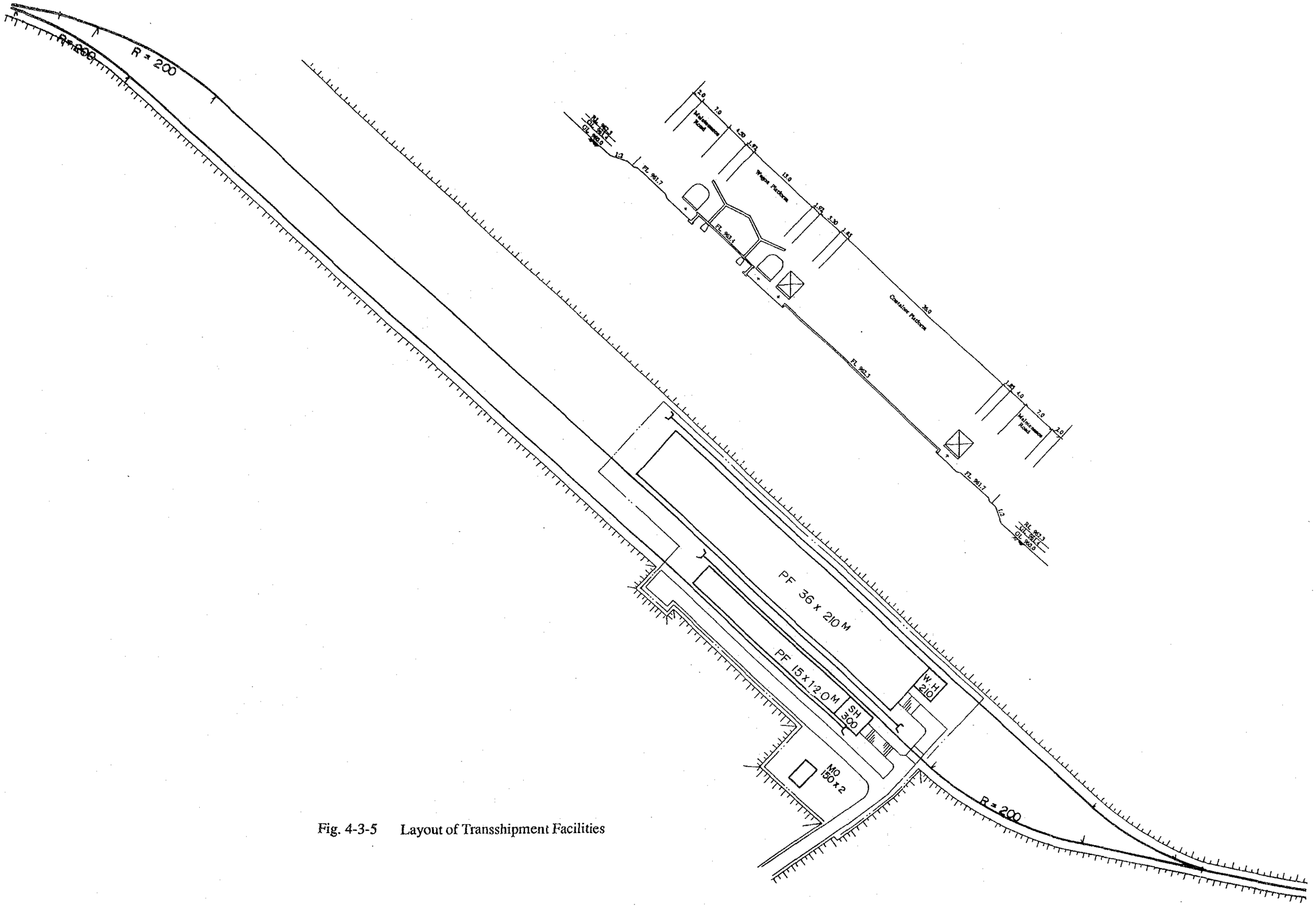
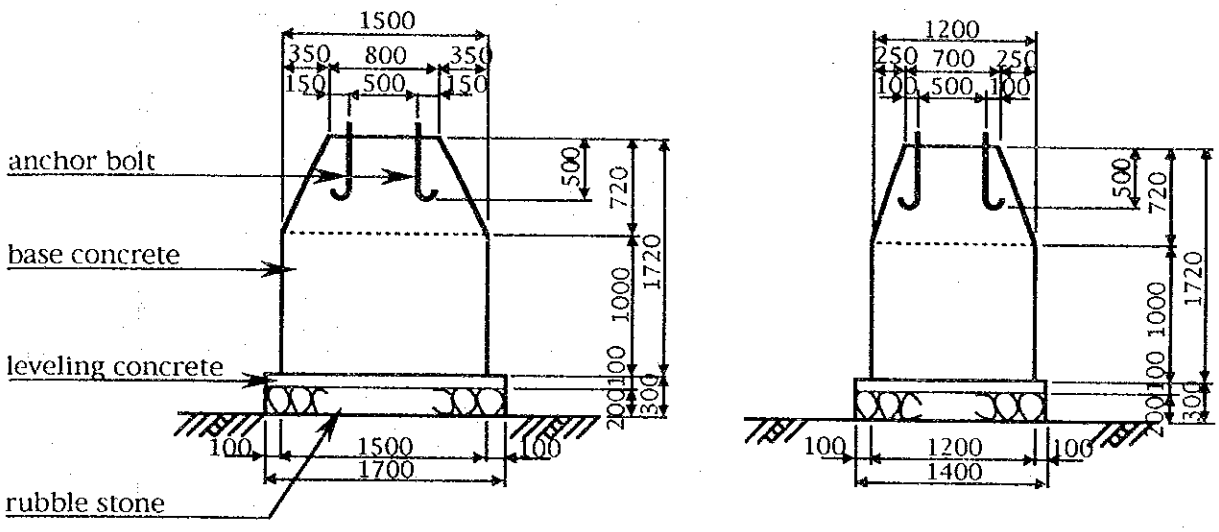
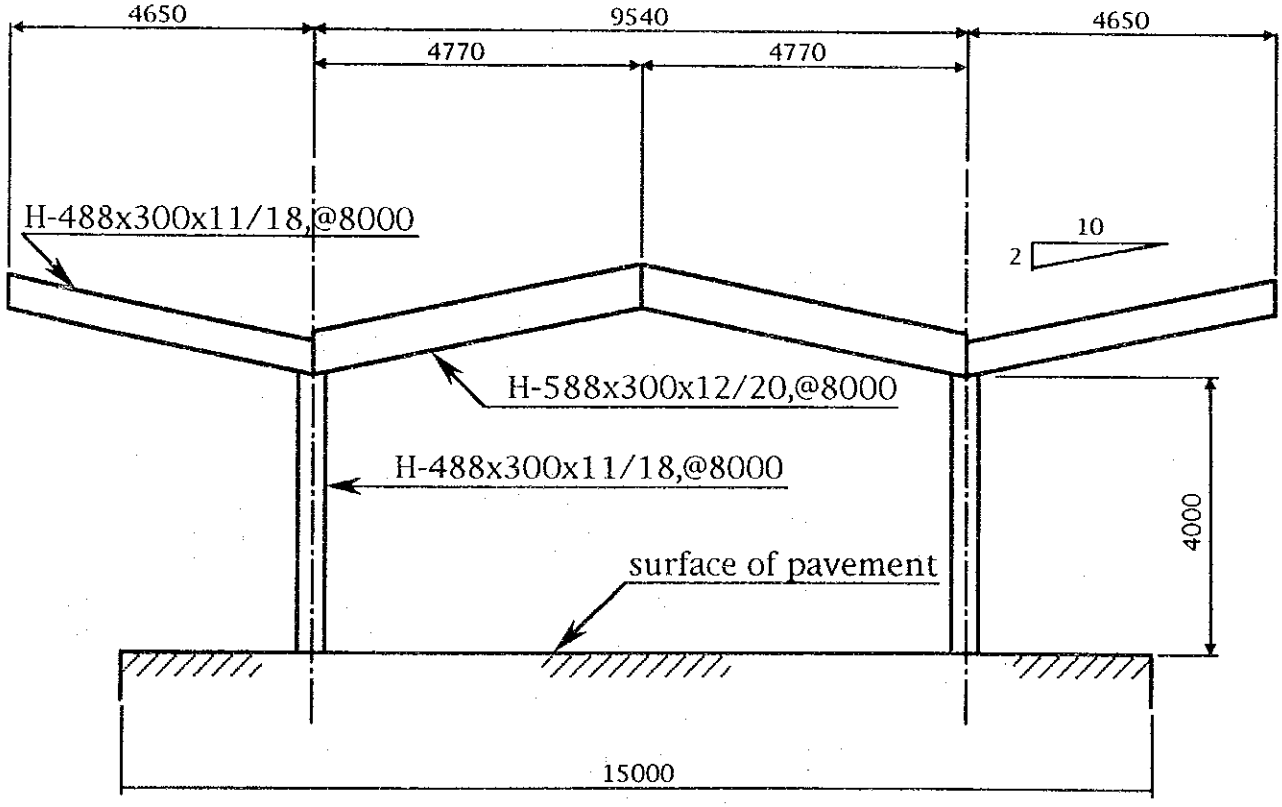


Fig. 4-3-5 Layout of Transshipment Facilities

Wagon Platform



Base Concrete of Roofing Support



Steel Structure of Roofing Support

Fig. 4-3-6 Base Concrete and Steel Structure of Roofing Support for Wagon Platform