Mongolia

Railway Transportation Rehabilitation Project(1)(2)

Field Survey: June 2003

1. Project Profile and Japan's ODA Loan

Railway Route Covered by the Project

Locomotive Repair Shop of Mongolian Railway

1.1. Background

At the time of appraisal in 1993, the transport system in Mongolia, an inland country bordered by Russia to the north and China to the south, mainly consisted of a railway, including a north-south trunk line, with a total length of 1,914km, and the roads running parallel with the railway lines. Among the road network, totaling 4,318km in length, only a 1,243km portion of the north-south route was paved and most of the east-west routes had not been paved.

According to freight transport volume (tons/km) data for 1991, railway transport accounted for the largest share of 68.8%, followed by road transport at 31.1%, indicating that railway was an important means of freight transport. By item of railway freight, coal, which is the main energy source in Mongolia, occupied a large share of 50.9%. But for passenger transport volume (persons/km), road transport had the top share at 46.6%, followed by railway and air transport at 30.5% and 22.9%, respectively. Railway transport came in second after road transport.

Most sections of Mongolian Railway were unelectrified single-track lines, except for some double-track sections. As of July 1993, Mongolian Railway owned 111 locomotives (all diesel), 227 passenger cars, and 1,865 freight cars. Railway construction in Mongolia started in 1938 with the technical support of the former Soviet Union. Ever since, they relied heavily on the former Soviet Union for the procurement of rails, cars, etc. and the lease of freight cars to make up for a shortage. As they avoided digging tunnels, the railway lines were built over many steep slopes and sharp curves. As a result, rails were subject to more wear than usual and needed to be replaced. However, following the collapse of the Soviet Union and the termination of the COMECON structure in 1991, the assistance from the Soviet Union to Mongolian Railway stopped. As it became difficult to procure rails and to lease freight cars, Mongolian Railway was unable to secure the necessary quantity of freight cars and rails.

Under such circumstances, the maintenance and operation of railway transport became more

difficult due to difficulty procuring the necessary machinery and materials. In addition, it was feared that the difficulty in operating railway transport could adversely affect the transport of important goods such as coal, the main energy source, and further worsen the Mongolian economy. Moreover, as the increase in the rental cost of freight cars affected the financial condition of Mongolian Railway, concerns arose over the balance of international payments of the country.

1.2. Objectives

The objectives of the project were to maintain Mongolian Railway's existing transport capacity and save foreign currency by reducing freight car rental fees, thus contributing stabilize the Mongolian economy.

1.3. Output

The project outputs were the introduction and upgrading of the equipment necessary to reinforce the Mongolian Railway transport capacity.

(1) Cars: two locomotive cars, 455 freight cars and 30 passenger cars

(2) Track equipment: track replacement totaling 92km, rail fasteners and rail construction machinery

(3) Communications equipment: installation of digital telephone switching system (3,000 lines x 1 set, 500 lines x 4sets)

(4) Controlling equipment: host computers (2 sets), terminal computers (50 sets)

(5) Locomotive maintenance equipment: machine tools and maintenance equipment for the minimum necessary overhaul

(6) Consulting service: procurement and technical support, operational management

1.4. Borrower/Executing Agency

Government of the Mongolian People's Republic/Mongolian Railway

1.5. Outline of Loan Agreement

L/A No.	MON-P1	MON-P2
Loan Amount/Loan Disbursed Amount	3,321million yen/ 3,306million yen	4,753million yen/ 4,585million yen
Exchange of Notes/Loan Agreement	November 1993/ November 1993	January 1995/ February 1995
Terms and Conditions -Interest Rate -Repayment Period (Grace Period) -Procurement	 1.0% 30 years (10years) General untied	 2.6% 30 years (10 years) General untied
Final Disbursement Date	November 1998	August 2000

2. Results and Evaluation

2.1. Relevance

At the time of appraisal, the freight transport volume (ton/km) had substantially declined since 1990 because of the discontinuation of support to Mongolian Railway from the former Soviet Union, due to the collapse of the COMECON system, as well as the economic confusion from the process of transition to a market economy (economic growth rates in 1991 and 1992 were ▲9.9% and ▲7.6%) (Table 1). However, as the National Development Board predicted that the freight transport volume would recover to the 1991 level by 1996 (Table 1), the project set the aims of maintaining the same level of transport capacity as the appraisal and meeting the demand for freight transport after the completion of the project.

In addition, as stated in "1.1 Background," the halt of assistance from the former Soviet Union, which was a great provider of operational and financial support to Mongolian Railway, made it difficult to carry out necessary rail replacements and secure cars, causing serious problems in the railway's operation and maintenance. Therefore, it was feared that such problems could adversely affect the transport of important goods such as coal, the country's main energy source, and further worsen the Mongolian economy.

Also, as freight car rent to be paid to the Russian government was scheduled to increase on a periodic basis according to the agreement with Russia, there was concern over negative effects on Mongolian Railway's financial condition and the balance of international payments of the country.

Therefore, considering Mongolian Railway's urgent and important impact on the national economy at the time of appraisal, the project was relevant at the time of appraisal.

Table 1: Actual and Forecast Freight Transport Volume in Mongolia as of the Appraisal

(Unit: million tons/km)

Item	Actual Result					Forecast		
	1987	1988	1989	1990	1991	1992	1993	1996
Railway	6,179.9 (74.5%)	6,241.1 (74.1%)	5,956.1 (73.8%)	5,085.9 (74.0%)	3,012.6 (68.8%)	2,785.0 (82.4%)	2,850.0 (81.8%)	3,490.0 (80.5%)
Road	2,099.1 (25.3%)	2,162.2 (25.7%)	2,097.9 (26.0%)	1,771.7 (25.8%)	1,362.5 (31.1%)	590.0 (17.5%)	630.0 (18.1%)	840.0 (19.4%)
Air	8.1 (0.1%)	10.6 (0.1%)	9.9 (0.1%)	7.8 (0.1%)	4.1 (0.1%)	3.7 (0.1%)	3.6 (0.1%)	3.9 (0.1%)
Water	5.2 (0.1%)	4.9 (0.1%)	5.0 (0.1%)	4.9 (0.1%)	1.7 (0.0%)	0.5 (0.0%)	0.5 (0.0%)	0.5 (0.0%)
Total	8,292.3	8,418.8	8,068.9	6,870.3	4,380.9	3,379.2	3,484.1	4,334.4

(Source) Final Report for SAPROF for the Railway Transport Capacity Reinforcement Project in Mongolia, February 1993.

In relation to the project plan, the Mongolian government formulated the Transport Sector Development Strategy in 1998 in cooperation with the World Bank. This strategy defines the transport infrastructure's role in the social and economic development of the country after the transition to a market economy and aims to stabilize the macro-economy, including reform of national enterprises. As for railway transport, improvement of the domestic transport network, including the railway and the reform of railway management, are recommended.

On the other hand, Mongolian Railway completed the Mongolian Railway Improvement Master Plan in 2002 under the direction of the government (as of August 2003, the Master

Plan was in the process of obtaining government approval). The pillars of the Master Plan are 1) improvement of hardware, mainly by modernizing repair shops for locomotives, freight cars, etc. and rehabilitating tracks to modernize and enhance the reliability of Mongolian Railway, 2) reorganization, including the possibility of privatizing the non-clerical and clerical sections, and 3) implementation of demand projection and market research, improvement of the operation plan based on the results, and development of an investment plan, etc.

This project was implemented to realize an efficient transport system by rehabilitating obsolete railway facilities including railway cars and modernizing the organization and management. In this regard, it is consistent with the abovementioned development strategy and the Master Plan.

In Mongolia, railway and road are still the major means of transport to date. The freight transported by railway (tons/km) made up 97.9% of all freight transported in 2002 (Table 2), indicating that the importance of railway transport in physical distribution in this country has increased since the 1993 appraisal in. Also, nearly 100% of the coal transported in the country (on the basis of ton/km) is transported by railway, which plays an important role in securing stable energy supply.

Therefore, the project has remained relevant to the present.

Table 2: Freight Transport in Mongolia (1992-2002)

(Unit: million tons/km)

Item	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Railway	2,756.4 (83.0%)	2,531.0 (90.2%)	2,131.7 (93.4%)	2,279.5 (93.5%)	2,528.6 (94.1%)	2,554.2 (95.1%)	2,815.3 (95.6%)	3,491.7 (96.4%)	4,282.5 (96.9%)	5,287.9 (97.4%)	6,461.3 (97.9%)
Road	559.1 (16.8%)	268.4 (9.6%)	146.7 (6.4%)	152.9 (6.3%)	152.4 (5.7%)	125.4 (4.7%)	123.0 (4.2%)	123.2 (3.4%)	126.1 (2.9%)	129.5 (2.4%)	133.6 (2.0%)
Air	5.4 (0.2%)	5.8 (0.2%)	4.9 (0.2%)	4.5 (0.2%)	4.3 (0.2%)	6.3 (0.2%)	7.7 (0.2%)	8.2 (0.2%)	9.4 (0.2%)	9.5 (0.2%)	9.0 (0.1%)
Water	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	0.2 (0.0%)	0.1 (0.0%)	0.2 (0.0%)	0.1 (0.0%)	0.2 (0.0%)	0.3 (0.0%)	0.4 (0.0%)	0.5 (0.0%)
Total	3,320.9	2,805.2	2,283.3	2,437.1	2,685.4	2,686.1	2,946.1	3,623.3	4,418.3	5,427.3	6,604.4

(Source) Mongolia Statistical Yearbook

Finally, we examine the relevance of the fiber-optic cable network plan.

The fiber-optic cable network component of the project was added in response to a request from the Mongolian government in 1997. The reason for the change was that Mongolian Railway's communication cables (overhead wires) had deteriorated badly due to wear and tear, strong winds blowing over plateaus, large difference in temperatures, fires, etc. and often caused communications system failures, which interfered with daily railway operations. In addition, the insufficient capacity of the Mongolian Railway cables used for international railway communications between Russia and China required using an alternative communications route. Other countries have pointed to this situation as an example of problems in international railway communications.

This fiber-optic cable network, in addition to improving the reliability of unstable domestic/international railway communications, also helped to establish basic conditions necessary for Mongolian Railway to introduce modernized transport management systems, including a train operation control system and the Management Information System (MIS).

Moreover, a fiber-optic cable network running from the north to the south was expected to contribute to the development of not only Mongolian Railway but also the country's communications sector.

Therefore, the fiber-optic cable network was relevant in that it improved and modernized Mongolian Railway's transport capacity and contributed to public communications.

JICA's 2002 Communication Master Plan Survey forecast a rapid increase in the demand for communications via the Internet and other means and predicted that the fiber-optic cable network would make a contribution to the communications sector. Therefore, the project plan concerning the fiber-optic cable network has remained relevant to the present..

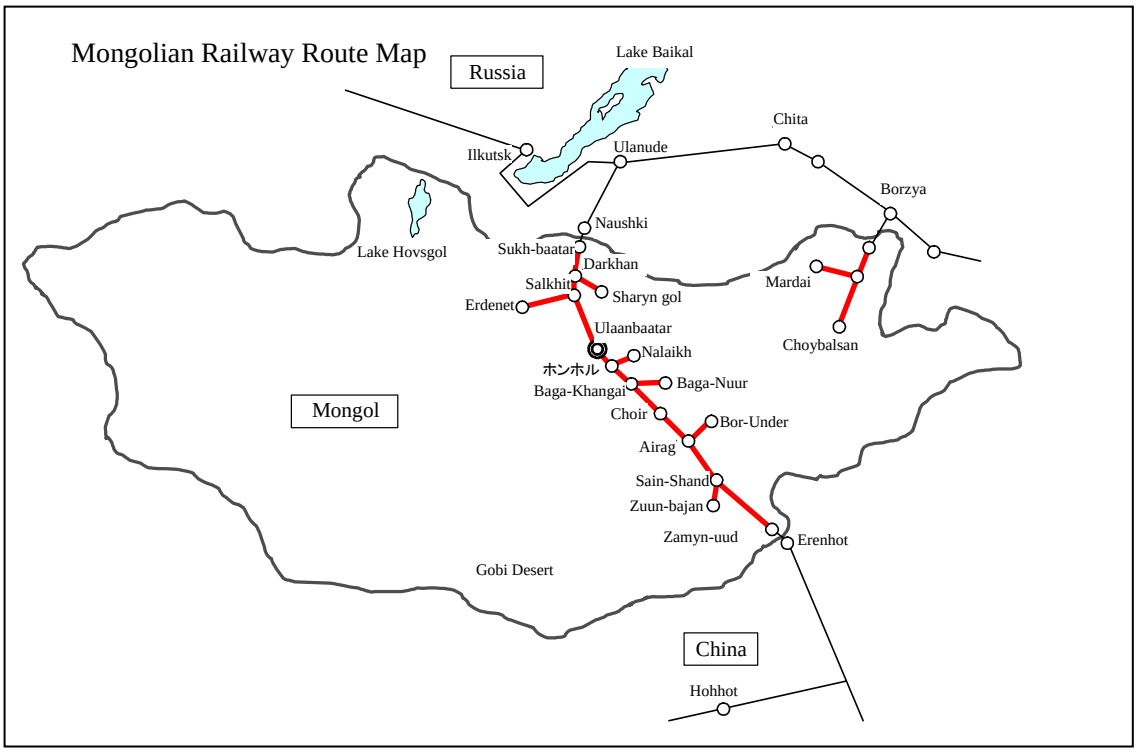
2.2. Efficiency

2.2.1. Output

The results planned at the appraisal in 1993 were 1) procurement of railway cars, 2) upgrading of track equipment, 3) upgrading of communications equipment (installation of digital switching facilities at the Ulaanbaatar Station and four major local stations), 4) introduction of controlling equipment (installation of computers in 50 major stations and establishment of a computer network to exchange freight information), 5) rehabilitation of the Ulaanbaatar Locomotive Repair Shop, and 6) procurement and technical support to Mongolian Railway and a consulting service on management, etc. (Fig. 1)

Some changes were made, including the establishment of the urgently needed fiber-optic cable network (12 cables, 1,300km), as mentioned above, introduction of digital equipment at 13 switching stations (railway stations) and the renewal of the electric power supply system at 18 stations. There were no other significant changes in results.

Fig.1 Project Area



2.2.2. Implementation Schedule

The project period was initially scheduled to be 42 months from November 1993 to April 1997 (from the signing of Loan Agreement to the completion of the consultant service), but actually took 77 months from November 1993 to March 2000 (same as above). The project period was extended because of some changes including the establishment of the fiber-optic cable network mentioned in "2.2.1 Output," which required an additional implementation period (October 1997-March 2000). The initially planned results, except for above changes, were achieved within the original project period.

2.2.3. Project Cost

The project cost 7,892 million yen (ODA portion: 7,892 million yen) against the planned 8,123 million yen (ODA portion: 8,074 million yen). In spite of changes, including the establishment of a fiber-optic cable network, the project cost turned out to be nearly the same as the initial budget (Table 3).

Contracts were granted efficiently mainly because freight car procurement cost 1,300 million yen less than estimated as a result of bidding. Although the procurement price was estimated based on the international price at the planning stage, most of the bids were for Russian-made freight cars whose prices were lower than the international price. There was no change in freight car specifications.

Table 3: Comparison of Planned and Actual Project Costs

(Unit: million yen)

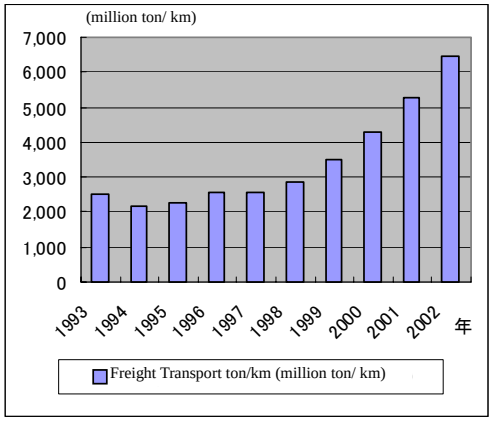
Item	Planned(A)	Actual(B)	(A)－(B)
1. Track equipment	1,072	963	109
2. Freight cars	2,321	1,006	1,315
3. Passenger cars	1,650	1,863	▲213
4. Locomotives	500	590	▲90
5. Locomotive maintenance equipment	712	676	36
6. Communications and controlling equipment	305	300	5
7. Fiber-optic cable network	0	1,764	▲1,764
8. Consulting service	395	486	▲91
9. Interest during construction	463	244	219
10. Price escalation	360	0	360
11. Reserve funds	345	0	345
Total	8,123	7,892	231

2.3. Effectiveness

2.3.1. Freight Transport

Mongolian Railway's volume of freight transport on a ton/km basis has been increasing steadily. Before project completion, there was little increase in freight transport in the six years from 1993 to 1999, while a more than twofold increase over 1999 was seen in the three years from 2000 to 2002, after project completion (Fig.2).

Fig.2: Freight Transport ton/km



(Source) Mongolian Railway

By type of freight, as of 2002, import freight accounted for 9.1% (1,059 thousand tons), export freight 7.3% (849 thousand tons), transit freight 26.4% (3,076 thousand tons), and domestic freight 57.2% (6,653 thousand tons). Volume of freight transit has increased particularly sharply since 1999, increasing 10-fold over the 10 years from 1993 to 2002(Table 4). Behind this is the increase in trade between Russia and China in the late 1990s [1], which boosted overland freight transport via Mongolia as the shortest route between Russia and China.

Freight transport by major item shows that raw materials such as coal, iron ore and construction materials occupy a large part of freight transported (Table 4). With the increase in freight volume, the percentage of coal against the total volume of Mongolian Railway's freight has declined. Still, coal accounted for 43% of all freight and 75% of domestic freight in 2002. In this project, 455 freight cars were purchased, including 300 open wagons for transporting coal from mines to thermal power stations.

[1] The rapid growth in trade between Russia and China in the late 1990s is attributable to the massive import of oil products from oil fields around Irkutsk in Russia caused by the energy shortage in China and the import of a large quantity of timber from the East Siberian region triggered by the substantial restriction on tree cutting projects imposed by the Chinese government as part of environmental conservation measures.

On the Russian side, too, imports of low-priced commodities, food and vegetables, and clothes from China have increased.

Table 4: Freight Transport by Type and Item

(Unit: thousand tons)

Item	Appraisal (1993)	(1994)	(1995)	(1996)	(1997)	(1998)	(1999)	Completion (2000)	2nd year (2001)	3rd year (2002)
A. Freight transport by type										
Import	946	682	869	690	777	730	714	938	884	1,059
Export	993	879	863	881	951	941	802	773	846	849
Transit	303	171	134	325	217	377	1,009	1,513	2,163	3,076
Domestic	5,614	5,341	5,460	5,563	5,389	5,651	5,689	5,956	6,277	6,653
Total	7,856	7,073	7,326	7,459	7,334	7,699	8,214	9,180	10,170	11,637
B. Freight transport by major item										
Coal	4,564	4,330	4,356	4,356	4,227	4,390	4,383	4,493	4,711	4,990
Construction materials	776	713	704	809	619	661	662	634	747	926
Oil prouducts	0	0	0	17	20	20	33	37	26	49
Fluorite	361	176	281	325	336	292	258	296	335	250
Timber	124	150	107	146	191	261	175	219	184	134
Iron ore	448	462	452	477	477	490	490	490	546	553
Others	1,583	1,242	1,426	1,329	1,464	1,585	2,213	3,011	3,621	4,735
Total	7,856	7,073	7,326	7,459	7,334	7,699	8,214	9,180	10,170	11,637

(Source) Mongolian Railway

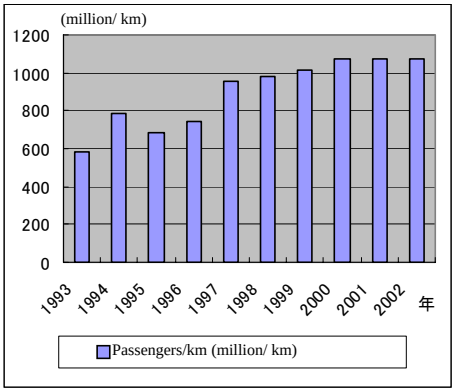
Thus, freight transport has grown substantially since project completion, mainly due to an increase in trade between China and Russia coupled with the recovery of the Mongolian economy in general. This project helps ensure that transport capacity can deal with the growing demand for freight transport. Also, the project plays an important role in stabilizing the energy supply as most coal is transported by railway.

2.3.2. Passenger Transport

Passengers/km on Mongolian Railway have increased 1.8 times over the past 10 years (1992-2002), though there was little change in the three years from 2000 to 2002 after project completion, and transport volume remained at about 1,070milion persons/km a year (Table 3).

Passenger transport volume (number of passengers) has not changed much, either, maintaining a level of 4 million passengers a year (Table 5), while the number of passengers on all transport modes including railway, road, and air has increased by 12.7 million (13.7 %) during the three years from 2000 to 2002.

Fig.3: Passengers/km



(Source) Mongolian Railway

Mongolian Railway passenger transport is limited to the north-south route via Ulaanbaatar. The railway passenger transport volume (number of passengers) has remained almost unchanged over the four years from 1999 to 2002, accounting for only 4% of total passenger volume. An overwhelmingly large share of

passenger transport in terms of transport volume is occupied by road transportation.
In terms of passengers/km carried, however, railway transport accounted for about 50% of the total, indicating that people rely on railway and air for long-distance travel, and road transport for relatively short distances (Table 5).

Table 5: Passengers/km and Transport Volume (1999-2002)

Item	(1999)	Completion (2000)	2nd Year (2001)	3rd Year (2002)
Passengers/km (million passengers/km)				
Railway	1,009.6 (56.1%)	1,067.2 (54.8%)	1,062.2 (53.9%)	1,066.5 (50.6%)
Road	358.4 (19.9%)	364.2 (18.7%)	371.1 (18.8%)	380.6 (18.0%)
Air	432.7 (24.0%)	514.6 (26.5%)	538.9 (27.3%)	661.2 (31.4%)
Total	1,800.7	1,946.0	1,972.2	2,108.3
Transport volume (million passengers)				
Railway	4.1 (4.7%)	4.3 (4.6%)	4.1 (4.2%)	4.0 (3.8%)
Road	83.3 (95.1%)	88.4 (95.1%)	94.1 (95.5%)	101.4 (95.9%)
Air	0.2 (0.2%)	0.3 (0.3%)	0.3 (0.3%)	0.3 (0.3%)
Total	87.6	93.0	98.5	105.7

(Source) Mongolian Railway, Mongolia Statistical Yearbook 2002

This project upgraded 30 obsolete passenger cars, or 10% of all passengers cars owned by Mongolian Railway, (Table 7) to mainly help maintain and secure long-distance passenger transport capacity in Mongolia.

2.3.3. Operating Ratio of Railway Cars

(1) Freight cars

Open wagons are mainly used to transport coal from mines to thermal power stations. Demand is high during winter while it declines in summer to 60% of that in winter. For efficient use year round, Mongolian Railway converts open wagons to container wagons in summer, when the demand for coal falls, in order to transport container freight between Ulaanbaatar and Zamyn-uud (Fig.1). According to Mongolian Railway, the operating ratio of open wagons is nearly 100%.

(2) Locomotives

The two General Electric (GE) locomotives procured in the project are used exclusively for freight transport. Of the 106 Mongolian Railway locomotives (as of 2002, see Table 7), all but the above two are outdated Russian-made locomotives. These outdated locomotives are not able to achieve their original capacity. The GE locomotives are more reliable and their operating ratio is almost 100%, according to Mongolian Railway.

(3) Passenger cars

Among 290 existing passenger cars as of 2002 (Table 7), 30 cars were procured under this

project. Most of the others were made in the 1980s. The 30 new cars are used exclusively for international express trains between Ulaanbaatar and Moscow and between Ulaanbaatar and Irkutsk. They operate once a week between Ulaanbaatar and Moscow (a roundtrip takes 10 days) and every other day between Ulaanbaatar and Irkutsk (a roundtrip takes four days). Usually 24 of the 30 cars are used for the trains operating between Ulaanbaatar and Moscow and two cars are used for trains between Ulaanbaatar and Irkutsk, while the remaining four cars are inspected and repaired in rotation. Table 6 below shows the average passenger capacity utilization ratio of international express trains in 2001 and 2002 (January to August), for reference.

Table 6: Average Passenger Capacity Utilization Ratio of International Express Trains

Section	2001	2002 (Jan.-Aug.)
1) Ulaanbaatar - Moscow	68.3%	73.1%
2) Moscow - Ulaanbaatar	67.6%	70.3%
3) Ulaanbaatar - Irkutsk	80.5%	82.3%
4) Irkutsk - Ulaanbaatar	72.1%	73.8%

(Source) Mongolian Railway

Table 7: Number of Mongolian Railway Cars (freight cars, passenger cars, and locomotives only)

(Unit: car)

	Appraisal (1993)	(1994)	(1995)	(1996)	(1997)	(1998)	(1999)	Completion (2000)	2nd Year (2001)	3rd Year (2002)
Freight cars	1,865	1,986	1,975	2,416	2,443	2,433	2,440	2,460	2,468	2,498
Passenger cars	227	202	202	276	278	288	289	289	290	290
Locomotives	111	105	105	105	107	107	108	111	111	106

(Source) Mongolian Railway

(Note) Passenger cars include those not used in transport but used as lodgings of employees working on the tracks.

2.3.4. Effectiveness of the renewal of track equipment

Mongolian Railway used Russian-made tracks, which wore down easily, especially on curves, because of the friction between the wheels and the tracks. Therefore, tracks were replaced once every six or seven months around curves with a diameter of 300m or smaller and every 8-19 months around curves with a diameter of 300-651m. This project replaced a total of 92km of track and procured track fastening devices, track connecting devices and track construction machinery. Tracks were replaced mostly on curves with Australian-made head hardened rails[2]. Although these rails are two or three times more expensive than the Russian rails, they are more durable and have a longer life and, therefore, they are cost effective in the medium- to long-term. The project's track replacement work, which was implemented in stages from 1995, effectively reduced the volume of work required for the replacement and increased the durability of the tracks.

[2] These rails with hard surfaces (heads) are superior in durability.

2.3.5. Safety and Maintenance

Table 8 below shows the number of railway accidents from 1994 to 2002. The number of derailments remained almost unchanged from 1994 to 2001 but decreased to 16 cases in 2002. The number of locomotive problems varied by year, though in 2002 it marked a nine-year high of 131 cases. This is because most of Mongolian Railway's locomotives are outdated Russian locomotives (some were made in the 1960s), including those operating beyond their replacement period, and often break down. Other minor troubles have almost been halved over the last nine years and the number has remained below 100 since the project completion.

Table 8: Number of Accidents

(Unit: case)

Item	(1994)	(1995)	(1996)	(1997)	(1998)	(1999)	Completion (2000)	2nd Year (2001)	3rd Year (2002)
Derailment	24	26	21	28	21	21	22	24	16
Collision	1	0	0	0	0	0	0	0	0
Minor collision	2	1	0	1	0	0	0	0	0
Locomotive problems	102	96	76	66	84	97	112	83	131
Other problems	212	173	158	168	129	107	79	96	99
Total	341	296	255	263	234	225	213	203	246

(Source) Mongolian Railway

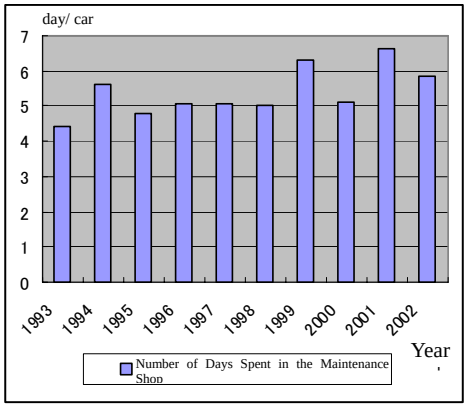
With respect to the passenger cars procured under the project, which are mostly used for international express trains, comfortableness and safety have been improved. According to Mongolian Railway, Russian Railway had pointed out some concerns over the safety of the international express trains of Mongolian Railway. After the completion of the project, they were improved to meet the Russian safety standards. As a result, no such concerns have been raised since the completion.

The number of days that each car spent in the maintenance shop where the project installed locomotive maintenance equipment was 5.4 days on average in 10 years from 1993 to 2002, and this figure has not decreased since project completion (Fig.4).

Among the reasons why the number of days has not been reduced as expected are 1) the Ulaanbaatar Locomotive Repair Shop continues to use some items of old equipment and further investment is needed in order to increase the capacity of the shop and 2) the locomotives other than the two GE locomotives procured under the project are old Russian locomotives (including those made in the 1960s) that take time to repair.

Therefore, although some aspects have improved, the contribution of the project to the safety of Mongolian Railway in its entirety cannot be defined clearly

Fig. 4: Number of Days Spent in the Maintenance Shop



(Source) Mongolian Railway

(Note) The data is only for the Ulaanbaatar Locomotive Repair Shop covered by the project.

because there are many safety aspects not covered by the project.

2.3.6. Communications equipment

(1) Digital switching stations and subscriber lines

Mongolian Railway has a communications network connecting each railway station and 25 points in neighboring areas. In the project, the analogue system of 18 switching stations was replaced by a digital system. This communications network is used for business purposes as a railway communications system exclusive to Mongolian Railway and also provides telephone service to the houses of employees of each station and general households in the neighboring areas. These general subscribers are those who reside outside the service area of Mongolian Telecommunications Company (MTC). On average, approx. 70% of subscriber lines are for the houses of Mongolian Railway employees and approx. 30% are for general households.

The installed capacity, lines in use and the capacity utilization ratio have all increased from 9,422 lines, 7,658 lines and 81% before the project completion to 9,738 lines, 8,573 lines and 88%, respectively (Table 9).

Table 9: Utilization State of Digital Switching Station Facilities Covered by the Project

(Unit: lines)

No	Switching Station	Before Completion			After Completion (As of June 2003)			Breakdown of Subscriber Lines		
								Business Use		Household Use
		Installed Capacity	No. of Lines	%	Installed Capacity	No. of Lines	%	MR	Others	
1	Sukhbaatar	500	400	80	600	494	82	101	13	380
2	Darkhan	1,280	860	67	1,280	960	75	169	14	777
3	Salkhit	300	200	67	312	224	72	53	0	171
4	Khutul	50	48	96	72	68	94	16	7	45
5	Orkhontuul	200	74	37	120	82	68	17	0	65
6	Erdenet	128	98	77	120	115	96	47	4	64
7	Zuunkharaa	662	590	89	662	641	97	150	40	451
8	Mandal	50	45	90	72	55	76	35	7	13
9	Tolgoit	100	50	50	72	69	96	34	0	35
10	Ulaanbaatar	3,952	3,620	92	3,952	3,866	98	1,176	208	2,482
11	Amgalan	200	178	89	216	207	96	55	3	149
12	Bagakhangai	200	110	55	168	129	77	63	32	34
13	Baganuur	100	52	52	120	67	56	51	0	16
14	Choir	500	320	64	528	370	70	255	30	85
15	Airag	200	160	80	260	182	70	118	12	52
16	Sainshand	500	450	90	656	563	86	260	6	297
17	Ulaanuul	100	43	43	120	90	75	33	6	51
18	Zamyn-uud	400	360	90	408	391	96	267	30	94
	Subtotal	**9,422**	**7,658**	**81**	**9,738**	**8,573**	**88**	**2,900**	**412**	**5,261**
	Others (7)	-	-	-	336	240	71	75	43	122
	Total	9,422	7,658	81	10,074	8,813	87	2,975	455	5,383

(Source) Mongolian Railway

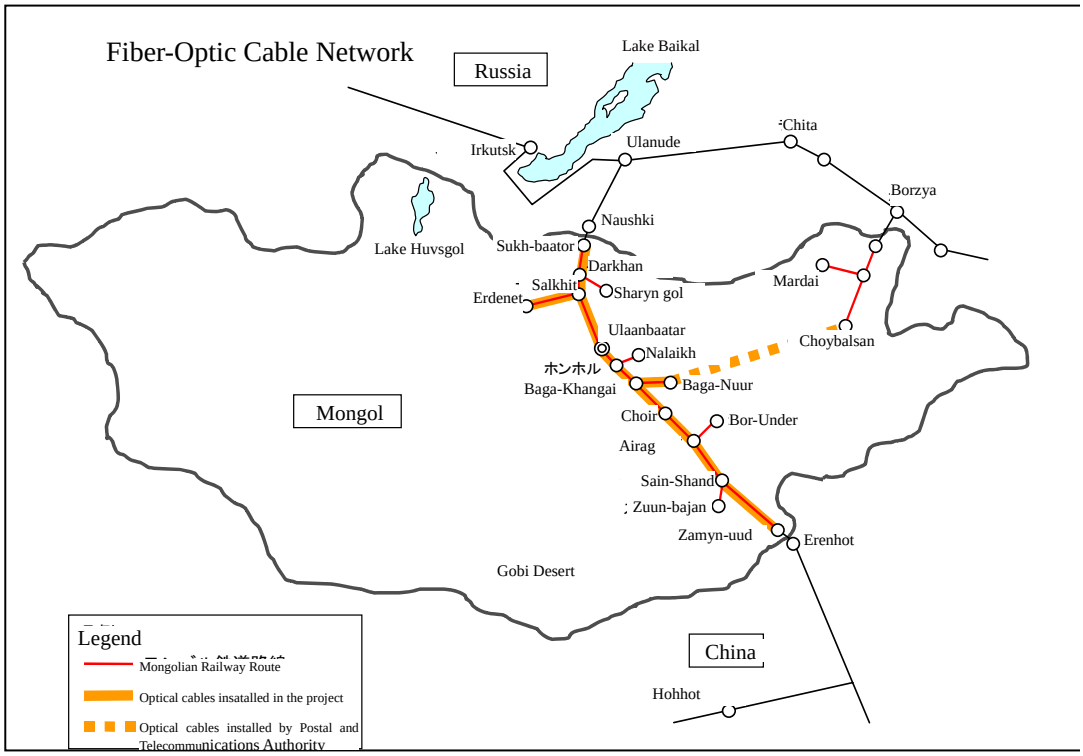
(Note) Subscriber lines for household use include those for the employees of Mongolian Railway and those for general households at the ratio of 7:3.

(2) Fiber-Optic Cables

In this project, twelve fiber-optic cables were installed (total length: 1,338km, see Fig. 5) and achieved a utilization ratio of approximately 80% partly due to the fact that the fiber-optic cable network was connected to Russia and China in April 2004.

In Mongolia, liberalization of the communications market began under the Communications Law in 2001. Mongolian Railway obtained a license for communications service and has been actively entering the information communications business by providing fixed telephone service within the country and Internet provider service.

Fig.5: Fiber-Optic Cable Service Area



2.3.7. Improvement of operational efficiency

In addition to improving the railway infrastructure, the project provided a consulting service concerning the fundamentals of railway management ranging from operational and financial management of Mongolian Railway to the operation of trains. As a result, Mongolian Railway carried out the following business reforms, including reorganization, in order to improve efficiency:

- The Technical Department was established in August 2001. The department is in charge of developing the technical improvement plan for the entire Mongolian Railway (enhancement of the operating ratio and reinforcement of the maintenance and management of newly installed machinery) and the annual business and financial plans (investment plan, overhaul plan and construction plan) and monitoring the implementation of these plans.
- Merger and abolishment of existing organizations: the Freight Wagon Department was merged into the Freight Transportation Department for the purpose of managing train operations and maintaining the freight business in a unified and efficient manner. In addition, Mergers of the Power Supply Divisions and Signaling & Communication Division, and of the Material Procurement Department and Trade Department were also

carried out. Moreover, in 2000, the Statistic Center was reorganized into the Statistics Information Center, which is in charge of the information system in addition to statistics.

- Commencement of new businesses: a travel company (Railway Tour) was established in March 2000 to launch travel businesses, including the operation of tours on chartered international passenger trains. In March 2003, an information network service company using fiber-optic cable lines (Railcom) was established.
- In order to improve efficiency of assistance from foreign countries, the position of Deputy Chairman (Finance & Economy) was created.

In addition, Mongolian Railway introduced a financial database system with the support of the World Bank in January 2003 (full operations started on July 10, 2003) and installed about 1,000 new computers with the grant and its own funds. According to Mongolian Railway, the above efforts to raise operational efficiency have improved budget planning, improved the operation schedule, and led to the introduction of IT, which has raised business efficiency. The medium- and long-term effects need to be examined as well.

2.3.8. Recalculation of Economic Internal Rate of Return (EIRR)

The EIRR of the project was calculated at 11.1% at time of appraisal. In this survey, recalculation on the same assumptions as the appraisal resulted in an EIRR of 14.4%.

(Assumptions for Calculation)

- Project life: 40 years
- Benefits: reduction of the rental fee of freight cars
- Costs: capital investment (freight car purchasing costs) and maintenance costs

2.4. Impact

2.4.1. Foreign currency savings

As Mongolian Railway did not have enough freight cars, it used foreign currency to rent freight cars from Russian Railway. The project procured 455 freight cars, saving a 1.6 million Swiss francs (approx. 0.13 billion yen) per year, according to a preliminary calculation by Mongolian Railway.

2.4.2. Impact on the improvement of freight service of Mongolian Railway

In order to clarify the project's impact on the improvement of the quality of Mongolian Railway's services, we interviewed five major customers of the freight service of Mongolian Railway. The list of interviewed companies appears in Table 10.

Table 10: List of Companies Interviewed as Beneficiaries

Company Name	Characteristics
Baganuur Coal Mine	A national enterprise (75% of shares are owned by the government) producing 3.1 million tons of coal a year (as of 2002), which accounts for 70% of all coal produced in Mongolia.
Ulaanbaatar No.4 Power Station	A national power station under the control of the Coal and Energy Authority. The largest power station in Mongolia (capacity: 540MW) generating 70% of power supply and 60% of heat supply in Ulaanbaatar.
IFFC (International Freight Forwarding Centre)	A freight transport company 100% owned by Mongolian Railway; 80% of all freight handled is transported by railway, 16% by truck and 4% by air. Major items handled are timber, fertilizer, oil, used automobile parts, food, etc.
MTT (Mongolian Transport Team Co., Ltd)	A private freight transport company; 97% of all freight handled is transported by railway, 2.5% by truck and 0.5% by air. Major items handled are plant machinery, construction materials, food, etc.
TUUSHIN Co., Ltd	A private freight transport company; 65-75% of all freight handled is transported by railway, 10-20% by truck and 5% by air. Major items handled are plant machinery, electric appliances, construction materials, used automobiles, etc.

Most freight carried for the Baganuur Coal Mine and Ulaanbaatar No.4 Power Station is coal. Mongolian Railway transports approx. 240,000 tons of coal a year between the Baganuur Coal Mine and Ulaanbaatar No.4 Power Station. As the coal consumption at the power station varies by season (coal consumption per day is 9,500 tons in winter and 5,000-5,200 tons in summer), freight cars make four round trips a day in winter and two round trips a day in summer. According to the Baganuur Coal Mine and Ulaanbaatar No.4 Power Station, the 300 open wagons for coal transport procured under the project have a larger loading capacity (70 tons) than the existing ones (66 tons) and consequently the loading weight of each wagon has increased. Therefore, the project helped improve transport efficiency.

With respect to the improvement of freight transport service, MTT says that from 1996 to 1998 when the increased volume of freight transport caused freight cars to be booked up, the company was sometimes kept waiting for four days before shipping freight. As a result of the increase in freight transport capacity (particularly the reinforcement of container freight transport) achieved by the project, it has become possible since 1999 to ship freight on the day following the order. Thus, the project has facilitated Mongolian Railway's freight reservation procedure.

On the other hand, some point out that Mongolian Railway cannot handle the ever increasing freight volume and that some improvements are required such as increasing locomotives and container cars, which are insufficient in number, or introducing a insulated container system or freight tracing system.

2.4.3. Impact of the introduction of fiber-optic cable network on Mongolia's communications sector

In this project, a fiber-optic cable network with a total length of 1,338km was established from Skhubaatar on the Russian border to Zamyn-uud on the Chinese border. As a result, a communications network connecting six provinces and 18 major towns was completed and international telephone lines in Russia, Mongolia and China were connected by wire. Thus, the environment for domestic and international telephone service has improved significantly.

Also, as private cellular phone companies have expanded their service areas[3] and it has become possible to connect the installed fiber-optic cables to those installed between Choybalsan and Baganuur[4], the area under the control of the Postal and Telecommunications Authority, where communications services can be offered has been expanding rapidly. After the completion of the project, the Internet business has been growing remarkably in Mongolia and the number of businesses and households that use the Internet has been increasing at a rapid rate.

According to three companies interviewed, as the installation of fiber-optic cable network accelerated introduction of IT and new means of communication such as e-mail, the business efficiency of each company has improved from previously when the telephone was the main means of information exchange. The companies also said that the installation of mobile equipment and telephones at each station helped facilitate communication.

Thus, fiber-optic cable network has had a positive impact on people's lives and on the development of Mongolia's communications sector and industries as well as on Mongolian Railway's communications system.

2.4.4. Environmental and Social Impact

This project upgraded the existing railway network and the existing locomotive factory and established a fiber-optic cable network along the existing tracks, neither of which required relocation of residents. There was no issue that could cause any environmental or social problem.

2.5. Sustainability

2.5.1. Operation and Maintenance system

Mongolian Railway is a joint venture company in which the Mongolian and Russian governments each have a 50%, stake. At present, the whole group has 14,064 employees (including 7,498 railway employees). Besides its main railway business, the huge Mongolian Railway group engages in railway-related businesses such as a railroad tie factory, power and water supply, a PC prestressed concrete sleeper factory, printing factory, and Railway University, and also runs hospitals, day-care centers, and schools mainly for its employees as well as housing and telephone businesses. Regarding Mongol Railway's relationship with Russia, in addition to financial cooperation, the First Deputy Chairman, Accounting Manager and a dozen engineers (specialists) have been sent from the Russian side. Basically, operational and technical functions in day-to-day operations are managed by the Mongolians on their own almost independently of Russia.

The project maintenance facilities are managed by the pertinent departments: Track Facilities Department for track equipment, Locomotive Facilities Department for locomotives, Freight Transportation Department for freight cars, Passenger Transportation Department for passenger cars, and Signaling, Communication & Power Supply Department for

[3] For example, a private cellular phone company Mobicom constructed a relay station in Choir where the fiber-optic cable is buried with a view to expanding its service area to cities in East Gobi such as Mandal Gobi and Dalan Dzadagad that have no telephone service.

[4] The Postal and Telecommunications Authority laid fiber-optic cables between Choybalsan and Baganuur with the support of the Korean government and connected them with the cables laid under this project at Baganuur.

communications equipment and fiber-optic cables.

2.5.2. Technical Capacity

According to the specialists sent by JICA to Mongolian Railway, the quality of repairs by the Ulaanbaatar Locomotive Repair Shop has improved as a result of the installation of new machinery under the project. The specialists also pointed out that the obsolete facilities of locomotive repair shops in Darkhan and Sainshand, Ulaanbaatar Passenger Car Repair Shop and Zuunkhara Freight Car Repair Shop, which were not covered by the project, need to be renewed as a top priority in the future.

The maintenance of each type of equipment is carried out as follows:

(1) Maintenance of tracks

The maintenance of tracks basically consists of major repairs every 16 years (large-scale maintenance implemented by removing tracks and ballast), medium repairs every eight years (overall replacement of ballast) and minor repairs every four years (partial replacement of ballast and sleepers). The Track Facilities Department allocates track maintenance units to each major station, which engage in maintenance and inspection of tracks every 25km. The maintenance unit conducts 1) visual track inspections every day and 2) comprehensive inspections of all lines twice a year, in spring and autumn. The site office evaluates the condition of the tracks and sends a monthly report to the headquarters. Based on the reports submitted by local offices, the headquarters draws up a maintenance plan and allocates budget for the following year.

(2) Maintenance of locomotives

Mongolian Railway owns three locomotive repair shops within the country (Ulaanbaatar, Darkhan, and Sainshand). The two GE locomotives procured under the project are maintained and inspected at the Ulaanbaatar Locomotive Repair Shop. Periodic inspections are usually conducted every month, every three months, every six months, every year, every two years, every four years and every eight years. An overhaul is made in the eighth year. As for GE locomotives, however, the Ulaanbaatar Repair Shop is only capable of conducting periodic inspections in the second year and subsequent inspections are conducted in Dairen, China, where the necessary maintenance facility exists. If more GE locomotives are procured in the future, the Mongolian Railway will consider expanding the facility of the repair shop in order to be able to conduct the four-year and eight-year inspections.

(3) Maintenance of freight cars

Freight cars are maintained and inspected at the Zuunkharaa Freight Car Repair Shop. This repair shop is capable of repairing six-eight cars a day (operating eight hours a day) and conducts maintenance and inspection of 1,500-1,600 cars a year. The average time spent on each car is about 0.75 day.

(4) Maintenance of passenger cars

The maintenance of passenger cars is carried out at the passenger car repair shop in Ulaanbaatar. Periodic inspections are conducted every six months, every year, and every four

years. An overhaul is performed on the fourth year. In addition, summer and winter inspections and daily inspections are conducted.

2.5.3. Financial Status

As for income, income from the railway business has been steadily increasing since 1997 due to the rapid increase of freight transport in recent years (Table 11). However, as expenditures in the railway business have increased by a greater margin than income, the return rate has declined and the profit from the railway business has not increased so much. Much of this is attributable to a new accounting method for overhaul costs (starting from FY 2000, the method of depreciating the overhaul costs in accordance with service life as capital expenditure was changed to the method of recognizing the costs as expenditure when incurred. As a result, depreciation costs have decreased since 2000, but other expenditures have increased, more than offsetting the lower depreciation costs. See Table 11.) Income from the railway business per employee, which is one productivity indicator, has increased from 337,000 Tug in 1997 to 339,000 Tug in 2001.

Regarding financial status, total assets in 2001 were 93,106 million Tug, twice the figure in 1997 (Table 12), mainly because tangible fixed assets have increased as a result of increased capital investment. On the other hand, liabilities have doubled from 1997 to 2001 to reach 67,375 million Tug because of capital investment using debts, most of which is the ODA loan. As a result, the equity ratio has declined from 32.1% (1997) to 27.6% (2001).

Other subsidiary businesses operated by Mongolian Railway have been recording losses as a whole on a continuous basis since 1997. Although some businesses are highly profitable, such as the International Freight Forwarding Center (IFFC) which had a profit of about 2,900 million Tug, the housing business and hospital, day-care center and school businesses posted a total loss of approximately 5,100 million Tug. In order to promote streamlining and efficiency of operations, Mongolian Railway is tackling restructuring and privatization of unprofitable businesses, including converting employees' houses to private-owned houses.

Table 11: Consolidated Income Statement of Mongolian Railway

(million Tug)

Category		1997	1998	1999	2000	2001
Income from Railway Business	Income from freight service	18,221.3	21,921.3	29,658.9	36,949.3	52,173.2
	Income from passenger service	8,131.2	9,846.9	9,998.3	11,344.5	11,624.5
	Other income	1,450.7	1,369.3	1,450.9	1,855.1	2,716.4
	Subtotal	**27,803.2**	**33,137.5**	**41,108.1**	**50,148.9**	**66,514.1**
Expenditure for Railway Business	Personnel expenses	4,428.0	6,173.4	7,376.1	9,364.0	11,349.0
	Fuel expenses	5,322.4	8,282.2	9,263.2	13,121.3	15,067.7
	Materials purchase costs	2,483.2	2,704.2	3,727.5	4,014.9	4,867.5
	Depreciation*	7,129.7	6,348.8	9,433.8	1,458.3	1,818.3
	Other expenditures	6,174.2	7,258.4	8,725.4	19,442.2	30,415.1
	Subtotal	**25,537.5**	**30,767.0**	**38,526.0**	**47,400.7**	**63,517.6**
Profit from Railway Business		**2,265.7**	**2,370.5**	**2,582.1**	**2,748.2**	**2,996.5**
Income from Subsidiary Businesses		14,783.5	17,947.9	22,419.5	26,304.5	28,785.9
Expenditure for Subsidiary Business		15,923.1	18,976.4	23,589.5	27,549.7	30,277.9
Profit from Subsidiary Businesses		**△1,139.6**	**△1,028.5**	**△1,170.0**	**△1,245.2**	**△1,492.0**
Consolidated Net Profit		**1,126.1**	**1,342.0**	**1,412.1**	**1,503.0**	**1,504.5**
Employees of Railway Business (persons)		6,715	6,899	7,102	7,232	7,498
Profit from Railway Business per Employee (thousand Tug)		337.4	343.6	363.6	380.0	399.6

(Source) Mongolian Railway

*It is unknown if the depreciation cost is being properly recorded.

Table 12: Consolidated Balance Sheet of Mongolian Railway

(million Tug)

Item	1997	1998	1999	2000	2001
Assets					
I. Current Assets					
Cash and deposits	2,659	3,791	5,431	3,533	6,009
Account receivable	900	1,493	2,285	1,722	1,936
Inventories	6,814	8,763	10,818	12,617	13,263
Others	2,001	1,253	2,687	2,820	4,192
(Total current assets)	12,374	15,300	21,221	20,692	25,400
II. Fixed Assets					
Tangible fixed assets	34,228	44,774	45,445	64,514	59,807
Intangible fixed assets	0	0	0	16	84
Investments and other assets	10	10	6	0	7,815
(Total fixed assets)	34,238	44,784	45,451	64,530	67,706
Total Assets(I＋II)	46,612	60,084	66,672	85,223	93,106
Liabilities and Shareholders' Equity					
III. Liabilities					
Current liabilities	2,285	3,570	8,340	6,822	10,855
Fixed liabilities	29,332	39,675	39,561	56,439	56,520
(Total liabilities)	31,617	43,245	47,901	63,261	67,375
IV. Shareholders' Equity					
Capital and Surplus	14,995	16,839	18,771	21,962	25,731
Total Liabilities and Shareholders' Equity(III ＋ IV)	46,612	60,084	66,972	85,223	93,106

(Source) Mongolian Railway

3.Feedback

3.1. Lessons Learned

None

3.2. Recommendations

None

Comparison of Original and Actual Scope

Item	Plan	Actual
1) Output		
(1) Upgrading of track equipment	Replacement of tracks: total length 92km Track fastening devices and track construction machinery	Same as planned
(2) Purchase of freight cars	455 cars Open wagons (300) Box wagons (80) Container cars (50) Oil tanker wagons (17) Water tanker wagons (8) 200 wheels	Same as planned
(3) Purchase of passenger cars	30 cars	Same as planned
(4) Purchase of locomotives	2 locomotives	Same as planned
(5) Improvement of locomotive maintenance equipment	Machine tools and maintenance machinery for the minimum necessary overhaul (Ulaanbaatar Locomotive Repair Shop)	Same as planned
(6) Improvement of communications equipment	Digital telephone switching stations (5) (3,500 lines) Installed at Ulaanbaatar and 4 major local stations	18 stations (9,458 lines) Fiber-optic cable network (12 cables, 1,338km) Renewal of electric system at 18 stations
(7) Improvement of controlling equipment	Host computers (2 sets) Terminal computers (50 sets) Installed at 50 major stations	Same as planned
(8) Consulting service	Procurement and technical support (96MM) Operational management (25MM)	Same as planned
2) Project Period		
(1) Selection of consultants	Jul. 1993 Dec. 1993	Jul. 1993 Jan. 1994
(2) Consulting service	Jan. 1994 Apr. 1997	Feb. 1994 Mar. 2000
(3) Track equipment	Jan. 1994 Mar. 1996	Feb. 1994 Dec. 1995
(4) Railway cars	Jan. 1994 Apr. 1996	Feb. 1995 Apr. 1997
(5) Communications and controlling equipment	Jan. 1994 Jun.1995 Jan. 1994 Jan. 1997	Feb. 1994 May 1995 Feb. 1994 Dec. 1996
(6) Maintenance equipment	—	Oct. 1997 Mar. 2000
(7) Fiber-optic cable network		
3) Project Cost		
Foreign Currency	8,074 million yen	7,892 million yen
Local Currency	49 million yen (195.5 million Tug)	0 million yen (0 Tug)
Total	8,123 million yen	7,892 million yen
ODA Loan Portion	8,074 million yen	7,892 million yen
Exchange Rate	1 tugrik＝0.25yen (July 1993)	1tugrik＝0.10 yen (2000 average)

Third Party Evaluator's Opinion on
Railway Transportation Rehabilitation Project (1)(2)

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Impacts

The Railway Transportation Rehabilitation Project (1)(2) was carried out from November 1993 to March 2000. The objectives of the Project were to maintain Mongolian Railways existing transport capacity and save foreign currency by reducing freight car rental fees, thus contributing to stabilization of the Mongolian Economy. At the time of Project appraisal in 1993 Mongolian Railway carried more than 90% of Mongolia's freight including coal which is the countries main energy source. With the loss of Soviet financial and operational support for Mongolian Railway and schedule fee increases for rolling stock rented from Russia there was fear that deterioration of rail transport capacity could worsen Mongolia's economy and negatively affect the balance of international payments. Considering Mongolian Railway's urgent and important impact on the national economy at the time of appraisal, the Project was relevant at the time of appraisal. Freight transport by railway increased to almost 98% by 2002 and is still the largest carrier of critical coal supplies necessary for securing a stable energy supply and there the Project remains relevant to the present.

During the Project from 1993 to 1999 there was little increase in freight transport but freight transport doubled in the three years following Project completion from 2000 to 2002. This increase in freight volumes was due to a recovering Mongolian economy and greatly increased trade between Russia and China which boosted overland freight transport via Mongolia as the shortest route between Russia and China. Thus freight transport has grown substantially since Project completion and the Project helped to ensure that transport capacity meets growing demand. However, there is concern that Mongolian Railway cannot handle ever increasing freight volumes and additional improvements will be required such as increasing the number of locomotives and container cars or introducing insulated container systems and freight tracing systems.

Income from the railway business has increased steadily since 1997 due to increased freight volumes however expenditures have increased more rapidly so profit margins, while increasing are, not commensurate with the increased business volume. Subsidiary businesses operated by Mongolia Railway have been recording losses as a whole since 1997. The International Freight Forwarding Centre is highly profitable but this is offset by losses in housing, hospital, day care and school businesses. Mongolia Railway is tackling he restructure and privatization of unprofitable businesses, including converting employees' housing to privately owned houses.

Positive impacts of the Project were seen in several areas in addition to enabling Mongolia Railways to keep up with current demand for freight transport. The Project established a fiber optic cable network which enabled Mongolia Railway to improve its communication capacity and expand into the communications business. Three customers of Mongolia Railway indicate that installation of a fiber-optic cable network accelerated introduction of IT and new means of communications such as e-mail thus improving the business efficiency of each of the companies. The fiber-optic cable network has also had a positive impact on people's lives and on the development of Mongolia's communications sector and industries.