Pakistan

Locomotive Building Project

Report date: March 2001
Field survey: August 2000

1. Project Profile and Japan's ODA Loan

Map of related factory sites

A locomotive manufactured under this project

1.1. Background

Looking at surface transport performance for passengers and freight in Pakistan in 1991, the share of road traffic was in excess of 80 percent for both passenger and freight transport. On the other hand, the share of railroads was about 13 percent for both passengers and freight, despite the fact that the long distance routes connecting the two ports of Karachi and Qasim, which handle 90 percent of Pakistan's import and export cargoes, and the key inland cities of Lahore and Peshawar, had a relative advantage over road routes and were playing an important role in the development of domestic industry.

In contrast, in and after fiscal year 1986/1987, in addition to the fact that no new diesel electric locomotives, the core of rail operations, were being procured, insufficient budgetary allocation including that from foreign currency, prevented the execution of sufficient maintenance and repair operations, which combined with the aging of rolling stock itself, was producing a year-on-year decline in operating ratios (approximately 75 percent in FY 1991/1992).

In addition, while Pakistan Railways (PR) had a fleet of 564 diesel electric locomotives in 1991, a total of 240 units had exceeded their serviceable life by 1992 although they were still being operated, which caused major obstructions to the implementation of the Development Programme for Rail Transport. In order to address this situation, the procurement of new diesel electric locomotives and their rehabilitation had become an essential task.

1.2. Objectives

To strengthen the capacity of rail transport and contribute to the improvement of transport conditions in Pakistan, by manufacturing diesel electric locomotives at the Risalpur Locomotive Factory, constructed with funds financed by a previous Japanese ODA loan.

* During the same period, another Japanese ODA-financed project was implemented to rehabilitate 54 diesel electric locomotives that had become deteriorated.

1.3. Project Scope

The project scope was to manufacture 18 diesel electric locomotives of 2,200 horsepower with a maximum running speed of 125km/hr, and included the following activities: (1) procurement of complete sets of components including engines, main generators, electrical control mechanisms and braking devices; (2) procurement and assembly of parts including electric motors and auxiliary generators; (3) processing, manufacture and assembly of raw materials for body work and coaches, etc. The ODA loan covered the entire foreign currency portion of the funds necessary for implementation of the above project scope and part of the local currency portion.

1.4. Borrower/Executing Agency

President of the Islamic Republic of Pakistan / Ministry of Railways

1.5. Outline of Loan Agreement

Loan amount/Loan disbursed amount	¥6,067 million/¥5,398 million
Exchange of notes/Loan agreement	August 1993/ August 1993
Terms and conditions	Interest Rate: 2.6%, Repayment period (grace period): 30 years (10 years), General untied
Final disbursement date	November 1999

2. Analysis and Evaluation

2.1. Relevance

In order to deal with the continuing deterioration of rolling stock and other facilities owned by PR and to render improvements to the status quo, a total of eight Japanese ODA loans including projects currently (* at the time of this evaluation) in progress, have been supplied to fund locomotive factory, locomotive rehabilitation and improvement of signaling equipment. The present project forms one link in this series.

A review of the role of railways in Pakistan's transport sector, which was conducted at the end of the 7th Five-Year Plan (end of June 1992), revealed an expansion of the said role centering on long distance bulk volume freight transport and increased significance being attached to investment in the rail sector under national investment plans. In addition, the government of Pakistan has been promoting a policy of

domestic locomotive production in order to conserve foreign currency reserves. This project, being in line with government policies for the railroad sector, was thus considered to be relevant.

2.2. Efficiency

(2.2.1.) Implementation Period

At the time of appraisal, project completion was scheduled for September 1996, but actual completion was delayed by approximately one year to September 1997. There were three main reasons for this delay as follows. (1) Confusion arising from changes in the customs system lengthened the time required for customs clearance resulting in approximately three-month delays in the arrival of raw materials and components at the factories. (2) 147 engineers were scheduled to be employed at the Risalpur Locomotive Factory to execute the necessary assembly work, however, government approval for this recruitment was delayed because it was promoting a policy to reduce the PR workforce. (3) There were defects in the diesel electric engines and traction motors procured, which necessitated repairs/replacement.

(2.2.2.) Project Costs

The initial cost estimates for the project called for funds totaling ¥8,174 million, however, the actual cost of the project was ¥9,097 million, or a cost overrun of 11.3 percent. Precisely, the foreign currency portion that was fully financed by the Japanese ODA loan actually ended up at ¥5,398 million, falling below the planned amount of ¥6,067 million, however the local currency portion, that was fully funded by the executing agency at lastactually ended up at Rp 1,223 million, 2.3 times the planned amount of Rp 531 million.

The following two reasons can be cited for the overrun in domestic currency costs. (1) Customs duties and taxes on imported materials and components increased due to hikes in import tariffs (planned level: Rp 225 million, actual: Rp 983 million). (2) Due to an approximately 40 percent drop in the Pakistan rupee against the yen as compared to appraisal forecasts at the time of procuring imported materials/components, procurement costs for some of the imports to be financed by local currency overran. Both factors were difficult to predict at the time of appraisal.

2.3. Effectiveness

(2.3.1.) Operating Status of Manufactured Locomotives

A total of 23 PHA-20 locomotives[1], i.e. 18 manufactured under this project and five others under another JBIC-funded project, are owned and operated by the

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Passenger Business Unit (PBU) of PR. These 23 units accumulated a total of 10,879,000 route kilometers between July 1, 1996 and June 31, 1999. This is equivalent to 11.75 percent of the 92,601,000 route kilometers for PBU's entire passenger fleet* for the same period. (Refer to Table 1)

* Including the rolling stock used for passenger-freight trains.

Table 1 Percentage Contribution to PHA-20 Route Kilometers

	1996-97*	1997-98	1998-99	3-year total
PHA-20 Route Kilometers ① (thousand km)	3,351	3,920	3,608	10,879
Route Kilometers for all Passenger Locomotives ② (thousand km)	32,165	29,877	30,559	92,601
Percentage Contribution ①/② (%)	10.42%	13.12%	11.81%	11.75%

Source: Ministry of Railways data
* Project completion: September 1997; fiscal years run from July 1 through June 31 each year.

(2.3.2.) Technical Transfer and Contribution to Plans to Build Locomotives Domestically

The Risalpur Building Factory* where all the locomotives were assembled, newly employed 147 engineers in preparation for this project. They have received the necessary training in manufacturing techniques under the administrative guidance of the construction supervisor of the Japanese supplier, and have subsequently been making a considerable contribution to locomotive manufacturing operations and to the domestic production policies being promoted for locomotive manufacture by PR.

* Constructed under the JBIC-financed project "Locomotive Factory Construction Project" (Loan Agreement signed in February 1984; loan amount: ¥9,760 million)

2.4. Impact

(2.4.1.) Promotion of Rail Related Businesses

Previously, Pakistan was almost wholly dependent on imported products when procuring locomotive components and spare parts. However, there has been gradual progress toward a switch to domestic products, and it is now possible to procure various components in country, including brake cylinders, starter batteries, gears and gear casing. This project has thus also contributed to promoting the businesses relating to locomotive parts production via the locomotive construction that was implemented using the JBIC finance.

(2.4.2.) Environmental Impact

The water containing oil that is discharged at the Risalpur Building Factory, the site of parts manufacture and locomotive assembly executed under this project, is treated at facilities located within the premises. There has been no particular negative environmental impact.

According to a survey conducted by PR, against the 1,800 BTU (453.6 kcal) of fuel required to transport 1 ton of freight by truck, a mere 300 BTU (75.6 kcal), or approximately one sixth, of fuel is required to carry the same volume by rail. Given that this is estimated to be effective in reducing atmospheric pollutants, it can be understood that rail transport is exerting a lower burden on the environment as compared to transport by road. Accordingly, this project, which has contributed to increasing passenger and freight transport on the railways, has also made a substantial contribution to environmental conservation.

2.5. Sustainability

(2.5.1.) Operating Status of Locomotives Built under This Project

The 18 locomotives built under this project are all owned, operated and maintained by PBU. At present, these locomotives are predominantly in service for limited express trains on the routes between Peshawar, Lahore, and Rohri.

Tables 3 and 4 show the operating status of the PHA-20 class locomotives built under this project. Using the inspection schedule shown in Table 2 to calculate the average number of days required for inspection yields an annual figure of 15.3 days, and an availability rate of 95.8 percent, excluding the days required for inspection. Although the availability rate of the PHA-20 units is on the decline, this is because Level I and II overhauls, which are conducted after 3 and 6 years of service, respectively, have started to be performed on the locomotives, and furthermore, inspections/repairs* are being conducted to address the crankshaft curvature problem that occurs in locomotives of the same class.

Crankshaft curvature has occurred in 14 of the 18 locomotives procured under this project; however, the cause of the problem has yet to be identified. All the problems were discovered during inspections, thus no accidents have occurred whilst the locomotives were in service.If the problem is left unresolved, it can exert a load on the engine and can cause internal damage. To prevent the problem from occurring, F-schedule inspections (refer to Table 2), which are usually conducted once a year, are being executed on a quarterly basis on the 4 classes of locomotives in which the same problem arises. Plans are in place to proceed with the elucidation of the causes of this problem in conjunction with PR suppliers.

Whilst the reliability and availability rates of the locomotives procured under this project are better than the mean values for PBU's 351 key locomotives, the resolution of the above problem is desirable in order to target even safer operation.

* Repairs take 2-3 weeks and cost approximately Rp 2.5 million per unit.

Table 2 Locomotive Maintenance and its Frequency

Designation	Frequency	Duration
Inspection at service completion	Every time	1.5 hours
A-Schedule Inspection	Once a week	2.5 hours
B-Schedule Inspection	Once a fortnight (every two weeks)	4.5 hours
C-Schedule Inspection	Once a month	6.0 hours
D-Schedule Inspection	Once a quarter	1 day
E-Schedule Inspection	Twice a year (biannually)	2 days
F-Schedule Inspection	Once a year or every 160,000km of operation	7 days
Full Service (Level II)	Once every 3 years or every 500,000km of operation	15 days
Full Service (Level I)	Once every 6 years or every 1-million-km of operation	25 days

Source: Ministry of Railways data

Table 3 Reliability Rate of Procured Locomotives (%)*

	Jul. 1999	Aug. 1999	Sep. 1999	Oct. 1999	Nov. 1999	Dec. 1999	Jan. 2000	Feb. 2000	Mar. 2000	Period average
PHA-20	99.08	99.38	99.51	99.84	99.22	99.49	99.80	99.06	98.71	99.34
Mean for key locomotives	97.88	97.79	98.30	98.15	98.11	98.25	97.77	97.90	97.86	98.00

Source: Ministry of Railways data

* Reliability Rate = percentage of operation with no delays exceeding 1-hour due to mechanical breakdown

Table 4 Availability Rate* of Procured Locomotives

Availability Rate	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00**
PHA-20	-	-	99.36	98.32	98.42	96.71	91.21	90.86	86.61
Average	75.56	75.80	76.56	76.15	75.32	72.80	71.50	69.77	68.35

Source: Ministry of Railways data

* Availability rate = percentage of days during each period when units were operational (inoperable = repairs and inspection)

** The data for FY 1999/2000 is the average for July 1999 through March 2000.

(2.5.2.) Maintenance System

PR conducts repairs to locomotives under a preventive maintenance system, identifying problem points at an early stage with the aim of preventing delays in services due to accidents. Under this preventative maintenance system, inspections are carried out according to the schedule shown in Table 2, irrespective of presence of problems. For the locomotives procured under this project, A-E Schedule inspections (refer to Table 2) are carried out at the locomotion depots in each area; F-Schedule inspections (refer to Table 2) are conducted at the Rawalpindi Repair & Rehabilitation Workshop; and Level I and II overhauls (refer to Table 2) are executed at the Lahore Factory and the Rawalpindi Workshop.

Moreover, in addition to the spare parts stored at the Karachi, Rawalpindi and

Lahore repair &rehabilitation workshops, basic items are also stored at other local depots. A system is in place whereby the assets and equipment necessary for operation, including spare parts and fuel, are distributed based on monthly orders from all depots.

(2.5.3.) Financial Status of Pakistan Railways (PR)

PR's operating income for the FY 1998/1999 was Rp 9,310 million, of which passenger revenue, freight revenue and other revenue were accounted for 46.1 percent, 45.5 percent and 8.4 percent respectively. The operating expenses totaled Rp 12,793 million. PR posted an operating deficit of Rp 3,483 million. PR's net losses, after non-operating income and expenditure such as interest payments, were Rp 6,806 million. While a part of the deficit was compensated by the railway reserve funds (a quasi-subsidy from the government), final deficits of Rp 4,655 million were carried forward to the next fiscal year.

Table 5 Operating Income and Expenditure (I/E) for Last Five Years

Fiscal Year	Operating Income	Operating Expenses	Operating Profits	Non-operating Income	Non-operating Expenses	Net Profit
1994-1995	9,721.6	11,673.5	–1,951.9	2.8	1,145.2	–3,094.3
1995-1996	8,286.0	13,622.9	–5,336.9	2.2	1,276.3	–6,611.0
1996-1997	9,804.0	12,969.7	–3,165.7	0.5	2,312.8	–5,478.0
1997-1998	9,940.9	12,761.3	–2,820.4	1.8	2,679.9	–5,498.5
1998-1999	9,310.2	12,793.4	–3,483.2	0.4	3,323.4	–6,806.6

In order to improve its financial status, PR has reduced its workforce from an average of 137,730 during 1975-1980 to 95,152 in FY 1998/1999, via employment reduction policies including the restriction of new hiring and the non-replacement of retired position. Moreover, in 1998 the debt-ridden PR, which was dependent on government subsidies, underwent structural reforms implemented by the government of Pakistan with the aim of improving operational efficiency, services, and so on. Under these reforms the entire PR was reorganized into three business units, namely the passenger business unit, the freight business unit and the infrastructure business unit. These three business units are to be established as separate companies and, once self-supporting systems have been put in place, are scheduled to be privatized while this process is deemed to take some time.

(2.5.4.) Budget for Operation and Maintenance (O&M)

The breakdown of the various operating expenses is as shown in Figure 2. O&M costs for rolling stock, track and building facilities are Rp 4,217 million, accounting for 44.9 percent of the total. The proportion for O&M costs is increasing in line with

the aging of equipment, and since the start of the 1990s in particular, has exceeded expenditure on operating costs (for fuel, personnel expenses, etc.) (refer to Table 3).

The operating budget is determined by PR, then distributed by the central government via the Ministry of Railways. The percentage of the amount of PR's budget claim approved by the government was 96.4 percent in FY 1998/1999 and 95.0 percent in FY 1999/2000. The O&M costs for the same fiscal year were 94.0 percent and 91.9 percent of the respective approved quotas. However, since it is not possible to finance the cost of large-scale repairs and rehabilitation, which require large amounts of foreign currency, under these O&M costs, such work is usually executed using foreign funds.

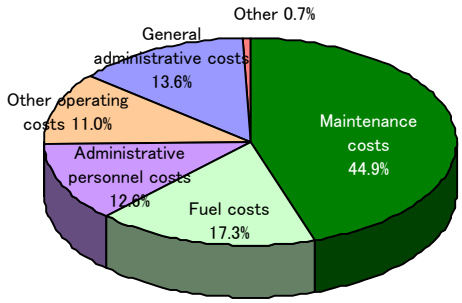

Figure 2 Breakdown of Ordinary Operating Expenses for Fiscal 1998/1999

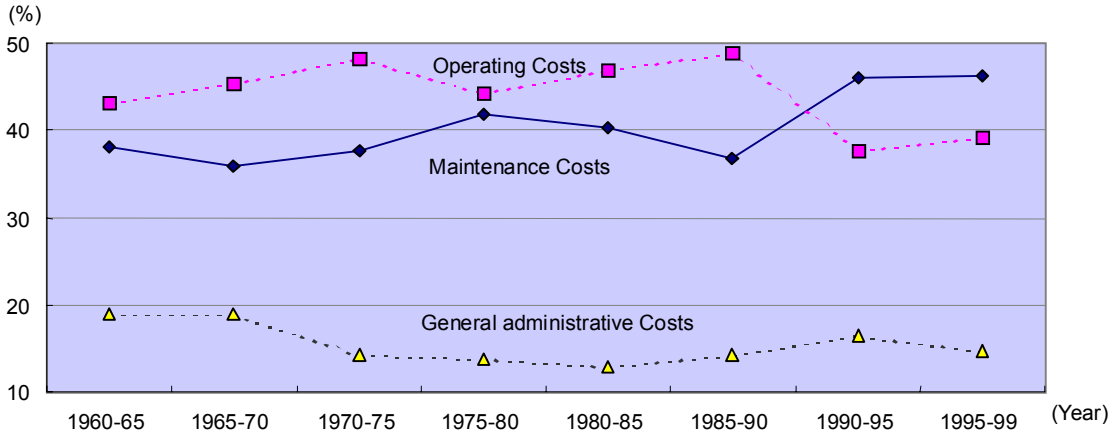

Figure 3 Percentage of O&M Costs against the Entire Operating Expenses

(2.5.5.) Deterioration of Rail Facilities and Declining Locomotive Availability Rate

Out of the 579 locomotives registered to PR, 333 have overrun their serviceable life. As a result, the availability rate of rolling stock has been decreasing since FY 1993/1994, and in FY 1999/2000 was at its lowest level of 68.35 percent.

Excluding passenger coaches and freight wagons, aging of facilities is proceeding across the board, with 300 kilometers of track requiring urgent repair and 60 rail bridges having exceeded their serviceable life.

Table 6 Percentage of equipment beyond serviceable life

	All	Beyond serviceable life	Percentage
Locomotives	579	333	58%
Passenger coaches	2,029	110	5%
Freight wagons	25,708	1,219	5%
Track	11,526km	6,224km	54%
Railway bridges	100	60	60%
Signaling	-	-	60%
Telecommunications equipment	-	-	80%
Electrical equipment	-	-	45%

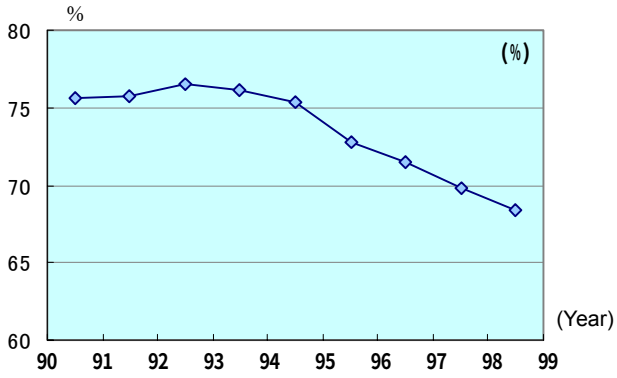

Figure 4 Operating Ratio of Registered Locomotives

Currently, Japan's ODA loan funds are being used to rehabilitate 48 diesel locomotives and to build 30 locomotives, thus a total of 78 locomotives are undergoing renewal. This is estimated to produce major improvements in the availability rate.

In addition, PR is planning to manufacture 69 diesel locomotives, rehabilitate 36 locomotives, procure 29 electric locomotives, rehabilitate 450 passenger coaches, and procure/manufacture 300 freight wagons, and it will continue with its efforts to renew its facilities.

Comparison of Original Plan and Actual Results

Item	Plan	Results
1. Project scope	Locomotive construction: PHA-20 (18) Weight in working order: 105 tons Weight of shaft: 17.5 tons Maximum running speed: 125km/hr Horsepower: 2,200 hp Fuel tank capacity: 7,274 liters	Same as left
2. Implementation schedule	October 1994 - February 1997 (29 months)	October 1994 - September 1997 (36 months)
3. Project cost		
Foreign currency	¥5,575 million	¥5,398 million
Local currency	Rp 531 million	Rp 1,223 million
Total	¥8,174 million	¥9,097 million
ODA loan portion	¥6,067 million	¥5,398 million
Exchange rate	Rp 1 = ¥4.89 (November 1992)	Rp 1 = ¥3.02 (weighted average)