

Ex-post Monitoring Report

Evaluator: Atsushi Hashimoto (Maenam Advisory Co., Ltd.)

Project Name: Pakistan "Track Circuits at 94 Mainline Stations Project" (L/A No. PK-P31)

Loan Outline

Loan Amount / Disbursed Amount: 3,221 million yen / 3,167 million yen

Loan Agreement: March 1992

Final Disbursement Date: December 1999

Ex-post Evaluation: FY2001

Executing Agency: Ministry of Railways

Project Objective

To install track circuits and electric lock systems at 94 stations out of 234 stations between Karachi and Peshwar (1,700 km) where the obsolete signal system was used and track circuit system was not installed, and to ensure railway transport safety and thereby contribute to the enhancement of the railway transport safety of the country.

Consultant: N.A.

Contractor: Marubeni Corporation (Japan), Siemens Pakistan Engineering

Overview of Results

Item	At the Time of Ex-post Evaluation	At the Time of Ex-post Monitoring
Effectiveness & Impact Effectiveness	<p>This project is to install the "track circuit system" at the target stations of the Pakistan Railway. The track circuit system is a train detection system that induces electric currents in the rails (positive current in one track and negative current in the other) whereby the axel of a vehicle causes a short circuit between the rails when a train arrives. Since steel sleepers were used on the tracks at some stations and the track circuit system does not work in such conditions (because steel sleepers cause a short circuit), replacement of these sleepers by concrete sleepers was also included in the project scope.</p> <p>(1) Enhancement of Safety a) Changes in the number of accidents No quantitative examination has been conducted on the contribution of</p>	<p>The track circuit system installed under the project has been working effectively since completion through to the time of ex-post evaluation and the field survey for ex-post monitoring, and helps prevent train collisions in the grounds of the stations covered by the project.</p> <p>(1) Enhancement of safety a) Changes in the number of accidents At the stations where the track circuit system and the electric lock system were installed, no signal system-related accident has occurred. Also, an accident resulting in injury or death caused by signal failure has not occurred since the last one caused by a point failure in 1996 (in which one person was killed and six were injured). (Reference: Although no signal-related accident has occurred, the total</p>

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	<p>the project to the reduction in the incidence of accidents. (Since there is no data available such as number of trains in operation or hours of train operation after project completion, it is difficult to quantitatively examine the contribution of the project to the reduction in the incidence of railway accidents.)</p> <p>The following facts have been confirmed (no accident occurred since the completion of the project according to the report):</p> <ul style="list-style-type: none"> •There have been no severe accidents reported since the new track circuit system was installed. •The safe image of train operation has been recovered according to Pakistan Railway. <p>(2) Internal Rate of Return FIRR: not calculated</p>	<p>number of accidents has not decreased, indicating that the safety of the railway operation by Pakistan Railway has not been enhanced. In a recent accident that occurred at Sarhad station in July 2005, more than 170 people were killed (according to another report, the death toll exceeded 500). The cause of this accident was the driver falling asleep and ignoring the signal. In order to prevent such an accident, measures were taken including the reduction in working hours, increase in the wage level, implementation of new safety training, etc.)</p> <p>Table 1: Changes in the number of railway accidents</p> <table border="1" data-bbox="1227 571 2022 1198"> <thead> <tr> <th></th> <th>1990</th> <th>2001</th> <th>2002</th> <th>2003</th> <th>2004</th> <th>2005*</th> </tr> </thead> <tbody> <tr> <td>Passenger car collision</td> <td>2</td> <td>0</td> <td>2</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>Freight car collision</td> <td>2</td> <td>1</td> <td>0</td> <td>2</td> <td>0</td> <td>1</td> </tr> <tr> <td>Locomotive collision</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Passenger car derailment</td> <td>61</td> <td>27</td> <td>24</td> <td>18</td> <td>11</td> <td>10</td> </tr> <tr> <td>Other derailment</td> <td>40</td> <td>76</td> <td>85</td> <td>54</td> <td>61</td> <td>50</td> </tr> <tr> <td>Attended crossing</td> <td>11</td> <td>8</td> <td>6</td> <td>5</td> <td>7</td> <td>4</td> </tr> <tr> <td>Unattended crossing</td> <td>33</td> <td>42</td> <td>35</td> <td>31</td> <td>40</td> <td>23</td> </tr> <tr> <td>Train fire</td> <td>3</td> <td>0</td> <td>2</td> <td>2</td> <td>2</td> <td>1</td> </tr> <tr> <td>Collision avoidance</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>9</td> </tr> <tr> <td>Total</td> <td>153</td> <td>154</td> <td>154</td> <td>112</td> <td>123</td> <td>87</td> </tr> </tbody> </table> <p>*Figures for 2005 are as of the end of June. Source: Pakistan Railway</p> <p>b) Delay in operation No delay in the operation occurred due to the defect of the signal system installed under the project.</p>		1990	2001	2002	2003	2004	2005*	Passenger car collision	2	0	2	0	1	1	Freight car collision	2	1	0	2	0	1	Locomotive collision	0	0	0	0	0	0	Passenger car derailment	61	27	24	18	11	10	Other derailment	40	76	85	54	61	50	Attended crossing	11	8	6	5	7	4	Unattended crossing	33	42	35	31	40	23	Train fire	3	0	2	2	2	1	Collision avoidance	1	0	0	0	1	9	Total	153	154	154	112	123	87
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		<p>The on-time service rate of Pakistan Railway as a whole is around 60% (including delays up to 10 minutes). Main reasons for delays are locomotive malfunctions, reduced speeds due to the bad conditions of tracks and signal malfunctions especially in case of rain. Since Pakistan Railway still uses lamp signals on some lines, signal malfunction is likely to occur when it rains. A project to improve the signal system between Lahore and Rawalpindi is planned to be implemented with the assistance of the World Bank.</p> <p>(2) Internal Rate of Return Not calculated</p>						
<p>Impact</p>	<ul style="list-style-type: none"> • Enhancement of the safety of railway transport and vitalization of the railway sector <p>No information or data available</p> <p><Reference></p> <p>(1) Passenger transport a) Results for passenger transport No information or data available</p>	<ul style="list-style-type: none"> • Enhancement of safety of railway transport and activation of the railway sector <p>The objective of the project is to prevent train collisions in station grounds by installing a track circuit system which electrically detects the entrance and passage of trains and displays such information on the display panel in the stationmaster's office. The fact that no accident has occurred at the stations where this system is installed shows that the system prevents train collisions in station grounds and contributes to safe railway operation.</p> <p><Reference> Indicators (1) to (3) below are not directly to measure the impact expected in the project on "enhancement of safety of railway transport", but they are thought to show an indirect contribution.</p> <p>(1) Passenger transport The volume of transport (passenger-kilometer) has continuously increased in the past 10 years (average annual increase rate: 0.8%), and the number of passengers in 2005 was 81 million. The average travel distance per passenger also increased from 248 km to 314 km. Pakistan Railway predicts that the total passenger-kilometers will reach 27,000 million passenger-kilometers by 2013.</p> <p>Table 2: Results of passenger transport</p> <table border="1" data-bbox="1227 1366 2024 1391"> <tr> <td></td> <td>1991</td> <td>1992</td> <td>1993</td> <td>1994</td> <td>1995</td> </tr> </table>		1991	1992	1993	1994	1995
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(2) Results for freight transport No data available		Number of passengers (million)	73.3	59.0	61.7	66.4	73.6	
		Total passenger-kilometer (million persons/km)	18,138	17,082	16,380	17,555	18,905	
		Average travel distance (km)	248	289	266	264	257	
		Revenue per passenger (Rs)	36	47	46	47	49	
		Number of passenger trains per day	310	326	327	307	305	
			1996	1997	1998	1999	2000	
		Number of passengers (million)	68.8	64.9	65.0	67.5	68.9	
		Total passenger-kilometer (million persons/km)	19,114	18,774	18,980	18,495	19,590	
		Average travel distance (km)	278	289	292	274	284	
		Revenue per passenger (Rs)	64	70	70	72	84	
		Number of passenger trains per day	279	209	213	218	223	
			2001	2002	2003	2004	2005	
		Number of passengers (million)	69.0	72.1	75.7	78.2	81.4	
		Total passenger-kilometer (million persons/km)	20783	22306	23045	24238	25621	
		Average travel distance (km)	301	308	304	310	314	
		Revenue per passenger (Rs)	95	102	108	119	126	
		Number of passenger trains per day	220	219	228	226	235	
		Source: Pakistan Railway						
		(2) Results of freight transport						
		The results of freight transport have improved and the total ton-kilometers has increased.						
		Table 3: Results of freight transport						
			2000	2001	2002	2003	2004	
		Total ton-kilometers (thousand)	4,519,528	4,572,734	4,819,756	4,796,269	5,013,540	
		Transport distance per ton (km)	771.0	782.6	779.8	781.2	782.1	
		Revenue per ton (Rs.)	790.3	795.5	800.8	706.3	824.8	
		Source: Pakistan Railway						

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	<p>(3) Impact on environment There has been no negative environmental impact reported.</p>	<p>(3) Environmental Impact There has been no negative environmental impact.</p>
Sustainability	<p>(1) Technical capacity Generally there are no problems. Technologies and skills to operate the new system have been acquired by the staff through the education system, and refresher courses are also provided. The adequate level of technical capacity seems to be maintained</p> <p>(2) O&M System The number of staff for the maintenance of the signal system is inadequate. The government stopped recruiting the staff from 1998 to 2000 (this seems to have caused a lack of young engineers). As of the time of the ex-post evaluation, Pakistan Railway has 1,949 engineers. It is reported that at most 500 engineers are necessary to provide adequate railway operation services.</p>	<div style="border: 2px solid black; padding: 5px; margin-bottom: 10px;"> <p>The situation has not improved since the time of ex-post evaluation. However, the system and technology to operate and maintain the equipment installed under the project are sufficient and sustainability of the project is maintained. In terms of financial status, the constant deficit is compensated by the national treasury and therefore no loss is reported. How to improve the income and expenditure position depends on the policy of the Pakistani government. Efforts are being made to increase revenue by improving the services.</p> </div> <p>(1) Technical capacity The situation remains the same from the time of ex-post evaluation and an adequate level of capacity is maintained. Newly hired employees are provided with an education program lasting 8 weeks for unskilled workers and 40 weeks for engineers and there is no problem in the system for the acquisition of technical skills. Also, refresher courses are provided at important steps of the promotion ladder. Thus, an adequate technical level is maintained.</p> <p>(2) O&M System The situation has not changed from the time of ex-post evaluation and the staff for the maintenance of the signal system is inadequate. The fixed number of staff (engineer level) of the Signal Engineering Department is 1,901 while the current number employed is 1,689 (the difference is the number of vacancies). The top management of Pakistan Railway says that these vacancies do not cause any problem in the operation. However, the on-site staff seems to think that the company is shorthanded.</p> <p>The total number of employees of Pakistan Railway has decreased from 91,500 in 2001 to 86,800 in 2005, showing that personnel reduction was implemented. This reduction is the result of the suspension of employment in addition to the retirement of employees.</p>

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	<p>(3) Financial status The table below shows data regarding the financial condition of Pakistan Railway. The operational revenue gradually decreased from 1997 to 1999 and then increased. This is mainly due to the increase in ton kilometers and passenger kilometers. Pakistan Railway is diligently striving for the improvement of its financial condition.</p> <p style="text-align: center;">Table: Financial Condition of Pakistan Railway (Unit: Million Rs)</p> <table border="1" data-bbox="412 520 1196 679"> <thead> <tr> <th></th> <th>1996-1997</th> <th>1997-1998</th> <th>1998-1999</th> <th>1999-2000</th> <th>2000-2001</th> </tr> </thead> <tbody> <tr> <td>Revenue</td> <td>9804</td> <td>9941</td> <td>9310</td> <td>9581</td> <td>11907</td> </tr> <tr> <td>Expenditure</td> <td>11975</td> <td>11886</td> <td>11922</td> <td>12044</td> <td>12726</td> </tr> <tr> <td>Surplus/Deficit</td> <td>-2171</td> <td>-1945</td> <td>-2612</td> <td>-2463</td> <td>-819</td> </tr> </tbody> </table> <p>As part of efforts to improve the financial condition, Pakistan Railway is planning to 1) reduce the number of cars operated on unprofitable routes, 2) reduce electric consumption, and 3) dismiss 5,000 employees.</p>		1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	Revenue	9804	9941	9310	9581	11907	Expenditure	11975	11886	11922	12044	12726	Surplus/Deficit	-2171	-1945	-2612	-2463	-819	<p>(3) Financial status The operating expenditure exceeds the income and the balance has been constantly in the red, posting a loss of 1,000–3,000 million Rupees every year. The deficit is compensated by the national treasury every year and therefore no loss is reported on the profit and loss statement. Pakistan Railway is given the status of an agency of the Ministry of Railways and the railway budget is considered as part of the national budget.</p> <p>Long distance passengers (traveling 100 km or more) occupy 50% of all passengers of Pakistan Railway (PR) and generate over 90% of the revenue, indicating that the services for these passengers are the main services of PR. Efforts are being made to increase income per passenger such as the introduction of a class with more attentive services aboard, the introduction of low-charge cars equipped with air conditioners and an increase in express trains services.</p> <p style="text-align: center;">Table 3: Income and Expenditure of Pakistan Railway (Unit: Million Rs)</p> <table border="1" data-bbox="1227 828 2024 1066"> <thead> <tr> <th></th> <th>2001/02</th> <th>2002/03</th> <th>2003/04</th> <th>2004/05</th> </tr> </thead> <tbody> <tr> <td>Operating Income</td> <td>13,046</td> <td>14,810</td> <td>14,635</td> <td>17,829</td> </tr> <tr> <td>Operating Expenditure</td> <td>15,402</td> <td>17,072</td> <td>17,900</td> <td>18,894</td> </tr> <tr> <td>Operating Profit/Loss</td> <td>-2,356</td> <td>-2,262</td> <td>-3,266</td> <td>-1066</td> </tr> <tr> <td>Interest Payment</td> <td>2,398</td> <td>3,394</td> <td>2,096</td> <td>2,145</td> </tr> <tr> <td>Current Account</td> <td>-4,755</td> <td>-5,656</td> <td>-5,361</td> <td>-3212</td> </tr> <tr> <td>Surplus/Deficit</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Source: Pakistan Railway</p> <p>It was not confirmed whether a reduction in the number of cars operated on unprofitable routes and a reduction in electric consumption were realized. A dismissal of employees was not conducted. However, the number of employees decreased from the time of ex-post evaluation by approximately 5,000 through natural decline.</p>		2001/02	2002/03	2003/04	2004/05	Operating Income	13,046	14,810	14,635	17,829	Operating Expenditure	15,402	17,072	17,900	18,894	Operating Profit/Loss	-2,356	-2,262	-3,266	-1066	Interest Payment	2,398	3,394	2,096	2,145	Current Account	-4,755	-5,656	-5,361	-3212	Surplus/Deficit				
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	<p>(4) O&M status</p> <p>Although there is the problem of the lack of staff, it seems that a certain level of quality has been maintained thanks to the education program including the refresher courses for veteran staff. The maintenance manual and the manual for periodic inspection are provided.</p> <p>Looking at the breakdown of the operating expenditure of Pakistan Railway for FY1999–2000, the repair and maintenance cost and the fuel cost occupy the large part, 45% and 13%, respectively. These figures are higher than those of Japan Railway (21% and 5% respectively) because Pakistan Railway continues to use decrepit rails, locomotives and buildings in bad conditions.</p>	<p>(4) O&M status</p> <p>The situation has not changed from the time of ex-post evaluation. A certain quality of maintenance is ensured and manuals are provided.</p> <p>The maintenance of signals is the responsibility of the Signal Engineering Department. A team composed of a Sub Engineer Signal, two Assistant Sub Engineers and four Maintainers usually covers three stations. According to the frontline workers, there is a shortage of skilled engineers. For all facilities including signals, 80% of the maintenance parts are domestically procured. Still, there is a difficulty in procuring some parts that need to be imported.</p> <p>Among the operational expenditure of Pakistan Railway for FY 2004–05, the ratio occupied by the repair and maintenance cost dropped to 36% while that by the fuel cost increased to 31% from the time of ex-post evaluation. Other information for determining the maintenance capacity of the executing agency was not available. As the maintenance cost of the system installed under the project is small, it can be said that a sufficient amount is allocated.</p> <p>(Reference)</p> <p>At all stations that we visited in the field survey, the track circuit system was functioning and no problem was found in the equipment. It often happens that due to insufficient maintenance of tracks the wooden joint part is damaged and the rail is connected at points where it should be insulated (in the track circuit, each rail section must be insulated from other sections). However, it does not cause malfunctioning of the entire system.</p>

Item	At the Time of Ex-post Evaluation	At the Time of Ex-post Monitoring
<p>Lessons Learned, Recommendations, Information Resources and Monitoring Methods</p> <p>(1) Follow up on lessons learned and recommendations made in the ex-post evaluation report or later evaluations</p> <p>(2) Proposals for securing sustainability and instructions given at the time of ex-post monitoring</p>	<p>Lessons learned and recommendations</p> <p>N.A.</p>	<div data-bbox="1227 284 2027 384" style="border: 2px solid black; padding: 5px;"> <p>The installed track circuit system is not an advanced technology but is suitable for the operation and maintenance capacity of Pakistan Railway. That is why sustainability of the project is well secured.</p> </div> <p>(1) Lessons learned and recommendations at the time of ex-post evaluation</p> <p>N.A.</p> <p>(2) Lessons learned and recommendations given seven years after the project completion</p> <p>– Lessons Learned</p> <p>The track circuit system installed under the project is not an advanced technology but is suitable for the level of operation and maintenance technology of the maintenance staff of the target stations (small sized stations where not many passengers get on and off trains) and therefore sustainability has been secured.</p> <p>– Recommendations</p> <p>N.A.</p>