Pakistan

Kohat Tunnel Construction Project (I)-(III)

External Evaluator: Junko Saikawa

Field Survey: November 2005

1. Project Profile and Japan's ODA Loan

Map of project area

Kohat Tunnel

1.1 Background

The North-West Frontier Province is located in the northernmost area of Pakistan and connected with the neighboring Punjab Province and the southern Sindh Province by National Highway 5 and National Highway 55, respectively.

National Highway 5, situated between Peshawar, the provincial capital of the province, and Karachi, the provincial capital of the Sindh Province, was the busiest route connecting major cities of the country. There was a need to arrange an alternative route for reducing traffic volume on Highway 5. For that purpose, the widening and improving project of Highway 55 (the Indus Highway), which is a trunk road that also begins at Peshawar, crosses Kohat and D.I. Khan, the major cities of the province, and reaches to Karachi, was brought into operation.

The widening and improving works of Highway 55 have been proceeding in the Indus Highway Construction Project, a yen-loan-financed project. However, the section of the highway around the Kohat pass, which is located between Peshawar and Kohat, 65km to the south, was yet to be repaired because the steep terrain made it difficult to widen and improve the road. The steep slopes, sharp curves and narrowness of the section prevented trailer trucks and large vehicles from passing there, and even vehicles able to use this route must travel at slow speed and in heavy traffic. There were also problems of safety caused by poor installation of guardrails on the valley side, falling rocks from the mountainside, continuing blind curves, etc. Considering these points, there was a great need to construct a tunnel as an alternative route.

1.2 Objective

This project's objective was to improve traffic conditions and increase the role of National Highway 55 (the Indus Highway) by constructing a new tunnel and new approach road as an alternative route to the Kohat pass, situated between Peshawar and Kohat of the Indus Highway, and thereby contribute to stimulate social and economic development in the North-West Frontier Province where poverty levels are high, and to promote a balanced economic development of Pakistan.

1.3 Borrower/Executing Agency

The President of the Islamic Republic of Pakistan/The National Highway Authority (NHA)

1.4 Outline of Loan Agreement

	Phase I	Phase II	Phase III
Loan Amount/ Disbursed Amount	5,437 million yen/ 5,417 million yen	4,032 million yen/ 4,017 million yen (confirm the final lending amount)*	3,149 million yen/ 3,105 million yen
Date of Exchange of Notes Date of Loan Agreement	November 1994/ November 1994	July 2001/ July 2001	January 2003/ February 2003
Terms and Conditions - Interest Rate - Repayment Period (Grace Period) Procurement	 2.6 %/year 30 years 10 years General untied	 1.8 %/year 30 years 10 years General untied	 1.8 %/year 30 years 10 years General untied
Final Disbursement Date	January 2002	Yet to be completed*	5 June 2006
Main Contractor	Taisei Corporation (Japan)		
Consulting Services	Pacific Consultants International (Japan), Mouchel Consulting Limited (U.K.), Engineering Associates (Pakistan), and NESPAK (Pvt.) Ltd. (Pakistan)		

Feasibility Study (F/S) etc.	M/P: Research for the national integrated transport plan in the Islamic Republic of Pakistan, JICA (1988) F/S: Created in consulting services of the Indus Highway Construction Project in 1990, re-examined in 1999

*The loan completion procedures of Phase 2 are to be conducted in September 2006. A postscript will be added on completion of the procedures.

2. Results and Evaluation

2.1 Relevance

2.2.1 Relevance at the time of appraisal

In the eighth National Development Five-Year Plan (1993-98) at the time of Phase I appraisal, the Indus Highway Construction Project was ranked as a major project of the road sector. The Kohat Tunnel Construction Project was also cited as one of the eleven major projects and had extremely high priority for the country. In the Ten-Year Development Plan (2001-2011) at the time of Phase II and III appraisals, the projects in operation including the Indus Highway and Kohat Tunnel project got priority, and a budget of 10 billion rupees was allocated to the Indus Highway project. In the Medium-Term Development Policy worked out by the Ministry of Communications and the National Highway Authority (NHA) (applicable in 2001-2004), they gave high priority to the completion of on-going projects and expansion of lanes in existing highways among donor-supported projects. The Kohat Tunnel project was also regarded as a matter of priority.

2.1.2 Relevance at the time of ex-post evaluation

In the National Highway Development Plan worked out by NHA (2004), factors such as (1) optimum use of existing roads by rehabilitation and refurbishment, (2) cost-effective investments, (3) improvement of a road network for promoting traffic and trade with Afghanistan, Central Asia and India, (4) improvement of raising-fund mechanisms and promotion of private-sector emergence, (5) ensuring road maintenance and safety, are taken into consideration. Highway 55, which is a trunk road connecting the south and the north regions of the country, still has importance in the light of (3), mentioned above.

2.2 Efficiency

2.2.1 Outputs

For civil engineering works and consulting services related to the tunnel and

the approach road, the comparison data between the plan and the performance are shown below. Main changes of plan and reasons are as the following:

- Because it was anticipated that increasing traffic volume would exceed the original estimate in the plan, the number of jet fans was increased from 7 to 11 (1 of them as a spare).
- For the north approach road, the original site was changed due to the difficulties in obtaining the consent of tribal people to their offering sites; however, the road length has been secured virtually as planned.
- As for the south approach road, it was relocated to avoid the prefectural government's office and an arsenal, and the road length was extended by about 4.7km.
- As a result of the relocation of approach road, TOR for re-examination of detailed design was added to consulting services.

Table 1. Comparison of Outputs Between the Plan at the Time of Appraisal and the Actual Performance

	Plan at Time of Appraisal	Actual Performance
1) Civil Engineering works		
a) Tunnel	Length: 1,885m Roadway width: 7.3m (opposing two lanes) Road paving: Concrete paving Ventilation system: Jet fan system (seven fans) Safety facilities: Emergency phones, fire extinguishers, emergency bays	Length: as planned Roadway width: as planned Road paving: as planned Ventilation system: Jet fan system (eleven fans) Safety facilities: As planned
b) Approach road	Length: North: 7.74km, South: 16.25km Roadway width: 7.3m (opposing two lanes) Shoulder width: 3.0m Road paving: Asphalt paving Bridges: At seven places Design speed: In the plain area: 90km/h, in the mountain area: 80km/h Ancillary facilities: Tollbooths, a maintenance office, a control building, an emergency building	Length: North: 7.79km:, South: 20.955km Roadway width: As planned Shoulder width: As planned Road paving: As planned Bridges: At 10 places Design speed: As planned However, traveling speed inside the tunnel is limited to 40km/h. Ancillary facilities: As planned

2) Consulting services		
	Bid assistance, construction management, conducting overseas-site training for engineering personnel of the executing agency, creating the operation and maintenance manual of the tunnel	Re-examination of detailed design, bid assistance, construction management, conducting overseas-site training for engineering personnel of the executing agency, creating the operation and maintenance manual of the tunnel, creating the standard operating procedures (SOP), providing guidance on operation and maintenance

Fig. 1 Simplified Diagram of the Project Site

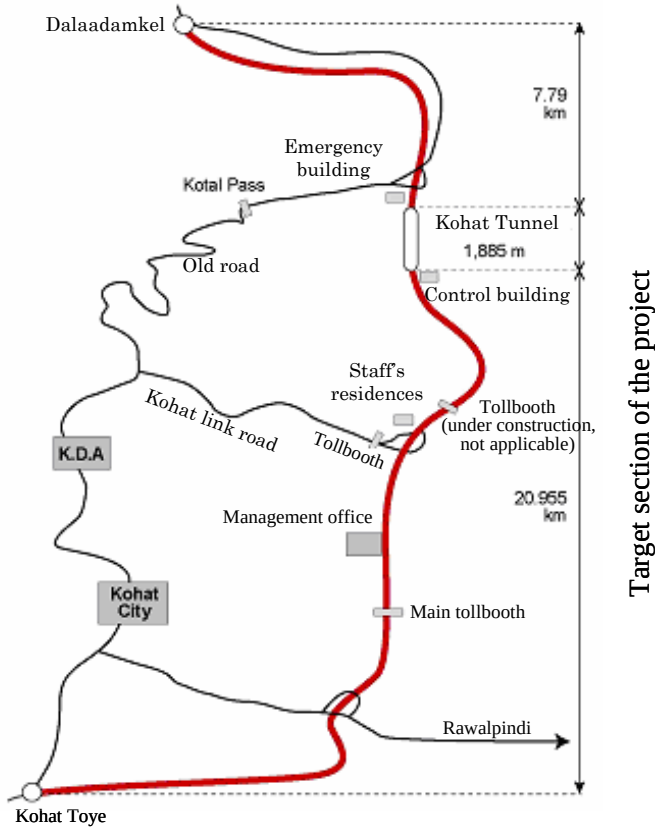

Fig. 2 Maintenance Office

Fig. 3 Control Building

2.2.2 Project Period

Although the whole construction period of the project had been initially planned as from November 1994 to November 2000 (73 months)[1], it was actually from November 1994 to April 2003 (102 months), 1.4 times longer than the plan. There was a delay of three years before the beginning of civil engineering works because of the re-examination of detailed design resulting from the relocation of

[1] The plan at the time of Phase I appraisal.

the approach road; prolonged selection of consultants resulting from the addition of TOR and the re-evaluation of the proposal evaluation; and delay in land acquisition for the north approach road. There was also delay of six and a half months in total during the construction works because the contractor had not obtained a working license and because Japanese consultants temporarily fled the site due to the terrorist attack of September 11, 2001.

Because the two-shift system was subsequently adopted for making up for delay, the original period of civil engineering works—December 1996 to November 2000 (48 months)—was actually from August 1999 to April 2003 (45 months) and it was shortened by three months.

2.2.3 Project Cost

The project cost had been originally planned as 10,462 million yen[2], but it actually became 15,623 million yen (the cost overrun of 5,161 million yen) (149% compared to plan). The factors of the cost increase were the increase of construction volume accompanied by design change, the relocation of the approach road and the increase of cost resulting from the higher price escalation than estimated due to the delay before civil engineering works (for about three years) (the CPI increasing rate during the 1994-98 period averages 10.8% a year).

2.3 Effectiveness

(1) Traffic volume

Fig. 4 A truck passing through the main tollbooth

The average traffic volume inside the tunnel and on the approach road was 5,463 vehicles/day in 2004, 65% of the planned value. The factors responsible for the situation seem that the standard value of 1996 was set in excess of the performance value, through adjustment of actually-measured traffic volume in consideration of daily and seasonal variation,[3] and that the construction of the main highway were not completed, such as Indus Highway, the section between Quetta and D.I. Khan of Highway 50 which link to the Indus Highway, and the section between Malana Junction and Sarai[4]. After the opening of the tunnel, traffic volume inside the tunnel and on the

[2] The plan at the time of Phase I appraisal.

[3] When computing traffic volume by using the measured value of 5,525 vehicles/day in March 1996 as a standard value, the planned traffic values in 2004 are 5,714 vehicles/day inside the tunnel and on the approach road, 2,449 vehicles/day on the old road, and 8,163 vehicles/day in total; consequently, the performance value of 5,463 vehicles/day in 2004 reaches 96% of the planned value.

[4] The Indus Highway is scheduled to be fully opened in 2008; Highway 50 (the section between Quetta and D.I. Khan) is scheduled to be completed in 2009; and the section between Malana Junction and Sarai is scheduled to be

approach road has been increased by 49% during the 2003-2004 period and 13% during the 2004-2005 period; the traffic volume has been increasing by exceeding the expected growth rate (at a 5% annual rate).

Table 2. Annual Average Daily Traffic Volume (Plan and Actual)

(Vehicles/day)

	1996		2000	2004		2005		2010
	Measured Value[*1]	Standard Value[*2]	Measured Value[*3]	Plan[*4]	Actual	Plan	Actual	Plan[*9]
Tunnel/ Approach Road	-	-	-	8,417	5,463[*5] (65% of plan)	8,837	6,149[*7] (70% of plan)	11,279
Old Road	5,525	7,266	5,822	3,607	781[*6] (22% of plan)	3,788	720[*8] (19% of plan)	4,834
Total	5,525	7,266	5,822	12,024	6,244 (52% of plan)	12,625	6,869 (54% of plan)	16,113

Source: NHA

*1: The measurement value in March 1996, *2: Adjusted by using the measurement value of 5,525 vehicles/day and considering daily and seasonal variation, *3: The measurement value in April 2000, *4: The planned value was computed based on the annual increase of 5% and the traffic inside the tunnel that was estimated as 70% of the total traffic, *5: Average in 2004, *6: The measurement value in April 2000, *7: Average in the period from January to November 2005, *8: The measurement value in June 2005, *9: The plan is an initial plan. The estimated value of traffic volume has not been re-examined.

(2) Shortening of transit time and reduction of travel cost

Transit time was shortened in all the types of vehicles compared to the old road. According to a beneficiary (driver) survey (total samples: 105), all the persons answered that transit time was shortened by use of the new route in comparison with the old road and 67 persons (64%) answered that transit time was cut more than 40 minutes off.

Fig. 5 Interview survey of drivers

completed in 2008. According to NHA, after the completion of them, traffic on the Indus Highway is expected to increase by about 30%.

Table 3. Shortening of Transit Time

		1999		2005			
		Actual *1		Plan		Actual *2	
		Time (min.)	Speed (km/h)	Time (min.)	Speed (km/h)	Time (min.)	Speed (km/h)
Tunnel/approach road Plan 30.1km Performance 30.6km	Car	-	-	22	82.1	22	83.5
	Van	-	-	25	72.2	24	76.5
	Bus	-	-	28	64.5	28	65.6
	Midi-truck	-	-	31	58.3	54	34.0
	Large Truck	-	-	36	50.2	67	27.4
Old road 35.5km	Car	36	59.2	41	52.0	30	71.0
	Van	47	45.3	51	41.8	40	53.3
	Bus	61	34.9	66	32.3	55	38.7
	Midi-Truck	67	31.8	74	28.8	108	19.7
	Large truck	84	25.4	85	25.1	141	15.1

Source: NHA
*1: The performance in 1999 is an estimated value calculated by dividing distance by estimated average speed.
*2: Transit time is the actual measurement value by NHA.

Although travel costs of each type of vehicles were calculated[5], they have not been re-examined after the completion of the tunnel. According to the driver survey, 82 persons (78%) answered that travel costs (fuel costs) were reduced using the tunnel/approach road in comparison with the old road.

(3) Improvement of Safety

It is impossible to judge whether the number of traffic accidents and failure decreases by virtue of the construction of the tunnel and approach road in the section consisting of the Kohat Tunnel and approach road because there are no data (before the project and at the time of ex-post evaluation) about the number of traffic accidents and failures on the old road. However, there is no substantial change in the accident rates between 2003 and 2004 in the light of the number of traffic accidents and failure inside the tunnel and on the approach road. According to the driver survey, all the sampled persons (105) answered that the tunnel and approach road was safer than the old road and the results of an inspection visit to

[5] Travel costs (rupee/km) of each type of vehicles inside the tunnel/on the approach road and on the old road in the plan are as follows:

	Tunnel/Approach road					Old Road				
	Car	Van	Bus	Midi-truck	Large truck	Car	Van	Bus	Midi-truck	Large truck
1999	-	-	-	-	-	3.75	9.25	20.50	17.75	23.00
2005	3.25	6.25	12.00	9.25	13.00	4.75	12.50	22.00	21.25	26.50

the old road bear
out such an opinion. Therefore, it is judged that safety of the relevant section has been improved.

Table 4. The Number of Traffic Accidents and Failures Inside the Tunnel and On the Approach Road

		2003 (July-December)	2004
Traffic accidents	Inside the tunnel	0	0
	On the approach road (To traffic volume, %)	7 （0.00094）	24 (0.0012)
Failures (to traffic volume, %)		112 (0.015)	370 (0.019)

Source: NHA

(4) Comfort of travel

There are no traffic jams at the Kohat Tunnel and approach road at present. Because the users of the old road have decreased to a little over 10 % of the total traffic volume in the section concerned, no traffic jam have occurred on the old road unless an accident happens. On an inspection visit to the old road, no traffic jam was seen there. According to the driver survey, all the sampled persons (105) answered that the tunnel/approach road brought out smoother traffic flow than the old road. In addition, in the survey, 35 persons (33%) answered that it was more comfortable to travel on the new route than the old road and 69 (66%) answered that it was comfortable to travel on the new route; thus, it is acknowledged that the project contributed to improvement of comfort of travel in the section.

Fig. 6 The old road, in the vicinity of the Kotal Pass

(5) Economic Internal Rate of Return (EIRR)

Although EIRR had been 12.3% at the time of appraisal, it became 5.99% as a result of re-calculation[6]. The factors responsible for the matter that the EIRR than

[6] In the same way as the time of appraisal, re-calculation was conducted by regarding initial investment and maintenance cost as total cost, and benefits from the reduction of travel cost and from the shortening of travel time as total benefits.

the planned value were the traffic volume being less than the planned value (the performance in 2004 was less than 70% of the planned value) and the maintenance cost (particularly, the labor cost and the vehicle traveling cost) significantly exceeding the planned cost caused by re-examination of the volume of maintenance work.

Although the values of traffic volume and EIRR have become less than the planned values because the planned standard value was originally set in excess of the performance value, the growth of traffic has been exceeding the planned value. There is shortening of transit time, easing of traffic congestion and improvement of safety; consequently, the project has sufficiently achieved the desired objective of "improving traffic safety and increasing the role of the Highway 55 as a trunk road."

2.4 Impacts

(1) Revitalization of the local economy

Because only a little over two years have passed since the opening of the tunnel (in July 2003), it is difficult to quantify the impact on the local economy at the time of ex-post evaluation[7]. Because the periphery of the tunnel is a desert area and the Kohat Tunnel/approach road is a fence road where entry into the road en route is prohibited, private stores and factories are not built in the areas along the road. According to a beneficiary survey, the majority of sampled persons answered that there was no significant improvement related to stores and factories in the areas along the road and the neighboring areas[8].

According to a beneficiary survey (driver) (total samples: 105), most drivers (104 persons) use the Kohat Tunnel and approach road for the purpose of business. More than half of the road users travel within the province centered on the section between Kohat and Peshawar (43 persons) and few users travel only within Kohat. Long-range travelers to other provinces or countries are more than 40% (16 persons to Punjab, 1 to Kashmir, 1 to Baluchistan, 27 to Sindh and 1 to Kabul). Considering thesefacts, the project has much potential in terms of promoting the in-provincial travel with the central focus on Peshawar for the purpose of

[7] It is impossible to compare the relevant indicators before and after the project because there are no statistical data after the opening of the tunnel. According to a hearing from the Chamber of Commerce and Industry of Peshawar, though the opening of the tunnel has had a little impact on urbanization of the area, the commercialization of the area will take more time to be brought about.

[8] According to a beneficiary survey (resident) (total samples: 87), 57 (66%) of sampled persons answered that there was no change related to stores in the neighboring areas and 86 (99%) answered that there was no change related to factories in the neighboring areas. In a beneficiary survey (draiver) (total samples: 105), 88 (84%) answered that there was no change related to stores and factories in the neighboring areas.

commercial and economic activities, and eventually ex-provincial travel[9].

According to a person responsible for the Peshawar fruit and vegetable market, about 500 trucks use the market in a day and about half of them use the Kohat Tunnel. It is also indicated that there have been drastic drops in delivery delays, improvements in the quality of vegetables and fruits carried in and out the market, and increases in the quantity of them.

Fig. 7 Peshawar fruit and vegetable market

(2) Improvement of Public Transportation

According to a beneficiary survey (resident) (total samples: 87), the majority (77 persons, 89%) answered that public transportation services were improved with the opening of the tunnel.

A bus company started the operation of a bus route through the Kohat Tunnel after the opening of the tunnel[10]. Another bus company in Peshawar which has operated on the section before the opening of the tunnel still operates three routes through the tunnel and provides five round trips a day[11]. Although passengers in the section were about 120-150 persons/day, they have increased to 200 persons/ day after the opening of the tunnel. From these, it can be seen that the project has contributed to improvement of public transportation services.

(3) Expansion of Access to and Use of Workplaces and Public Facilities

Objectives of the users of the Kohat Tunnel and frequencies of visiting destinations according to a beneficiary survey (resident) are as shown below. 84 persons (97%) answer that travel time to destinations has been shortened and 78 persons (90%) answer that visitation opportunities have increased with the opening of the Kohat Tunnel[12].

[9] In the interviews to transporters (2 persons in Kohat and 1 in Peshawar), shortening of transport time (mitigation of traffic jams), improvement of travel safety and the reduction of fuel costs caused by the opening of the tunnel were cited. Two transporters said that there was no significant change in operational areas and transaction volume before and after the opening. On the other hand, a cement carrier in Kohat said that operational areas were expanding to the north areas of the tunnel and transaction volume had been increasing.

[10] Daewoo Bus Corporation, which has a terminal in Peshawar, started the operation of the bus route through the Kohat Tunnel as of September 2005 and provides services of Peshawar - Kohat - Kalakh - D.I. Khan: three round trips a day, Peshawar - Kohat - Kalakh - D.I. Khan - Vakhar - Chalk Azam - Multan: two round trips a day, that is, five round trips in total. In the present circumstances, passengers are almost 70% of the nominal riding capacity.

[11] The bus company has been providing services in the vicinity of Peshawar and Kohat for 18 years. At present, it owns 20 buses and operates more than 30 routes. The routes through the tunnel are three: Peshawar - Kohat, Peshawar - D.I. khan, and Peshawar - Khairpur.

[12] NHA said that a commute from Kohat to Peshawar which had been formerly difficult became possible with the opening of the tunnel.

Table 5. Objectives of Using the Tunnel/Approach Road

(Total samples: 87, multiple answers allowed)

Destinations	Visiting Frequencies			Total
	2-4 times/ month	5-10 times/ month	More than 11 times/month	
Workplace	17	3	0	20
School	9	7	5	21
Medical facility	35	3	0	38
Relative's home	26	3	1	30
Market	6	3	0	9
Sightseeing and fieldtrip	9	2	2	13

According to hearings from three medical facilities in Kohat, while there is no significant change in the number of patients[13], it becomes possible to transport emergency patients to Peshawar.

According to hearings from schools (high schools, colleges and universities) in Kohat and Peshawar, commutes of students and teachers have become easier and it is said that the attendance rates at morning classes have improved. They also say that since the commute from Kohat to Peshawar has been possible, many schoolgirls are going on to schools in Peshawar after graduating high schools.

(4) Creation of Employment Opportunities and Increase of Income

According to a beneficiary survey, 68 residents (78%) and 75 drivers (71%) answer that there is no change in employment opportunities[14].

As for income, though 65 residents (75%) answer that the project has not caused their income to increase, 65 drivers (62%) answer that their income have increased as a result of the project.

(5) Environmental and Social impacts

With the implementation of the project, 125ha of land was acquired for the south approach road section and 40ha for the north approach road section; the resident relocation of five and four households, respectively was also conducted.

[13] From one of the facilities, there was the opinion that as patients from the north side of the tunnel (particularly women patients) have increased and because patients going to hospitals in Peshawar have increased, caused by improvement of access, there may not be any significant change in the number of patients in medical facilities of Kohat.

[14] Because more than 70% of operation and maintenance staff are employed from the local residents, the project contributes to creation of employment in the local areas (though it is rather limited). Because the latest data for the unemployment rate in Kohat Prefecture is 38.72% (45.4% in the rural area, 27.7% in the urban area) in 1998, it is impossible to compare the change before and after the project.

Land acquisition and resident relocation procedures were carried out in the south approach road section according to the Land Acquisition Act, and land compensation of 112.4 million rupees and other (to buildings, crops, etc.) compensation of 20 million rupees was paid. Because the north approach road section is located in the tribal area where the act is not effective, compensation was decided in consultation between NHA and elders of tribes, and land compensation of 80 million rupees and other compensation of 7.25 million rupee was paid through a political agent. Initially, it was scheduled that land acquisition and resident relocation would be completed in 1995, but the arrangements were significantly delayed, being completed in 2000.

Because most of the vicinity of the tunnel and approach road is located in a desert area without residents, there is no fear of exhaust gases and noise from vehicles adversely affecting residents living in the vicinity[15], thus, no periodic environmental monitoring has been conducted, and it is not scheduled to be conducted hereafter. Inside the tunnel, a monitoring system observes the concentration of carbon monoxide in the air and visibility at all times. When the measured value exceeds the standard value, jet fans automatically start operating[16]. In the event that traffic increases in future, there is a possibility that current ventilating facilities could become insufficient. According to NHA, it is suggested that when traffic reaches the level of about 12,000 vehicles/ day, additional jet fans will be installed.

2.5 Sustainability

2.5.1 Executing agency

2.5.1.1 Technical capacity

In the initial plan, operation and maintenance was assumed to be carried out by NHA staff. However, it was decided to contract out to the project to the private sector on the grounds that the Pakistan Government was starting to promote private sector participation in operation and maintenance of public projects and facilities and that it was difficult to increase the number of staff.

Under its supervisory responsibility, NHA selected a private company by competitive tender bid[17] and contracted out the operation and maintenance (on a five-year contract from May 2003), and a sufficient number of staff with excellent

[15] According to a beneficiary survey (resident), 2 persons indicated air pollution, 4 indicated noise and 1 indicated vibration as adverse influences of the project, but the number is limited.

[16] According to a beneficiary survey (draiver), 90 drivers answer that they did not feel air pollution from automobile fumes inside the tunnel.

[17] AXS (PVT) Ltd.

technical abilities has been stationed. The project consultants created the standard operating procedures (SOP) during the project implementation, and offered training to NHA monitoring staff and AXS staff before the start of operation. Accordingly, there are no problems related to the staff's technical skills.

2.5.1.2 Operation & Maintenance System

The entrusted private company is situated under the chief operating officer (COO) of NHA. The COO has a responsibility to give appropriate guidance to the company and supervise its performance. At present, a staff of 365 people resides 24 hours with three shifts and conduct operation and maintenance based on SOP. Thus, there are no problems concerning the maintenance of the tunnel/approach road.

2.5.1.3 Financial status

The road maintenance account (RMA) was established in May 2002. In addition to tolls collected from all over the country, other financial sources such as earnings from the road construction site, traffic fines, maintenance grant form the government, maintenance funds from international organizations, etc. are put to the Road Maintenance Account and allocated to rehabilitation, overlays[18], regular maintenance and daily maintenance work. The income and outgo of RMA is as shown below. Because the cost required to maintain the total length of National Highway that falls under the jurisdiction of NHA has been increasing due to a new road construction and the partial transfer of provincial roads to national highways, it becomes impossible to cover maintenance cost only by net income including collected tolls and the government subsidy is also continuously allocated.

The maintenance expenses of the Kohat Tunnel/approach road are 88.62 million rupees in FY2003/04, 101.3 million rupees in FY2004/05 and 81.81 million rupees in FY2005/06 (as of October)[19]. Enough funds are allocated from the RMA to cover these expenses.

Table 6. Transition of RMA Incomes and Expenses

Millions of rupees	2003-04	2004-05	2005-06
Net Income	4,030	5,125	5,280
Government Subsidiary	825	1,900	1,200

[18] Repairing works paving on existing pavement.

[19] Although the project (Kohat Tunnel/approach road) does not have an independent maintenance account, toll earnings in the section are 43.59 million rupees in FY2003/04, 116.72 million rupees in FY2004/05 and 109.23 million rupees in FY2005/06 (as of October) and exceed the maintenance expenses in FY2004/05 and 2005/06.

Total Income	4,855	7,025	6,480
Total Expenses	4,441	6,238	7,737

Source: NHA

2.5.2 Operation and Maintenance Structure

The weight limit is set as 10 tons per axle to prevent road damage, and weight meters are provided in major tollbooths to control passage of over-loaded vehicles. For preventing accidents in the tunnel, limits are set for all traveling vehicles (which are limited to 5.1m in height and 2.5m in width, and are not permitted to carry combustible and/or chemical goods) and checkpoints are provided. Responses in emergency situations in the tunnel such as traffic accidents, vehicle fire, etc. are specified in the SOP in detail, and emergency drills are regularly conducted.

Maintenance is regularly performed, and facilities of the tunnel and approach road are generally good except slight damage to the shoulder of the approach road. According to a beneficiary survey (driver), over 90% of all persons are satisfied with the facility maintenance situation, and almost all persons are satisfied with the operation and maintenance of facilities.

3. Feedback

3.1 Lessons learned

As seen in the land acquisition and resident relocation procedures of this project, land acquisition and resident relocation, which may cause the delay in the implementation of the project, should be addressed and solved early on at the planning stage, taking into consideration the social and economic particularity of the target area.

In the mid-term review stage during the implementation of the project (at the time of appraisal of Phase 2, 3 and others), in addition to project cost and project term, indicators related to effectiveness also need to be re-examined.

3.2 Recommendations

To NHA

To understanding effects of the project and for the future planning purpose, NHA needs to consider to update traffic volume estimation taking into account the result of the regular monitoring of traffic volume on the relevant section (tunnel/approach road, old road) and the monitoring of the progress of projects concerned influencing the traffic volume of the section.

The Kohat Tunnel is the first large road tunnel in Pakistan and the first case of maintenance being entrusted to the private sector. In the present situation, efficient and effective maintenance is performed. For sustaining the situations in future, it is necessary to pay continuous attention to enhancing the monitoring system of the performance.

The commemorative stamps of the Kohat Tunnel for the project

The Kohat Tunnel is well known in Pakistan as it is the first large road tunnel in the country and constructed with the assistance from Japan.

Comparison of Original and Actual Scope

Item	Plan	Actual
①Outputs 1) Civil engineering works a) Tunnel	Length: 1,885m Roadway width: 7.3m (opposing two lanes) Road paving: Concrete paving Ventilation system: Jet fan system (seven fans) Safety facilities: Emergency phones, fire extinguishers, emergency bays	Length: As planned Roadway width: As planned Road paving: As planned Ventilation system: Jet fan system (eleven fans) Safety facilities: As planned
b) Approach road	Length: North: 7.74km, South: 16.25km Roadway width: 7.3m (opposing two lanes) Shoulder width: 3.0m Road paving: Asphalt paving Bridges: At seven places Design speed: In the plain area: 90km/h, in the mountain area: 80km/h Ancillary facilities: Tollbooths, a maintenance office, a control building, an emergency building	Length: North: 7.79km, South: 20.955km Roadway width: As planned Shoulder width: As planned Road paving: As planned Bridges: At 10 places Design speed: As planned However, traveling speed inside the tunnel is limited to 40km/h. Ancillary facilities: As planned
2)Consulting services	Tendering assistance, construction management, conducting overseas-site training for engineering personnel of the executing agency, creating the operation and maintenance manual of the tunnel	Re-examination of detailed design, bid assistance, construction management, conducting overseas-site training for engineering personnel of the executing agency, creating the operation and maintenance manual of the tunnel, creating the standard operating procedures (SOP), providing guidance on operation and maintenance
②Project Period Civil engineering works	November 1994-November 2000 (73 months) December 1996-November 2000 (48 months)	November 1994-April 2003 (102 months) August 1999-April 2003 (45 months)
③Project cost* Foreign currency Local currency Total ODA Loan Portion Exchange rate	7,796 million yen 7,049 million yen (3,481 million rupees) 14,845 million yen 12,618 million yen 1 rupee = 2.02 yen (average in the period from	7,721 million yen 7,902 million yen (3,951 million rupees) 15,623 million yen 12,495 million yen 1 rupee = 2.00 yen (average in the period from

	1997 to 2002)	1997 to 2004)

Note*: the planned value of the project cost is that of Phase III appraisal.