2.3 Railway

2.3.1 Infrastructure

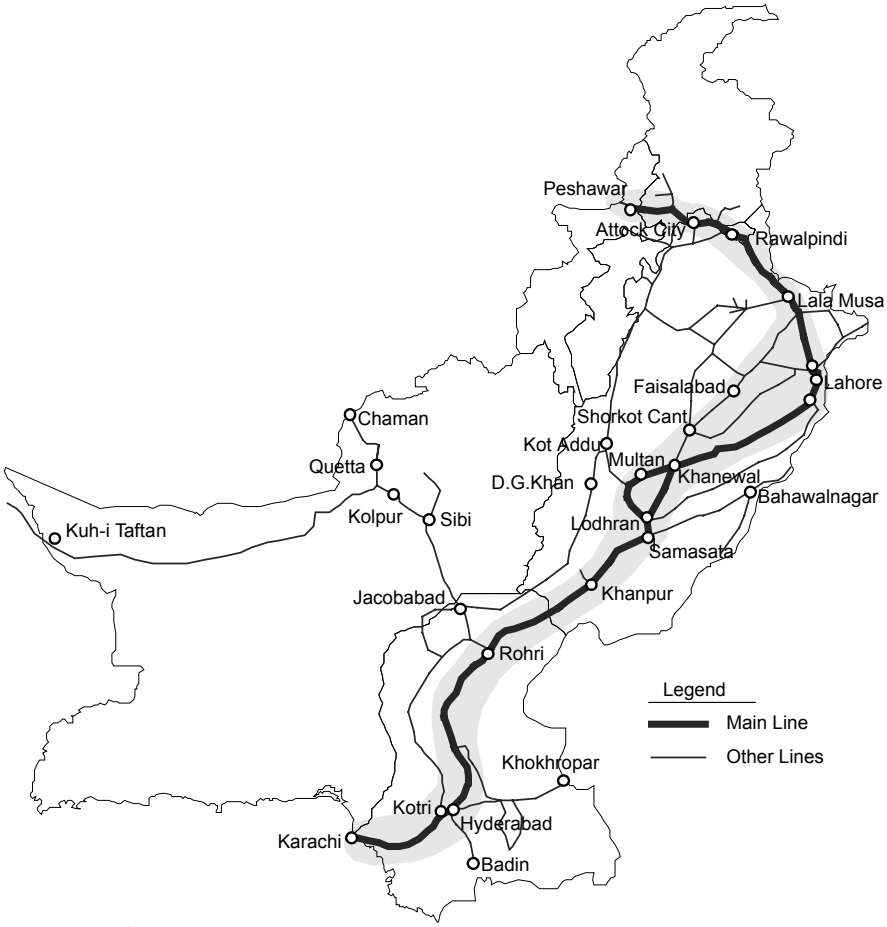
(1) Railway Network

The first railway of Pakistan, between Karachi City and Kotri, was opened in 1861. At the time of independence, most of the existing network had been constructed.

The Pakistan Railways network is comprised of 7,791 route-kilometres; 7,346 km of broad gauge and 445 km of metre gauge. There are 625 stations in the network, 1,043 km of double-track sections (in total) and 285 km of electrified sections.

The Main Line (official route name) is connects the following major stations; Karachi, Multan, Lahore, Rawalpindi and Peshawar. The term "the main corridor" used in this study means the lines including the Main Line and its bypass lines.

The existing Pakistan Railways network is shown in Figure 2.3.1.



Source: JICA Study Team

Figure 2.3.1 Pakistan Railway Network

(2) Railway Tracks

The railway network in Pakistan is comprised of 7,791 route-kilometres; 7,346 km of broad gauge and 445 km of metre gauge (See Table 2.3.1).

Out of the 7,791 km railway network, double track sections account for 1,043 km in total, and electrified sections for 285 km.

The Pakistan Railways have not constructed any new routes since 1982, and have instead abolished light-traffic branch lines since the 1980's.

Table 2.3.1 Route and Track Length by Gauge

Year	Route Kilometers			Track Kilometers		
	Broad Gauge	Meter Gauge	Total	Broad Gauge	Meter Gauge	Total
1990-1995 average	7,718.37	445.50	8,163.77	11,345.52	555.10	11,900.62
1996-2000 average	7,346.22	477.00	7,823.22	10,971.00	555.10	11,526.10
2004/05	7,346.00	445.00	7,791.00	10,960.00	555.00	11,515.00

Source: Pakistan Railways Year Book 2004/05

The network is ranked into six classifications of lines based on their role and level of importance, as shown in Table 2.3.2.

Table 2.3.2 Classification of the Lines in 2004/05

Classification	Route-kilometres	Remarks
Primary A	2,124 km	
Primary B	2,622 km	
Secondary	1,185 km	
Tertiary	1,416 km	
Metre Gauge	439 km	
Narrow Gauge	---	At present abolished

Source : Pakistan Railways

The Main Line of Karachi – Lahore – Rawalpindi – Peshawar (1,685km) and its bypass lines through Faisalabad mostly corresponds to Primary A. Of the 439 km of metre gauge lines, 126 km is being converted into broad gauge to connect to the line in India which has already been converted into broad gauge. No narrow gauge lines are currently in service, but tracks for these lines remain.

In the Karachi - Peshawar section and the bypass lines through Faisalabad and some other sections, the allowable maximum axle load is 22.86 ton, which is the standard for the largest 3,000 HP locomotives and new high performance freight wagons with full loading. The allowable axle load for other lines is 17.27 ton or less.

The gradient of each line is not steep except for a few sections. Along the main corridor, the maximum gradient is less than 6.7/1000 except for the 10/1000 gradient between Rawalpindi and Peshawar, which is suitable for massive freight transport. There is an exceptionally steep gradient of 40/1000 between Sibi and Chaman.

In the section of Karachi – Lala Musa and the bypass lines through Faisalabad, the maximum permissible speed is actually 95 to 105 km/hr. In other lines, it is lower: generally from 50 to 75 km/hr.

Track strengthening and rehabilitation works are underway based on the plan for "Rehabilitation and Improvement of Tracks (2001-2006)". The works are currently half finished. The progress of the track strengthening and rehabilitation work is shown in Table 2.3.3.

Table 2.3.3 Progress of Track Strengthening and Rehabilitation Work

Section	Track km	Rail		Sleepers		Ballast thickness	
		Improved	Not Improved	Improved	Not Improved	Improved	Not Improved
Primary - A	3,031 km	2,634 (87%)	397 (13%)	2,625 (87%)	406 (13%)	657 (22%)	2,374 (78%)
Primary - B	2,674 km	1,365 (51%)	1,309 (49%)	758 (28%)	1,916 (72%)	79 (3%)	2,595 (97%)
Secondary	1,185 km	690 (58%)	495 (42%)	87 (7%)	1,098 (93%)	12 (1%)	1,173 (99%)
Tertiary	1,500 km	1,239 (83%)	261 (17%)	783 (52%)	717 (48%)	106 (7%)	1,394 (93%)
Karachi-Lahore	2,264 km	2,191 (97%)	73 (3%)	2,196 (97%)	68 (3%)	522 (23%)	1,742 (77%)

Source: Pakistan Railways

The purpose of track strengthening and rehabilitation work is to enhance operational speeds and minimize maintenance costs. The structural standard for track strengthening of Primary-A and Primary-B sections is shown below (Table 2.3.4).

Table 2.3.4 Structural Standard

Classifications	Primary-A	Primary-B
Rail	UIC54/100RE	100RE/90R
Sleepers	1,640 sleepers/km	1,562 sleepers/km
Ballast thickness	30cm	25cm
Speed	120km/hr	100km/hr

Source: Pakistan Railways

(3) Signalling System

The existing interlocking systems on the Pakistan Railways are classified into four types: one relay interlocking system and three mechanical interlocking systems. The existing interlocking systems are listed in Table 2.3.5.

Table 2.3.5 Existing Interlocking Systems

Type	Speed	Locking	Stations	Year of Installation
Mechanical Signalling				
Non-interlocked	15 km/hr		165	1947
Standard-I	50 km/hr	Indirect (key)Locking	215	1947-1995
Standard-II	70 km/hr	Indirect (key)Locking	19	1947
Standard-III	120 km/hr	Indirect (key)Locking	210	1947-1999
Electrical Signalling				
All Relay Interlocking			39	1962-1969

Source : Pakistan Railways

The existing block systems are broadly classified into the following:

- Absolute block system (seven types)
- Automatic block system
- Automatic block system with CTC (Centralized Traffic Control)

Classified block systems are listed in Table 2.3.6.

Table 2.3.6 Existing Block System

System		Stations		Year of Installation
Morse Telegraphy	(Paper Line Clear)	262		1947
Neal's Token Insts	(Single Line)	126		1947
Siemen's Tokenless	(Single Line)	128		1965/93
Style U Tokenless	(Single Line)	39		1969
Style N Tokenless	(Single Line)	2		1960
Tyre's Block Insts	(Double Line)	65		1954
Carson Block Insts	(Double Line)	5		1960
Automatic Block		16	154km	1970/97
Automatic Block with CTC		9	34km	1962/84

Source : Pakistan Railways

The automatic block system is only installed in a limited section of the 188km between Karachi and Hyderabad. Most of the signals, other than the automatic block system, are semaphores.

(4) Telecommunication System

At present, the Pakistan Railways are equipped with a telecommunication systems at present. The train radio system on the main corridor is operational, but the technology is obsolete, as is that of the signalling system.

(5) Double Tracks

Double track sections are only 1,043 km out of a total out of 7,791 route-kilometres. Most of the double track sections are located in the most critical section (Karachi City - Lahore, 1,218 km). The double-tracking works between Lodhran and Khanewal via Multan are under construction, and due for completion in 2005/06.

Photo: Double tracking work between Multan and Khanewal

Photo: Single track section remained between Karachi and land for double track between Khanewal and Raiwind

(6) Structure

Most of tracks along the Pakistan Railways are laid on embankment. There are a total of 14,570 bridges of which 22 bridges are recognized as large scale bridges. Almost all of these bridges were constructed more than 100 years ago. They require rehabilitation or replacement work.

(7) Electrification

The electrified section is limited to between Kanewal and Lahore (285 km) and some branches. These were electrified 35 years ago, and no extensions have been carried out since that time. Presently, the electrification facilities are aging and require rehabilitation.

2.3.2 Rolling Stock

(1) Locomotives

The Pakistan Railways has 520 diesel locomotives, 23 electric locomotives and 14 steam locomotives including those for metre gauge. The steam locomotives are mostly out of daily services. The locomotives are mainly of 3000 HP class. The number of locomotives classified by performance is; 115 of 3,000 HP, 276 of 2,000 HP (including 2,400 HP).

Most of the locomotives are aging and decrepit, and some of them are out of services. Table 2.3.7 shows the number of over-aged locomotives over 20 years old. The reliable locomotives under 20 years old or ones recently rehabilitated are listed in Table 2.3.9.

Table 2.3.7 Number of Over-aged Locomotives over 20 years old

CLASS	Performance	Year Built	Number on Books	Number to be Condemned	Remark
GMU-30	3,000 HP	1975	36		36 Locos have been planned for rehabilitation
ARU-20	2,000 HP	1076	20	1	32 Locos have been planned fir recommissioning
ARPW-20		1982	27	18	
GEU-20		1971	9	13	
HAU-20R		1982	27		
HPU-20		1982	4	4	
ALU-20R		1985	3		
GEU-15	1,500 HP	1970	16	9	23 Locos have been planned for recommissioning
GMCU-15		1975	29		
GMU-15		1975	31		
ALU-12	1,200 HP	1962	32	17	
HAU-10	1,000 HP	1980	4		
ALU-95	950 HP	1958	18	9	
Total			256	71	

Source : Pakistan Railways

Table 2.3.8 Locomotives under 20 years old or Recently Rehabilitated

Name	Performance	Number on Book	Remarks
HGMU-30	3,000 HP	28	
HBU-20	2,000 HP	60	
PHA-20	2,000 HP	23	
AGE-30	3,000 HP	30	
GRU-30	3,000 HP	48	Rehabilitated recently
RGE-20	2,000 HP	27	Rehabilitated recently
RGE-24	2,400 HP	21	Rehabilitated recently
DPU-30	3,000 HP	17	
DPU-20	2,000 HP	7	
Total		261	

Source : Pakistan Railways

Electric locomotives were introduced 35 years ago when the electrification works were completed, however they are already aging. The number of electric locomotives has not increased since their introduction in 1970 because there has been no extension of the electrified section of the railway. Due to the lack of sound electric locomotives, most trains are hauled by diesel locomotives even in the electrified section today.

Photo: DHL running under wire new and powerful GM-made 3,000 HP-DHL, purchased with Japanese ODA between Lahore and Khanewal

Photo: Lahore DEL Depot GM-made 3,000 HP-DHL

(2) Passenger Coaches

The total number of passenger coaches on the Pakistan Railways was 1,865 at the end of 2004/05. This number includes 1,604 vehicles for conveyance of passengers and 214 vehicles for conveyance of luggage, parcels, mail, automobiles and horses, etc. This does not include departmental vehicles and 273 coach brake-vans.

(3) Freight wagons

The number of freight wagons on the Pakistan Railways was 21,556 at the end of 2004/05 comprising 10,491 covered wagons, 5,526 opens wagons and 5,216 special type wagons (for carriage of liquids, explosives, machinery, live-stock, timber and rails, etc.). This does not include 629 departmental wagons and 328 brake-vans. A total of 17,863 of those wagons are 4-wheelers, and the rest are mostly 8-wheelers.

Most of the wagons are out of date and of low performance. They are only equipped with vacuum brake systems. Some wagons, mainly the 4-wheelers, are restrained to operation speeds less than 55 km/hr because of their low stability.

The only high performance wagons that are currently useful are 130 flat wagons that were purchased from China and are used for container transport. The Pakistan Railways have a project to introduce 1,300 high performance wagons including 80 brake vans between 2002/03 to 2005/06. The introduction of the 130 flat wagons enabled the Pakistan Railways to start high speed container transport services between Karachi/Qasim ports and Lahore/ Faisalabad dry ports with six pairs of trains per week.

The actual transport time from Karachi to Lahore for the new high performance wagons is 26 hours, whereas that of conventional wagons is about 60 hours because of not only a long running time but also a long waiting time. Thus the existing conventional wagons take 2.5 times longer than locomotives.

(4) Manufacturing and Services

The Pakistan Railways undertake various non-core activities such as manufacturer, contractor, consultant as well as hospital and school services and other services. These activities are a relic of the past when the railway was the largest and most advanced enterprise and the primary land transport means. These activities are managed together with the railway under the unified regulations, even though they are not directly related to daily management, operation and maintenance of the railway. Their customer base is narrow and almost exclusively Pakistan Railways.

2.3.3 Achievements of the Previous Master Plan, JICA Study 1995

The previous JICA study, "The Study on National Transport Plan in the Islamic Republic of Pakistan", February 1995, predicted that the traffic demand for the railway would be 36,089 million passenger-km and 21,131 million ton-km in 2005/06, surmising the passenger traffic would keep its share and freight traffic would satisfy its share of an "economically desirable modal split". However, the actual traffic demand in 2004/05 was 24,237 million passenger-kilometres and 5,013 million ton-kilometres, which is contrary to the predictions in the study.

The proposed railway project in the Master Plan consists of 17 projects of a total estimated cost of Rs. 146 billion. Each item and its proposed achievements are summarized in Table 2.3.9. As shown the table, there has been little progress on projects between 1995/96 and 2004/05. In particular, the improvement of the signalling system has been neglected, even though serious accidents were caused by problems in signalling system at Sangi in 1990 and at Ghotki in 1992.

As for rolling stock, not only locomotives but also passenger coaches and freight wagons have not been procured to the required scale. Above all, the lack of wagons required to meet the current customer needs has caused the catastrophic fall in its share of the land transport market

Double-tracking works for the remaining single track section on the corridor between Karachi and Lahore was executed only partially, and a section of 245 km (Khanewal - Raiwind) remains to be completed.

Since the 1970s, the road sector has been made a priority for investment in the transport sector and investment in the railway sector has been restrained. Therefore, the railway infrastructure and rolling stock has become aged and decrepit. In response, the government adopted the policy to increase investment in the railway sector in the eighth Five Year Plan (1993/94 – 1997/98) and allocated a budget. However, the government could not execute the budget for the railway due to the fragile national economic situation. The largest project implemented in this period was the purchase of thirty 3,000 HP diesel locomotives. This project was funded by OECF (in present, JBIC: Japan Bank for International Cooperation).

In July of 1997, in order to implement a radical reform of the Pakistan Railways, which were in a critical situation, the government decided to privatise the Pakistan Railways with the assistance of the World Bank. The Pakistan Railways considered themselves to be self-sufficient without the government support and attempted to reduce the government support in advance. Therefore, a backlog of investment in replacement, rehabilitation and daily maintenance were further amplified.

In the beginning of the year 2000, the government decided to postpone the privatisation. At the same time, the government approved to the execution of the Emergency Repair Plan (ERP) to the scale of Rs. 40.8 billion thereby promoting the rehabilitation and improvement of infrastructure and rolling stock.

Consequently, the Pakistan Railways commenced work on backlogged projects such as the purchase of diesel locomotives, coaches and high-performance wagons, track strengthening and rehabilitation work on main lines and double-tracking work in the section of Lodhran - Multan - Kahnewal. However, the project for the improvement of the signalling system has been postponed so far.

The above investment projects for the railways were listed in the Ten Year Plan (2001/02 – 2010/11) and are taken over in the Medium Term Development Framework (MTDF) 2005-2010.

Table 2.3.9 Proposed railway project for the Master Plan in 1995

No.	Projects	Estimated Cost (Rs. Million)	Achievement until 2004/05
1	Automatic block signalling	2,220	No progress
	Karachi - Lahore	1,760	
	Lahore - Rawalpindi	460	
2	Electric/Relay interlocking	2,340	No progress
	Karachi - Lahore		
3	Tokenless block signalling and colour light signals	1,630	No progress
	Jacobabad - Quetta	340	
	Kotri - Habib Kot	400	
	Chak Jhumra - Lala Musa	270	
	Attock City - Sher Shah	570	
	Wazirabad - Sialkot	50	
4	Centralised traffic control system	1,100	No progress
5	Track renewal	7,120	Partial progress
	Rail	6,510	
	Sleeper	610	
6	Electrification	17,420	No progress
	Samasata - Khanewal	1,170	
	Kiamari - Samasata	16,250	
7	Double tracking	7,760	Partial progress
	Lodhran - Sher Shah	720	Under construction
	Multan - Khanewal	2,950	Under construction
	- Raiwind		No progress
	Shahdara Bagh - Rawalpindi	2,820	No progress
	Shahdara Bagh - Faisalabad	1,270	No progress
8	Upgrading KYC - LLM section	5,500	Partial progress
9	Electric locomotives	4,350	No progress
	Procurement	3,300	
	Revamping	1,050	
10	Diesel locomotives	43,800	Partial progress
	Procurement (3,000HP, 2000HP)	40,300	30xAGE-30, 12xDPU-30, 7xDPU-20
	Rehabilitation	3,000	108x2,000HPClass
	Traction motor renewal	500	Progress
11	Procurement of wagon movers	4,700	
12	Procurement of Wagons	13,000	Partial progress 130 flat wagons out of 1,300 projected
13	Replacement of coaches	13,700	Partial progress 108 new coaches out of 175 projected
14	Improvement of rolling stock	3,000	Progress
	Air brake	1,000	
	Roller bearing	1,000	
	Air conditioner	1,000	
15	Improvement of container traffic	2,400	Partial progress
	Karachi Dry Port	400	
	Lahore Dry Port	1,600	
	Other dry ports	400	
16	Information system and communi- cation system	2,230	Partial progress
	Management information system	330	
	Seat reservation system	400	
	Communication system	1,500	
17	Miscellaneous and minor projects	13,330	
	Total	145,600	

Source: The Study on National Transport Plan in the Islamic Republic of Pakistan, February 1995

2.3.4 Railway Transport

(1) Passenger Transport

a) Past and Present Situation

As shown in the Table 2.3.10, the number of railway passengers began to decrease due to motorization at the end of the 1970s and reached its lowest level in 1998/99. Since hten the number of passengers has increased and is on track to recover. The number of passengers was 67.5 million in 1999/2000 and 78.1 million in 2004/05, an increase of 16% over the last five years.

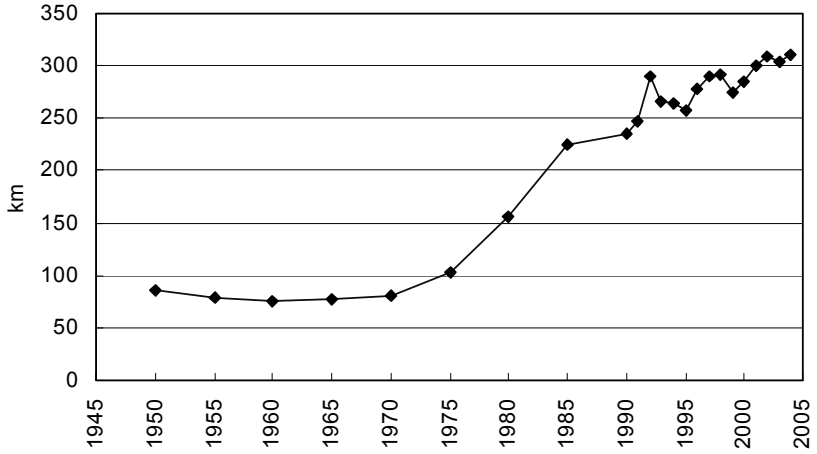
Passenger-km was 18.5 billion in 1999/2000 and 24.2 billion in 2004/05, an increase of 31% over the last five years. The Pakistan Railways specialize in express services for middle/long distance intercity passenger transport.

Table 2.3.10 Railway Passenger Data

Year	No. of Passengers (million)	Total Passenger Kilometres (million)	Average No. of Kilometres Travelled per Passenger	Average Revenue per Passenger (Rs.)	Average Rate Charged per Passenger per Kilometre (in Paisa)
1950-1955 average	78.9	6,778.5	85.9	1.50	1.75
1955-1960 average	102.7	8,064.0	78.5	1.56	1.99
1960-1965 average	126.3	9,533.6	75.5	1.55	2.05
1965-1970 average	130.5	10,025.2	76.9	1.83	2.28
1970-1975 average	134.1	10,792.2	80.2	2.36	2.93
1975-1980 average	145.7	15,112.0	103.7	4.47	4.31
1980-1985 average	113.5	17,402.6	155.3	11.32	7.21
1985-1990 average	82.3	18,483.2	224.3	21.15	9.42
1990/91	84.9	19,963.7	235.2	27.72	11.79
1991/92	73.3	18,158.0	247.7	36.54	14.75
1992/93	59.0	17,082.3	289.3	47.13	16.29
1993/94	61.7	16,385.1	265.5	45.70	17.23
1994/95	66.5	17,555.4	264.1	46.70	17.68
1995/96	73.7	18,904.8	256.7	48.85	19.03
1996/97	68.8	19,114.4	277.8	64.48	23.21
1997/98	64.9	18,773.8	289.4	70.60	24.22
1998/99	65.0	18,979.8	292.0	69.77	23.89
1999/00	67.5	18,495.3	273.9	72.41	26.43
2000/01	68.9	19,589.7	284.4	84.25	29.61
2001/02	69.0	20,782.9	301.1	95.10	31.60
2002/03	72.4	22,305.6	308.1	102.62	33.30
2003/04	75.7	23,045.1	304.4	108.44	35.62
2004/05	78.1	24,237.7	310.0	118,9	38.37

Note : Excludes differential on government traffic and Public Service Obligation
Source : P.R. Yearbook

The average distance travelled has been increasing, and at present exceeds 300 km as shown in Figure 2.3.2. This indicates that short distance travel has shifted from railway to road transport, and the role of railway is specialized in middle/long distance travel. In current years, the degree of change tends to be slow.



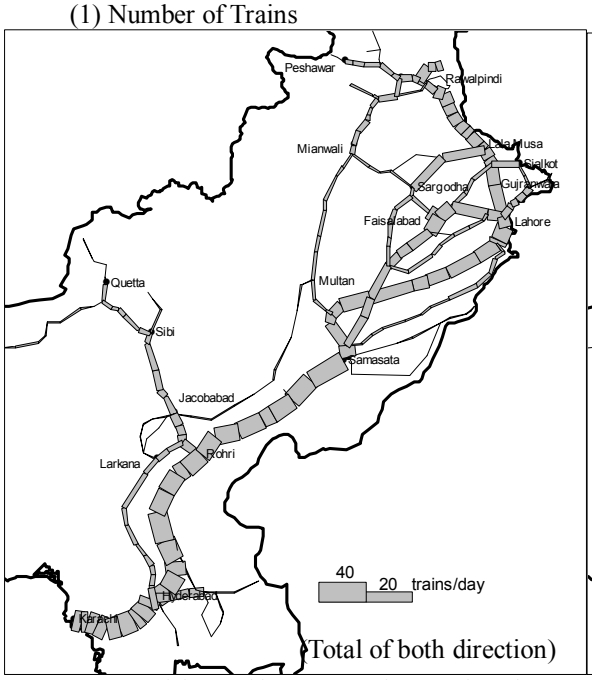
Source: PR, JICA Study Team

Figure 2.3.2 Change in Average Distance Travelled

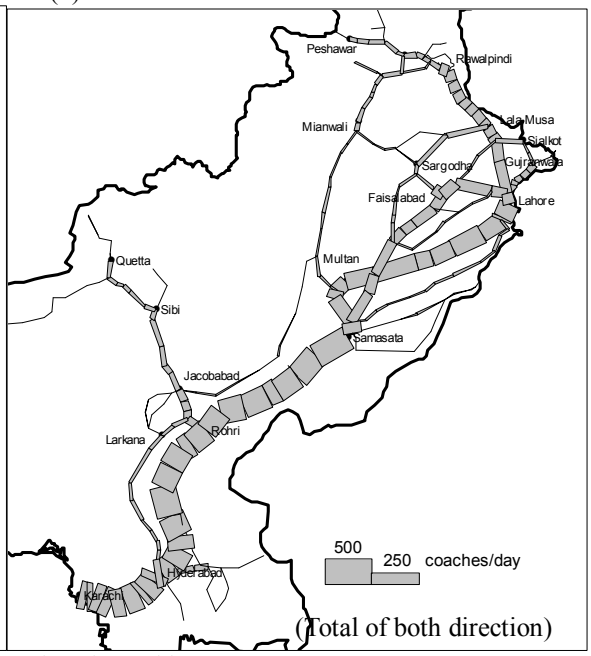
In 2004/05, the overall average transport density was 8,500 passengers per day. In the sections where passenger trains are running everyday, the average transport density increases to 10,600 passengers per day.

In the most congested section, Karachi - Lodhran, 18 to 21 pairs of passenger trains are operated in one day. These trains consist of 10 to 20 coaches. The daily operation volume of passenger trains/coaches is shown in Figure 2.3.3.

(1) Number of Trains



(2) Number of Coaches



Source: Elaborated by JICA Study Team based on Operation Time Table

Figure 2.3.3 Daily Operation of Passenger Trains

b) Rate Structure

Currently, passenger services are classified into seven classes according to the quality of service and coaching vehicles.

- Air-conditioned Sleeper
- Air-conditioned Sitter

- Air-conditioned Lower Special
- Air-conditioned Lower
- First Class
- Economy Class
- Second Class

Table 2.3.11 shows the distribution of passengers by the classes. For a long time, 96% to 97% of passengers have used the lower classes (economy class and second class). The air-conditioned lower class was started in 2004/05 with the aim of the improving passenger services. Now second class is only offered only for local trains.

Table 2.3.11 Pakistan Railways: Classification of Passenger Services

(Thousand)

Class / Year	Air-Conditioned Class				Air-Conditioned Lower		First Class Sleeper		Economy Class		Second Class		Total
	Sleeper		Sitter										
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
1995/96	78	0.11	258	0.35	737	1.00	627	0.96	30,083	41.50	41,379	56.18	73.652
1996/97	69	0.10	250	0.36	1,254	1.82	632	0.92	29,645	43.09	36,951	53.71	68,801
1997/98	72	0.11	291	0.45	1,453	2.24	628	0.97	29,819	45.50	32,607	50.26	64,870
1998/99	72	0.11	251	0.39	1,415	2.18	610	0.98	30,768	47.34	31,812	49.00	64,988
1999/00	89	0.13	240	0.36	1,481	2.19	625	0.93	30,241	44.80	34,832	51.59	67,508
2000/01	99	0.15	163	0.24	1,511	2.19	683	0.99	32,373	47.01	34,080	49.42	68,859
2001/02	99	0.15	145	0.21	1,444	2.10	585	0.84	34,886	50.56	31,844	46.14	69,003
2002/03	95	0.14	139	0.20	1,909	2.62	403	0.55	37,225	51.42	32,632	45.07	72,397
2003/04	91	0.12	138	0.18	1,867	2.47	417	0.55	38,880	51.36	34,307	45.32	75,700
2004/05	94	0.12	142	0.18	1,928	2.45	413	0.55	40154	51.36	35430	45.32	78,179

Source: Pakistan .Railways. Yearbook

Table 2.3.12 shows the passenger fares for the Pakistan Railways. Passenger fares are classified by the classes and distance zones. The air-conditioned lower special class is only provided in the section between Karachi and Lahore. The fare for this class is set according to the section. Table 2.3.13 shows the fare of air-conditioned lower special in comparison to other classes.

Table 2.3.12 Passenger Fares

Class	Fare (Rs.)		
	Minimum	100 km	500 km
Air-conditioned Sleeper	130	240	1,160
Air-conditioned Sitter	80	130	630
Air-conditioned Lower	80	80	450
First Class Sleeper	60	70	420
Economy Class	10	35	210
Second class	7	25	130

Source: Pakistan Railways

Table 2.3.13 Fare for the Class of Air-conditioned lower special class

Unit: Rs.

Section	Air-conditioned Lower Special	Air-conditioned Sleeper	Economy
Lahore - Karachi	1,280	1,870	510
Lahore - Hyderabad	1,090	1,670	460
Lahore - Multan	410	650	160

Source: Pakistan Railways

(2) Freight Transport

a) Past Trend

The change in freight traffic is shown in Table 2.3.14. The total number of tons carried and ton-km have been on a downward trend since 1960-65 and 1980-85 respectively, and in these years, are slightly in uptrend.

Table 2.3.14 Pakistan Railways: Freight Data

Year	Tons carried (Thousand)	Ton-kilometres (Million)	Average Kilometres Carried by a Ton
1950-1955 average	9,244	4,377.9	477.0
1955-1960 average	11,703	5,479.8	468.2
1960-1965 average	14,156	7,212.7	514.4
1965-1970 average	14,619	7,899.9	550.8
1970-1975 average	12,715	7,906.7	626.3
1975-1980 average	13,367	8,598.5	665.3
1980-1985 average	11,185	7,379.1	666.2
1985-1990 average	10,960	7,942.6	732.2
1990/91	7,717	5,708.6	742.3
1991/92	7,560	5,961.6	792.4
1992/93	7,769	6,180.3	798.8
1993/94	8,036	5,938.8	741.7
1994/95	7,356	5,661.0	772.8
1995/96	6,854	5,077.4	742.3
1996/97	6,380	4,607.0	727.1
1997/98	5,977	4,447.3	745.8
1998/99	5,448	3,969.5	730.6
1999/00	4,770	3,753.5	759.3
2000/01	5,894	4,519,5	771.0
2001/02	5,866	4,572.7	782.6
2002/03	6,180	4,819.8	779.8
2003/04	6,140	4,796.3	781.2
2004/05	6,410	5,013.5	782.1

Source: P.R. Yearbook.

b) Commodities

Major commodities handled by the Pakistan Railways are: 1) petroleum and other non-dangerous hydrocarbon oils (18.1%), 2) chemical manures (9.9%) and 3) railway material and stores (17.4%). The volume of each commodity carried in the fiscal year 2003/04 is shown in Table 2.3.15. Change of transport volume of main commodities in recent 5 years is shown Table 2.3.16.

Table 2.3.15 Commodity Volume Carried

Name of commodities	Freight Carried (Tonnes)	Tonne Kilometres (Tonnes-km)	Kilometres of (km)
Iron and Steel Division "A" includes angle, axles, sheets, girders etc.,	8	6,306	788
Sugar	72	56,634	787
Paddy and Rice	41	32,147	784
Cement	51	39,977	784
Oil Division "D" includes vacuum refined edible oil	40	31,366	784
Gypsum	23	17,972	781
Oil Seeds	201	157,031	781
Petroleum and other hydrocarbon oils non-dangerous i.e., having flashing point at above 76 Fahr.	1,111	867,812	781
Coal and Coke for the Public	362	282,715	781
Chemical manures (Fertilizers)	609	475,451	781
Fire wood	64	49,651	776
Ballast and Stone	25	19,259	770
Machinery, other than electrical	4	2,791	698
Other grains and pulses	4	2,713	678
Sugarcane	2	1,306	653
Timber	1	470	470
Live-stock	1	429	429
Salt	132	36,647	278
Miscellaneous	2,069	1,686,558	815
Total	4,820	3,767,235	782
Departmental Commodities			
Coal, Coke and Patent fuel for Railways (including H.S.D. and furnace oil)	253	195,120	771
Railway Material and Stores	1,067	833,914	782
Total	1,320	1,029,034	780
G-Total	6,140	4,796,269	781

Source: PR

Table 2.3.16 Change in Transport Volume for Main Commodities

Name of commodity	Ton-Km of Commodity (Thousand)				
	2000/01	2001/02	2002/03	2003/04	Ratio of 2003/2000
Sugar	10,530	2,613	77	56,634	5.38
Paddy and Rice	13,204	16,977	37,098	32,147	2.43
Ballast and Stone	4,334	3,901	8,235	19,259	4.44
Coal and Coke for the Public	104,386	815,520	163,104	282,715	2.71
Salt	30,321	33,353	32,802	36,647	1.21
Iron and Steel	10,930	2,186	6,558	6,306	0.58
Petroleum and other hydrocarbon oils non-dangerous	1,990,675	2,064,518	1,755,677	867,812	0.44
Cement	138,280	66,374	68,586	39,977	0.29
Gypsum	75,157	71,269	81.635	17,972	0.24
Wheat	71,717	131,481	204,456	886	0.01

Source: Pakistan Railways

c) Rate Structure

Table 2.3.17 shows the basic rate scale for freight transport on the Pakistan Railways. The freight fare is determined on a commercial basis for each commodity, taking account of the following factors; volume, weight, form (type of packing), method of loading, susceptibility to transport losses.

Table 2.3.17 Pakistan Railways: Basic Rate Scale

Distance (km)	Rate (Paisa per tonne per km)
1-250 km	37.85
+ 250-300 km	28.65
+ 301-500 km	18.95
+ 501 km and Above	16.95

Note: Basis of Rate Scale 100
Source: PR

d) Freight Operation

There is not currently a fixed operation diagram for freight trains. Freight trains are operated in intervals between the running of passenger trains and are frequently are forced to stop and wait for the passing and exchanging of passenger trains.

The Pakistan Railways offers container transport services between Karachi/Qasim ports and dry ports in Lahore, Faisalabad, Rawalpindi, Peshawar and Quetta. Most of the containers transported by railway are handled in the Lahore dry port, which was established in 1973 as the first dry port in Pakistan. The high speed container transport service commenced in 2003/04 with six pairs of trains per week.

2.3.5 Administration of Railway Sector

(1) Pakistan Railways (PR)

Pakistan Railways (PR) is a department of the MOR and is governed by the Railway Act of 1890. The Railway Board is the decision making organ and the Secretary of the MOR serves as its Chairman. The PR comprises two functional units: the Operation Unit and the Manufacturing and Service Unit each headed by a General Manger who is accountable to the Railway Chairman for the performance of the unit. The Operation Unit overseas train operations and all related functions, i.e. business units for passengers, freight and infrastructure. The Manufacturing and Service Unit is responsible for the management of the Concrete Sleeper Factories, Locomotive and Carriage Factories, Workshops, Hospitals and medical services, Schools and two consulting firms namely Pakistan Railway Advisory and Consultancy Services Ltd, (PRACS) and Railway Constructions Pakistan Ltd. (RAILCOP).

PR has seven territorial divisions, at Peshawar, Rawalpindi, Lahore, Multan, Sukker, Karachi and Quetta, and a Mechanical Division, Workshop Division at Moghalpura, and Administrative Division at the Headquarters in Lahore. The territorial and work divisions are each headed by a Divisional Superintendent, reporting to the General Manager (Operations). The Divisional Superintendent is assisted by the Divisional and Assistant Officers of their respective departments, i.e. engineering department (civil, mechanical, electrical, signal and telecommunications), Mechanical, Transportation, Commercial, Accounts and Railway Police. The number of employees of PR is 90,000. An allocation of Rs.62.5 billion has been made for the railway under the PSDP. This includes Rs.21.5 billion for on-going works and Rs.41.0 billion for new projects.

The Pakistan Railway network has 625 stations in its system connecting of the major cities in four provinces from North to South and East to West. The section of network Karachi-Lodhran (843 km) and 193 km of other short sections are double tracks, and 286 km from Lahore to Khanewal is electrified. The railway network is also connected to three neighbouring countries, Iran at Kohi Taftan, India at Wagha and Afghanistan at Chaman and

Landi Kotai on the north-western border.

(2) Institutional Reform of the Pakistan Railways

The PR was organized as a subordinate department of the Ministry of Railways. This form of organization proved increasingly ineffective in coping with competition, as PR's pre-eminent position was increasingly challenged in the post deregulation era.

In 1995, the JICA Study on the National Transport Plan in the Islamic Republic of Pakistan recommended the creation of a Pakistan Railway Corporation, similar to PIA, with a Ministerial presentation in the board. The ownership and overall direction of the railway would remain in the public sector, but day-to-day running of the railway would be passed on to commercially oriented managers with clearly defined targets and responsibilities. The study concluded that, ultimately, given the expectation of increased productivity and profitability in the railway sector, such a structure would be suitable for the privatization of the railways, if that was politically desirable.

In 1997, the GOP announced its strategy for the privatization of the Pakistan Railways. The strategy is to restructure the PR into three core businesses namely Passengers, Freight and Infrastructure. A new public entity (the Railway Resettlement Agency) will be created to retain all surplus assets and liabilities, including labour, real estate, debts and environmental clean up obligations. In addition, a new Railway Regulatory Authority will be established under a new regulatory framework for regulating the largely private sector rail industry. This plan was failed and caused a negative impact on the moral of the PR employees.

In 2004, after 10 years of JICA recommendations and the unsuccessful attempts at the PR. privatization in 1997, the GOP has decided to create a Pakistan Railways Corporation. The objectives are:

- To promote the railway as the preferred mode of transport in the country;
- To grant the Pakistan Railways Corporation sufficient autonomy to operate and to enable it to effectively compete with other modes of transport;
- To allow the Corporation to procure finances directly from banks/market under suitable terms.

The new Board consists of a Chairman, CEO, and nine directors: three from the GOP, three from the Corporation and three from the private sector. The CEO will be recruited from the private sector. The GOP provides the Board with more autonomy and power for its governance.

(3) Reorganization of Management

The institutional reform calls for:

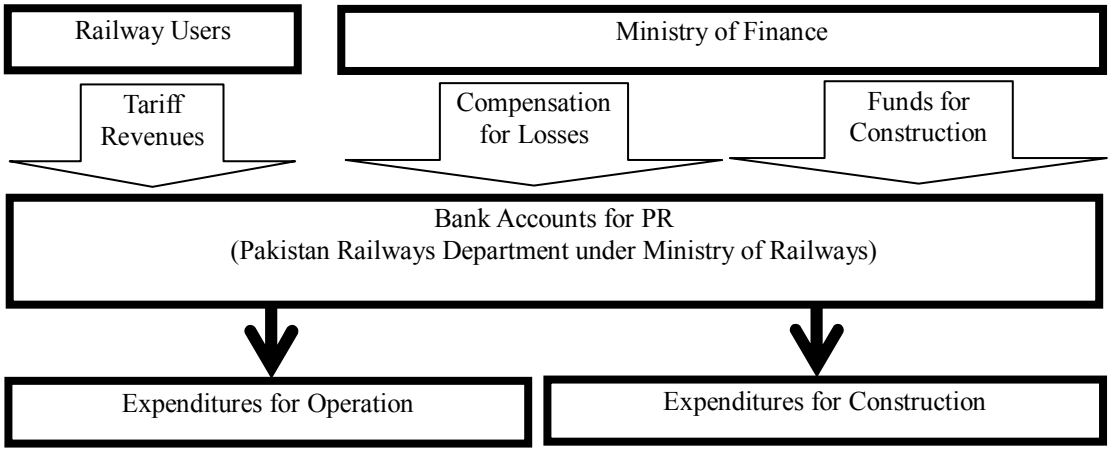
- Transferral from the strong social service aspects of the management structure to a commercially oriented railway
- Increasing performance by creating a business management structure to enhance management responsibilities and accountabilities and enable profit centre accounting
- The curtailment of surplus employees is one of the top priorities
- Creating a financially sustainable structure.

The financial structure of the PR has been an ad hoc and unsustainable and there have been no tests, or monitoring to underpin budgetary support. During the 1990's there was no investments in the railway infrastructure except for the procurement of locomotives. In the absence of a clear long-term plan or short-term goals and the "Shock Treatment" of 1998, the railway has failed to organize itself to receive PSDP allocations to cover maintenance of the rolling stock and rail structure. As a result the infrastructure and rolling stock are out of date and require a substantial amount of investment in order to function as one of the key transport systems in the country.

2.3.6 Financial Situation

(1) Financial Resources for Railways

The implementing agency of the railway sector is the Pakistan Railways (PR), which is funded in the following manner.



Sources: Interview with Pakistan Railways

Figure 2.3.4 Flow of Funds for the PR

The Joint Secretary of the Ministry of Railways is also the Chairman of the Railway Board. In a different manner to railway companies, the tariff revenues and expenditures are managed through the bank account controlled by the State Bank of Pakistan.

One of the biggest income streams for the PR is the tariff revenue. However, based on the financial statements, the tariff revenue does not are not recover the entire costs, and the PR continues to run at a loss. This loss is compensated for by the MOF. In addition, the development of the facilities and equipments is also funded by the MOF. Therefore, under the current situation where most of the financing relies on the National Budget, there is a risk that the financing for developments and ordinary operations of the PR is influenced by other sectors (like the defence sector), which may be a threat to the sustainable development and operation of the PR.

(2) Financial Outlook of PR

The financial status of the PR is described in Table 2.3.18. According to Table 2.3.18, "(1) Gross Revenues" have slightly exceeded "(2) Ordinary Working Expenses" from the fiscal year 1999/2000 to the fiscal year 2003/04. However, the Gross Revenues are considerably insufficient to recover "(3) Other Costs for Employees", "(4) Appropriation to Depreciation Reserve Fund" and "(6) Interests on Debt". Consequently, the PR must rely on "(8) Grants from Government" to compensate for the losses. In addition, the value of the grants have significantly increased in recent years. The largest item in 'Other Costs for Employees' is the Pension Payments to pensioners. According to the interview with the PR, the current number of pensioners amounts to around 90,000. At present, it is not possible to generate sufficient funds from the tariff revenue for the Pension Payments.

In the accounting system of the PR, the exact depreciation costs are not calculated according to the book value and economic life of the facilities, because the existing accounting system is based on the single entry accounting system. Therefore, instead of calculating the exact amount of depreciation costs, the Depreciation Reserve Fund is appropriated based on rough estimations. The Depreciation Reserve Fund is expected to become a financial resource for the replacement of the existing facilities in the future. Therefore, under the current

circumstances where the revenue is insufficient to recover the amount appropriated in the Depreciation Reserve Funds, the financial resources for the replacement of the existing facilities are not adequately accumulated for the PR.

Table 2.3.18 Revenue and Expenditure of the PR

(Unit: Million Rs.)

FY	1999/2000	2000/01	2001/02	2002/03	2003/04
(1) Gross Revenues					
Passenger	4,889	5,802	6,569	7,430	8,218
Freight	3,969	4,715	4,790	5,071	4,566
Parcel & Other Coaching Earning	716	606	807	905	928
Others	316	816	881	1,404	923
Total	9,889	11,939	13,046	14,810	14,635
(2) Ordinary Working Expenses					
Administration	1,439	1,526	1,527	1,618	1,999
Repair & Maintenance	4,099	4,220	4,744	5,294	5,344
Operational Staff Costs	1,216	1,205	1,248	1,383	1,498
Operational Fuel Costs	1,870	2,581	2,710	3,290	3,652
Others	1,193	1,339	1,086	1,097	884
Total	9,817	10,871	11,315	12,682	13,377
(3) Other Costs for Employees					
Pension Payments	**2,278**	**2,724**	**2,922**	**2,882**	**2,955**
Others	201	196	172	308	369
Total	2,478	2,920	3,094	3,190	3,324
(4) Appropriation to Depreciation Reserve Fund	**993**	**993**	**993**	**1,200**	**1,200**
(5) Operational Surplus ((1) – (2) – (3) – (4))	-3,399	-2,847	-2,356	-2,262	-3,266
(6) Interest on Debt etc*	**3,142**	**2,513**	**2,399**	**3,394**	**2,096**
(7) Net Profit ((5)-(6))	-6,541	-5,360	-4,755	-5,656	-5,361
(8) Grants from Government	**3,767**	**4,400**	**6,000**	**8,100**	**8,001**
Surplus ((7)-(8))	-2,773	-959	1,246	2,446	2,641

*Small amounts of miscellaneous Receipts are deducted.
Source: Year Book 2003/04 (Ministry of Railways) and PR Financial Statement

In addition, the Gross Revenue is insufficient to recover the Interest Payments on Debt. According to the financial statements of the PR, the liability amounted to Rs. 35 billion at the end of the fiscal year 2003/04. The annual interest payments on these liabilities amounted to between Rs. 2 billion and Rs. 3 billion. Therefore, under the current situation, it is difficult for the PR alone to create new financial resources for development.

The reason why the PR has continued to incur losses lies in the following facts.

(i) A railway business requires enormous investment to develop infrastructure such as Land, Structural & Engineering Works and Equipment.
(ii) The current Operation & Maintenance (O&M) and investments of the PR need to be reviewed and improved.

With regards to (i), considering the nature of a railway business, large investments are inevitably required to develop infrastructure, and the financial support of the government is also indispensable. On the contrary, there could be some losses caused by possible inefficiencies (Fact (ii)), which should be eliminated.

However, there is no accounting and management system in place to distinguish the losses caused by the possible inefficiencies from the ones caused by the investments. In addition, as the exact depreciation costs are not able to be calculated, it is difficult to grasp the influence of each investment on the profit and losses of the business.

2.3.7 Issues and Problems

(1) Infrastructure

a) Insufficient Signalling System

A tragic accident occurred at Sharhad on 19th of July 2005. This accident could have been avoided with a proper signalling system.

Various types of interlocking systems are applied, but some stations on miner lines are excluded from the interlocking system. In addition, the ATP has so far been installed even though the operation speed is 120km/hr.

An automatic block system has only been installed over a section of 188 km out of 7,791 km, and is not been installed even in the double track sections. Most of the signals, other than the sections with the automatic block system are semaphores which are dim, difficult to be recognized in night time, and require frequent maintenance work. Improvement of the signalling systems, including the installation of automatic train protection devices (ATP), is postponed.

The existing signalling system is insufficient for the current operation and safety requirements due to because of the following problems;

- No back-up system,
- Many staff required to switch signals,
- No spare parts due to quite old types of signals,
- Quite small line capacity regardless the double track,
- Low night visibility of semaphores at night and higher danger of oversight,
- Restricted train speed at 15 km/hr in large station yards

b) Unsatisfactory Telecommunication System

The telecommunication system aids the sales systems and smoothes train operation smooth leading to a credible high-quality service and raising safety levels. The current telecommunication system is not satisfactory for a sustainable railway network.

Table 2.3.19 Problems with the Existing Signalling System

Item	Remark
No back up System	A backup system is important because the scale of damage caused by an accident on the railway is very large. There are many trains running on the Main Line, and the ratio of accidents such as oversight of signals is likely to be high. In addition, since the Pakistan Railways operate high-speed trains at the speed of 105–120 km/hr, an accident may result in quite large damages. However, currently, no automatic train protection system (ATP) has been installed to provide a back-up system and protect against human errors such as oversight of red signal.
Many staff required to switch signals	At each stations, it is necessary to allocate a group of five staff for each of three shifts at a station – a station master (or their alternative), one signalman for signal cabins in each direction, and one sub-signalman for the turnouts in each direction. (The reason for the allocation of sub-signalmen is that a turnout sometimes does not function by remote control from a signal cabin.). Taking account of backup staff for holidays and staff for management, it is necessary to allocate at least 25 staff at each station. Since only one train is allowed to run between an adjoining two stations, stations are laid out at every 10 -15 km in the section between Karachi and Lahore on the Main Line, where the train operation density is high. The group of staff is allocated at each station.

cont. of Table 2.3.19

Item	Remark
No spare parts due to quite out-dated type of signals	No suppliers can provide spare parts as the signals in use are quite out-dated. Currently, the Pakistan Railways makes do with some spare parts from abolished stations. However, in case additional spare parts are required more in the future, the Pakistan Railways has no choice but to purchase specially manufactured expensive parts. By the abolishing some stations, the Pakistan Railways curtailed the number of staff required, however the spacing between some stations became longer causing new bottlenecks.
Quite small line capacity regardless of the double tracks	Only one train is allowed to run in one direction between adjacent stations. It takes a long time to communicate and switch signal levers in order for a follow-on train to depart from the preceding station. The long handling time of the current signalling systems disturbs the smooth train operation and amplifies delays. During the site investigation, it was often observed that trains were forced to slow down or make a long stop for changing handling levers. Therefore, despite the double track section, the line capacity is quite low, and other facilities are not utilized efficiently. Note: JICA Study Team
Long waiting time required to overtake a train running at a different speed	When a slow freight train or local passenger train is overtaken by an express train, the slow train is forced to wait until the express train passes, because only one train at a time is allowed to run between stations. In this case, the waiting time for those trains is the total of the following 1) and 2): 1) running time of an express train for two station-to-station distances and signal sighting distance; and 2) time for switching signal levers twice. Depending on the station-to-station distance, a train will be required to wait for 20-30 minutes. There is not only the long waiting time, the number of times a train needs to stop also increases, because the next train will catch up with the waiting train. Therefore, the travelling time for slow trains becomes quite long. In the time zone when express passenger trains are in operation at intervals of 20–30 minutes, once caught up with, slow trains may not be able to run forward for quite some time. This causes a serious drop in the average train speed for freight trains. Taking economic efficiency into account, it is not realistic to operate heavy freight trains at high-speeds like passenger trains. Although high performance wagons are to be introduced in the future, the problem of long waiting times will remain to some extent. With regarding to local passenger trains, delays further amplify the long unexpected waiting times. In order for an express train to avoid overtaking a local train at a middle station, the express train sometimes follows the local train until a large station is reached, where the standing time will be long.
Low night visibility of semaphores and higher danger of oversight	A semaphore is an obscure lamplight through coloured glass, and it is too dim to recognize during the night time. An oversight of a signal sighting sign may cause a driver to be late in the sighting the signal. In fact, a driver will sometimes turns off the headlights to confirm the signals.
Restricted train speed at 15 km/hr in large station yards	Train speed is regulated at 15 km/hr in the following large station yards; Karachi City, Karachi Cant., Kotri, Hyderabad, Rohri, Samasata, Lodhran, Sher shah, Multan Cant., Khanewal, Raiwaind and Lahore. This train speed significantly influences travel times. The signalling system, track alignment in station yards and inadequate maintenance of turnouts, creates th need for this speed restriction. It is necessary to improve the train speed by the improvement of the signalling system and track strengthening work including turnouts on the main tracks.

Note: JICA Study Team

c) Delay in Track Strengthening/Rehabilitation Works along the Main Corridor

Currently, the actual maximum speed is 95 to 105 km/hr on the main corridor. The actual speed meets the present requirement for transport services, but it is not sufficient for sustainable railway management.

d) Remaining Single Track Section on the Main Corridor

A single track section of 245 km (Khanewal - Raiwind) is still remaining on the main

corridor. The traffic is heavy in this section as well as the other double track sections. However, the scheduled speed is forced to be reduced in this section because trains must wait to exchange, and delays are amplified by unexpected waiting. This means that the single track section disturbs effective train operation.

e) Aging of Bridges and Poor Repainting Work for Steel Bridges

Most of the bridges have problems due to aging. In particular, five bridges are recognized as "Bridges requiring attention", and rehabilitation or reinforcement works are required according to the level of aging. In addition, repainting work for the maintenance of steel bridges has not been adequately due to the lack of funds and skilled work force.

f) Inadequate Priority for Electrification

The Pakistan Railways has planned to extend the electrified section to Samasata together with the rehabilitation of the existing electrified facilities that are aging. They also plan to electrify the second track to meet the double tracking plan just within the electrified section. (The existing electrified section is 285 km and the proposed is 404 km in total.)

There is a low priority for the extension and rehabilitation of the electrified section, because partial electrification is inefficient. Partial electrification requires the frequent changing of, and only short runs for locomotives. In addition, the power supply in Pakistan is not stable enough to extend the electrification.

The double-tracking plan has a higher priority than electrification. It is not possible to electrify only one track of a double track. Therefore, in carrying out double tracking, due consideration should be given to the choice of electrification.

(2) Rolling Stock

a) Shortage of Reliable and High Performance Locomotives

Currently, the Pakistan Railways owns 557 locomotives, but the age of more than half of these is beyond their expected lifetime, which increases maintenance works.

b) Shortage of Suitable and Attractive Passenger Coaches

The existing fleet of passenger coaches is insufficient to carry out the required services. Express trains are always crowded, and people are forced to purchase tickets far in advance to reserve their seats. Commencement of new train services and additional coaches resulted in an increase of passengers in recent years.

Out of new 175 coaches, New 108 have been imported from China. These commenced operation in 2003/04. Out of the 450 coaches in a rehabilitation plan, 317 are sent from the Carriage Factory, Islamabad. Some of them are converted to allow for the new service of "air-conditioned lower (special)".

The maximum permissible operation speed of these new and rehabilitated coaches is 140 km/hr, if all other conditions are satisfied. They have the much potential to improve the services and competitiveness in the future, however, at present the quantity and service level of passenger coaches is too low.

c) Shortage of High Performance Freight Wagons

The operation speed of freight trains is relatively the low due to low performance of the existing freight wagons.

PR has only 130 flat wagons (purchased from China) for container transport which can be regarded as high performance wagons. Almost all freight trains operate at less than 55 km/hr. Such low speed operation requires not only a long operating time but also a long waiting time. Thus, the average speed is extremely low, and the current system of railway freight

transport is not able to meet the market demand. In addition, low speed operation interrupts the effective use of valuable locomotives.

Most of the existing 4-wheelers will be useless in the near future because they are unsuitable for the current transport system.

(3) Transport

a) Severe Competition

The passenger transport on the Pakistan Railways is steady with express services for middle to long distance intercity transport. However, competition from road transport is predicted to be further intensified in the future with the progress of road construction projects and the development of the automobile industry. Moreover, as the Pakistan economy develops, customers of the upper class railway services who pay high fares will become wealthier. Consequently, those customers will shift to air transport or begin to use private cars. The Pakistan Railways operate in a severely competitive environment. Therefore, continuous to keep up with the changing environment are required for the railway to survive.

b) Low Fares

One of the key problems in passenger transport is that the "economy class" fare is too low to cover the costs despite the fact that earnings from the economy class are the main earnings. The revenue from economy class and second class amounts to 77% of the total revenue from passenger transport. Considering the highly competitive situation, it is necessary to raise fares and offer higher quality services that can attract passengers and attract higher fares, for example the introduction of the "Air-conditioned Lower (Special)".

c) Serious Delays

Long distance trains have considerable delays, and the length of the delay accumulates towards the end of the journey. This is a serious problem that degrades the value of the railway service. For example, the service of "7up Tezgam" from Lahore to Rawalpindi appears to be convenient on the time table, but actual operation times are not given on the time table.

For example, the actual delays observed by the study team during the site investigation were as follows (Table 2.3.20).

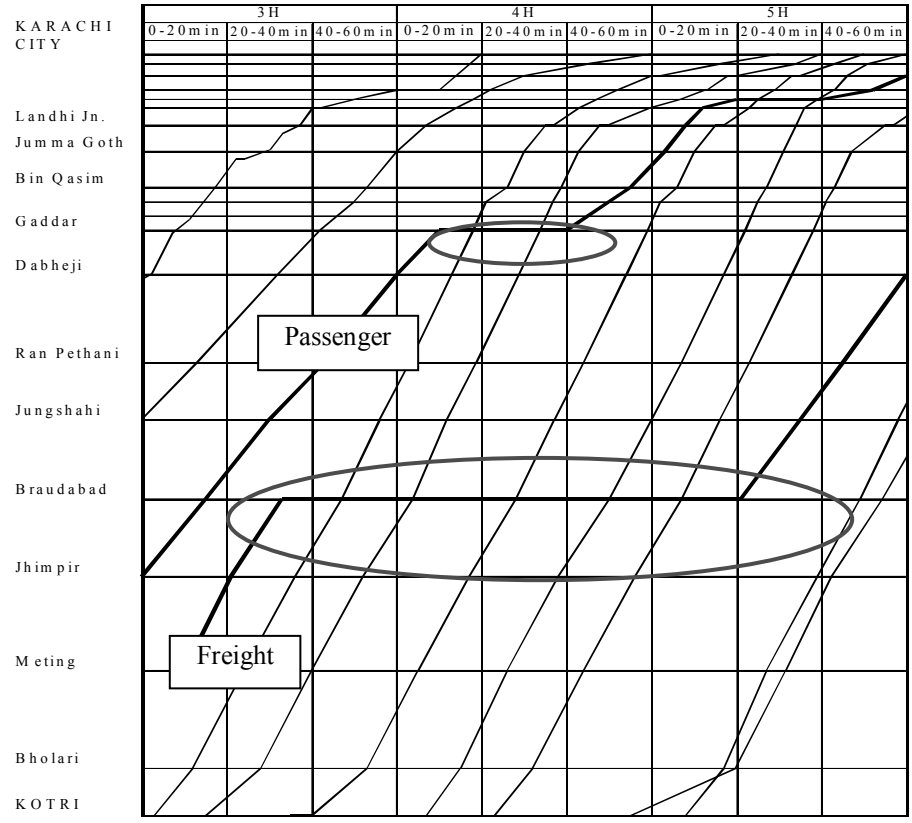
Table 2.3.20 Actual Delays Observed

Date	Train #	Station	Delay
20 July 2005	8DN	Khanewal Jn.	1 hr. 13 min.
	a	Rohri Jn.	4 hr. 36 min.
	a	Karachi Cantt.	4 hr. 55 min.
28 July 2005	29UP	Dabheji	15 min.
		Ran Pethani	47 min. (increasing 32min.in 18.4 km)
		Rohri Jn.	1 hr. 6 min.
		Lodhran	1 hr. 48 min.
		Multan	1 hr. 55 min.
29 July 2005	115UP	Multan (Start)	41min.
		Lahore	1 hr. 40 min.
30 July 2005	103UP	Rawalpindi	26 min.

Source: JICA Study Team

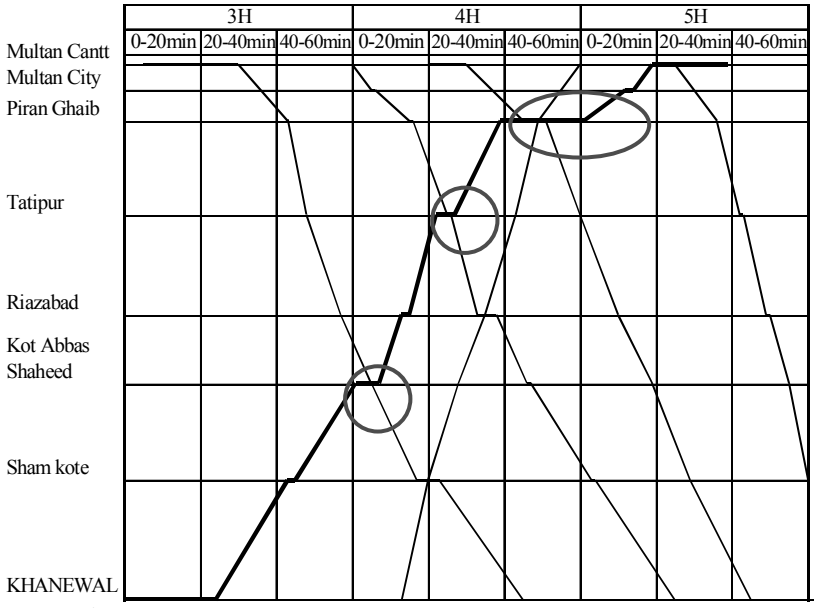
On 28 July 2005, the 29UP train took 42 minutes from Dabheji to Ran Pethani (18.4km) accumulating a delay of 32 minutes This delay was caused by speed restriction attributed to the track strengthening work over a long section. Construction/maintenance work should be limited to an appropriate length to minimize delay to train in service. To decide this length, both the economic efficiency of the construction/maintenance work and the effect of the works on the quality of services should be taken into consideration.

Figure 2.3.5 and Figure 2.3.6 illustrate examples of long waiting time of trains, which express the level of service of the existing train operation.



Source: JICA Study Team

Figure 2.3.5 Example of Long Waiting Time of Freight Train



Source: JICA Study Team

Figure 2.3.6 Example of Long Waiting Time on Single Track Line

d) Insufficient Capacity

The carrying capacity of the passenger transport is insufficient. The express trains, which are the main services on the Pakistan Railways, are always overcrowded and it is difficult to offer immediate seat reservations. Travelling without a seat is unfavourable for long distance express services. This situation results in customers in choosing other means of travel.

e) Less Attention to Freight Transport

Currently freight transport is not treated on an equal terms with passenger transport. For example, there is a higher priority for locomotives to be used for passenger transport. Freight trains have no fixed operation diagram and no precedence in the actual operation adjustment. In order to prosper, it is essential that the freight business, such as high speed container transport, obtains equal status with passenger transport.

(4) Administration

a) Obscure Responsibilities for Each Business Unit

The responsibilities of the three business units under the operation unit; the infrastructure business unit, passenger business unit and freight business unit, are not clearly divided.

b) Non-core Business Activities under the Direct Management of PR

The non-core activities under the Manufacturing and Services Unit are managed together with the railway under the unified regulation, and their customers are limited to the Pakistan Railways. This situation prevents the activities from prospering by broad and free business and forces the Pakistan Railway to bear a considerable burden.

The non-core businesses are to be separated from the railway as stand alone businesses so that each business can be well managed. They can then expand their customer bases and business categories, make the most of their property and human resources and raise efficiency by applying suitable management principles without any restraints from the railway management.

For example, the carriage factory is able to manufacture not only carriages but also steel bridges, large automobile chassis/bodies and containers for customers other than the Pakistan Railways. Concrete sleeper factories are able to manufacture various concrete products such as piles, poles, U-shaped gutters as well as sleepers. They can sell those products to a broad range of customers.

As for hospitals and schools, a comprehensive reform must be carried out whereas the facilities can be useful as property.

(5) Summary of Issues

The Pakistan Railways has many issues. They are mainly due to a backlog caused by a shortage of funds in the 1990s. Other issues are the result of overlooking the demand in the transport market.

The issues are summarized below:

- Completion of track strengthening of the main corridor, in which the maximum speed of 120km/hr is applied for the highest standard section;
- To set maintenance schedule and to make outfit and equipment satisfactory with track maintenance work because not only track strengthening, but also maintenance work such as tamping and re-alignment is indispensable to keep tracks in good condition.;
- To improve telecommunication system – improvement of signalling systems inevitably accompanies enhancement of telecommunication systems;
- To double –tracked the single track section between Khanewal and Raiwind as early as possible, considering that improvement of bypass routes as an alternative is expected to be much more expensive than the double tracking;
- To increase the number of high performance locomotives in order to provide more reliable and sustainable services and to expand railway transport;.
- To secure high performance wagons and locomotives to realize high speed freight transport service ;
- To increase the number of coaches to improve quality of services;
- To introduce suitable high performance wagons as much as possible for railway freight transport to survive.

2.4 Port

2.4.1 Ports

(1) Introduction

Pakistan's coastline faces the Arabian Sea and is approximately 1,100 km in length, of which 330 km is in the Sind Province and 770 km is in the Baluchistan Province. The ports of Karachi and Qasim are located in the Sind Province and are the only deep sea ports in Pakistan as shown in Figure 2.4.1.

Along the coastline there are several ports including two international ports; the ports of Karachi and Qasim. Other ports are mostly small ports such as Jiwani, Gwadar, Pasni, Kalmat, Ormara, Sonmiani, Nargar Parkar and Keti Bunder.

Since 1950 Pakistan has expanded its port facilities. Karachi port was originally Pakistan's only port. A second port was built at the port of Qasim and became operative in the early 1980's. Government policy in recent years has been to promote privatization, and both ports have been developed with the assistance of private funds.

The total cargo volume through the two ports in 2003/04 was 43.4 million tons, about 1.6 times the volume in 1991/92. Therefore, this study considers the two ports of Karachi and Qasim as part of the study for the national transport plan.

(2) Natural Conditions

a) Geography

The Port of Karachi is located to the west of the mouth of the Indus River. The port is situated between the Western and Eastern Backwater. The Western Backwater (behind the West Wharf) is an area of approximately 35 km^2, and the Eastern Backwater (behind the East Wharf) is an area of about 6 km^2 and some of the area is covered with mangroves. The harbour entrance is protected by Manora Breakwater (480 m) and Keamari Groyne. The surface is mostly covered with mud and many creeks running through a shallow area.

The port of Qasim is located between Phitti, Kadiro and Gharo Creeks. The whole channel is divided into outer and inner channels with a total length of 43.7 km. The outer channel is open to waves approaching from the southwest during the monsoon season, while the other is in the protected creek.

b) Tides

The major tidal levels are as shown in Table 2.4.1.

Table 2.4.1 Tidal Levels

unit: m

Tidal Level		Karachi	Qasim
Highest Astronomic Tide	H.A.T	3.20	3.44
Mean Higher High Water	M.H.H.W	2.68	2.93
Mean Lower High Water	M.L.H.W	2.19	2.26
Mean Sea Level	M.S.L	1.65	1.74
Mean Higher Low Water	M.H.L.W	1.10	1.22
Mean Lower Low Water	M.L.L.W	0.43	0.55
Chart Datum		0.00	0.00
Lowest Astronomic Tide	L.A.T	-0.43	-0.58

Source: Pakistan Tide Tables

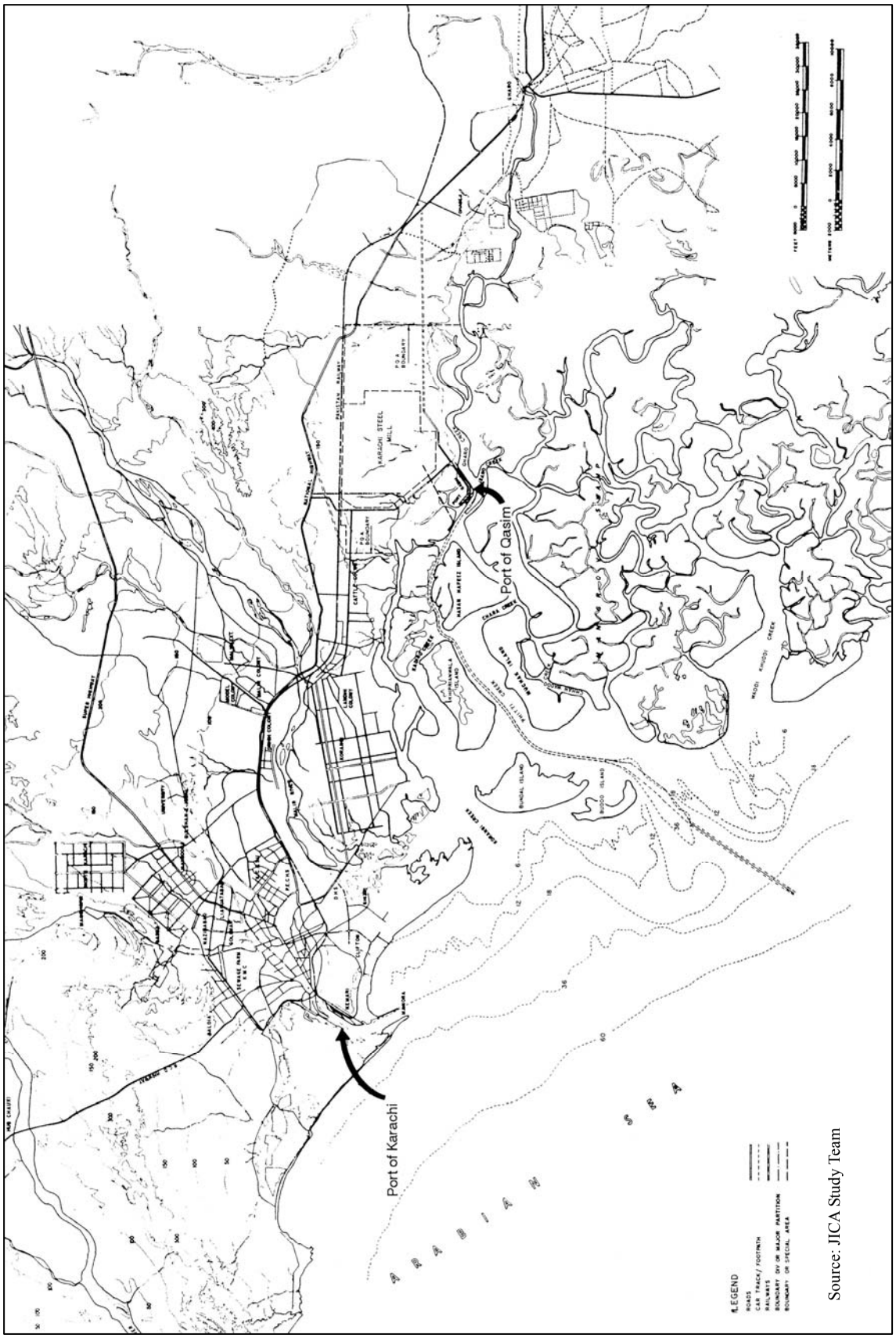


Figure 2.4.1 Karachi and Qasim Ports Area

c) Currents

Observations of the maximum velocity and direction of the currents at the port of Karachi were carried out at points near the top of the Manora Breakwater in July and August, 1971. According to the observations, the direction of the flood currents is eastward at both points. The velocity of the flood currents is approximately 0.3 m/sec. The direction of the ebb currents is south westward and the velocity is between 1 m/sec and 1.25 m/sec. These velocities are relatively low and can be considered not to affect the navigation of vessels.

The maximum velocity and direction of the currents at the outer channel of the port of Qasim during spring tide were assumed based on the two observation points. The direction of the current inside the Phitti creek was determined by the tides. Discharges of the rivers flowing into the creek are small, so their contributions are negligible. According to the Pakistani Chart (PAK-20), the maximum current velocity in the channel (near Buddo Island) during spring tide is 1.5 m/sec for flood current and 2.5 m/sec for ebb current. Velocities in Phitti creek are 1.25 m/sec for flood current and 1.5 m/sec for ebb current. It is understood that the current speed is generally not strong, however, during the spring tide period the maximum current could affect the navigation of ships in the narrow channel.

d) Earthquakes

Pakistan lies in the active seismic region which runs through Indonesia to the Himalayas. However, in the Karachi region, no earthquakes of any considerable magnitude are reported.

According to a map of the seismic zone prepared by the Department of Meteorology and Geophysics of West Pakistan, the seismic factor in the Karachi region ranges from 0.05 to 0.10. According to the "Soil Investigation Report for Marginal Wharf Project in Port of Qasim in 1976", the port area lies in a minor seismic zone, with acceleration ranging from 0.05 to 0.07.

(3) Berthing Facilities

a) Karachi Port

The Port has five water areas: the Approach Channel, Channel Bend, Lower Harbour, Upper Harbour and Juna Bunder. The berth facilities are comprised of the East Wharf, West Wharf, Juna Bunder Wharf, Barge Wharf and Oil Piers, which have transit sheds or plinth. The entrance of the port is protected from open sea waves by the Keamari Groyne and Manora Breakwater as shown in Figure 2.4.2.

There are a total of 30 berths, 17 on the East Wharf, 7 berths on the West Wharf and 6 berths on the Juna Bunder Wharf. Three Oil Piers including Oil Pier II which is under construction are located in the lower harbour.

In addition, there are two international container terminals such as Karachi International Container Terminal (KICT) and Pakistan International Container Terminal (PICT) as described below.

KICT is situated at berth Nos. 28 to 30 on the West Wharf with a total quay length of 600 m. The major shipping lines using the KICT terminal are: APL, Cosco, Evergreen, Hanjin HMM, Lloyd Triestino, OOCL, PONL, Seacon, TSK, Wan Hai and Yang Ming.

PICT is situated at berth Nos. 6 to 9 on the East Wharf with a total terminal area of some 22 hectares, a quay length of 600 m and a water depth in front of the quay of 10.5 m.

Lists of the channels, berths and storage facilities are presented in Table 2.4.2, Table 2.4.3 and Table 2.4.4.

Table 2.4.2 Navigation Channels at the Port of Karachi

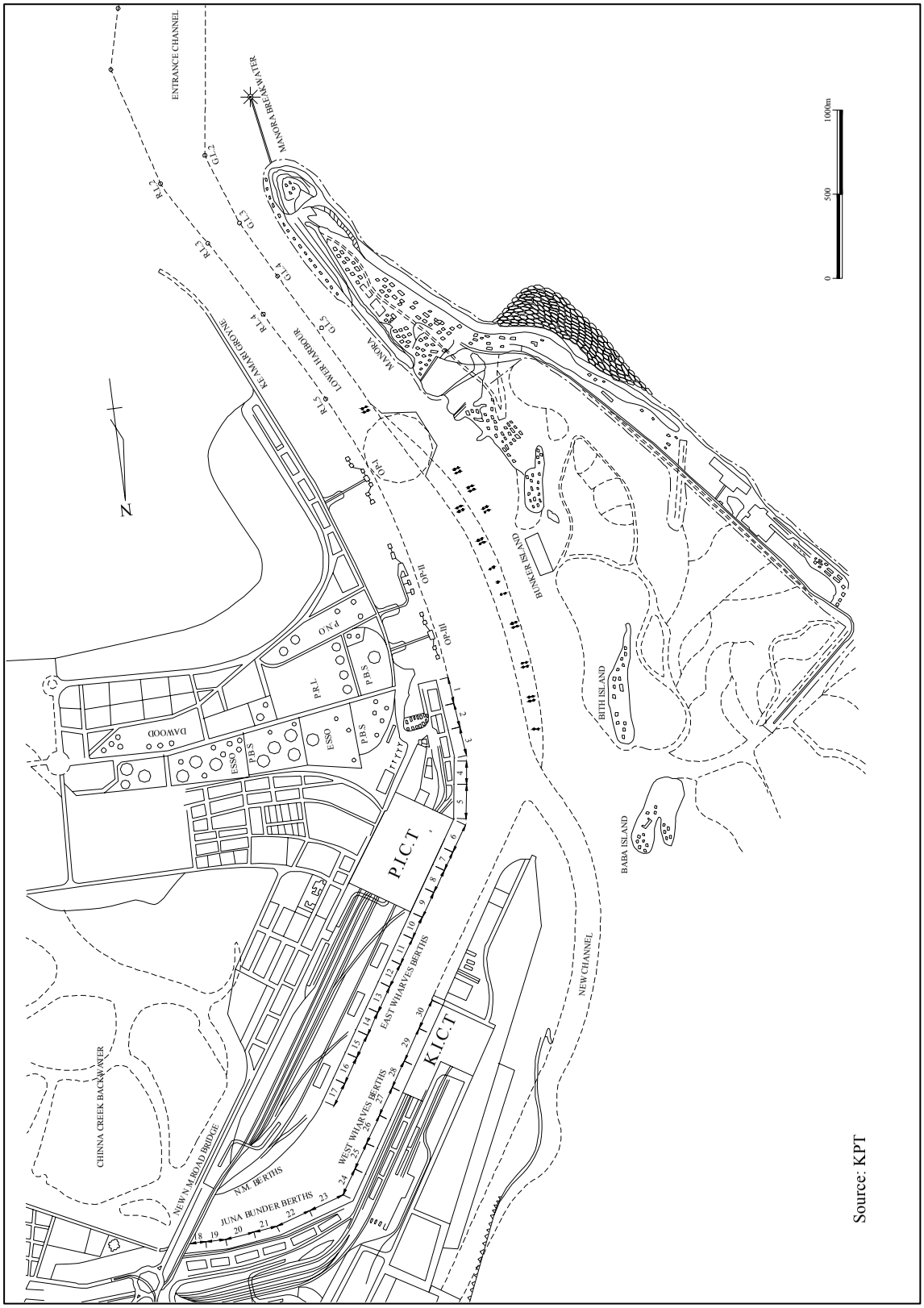
Sectors	Length (m)	Width (m)	Sanctioned Depth (m)
Approach Channel	2,870	180	12.2
Entrance Channel Bend	1,550	200-600	12.2
Lower Harbour	3,075	200-300	11.3
Upper Harbour	2,435	200-330	10.7
Juna Bubdar	1,510	200-300	9.1
PIDC Channel	-	-	7.6

Source: KPT

Table 2.4.3 Berth Facilities at the Port of Karachi

Wharf	Berth No.	Length (m)	Sanctioned Depth (m)	Design Depth (m)	Remarks
East Wharf	1	157	10.4	11.6	
	2	146	10.4	11.6	
	3	171	10.4	11.6	
	4	137	10.4	11.6	
	5	204	11.5	13.7	
	6	177	11.5	13.7	PICT
	7	119	11.5	13.7	
	8	146	11.5	13.7	
	9	162	11.5	13.7	
	10	140	10.4	10.5	
	11	168	10.4	10.5	
	12	148	10.4	10.5	
	13	168	10.4	10.5	
	14	148	10.4	10.5	
	15	148	10.4	10.5	
	16	168	10.4	10.5	
	17	148	10.4	10.5	
Total	17	2,655			
Juna Bunder	18	148	9.1	10.5	
	19	165	9.1	10.5	
	20	165	9.1	10.5	
	21	162	9.1	10.5	
	22	168	7.3	7.3	
	23	168	7.3	7.3	
Total	6	976			
West Wharf	24	168	9.8	10.5	
	25	168	10.4	10.5	
	26	183	10.4	10.5	
	27	183	10.4	10.5	
	28	171	10.4	11.6	KICT
	29	213	10.4	11.6	
	30	183	10.4	11.6	
Total	7	1,269			
Oil Berth	OP-I	322	13.4	14.6	Max. 35,000 DWT
	OP-II	-	-	-	Under construction
	OP-III	-	13.4	13.7	Max. 75,000 DWT
Total	3	-			

Source: KPT



Source: KPT

Figure 2.4.2 Port of Karachi

Table 2.4.4 Storage Facilities at the Port of Karachi

unit: m^2

Location	Covered Area	Open Area	Total
East Wharf	69,815	182,315	252,130
West Wharf	64,590	194,122	258,712
M.I Yard/Juna Bunder	15,812	57,321	73,133
K.G.C.C.	11,151	63,187	74,338
T.P.X	147,203.5	156,688.5	303,892
New T.P.X.	-	26,357	26,357
Total	308,571.5	679,990.5	988,562

Source: KPT

b) Qasim Port

The Port is located about 60 km south-east of the port of Karachi, and became fully operational in 1983. It has an entrance navigation channel of about 44 km in length, which allows the passage of 50,000 DWT ships at high tide and 25,000 DWT ships in all weather conditions as shown in Figure 2.4.3. Lists of the channels and berths are presented in Table 2.4.5 and Table 2.4.6.

Table 2.4.5 Navigation Channels at the Port of Qasim

Sectors	Length (m)	Width (m)	Sanctioned Depth (m)
Approach Channel	14.1	225	14.5
Inner	25.1	200	12.5
Reach	4.5	300	12.0

Source: PQA

Table 2.4.6 Berth Facilities at the Port of Qasim

Wharf/Terminal	Berth No.	Length (m)	Depth (m)	Apron Width (m)	Remarks
Marginal Wharf	1	200.0	10.0	30.0	
	2	200.0	10.0	30.0	
	3	200.0	10.0	30.0	
	4	200.0	10.0	30.0	
sub-total	4	800.0			
Qasim International Container Terminal (QICT)	5	200.0	12.0	32.8	QICT
	6	200.0	12.0	32.8	
	7	200.0	12.0	32.8	
Sub-total	3	600.0			
Total	7	1,400.0			
Iron Ore and Coal Berth (IOCB)	1	279.0	12.8	21.0	
FOTCO Oil Terminal	1	280.0	12.0	20.0	
ENGO Vopak Terminal	1	325.0	11.0	15.0	

Source : PQA

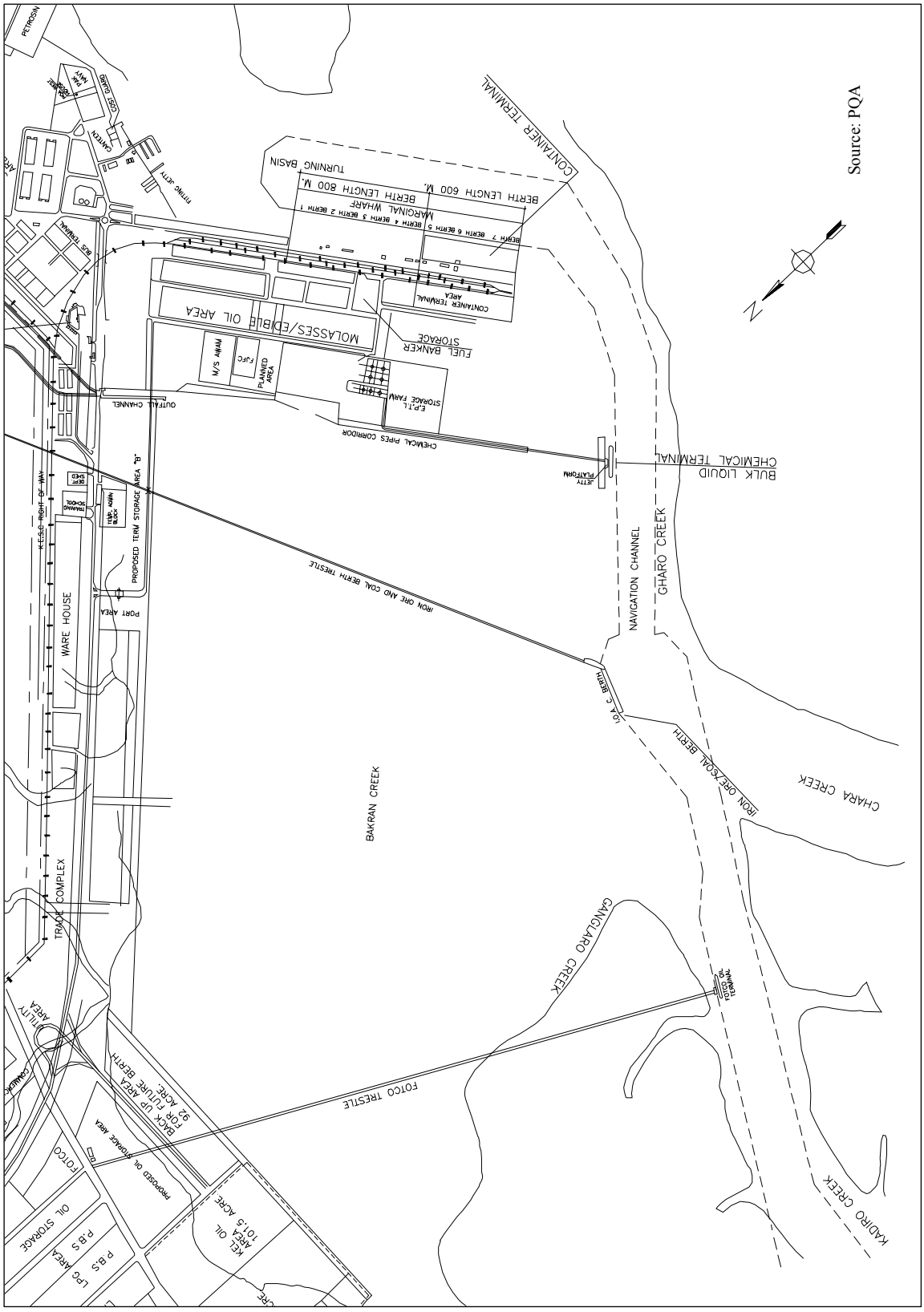


Figure 2.4.3 Port of Qasim

The "Marginal Wharf" is comprised of seven berths with a total length of 1,400 m. Berth Nos. 1 to 4 are used as multi-purpose terminals and handle edible oil, liquid bulk, chemicals and LPG (berth No. 1), wheat, fertilizer, rice and cement (berth Nos. 3 to 4) and can take fully laden ships up to 25,000 DWT. Berth Nos. 5 to7 are used for container handling by

QICT and can accommodate ships up to 35,000 DWT. There are four private terminals as follows.

Iron Ore and Coal Berth (IOCB)

The berth is exclusively used by Pakistan Steel Mills and designed to accommodate ships of 75,000 DWT, however, due to channel constraints, the cargo parcel size is limited to about 55,000 tons. The permissible LOA is 225 m and beam is 40 m. Current depth alongside is 12.8 m. The berth is connected to a stockyard by a 4.5 km conveyor belt system and has two unloaders (grab gantry cranes) with a rated capacity of 600 tons/hour per unloader (total is 1,200 tons/hour).

Qasim International Container Terminal (QICT)

The berth is situated at Nos. 5 to 7 of the marginal wharf including a 400 m back up space. Total berth length is 600 m with a width of 32.8 m and a water depth of 12.0 m. Therefore, the permissible dimensions of vessels are 245 m LOA, 32.25 m beam and 11.0m draft. The total terminal area is about 240,000 m^2, with a stacking area of about 195,000 m^2. Cargo handling operations within the terminal are performed by the terminal's own staff. The major shipping lines using the QICT terminal are: Maersk Sealand, NSCSA, PONL and TSK.

FOTCO Oil Terminal

The berth is designed to accommodate vessels up to 75,000 DWT but due to the limited channel depth, the maximum draft of vessels is 11.0 m. Vessel size of up to 245 m LOA and 40 m beam are permitted. Current depth alongside is 12.0 m. The cargo loading/unloading facilities consist of two 16-inch marine loading arms. The cargo pipeline supplies the onshore terminal point about 4 km from the berth.

Engro Vopak Terminal

The berth was constructed in 1997 and is 11.0 m in depth. Cargo handling is carried out by loading arms or hoses depending on the cargo. The berth is connected to the storage area by a causeway of 2 km, with pipelines for various chemicals and LPG running along the trestle.

2.4.2 Port Transport

(1) Cargo Handling Volume

Table 2.4.7 summarizes the total cargo volume and annual increase rate from 1991/92 to 2003/04 at the ports of Karachi and Qasim. Exports and imports of general cargo have been increasing at high growth rates. The annual growth rate of exports is higher than that of imports.

Table 2.4.7 Cargo Handling Volume at the Ports of Karachi and Qasim

	Handling Volume (000' tons)				Annual Growth Rate (%)		
	1991/92	1993/94	1998/99	2003/04	1991-04	1993-04	1998-04
Import							
General Cargo	3,821	4,111	5,884	11,191	9.4	10.5	13.7
Dry Bulk Cargo	7,090	6,810	7,129	6,377	-0.9	-0.7	-2.2
Liquid Bulk Cargo	10,706	13,455	17,642	15,824	3.3	1.6	-2.2
Total Import	21,618	24376	30,655	33,391	3.7	3.2	1.7
Export							
General Cargo	2,872	2,736	3,233	6,647	7.2	9.3	15.5
Dry Bulk Cargo	1,474	855	2,189	976	-3.4	1.0	-14.9
Liquid Bulk Cargo	1,648	2,102	2,512	2,411	3.2	1.8	-0.8
Total Export	5,993	5,633	7,935	10,034	4.4	5.9	4.8
Total (Imp+Exp)	27,611	30,009	38,590	43,425	3.8	3.8	2.4

Source: JICA Study Team

a) Karachi Port

Figure 2.4.4 shows the cargo tonnage handled by type of cargo at Karachi port for 1991/92 through to 2003/04. During this period the total port traffic increased from 20.5 million tons in 1991/92 to 27.8 million tons in 2003/04. Traffic at the port has been predominately imports with 21.7 million tons of imports in 2003/04 accounting for 78.1% of total traffic.

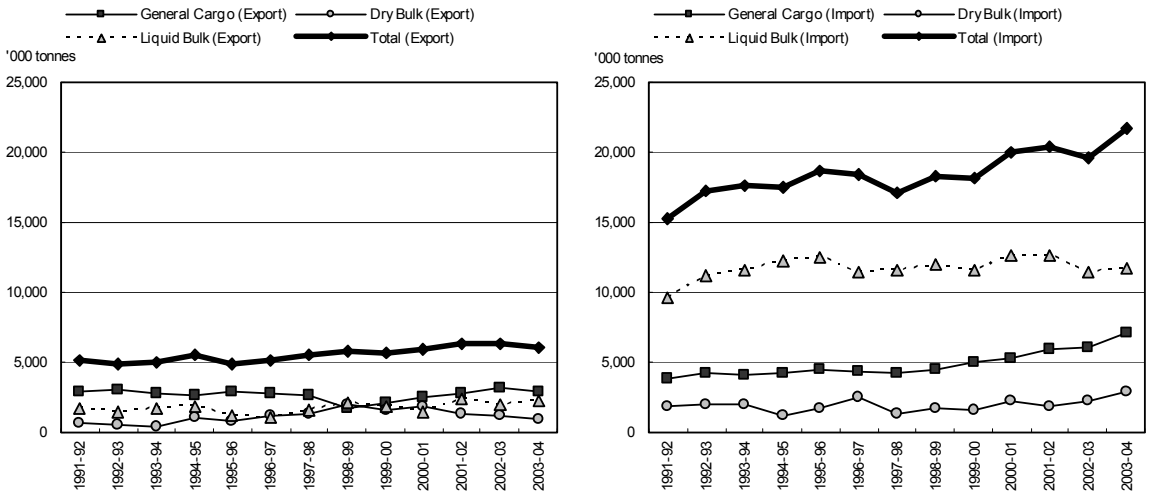


Figure 2.4.4 Cargo Handled at the Port of Karachi

Imported Cargoes

There has been a significant difference in the growth of general cargo, dry bulk, and liquid bulk within imports.

As can be seen from Table 2.4.8, imported general cargo reached 7.1 million tons in 2003/04 up from 3.8 million tons in 1991/92 and 4.5 million tons in 1998/99. This represents annual increase rates of 5.3%, 5.6% and 9.3% from 1991/92 to 2003/04, 1993/94 to 2003/04 and 1998/99 to 2003/04 periods, respectively.

Dry bulk dropped from 1.9 million tons in 1991/92 to 1.8 million tons in 1998/9, however it then rapidly increased to 2.9 million in 2003/04 on the strength of an annual average increase rate of 10.7%.

Liquid bulk steadily increased from 9.6 million tons in 1991/92 to 12.0 million tons in 1998/99, however, fell to 11.7 million tons in 2003/04. Diesel and other oils rapidly increased to 3.6 million tons in 2003/04 from 0.7 million tons in 1991/92. However, crude oil and fuel oil decreased from 8.4 million tons in 1991/92 to 7.5 million tons in 2003/04 and from 1.1 million tons in 1991/92 to 265 thousand tons in 2003/04.

Exported Cargo

The total exported cargo at Karachi port marginally increased from 5.2 million tons in 1991/92 to 6.4 million tons in 2001/02, however, exports were down slightly in 2003/04 at 6.1 million tons.

Exported general cargo registered 2.9 million tons in 2003/04 or 48.1% of total export, which is basically unchanged from the approximately 3.0 million tons recorded in 1991/92.

The handling volume of rice reached 761 thousand tons in 2003/04 and accounted for 81.2% of dry bulk exports.

Molasses exports reached 1.5 million tons in 2003/04, accounting for 68.7% of total liquid bulk exports. Naphtha and petroleum products registered 695 thousand tons in 2003/04, accounting for 31.3% of liquid bulk exports.

b) Qasim Port

Figure 2.4.5 shows the cargo tonnage handled by type of cargo at Qasim port for 1991/92 through to 2003/04. During this period, total port traffic rapidly increased from 7.2 million tons in 1991/92 to 15.6 million tons in 2003/04 with an annual increase rate of 6.7%. Traffic at the port has been predominately imports, with 2003/04 imports of 11.7 million tons accounting for 74.7% of total traffic.

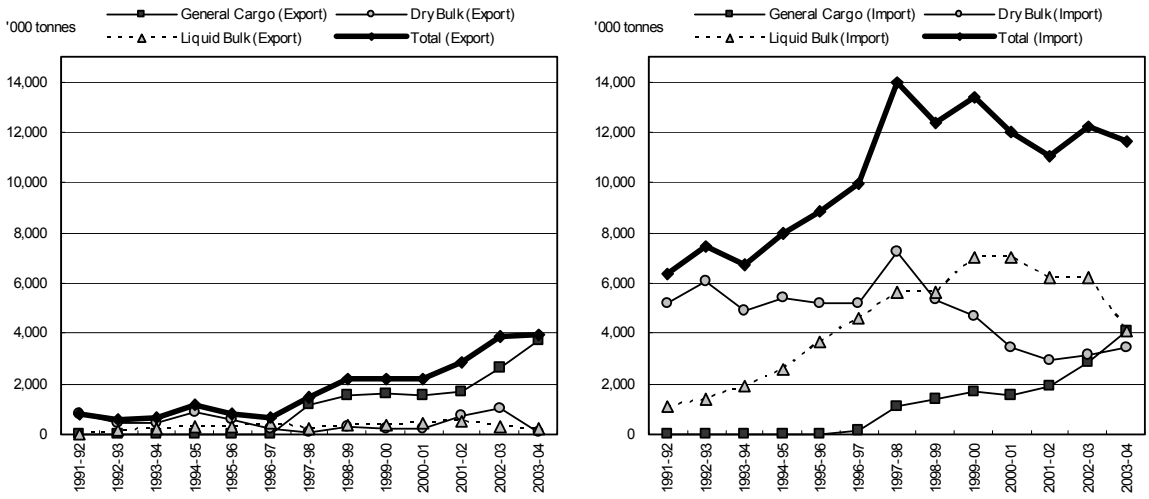


Figure 2.4.5 Cargo Handled at the Port of Qasim

Imported Cargoes

As can be seen from Table 2.4.9, total imports rapidly increased from 6.4 million tons in 1991/92 to 13.4 million tons in 1999/00, however, decreased to 11.7 million tons in 2003/04. This represents an annual increase rate of 5.2%, 5.6% and -1.1% from 1991/92 to 2003/04, 1993/94 to 2003/04 and 1998/99 to 2003/04 periods.

Dry bulk cargo steadily increased from 5.2 million tons in 1991/92 to 8.4 million tons in 1997/98, however, decreased to 7.6 million tons in 2003/04. General cargo makes up 35.4% of the total imported cargo and has rapidly increased from 16 thousand tons in 1991/92 to 4.1 million tons in 2003/04 with an annual increase rate of 58.8%. Liquid bulk rapidly increased from 1.1 million tons in 1991/92 to 7.1 million tons in 1999/00, however, decreased to 4.1 million tons in 2003/04. Edible oils rapidly increased from 19 thousand tons in 1992/93 to 1.4 million tons in 2003/04.

Exported Cargo

Total exports at Qasim port in 2003/04 reached 4.0 million tons with an annual growth rate of 14.2% from 1991/92 through 2003/04. Of this total 3.7 million tons or 94.2% were general cargo.

Table 2.4.8 Cargo Handled at the Port of Karachi

Unit:000'ton

	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
IMPORTBULKCARGO													
Cement	7	45	89	301	24	0	0	0	0	7	0	0	0
Fertilizer	832	1,154	1,433	568	1,291	1,738	1,073	1,563	1,158	981	1,060	1,278	1,281
RockPhosphate	314	280	276	251	320	183	165	162	286	294	322	307	324
IronScrap	596	353	62	0	45	131	100	24	43	329	225	30	72
Sugar	113	59	39	1	0	460	0	0	39	581	42	53	67
Sulphar	23	39	26	21	11	23	15	15	29	35	8	7	15
Repseeds				0	0	0	0	0	0	21	34	70	0
Wheat	5			3	3	0	0	0	4	8	0	47	0
Coal&Coke				0	0	0	0	0	0	0	102	299	1,126
SoyaBean				0	0	0	0	0	0	0	48	87	50
Bitumen				0	0	0	0	0	0	0	0	0	3
Total	1,889	1,930	1,926	1,146	1,693	2,536	1,352	1,764	1,559	2,255	1,841	2,178	2,939
IMPORTGENERALCARGO													
Bamboos				1	4	2	3	0	0	0	0	0	0
Dyes&Chemicals	167	172	144	162	193	172	106	128	127	100	81	117	72
Jute				49	5	5	15	68	73	100	89	92	120
NewsPrin-				45	49	45	25	19	22	15	10	7	2
OtherPaper				46	47	42	21	23	8	10	8	19	4
Timber				1	3	2	2	2	3	2	5	23	8
Logs				21	16	23	21	8	13	13	12	5	12
Tea	56	69	56	62	42	25	27	54	39	0	0	13	37
Iron&Steel	395	399	456	544	600	387	283	389	504	655	617	634	734
MotorVehicles	24	81	32	16	11	13	9	11	11	2	4	7	8
Tractors				0	0	0	0	0	0	0	0	0	0
RubberScrap				2	4	1	1	0	0	0	0	0	0
DangerousCargo	50	52	53	49	59	44	34	36	30	21	21	11	8
AfghanCargo	56	61	75	91	52	52	70	59	76	144	198	197	219
OtherCargo	3,057	3,352	3,285	3,090	3,389	3,544	3,597	3,723	4,044	4,180	4,832	4,937	5,841
Total	3,805	4,187	4,101	4,181	4,475	4,357	4,215	4,520	4,952	5,241	5,875	6,063	7,064
IMPORTLIQUIDBULKCARGO													
CrudeOil	*1 8,378	*1 9,454	*1 10,384	4,022	4,252	3,841	4,233	4,499	4,584	6,860	7,528	7,174	7,519
Diesel&OtherOil	*2 67	*2 154	*2 119	5,263	5,859	5,650	5,509	5,852	5,949	4,651	3,683	3,215	3,616
FuelOil	*3 1,127	*3 1,531	*3 1,081	1,559	1,448	1,240	1,205	1,016	642	615	803	648	267
PalmOil				1,097	818	558	382	237	183	264	391	197	144
Soyabeanoil				196	104	150	136	339	183	106	167	74	74
Tallow				62	71	31	82	91	97	71	41	87	110
Total	9,572	11,139	11,585	12,200	12,552	11,470	11,547	12,034	11,639	12,567	12,614	11,395	11,730
TotalImports	15,266	17,255	17,611	17,526	18,719	18,362	17,114	18,318	18,149	20,063	20,330	19,637	21,732
EXPORTBULKCARGO													
Fertilizer				0	0	0	0	0	0	1	0	25	0
Rice	565	436	420	990	741	1,088	1,202	1,607	1,469	1,769	1,227	904	761
Steel				0	0	0	0	0	11	0	0	0	0
Wheat				29	51	59	0	0	0	0	0	153	27
ChoromeOre	42	44	20	19	1	0	66	43	92	91	79	70	40
Sugar			18	0	0	0	27	282	0	0	0	16	30
Cement	*4 65	*4 51		0	14	49	16	0	3	0	0	0	2
Clinker				0	0	0	6	0	0	0	0	0	42
Slag				0	0	0	0	0	0	0	0	0	35
Total	672	531	458	1,037	806	1,196	1,317	1,932	1,574	1,861	1,306	1,168	936
EXPORTGENERALCARGO													
Cotton	320	156	85	30	231	13	60	2	75	116	35	36	18
CottonYarn	240	211	251	257	237	223	43	72	165	113	128	91	54
Cowdung	143	199	186	85	4	0	0	0	0	0	0	0	0
FoodGrain				0	0	0	0	0	0	0	0	0	0
GuwerMeal/OilCake				37	64	24	16	9	22	13	12	7	11
Leather(hide&skin)				4	3	3	2	2	5	5	5	5	4
RiceBran				5	0	6	0	0	0	0	0	0	0
SportsGoods				7	10	13	5	2	5	7	8	6	4
Textiles	212	199	266	285	294	326	119	141	289	275	332	277	227
OtherCargo	1,952	2,213	1,948	1,966	2,087	2,193	2,415	1,450	1,601	2,031	2,189	2,680	2,606
Total	2,866	2,978	2,736	2,677	2,930	2,802	2,659	1,678	2,162	2,559	2,709	3,101	2,924
EXPORTLIQUIDBULKCARGO													
Molasses	1,081	1,013	1,614	1,701	1,027	1,049	1,517	2,070	1,718	1,128	1,734	1,292	1,525
PeroliumProduct	217	125	151	18	6	3	0	2	29	79	285	50	79
Naptha	*5 350	*5 267		101	64	30	21	21	111	283	321	659	616
Oil(ForBunkers)				37	30	34	56	32	17	9	6	2	0
Total	1,648	1,406	1,764	1,857	1,126	1,115	1,594	2,125	1,876	1,499	2,346	2,004	2,221
TotalExports	5,186	4,914	4,959	5,572	4,862	5,113	5,570	5,735	5,612	5,918	6,362	6,273	6,081
Total(Imp+Exp)	20,452	22,170	22,570	23,098	23,581	23,476	22,685	24,053	23,761	25,982	26,692	25,909	27,813

Note;*1:Crudeoil,diesel,fueloil,etc*2:LPG,kerosene,etc.*3:Edibleoils*4:Cementandclinker*5:Crudeoil
Source: KPT

Table 2.4.9 Cargo Handled at the Port of Qasim

Unit:000'ton

	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
DRYIMPORTS													
Wheat	2,215	2,866	1,686	2,526	2,031	2,541	4,243	3,228	2,050	125	256	132	66
Phosphate	0	28	0	0	0	0	0	0	0	0	52	436	463
Urea	338	317	27	26	82	0	0	0	0				
Sugar	12	12	0	0	0	211	7	0	0	440	0	0	0
Pulses	0	122	25	65	112	0	0	0	0	27	43	0	0
Cement	0	18	89	0	0	0	0	0	0				
Jute	0	0	17	35	66	88	91	10	9	0	0	0	0
PigIron	0	0	0	0	0	112	0	0	0				
Live-stock(Innumber	0	0	0	0	25	44	0	0	29	0	0	0	0
MobileUnits(Innumb	0	0	0	8	3	0	0	0	0				
IronOre	1,623	1,701	2,032	1,653	1,793	1,322	1,776	1,196	1,623	1,763	1,604	1,543	1,770
Coal	985	1,044	1,007	1,114	1,030	845	1,084	915	957	1,056	913	1,032	1,139
Mang.Ore	30	0	0	0	28	22	24	16	26	26	64	37	0
GeneralCargo	16	0	10	4	11	168	1,124	1,364	1,659	1,532	1,917	2,878	4,127
Sub-Total	5,218	6,109	4,894	5,431	5,180	5,352	8,350	6,729	6,352	4,969	4,849	6,058	7,565
LIQUIDIMPORTS													
FurnaceOil	1,103	1,345	1,704	2,280	3,256	3,802	4,665	4,115	5,502	4,664	3,611	3,775	702
Chemicals	31	16	17	19	30	72	126	370	669	762	562	560	930
EdibleOil	0	19	115	218	326	716	787	1,094	873	1,075	1,040	1,101	1,355
CarbonOil	0	0	0	0	0	0	0	0	0	7	5	19	167
LPG	0	10	35	58	49	25	23	28	12	0	11	8	20
HSD	0	0	0	0	0	0	0	0	0	496	1,004	734	920
Sub-Total	1,134	1,390	1,871	2,575	3,662	4,615	5,602	5,608	7,056	7,004	6,233	6,197	4,094
DRYEXPORTS													
Wheat(Re-exp)	0	0	0	0	0	0	0	0	0	35	689	963	19
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0
PigIron	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	28	0	0	18	20	11	0	0	0	0	0	0	0
Rice	774	404	339	556	527	206	52	96	108	98	0	0	0
Cotton	0	0	0	0	0	0	0	0	0	0	0	0	0
Sugar	0	0	88	284	4	0	49	161	0	0	0	12	13
SteelBillets	0	0	0	0	0	0	0	0	0	0	0	0	0
HRSCoils/SteelPipes	0	0	0	0	0	0	0	0	0	4	0	0	0
Fertilizer(Urea)	0	0	0	23	10	0	0	0	60	63	37	13	0
Cowdung	0	0	0	0	0	0	0	0	0	0	0	0	0
Cement	0	0	0	0	0	16	0	0	68	0	0	0	8
GeneralCargo	6	0	0	7	0	1	1,164	1,555	1,603	1,548	1,649	2,602	3,723
Sub-total	807	404	427	888	561	235	1,265	1,813	1,839	1,748	2,375	3,590	3,763
LIQUIDEXPORTS													
CrudeOil	0	158	248	300	274	456	221	387	335	430	475	302	183
Molasses	0	0	0	11	0	0	0	0	0	21	19	0	7
FurnaceOil(Re-Exp)	0	0	0	1	0	0	0	0	0	0	0	0	0
Sub-Total	0	158	248	312	274	456	221	387	335	451	494	302	190
GRANDTOTAL	7,159	8,061	7,440	9,197	9,649	10,614	15,438	14,537	15,553	14,173	13,952	16,146	15,620

Source: PQA

(2) Container Traffic

Table 2.4.10 and Table 2.4.11 show the annual container movements at the ports of Karachi and Qasim for 1997/98 through to 2003/04. In 2003/04, there were 1.2 million TEUs movements at the two ports, of which 1.0 million TEUs, or nearly 80.9% of the total were full container movements,.

a) Karachi Port

Container traffic has been a growing component of port traffic between 1997/98 and 2003/04. In 2003/04 824,753 TEUs were handled which is more than 1.6 times the 505,287 TEUs handled in 1997/98.

During the 1997/98 to 2003/04 period, container traffic has increased at an annual average rate of 8.5%. Container traffic has been roughly balanced between import and export movements.

The share of empty containers for imports and exports in 2003/04 was 6.5% and 37.2%, respectively. The cargo volume for a loaded import and export container in 2003/04 was 14.5 ton/TEU and 13.8 ton/TEU respectively.

Table 2.4.10 Container Traffic at the Port of Karachi

	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Import							
Empty Container							
20 ft.	16,719	17,618	13,959	17,618	18,163	14,403	12,075
40 ft.	10,827	7,702	16,700	21,045	15,340	10,221	8,105
TEU	38,373	33,022	47,359	59,708	48,843	34,845	28,285
Loaded Container							
20 ft.	118,951	130,181	113,174	146,107	155,961	164,221	190,350
40 ft.	50,960	56,744	62,537	65,456	83,911	92,890	109,418
TEU	220,871	243,669	238,248	277,019	323,783	350,001	409,186
Cargo volume (ton)	3,259,497	3,680,440	4,031,331	4,250,090	4,942,097	5,125,277	5,943,115
Total (TEU)	259,244	276,691	285,607	336,727	372,626	384,846	437,471
Export							
Empty Container							
20 ft.	27,695	28,034	33,164	34,821	38,228	38,039	65,011
40 It.	10,125	17,477	20,480	10,856	22,083	28,040	39,451
TEU	47,945	62,988	74,124	56,533	82,394	94,119	143,913
Loaded Container							
20 ft.	101,330	106,988	115,355	118,640	124,280	129,891	116,715
40 ft.	48,384	39,738	55,714	68,698	68,296	67,877	63,327
TEU	198,098	186,464	226,783	256,036	260,872	265,645	243,369
Cargo volume (ton)	2,625,490	2,642,251	2,989,347	3,329,883	3,523,639	3,652,708	3,359,051
Total (TEU)	246,043	249,452	300,907	312,569	343,266	359,764	387,282
Grand Total (TEU)	505,287	526,143	586,514	649,296	715,892	744,610	824,753

Source: KPT

b) Qasim Port

Container traffic has rapidly increased since 1997/98, when the operation of QICT commenced.

During the period from 1997/98 to 2003/04, container traffic increased from 132,743 TEUs in 1997/98 to 421,369 TEUs in 2003/04 at an annual average increase rate of 21.2%. In a similar manner to the Karachi port, container traffic has been roughly balanced between import and export movements. The percentage of empty import and export containers in 2003/04 was 16.6% and 14.7%, respectively. Qasim port has prepared the annual container movements, however the cargo volume of loaded container has not been recorded.

Table 2.4.11 Container Traffic at the Port of Qasim

	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Import							
EmptyContainer							
20ft.	9,625	12,654	9,621	6,172	4,518	13,009	7,036
40ft.	11,629	11,828	12,989	11,992	11,702	14,227	13,126
TEU	32,883	36,310	35,599	30,156	27,922	41,463	33,288
LoadedContainer							
20ft.	12,540	12,261	11,523	13,258	17,506	39,500	65,299
40ft.	9,416	12,214	11,524	10,881	15,688	28,440	51,225
TEU	31,372	36,689	34,571	35,020	48,882	96,380	167,749
Total(TEU)	64,255	72,999	70,170	65,176	76,804	137,843	201,037
Export							
EmptyContainer							
20ft.	773	880	812	1,248	623	5,733	11,079
40It.	963	2,111	2,338	674	1,432	2,859	10,692
TEU	2,699	5,102	5,488	2,596	3,487	11,451	32,463
LoadedContainer							
20ft.	25,157	34,521	31,444	29,580	29,600	51,156	65,769
40ft.	20,316	25,994	28,964	28,743	31,802	45,659	61,050
TEU	65,789	86,509	89,372	87,066	93,204	142,474	187,869
Total(TEU)	68,488	91,611	94,860	89,662	96,691	153,925	220,332
GrandTotal(TEU)	132,743	164,610	165,030	154,838	173,495	291,768	421,369

Source:QPA

c) Containerized Ratio at Karachi Port

Table 2.4.12 shows the containerized ratio at Karachi port. 9.3 million tons of cargo was handled in containers in 2003/04, accounting for 84.9% of the port's total general cargo traffic and other cargo.

Table 2.4.12 Containerized Ratio at Karachi Port (Million Tons/Year)

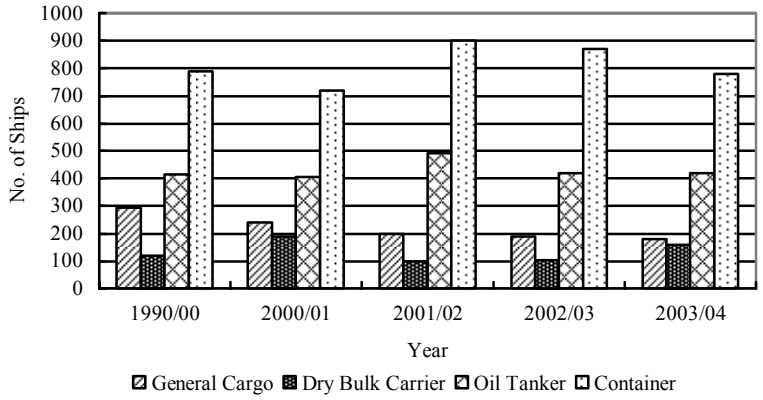
	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Import							
Containerizable Cargo	4.33	4.56	5.06	6.19	6.20	6.24	7.27
Containerized Cargo	3.26	3.68	4.03	4.25	4.94	5.13	5.94
Containerization (%)	75.3	80.7	79.6	68.7	79.7	82.1	81.7
Export							
Containerizable Cargo	3.86	3.28	3.63	4.33	3.94	4.00	3.68
Containerized Cargo	2.63	2.64	2.99	3.23	3.52	3.65	3.36
Containerization (%)	68.0	80.4	82.3	77.0	89.5	91.2	91.2
Total							
Containerizable Cargo	8.19	7.84	8.69	10.51	10.13	10.25	10.96
Containerized Cargo	5.88	6.32	7.02	7.58	8.47	8.78	9.30
Containerization (%)	71.8	80.6	80.8	72.1	83.5	85.7	84.9

Source:KPT

(3) Vessels Calling at the Ports

a) Karachi Port

According to the KPT's classification, vessels calling at the port of Karachi are divided into four types; general cargo vessels, oil tankers, dry bulk carriers, and container vessels as shown in Figure 2.4.6. According to the actual records in 2003/04 around 1,500 vessels called at the port. Almost half (50.7%) or 783 of the vessels that called the port were container vessels. Oil tankers and general cargo vessels followed, accounting for 27.1% (418 vessels) and 11.9% (184 vessels), respectively. In terms of the volume of cargoes handled at the port, the oil tankers accounted for 50.2% of the total volume, and container vessels, dry bulk carriers and general cargo vessels accounted for 33.4%, 13.9% and 2.5% respectively.



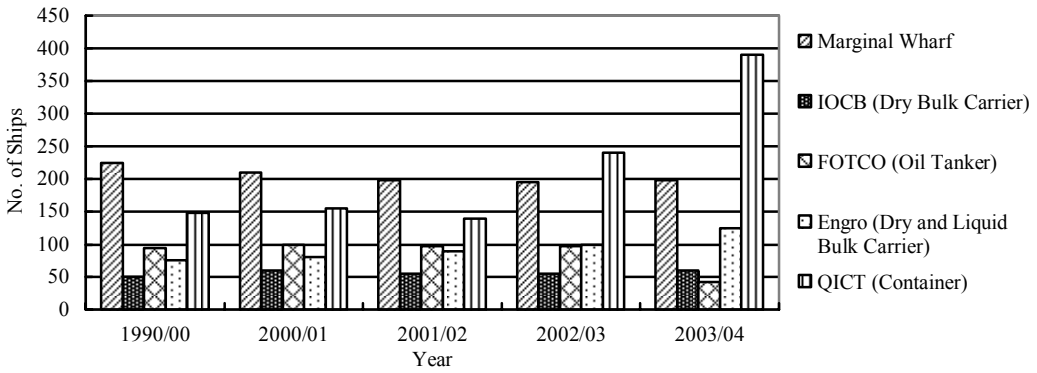
Source: KPT

Figure 2.4.6 Number of Vessels Calling at the Port of Karachi

b) Qasim Port

The vessels calling at the port of Qasim are classified by the terminal in the port statistics as Marginal Wharf (general cargo and others), IOCB (dry bulk carrier), FOTOCO Terminal (oil tanker), ENGRO Terminal (dry and liquid bulk carrier) and QICT (container) as shown in Figure 2.4.7.

There were 806 vessels calling at the port in 2003/04. Vessels of QICT (container vessels) accounted for 47.9% (386 vessels) of the total number. In terms of the volume of cargoes handled at port, the container carriers and liquid bulk accounted for 45.6% and 27.4% respectively. Iron and coal carriers accounted for 18.6%.



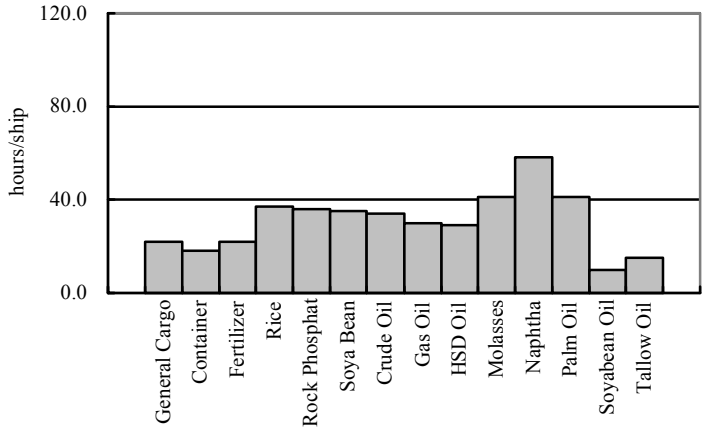
Source: PQA

Figure 2.4.7 Number of Vessels Calling at the Port of Qasim

(4) Waiting Time for Berthing

a) Karachi Port

According to the KPT's records in 2003/04 the average waiting time for general cargo vessels, fertilizer and rice carriers reached 21.6 hours per ship, 20.2 hours per ship and 37.2 hours per ship. While crude oil, HSD oil and Naphtha carriers reached 34.7 hours per ship, 30.3 hours per ship and 56.4 hours per ship respectively. Container vessels had an average waiting time of 18.1 hours per ship. Remaining vessels, except Palm Oil and Molasses carriers, kept within 40.0 hours per ship as shown in Figure 2.4.8.

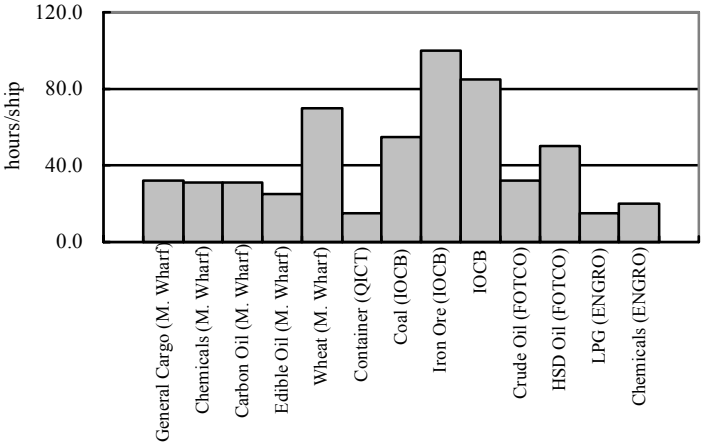


Source: KPT

Figure 2.4.8 Vessel Waiting Time at the Port of Karachi (per ship)

b) Qasim Port

According to records, in 2003/04 the average waiting time for the iron ore carriers reached 100.7 hours per ship, which is the longest waiting time at the Qasim port. Wheat carriers (Marginal Wharf), HSD oil carriers (FOTOCO Terminal) and general cargo vessels (Marginal Wharf) followed the iron ore carriers, accounting for 69.8, 48.3 and 33.4 hours per ship respectively. Container vessels had an average waiting time of 12.4 hours per ship, which was shorter than at Karachi port despite the long navigation channel as shown in Figure 2.4.9.



Source: PQA

Figure 2.4.9 Vessel Waiting Time at the Port of Qasim (per ship)

(5) Utilization of Berths

a) Karachi Port

The utilization of berths at the port of Karachi is classified according to vessel type, namely, general cargo vessels, container vessels, dry bulk carriers and tankers as shown in table 2.4.13.

Table 2.4.13 Utilization of Berths at the Port of Karachi

Berth	Berth No.	Total Length (m)	Actual No. of Berths	No. of Vessels	Actual Berthing Time (hours/ship)	Actual Berthing Time (hours)	Berth Occupancy Rate (%)	
East Berth	1 - 5	815	5	230	132.5	30,474	69.6	
	6 - 9	604	2	121	43.6	5,271	30.1	PICT
	10 - 17	1,236	8	345	125.6	43,331	61.8	
Juna Bunder Berth	18 - 19	316	2	40	159.8	6,391	36.5	
	20	165	1	19	157.8	2,999	34.2	
	21	162	1	8	216.5	1,732	19.8	
	22	168	1	-	-	-	-	
	23	168	1	-	-	-	-	
West Berth	24 - 27	702	4	196	125.9	24,674	70.4	
	28 - 30	567	2	333	22.2	7,395	42.2	KICT
Oil Berth	OP-1	-	1	114	48.6	5,545	63.3	
	OP-2	-	1	-	-	-	-	Under construction
	OP-3	-	1	180	38.7	6,957	79.4	

Note: This table was made based on the information of KPT
Source: JICA Study Team

There are 27 berths used for loading and unloading dry and liquid cargoes and three oil berths. According to the several kinds of records of the cargo-handling operation in 2003/04, 25 of the 27 berths and the two oil berths were operational. The total number of ships which moored at the 25 berths and two oil berths was 1,292 and 294 respectively.

The average berthing/operation time per ship is 376.0 hours for rock phosphate carriers, 235.0 hours for fertilizer carriers and 143.6 hours for rice carriers. The average volume of cargoes handled per vessels is 67,739 tons per oil tanker, 61,288 tons per HSD oil tanker, 1,040 TEU per container vessel and 6,604 tons per general cargo vessel.

The berth occupancy rate at the port of Karachi maintained normal values in 2003/04 except for the East Berth Nos. 1 to 5, West Berth Nos. 24 to 27 and the oil berths, because OP-II is under construction and the Berth No. 1 is being utilized for oil handling on a temporary basis.

b) Qasim Port

The utilization of berths at the port of Qasim is classified according to vessel type, namely, general cargo vessels including various kinds of vessels, dry bulk carriers laden with wheat, dry bulk carriers laden with iron ore and coal, and tankers as shown in Table 2.4.14. The "Marginal Wharf" is comprised of seven berths with a total length of 1,400 m. Berth Nos. 1 to 4 are used as multi-purpose terminals, while berth Nos. 5 to 7 are used for container handling by QICT. There are four private terminals.

Table 2.4.14 Utilization of Berths at the Port of Qasim

Terminal	Berth No.	Total Length (m)	Actual No. of Berths	No. of Vessels	Actual Berthing Time (hours/ship)	Actual Berthing Time (hours)	Berth Occupancy Rate (%)	
Marginal Wharf	1 - 4	800	4	189	67.3	12,718	36.3	
	5 - 7	600	2	377	25.4	9,557	54.5	QICT
FOTCO Oil	-	-	1	35	48.4	1,694	19.3	
ENGRO	-	-	1	124	24.9	3,093	35.3	
IOCB	-	-	1	66	88.3	5,827	66.5	

Note: This table was made based on the information of PQA
Source: JICA Study Team

According to the record of cargo-handling operations, in 2003/04 the total number of ships which moored at the four berths and four private berths was 189 and 602, respectively. The average mooring time per ship for wheat carriers and general cargo vessels at marginal wharf, iron ore and coal carriers at IOCB, crude oil tanker at FOTOCO, LPG carriers at ENGRO and container vessels was 169.2 hours, 151.4 hours, 88.3 hours, 69.6 hours, 21.4 hours and 25.3 hours, respectively. The average volume of cargo handled per vessels is 55,667 tons per crude oil tanker, 47,458 tons per coal carrier, 9,565 tons per general cargo vesswl and 16,500 tons per wheat carrier.

The berth occupancy rate at the port of Qasim was 36.3% at berth Nos. 1 to 4 and 66.5% (slightly high) at the iron ore and coal berth in 2003/04.

(6) Cargo Handling Productivity

a) Karachi Port

According to KPT, the cargo-handling productivity of the general cargo vessels laden with various kinds of cargo was less than 75.1 tons per hour on average and was higher than the 62.9 tons per hour on PQA's records. The average cargo-handling productivity in 2003/04 was:

- General cargo: 75.1 ton/hour
- Container: 30.3 TEU/hour
- Crude oil: 1,326.8 ton/hour
- HSD oil: 1,435.5 ton/hour

At present, oil berth OP-II is under construction. After completion of berth OP-II, the average handling productivity is anticipated to be around 2,800 tons per hour.

b) Qasim Port

According to PQA, the average cargo-handling productivity in 2003/04 was:

- General cargo: 62.9 ton/hour
- Container : 43.8 TEU/hour
- Crude oil : 799.4 ton/hour
- HSD oil : 632.0 ton/hour
- Wheat : 97.5 ton/hour
- Iron ore and coal: 499.4 ton/hour

Considering the capacity of the existing unloaders (nominal capacity is 1,200 tons per hour two unit), the actual productivity seems to be very low.

(7) Port Tariff

The present main tariff at both ports is shown in Table 2.4.15. The tariff of PQA is about 12% lower than that of KPT excluding wharfage.

Table 2.4.15 Main Tariff of KPT and PQA

	Unit	KPT Revised in Sept. 2004	PQA Revised in May 2005
Pilotage	US$/GRT	0.15	0.13
		Over 5000GRT	
Haulage and Towage	US$/tug/act	485	485
Mooring Fee	US$ per GRT	0.05	0.04
Berthage Fee	US$ per GRT	0.08	0.08
		For first 24 hrs	
Port Dues	US$ per GRT	0.40	0.32

Wharfage		Import	Export	Import	Export
Break Bulk	Rs./ton	70.00	35.00	44.00	31.00
Dry Bulk Cargo	Rs./ton	54.00	40.00		
Wheat	Rs./ton	21.00	21.00		
Coal	Rs./ton	44.00	40.00	34.00	34.00
Crude, Diesel, Kerosene oil, Fuel	Rs./1000 Litre	30.00	30.00	25.00	25.00
Edible Oil	Rs./1000 kg	35.00	35.00	31.00	31.00
Molasses	Rs./1000 kg	18.00	18.00	11.00	15.00
Tractor, Tracked vehicle, etc.	Rs./CBM	256.00	126.00	218.00	68.00
Motor vehicle	Rs./CBM	316.00	158.00	275.00	83.00
Tyre, Tyre scrap, Accessories	Rs./ton	316.00	158.00	275.00	275.00
Food grain, fertilizer. Etc	Rs./ton	25.00	25.00	21.00	17.00
Food grain, flour and seed	Rs./ton			21.00	17.00
Fertilizer, rock phosphates ecl. Cow dung	Rs./ton			14.00	14.00
Container		LCL Container (s) Rs./ton x 2		Size 20 ft Rs.	
		70.00	35.00	620.00	620.00
		FCL Container (s) Rs./ft		Size 40 ft Rs.	
		90.00	35.00	1240.00	1240.00
		Empty Container (s) Rs./ft		Over Size 40 ft Rs./ft	
		40.00	40.00	34.00	34.00

Source: The Gazette of Pakistan, KPT Tariff

2.4.3 Administration of Port and Shipping Sector

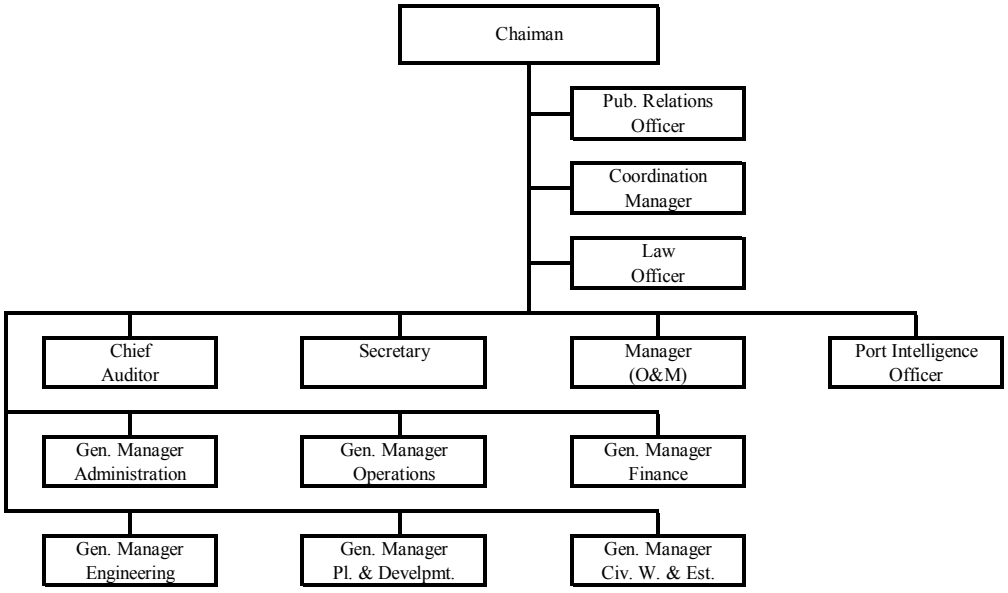
(1) General

The Ministry of Ports and Shipping controls the administration of ports and shipping in Pakistan. The Director General of Ports and Shipping of MOPS is in charge of the overall administration of the various organizations related to ports and shipping. All practical works are conducted by organizations which are autonomous bodies under the control of the Director General of Ports and Shipping.

(2) The Karachi Port Trust (KPT)

KTP is based on the Karachi Port Trust Act of 1886. The highest decision-making organ is the Board of Trustees which consists of 11 members including the Chairman who is appointed by the Federal Government and other trustees are representatives of ship owners, shippers, port labours and the Government. Important matters such as the lease, sale and transfer of property, the general budget, major investments and the revision of port fees require prior approval by the Government. There are about 5,500 employees.

Figure 2.4.10 shows the organization chart of KPT.



Source: KPT

Figure 2.4.10 Organization Chart of KPT

At present, KPT is promoting privatization according to government policy, and the following privately operated terminals have been established:

Karachi International Container Terminal (KICT)

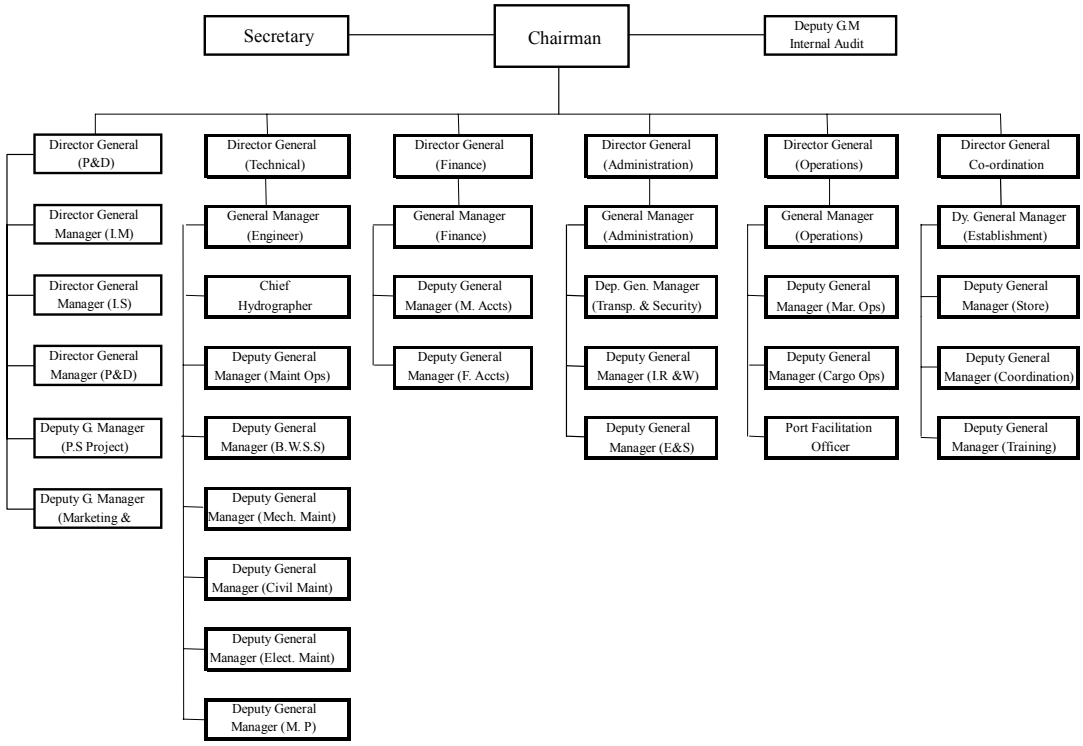
The terminal has been in operation since 1998 and it was originally leased out by KPT to APL, Pakistan on a BOT basis for 20 years. However, Hutchison Port Holdings have now taken over and are operating the terminal.

Pakistan International Container Terminal (PICT).

The terminal was operated by Premier Mercantile Services and was the first private terminal to be owned and operated by a Pakistani company. However, it was leased to Trustees of the Port of Karachi for 21 years commencing in June 2002.

(3) The Port Qasim Authority (PQA)

PQA is based on the Port Authority Act of 1973. PQA controls the land, water area and various facilities inside the port area as prescribed by the Act. The highest decision-making organ is the Board consisting of not less than three and not more than seven members including the Chairman, who is appointed by the Government. As at the port of Karachi, PQA must obtain the prior approval of the Government concerning important matters at the Port of Qasim. PQA has approximately 1,600 employees. Figure 2.4.11 shows the organization chart of PQA.



Source: PQA

Figure 2.4.11 Organization Chart of PQA

At present, PQA is promoting privatization for the port development, and the following privately operated terminals have been established:

Iron Ore and Coal Berth (IOCB)

This berth was built by PQA and has been leased to Pakistan Steel; PQA is responsible for maintenance. IOCB commenced operation in 1980 and the equipment for unloading and transferring the ore and coal to Pakistan Steel has been installed and is maintained by Pakistan Steel. The berth has been leased to Pakistan Steel.

Qasim International Container Terminal (QICT)

The agreement was signed in 1995 between PQA and a group of companies led by P&O Ports-Australia, and QICT commenced operation in 1997. Berth Nos. 5 to 7 of the marginal wharf including a 400 m back up space has been leased to the owners of QICT on a BOO basis.

FOTCO Oil Terminal

The agreement was signed between PQA and FOTCO in 1992. The terminal was constructed on a BOO basis and the charges for a minimum of four million tons of heavy furnace oil per year have been guaranteed by the Government of Pakistan.

Engro Vopak Terminal

The agreement was signed between PQA and Engoro Chemicals, Pakistan and VOPAC Holland in 1998. The terminal was constructed on a BOO basis.

Therefore, only Marginal Wharf berths Nos. 1 to 4 are under direct management of PQA. Berth No.1 is being used for liquid bulk handling and berths Nos. 2 to 4 for dry bulk.

(4) Pakistan National Shipping Corporation (PNSC)

PNSC is a shipping company, whose shares are mainly held by the Federal government. At the end of the fiscal year 2003/04, the Federal government held approximately a 90% share of the PNSC.

2.4.4 Financial Situation

In the MTDF, from the fiscal year 2005/06 to the fiscal year 2009/10, an allocation of Rs.117 billion (Rs.13 billion under the public sector development programme and Rs. 104 billion under the self-financing and private sector financing programme) is envisaged for the development works of the Ports and Shipping sector. Most of the development works depend on the financial capacity of the implementing agencies and private financing.

(1) Financial Status of KPT

Table 2.4.16 shows the trend in the financial status of the KPT. According to Table 2.4.16, the KPT consistently generates a surplus every year and the financial status of the KPT is stable. In particular, the revenues generated from investment activities sustain the financial stability of the KPT. In the fiscal year 2002/03, the investment revenue was equal to 76% of the operational revenue. The operational revenue amounted to Rs. 860 million and the investment revenue amounted to Rs. 3,623 million, which accounts for approximately 84% of the total surplus.

Table 2.4.16 Trend in the Financial Status of the KPT

(Unit: Million Rs.)

FY	1998/99	1999/2000	2000/01	2001/02	2002/03	% per Revenues (2002/03)
(1) Revenues						
Cargo Handling	1,487	1,608	1,709	1,847	1,854	
Cargo Storage	1,660	564	455	420	480	
Ship Movement & Services	1,845	1,779	2,283	2,448	2,154	
Property management	155	227	217	424	275	
Total	5,147	4,178	4,665	5,139	4,763	100.0%
(2) Expenses						
Labor	2,748	2,673	2,521	2,496	2,584	
Repairs and Maintenance	308	308	344	155	153	
Other Operational expenses	865	912	896	830	681	
Depreciation Costs	467	417	560	526	485	
Total	4,388	4,309	4,321	4,007	3,903	81.9%
(3) Operational Profits (1)-(2)	760	-131	344	1,132	861	18.1%
(4) Investment Revenues etc	1,791	2,090	2,499	2,925	3,623	76.1%
(5) Interest Payments	207	197	178	179	151	3.2%
(6) Others*	1,783	-12	-121	1	-40	-0.8%
Total Surplus (3)+(4)-(5)-(6)	4,128	1,749	2,721	4,059	4,293	90.1%

* In the fiscal year 1998/99, items of prior year adjustment are included.
Source: Karachi Port Trust Financial Statements

The KPT has enormous financial resources based on the surplus accumulated so far (Rs. 32.6 million at the end of the fiscal year 2002/03). This is invested in bonds issued by the Pakistan government. Table 2.4.17 shows a list of the investments at the end of the fiscal year 2002/03.

Table 2.4.17 List of Investments of the KPT

Type of Investments	Amounts (Unit: Rs. Million)	Rate of Profits
Federal Investment Bonds	4,234	15% per year
Pakistan Investment Bonds	6,770	13-15% per year
Defence Saving Certificate	5,775	8.15% per year
Others	1	-
Total	16,780	-

Source: Karachi Port Trust Financial Statements

Table 2.4.18 shows the revenue and expenditure budget of the KPT for the fiscal year 2004/05. As shown in the table, the investment revenue is estimated to be nearly Rs. 4 billion, which equates to 77% of the ordinary revenues.

Table 2.4.18 Budget of the KPT (2004/05)

Items	Rs. Millions		% per Revenues
(1) Revenues			
Cargo Handling	2,295	44.9%	
Ship Movement and Services	1,962	38.4%	
Cargo Storage	578	11.3%	
Property Management	278	5.4%	
Total	5,113	100.0%	100.0%
(2) Expenditures			
Labor	2,497	51.4%	
Outsourcing of Repairs and Maintenance	717	14.8%	
Others	1,645	33.9%	
Total	4,859	100.0%	95.0%
(3) Operating Surplus (1)-(2)	254		5.0%
(4) Investment Revenues	**3,935**		**77.0%**
(5) Total Surplus (3)+(4)	4,189		81.9%

Sources: Prepared by JICA Study Team with Data from World Bank

Based on the financial resources of the KPT, it is envisaged that there may not be any financial hazards in the development of Karachi Port.

(2) Financial Status of the PQA

In the MTDF, from the fiscal year 2005/06 to 2009/10, more than Rs.23 billions in investments is envisaged for Qasim Port, which includes Rs.13.5 of investments to be procured by private financing. In order to attract private investors, the profitability of the business in Qasim Port business is important. Table 2.4.19 shows the trend in the financial status of the PQA.

Table 2.4.19 Trend in Financial Status of the PQA

(Unit: Million Rs.)

FY	1999/00	2000/01	2001/02	2002/03	2003/04
(1) Revenues					
Operational Income	1,509	1,570	1,768	1,730	1,924
Other Income	221	181	196	251	250
Total	1,730	1,751	1,964	1,981	2,175
(2) Costs					
Salaries etc	382	442	529	561	548
Administration Costs	189	222	215	224	261
Maintenance Costs	197	542	332	547	287
Depreciation Costs	119	113	118	111	130
Others	4	68	297	86	48
Total	891	1,387	1,491	1,529	1,274
(3) Operating Surplus (1)-(2)	840	365	473	451	901
(4) Other Revenues	259	309	307	247	179
(5) Other Charges	113	7	55	-125	-10
(6) Net Surplus (3)+(4)-(5)	986	666	725	822	1,089

Source: Qasim Port Authority Financial Statements

The operational surplus of the PQA is stable, and the business related to the operation of Qasim Port seems profitable. According to Table 2.4.19, the PQA have continuously created a surplus in recent years. The PQA accumulated a financial surplus amounting to nearly Rs. 5 billion at the end of the fiscal year 2003/04. Consequently, the profitability of the Qasim Port business is likely to attract investors, and it is envisaged that there may not be any financial hazards in the development of the Qasim Port.

(3) Financial Status of PNSC

In the MTDF, from the fiscal year 2005/06 to 2009/10, an allocation of Rs.12 billion for development works is assumed to be funded by the PNSC. Therefore, the financial status of the PNSC is extremely important for the development of the shipping sector. Table 2.4.20 shows the trend in the financial status of the Pakistan National Shipping Corporation (PNSC).

Table 2.4.20 Trend in the Financial Status of the PNSC

(Unit: Million Rs.)

FY	1999/2000	2000/01	2001/02	2002/03	2003/04
Operational Revenues	3,540	5,459	4,625	3,631	2,736
Operational Expenses	3,839	5,014	4,012	2,785	2,041
Operational Profits	-299	445	613	846	695
Other Income	127	216	234	124	1,424
Other Expenses	316	915	344	234	254
Profit before Taxation	-489	-254	503	736	1,866
Taxation	94	45	172	269	232
Profit after Taxation	-582	-300	330	467	1,634

Source: Pakistan National Shipping Corporation Annual Report 2004

Up until the fiscal year 2000/01, the PNSC continually suffered from losses. However, in the fiscal year 2001/02, the PNSC reformed its business. One of the biggest changes was to discard unprofitable routes and concentrate its business resources on the profitable routes. With this reform, the PNSC began to make a profit from 2001/02. Subsequently, in the fiscal year 2003/04, the PNSC recorded a profit of Rs. 1.6 billion. Therefore, it is envisaged that there may not be any financial hazards in the development of the shipping sector under the current financial situation in the PNSC.

2.4.5 Issues and Problems

In this section, the problem areas in the existing handling systems at the ports are identified together with a preliminary assessment of overall performance.

(1) Karachi Port

- According to the KPT's records in 2003/04 the berth occupancy ratio maintained normal values. However, two berths, Nos. 22 and 23, were not used for cargo handling, despite the limited available space within the existing port area. Effective utilization of the existing facilities is required.
- At Karachi port, various kinds of cargo are being handled at conventional berth (except at berths Nos. 6 to 9 (PICT) and 28 to 30 (KICT)). This includes general cargo, fertilizer, rice, phosphate and scrap. The dry bulk carriers are being forced to moor for a long time at the berths due to the low cargo-handling productivity. Therefore, it is necessary to provide specialized dry bulk handling facilities.

(2) Qasim Port

- Berth Nos. 2, 3 and 4 handle dry bulk cargo such as wheat, coal, sugar, and fertilizer. The major import is wheat, of which 1.1 million tons was handled in 2002/03. However, Qasim port does not yet have a specialized terminal for the handling of wheat and this fact is one of the main reasons for the long period of waiting and mooring times. Therefore, it is necessary to provide specialized dry bulk handling facilities.
- There is a restriction on night navigation at the Qasim port due to navigation facilities. Currently, vessels of LOA 202 m can be accommodated during the night on a request basis. Therefore, it is necessary to develop the navigation system as soon as possible.

(3) Both Ports

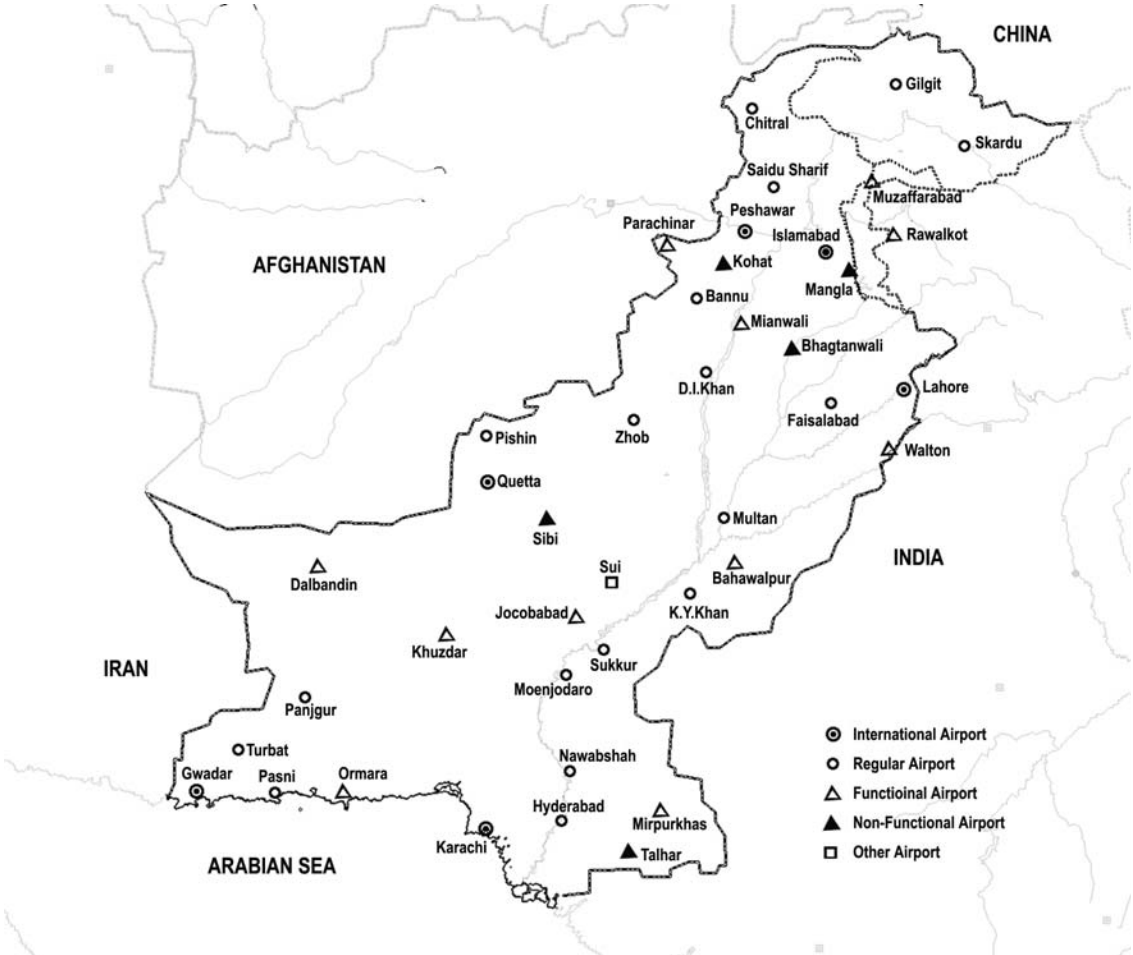
- Neither port has introduced an EDI system. The computer system of both ports covers only management of vessel arrivals an departures but does not cover other operation and management works such as operation at conventional and container terminals. However, some shipping lines have already developed their own world-wide computer systems. The computer system is competent for processing statistics, however, neither port has fully utilized the potential of their systems. With regard to statistics, the present system covers only vessel statistics but these are not compiled periodically or systematically. Cargo statistics are not compiled at all.

2.5 Airport

2.5.1 Airports and Air Traffic Control

(1) Airports

Airports in Pakistan can be divided into several categories. There are the airports used only by the Air Force, the airports administered by the Air Force but used by both Air Force and civil aviation, the airports administered by CAA (Civil Aviation Authority) and used by both the Air Force and civil aviation, and the airports administered by the CAA (Civil Aviation Authority) and used by civil aviation only. Based on the standards of ICAO, the issuance of AIP and the release of NOTAM are handled properly. Information on the maintenance of navigation facilities all over the country is also implemented correctly. Table 2.5.1 is a list of the airport facilities. In the airports which are managed by the CAA, the maintenance of the facility is done under the CAA's budget and its main revenue comes from the landing fees and air navigation charges.



Source : CAA Statistics of Pakistan / AIP

Figure 2.5.1 Airport Locations

Table 2.5.1 Airport Condition and Facilities in Pakistan

District	Airport	2002-03			Admini-strative	Category	Runway (m)	Navigation Facilities
		Aircraft Movement	Passenger	Cargo (t.)				
Balochistan	Quetta	2,480	239,425	1,346	JF	I	3,658 X 46	NDB, VOR
	Gwadar	1,827	45,956	81	C	I	1,524 X 23	NDB
	Jiwadar				C	R	1,783 X 46	
	Jiwani				C	F	1,783 X 46	NDB, VOR
	Khuzdar				C	F	1,829 X 30	NDB
	Panjgur	346	7,147	32	C	R	1,524 X 23	NDB, VOR
	Pasni				JC	R	2,743 X 46	NDB
	Sui	198	7,907	7	P	P	1,524 X 46	
	Turbat	1,323	30,131	1	C	R	1,829 X 30	NDB
	Zhob	54	994		C	R	1,829 X 30	NDB, VOR
	Dalbandin				JC	F	1,524 X 25	
	Ormara				C	F	1,524 X 23	NDB
	Sibi					N	1,829 X 23	
Sindh	Karachi	44,005	4,870,544	166,202	C	I	3,200 X 60	ILS,VOR,NDB
	2nd R/W						3,400 X 60	
	Hyderabad				C	R	2,133 X 31	
	Moenjodaro	698	14,234	11	C	R	1,981 X 30	NDB
	Nawabshah	8	-		JC	R	2,743 X 46	NDB, VOR
	Sukkur	2,179	84,092	222	JC	R	2,743 X 30	NDB
	Jacobabad	286	2,860	4	JF	F	3,048 X 31	
	Mipur Khas				JF	F	3,048 X 46	
	Talhar					N	2,743 X 23	
Punjab	Islamabad	20,418	2,556,483	41,286	JF	I	3,292 X 46	ILS,VOR,NDB
	Lahore	24,641	2,714,246	76,341	JC	I	3,360 X 46	ILS,VOR,NDB
	2nd R/W						2,743 X 46	
	Faisalabad	1,934	147,789	1,239	JC	R	2,826 X 46	ILS,NDB
	Multan	4,420	231,131	1,484	JC	R	2,743 X 30	ILS,VOR,NDB
	Mianwali				JF	F	3,048 X 46	
	Bahawarpur	910	24,187	16	C	F	2,850 X 30	
	R.Y.Khan	1,060	38,170		C	R	3,000 X 45	NDB, VOR
	Bhagtanwala					N	1,920 X 46	
	Mangla					N	1,524 X 31	
	D.G.Khan				C	R	1,981 X 30	NDB
North West Frontier	Peshawar	7,948	729,599	10,406	JF	I	2,743 X 46	NDB, VOR
	Chitral	673	23,806	45	C	R	1,768 X 31	
	D.I.Khan	118	1,447	2	C	R	1,524 X 23	NDB, C-VOR
	Saidu Sharif				C	R	1,829 X 46	NDB
	Bannu				C	R	1,829 X 30	NDB
	Kohat				JF	F	2,352 X 46	
	Parchinar					N	1,219 X 23	
Northern Area	Gilgit	760	26,670	31	C	R	1,646 X 30	NDB
	Skardu	266	24,080	222	JC	R	1,981 X 30	NDB
	Muzaffarabad				C	F	914 X 23	NDB
	Rawalakot				C	F	914 X 23	NDB

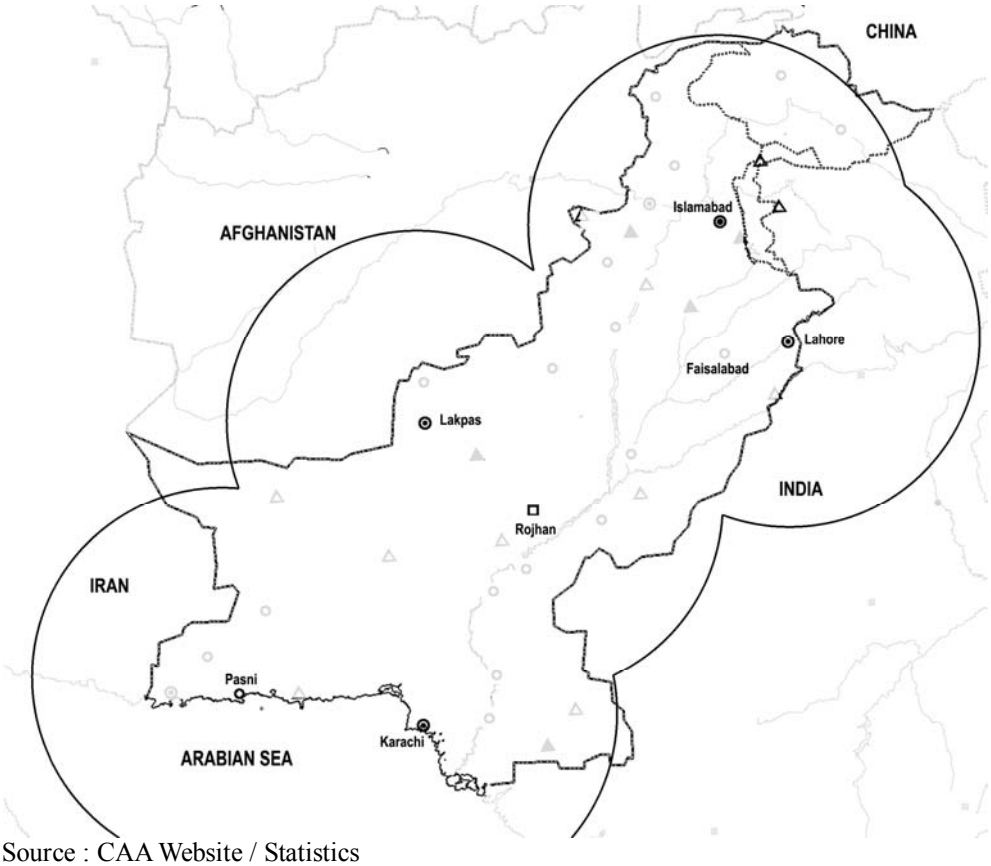
Administrative: F=Air Force / C=CAA / JF=Joint but ATC by Air Force / JC=Joint but ATC by CAA

Category:I=International Airport / R=Regular Airport / F=Feeder Airport / P=Private Airport / N=Non Oparation

Source : CAA Statistics of Pakistan / AIP

(2) Air Traffic Control Service in Pakistan

Terminal Air Traffic control at the airports and the Area Control over Pakistan are performed appropriately by the CAA. Area Control services are operated at Karachi and Lahor. These two places deal with the southern and northern part of Pakistan respectively. Most of the air space, which Pakistan CAA controls, is covered by the six radar facilities as shown in Figure 2.5.2. The radar control is done appropriately. The CAA has training courses for the staff who take care of these control operations and the staff who take care of the maintenance of ATC facilities. These courses are administered according to the ICAO standards.



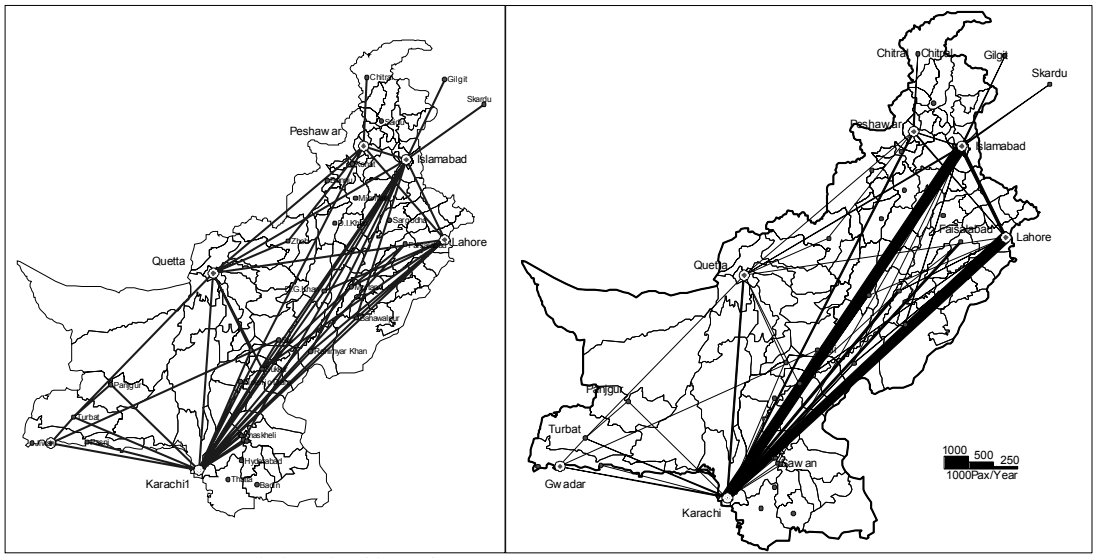
Source : CAA Website / Statistics

Figure 2.5.2 CAA Radar Coverage Chart

2.5.2 Air Transport

(1) Domestic Airline Network

Figure 2.5.3 (below left) shows the domestic airline network and the right figure shows the estimated passenger volume by air route in Pakistan. It is clear that the number of flights between Karachi and Islamabad / Karachi and Lahore are outstanding among domestic flights in Pakistan.

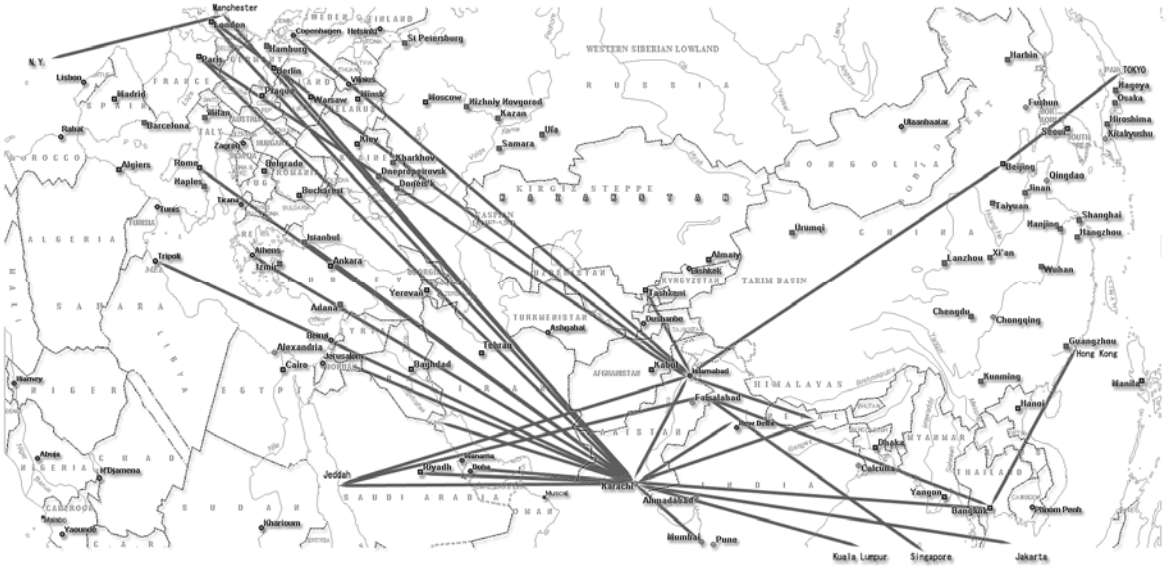


Source : Source : CAA Statistics of Pakistan / AIP

Figure 2.5.3 Domestic Flight Network and Number of Flight

(2) PIA (Pakistan International Airline)

In 1947, when Pakistan attained independence, PIA (Pakistan International Airline) was established with the support of the government. It has been developed as the flagship carrier of Pakistan. Even though there are now several private airlines operating after the private airline liberalization in 1992, PIA is still the biggest airline in Pakistan, and has been steadily expanding its operation. Figure 2.5.4 shows PIA International Operation Route



Source : PIA website

Figure 2.5.4 PIA International Flight Route 2005

(3) Other Airlines

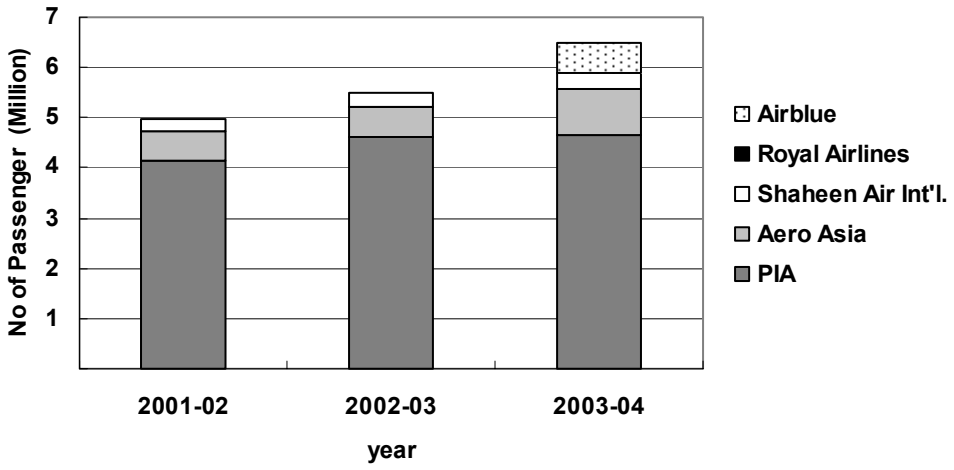
As shown in Figure 2.5.5 shows, after the Private Airline Liberalization in 1992, many airlines entered the industry. They are competing through the use of the latest technology such as on-line booking and E-tickets and the corresponding low costs.

Airline	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
PIA														
Aero Asia														
Shaheen Air Int'l.														
Royal Airlines														
Airblue														
Bhoja														
Raji														
Hajveri														
Safe Air														

Source : CAA Statistics of Pakistan

Figure 2.5.5 Time Line of the Commercial Airline Activity

PIA carried 4.66 million passengers in 2003/04, accounting for 79.4% of domestic air passengers in Pakistan, followed by Aero Asia at 15.6%, Airblue at 10.1% and Shaheen Air International at 4.9% as shown in Table 2.5.6.

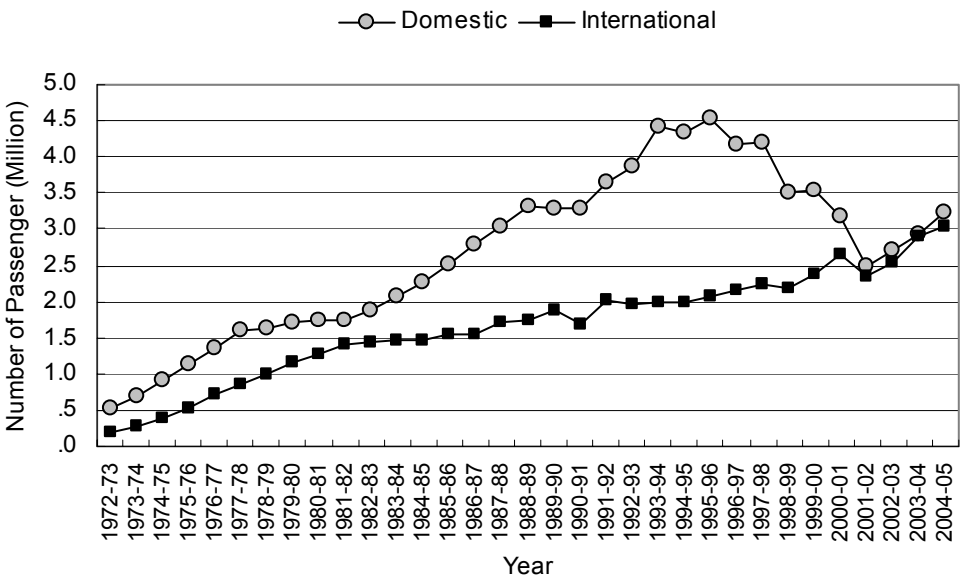


Source : CAA Statistics of Pakistan

Figure 2.5.6 Air Passenger Traffic by Airline (Domestic)

(4) Air Passenger Traffic

Domestic flights in Pakistan carried 2.9 million passengers and 48,800 tons of cargo in 2003/04. Passenger transport volumes in terms of revenue passenger kms (RPKs) were 2.4 billion RPKs in 2003/04, which was a tenth of the passenger transport by rail, and a hundredth of the passenger transport by road. Cargo cartage was very small at 49,000 ton-kms. Passenger traffic on domestic flights reached a peak volume of 4.5 million in 1995/06, and then decreased rapidly to 2.5 million in 2001/02. Since 2001/02, the passenger traffic has been increasing at an annual rate of 7.7% as shown in Figure 2.5.7. Passenger traffic on international flights did not experience a sharp decrease and has recently shown a steady increase.



Source: CAA Statistics of Pakistan

Figure 2.5.7 Air Passenger Traffic in Pakistan

Figure 2.5.8 shows the percentage of total passengers by airport in Pakistan. The four major airports (Karachi, Islamabad, Lahore and Peshawar) have 85% of the total air passengers in Pakistan, as shown in Figure 2.5.8.

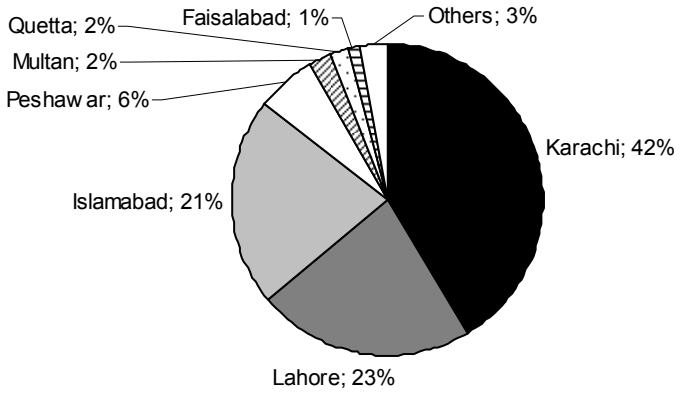
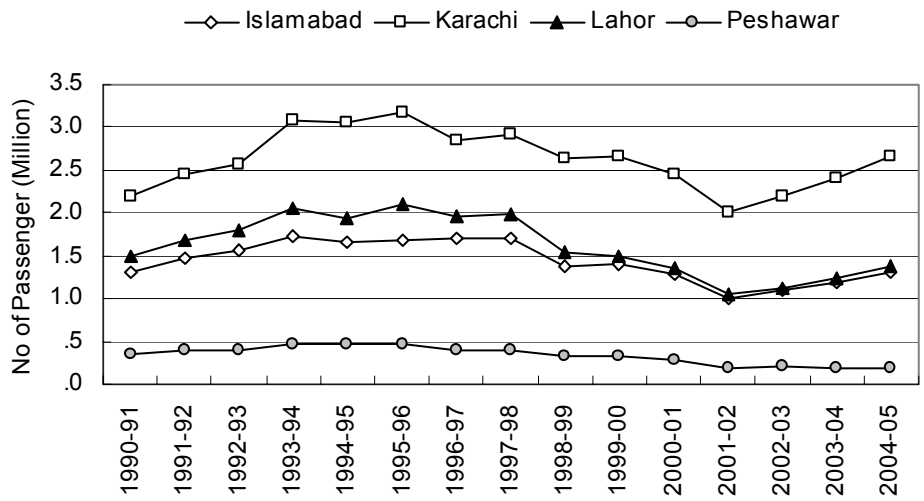


Figure 2.5.8 International Passengers by Airport

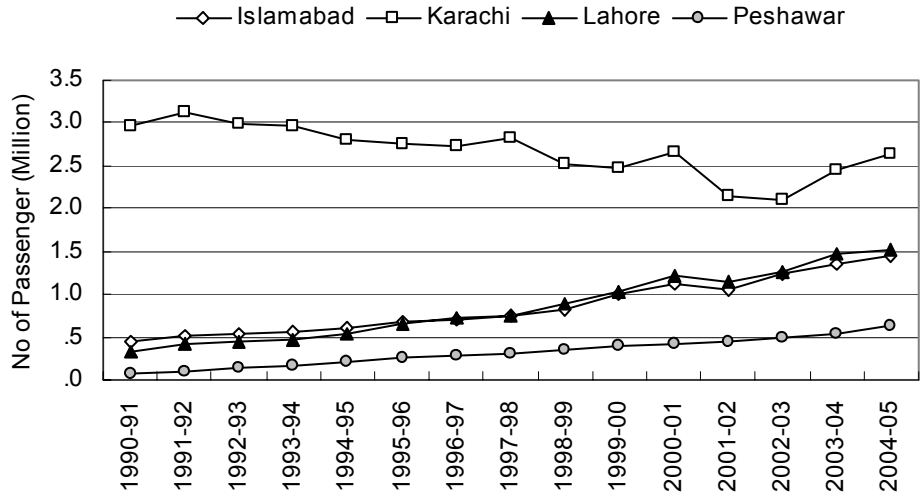
Figure 2.5.9 and Figure 2.5.10 show the trend in domestic and international passenger at the four airports. The number of domestic passengers at the four airports decreased during the period of 1995/06 – 2001/02 and began to increase in 2001/02 except for Peshawar Airport as shown in Figure 2.5.9.



Source : CAA Statistics of Pakistan

Figure 2.5.9 Domestic Passengers at Four Major Airports

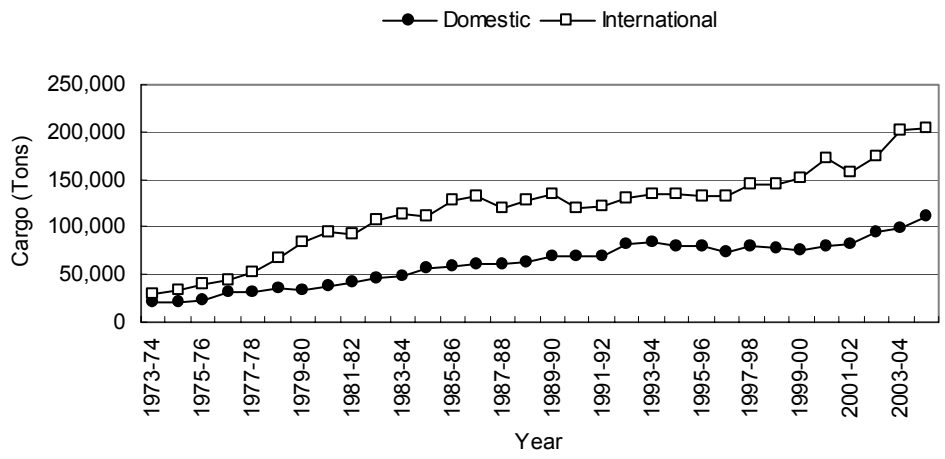
Although the number of international air passengers is increasing as mentioned above (Figure 2.5.9), Karachi Airport was losing international air passengers in the 1990s while the traffic at other airports increased as shown in Figure 2.5.10. The traffic at Karachi Airport began to increase in 2001/02, as well as the recovery of domestic passengers in 2001/02.



Source : CAA Statistics of Pakistan

Figure 2.5.10 International Passenger at Four Major Airports

Air cargo traffic has been increasing steadily, except for a slight decrease in domestic air cargo in the 1990s when it had been slightly decreased, as shown in Figure 2.5.11.



Source : CAA Statistics of Pakistan

Figure 2.5.11 Total Cargo at all Airports

2.5.3 Administration of Aviation Sector

Currently, the Pakistani airport facilities are managed by the Pakistani Civil Aviation Authority (CAA) and the Air Force. The CAA is under the administration of the MOD (Ministry of Defence) but deals only with civil aviation. It performs ATC (Air Traffic Control) at civil airports and maintenance of airport facilities. Major capital comes from the government. The PIA, which is a major airline in Pakistan, is currently implementing its privatisation plan. The government still holds more than 50% of the PIAs outstanding shares., however it is managed as a private organization. The ASF is the Airport Security Force under the MOD (Ministry of Defence), which has the responsibility for aviation safety. The number of airlines has been increasing since privatisation. Now, other than the PIA, there are 4 airlines operating scheduled domestic and international flights. There are also sporadic service airlines as well.

(1) CAA (Civil Aviation Authority)

The CAA is organized under the MOD and was established in 1982 to promote safe operation and to develop transportation to meet the increase in air traffic increase. The CAA is responsible for planning, construction/improvement and maintenance of airport facilities such as runways, aprons, terminal buildings, cargo buildings and air navigation systems, and for the provision of air safety facilities such as fire fighting and rescue facilities. It also acts as the aeronautical authority to enforce aviation rules and regulations including aircraft development in the country.

(2) ASF (Airport Security Force)

In Pakistan, originally, the MOD (Ministry of Defence) used to administer all the airports as a part of the military facility. In 1976 the MOD started the ASF (Airport security force) as an organization, under the administration of the MOD, which takes responsibility for the security of all airports and aircraft passengers.

2.5.4 Financial Situation

In the airline sector of Pakistan, there are two implementing agencies: Civil Aviation Authority (CAA) and Pakistan International Airlines Corporation (PIAC). The CAA is a governmental autonomous body, which is in charge of airport operations. The PIAC is a national airline company, whose shares are mainly held by the Government of Pakistan. At the end of the fiscal year 2004 (ended December 31, 2004), the Government of Pakistan held 87% of the PIAC stock.

In the MTDF, from the fiscal year 2005/06 to 2009/10, more than Rs.130 billions in investments is envisaged for the airline sector, which includes Rs.17.4 billions in investments to be procured by the CAA, and Rs.109.9 billion for aircrafts to be procured by the PIAC.

(1) Financial Status of the CAA

The CAA will make an investment of Rs.17.4 billion during the MTDF to complete a programme using its own financial resources. Table 2.5.2 shows the trend in the financial status of the CAA.

Table 2.5.2 Trend in the Financial Status of the CAA

(Unit: Million Rs.)

Fiscal Year	1995/96	1996/97	1997/98	1998/99	1999/2000
(1) Revenues					
Operational Income	2,759	3,098	3,321	3,754	4,122
Non-Operational Income	639	676	817	837	1,103
Total	**3,398**	**3,774**	**4,138**	**4,591**	**5,225**
(2) Expenditures					
Administrative Expenses	1,386	1,742	1,605	1,925	2,441
Repair & Maintenance	199	216	249	154	327
Depreciation	545	609	582	574	671
Financial Charges	477	421	395	1,125	1,029
Others	97	169	129	107	140
Taxation	220	263	346	-339	250
Total	**2,924**	**3,420**	**3,306**	**3,546**	**4,858**
(3) Surplus (1)-(2)	**474**	**354**	**832**	**1,045**	**367**

Sources: Data from World Bank

The CAA controls the domestic airport and international airports in the main cities, such as Karachi, Lahore, Islamabad, Peshawar and obtains revenue from airplane operators through those airports. According to Table 2.5.2, the financial status is stable, and the surplus is continuously positive.

In the MTDF, the CAA plans to develop a new Islamabad Airport, the cost of which is estimated to be Rs.12.8 billion. The CAA plans to finance the development from bank consortiums and international capital markets. It is envisaged that there may not be any financial hazards for the developments as the financial condition of the CAA is stable.

The CAA charges the airlines, which use airport and air traffic control services in Pakistan. This is the major income of the CAA. Table 2.5.3 shows the Navigation Aid usage charge and Table 2.5.4 shows the Landing Charge and Housing Charge.

Table 2.5.3 Navigation Charge for Over Flight in Pakistan

Navigation Charge for Over Flight in Pakistan (per flight)				
Weight of Aircraft (Tons)				
Exceeding 1 Ton But not 40 Tons	Exceeding 40 Ton But not 120 Tons	Exceeding 120 Ton But not 160 Tons	Exceeding 160 Ton But not 250 Tons	Exceeding 250 Tons
US$208	US$273	US$313	US$352	US$417

Source : CAA Statistics of Pakistan

Table 2.5.4 Landing Charge

(per ton)

	International Flight (Weight of Aircraft)			Non-International Flight (Weight of Aircraft)		
	Not Exceeding 1 Ton	Exceeding 1 Ton But not 250 Tons	Exceeding 250 Tons	Not Exceeding 1 Ton	Exceeding 1 Ton But not 250 Tons	Exceeding 250 Tons
International Airport	US$ 12.75	US$ 7.00	US$ 20.00	Rs. 1.50	Rs. 1.20	Rs. 6.20
Domestic Airport					Rs. 1.00	Rs. 5.20

Source: CAA Statistics of Pakistan

Table 2.5.5 Aircraft Housing Charge

	Aircraft Housing Charge (per tons)					
	INTERNATIONAL FLIGHT			NON-INTERNATIONAL FLIGHT		
	Weight of Aircraft (Tons)			Weight of Aircraft (Tons)		
	Not Exceeding 1 Ton	Exceeding 1 Ton But not 250 Tons	Exceeding 250 Tons	Not Exceeding 1 Ton	Exceeding 1 Ton But not 250 Tons	Exceeding 250 Tons
Karachi / Islamabad / Lahor	US$3.14	US$3.14	US$36.00	Rs.1.00	Rs 1.00	Rs 3.60
All Other				Rs.0.90	Rs.0.90	Rs.2.70

Source : CAA Statistics of Pakistan

In addition, the CAA charges a passenger service charge at airports as shown in Table 2.5.6. The Passenger Service Charge is included in air tickets.

Table 2.5.6 Passenger Service Charge

Domestic	International Flight Passenger		
	Economy	Business	First
Rs. 100	Rs. 400	Rs. 600	Rs. 800

Source : CAA Statistics of Pakistan

(2) Financial Status of PIAC

In the MTDF, Rs.109.9 billion for aircrafts is to be financed by the PIAC. The investments depend on the financial resources of the PIAC. Table 2.5.7 shows the trend in the financial status of the PIAC. Up until the fiscal year 2001, the financial status of the PIAC was in a critical condition. In the fiscal year 2001, the total liabilities exceeded the total assets, and the accumulated loss amounted to nearly Rs. 13 billion. In order to resolve this problem, from the fiscal year 2000 to 2002, the PIAC changed the management and rationalized the organization (including the abolishment of unprofitable routes) with the financial assistance of the government. The financial status of the PIAC began to improve from the fiscal year 2002, and consequently, the profit after tax became positive.

Table 2.5.7 Trend in the Financial Status of the PIAC

(Unit: Million Rs.)

FY	2000	2001	2002	2003	2004
(1) Operational Income					
Passenger	32,433	36,646	35,977	40,613	49,207
Excess Baggage	1,025	1,002	1,064	951	939
Freight	3,520	4,063	3,908	3,962	4,554
Mail	176	214	203	202	267
Charters	21	108	540	696	623
Others	2,052	1,575	1,982	1,529	2,198
Total	39,228	43,608	43,674	47,952	57,788
(2) Cost and Expenditures					
Personal Costs	10,460	7,784	7,984	8,320	9,444
Aircraft Fuel and Oil	12,321	12,211	9,336	11,605	17,319
Depreciation	2,569	2,651	4,503	3,303	4,189
Others	16,683	20,597	16,274	19,346	24,920
Total	42,033	43,242	38,097	42,574	55,872
(3) Profit from Operation(1)-(2)	-2,805	366	5,577	5,378	1,916
(4) Other Income	713	616	289	664	2,187
(5) Finance Cost and Provision etc	3,054	2,864	3,755	2,342	3,266
(6) Profits before Tax (3)+(4)-(5)	-5,146	-1,882	2,111	3,700	837
(7)Tax	-9	-324	-238	-2,401	1,469
(8)Profits after Tax (6)+(7)	-5,155	-2,206	1,873	1,298	2,307

Source: Pakistan International Airline Corporation Annual Report

Based on the current financial status, the PIAC is going to obtain new aircraft or replace its existing aircraft. The detail of the PIAC's investment is shown in Table 2.5.8. As described in Table 2.5.8, most of the investments are to be financed, based on the financial credibility of the PIAC. It is envisaged that there may not be any financial hazard for the investments from the PIAC.

Table 2.5.8 Details of Investment Financed by the PIAC

Year	Items	Method		Amounts (USD Million)
2005	4 A310-300	Lease	Lease from Other International Operating Companies	75
	7 New Turbo-Prop	Purchase	To be Financed by Manufacturer.	105
2006	2 Boeing 777-200LR	Purchase	To be Financed by the Banks Based on the Coordination of Boeing	360
	3 Boeing 777-300LR	Purchase		600
	1 Boeing 777-300LR	Purchase		160
2007/ 2008	6 Narrow body Twinjet	Lease / Purchase	Details have NOT Been Decided	350
2009/ 2010	2 Narrow body Twinjet	Lease / Purchase	Details have NOT Been Decided	120
Total				1,770

Source: MTDF and Interview Survey with PIAC

2.5.5 Issue and Problems

In the northern mountain area of Pakistan, the high altitude area is monitored by the radar. Most of the low altitude areas are not contactable by radar . Therefore, in the future, the improvement in air traffic control systems such as the introduction of an ADS (Automatic Dependent System) which uses the satellite or VDL (VHF Data Link) should be considered.

Islamabad Airport is experiencing a sudden increase in the number of air passengers and the cargo, however, the facility is not equipped for handling this increase. Consequently, there is a plan to move to the new airport and the opening of the new airport is urgently needed.

The airports at Peshawar and Multan are also facing an increase in air passengers, however the terminal buildings are not large enough to deal with the large number of air passengers, and this is causing an inconvenience to passengers. Prompt expansion is needed.

Chapter 3. SOCIO-ECONOMIC FRAMEWORK

3.1 Regional Structure and Transport

(1) Regional Structure

Pakistan has a strong corridor of concentrated economic activity along the Grand Trunk Road (N-5, Peshawar-Islamabad/Rawalpindi-Lahore) and a portion of N-5 (Lahore – Karachi). The distance between Peshawar and Lahore is approximately 440km, and it is approximately 1,300km between Lahore and Karachi. Traffic volume along N-5 is estimated to account for 38% of the total intercity traffic in Pakistan in terms of vehicle-km (PTPS JICA Study Team). In addition to the corridor, other large cities are located throughout Punjab Province. Punjab Province has over half of the total population of Pakistan. In addition, Quetta is the provincial capital of Balochistan and plays an important role as a gateway to Afghanistan. Although Quetta-Karachi is an important international route, the current population density is very low. Figure 3.1.1 illustrates the regional structure mentioned above.

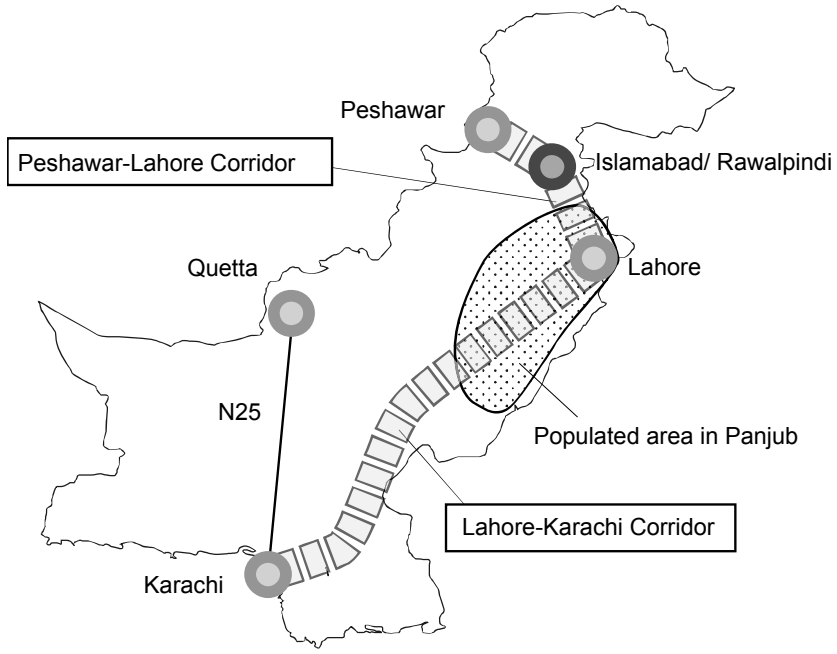
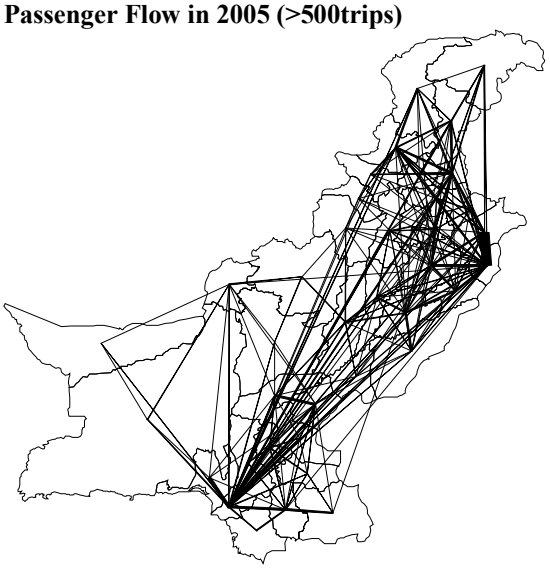


Figure 3.1.1 Major Cities and Corridors

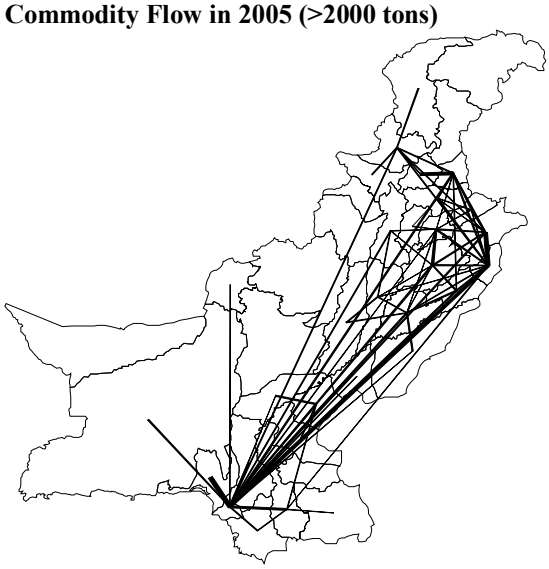
(2) Regional Transport

Passenger and freight movement reflects the regional structure mentioned above. Figure 3.1.2 illustrates the distribution pattern of passenger and freight transport. It is observed that passenger transport concentrates in Punjab, and major passenger trips are found between the large cities. There is a high intensity of freight movement on the corridor along N-5, and it is clear that Karachi is the most important transport node where a large number of freight trips generate from and concentrate to. This demonstrates the fact that the international trade of Pakistan is solely concentrated around the only major port in the country, namely, Karachi, which accounts for over 90% of Pakistan's import and export. Therefore, there is a high demand on transport infrastructure for freight movement between the regions and the port for international trade. Because of this, the country has to bear the long-distance land transport and high transport costs.

Passenger Flow in 2005 (>500trips)



Commodity Flow in 2005 (>2000 tons)



Note: These figures were created from PTPS O/D Tables

Figure 3.1.2 Transportation Flow in Pakistan, 2005

(3) National Trade Corridor

The Government of Pakistan has recently started the National Trade Corridor Improvement Program (NTCIP) for speedier and economical delivery of import and export goods. The National Trade Corridor (NTC) consists of all transport modes in Pakistan, and the NTCIP will reduce the transport cost for foreign trade by improving the NTC that goes through the territory of Pakistan between Karachi and Peshawar. The development of the NTC will accelerate the regional development along the corridor.

(4) Transport in Rural Area

In Pakistan, over two-thirds of the population live in small rural villages, whereas the remaining one-third live in a few large cites with population in the millions. Due to historical reasons and lack of regional planning, there are a few medium size conurbations in Pakistan. These small to medium size cities are concentrated along major highways as ribbon developments. They act as access centres for smaller villages and provide goods and services that are available in major cities.

The rural two-thirds of the population generate approximately a quarter of the countries GDP in terms of primary sector output. The industrial output, in terms of the GDP, is almost the same as the primary sector and is concentrated in the few large cities. The tertiary sector accounts for the remaining half of the GDP, and is also concentrated in the major cities. The diversity of output locations for primary and secondary sectors and the un-even population distribution requires a considerably intense movement of goods for 'local consumption' between cities and rural areas.

3.2 Population and Labour Force

3.2.1 Population

(1) Past Trend

The population of Pakistan is officially estimated at 153.45 million, to be the 6th largest national population in the world (Table 3.2.1). However, the national population figures from different sources do not tally due to different ways of estimation and different coverage. The first population census was taken after the World War II, in 1951, and followed by the census in 1961, 1972 and the latest one in 1998.

According to the old census, the annual growth rate of the population was lower than 2.0% in 1951. Following this, mortality declined sharply, but fertility did not accompany this change. Consequently, the annual population growth rate increased to 2.5% in 1961 and 3.6% in 1972. Since the 1970s, the Government has been making efforts to implement an intensive family planning programme. Thereby, the fertility and birth rate started to decline, and the population increase was lowered to the average rate of 2.6% during the inter-censal period of 1981 – 1998. In the MTDF, the population growth rate was estimated to be below 2.0% for the first time in 2003 and in 2005 at 1.87%. (Table 3.2.2)

Table 3.2.1 Population and Rate of Birth, Death and Increase

Mid-Year	Population (Million)	Crude Birth Rate(per mill)	Crude Death Rate(per mill)	Annual Rate of Increase (%)
1981	85.09	-	-	-
1991	112.61	39.50	9.80	-
1992	115.54	39.30	10.10	2.60
1993	118.50	38.90	10.10	2.56
1994	121.48	37.60	9.90	2.51
1995	124.49	36.60	9.20	2.48
1996	127.51	35.20	8.80	2.43
1997	130.56	33.80	8.90	2.39
1998	133.48	-	-	2.24
1999	136.69	30.50	8.60	2.40
2000	139.76	-	-	-
2001	142.86	-	-	-
2002	146.75	-	-	2.72
2003	149.65	27.30	8.00	1.98
2004	152.53	27.80	8.70	1.92
2005*	153.45	-	-	

Source :Pakistan Economic Survey, 2004 – 2005, Statistical Appendix, P93
* Population in 2005 is estimated in MTDF2005 (Part 2,Chapter 9 P9-1)

Table 3.2.2 Change in population and Growth Rate in Pakistan

Census Year	Population (million)	Average annual Intercensal Population Growth Rate (%)	Percentage Intercensal Increase (%)
1951	33.82	1.8	-
1961	42.97	2.5	27.09
1972	65.32	3.6	52.31
1981	84.25	3.1	29.01
1998	133.32	2.6	57.09
2003*	147.69	1.96	10.78
2004*	150.58	1.92	1.96
2005*	153.45	1.87	1.92

Source : MTDF, Chapter 7
Note : * Estimated by MTDF

(2) Future Population

The MTDF asserted that reducing the population growth rate is a basic prerequisite for Pakistani economic growth through improving labour productivity and accelerating social development. Table 3.2.3 shows the MTDF demographic targets, which aims at lowering the population growth rate down to 1.63% by 2010 by raising the contraceptive prevalence rate from 36% in 2005 to 51% in 2010.

Table 3.2.3 MTDF Demographic Targets

Year	Total Fertility Rate (TFR), %	Crude Birth Rate (CBR),%	Crude Death Rate(CDR), %	Rate of Growth (%)	Contraceptive Prevalence Rate
2005	3.50	27.1	8.4	1.87	36.0
2006	3.28	26.1	8.2	1.80	38.0
2007	3.13	25.5	7.9	1.76	41.0
2008	3.00	25.0	7.7	1.73	45.0
2009	2.85	24.3	7.5	1.69	48.0
2010	2.70	23.6	7.3	1.63	51.0

Source: MTDF, Chapter 7

In the period from 2005 to 2010, the total fertility rate is expected to decline by 23% from 3.50% to 2.70%, while the crude birth rate will drop only 13% due to the high momentum, and as the crude death rate is also decreased, the population growth rate will be lowered from 1.87% to 1.63%.

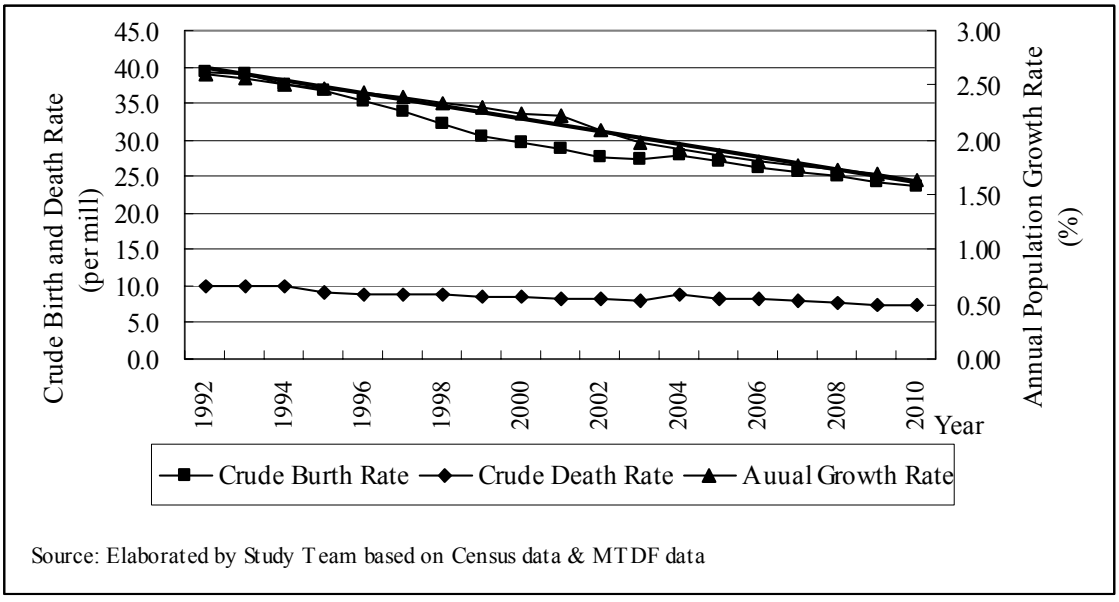
In order to extrapolate the population trend, a linear equation was determined using population growth rates observed between 1992 and 2010 (growth rates between 1992 and 2004 are estimates, and those between 2005 and 2010 are targets). (Figure 3.2.1)

$$R = 116.865 - 0.05734\,t \quad (r = 0.986)$$

Where: R: Annual population growth rate (%)
t : Year

Although the regression line shows a good fit for the period of input data, it may be risky to use the equation directly for a period longer then 20 years as it causes the growth rate to decline annually by a constant value (below 1.0% in the year of 2021 and at 0.47% in 2030). However, the growth rate will hardly become lower than 1.0% in 20 - 25 years.

Consequently, the equation was only applied up to the year 2015, and after 2015 the gradient of the regression line was divided by 2.0 every five years, to make the line level off towards the value of 1.0% (Figure 3.2.2).



Source: Elaborated by Study Team based on Census data & MTDF data

Figure 3.2.1 Linear Regression on Annual Population Growth Rate

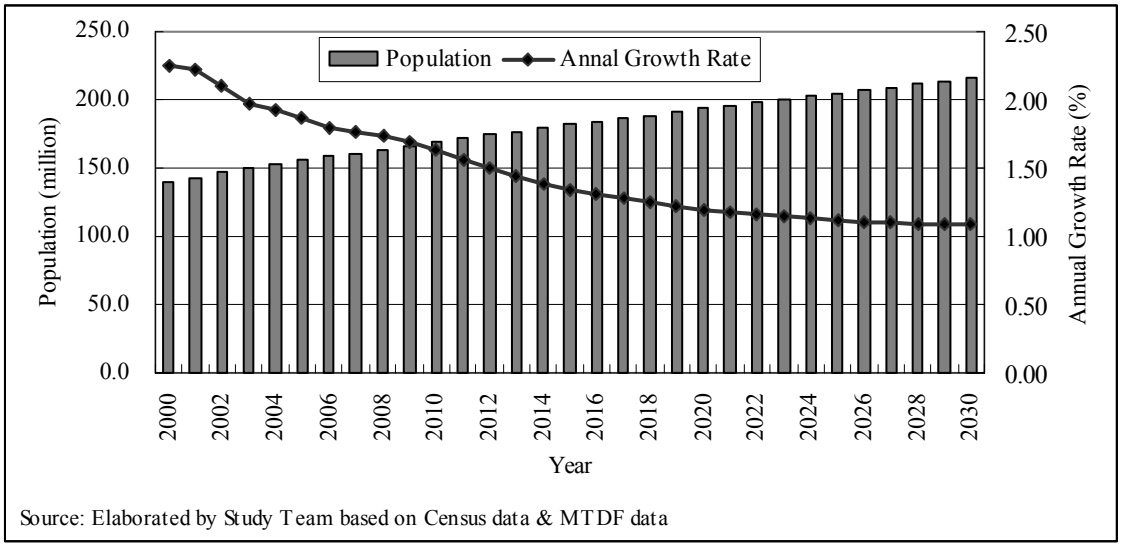


Figure 3.2.2 Future Population Growth Rate and Population, 2005-2030

Table 3.2.4 Projected Population of Pakistan, 2005-2030

Year	Population (million)	Growth Rate (%)	Year	Population (million)	Growth Rate (%)	Year	Population (million)	Growth Rate (%)
2001	143.8	2.13	2011	171.9	1.56	2021	195.7	1.17
2002	146.8	2.05	2012	174.5	1.50	2022	198.0	1.16
2003	149.7	1.98	2013	177.0	1.45	2023	200.3	1.15
2004	152.5	1.92	2014	179.4	1.39	2024	202.5	1.13
2005	155.4	1.87	2015	181.8	1.33	2025	204.8	1.12
2006	158.2	1.80	2016	184.2	1.30	2026	207.0	1.11
2007	161.0	1.76	2017	186.5	1.27	2027	209.3	1.10
2008	163.7	1.73	2018	188.9	1.25	2028	211.6	1.10
2009	166.5	1.69	2019	191.2	1.22	2029	213.9	1.09
2010	169.2	1.63	2020	193.4	1.19	2030	216.2	1.08

Source: JICA Study Team

Based on the said assumption, the future population of Pakistan was forecasted (Figure 3.2.2 and Figure 3.2.4). Population will exceed 200 million by 2023 and reach 216 million or 1.4 times the present population in 2030. Based on the 1998 census, the United States Census Bureau made a long-term projection of Pakistani population which is shown in Table 3.2.5. Compared to the PTPS projection, the population projected by the US Census Bureau is slightly higher (4.1million or 1.8% in 2030).

Table 3.2.5 Population Projection by US Census Bureau

Year	Population (million)
2005	155.7
2010	171.3
2015	185.0
2020	199.7
2025	209.7
2030	220.3

Source: US Census Bureau

(3) Regional Distribution

Geographically, the population of Pakistan is unevenly distributed as shown in Table 3.2.6 and Figure 3.2.3. The two provinces of Punjab and Sindh contain 78% of the total population, while the other provinces (with 57% of national land) contain only 22% of the population.

Table 3.2.6 Regional Population in Census Year

In 1000 population

Region/ Province	Urban Population			Rural Population			Total Population		
	1972	1981	1998	1972	1981	1998	1972	1981	1998
Islamabad	77	204	529	158	136	276	235	340	805
Punjab	9,183	13,052	23,019	28,428	34,241	50,602	37,610	47,292	73,621
Sindh	5,726	8,243	14,840	8,430	10,786	15,600	14,156	19,029	30,440
NWFP	1,196	1,665	2,994	7,193	9,396	14,750	8,389	11,061	17,744
Balochiostan	399	677	1,569	2,029	3,655	4,997	2,429	4,332	6,566
FATA	13	-	85	2,478	2,199	3,091	2,491	2,199	3,176
Pakistan	16,594	23,841	43,036	48,716	60,412	89,316	65,310	84,253	132,352

Note: not inclusive of the population of AJK and Northern Area
Source: Pakistan Economic Survey 2004-05, Statistical Appendix P.95

Figure 3.2.3 clearly shows the concentration of population in the corridor along the Indus, its tributaries and the corridor from Lahore to Peshawar via Islamabad/ Rawalpindi.

According to the 1998 census, about one person out of three lives in an urban area. This urban population ratio has been steadily growing from 25 % in 1972 and 28 % in 1981. Most of the urban population live in Punjab and Sindh. The most populous city is Karachi (9.3 million in 1998), followed by Lahore (5.4 million), Faisalabad (2.0 million), Rawalpindi (1.4 million), Multan (1.2 million), Hyderabad (1.2 million), Gujranwala (1.1 million) and Peshawar (1.0 million). Quetta, the capital of Balochistan had a population of 0.6 million in 1998.

Provincial population was projected by extrapolating the 1998 population using the 1981-1998 growth rates and then adjusting the projected population to meet the total forecast population of Pakistan. Table 3.2.7 shows the projected provincial population.

Table 3.2.7 Projection of Provincial Population, 2005 – 2030

Province	1998	2005	2010	2015	2020	2025	2030
Islamabad	805	1,119	1,441	1,832	2,278	2,884	3,559
Punjab	73,621	86,110	93,335	99,813	104,410	111,232	115,516
Sindh	30,440	36,005	39,466	42,680	45,149	48,641	51,083
NWFP	17,744	21,012	23,059	24,966	26,441	28,519	29,986
Balochiostan	6,566	7,596	8,143	8,613	8,911	9,390	9,644
FATA	3,176	3,602	3,785	3,925	3,981	4,112	4,141
Pakistan	132,352	155,444	169,229	181,828	191,169	204,777	213,928

Source: JICA Study Team

The forecasted provincial population was further subdivided into traffic zones which were composed by combining several adjacent districts (taking into consideration their geographically homogeneous nature). The results are shown in Table 3.2.8 and illustrated in Figure 3.2.4. The population distribution was forecast based only on the past trend and did not take into account any large-scale investments for regional development, except for the Gwardar area development in Balochistan.

The total population of Pakistan is expected to exceed 200 million in 20 years with an increase of about 50 million, of which 51% will occur in Punjab, 26% in Sindh and 16% in .NWFP together with FATA. Balochistan and Islamabad are projected to experience the same increase of 1.8 million, respectively.

The trend in zone-wise distribution clearly shows that significant increases are observed in

zones of the provincial capitals or zones of large cities, while rather moderate increases are observed in other zones. This indicates that an intensive migration from rural to urban area will continue in the future.

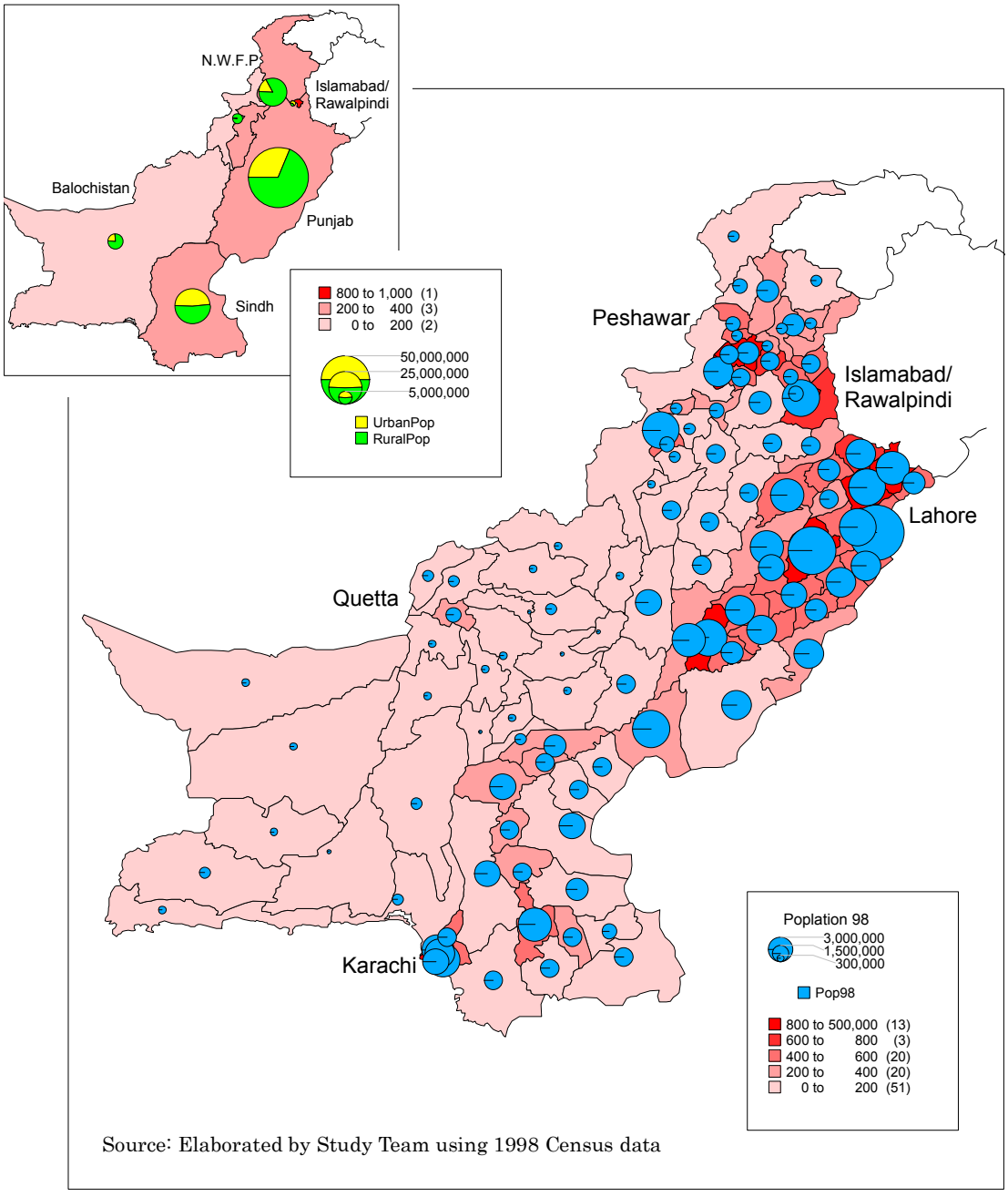


Figure 3.2.3 Population Distributions and Density, 1998

Table 3.2.8 Future Population by Traffic zone

(1,000 persons)

Traffic Zone		Census Population			Estimated and Forecast Population					
No.	Zone Name	1972	1981	1998	2005	2010	2015	2020	2025	2030
1	Malkand	1,238	1,523	2,660	3,275	3,630	3,969	4,243	4,619	4,901
2	Swat	888	1,233	2,199	2,731	3,046	3,350	3,604	3,948	4,215
3	Mansehra	2,069	2,701	3,506	3,820	3,997	4,125	4,162	4,277	4,283
4	Mardan	1,204	1,507	2,487	2,992	3,262	3,508	3,689	3,951	4,123
5	Peshawar	2,492	2,730	4,805	5,936	6,595	7,227	7,744	8,450	8,986
6	Kohat	1,145	1,412	1,982	2,230	2,388	2,522	2,604	2,738	2,806
7	Bannu	818	950	1,527	1,817	1,966	2,098	2,189	2,326	2,409
8	D.I.Khan	781	945	1,521	1,811	1,960	2,092	2,184	2,321	2,405
Subtotal NWFP		10,635	13,000	20,685	24,614	26,844	28,891	30,422	32,631	34,127
9	Islamabad	1,982	2,462	4,169	5,041	5,598	6,133	6,574	7,177	7,641
10	Attok	749	877	1,275	1,448	1,537	1,611	1,651	1,723	1,754
11	Jhelum	1,285	1,435	2,021	2,265	2,382	2,472	2,510	2,596	2,618
12	Gujrat	1,899	2,255	3,209	3,611	3,810	3,966	4,039	4,189	4,238
13	Sargodha	1,558	1,912	2,666	2,976	3,121	3,229	3,269	3,371	3,389
14	Khushab	543	641	906	1,016	1,070	1,111	1,129	1,168	1,179
15	Mianwali	1,096	1,377	2,108	2,445	2,635	2,802	2,916	3,090	3,193
16	Sialkot	2,344	2,711	3,989	4,551	4,848	5,096	5,241	5,489	5,607
17	Gujranwala	2,060	2,676	4,234	4,978	5,418	5,819	6,113	6,542	6,827
18	Sheikhupura	1,657	2,110	3,321	3,896	4,234	4,540	4,762	5,088	5,302
19	Faisalabad	4,248	4,696	7,051	8,113	8,696	9,196	9,513	10,024	10,301
20	Jhang	1,555	1,971	2,834	3,204	3,391	3,541	3,617	3,763	3,819
21	Lahore	3,774	5,073	8,695	10,565	11,773	12,944	13,923	15,254	16,297
22	Sahiwal	2,684	3,549	5,363	6,187	6,643	7,038	7,295	7,701	7,928
23	D.G.Khan	1,142	1,583	2,747	3,355	3,752	4,141	4,470	4,916	5,272
24	Muzaffagath	1,565	2,164	3,757	4,589	5,133	5,665	6,116	6,726	7,212
25	Multan	4,160	5,409	8,448	9,880	10,713	11,461	11,995	12,788	13,294
26	Bahalnagar	1,074	1,374	2,061	2,372	2,541	2,687	2,779	2,928	3,009
27	Bahawalpur	1,071	1,453	2,433	2,928	3,240	3,538	3,779	4,112	4,363
28	Rhahim Yan Khan	1,399	1,841	3,141	3,809	4,239	4,654	4,999	5,469	5,835
Subtotal Punjub		37,845	47,570	74,426	87,229	94,777	101,645	106,687	114,116	119,075
29	Loralai	340	719	956	1,041	1,098	1,141	1,160	1,199	1,208
30	Quetta	502	762	1,501	1,921	2,145	2,361	2,540	2,781	2,967
31	Chagai	65	120	203	243	259	272	279	292	297
32	Dera Bugti	682	1,036	1,619	1,883	1,983	2,058	2,089	2,158	2,171
33	Khuzdar	421	854	1,141	1,244	1,300	1,340	1,350	1,385	1,383
34	Gwadar	296	653	833	891	963	1,026	1,068	1,133	1,170
35	Lasbela	125	188	313	373	396	415	424	442	448
Subtotal Balochistan		2,431	4,333	6,566	7,596	8,143	8,613	8,911	9,390	9,644
36	Shikarpur	1,232	1,596	2,285	2,575	2,705	2,802	2,837	2,924	2,937
37	Larkana	921	1,139	1,927	2,327	2,568	2,794	2,973	3,219	3,396
38	Sukkur	862	1,134	1,900	2,285	2,514	2,728	2,894	3,124	3,286
39	Dadu	811	1,082	1,669	1,940	2,083	2,206	2,284	2,407	2,471
40	Khairpur	725	981	1,547	1,814	1,960	2,089	2,176	2,307	2,384
41	Nawabshah	1,365	1,667	2,190	2,383	2,514	2,615	2,659	2,753	2,777
42	Sanghar	674	893	1,422	1,675	1,815	1,940	2,027	2,156	2,234
43	Tharparkar	1,016	1,502	2,483	2,970	3,255	3,518	3,717	3,997	4,188
44	Hyderabad	1,626	2,022	2,834	3,167	3,406	3,611	3,743	3,950	4,060
45	Badin	641	813	1,193	1,358	1,480	1,591	1,671	1,787	1,862
46	Thatta	676	761	1,113	1,266	1,378	1,480	1,554	1,660	1,728
47	Karachi	3,607	5,438	9,856	12,244	13,786	15,306	16,614	18,356	19,760
Subtotal Sindh		14,156	19,029	30,420	36,005	39,466	42,680	45,149	48,641	51,083
Pakistan Total		65,067	83,931	132,097	155,444	169,229	181,828	191,169	204,777	213,928

Source: JICA Study Team

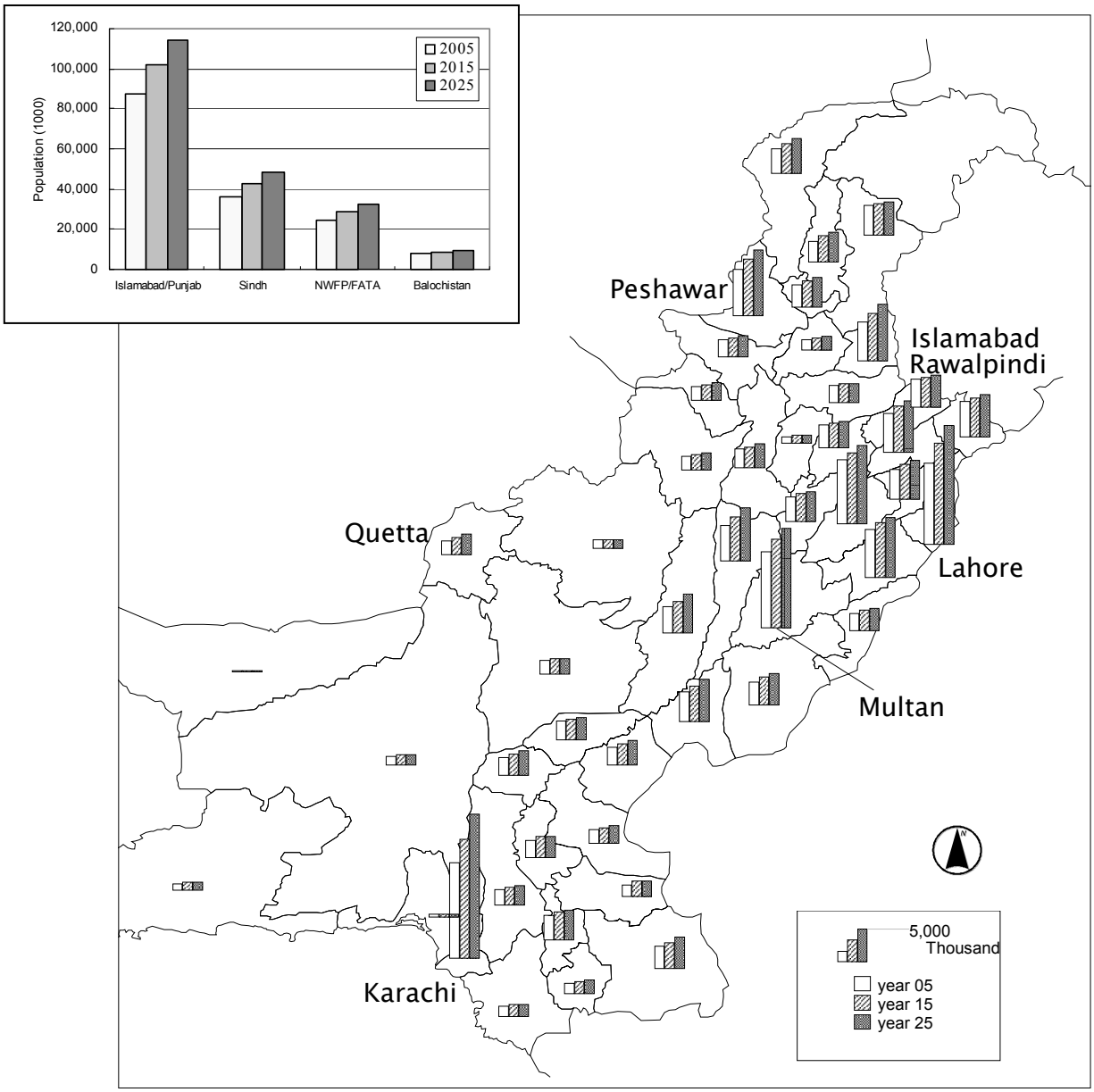


Figure 3.2.4 Future population Increase by Province and Traffic Zone

3.2.2 Labour Force and Employment

(1) Labour Force

As shown in Table 3.2.9, the labour force rate has been rising in Pakistan, reaching the current rate of 30%. This is due to the change in age-structure and participation of the female population. However, 30% is still low compared with south-east Asian countries attaining a steady economic growth. The labour force rate will continue to rise and MTDF foresees the rate will reach 31.2% in 2010 (shaded area in Table 3.2.9). The unemployment rate is currently very high at 7.7%. MTDF aims at gradually lowering this rate to 4% by 2010.

Table 3.2.9 Trends of Labour Force and Employment

Year	Population (million)	Working Age Population (million)	Labour Force (million)	Employed (million)	Unempl-oyed (million)	Working Age Pop. Rate (%)	Labour Force Rate (%)	Unemploy-ment Rate (%)
1996	127.51	87.87	35.01	33.13	1.88	68.9	27.5	5.37
1997	130.56	86.91	37.45	35.16	2.29	66.6	28.7	6.11
1998	133.61	88.92	39.26	36.94	2.32	66.6	29.4	5.91
1999	136.64	90.95	40.15	37.78	2.37	66.6	29.4	5.90
2000	139.76	94.59	40.49	37.32	3.17	67.7	29.0	7.83
2001	142.86	96.69	41.38	38.14	3.24	67.7	29.0	7.83
2002	145.96	99.70	43.21	39.64	3.57	68.3	29.6	8.26
2003	149.03	101.80	44.12	40.47	3.65	68.3	29.6	8.27
2004	150.47	103.54	45.76	42.24	3.52	68.8	30.4	7.69
2005	153.96	106.72	46.82	43.22	3.60	69.3	30.4	7.69
2006	156.32	109.16	47.60	44.36	3.24	69.8	30.5	6.81
2007	159.13	111.94	48.59	45.66	2.93	70.3	30.5	6.03
2008	161.93	114.75	49.71	47.04	2.67	70.9	30.7	5.37
2009	164.74	117.60	50.90	48.53	2.37	71.4	30.9	4.66
2010	167.52	120.47	52.21	50.12	2.09	71.9	31.2	4.00

Source: Labour Force Survey by Federal Bureau of Statistics and MTDF

In order to forecast employment levels up to the year 2030, the followings two assumptions were made:

- The labour force rate will continue to increase at the same pace as during 2000-2010 and reach 34.2% in 2030.
- The unemployment rate will be maintained at 4% after 2010.

Accordingly, employment in 2030 will be 71 million or 1.64 times the level of employment in 2005, while total population will increase 1.41 times (Table 3.2.10). Therefore, Pakistan has to create 28 million working opportunities in 25 years. The agricultural sector appears to have a limited capacity for new job creation and the consequently the majority of the new workers will have to be absorbed in the secondary and tertiary sectors. This will also accelerate the concentration of people in urban areas

Table 3.2.10 Future Labour Force and Employment

Year	Population (million)	Working Age Population (million)	Labour Force (million)	Employed (million)	Unemp-loyed (million)	Working Age Pop. Rate (%)	Labour Force Rate (%)	Unemploy-ment Rate (%)
2005	153.96	106.72	46.82	43.22	3.60	69.3	30.4	7.69
2010	167.52	120.47	52.21	50.12	2.09	71.9	31.2	4.00
2015	181.83	131.69	58.04	55.72	2.32	72.4	31.9	4.00
2020	193.44	141.11	63.21	60.68	2.53	72.9	32.7	4.00
2025	204.78	150.45	68.47	65.72	2.74	73.5	33.4	4.00
2030	216.24	160.02	73.93	70.97	2.96	74.0	34.2	4.00

Source: JICA Study Team

(2) Employment by Sector

Based on the industrial classification in Table 3.2.11, the sectoral composition of employment was forecast based on the provincial characteristics in 2002 (Table 3.2.12), and the past and future trend of shares in the industrial sector (Table 3.2.13). In order to make the sum of provincial employment and the sum of the employment by sector tally with the national total, an iteration process was taken. The results are shown in Table 3.2.14 and Figure 3.2.5.

Table 3.2.11 Industry Classification in Pakistan

Commodity Producing Sectors	Primary Sector	1. Major Crops 2. Minor Crops 3. Livestock 4. Fishing 5. Forestry
	Secondary Sector	6.Mining & Quarrying 7. Manufacturing 8. Construction 9. Electric and Gas & Water Supply
Service Sector	Tertiary Sector	10. Transport, Storage & Communication 11. Wholesale & Retail Trade 12. Finance & Insurance 13. Ownership of Dwellings 14. Public Administration & Defence 15. Community & Social Services

Source: MTDF and JICA Study Team

Table 3.2.12 Employment Composition by Province in 2002

Sector	Punjub	NWFP	Balochistan	Sindh	Pakistan
Primary Sector	45.2	40.9	46.0	37.9	43.5
Secondary Sector	21.3	18.1	13.5	20.0	20.3
Tertiary Sector	33.5	41.1	40.6	42.2	36.2
Total	100.0	100.0	100.0	100.0	100.0

Source: Labour Force Survey, 2002

Table 3.2.13 Change in Employment Composition by Industrial Sector

Year/Period	Primary Sector	Secondary Sector	Tertiary Sector	Total
1990	51.2	19.8	29.0	100.0
1991-95	48.0	18.9	33.1	100.0
1996-00	46.8	17.9	35.3	100.0
2001-05	43.7	20.0	36.2	100.0
2006-10	40.5	20.6	38.9	100.0
2010	38.7	20.7	40.5	100.0
2015	36.1	21.7	42.1	100.0
2020	33.7	22.8	43.5	100.0
2025	31.5	23.9	44.7	100.0
2030	29.4	25.0	45.6	100.0

Source: MTDF and JICA Study Team

Table 3.2.14 Employment by Industrial Sector and by Province

Item	Year	Punjab	NWFP	Balochistan	Sindh	Pakistan
Population	2005	87,229	20,920	6,566	30,440	155,444
	2010	94,777	24,614	7,596	36,005	169,229
	2015	101,645	26,844	8,143	39,466	181,828
	2020	106,687	28,891	8,613	42,680	191,169
	2025	114,116	30,422	8,911	45,149	204,777
	2030	119,075	32,631	9,390	48,641	213,928
Employed	2005	27,886	4,820	1,779	8,735	43,220
	2010	31,428	5,982	2,130	10,580	50,120
	2015	34,708	6,718	2,352	11,942	55,720
	2020	37,429	7,429	2,556	13,269	60,683
	2025	40,772	7,966	2,693	14,294	65,725
	2030	43,555	8,748	2,905	15,766	70,974
Primary Sector	2005	12,546	1,958	814	3,288	18,606
	2010	12,812	2,177	879	3,552	19,420
	2015	13,234	2,277	909	3,722	20,142
	2020	13,349	2,347	926	3,843	20,464
	2025	13,579	2,343	913	3,843	20,678
	2030	13,563	2,401	924	3,944	20,832
Secondary Sector	2005	5,926	869	239	1,740	8,774
	2010	6,867	1,097	293	2,134	10,390
	2015	7,966	1,288	340	2,511	12,105
	2020	9,024	1,491	389	2,911	13,815
	2025	10,308	1,671	430	3,270	15,680
	2030	11,563	1,923	489	3,768	17,743
Tertiary Sector	2005	9,414	1,993	726	3,707	15,840
	2010	11,749	2,708	959	4,895	20,310
	2015	13,509	3,152	1,103	5,709	23,474
	2020	15,057	3,590	1,242	6,514	26,404
	2025	16,885	3,951	1,350	7,181	29,367
	2030	18,429	4,424	1,492	8,053	32,398

Source: MTDF and JICA Study Team

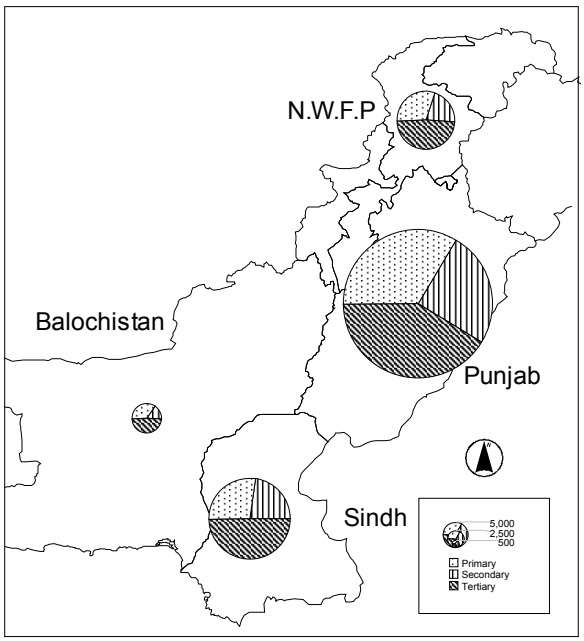


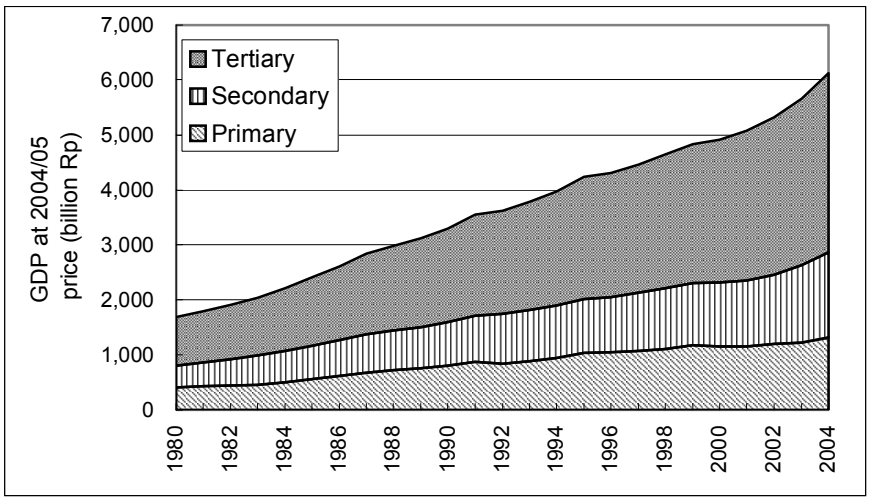
Figure 3.2.5 Employment Composition by Industrial Sectors in 2025

3.3 Economic Growth

3.3.1 Past and Recent GDP Growth

Since the 1980s, the economy of Pakistan has been performing well except for the period of 1995-2000 which was badly affected by the global financial crisis, attaining 5.2 – 7.3% of the 5-year average growth rate. Of particular note is GDP growth of 8.4% per annum in 2004/5.

The increase in GDP between 1980 and 2004 is made up of the primary sector (20%), secondary sector (26%) and tertiary sector (54%), respectively. Over the same period, the primary sector decreased its share of the total GDP by 3.1% and the secondary and teriary sectors increased by 1.9% and 1.2%.



Source: Pakistan Economic Survey, 1985/6 – 2004/5, elaborated by Study Team

Figure 3.3.1 Trend of GDP Growth by Sector

Table 3.3.1 Past Performance of Economic Growth

(Billion Rs. at 2004/05 price)

Year	GDP		Primary Sector		Secondary Sector		Tertiary Sector	
	Billion (Rs)	Average Growth Rate (%)	Billion (Rs)	Compo-sition (%)	Billion (Rs)	Compo-sition (%)	Billion (Rs)	Compo-sition (%)
1980	1,689	-	418	24.7	393	23.2	879	52.0
1985	2,404	7.3	560	23.3	607	25.2	1,237	51.5
1990	3,295	6.5	801	24.3	790	24.0	1,704	51.7
1995	4,238	5.2	1,036	24.5	985	23.3	2,216	52.3
2000	4,918	3.0	1,157	23.5	1,164	23.7	2,597	52.8
2004	6,130	5.7	1,323	21.6	1,540	25.1	3,267	53.3

Source: Elaborated by Study Team based on Pakistan Economic Survey, 2004-05

3.3.2 Projection of Economic Growth

Due to the recent good performance in economic growth, the Government is aiming for high growth rates over the MTDF period, starting at 7.0% in 2005/06, becoming higher year by year up to 8.2% in 2009/10. The average growth rate over the five years is 7.6%.

As the investment and financial markets are expanding, it is possible that the target may be attained. However, such a high growth is hardly sustained for a long period. The JICA Study Team has prepared three scenarios for the macro-economic framework:

1) High growth scenario: To maintain the average rate of MTDF of 7.6% for 20 years after

2010.

2) Medium growth scenario: The growth rate of 7% will continue until 2010/11, and then start to decline by 0.5% every five years

3) Low growth scenario: The growth rate of 7.0% will decline by 0.5% every year until 2010/11, and will then gradually drop to 3.0% in the year 2025.

Table 3.3.2 and Figure 3.3.2 show the economic growth rates under each scenario.

Table 3.3.2 Economic Growth Scenarios

Year	Annual Growth Rate (%)		
	High	Medium	Low
2005/06	7.0	7.0	7.0
2006/07	7.3	7.0	6.5
2007/08	7.6	7.0	6.0
2008/09	7.9	7.0	5.5
2009/10	8.2	7.0	5.0
2010/11-2014/15	7.6	6.5	4.0
2015/16-2019/20	7.6	6.0	4.0
2020/21-2024/25	7.6	5.5	3.0
2025/26-2029/30	7.6	5.0	3.0

Source: JICA Study Team

Figure 3.3.2 Economic Growth Scenario

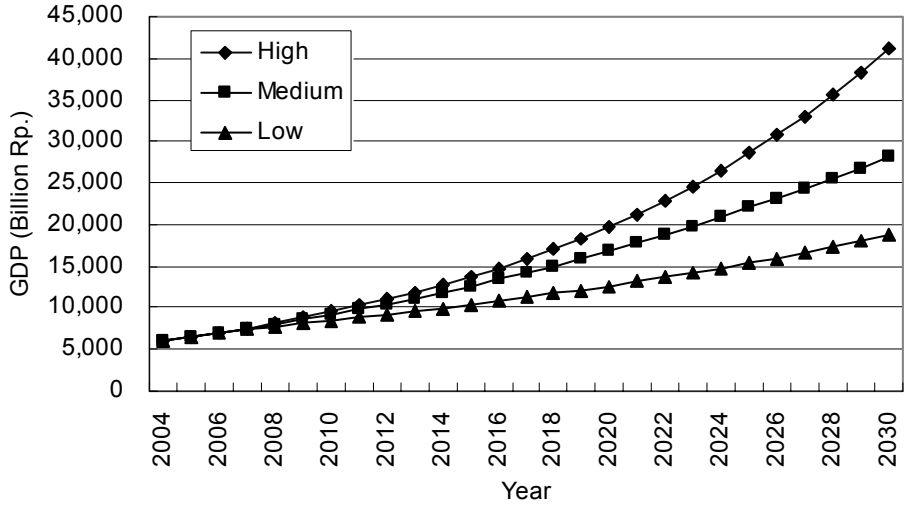
Under these conditions, the Pakistan economy will grow as shown in Table 3.3.3 and Figure 3.3.3. In the 20 years until 2025, the Pakistan economy will expand by 3.3 times in High Case, 2.5 times in Medium Case, and 1.7 times in Low Case. Accordingly, GDP per Capita will rise from Rs. 42,213 (US$700) to Rs. 139,000 (US$ 2,300) for High Case, Rs. 108,000 (US$1,800) for Medium Case and Rs. 75,000 (US$1,250) for Low Case.

The JICA Study Team used the medium case as the planning base.

Table 3.3.3 Projection of GDP and GDP per Capita by Scenario

Year	Population (million)	High Case		Medium Case		Low Case	
		GDP (Rs. Billion)	GDP per Capita (Rs.)	GDP (Rs. Billion)	GDP per Capita (Rs.)	GDP (Rs. Billion)	GDP per Capita (Rs.)
2005	155.4	6,559	42,213	6,559	42,213	6,559	42,213
2010	169.2	9,513	56,214	9,199	54,361	8,531	50,408
2015	181.8	13,721	75,460	12,604	69,319	10,379	57,079
2020	193.4	19,790	102,304	16,867	87,195	12,627	65,277
2025	204.8	28,543	139,386	22,045	107,652	15,363	75,023
2030	216.2	41,168	190,381	28,135	130,110	18,691	86,438

Note: Projection by JICA Study Team



Note: Projection by JICA Study Team

Figure 3.3.3 Projection of GDP by Scenario

3.4 Freight Transport Demand

3.4.1 Analysis of Major Commodities

(1) Oil and Petrol Products

Pakistan does have some oil reserves and produces crude oil. However, there is an enormous gap between local production and demand: Pakistan imported 7.8 billion tonnes of crude oil in 2003-04 while the export of crude oil was 0.1 billion tonnes in the same year (Pakistan Energy Yearbook).

The consumption of oil products is depicted in Figure 3.4.1. The figure shows that the demand for oil products, mostly petrol and diesel, is insatiable, and is increasing almost unabatedly with the exception of furnace oil, for which demand dropped almost to the half in 2003/04. The demand for kerosene oil has been continually decreasing over the years due to the availability of sui (natural) gas for cooking. Also, the amount of kerosene is relatively small compared to the demand for petrol and diesel.

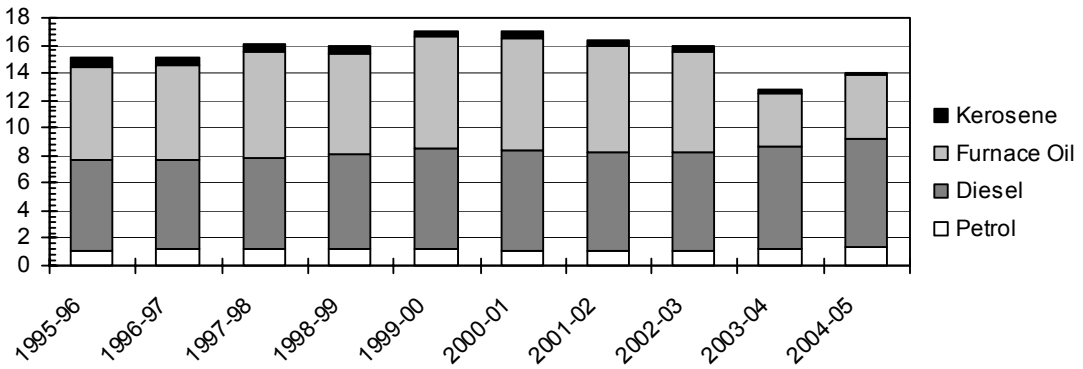


Figure 3.4.1 Consumption of oil products in Pakistan (tonnes/year)

(2) Agricultural Products

The agriculture sector accounts for about 90% of the country's primary sector GDP and in 2004-05 it is estimated to be just over 23% of the GDP. It employs about 43% of the labour force and provides a livelihood for close to two-thirds of the population. The key agricultural products of interest are those which are essential: wheat and rice as the main staples, maize as animal fodder, and other major cash crops such as cotton and sugarcane.

Growth in the agriculture sector growth has been quite variable over the last decade. There are many reasons for these variations, however the main ones are: weather conditions, drought, pest control, effective use of available water, availability of treated and higher quality seeds, and use of fertilizers.

Table 3.4.1 and Table 3.4.2 show the recent trends in the production of the major agricultural products. Crops have increased at a rate of 4.0% p.a. while meat, milk and fish have shown a slightly less growth of 2.8% p.a.

Table 3.4.1 Production of Crops (2000 – 04)

"000" Tonnes

Items	Actual				ACGR (%)
	2000-01	2001-02	2002-03	2003-04	
Grains	25,986	24,310	25,890	26,854	1.1
Wheat	19,024	18,226	19,183	19,500	
Rice	4,803	3,882	4,479	4,848	
Basmati	1,629	1,999	2,304	2,522	
Others	3,174	1,883	2,174	2,326	
Maize	1,643	1,664	1,737	1,897	
Other Cereals	516	538	491	609	
Cash Crops	46,366	50,787	54,694	56,090	6.6
Cotton (Lint)	1,820	1,803	1,737	1,709	
(Million Bale)	(10.7)	(10.6)	(10.2)	(10.05)	
Sugarcane	43,606	48,042	52,056	53,491	
Tabacco	85	95	88	86	
Pulses	621	594	930	871	11.9
Gram	397	362	675	611	
Others	224	232	255	260	
Oil Seeds	4,085	4,080	3,951	4,160	0.6
Cottonseed	3,640	3,606	3,473	3,418	
Rape & Mustard and Canola	231	221	235	238	
Sunflower	70	78	131	359	
Others	145	175	112	145	
Vegetables	6,089	5,990	6,254	6,415	1.8
Potato	1,666	1,731	1,946	1,938	
Onion	1,563	1,385	1,428	1,449	
Other vegetables	2,860	2,874	2,880	3,028	
Fruits	5,892	5,900	5,742	5,712	-1.1
Total*	89,039	91,661	97,461	100,102	4.0

Note: * 1 Bale = 0.25 ton
Source: MTDF

Table 3.4.2 Production of Meat, Milk and Fish

"000" Tonnes

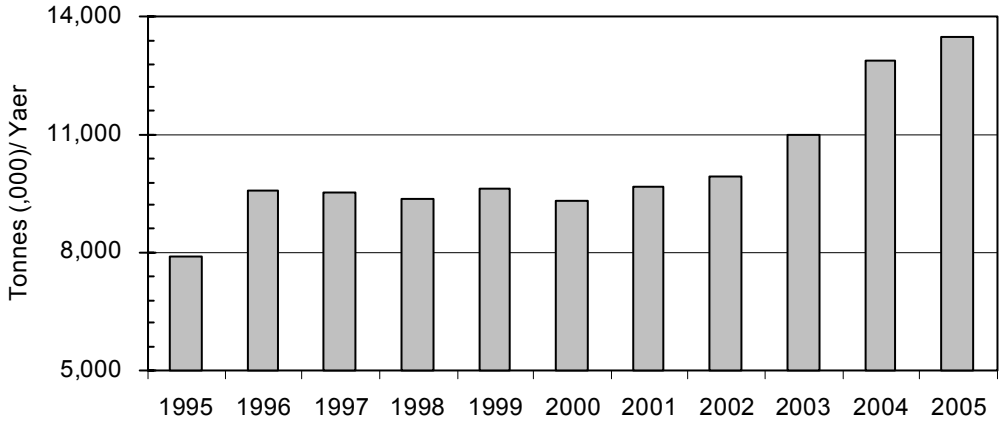
Items	Actual					ACGR (%)
	2000-01	2001-02	2002-03	2003-04	2004-05	
Meat	2,015	2,072	2,134	2,212	2,275	3.1
Beef	1,010	1,034	1,060	1,087	1,115	2.5
Mutton	666	683	702	723	740	2.7
Poultry	339	355	372	402	420	5.5
Milk	26,284	27,055	27,811	28,624	29,472	2.9
Fish	630	638	559	564	574	-2.3
Inland	179	183	157	163	170	-1.3
Marine	451	455	402	401	404	-2.7
Total	28,929	29,765	30,504	31,400	32,321	2.8

Source: MTDF

(3) Cement and Building Materials

The cement industry in Pakistan has endeavoured to produce enough cement for local consumption. When a shortfall has occurred, cement has been imported to meet local demands. Figure 3.4.2 presents the variation in the production of cement over the last decade.

It can be seen that the production of cement has been steady over the last decade, at around nine million tons per annum. However, the recent rapid growth in economic activity has generated a higher demand for cement leading to higher output from old plants and new plant(s) coming on line. The overall average growth was just over 5% from 1995 to 2005.



Source: Pakistan Statistics

Figure 3.4.2 Production of Cement in Pakistan

The demand for other building materials such as bricks and sand is generally met by local production. There is no export or import involved. Although these commodities are commonly transported by road, the travel distances are considered to be relatively short.

The growth in demand for building materials would generally follow the economic trends, and confidence in the economy as whole. With the forecast of high growth in the economy, demand for such commodities would also rise inline with the economic growth.

(4) Manufactured Goods

The proportion of manufactured goods in the volume of freight transported has been increasing as industrialization proceeds. Table 3.4.3 shows the export trends for the major industrial products.

Table 3.4.3 Export Trends for Major Industrial Products

(US$ million)

	2000-01	2001-02	2002-03	2003-04	ACGR (%)
Textile	5,756	5,778	7,225	8,039	11.8
Leather	658	623	621	666	0.4
Chemical	157	153	261	263	18.8
Engineering Goods	194	221	254	262	10.5
Others	684	722	733	743	2.8
Total	7,449	7,497	9,094	9,973	10.2

Source: MTDF

The export of manufactured goods has thus increased at a higher rate than the GDP of Pakistan. If Pakistan's economy grows at a considerably higher rate than the past decade, then the export of manufactured goods will increase rapidly. This is caused by the synergy of the rising share of the manufacturing industry and the high elasticity in the production of this industry to the entire economic growth, i.e. GDP.

Although this analysis does not necessarily show that the transport demand increases according to the export of manufactured goods, its higher growth should be duly taken into account in the transport demand forecast.

3.4.2 Suggested Growth of Freight Transport Demand up to 2025

Table 3.4.4 summarizes the growth rates (ACGR) assumed in MTDF for production, consumption and export of selected goods. In general, higher growth is assumed for industrial goods rather than agricultural products and raw materials. Also in MTDF, land transport demand for freight is assumed to grow at an average annual rate of 6.3% (10.0% for railway and 6.1% for road) as shown in Table 3.4.5. For the same period, MTDF assumes a growth of GDP at 7.6% a year. This means that the elasticity of land freight traffic demand against GDP is less than 1.0.

The growth rate of land freight traffic demand assumed in MTDF seems to be a little underestimated due to the following reasons:

A. In the past, the land traffic volume has increased at an average annual rate of 8.6% in terms of ton-km from 1990/91 to 2003/04. This is higher than the growth rate of GDP which was 5.2 – 7.3% during the same period.

B. Taking into account the future structural change of Pakistani industries which is only reflected in MTDF, the freight transport demand is likely to increase faster than that projected by MTDF. This is particularly true on a ton-km basis, because the growth of industrial products which move in larger spheres will be higher than agricultural products and raw materials which tend to move within local production/consumption areas.

In conclusion, it is reasonable for PTPS to assume a future demand growth of land freight transport slightly higher than GDP on a ton-km basis, and the same or slightly lower than GDP on a ton basis, as exemplified in Table 3.4.6.

Table 3.4.4 Growth of Production, Consumption and Export assumed for Selected Goods in MTDF, 2004/05-2009/10

	2003-04	2009-10	ACGR (%)
POL Products Demand (million tons)	16.8	20.7	4.3
Agricultural Products (thousand tons)			
- Grains	29,476	35,977	3.8
- Cash Crops	49,050	61,056	4.5
- Pulses	1,041	1,561	8.4
- Oil Seeds	5,844	7,493	5.0
- Vegetables	6,988	10,004	7.4
- Fruits	6,000	9,445	9.5
- Meat	2,275	3,124	6.5
- Milk	29,472	43,304	8.0
- Fish	574	725	4.8
Export of Major Industrial products (US$ million)			
- Textile	8,999	14,528	10.1
- Leather	790	1,347	11.3
- Chemical	300	1,114	30.0
- Engineering Goods	165	920	41.0
- Cement	42	84	14.9

Source: MTDF

Table 3.4.5 Freight Traffic Growth Assumed in MTDF

	2003-04	2009-10	ACGR (%)
Freight Traffic (Million ton-km)			
Railway	4,800	8,503	10.0
Road	138,668	198,155	6.1
Total	143,468	206,658	6.3

Source: MTDF

Table 3.4.6 Likely Growth of Land Freight Transport Demand

	ACGR (%) 2005 – 2025	Ratio (2025/2005)
Ton-km Basis	6.2 – 7.2	3.3 – 4.0
Ton Basis	5.2 – 6.2	2.8 – 3.3
GDP Growth (Medium Case)	6.2	3.4

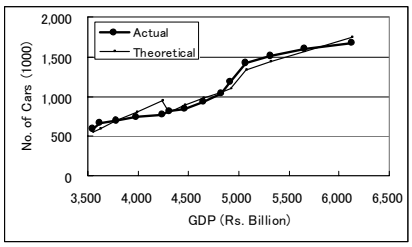
Note: Assumption by JICA Study Team

3.5 Future Motorization

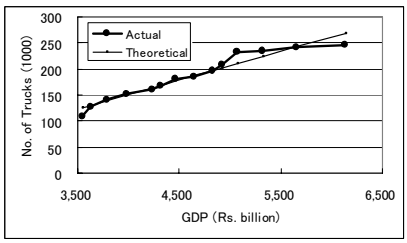
3.5.1 Increase of Vehicles

The historical trend in the number of vehicles in Pakistan fits well with the trend in GDP as shown in Figure 3.5.1. The linear models in Table 3.5.1 were obtained by regression analysis and the correlation coefficients were high enough to use the models for the projection. Using the medium growth case, stated in the section 2 of this chapter (4.2), for the future economic growth, the future numbers of vehicles were estimated by the models as shown in Figure 3.5.2 and Table 3.5.1.

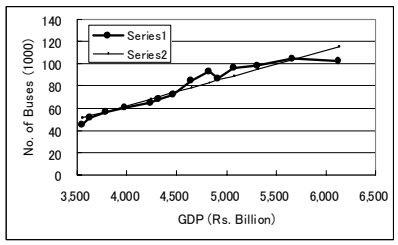
(1) Car



(2) Truck



(3) Bus



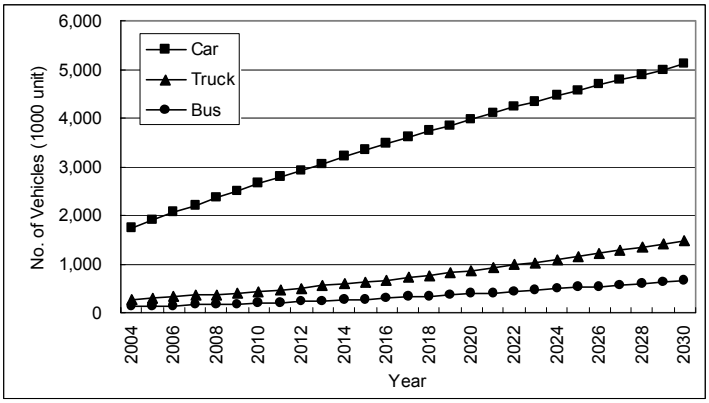
Source: JICA Study Team

Figure 3.5.1 Correlation between Number of Vehicles and GDP

Table 3.5.1 Regression Equation of Number of Vehicles on GDP

Vehicle Type	Regression Equation	Correlation Coefficient (R)
Car	$Y = 2198.89\ Ln(X_1) - 247.719 Ln(X_2) - 17423.6$	0.9799
Truck	$Y = 0.055452\ X_1 - 70.5714$	0.9707
Bus	$Y = 0.024867\ X_1 - 37.1298$	0.9565
Y: No. of Vehicle (1000unit), X_1: GDP (Rs million at 2005 price), X_2: Dummy variable (1.0 for year 1996 to 2000 and 1.0 for other years)		

Source: JICA Study Team



Source: JICA Study Team

Figure 3.5.2 Future Increase of Vehicle Fleet in Pakistan

In 2005, the number of cars used in Pakistan is estimated at 1.9 million and this is predicted to increase to 4.6 million, 2.4 times the present quantity, by 2025. In the same way, the number of trucks is predicted to increase by 3.9 times from 293,000 units to 1,152,000 units and the number of buses is predicted to increase by 4.0 times from 126,000 units to 511,000 units.

Table 3.5.2 Future Vehicle Fleet in Pakistan

(1,000 unit)

Year	Car	Truck	Bus	Total
2004	1,753	269	115	2,137
2005	1,902	293	126	2,321
2010	2,645	440	192	3,277
2015	3,338	628	276	4,242
2020	3,978	865	382	5,226
2025	4,567	1,152	511	6,230
2030	5,104	1,490	662	7,256

Source JICA Study Team

3.5.2 Investment in Truck Fleet and Bus Fleet

The cost to increase the number of trucks and buses to the level forecasted above was estimated, taking into account both the new demand and the renewal demand. Table 3.5.3 shows the weighted average of market prices for trucks and buses to be Rs 2.11 million for a truck and Rs. 3.00 million for a bus, respectively (at 2005 prices).

Table 3.5.3 Average Price of Truck and Bus

Vehicle Type		Weight	Price (Rs.)	Average price (Rs.)
Truck	Pickup	0.35	496,600	175,378
	Truck 2Axle	0.37	2,750,000	1,015,540
	Truck 3Axle	0.25	3,300,000	812,432
	Tanker	0.03	3,650,000	114,481
	Total	1.00	-	2,117,830
Bus	Mini-Bus	0.35	2380333	833,117
	Bus	0.65	3326250	2,162,063
	Total	1.00	-	2,995,179

Source: JICA Study Team

The net increase in the number of trucks from 2005 to 2030 is 1,196,000 units. If the average life of a truck is assumed to be 12 years, all the existing vehicles (293,000 units) will need to be replaced and in addition, all trucks newly purchased between 2006 and 2013 will also need to be replaced by 2025. In the same manner, all trucks newly purchased before 2019 will need to be renewed by 2030. Thus, the cumulative number of trucks to be renewed by 2030 is calculated at 1,055,000 units (Table 3.5.4). The total number of trucks to be procured in 25 years is 2,251,000 units and total cost is approximately Rs.4,700 billion.

With regard to buses, the new demand in 25 years is forecasted at 537,000 units and the renewal demand is calculated at 462,000 units, resulting in a total cost of Rs.3,000 billion. The total cost of trucks and buses will reach Rs 7,800 billion (US$ 130 billion). Most of this huge amount will be invested not by the government sector, but by the private sector. The future fleet size and the cost (investment amount) will be a basis for the development of policy on transport business and administration activities.

Table 3.5.4 Required Fleet and Investment in Trucks and Buses

Period	Truck				Bus			
	Required Fleet (1000 unit)			Investment (Rs. Billion)	Required Fleet (1000 unit)			Investment (Rs. Billion)
	New	Renewal	Total		New	Renewal	Total	
2006-2010	146	122	269	570.1	66	52	118	353.8
2011-2015	189	122	311	660.1	85	52	137	410.8
2016-2020	236	204	440	934.9	106	89	195	584.6
2021-2025	287	293	580	1,231.1	129	129	258	772.0
2026-2030	338	314	652	1,383.5	151	139	290	869.8
2006-2030	1,196	1,055	2,251	4,779.8	537	462	999	2,991.0

Source: JICA Study Team

Chapter 4. TRANSPORT DEMAND PROJECTION

4.1 Demand Forecast Methodology

4.1.1 Process of Demand Forecast

As the model for the previous JICA Study was found to provide a good projection of traffic demand, the same approach as the previous study was applied for the demand forecast. The previous JICA Study projected transport volumes in 2005/06 to be 339 billion passenger-km (BPK) and 89.3 billion ton-km (BTK). On the other hand, the estimated volumes will be lower than the actual ones in 2005/06, which was estimated at 162.12 BTK in the MTDF. However, considering the difference between the estimated GDP and actual GDP, the forecast model for passenger transport can project the future transport volume well.

Using a regression analysis, the future passenger-km and ton-km of land transport were estimated as a control total for growth scenarios. Meanwhile, the future trip distribution (passenger and freight O/D tables) was estimated using the four-step forecast method, and passenger-km and ton-km were calculated from the O/D tables. Subsequently, the O/D tables were adjusted so that the passenger-km and ton-km coincide with that of the control total. The traffic volume on roads was calculated based on the adjusted O/D tables using the traffic assignment model. Figure 4.1.1 illustrates the process adopted for the demand forecast.

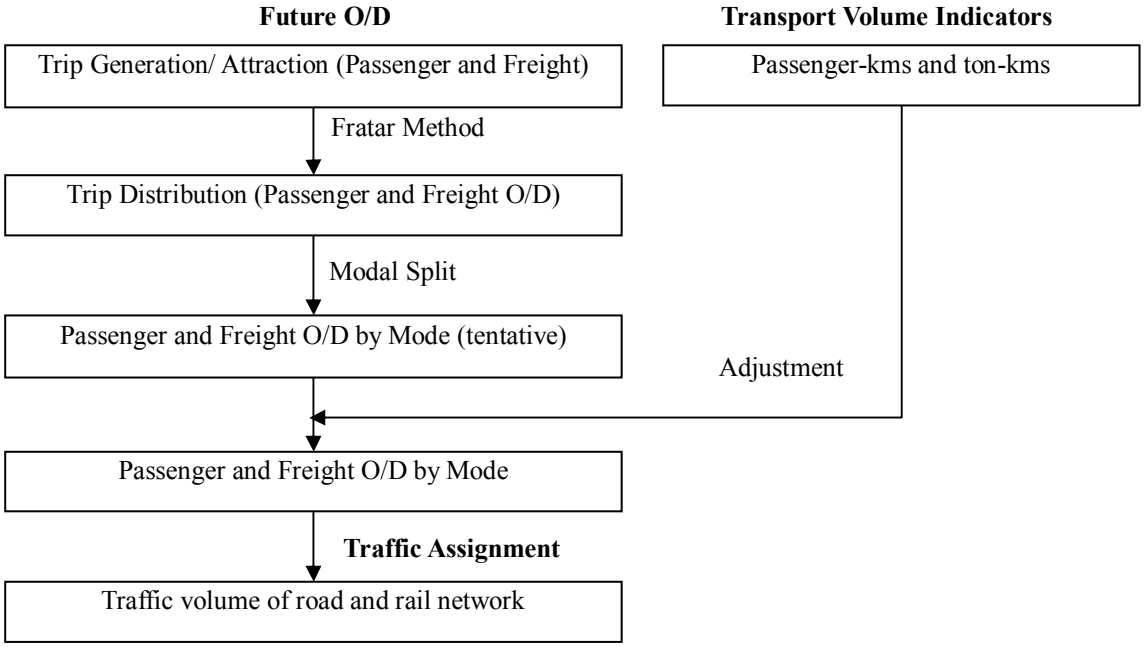


Figure 4.1.1 Process followed for the Demand Forecast

Traffic demand for air transport was estimated separately because the impact of air transport on land transport was expected to be low in the future.

4.1.2 Traffic Survey

A reliable nationwide vehicle O/D matrix, representing an origin-destination pattern of vehicle trips in a country, is valuable information for the projection of traffic demand. In order to make the nationwide O/D matrix for Pakistan, the Study Team carried out a nationwide traffic survey during August and September 2005. The survey consisted of a Roadside O/D Interview Survey (RIS) at 100 locations, a Manual Classified Traffic Count Survey at the same 100 locations and other supplemental surveys. The survey locations were selected from the points where major roads cross district boundaries in accordance with the zoning system applied in PTPS. The survey was undertaken over a period of 16 hours, between 6:00 and 22:00. From RIS, more than 75,000 samples were collected, and the average sampling rate amounted to 34.9%. Districts are the minimum level of information on origins and destinations in the RIS data.

4.1.3 Zoning System

The demand forecast for road transport was carried out based on the PTPS Zoning System, with 45 traffic analysis zones including 39 zones in Pakistan and 6 zones in the external area as shown in Figure 4.1.2. A district is the minimum unit of a traffic analysis zone. Since it is necessary to catch all of the traffic crossing the borders of the traffic analysis zones, districts were merged when too many roads were found to cross the boundary between them. The list of districts for each traffic zones is shown in Table 4.1.1.

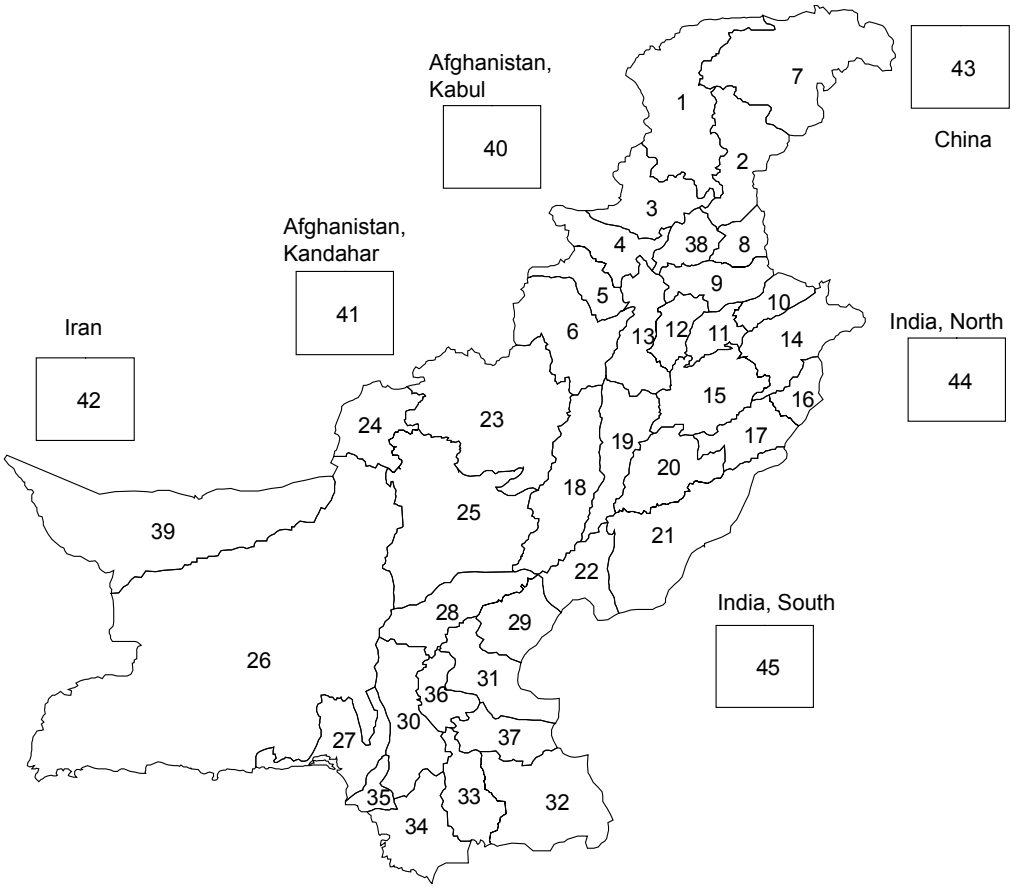


Figure 4.1.2 PTPS Zoning

Table 4.1.1 Traffic Analysis Zone and District

Province	Traffic Zone No.	Traffic Zone Name	District Name	District Code
NWFP	1	Malakand	Malakand	174
			Upper Dir	175
			Lower Dir	176
			Swat	177
			Chitral	179
			Bajaur Agency (TA)	180
			Shangla	178
	2	Mansehra	Abbottabad	141
			Haripur	142
			Mansehra	143
			Kohistan	151
			Bat Gram	152
	3	Peshawar	Peshawar	111
			Nowshera	112
			Charsada	113
			Khyber Agency (TA)	114
			Mardan	121
			Swabi	122
			Bunar	123
			Mohmand Agency (TA)	181
	4	Kohat	Kohat	131
			Hangu	132
			Karak	133
			Orakzai Agency (TA)	134
			Kurram Agency (TA)	135
	5	Bannu	Bannu	171
			Lakki	172
			North Waziristan (TA)	173
	6	D.I. Khan	Dera Ismail Khan	161
			Tank	162
			South Waziristan (TA)	163
North Area	7	Gilgit	Gilgit Northern Areas	471
			Azad Jamu & Kashmir	481
Panjab	8	Islamabad	Islamabad	211
			Rawalpindi	212
	38	Attock	Attock	213
	9	Jhelum	Jhelum	214
			Chakwal	215
	10	Gujrat	Gujrat	252
			Mandi Bahauddin	255
	11	Sargodha	Sargodha	221
	12	Khushab	Khushab	222
	13	Mianwali	Mianwali	223
			Bhakkar	224
	14	Sheikhupura	Sialkot	253
			Narowal	254
			Gujranwala	251
			Hafizabad	256
			Sheikhupura	243
	15	Faisalabad	Faisalabad	231
			Toba Tek Singh	233
			Jhang	232
	16	Lahore	Lahore	241
			Kasur	242
	17	Sahiwal	Okara	244
			Sahiwal	263
			Pakpattan	266
	18	D.G.Khan	Dera Ghazi Khan	271
			Rajanpur	273
	19	Muzaffaragarh	Muzaffargarh	272
			Layyah	274
Panjab	20	Multan	Multan	261
			Vehari	262
			Khanewal	264
			Lodhran	265
	21	Bahawalpur	Bahawalnagar	282
			Bahawalpur	281
	22	Rahim Yar Khan	Rahim Yar Khan	283
Balochistan	23	Loralai	Zhob	421
			Killa Saifullah	422
			Loralai	423
			Musakhel	424
			Barkhan	425
	24	Quetta	Quetta	411
			Pishin	412
			Qilla Abdullah	413
	39	Chagai	Chagai	414
	25	Dera Bugti	Sibi	431
			Kohlu	432
			Derabuqti	433
			Ziarat	434
			Nasirabad	441
			Jafarabad	442
			Bolan	443
			Jhalmagsi	444
	26	Khuzdar	Kalat	451
			Khuzdar	452
			Kharan	453
			Awaran	454
			Mastung	455
			Turbat/ Kech	461
			Gwadar	462
			Panjgoor	463
	27	Lasbella	Lasbella	456
Sindh	28	Shikarpur	Shikarpur	322
			Jaccobabad	323
			Larkana	321
	29	Sukkur	Sukkur	311
			Ghotki	315
	30	Dadu	Dadu	334
	31	Khaipur	Khairpur	312
	36	Nawabshah	Nausheroferoz	313
			Nawabshah	314
	37	Sanghar	Sanghar	344
	32	Tharparkar	Mirpur Khas	341
			Tharparkar	342
			Umer Kot	343
	33	Hyderabad	Hyderabad	331
			Badin	332
	34	Thatta	Thatta	333
	35	Karachi	Karachi	351

	Traffic Zone No.	Traffic Zone Name	Code
Foreign	44	India (Panjub)	501
	45	India (Sind)	502
	40	Afghanistan (Kabul)	511
	41	Afghanistan (Kandahar)	513
	42	Iran	521
	43	China	531

Source: JICA Study Team

4.1.4 Making the Present O/D Matrices

(1) Overall Steps

The O/D matrices of road traffic for passenger and freight were created according to the steps shown in Figure 4.1.3.

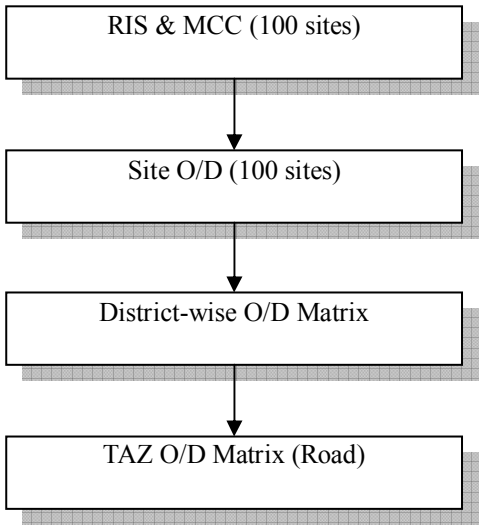


Figure 4.1.3 Overall Steps for Creating O/D Matrices

(2) Site O/D Matrix

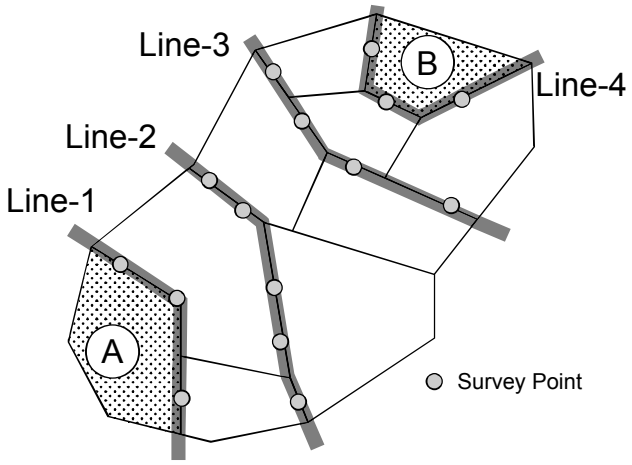
A Site O/D Matrix means an O/D matrix at each survey site, having information of origin, destination, the number of vehicles by vehicle type, the number of passengers by vehicle type, and freight volume by commodity category[1]. The vehicle and passenger O/D were created from field data by multiplying each interview record by multiplying expansion factors at each site. The average payload of truck by vehicle type by commodity type was calculated from RIS data, and was used to calculate the freight volume in a Site O/D Matrix.

In principal, the field data should be adjusted by several factors such as daily fluctuation and seasonal fluctuation. However, since there are not enough traffic data to estimate such fluctuation factors in Pakistan, the field data were directly applied to make Site O/D Matrices.

(3) District-wise O/D Matrix

If the boundary of a TAZ forms a cordon line, the O/D table relating to the TAZ can be directly calculated by adding up O/D tables on the cordon line. On the other hand, an O/D pair can be calculated using several lines that can catch the all traffic relating the O/D pair as shown in Figure 4.1.4. In such case, each O/D pair between two districts was calculated as the average of O/D pairs on such kind of lines ("screen line"), and a district-wise O/D matrix was produced from all O/D pairs. This O/D matrix includes not a few blanks because not all inter-district traffic was recorded in the RIS.

[1] 100 Commodity types in RIS are grouped into 30 categories.



The O/D pair between "A" Zone and "B" Zone can be calculated using Line-1, Line-2, Line-3, and Line-4. This creates four different O/D pairs that must be equal ideally.

Figure 4.1.4 Example for O/D Pair Calculation

(4) TAZ O/D Matrix

The O/D matrix for a traffic analysis zone (TAZ) was produced from the district-wise O/D matrix by merging district zones.

Figure 4.1.5 illustrates desired lines taken from the O/D matrix, based on the PTPS zoning system (45 zones).

Figure 4.1.5 Vehicle Trip Distribution (2005)

4.1.5 Comparison of O/D data

Figure 4.1.6 shows the number of vehicle trips calculated in JICA Studies for 1985/86, 1992/93 and 2005 (PTPS). The vehicle trips increased from 69,896 trips/ day in 1985/86 to 152,502 trips/ day in 1992/03 and 277,353 trips in 2005 as shown in Table 4.1.2. Although an annual growth rate of 5.1% shows a similar increase in passenger-km and freight ton-km, the increase in the number of bus trips is very high at 9.9% while that of trucks is low at 2.1%.

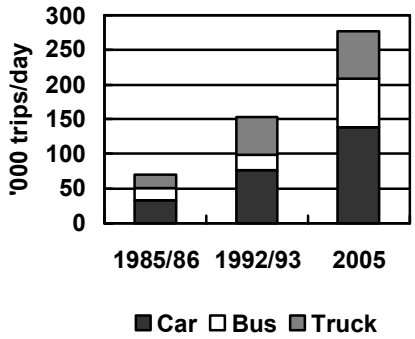


Figure 4.1.6 Vehicle Trips

Table 4.1.2 Comparison of Vehicle OD Tables

(Trips/day)

Year	Car	Bus	Truck	Total	Survey
1985-86	33,100	17,587	19,209	69,896	JICA
1990	60,054	16,026	44,563	120,643	NTRC
1992-93	76,377	22,389	53,736	152,502	JICA
*	*5.1%*	*9.9%*	*2.1%*	*5.1%*	
2005	139,328	69,236	68,789	277,353	PTPS

Note: 1) * Figures with % show annual growth rate.
2) PTPS Data of the year 2005 is regarded as the data of 2004-05
3) Zoning system is different among NTRC, the previous JICA Study, and PTPS

Figure 4.1.7 illustrates the number of passenger and freight trips by road. The number of passenger trips by road increased from 1.48 trips/day in 1992/93 to 2.24 trips/day in 2005 at an annual growth rate of 3.5%. The lower growth rate for passenger trips than for bus trips reflects the significant increase in minibuses (wagons) compared to large buses. The volume of freight being transported increased from 322 tons/day in 1992-93 to 710 tons/day in 2005 at an annual growth rate of 6.8%. The higher growth rate is due to the increase in the average load per truck from 6.0 tons /truck to 10 tons/ truck.

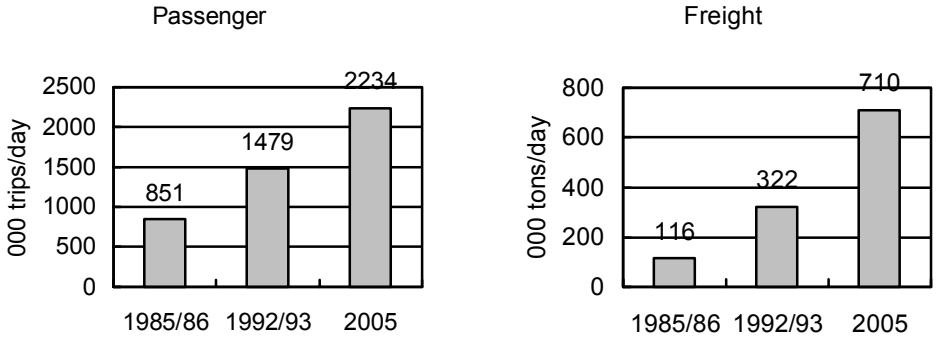
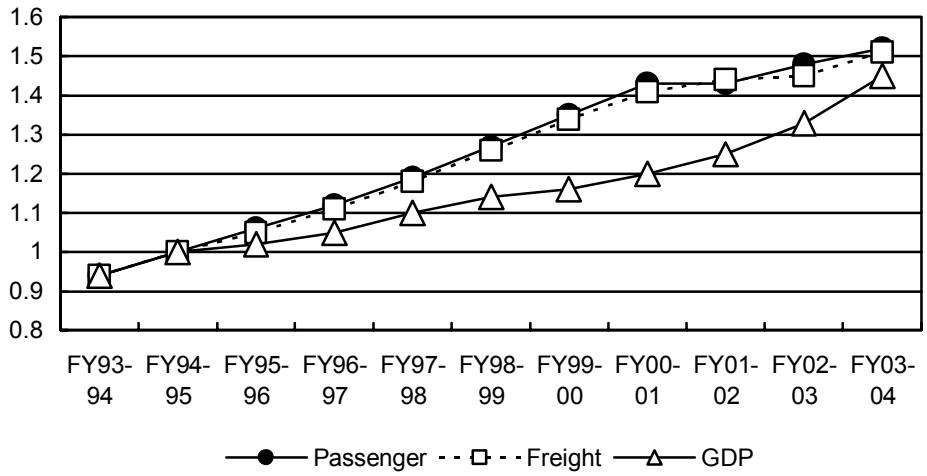


Figure 4.1.7 Passenger Trips and Freight Trips (Road)

4.2 Projection of Transport Volume Indicators

4.2.1 Overall Land Transport Demand

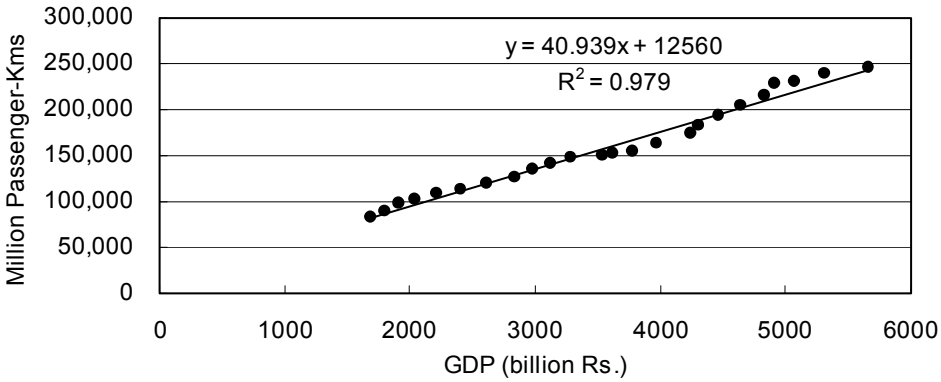
Passenger-km and ton-km have been estimated as important indicators of transport volumes for transport demand analysis and strategic targets for the transport sector in Pakistan. The average growth rate of passenger-km in the period was higher (at 4.8%) than that of ton-km (at 4.4%). The growth rates had been higher than the GDP growth rate prior to 2000/01, while they were lower than the GDP growth rates over the recent four years as shown in Figure 4.2.1. The average growth rates for passenger-km and ton-km between 1994/95 and 2000/01 were 5.8% and 5.2%, respectively. For the same two measures the growth rates between 2000/01 and 2003/04 were 3.4% and 3.2% respectively. Since these indicators have a strong relationship to GDP, passenger-km and ton-km were estimated using a regression model.



Note: Passenger-km and Freight ton-km are taken from Economic Survey, 2004.

Figure 4.2.1 Increase in Land Transport Volume and GDP (1.0 in FY94-95)

The regression model for projecting passenger-km used data for the past 20years between 1980/01 and 2003/04 as shown in Figure 4.2.2.

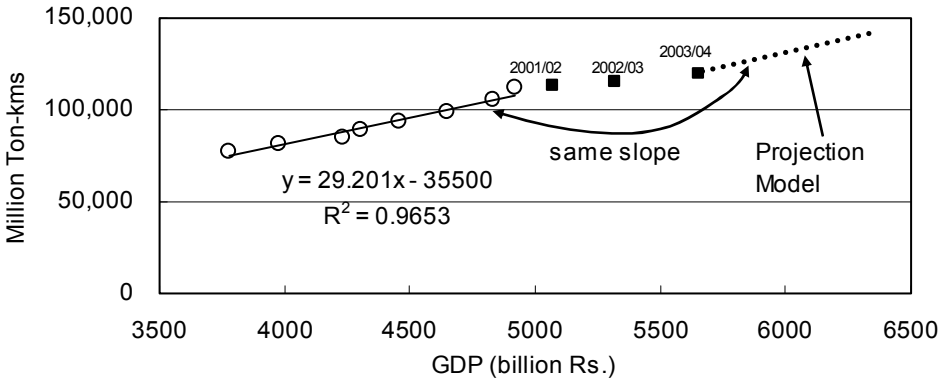


Source: Economic Survey 2004 (Passenger-kms), JICA Study Team (GDP)

Figure 4.2.2 Regression Analysis for Passenger-Kms

As freight transport showed a sharp increase in the late 1990's unlike passenger transport (refer Figure 2.2.4 in Chapter 2), the recent data between 1993/94 and 1994/95 was used to estimate the slope of the linear model. Values from 2001/02 to 2004/04 were not used

because they did not appear to follow the trend. The linear with the same slope intersecting the point of 2003/04 was applied as the projection model for freight transport as shown in Figure 4.2.3.



Source: Economic Survey 2004 (Passenger-kms), JICA Study Team (GDP)

Figure 4.2.3 Regression Analysis for Ton-Kms

The projection model was used to estimate the future transport volumes based on the medium growth scenario as shown in Table 4.2.1.

Table 4.2.1 Projection of Land Transport Demand

Year	Passenger-kms (Million Passenger-kms)	Ton-kms (Million Ton-kms)	X (billion Rs.) GDP at 04/05 price
	40.939x + 12,560	29.02(x – 5,657) + 119,040	
2005-06	294,785	141,660	6,559
2010-11	438,131	207,881	9,199
2015-16	622,967	293,268	12,604
2020-21	854,406	400,185	16,867
2025-26	1,135,494	530,037	22,045
2030-31	1,466,149	682,787	28,135
Annual Growth Rate			
05/06 – 10/11	8.25%	7.97%	7.00%
10/11 – 25/26	6.55%	6.44%	6.00%

Source: JICA Study Team

4.2.2 Inter-zonal Transport Volume

Inter-zonal transport is that which crosses traffic zone boundaries, and has been incorporated into demand forecast models in the previous JICA Studies (1983, 1998, and 1995). The inter-zonal transport volume is less than the overall transport volume both in terms of passenger-km and ton-km. As a whole, the proportion of inter-zonal transport to the overall transport volume tends to decline as shown in Table 4.2.2. The sharp drop in the proportion between 1992/93 and 2005/06 is the result of an unnatural increase in freight ton-km in 1992 and 1993.

Table 4.2.2 Share of Interzonal Traffic

(%)

	Passenger-kms			Ton-kms		
	Road	Rail	Total	Road	Rail	Total
1980-81	0.554	0.912	0.626	0.907	0.984	0.930
1985-86	0.473	0.938	0.542	0.789	1.000	0.838
1992-93	0.526	0.967	0.576	0.774	0.979	0.803
2005-06	0.473	0.950*	0.524	0.659	0.950*	0.700

Source: NTPS JICA in 1983, 1988, and 1995, and this study
Note: * Assumption

It is expected that the large cities will continue to grow and the number of trips will increase within traffic zones at a higher rate than inter-zonal trips. On the other hand, trade and industrial trips will also grow at a rate that will be able to support economic growth. Therefore, the proportion of inter-zonal trips will decrease to some extents; however this is anticipated to be at a low rate. The future inter-zonal transport volume is projected using the estimated proportion of inter-zonal transport as shown in Table 4.2.3.

Table 4.2.3 Projection of the Future Interzonal Transport

(Million Passenger-kms/ Million Ton-kms)

	Passenger-kms			Ton-kms		
	Total	Interzonal	Ratio	Total	Interzonal	Ratio
2010-11	438,131	212,494	0.485	207,881	133,044	0.640
2015-16	622,967	292,794	0.470	293,268	184,759	0.630
2025-26	1,135,494	516,650	0.455	530,037	328,623	0.620
2030-31	1,466,149	667,098	0.455	682,787	423,328	0.620

Source: JICA Study Team

4.3 Future O/D Table

4.3.1 Trip Generation and Attraction

The volumes of passenger trips and freight trips were based on the estimation of Regional Gross Domestic Products (RGDP), assuming that the volumes will increase in proportion to the increase in RGDP. The volume at each traffic zone was adjusted by the estimation of the total passenger-km and ton-km.

4.3.2 Trip Distribution

Tentative future OD matrices were estimated by the fratar method using the present O/D matrices and the estimated trip generation and attraction. Passenger-km and ton-km were calculated from the tentative matrices and adjusted to meet the estimated volume of inter-zonal transport. In order to convert passenger volumes and freight volumes to the number of vehicles, it was assumed that the present modal share, passenger occupancy rate, and average loading of a truck will be the same in the future. Figure 4.3.1 illustrates the results from the projection of the trip distribution.

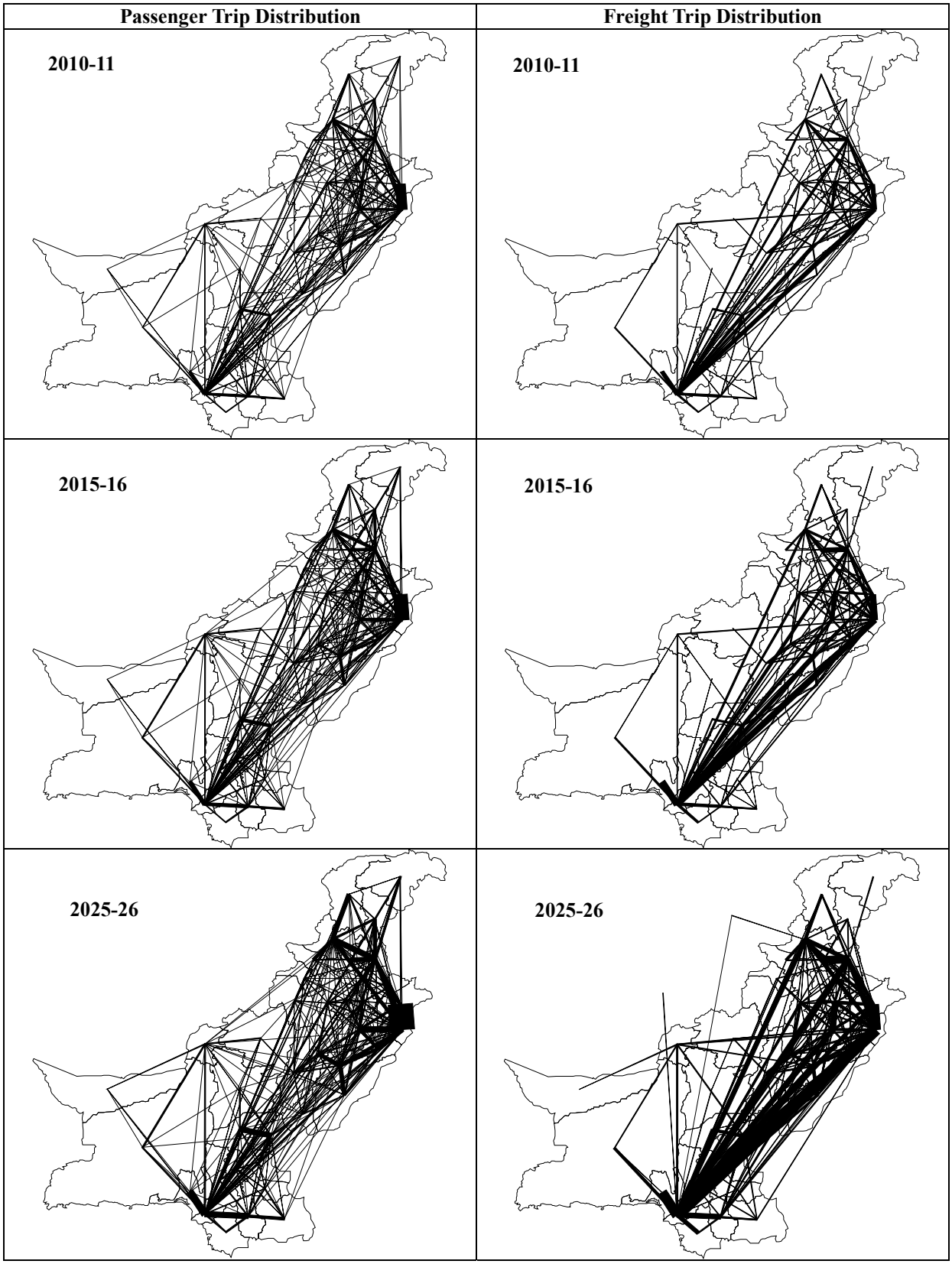
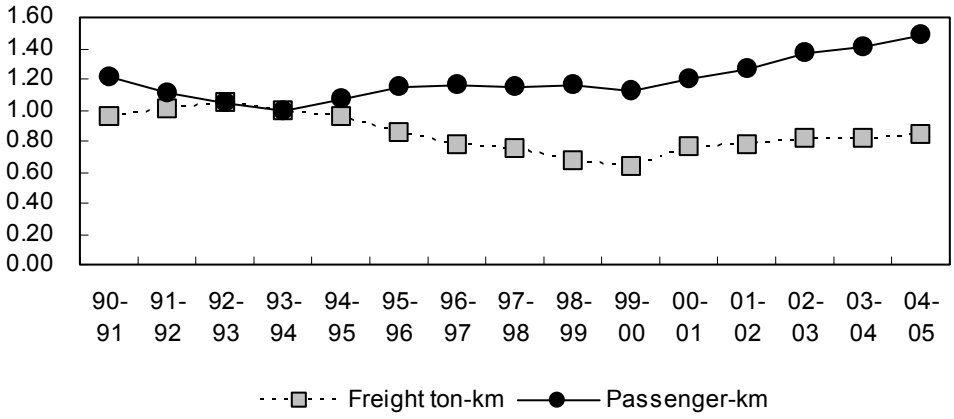


Figure 4.3.1 Desired Line of Road Transport (Projection)

4.3.3 Modal Share between Road and Rail

(1) Past Trend of Railway Transport

Passenger transport by rail in passenger-km increased at an annual rate of 3.5% from 1993-04 to 2003-04. Although this was lower than the annual growth rate of passenger transport by road (which was 5.0% in the same period), passenger transport by rail showed steady growth in the last ten years. On the other hand, freight transport decreased in the same period at an annual rate of –2.1%. The volume reached its lowest level at 3.75 billion ton-km in 1999/2000, and began to increase at an annual growth rate of 6.0% over recent years (Figure 4.3.2).



Source: Pakistan Railways

Figure 4.3.2 Increase in Transport Volume by Rail (1.0 in 1993-94)

This does not necessarily mean that "demand" for freight transport by rail is essentially small, because transport demand by rail is strongly affected by the level of service of the railway system.

(2) Comparison of Transport Cost between Road and Rail

a) Unit Cost

In order to realize the system optimization that minimizes the total transport cost, rail and road should properly share the entire transport demand in accordance to their characteristics of cost performance. Research on optimization and policy measures to guide the demand toward the optimal share are essential for a successful multi-modal transport system.

Comparison of unit costs between railway and road transportation can give a suggestion for realization of the optimal modal share. Table 4.3.1 shows the unit costs1 of the PR under the current situation. According to Table 4.3.1, the unit costs for both passenger services and freight services are calculated at around Rs. 0.5.

[1] In this analysis, the "Unit Costs" are assumed to be composed of the "Ordinary Working Expenses" and the "Allocation of Depreciation Reserve".

Table 4.3.1 Unit Costs of PR

Rs. Million

	1999/ 2000	2000/ 01	2001/ 02	2002/ 03	2003/ 04	Averag e
(1) Ordinary Working Expenses						
Administration	1,439	1,526	1,527	1,618	1,999	1,622
Repair & Maintenance	4,099	4,220	4,744	5,294	5,344	4,740
Operational Staff Costs	1,216	1,205	1,248	1,383	1,498	1,310
Operational Fuel Costs	1,870	2,581	2,710	3,290	3,652	2,820
Others	1,193	1,339	1,086	1,097	884	1,120
Sub Total	9,817	10,871	11,315	12,682	13,377	11,612
(2) Appropriation to Depreciation Reserve	993	993	993	1,200	1,200	1,076
(A) Total*	10,810	11,865	12,309	13,882	14,577	12,689
(B) Costs for Passenger Services	8,960	9,657	10,024	11,425	12,026	10,419
(C) Costs for Freight Services	1,850	2,207	2,284	2,457	2,550	2,270
(D) Passenger-Kilometres (Million)	18,498	19,590	20,783	22,306	23,045	20,844
(E) Ton-Kilometres (Million)	3,753	4,520	4,573	4,820	4,769	4,487
Unit Costs (Rs.)	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
(B)/(D) Unit Costs for Passenger Services	**0.484**	**0.493**	**0.482**	**0.512**	**0.522**	**0.499**
(C)/(E) Unit Costs for Freight Services	**0.493**	**0.488**	**0.500**	**0.510**	**0.535**	**0.505**

* The total costs are divided into the costs for passenger services and freight services in proportion to the ratio of train kilometres of each business unit.

Sources: Prepared by JICA Study Team with Data from P.R. Yearbook 2000/01, 2003/04

On the other hand, in the road transport that is a competitor of the railway transport, the unit costs excluding infrastructure costs can be estimated at Rs. 2.5 for passenger services and Rs. 1.5 for freight services. Table 4.3.2 shows a rough calculation of unit costs of road transport.

Table 4.3.2 Unit Costs of Road Transport

Unit Cost per Person per KM				
Type of Vehicle	Car	Mini Bus	Bus	Total
(1) Average Number of Person	3.1	17.4	45.0	-
(2) Assumed Costs per km (Rs.)	11.0	16.5	26.9	-
(3)=(2)/(1) Average Costs per Person per km (Rs.)	3.5	1.0	0.6	-
(4) Percentages of Vehicle Type	60.6%	24.5%	14.9%	100.0%
(5)=(3)*(4) Weighted Average Costs per Person per km (Rs.)	2.1	0.2	0.1	**2.5**

Unit Cost per Ton per KM	
Type of Vehicle	Truck
(6)Average Ton	16.0
(7) Assumed Costs per km (Rs.)	24.5
(8)=(7)/(6)Assumed Costs per Ton per km (Rs.)	**1.5**

Sources: Prepared by JICA Study Team with Data of the O/D Survey

Even if the unit costs of road transport do not include the infrastructure costs, the unit costs of the railway transport are cheaper than those of road transport[1]. Therefore it can be concluded that the railway business has sufficient price competitiveness.

[1] Assuming that the construction of one kilometre of road costs Rs. 15 million, the unit costs including depreciation costs of the road are calculated at Rs. 2.6 in the passenger services and Rs. 1.7 in the freight services.

b) Transport Cost by Distance

The unit cost of freight transport per kilometre by rail (Pakistan Railways) is calculated at Rs. 0.51 from ordinary working expenses and depreciation of the Pakistan Railways as shown in Table 4.3.3. The ordinary working expenses consist of administration, repair & maintenance, operation fuels, operation staff, and other expenses.

Table 4.3.3 Calculation of Transport Cost per Kilometre by Rail

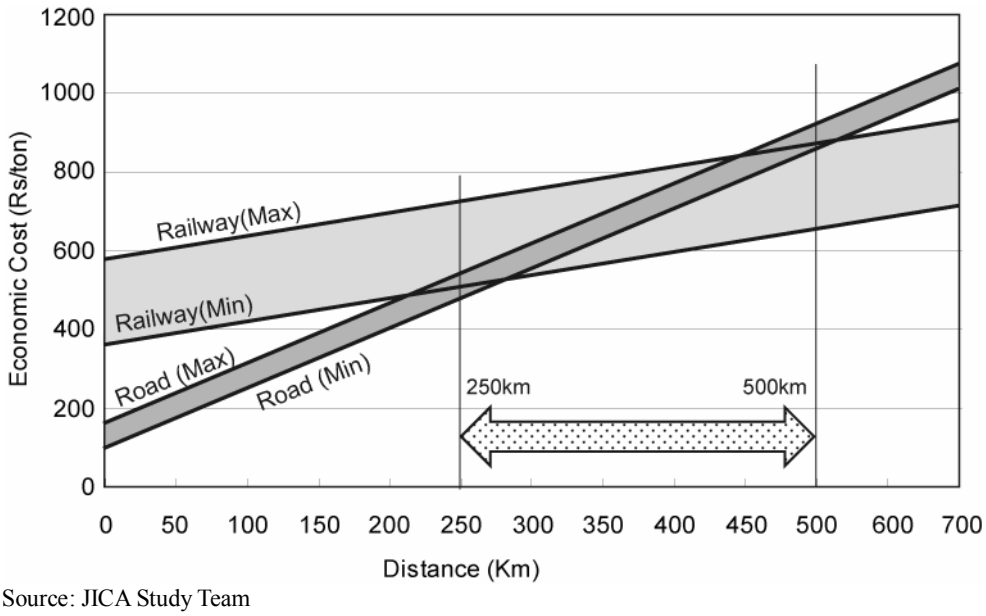
Average ordinary working expense and depreciation (2000/01-03/04) (a) Rs. Million	Average train kilometres (2000/01-03/04) (b) Million train-km	Train Operating Cost per train-km (c) = (a)/(b) Rs. per train-km	Average Tons carried by train (2000/01-03/04) (d) Tons per train	Transport unit cost by rail per kilometre (c)/(d) Rs. /ton /km
13,158	37.335	352.4	692	0.509
P.R. Yearbook	P.R. Yearbook	-	P.R. Yearbook	-

Note: PTPS calculation with data from Pakistan Railways Yearbooks

The vehicle operating costs of a truck carrying 15 tons of cargo was estimated at about Rs. 21 per kilometre (Refer to Annex G). From this, the unit cost of freight transport by road can be estimated at Rs. 1.4 /ton/km.

Loading and unloading costs of a truck are roughly in the range of Rs. 50 to 80 per ton. It is assumed that those costs of a railway are in the range of Rs. 30 to 48 per ton. Freight transport by rail requires additional loading and unloading by feeder trucks.

Figure 4.3.3 illustrates the transport costs by road and rail by distance. The costs include operating costs, maintenance & management costs, and loading& unloading costs. Cargo holding costs at warehouses or terminals are excluded. On this basis, it can be said that distances between 250– 500km are in the competitive range.



Source: JICA Study Team

Figure 4.3.3 Comparison of Economic Cost between Truck and Railway

c) Tariff

A comparison of tariffs between trucks and railways also gives some views of the modal share. As can be seen in Figure 4.3.4, the railway tariff is advantageous for all kinds of commodities over 440km, even including loading and unloading charge.

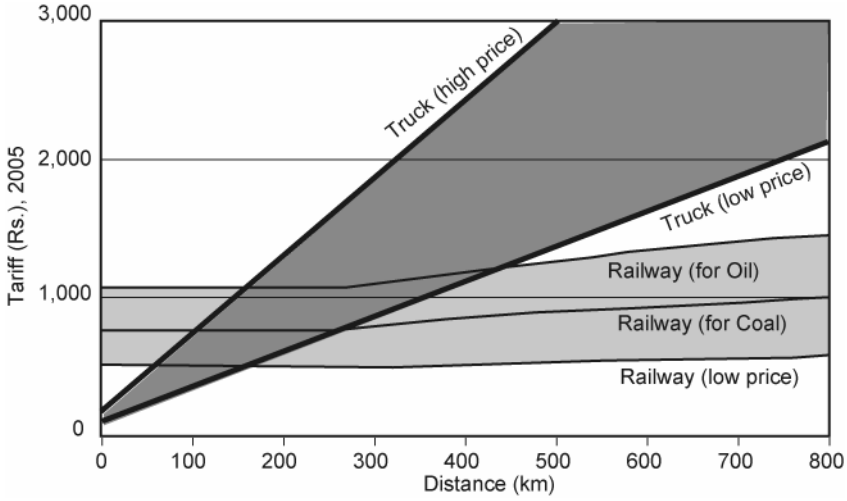
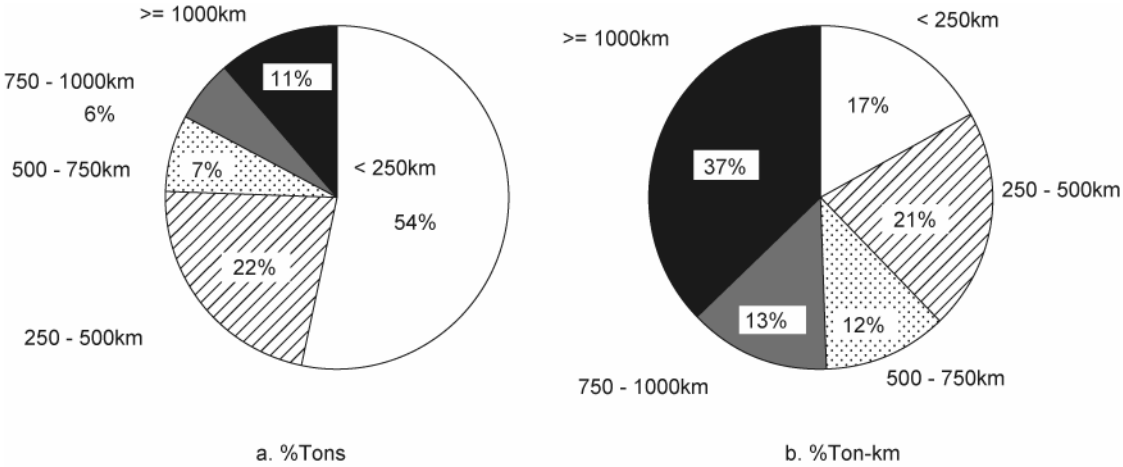


Figure 4.3.4 Comparison between truck tariff and railway tariff

(3) Possible Demand for Freight Transport by Rail

Considering the cost analysis mentioned above, railway has the advantage of saving the economic costs of freight transport for a long distance about over 500km. According to the PTPS Traffic Survey, 1/4 of freight transport by road is the long distance transport over 500km as shown in Figure 4.3.5. This means that Pakistan bears higher transport cost than is possible with an adequate modal shift from road to rail. It is desirable that the 1/4 of cargos be transported by rail. At least, 11% of cargos, whose travel distance exceed 1,000km, should be carried by rail. The pie chart in Figure 4.3.5 illustrates the proportion of ton-km of freight transport by road by distance. This shows that freight transport over a distance of 500km account for 62% of the total in terms of ton-km. These charts imply that freight transport demand by rail is very high.



Source: PTPS Traffic Survey

Figure 4.3.5 Proportion of Freight Transport Volume by Road by Distance

(4) Target Modal Share of Freight Transport

Estimating the modal share of freight largely depends on the extent to which the railway will be improved as the existing railway capacity is insufficient. The economic cost analysis shows that the economic cost of freight transport by rail for 1,000km is only 30 – 40% of that by road transport, even inclusive of feeder transport cost and loading/ unloading cast at terminals. The cost analysis for tariff shows that transporting freight by rail is advantageous where the transport distance is over 440km. This is consistent for all kinds of commodities and takes into account loading and unloading costs.

In the light of the cost analysis, PTPS sets a target modal share as follows:

Table 4.3.4 Target Railway Share of Freight Transport by Transport Distance

Year	1,000km	2,000km
2015	30%	50%
2025	50%	80%

Note: PTPS Recommendation

The logit choice model was applied to make a function that calculates the railway share by travel distance of freight transport. The formula is:

$$P_R = \frac{1}{1+\exp(U_T - U_R)} \qquad (4.1)$$

where P_R = Railway share
U_T = Utility function of truck transport
U_R = Utility function of rail transport

Considering the economic cost by travel distance in Figure 4.3.3, PTPS applied the following formulas as the utility functions above:

$$U_T = c(-1.4x + a) + K \ , \ U_R = c(-0.51y + b)$$

x = Travel distance of freight transport by road (km)
y = Travel distance of freight transport by rail (km)
a, b, c: Constant values
$K = \ln(500/x)^2$ where x <500, K = 0 where x >= 500

From this, the exponent portion in (4.1) works out to be:

$$U_T - U_R = c(-1.4x + 0.51y + a - b) + K \ .$$

In the formulas, 1.4 and 0.51 are the slopes of the lines of road and rail in Figure 4.3.3. The constant values of a, b, and c are calculated so that the target modal share in Table 4.3.4 can be obtained from the formulas. The calculated constant values are:

Table 4.3.5 The Model Parameters for the Modal Share Calucation

	c	*a* - *b*
2015	8.369×10^{-4}	2020
2025	1.373×10^{-3}	1010

Note: PTPS Calculation

When the distance travelled is the same between road and rail, the formula illustrates the conversion curves as shown in Figure 4.3.6.

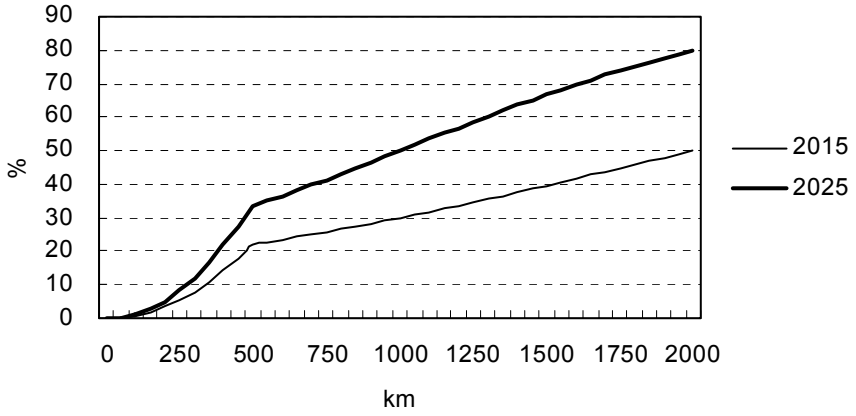


Figure 4.3.6 Conversion Curve of Railway

Using the conversion formula, the future railway demand was estimated as shown in Table 4.3.6. The railway transport volume in ton-km is expected to grow over six times higher by 2015 and 20 times by 2025. The target modal share is one third of the total interzonal transport (ton-km) in 2025.

Table 4.3.6 Future Potential Demand of Railway (Interzonal)

	Freight Traffic (million ton/ year) *[1]			Transport Vol. (billion ton-km/year)		
	2005	2015	2025	2005	2015	2025
Total	241	440	748	99	185	329
Road	234 *97.1%*	401 *91.2%*	636 *85.0%*	93 *93.9%*	148 *79.9%*	218 *66.2%*
Rail	7 *[2] *2.9%*	39 *8.8%*	112 *15.0%*	6 *[3] *6.1%*	37 *20.1%*	111 *33.8%*

Note: Figures with % are composition of each mode of the total.
Note: Freight Traffic (million tons/ year) was estimated using the average trip length.
Note: *[2]: 6.79 in 2005-06, JICA Estimation
Note: *[3]: 6.12 in 2005-06, MTDF

(5) Railway Passenger

The number of railway passengers has been increasing at an annual rate of 3.5% in recent years. There are two competitors to be considered for passenger transport by rail: domestic flights and long-distance buses. However, according to the Passenger Interview Survey, the markets for railway and air passengers are different in view of personal income level, and the number of air passengers can be estimated separately. On the other hand, the mode choice between rail and bus need to be considered because customers of rail and bus are similar. It is expected that bus services between major cities increases as road networks expand, and the number of passenger by rail also increases through improving the train service. Therefore, it is rational that the steady growth of railway passengers will continue.

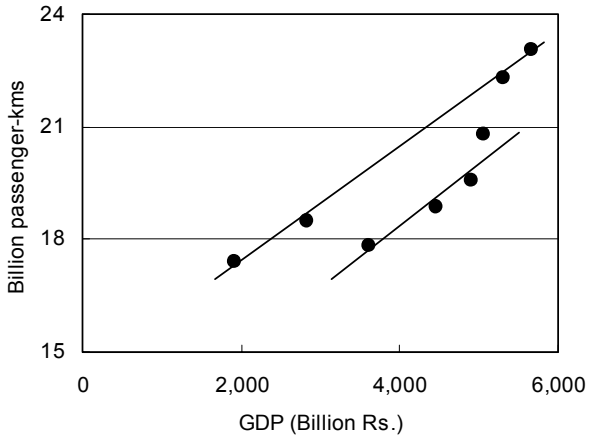
The future transport volume of railway passenger in terms of passenger-km was estimated using a regression model based on statistics over the last ten years as follows.

Table 4.3.7 Projection of Railway Passenger Demand

(Million Passenger-kms)

Year	Total (All Pakistan)	Interzonal		
	Railway	Total	Railway	Modal Share
2005-06	24,199	154,397	22,989	14.9%
2010-11	28,124	212,494	26,718	12.6%
2015-16	33,185	292,794	31,526	10.8%
2025-26	47,219	516,650	44,858	8.7%
2030-31	56,273	667,098	53,459	8.0%

Note: The ratio of interzonal transport to the total for railway passenger is assumed to be 0.95
Source: JICA Study Team



Y=1.45687X1-2155.62X2+14448.5
(R=0.998)

Where;
Y: Annual demand in million passenger kms
X1: GDP in Rs. Billion
X2: Dummy Variable (zero after the year 2002)

Source: JICA Study Team

Figure 4.3.7 Regression Analysis of Passenger Demand for Railway Passenger

4.3.4 Summary of Demand Forecast for Land Transport

Passenger transport volume by road was calculated as the difference of the passenger-km by rail subtracted from the total passenger-km. On the other hand, freight transport by road was calculated using a conversion formula between road and rail. The results of the estimation are summarized in Table 4.3.8 and Table 4.3.9.

Inter-zonal passenger transport in passenger-km will increase at a high annual rate of 6.6% for the next five years and 6.4% from 2010/11 to 2025/26. Although the passenger transport by rail will increase at a steady growth rate of 3% and 3.5%, the railway share of inter-zonal transport will decrease to 8.7% in 2025-26.

Table 4.3.8 Projection of Passenger Transport Demand

(Million Passenger-km/ Year)

	All Pakistan			Inter-zonal		
	Total	Road	Rail	Total	Road	Rail
2005-06	294,785	270,586	24,199	154,397	131,408	22,989
2010-11	438,131	410,007	28,124	212,494	185,776	26,718
2015-16	622,967	589,782	33,185	292,794	261,269	31,526
2025-26	1,135,494	1,088,275	47,219	516,650	471,792	44,858
2030-31	1,466,149	1,409,876	56,273	667,098	613,638	53,459
AGR*						
05/06-10/11	8.25%	8.67%	3.05%	6.60%	7.17%	3.05%
10/11-25/26	6.55%	6.72%	3.51%	6.44%	6.41%	3.51%
Mode Share						
2005-06		91.8%	8.2%		85.1%	14.9%
2015-16		94.7%	5.3%		89.2%	10.8%
2025-26		95.8%	4.2%		91.3%	8.7%

Note: *Annual Growth Rate

The results of the demand forecast for freight transport show a significant increase in railway demand as shown in Table 4.3.9. Interzonal freight transport by rail is expected to account for 33.8% in 2025-06. Note that the figures express potential demand rather than a prediction, and this should be considered as the target demand for railway development.

Table 4.3.9 Projection of Freight Transport Demand (Million Ton-kms)

(Million Ton-kms)

	All Pakistan			Interzonal		
	Total	Road	Rail	Total	Road	Rail
2005-06	141,600	135,480	6,120	99,223	93,409	5,814
2010-11	207,881	197,107	10,774	133,044	122,809	10,235
2015-16	293,268	254,086	39,182	184,759	147,536	37,223
2025-26	530,037	412,976	117,061	328,623	217,415	111,208
2030-31	682,787	530,433	152,354	423,328	278,591	144,737
AGR*						
05/06-10/11	7.98%	7.79%	11.98%	6.04%	5.63%	11.98%
10/11-25/26	6.44%	5.05%	17.24%	6.21%	3.88%	17.24%
Mode Share						
2005-06		95.7%	4.3%		94.1%	5.9%
2015-16		86.6%	13.4%		79.9%	20.1%
2025-26		77.9%	22.1%		66.2%	33.8%

Note: *Annual Growth Rate

4.3.5 Traffic Forecast in MTDF

The traffic forecast for roads and railways up to 2010 is appended to the MTDF as shown in Table 4.3.10 and Table 4.3.11. According to the MTDF, the passenger demand and freight demand are estimated to increase by 1.38 times and 1.35 times, respectively, over the next five years. However, 215.09 BPK of passenger traffic by road in 2004/05 seems to be an underestimation because the actual volume was 222.78 BPK in 2003/04. Considering the rapid increase in the number of passenger cars and the growth in commuter trips in the large cities, the higher demand forecast of PTPS is reasonable. The forecast of passenger traffic volume by railway in MTDF is similar to that in PTPS.

Table 4.3.10 Passenger Traffic Forecast in MTDF and PTPS

(Passenger: Billion Passenger-Km)

Fiscal	Road				Railway		Total	
Year	Actual*	MTDF	PTPS	Actual*	MTDF	PTPS	MTDF	PTPS
2003/04	222.78	-	-	19.96	-	-		
2004/05	-	215.09	-	-	23.80	-	238.89	-
2005/06	-	230.15	270.59	-	24.59	24.20	254.74	294.79
2006/07	-	246.26	-	-	25.40	-	271.66	-
2007/08	-	263.49	-	-	26.23	-	289.72	-
2008/09	-	281.94	-	-	27.10	-	309.04	-
2009/10	-	301.67	-	-	27.99	-	329.66	-
2010/11	-		410.01	-		28.12		438.13
AGR %	-	7.00	8.67	-	3.30	3.05	-	8.25

*: Economic Survey 2004
Source: Economic Survey, MTDF, JICA Study Team

On the contrary, the freight traffic volume by road in 2004/05 seems to be an overestimation, considering the actual value in 2003/04. PTPS forecasted freight traffic volume by road to be smaller than that of MTDF, but applied a higher annual growth rate at 7.79%. The forecast of PTPS approximates to that of MTDF. The results of freight traffic forecast by railway are the same between MTDF and PTPS.

Table 4.3.11 Freight Traffic Forecast by MTDF and PTPS

(Freight: Billion Ton-Km)

Fiscal	Road			Railway			Total	
Year	Actual	MTDF	PTPS	Actual	MTDF	PTPS	MTDF	PTPS
2003/04	114.24	-	-	4.80	-	-	-	-
2004/05	-	147.17	-		5.46	-	152.63	
2005/06	-	156.00	135.48	-	6.12	6.12	162.12	141.60
2006/07	-	165.36	-	-	6.85		172.21	
2007/08	-	175.28	-	-	7.67		182.95	
2008/09	-	185.80	-	-	8.59		194.39	
2009/10	-	196.94	-	-	9.62		206.56	
2010/11	-	-	197.11	-	-	10.77	-	207.88
AGR %	-	6.00	7.79	-	12.00	11.98	6.26	7.98

*: Economic Survey 2004
Source: MTDF, JICA Study Team

4.4 Traffic Assignment Model

A traffic assignment model was developed in PTPS to estimate the traffic volume for roads under various scenarios. The characteristics of the traffic assignment model are:

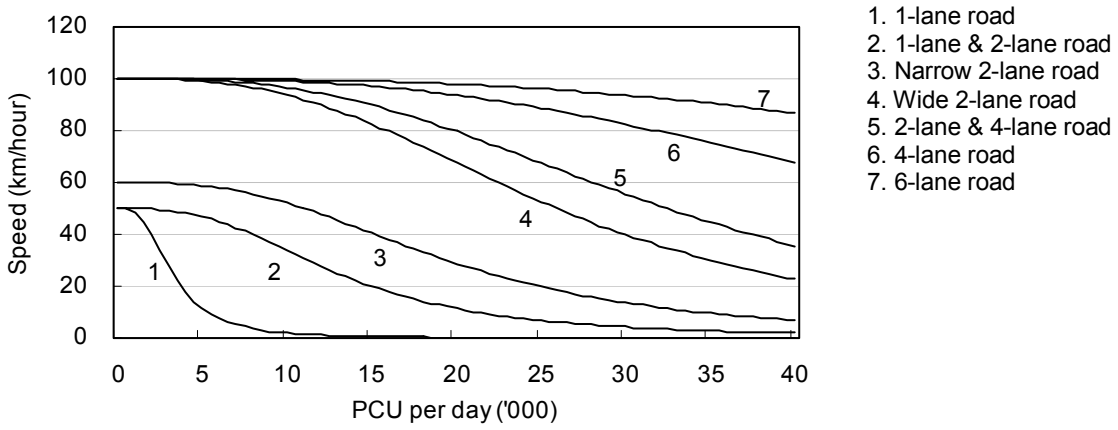
- Vehicle Type: Car, Bus, and Truck
- O/D Matrix: Daily District-wise O/D Matrix (117zone)
- Assignment Type: User Equilibrium- Fixed Demand Traffic Assignment
- Network size: 844 links and 582 nodes (The size differs with scenario.)
- Network data: all of the national highways, most of the provincial roads, and other important roads using 7 categories
- Speed-flow Relationship: BPR function

The daily traffic for every O/D pair was assigned to each link according to daily speed-flow relationships by link category. The BPR1 function was applied as the daily speed-flow relationship. The function is:

$$t = t_0\left[1 + 0.48(V/C)^{2.82}\right]$$

where t = travel time
t_0 = travel time at free speed
V = traffic volume of the link in PCU
Q = traffic capacity

The curves of the function by road category are illustrated in Figure 4.4.1. Although the model treats three vehicle categories, the calculation converged successfully.



Source: JICA Study Team

Figure 4.4.1 Daily Speed-Flow Relationships for Traffic Assignment

[1] Bureau of Public Roads, USA