4.5 Assessment

4.5.1 General

(1) Road Network and Candidate Projects

In the sections 4.3 and 4.4, road development plans were studied and candidate projects were proposed in two groups; for the short term of the 8th FYP and for the medium term of 1999 to 2006. Those were related to the network of approximately 19000km composed of national highways administered by NHA and main provincial highways under the provincial C&Ws, but minor roads were not covered. Those candidate projects grouped into two implementation periods were assessed of the preliminary economic viability.

Conditions of economic evaluation

- Economic project cost at 80% of the financial cost
- Assuming 5 years for implementation
- Annual maintenance cost every year and a resurfacing cost at the 6th year of operation.
- 10 years for operation benefit
- Benefit is estimated by savings in VOC because of improved/widened roadway. The growth of benefit is assumed at 5 % per annum upto 2005 and 4% for years after that.
- A rate of 12% is used for the capital cost (discount rate).

(2) Committed Projects

At the moment, Pakistan has allocated an unusually larger fund than in the 7th FYP period, for the improvement of road system. It is due to urgent and critical necessity for betterment of arterial corridors. Foreign funding agencies have cooperated by lending part of funds for these urgent works, while federal government has also allocated domestic resources for the betterment of arterial national highways. This study is not in a position to recommend to change those committed projects.

In the economic assessment methodology, committed projects were included in "without cases".

4.5.2 Recommended Projects for Short Term

The economic internal return (EIRR) was estimated for the recommended projects. They are widening works of the existing low capacity section. Compared to the cost of improvement, the benefit of savings in vehicle operation cost was quantified in a normal procedure. EIRR of those improvements of the recommended projects during the short term period was high at 36 % on average as shown in Table 4.5.1.

Table 4.5.1 Economic Cost & Benefit Recommended Projects for Short Term

		Link	Economic analysis		
			IRR	B/C	NPV
	Total of Recomended Pro. for the short term		0.36	3.04	6,917.41
1	N-70. Muzaf-Multan	4,564	0.30	2.37	718.13
2	Bal. Sanjawi-Loralqai	4,081	0.36	2.94	392.25
3	Bal. Quentta-Sanjawi	4,119	0.36	2.94	2,698.52
4	Pun. Chauk Munda-	4,461	0.59	6.97	818.86
5	Pun. -Chauk Munda	4,469	0.58	6.91	926.81
6	Pun. Sihal-	8,481	0.32	2.54	1,037.14
7	Pun. -Rawalpindi	8,483	0.28	2.08	325.71

Note : The discount rate is assumed at 12%.

4.5.3 Recommended Projects for Medium Term

A road network was formulated for 2006 by integrating the committed and recommended projects after 1999. Traffic assignment with the committed sections for 2006 was conducted and the result showed a number of road sections with traffic exceeding the capacity, V/C >1.00, for which projects were recommended.

Those are listed in Figure 4.3.2 and Appendix Table 4.3.2. Economic analysis was conducted for those recommended ones for medium term and the results are shown in Table 4.5.2. Those widening works are justified in economic terms since EIRR is estimated at 30% on average.

Table 4.5.2 Economic Cost and Benefit of Recommended Projects for Medium Term

		Link	Economic analysis		
			IRR	B/C	NPV
Rec.	Total of Recom. Pro. For the medium term		0.30	0.87	12,294.44
1	Muzaf-Ghazi G	4,344	0.28	2.98	588.59
2	Ghazi G -DGKhan	4,357	0.10	0.87	85.50
3	Loralai-Rakini	4,059	0.28	3.28	2,553.52
4	Hyderab-Mirpur	2,194	0.14	1.12	57.85
5	Umarkot-Mirpur	2,681	0.31	3.54	1,066.76
6	Atharan-Garh M	5,431	0.34	4.06	676.01
7	Okara-(north)	5,702	0.27	2.66	26.98
8	Jalanwala-Okara	5,717	0.46	8.77	1,860.53
9	Jalanwala-Faiza	5,727	0.21	1.83	396.83
10	Sargoda-(north)	5,805	0.40	6.04	126.19
11	Kushab-(east)	5,815	0.15	1.54	18.90
12	Jalanwala-(east)	6,772	0.32	3.45	1,341.73
13	Gujranw-Siarkot	6,918	0.38	24.09	7,728.62
14	Kotri-(south)	7,874	0.37	4.57	236.27
15	Gujranw-Kanewal	7,945	0.41	5.22	1,192.09
16	Sargoda-(north)	8,214	0.11	0.95	4.63

Note : The discount rate is assumed at 12%.

4.5.4 Budget Scale

(1) Federal.

Budget expenditures to strengthen the road system can be classified into two jurisdictional flows; federal government through NHA for its national highways mostly, and provincial governments through its C&Ws for provincial highways. In addition, there are local municipalities and cantonment administrations taking care of urban and community roads, but they are not discussed in this study since they are local and cannot be studied at the same level simultaneously with the nation wide major road system.

The budget allocation for the 7th FYP of the federal government increased more than 3 times than the previous 6th FYP. In the current 8th FYP the planned cost to strengthen national highways increased nearly 3 times than the 7th FYP, a larger rate of increase than the overall federal budget in the same period. Actual expenditure was 80% (20,090/25,488=0.80) of the planned cost in the 7th FYP as shown in Table 4.5.3. But, it is quite difficult to determine what percent will be realized in this 8th FYP because of uncertain factors; it may be 80% or 50% depending on the extent of available government funds, progress in construction works, unexpected flood damage and others.

(2) Provinces

According to the information from C&W of provinces, determination of the FYP at a provincial level has not been identified yet. A budget is proposed every year to the province parliament by C&W to meet local requirements in the province, and implemented after the approval. Difference between the proposed cost and the actual expenditure is modest. No large increased allocation to the road sector in a specific year can be seen because of strict constraints in the province budget scale. In practice a 20-30 % increase in the planning cost in the budget is seen every year in the recent years. Table 4.5.4 shows the total expenditures for improvement, rehabilitation and administration in the 7th FYP and an estimate for the 8th and 9th FYP, where the figure for the 9th FYP assumes an increase of 0.40 from the previous 8th FYP.

(3) Others

For the national highways, if the cost Rs. 70,174 is spent out, the ratio of expenditure over the plan cost of Rs. 74,687 million in the 8th FYP is 94%. However, the spending schedule in this FYP will be influenced by a number of uncertain factors. Even if the large scale improvement is finished in several years, there will appear other needs of funds for rehabilitation and improvements at various sections, general maintenance of the whole national highways, and new projects to be started. Those needs will increase much in the 9th FYP, although difficult to quantify. A shift of budget and resource toward those needs should be investigated and prepared.

For the provinces, the cost of the recommended projects in the Short Term is Rs. 2,371 million and the ratio in the estimated total budget of the 8th FYP, Rs. 22,479 million, is 11%. The cost of Rs. 4,814 million in Medium Term is 15% of the estimated total budget. These do not seem to be a heavy burden in the budget, but there are unknown cost for betterment of lower class provincial highways, not included in this study. However, those provincial roads are far below the normal service level and require urgent substantial funds.

Table 4.5.3 Plan Cost by NHA , 7th - 9th FYP

(Rs.million)

Main Projects	The 7th FYP Plan cost Rs. mill 1988 a	The 7th FYP Expenditure. Rs. mill curr b	The 8th FYP Plan Rs. mill 1993 c	The 9th FYP 5 yrs Rs. mill 1993 d 1)	Total b-d e
Committed & On-going Projects					
1. Motorway	0	6,900	9,460	-	16,360
2. N-5 Dual. & Rehab.	12,897	10,011	29,796	4,340	44,147
3. Lahore BYP (include Prov. Bridge)	-	0	Phase 1 2,870+350	Phase 2 440	3,660
4. N-25 Imp.	658	56	2,240	2,170	4,466
5. N-55 Imp.	4,098	Phase 1 2,763	Phase 1,2 15,745-5,863	Phase 3 5,863 *	18,508
6. N-40		23	1,987	3,466	5,476
7. N-70 Imp.	-	-	1,341	3,129	4,470
8. etc.	2,334	337	3,868	9,80	4,205
9. Kohat BP & Tun.		-	1,800	601 *	2,401
10. Sukkur Br	-	0	1,000	1,006 *	2,006
11. Others 2)	5,501	0	5,580	8,500	14,080
Total	25,488	20,090	70,174 (70,174 after +- adjusted)	38,595	128,859

Source : Planning Commission (February & August, 1994)

Note : 1) By this study, only for the continued projects from the 8th FYP.

2) Including Meklan Coastal Road and Karakoram Highway.

+ means they should be added in the planned cost of the 8th FYP.

Table 4.5.4 Expenditure by Provincial C&W, 7th - 9th FYP

Provinces	The 7th FYP Expenditure. Rs.mill curr	The 8th FYP Plan Rs.mill 1983	The 9th FYP 3) 5 years
Balluchistan	2,272	885 1)	1,238
NWFP	2,480	4,227 1)	5,918
Sind	4,373	5,959 2)	8,343
Punjab	8,364	11,408 2)	15,971
Total	17,489	22,479	31,470

Source : C&W of each Province, (February, 1994)

Note : 1) Aplan was drafted in 1992-1933.

2) The five year plan of C&W of those provinces are not available, the target cost of the FYP is estimated by the ratio of Balluch and NWFP.
(884.55+4,227.39)/(2,272+2,480)=1.364
Sind 4,366.63*1.364=5959.01
Punjab 8,383.61* 1.364= 11407.96

3) An estimate by multiplying 1.4 to the 8th FYP.

4.5.5 Road User Charges and Expenditures

(1) NTRC's Study, 1987.

In Pakistan, the revenues from road user charges are put in the general budget of the central government and provincial/local ones, not specifically designated to expenditures for roads. However, a study "Road User Charges in Pakistan" was conducted in 1986-87 by NTRC to compare revenues (government incomes) and expenditures related to roads of the country. The study indicates "the taxes paid by road users were more than the expenditures on roads in 1984-85. If the all revenues through taxes on road users are allocated to the expenditures, for example, the expenditures can be expanded by 90 % in that year". In reality, the budget balance 'revenues = expenditures' was not practiced even implicitly, and the revenues from road users have been incorporated in the general revenue in every level of the governments.

Table 4.5.5A Tax Revenues and Expenditures of Roads, 1984-85

(Rs million)

Tax Revenues from Fuel & Vehicles			Expenditures on Roads	
Federal			Federal	1,010
	Veh. & parts	3,868		
	Gasoline & diese	1,866		
	Crude & mobli C	881		
	Total	6,615		
Provincial			Provinces	2,189
	Regist. & license	824		
	Toll, etc	80		
	Total	904		
local			Local	1,014
	Toll, rent	102		
	Total	102		
G. total		7,621	G. total	4,213
	(Exp/Rev)	(100)		(55)

Source: Table S8, Road User Charges in Pakistan (NTRC, 1987)

(2) HAAS Study, 1993

The analysis was conducted by HAAS Consult in "Study of the Arterial Highway Network of Pakistan to the Year 2015" in 1993. It estimated the tax revenues related to motor vehicles from 1989-90 to 1993-94 as shown in Table 4.5.5B. But the study did not show figures in the expenditure side of the same period, pointing out difficulties in gathering data from various agencies. Only the data shown were NHA's budget and realized expenditures from 1988-89 to 1993-94, which are in Table 4.5.6.

Table 4.5.5B Taxes & Duties related to Motor Vehicles, 1989-90 to 1993-94

(Rs million)

	1989/90	1990/91	1991/92	1992/93	1993/94	Total	(%)
Federal							
1. Import duties							
(Veh Surcharge, Iqra, etc.)	5,600	4,800	5,200	5,700	5,500	26,800	
2. Sales tax import	700	800	1,000	1,300	1,500	5,300	
3. Excise Federal							
(tyres, pol products)	2,100	2,200	2,512	2,120	2,209	11,141	
4. Domestic sales tax							
Est. (veh. parts, oil)	1,200	1,400	1,100	1,700	1,800	7,200	
5. POL surch, fuel tax	4,900	9,050	8,800	9,480	4,660	36,890	
6. Total 1-5	14,500	18,250	18,612	20,300	15,669	87,331	(83)
Provincial							
7. Motor veh. Regist.							
License fees	930	1,100	1,200	1,360	1,500	6,090	(6)
Local							
8. Octroi, levies, tolls	1,400	1,600	2,600	2,500	3,000	11,100	(11)
Total	16,830	20,950	22,412	24,160	20,169	104,521	(100)

Source: Table IV-4, Haas Study (1993)

Table 4.5.6 Budget & Actual Realization, NHA Development Programs, 1988-89 to 1993-94

(Development projects in Rs Million)

	1988/89	1989/90	1990/91	1991/92	1992/93	Total
1 Budget allocation	980	1,077	1,742	4,000	18,200	11,800
2 Actual realization	925	1,068	1,656	na	na	na
Estimated by using .94 1)				3,760	17,108	11,092
3 Ratio 2/1 in %	94%	99%	95%	94%	94%	94%

Source: Table IV-18, HAAS Study (1993)
Notes: 1) Estimated by JICA team using a ratio, 0.94

Another Table 4.5.7 can be produced by using Tables 4.5.5 and 4.5.6, in which it is found the total expenditure is likely at 105% and 92% of the revenue total in 1992-93 and 1993-94, respectively. In those two years, it should be reminded, the expenditures increased more than 3 times because of ambitious highway development programs, in which the majority is for national highways.

Table 4.5.7 Estimated Revenues & Expenditures related to Roads, 1992-93 & 1993-94

(Rs million)

	Revenues 1)	1992/93	1993/94		Expenditures	1992/93	1993/94
1	Federal	20,300	15,700	1	Federal 2)	20,520	13,320
2	Provincial	1,360	1,500	2	Provi. 3)	3,600	3,960
3	Local	2,500	3,000	3	Local 4)	1,190	1,300
	Total	24,160	20,200		Total	25,310	18,580
	Ratio Exp/Re	(100)	(100)			(105)	(92)

(3) Roughton Study, 1994

The recent study conducted by Roughton Inter. & AA Ass. was "Phase 1, Transport Study in Third Farm to Market Road Project (October, 1994)". Again similar to the HAAS study, Roughton study did not present a table of revenue and expenditure in the past up to 1992-93. Table 4.5.8 shows the revenues alone in 1992-93. In the table the tax revenue from POL products was split into railways, agri-tractors and vehicles and the share of road vehicles was estimated at 36 %, Rs. 3.1 billion. Duties was Rs. 5.4 billion, provincial receipts at Rs. 1.5 billion, and the total in that year was estimated at Rs. 10 billion.

Table 4.5.8 Revenues related to Roads, 1992/93

(Rs million)

	Amount	Total
1. Federal		
Import duty on mineral, fu	793	
Iqraa, excise on POL Prod.	2,149	
Excise on crude oils	380	
Surcharge on petrol Prod.	5,300	
Total	8,622	
Of which road users 36%		3,104
Customs duty on Vehicles	4,879	
Iqra on Vehicles & parts	561	
Total	5,440	5,440
S. total		8,544
2. Provincial governments		
Registration, licensing	1,495	
Total	1,495	1,495
3. G. total		10,039

Source: Table 4.11 in Roughton Study (October, 1994)

Expenditures on roads filed in Roughton study are summarized in Table 4.5.9 in which a large increase is found after 1992-93 caused by extensive road development program of NHA including Motorway-1.

Table 4.5.9 Expenditures on Roads, 1989-90 to 1993-94

		1)	1)	2)	2)	2)	
Federal	Const	885	1,181	878	16,000	11,800	30,744
	Maint	197	275	378	483	504	1,837
	Total	1,082	1,456	1,256	16,483	12,304	32,581
Provincial	Const	1,958	2,407	3,855	4,158	3,383	15,761
	Maint	692	789	1,277	1,397	1,380	5,535
	Total	2,650	3,196	5,132	5,555	4,763	21,296
Local	Const	392	422	464	511	562	2,351
	Maint	95	95	105	115	126	536
	Total	487	517	569	626	688	2,886
Admin. 9%* tot 3)		380	465	626	2,040	1,598	5,109
Total		4,599	5,634	7,583	24,703	19,353	61,872

Source: 1) Table 4.3.a & b in Roughton Study (October, 1994)
2) Table 4.5 in Roughton Study (October, 1994). But data for local governments are filled in by assuming a 10% increase from the previous year.
3) The 9 % is used for estimating Admin. cost as in Roughton Study.

Since taxes on fuels at Rs 3104 million in Table 4.5.8 seems too low, another figure can be calculated in Table 4.5.10 by referring to tax rates, consumption rates by vehicle and vehicle-km in 1992. Thus the estimated revenue through taxes on fuels is Rs. 17.7 billion in 1992-93. By using the calculated revenue, the revenues and expenditures in 1992-93 are summarized in Table 4.5.11, where the expenditures mounted to 91% of the road-related revenues in the context of Roughton Study.

Table 4.5.10 Vehicles, Annual km, Fuel Consumption & Tax Revenue in 1992-93

Vehicle	Number on Roads	Annual km per Veh	Annual km Total, mill	Fuel cons. per Veh.	Fuel cons. Total, mill	Tax rate per little	Tax Rev. Rs mill.
a	b	c	d=b*c	e	f=d/e	g	h=f*g
1992/93							
Sml Veh	726,700	13,000	9,447	7	1,350	8.28	11,175
Wagon	49,700	50,000	2,485	5	497	1.16	577
Bus	48,500	60,000	2,910	4	728	1.16	844
Truck	96,900	70,000	6,783	4	1,696	1.16	1,967
M/C	1,060,600	8,000	8,485	20	424	7.42	3,148
Total	1,982,400	-	30,110	-	4,694	-	17,710
1993/94							
Sml Veh	810,200	13,000	10,533	7	1,505	10.48	15,769
Wagon	57,000	50,000	2,850	5	570	1.92	1,094
Bus	51,700	60,000	3,102	4	776	1.92	1,489
Truck	109,400	70,000	7,658	4	1,915	1.92	3,676
M/C	1,166,500	8,000	9,332	20	467	9.43	4,400
Total		-	33,475	-	5,231	-	26,428

Table 4.5.11 Revenues and Expenditures, 1992-93 (Rs. million)

		Revenues	Expendi. 3)
1. Feder.	17710		
	5440	23,150	17,966
2. Provincial	1495	1,495	6,055
3. Local		2,500	682
Total		27,145	24,704
Ratio		100%	91%

(4) Updating

JICA team itself has gathered available data of road expenditures during January 1995 as shown in Table 4.5.12 which are not the same as the data Roughton Study and HAAS Study. Without re-editing the differences among the data, review has been conducted as follows:

Table 4.5.12 Road Expenditures in the 7th FYP

(Rs million)

	1988/89	1989/90	1990/91	1991/92	1992/93	Total
1. Federal (NHA)						
Conctruction	885.0	1,181.3	1,646.1	7,841.3	11,407.9	22,961.6
Maintenance	195.9	263.3	281.6	378.0	480.0	1,598.8
Administration	5.2	5.0	6.5	9.2	20.8	46.7
Total	1,086.1	1,449.6	1,934.2	8,228.5	11,908.7	24,607.1
2. Provincial						
Conctruction	2,794.2	3,376.7	3,759.9	4,133.6	4,884.5	18,948.9
Maintenance	592.2	651.6	701.7	825.9	1,277.5	4,048.9
Administration	497.5	606.3	563.8	622.6	828.8	3,119.0
Total	3,883.9	4,634.6	5,025.4	5,582.1	6,990.8	26,116.8
3. Municipal & Districts						
Conctruction	1,352.0	1,352.0	1,352.0	1,487.0	1,487.0	7,030.0
Maintenance	0.6	0.7	0.7	0.8	0.8	3.6
Administration	0.6	0.7	0.7	0.8	0.8	3.6
Total	1,353.2	1,353.4	1,353.4	1,488.6	1,488.6	7,037.2
4. G. total	6,323.2	7,437.6	8,313.0	15,299.2	20,388.1	57,761.1

Source: 1. NHA. The data include expenses by NLC & FWO
2. Annual budget statements 1988/89...92/93 in each province
3. Estimated by using changes in road km from 1988 to 91 & unit cost. Figures after 91/92 are estimated, together with Admin. cost.

Table 4.5.13 Revenue from Road Users in 7th FYP

(Rs million)

	1988/89	1989/90	1990/91	1991/92	1992/93	Total
1. Federal (NHA)						
Duties & taxes	13,050	14,500	18,250	18,612	20,300	84,712
2. Provincial						
Reg & lisence	837	930	1,100	1,200	1,360	5,427
3. Local						
Octroi & rent	1,260	1,400	1,600	2,600	2,500	9,360
Total	15,147	16,830	20,950	22,412	24,160	99,499

Source: 1)Estimated by multiplying 0.9 to those in 1989/90.

1)Revenue and Expenditure in 7th FYP

A comparison of revenue and expenditure as a whole was conducted using the tables previously presented.

Table 4.5.14 Revenue and Expenditure in 7th FYP

(Rsmillion)

	1988/89	1989/90	1990/91	1991/92	1992/93	Total
1. Revenue	15,147	16,830	20,950	22,412	27,145	102,484
2. Expendi.	6,323	7,438	8,313	15,299	20,388	57,761
3. Ratio R/E	42%	44%	40%	68%	75%	56%

a. Revenue has grown in accordance with increases in import and taxes. A major change in fuel taxes in 1991 seems to have raised the revenue by 24% from 1990. The majority of revenue in 1992-93 was calculated by the consumed fuel volume estimated and tax rate per litter, which are different from the revenues in other years. However, an overall tendency would not change if the figure is revised.

b. The expenditure side showed an increase in 1992 and 1993 when ambitious development plan of national highways began. The ratio of Expenditure/Revenue was

less than 50% upto 1990-91, but after 1991-92 the ratio has become 70% or more.

c. Loans and their repayment schedules with WB and others are not taken into account because they are much dependent on the decision in financial management of the government over a long period of 30-40 years.

2) The 8th FYP

A comparison is given in Table 4.5.15 for the 8th FYP in which changes in tax rate on fuel in August 1993 was taken into account. After that, revenues in the future were assumed to groew at conservative and modest rates. The expenditure side is composed of recommended projects shown in Table 4.6.1. Annual cost allocation was done by dividing the total by five. Expenditures by province and district were assumed to include the cost of recommended projects which are supposed to increase a little over the plan period.

Table 4.5.15 Revenue and Expenditure in 8th FYP

(Rsmillion)

	7th FYP		8thFYP 2)					
	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	Total
1. Revenues	1)	1)						
Federal	18,612	23,150	31,868	31,868	33,461	33,461	35,134	165,792
Provinces	1,200	1,495	1,500	1,500	1,600	1,600	1,700	7,900
Local	2,600	2,500	2,500	2,500	2,600	2,600	2,700	12,900
Total	22,412	27,145	35,868	35,868	37,661	37,661	39,534	186,592
2. Expenditures								
N H A	8,229	11,909	14,171	14,171	14,171	14,171	14,171	70,855
Provinces	5,582	6,991	7,491	7,491	7,866	7,866	8,259	38,972
Local	1,489	1,489	1,989	1,989	2,088	2,088	2,192	10,347
Total a	15,300	20,389	23,651	23,651	24,125	24,125	24,622	120,174
Maint Exp b			2,834	2,834	4,251	4,251	4,251	14,171
Tot a+b=c	15,300	20,389	26,485	26,485	28,376	28,376	28,874	134,345
3. Exp a/Rev	68%	75%	66%	66%	64%	64%	62%	64%
4. Exp c/Rev	68%	75%	74%	74%	75%	75%	73%	72%

Notes: 1) In current prices, 2) inprices 1993-94

a. Table 4.5.15 indicates the overall expenditure on roads in the 8th FYP at 64 % of the total revenue on an assumption that all taxes and duties on vehicles and fuels are used for roads. If an emphatic policy to level up maintenance and repairing works of roads in every class is implemented with an allocation equivalent to 20% of the NHA's projects, the expenditure becomes 72% in the 8th FYP. (Instead, it can be thought that the revenue could be reduced by the same percentage.) Here remains a problem of sharing the revenue between roads and other facilities, although 100% is assumed in the above discussion. In the HAAS study 70% was used for allocating the fuel tax revenue for roads.

b. The above finding that in the 8th FYP the total cost of road development will be at 64% to 72% of the total revenue generated from road user vehicles and fuels does not guarantee the fixed revenue over the period. The allocation from the revenue depends on the governmental general policies. At present, customs and all tax revenues are brought in the general income of governments and not committed to specific programs. For example, there are opinions that import duties and octroi charges are outside the road user charges as those are better to be categorized in the general revenue itself. If this opinion becomes prevailing, the above percentages in Table 4.5.15 may change. However, from the road administration sides, a stable stream of fund allocation is desirable. It is strongly felt that a broad consensus should be developed to define the share of road user charges which may be able to be spent on roads.

c. It is said trucks and trailers are the main causes of road deterioration, while their tax payment through diesel fuel is not proportional to the extent of road damage caused by them. The Roughton Study recommended a number of revisions among which the tax on diesel is proposed as follows:

			1993/94	1995/96
Super	sale	in Rs/l	14.27	20.00
	tax	in Rs/l	10.48	15.17
Diesel	sale	in Rs/l	6.12	10.00
	tax	in Rs/l	1.92	4.57

HAAS study also recommended to increase taxes on fuels, through which market prices become closer to the international level. JICA study agrees basically to revise the road user charges as those studies recommends, but an extensive study and refinement are needed on the rates of increase among user charges and on how they should be distributed.

d. Toll road construction as BOT dose not seem to be lucrative from the viewpoint of private funds. It may be realized in case of roads in highly congested urban areas. Current toll road system is only on a bridge or a road section to raise revenue from users at a level to cover the maintenance and rehabilitation cost, not high enough to retrieve the initial investment. Common criteria of charging tolls among NHA, provinces and districts should be established.

4.6 Recommendations

4.6.1 Summary of Projects Recommended

The summary of the cost of the proposed projects for the short term and the medium term is shown in Table 4.6.1. The total cost for the 8th FYP is Rs. 73.2 billion and the total cost for Medium term period (1999-2006) is Rs. 46.6 billion.

4.6.2 Recommendations

(1) Arterial National highways.

The current programs committed by NHA to strengthen arterial national highways should be given high priority, since they have been under implementation in the past years. Construction work should not be halted and every effort should be concentrated to realize earlier completion. Other recommended projects are found in road sections having larger traffic volume worthy for widening/improvement. Following this study, they should be reviewed of its technical and economic feasibility and be included in the priority group to be implemented.

In general, those ambitious programs by NHA will be completed and the road capacity will be able to meet the traffic demand upto the year 2006. The recent study by NHA "Study of the Arterial Highway Network of Pakistan to the year 2015" (HAAS, November 1993) also has the same view.

Emphasis on the development policies for national highways should be shifted to maintenance and rehabilitation of highways through appropriate budget allocation, rather than new road construction. The study has a view that the network will be well developed in the coming 10 years, and the focus is to rehabilitate and maintain those roads.

(2) Provincial Highways

There are recommended projects on the provincial highways. They were assessed worthy to be implemented because of growing traffic demand. However, funding and execution of those projects are not within the reach of the federal government. They are dependent on the provincial parliament and C&W. Refinement of the recommendations through feasibility studies and preparatory steps to get approval in the province are necessary. A coordination of the programs of the federal government with those in the provinces are necessary to realize a reasonable well-balanced network development.

Similarly to the national highways, need to strengthen maintenance and rehabilitate provincial roads will increase in the coming years. It is felt the maintenance is far behind the least necessary level, resulting in a higher cost for transport. Actions to strengthen provincial roads are necessary. It should be noted that a new study is necessary to determine a plan for strengthening provincial or regional road network, since the network and zones used in this NTPS are not suitable to discuss the regional road development.

Table 4.6.1 Summary of Recommendations

(Rs million)

Item	Expendi. (7th FYP)	Short Term Completion (8th FYP)	Medium Term Completion (9th FYP plus)	Short & Medium 1993-2006 (8&9th FYP plus)	Total 7th..... Medium
National Highway Committed					
1. Motorway	6,900	9,460		9,460	16,360
2. N-5	10,011	29,796	4,340	34,136	44,147
3. Lahore Bypass (with prov. Br.)		3,220	440	3,660	3,660
4. N-25	56	2,240	2,170	4,410	4,466
5. N-55	2,763	9,882	5,863	15,745	18,508
6. Kohat T&BP		1,800	601	2,401	2,401
7. Sukkur Br.		1,000	1,006	2,006	2,006
8. N-70		1,341	3,129	4,470	4,470
9. N-40	23	1,987	3,466	5,453	5,476
10. Others (N-35, etc.)	337	7,448	9,080	16,528	16,866
11. Meklan Coast Rd.(Committed)		2,000	8,500	10,500	10,500
National Highway Recommended					
1. N-70		681	3,201	3,882	3,882
Total of National Highways	20,090	70,855	41,796	112,651	132,741
Province Highways					
Recommended	-	2,371	4,814	7,185	7,185
G. Total	20,090	73,226	46,610	119,836	139,926

The study has a view that efforts to strengthen the national highways in a large scale will be over within the 8th & 9th FYPs, then there comes a need to strengthen provincial highways. The 21st Century will be the time for provincial road system development. Federal and Province governments should recognize this trend and improve an administrative system, taxation and resource exploitation, budget allocation, etc. With this viewpoint a new study to strengthen provincial roads is recommended. Zones and network should be different from this national transport plan study and the area to be studied should be regional: Sind and Punjab respectively for example.

(3) Lowari Project.

The 8th FYP includes the Lowari pass improvement in its project list. The project is to construct a tunnel of 9 km under the Lowari pass, which will serve for a year round passable road to Chitral. Every year the pass is blocked by snow for more than 6 months, and during that time a road via Afghanistan has been used to link Chitral and Peshawar. However, the civil war in that country will not cease in the near future. In the past feasibility studies were conducted but the results were "economically not feasible" because of a high tunnel cost compared to the traffic using the route. The situation is not likely to change at present.

Currently another study by SWECO has been conducted [Lowari Tunnel Project : Final Feasibility Study and Design Review (SWECO & PCI, January 1995)]. The study is in the draft final stage in January 1995. It showed the followings:

1. Total tunnel cost in financial terms Rs 9,165 million
   Tunnel & Mechanics Rs 7,971 million
   Supervising, Conti,etc. Rs 1,194 million
2. Construction period from mobilization 5 years
3. Economic IRR, direct benefits 2.4 %
   with Indirect benefits 14.0 %

The project requires a large amount of funds for construction. EIRR is low when savings in vehicles operation cost are alone taken into account, while EIRR becomes 14% when indirect benefits are included. Although those figures are yet to be finalized, discussions of the content of indirect benefits may be necessary.

In a practical sense, even if the conclusion is economically feasible, it will take years for

detailed engineering and following steps to have a contract with consultants and contractors, then implementation in no-snow seasons. At the same time funding source is to be secured if loans from outside is to be utilized. During those years, route via Afghanistan should be used for need in winter season of Chitral people. Diplomatic efforts to have safe passing of the route should be conducted at first, regardless of the tunnel construction.

There remains two critical problems: maintaining road protecting from rock fall on the approach sections, and an integrated development policy of Chitral area in which economic and social standards are lower than other areas. Plans and funding for these problems should be established.

It should be noted that there is a plan of international road connection with the CAS region, passing Lowari - Chitral - Dorah (tunnel) - Afganistan - Tajikistan. The plan is still in a conceptual stage to be studied in a long range development program.

(4) Mardan - Malakand Pass

The provincial road between Mardan and Malakand is assessed of the need of widening in the medium term period. This is not listed in the recommended projects, since the cost of tunnel is not estimated yet. The road is running over a pass in a similar way as the Kohat Tunnel expected to be finished in 1999 or 2000. Traffic volume on Mardan - Malakand pass is also high and expected to increase because the road is towards Swat, Chitral etc. with potentials of development. A feasibility study is recommended for this project.

Simultaneously, an integrated regional development plan should be studied and established for the northern area beyond Mardan, which may include agriculture, forestry, industry and tourism.

(5) International Development

1) Present Situation

At the moment, international traffic movement on roads are minimal in volume. International instabilities in neighboring countries have discouraged movements crossing the borders, while economy in inland countries has not diversified yet to accelerate import and export as well as movement of passengers. Trade characteristics of Central Asia Countries (CAS) can be seen in Table 4.6.2 where trade with the countries in the former USSR is shown in percentage of GDP of each country in comparison with trade outside the former USSR.

In 1991, export or import with the former USSR was more than 18 % of GDP, while the figures with outside the USSR was only 1.5 - 7.0%. Kazakhustan had a change in 1992 due to the increase of export of gas, oil, etc. to European countries. Import from the outside was 16.3% which is a half in percentage with those from the former USSR countries. Due to the background of CAS, their economic relationship with the former USSR and eastern Europe countries was still substantial in those years.

2) Problems

In association with the CAS's traffic to/from Pakistan, trade and transport problems with CAS can be summarized as follows:

Capability to open and promote new market for CAS.
Policies of import/export and customs procedures.
Road network, driving practice, and vehicle maintenance.
Snow in high mountain area.
Civil war in Afghanistan.

Those problems were discussed in "Study of the Arterial Highway Network of Pakistan to the Year 2015" (HAAS Consult, November 1993). Also the HAAS study noted that main products of CAS are more or less the same like Pakistan (cotton, wheat, wool, leather, livestock).

3)Development

In the long run, CAS with a total of 52 million population is certain to develop and diversify their economy, with which increases are expected in export/import of those countries with

Pakistan, as well as Gulf states, and South-east Asian countries through ports of Bandar Abbas, Gwadar, Karachi as well as Qasim. The main road network in those countries are in Figure 4.6.1.

Figure 4.6.1 Central Asia States (CAS) and Pakistan

Legend :

International Lincage

National Highway

Provincial Road

Table 4.6.2 Trade and GDP in percent, CAS 1988 to 91

(in % of GDP)

Country	to/from	1988	1989	1990	1991	1992
Kazakhustan						
export	outside former USSR	2.5	2.4	1.5	1.5	20.1
	within former USSR	19.7	17.8	15.3	17.9	20.3
import	outside former USSR	3.8	3.4	2.9	3.6	16.3
	within former USSR	32.3	31.6	26	21.8	31
Uzbekistan						
export	outside former USSR	-	5.2	3.5	3.9	-
	within former USSR	30.5	27.8	25.2	30.9	-
import	outside former USSR	-	6.4	7.1	6.4	-
	within former USSR	36.2	39.2	36.6	29.5	-
Turkmenistan						
export	outside former USSR	3.7	3.6	2.3	* 5.9	-
	within former USSR	36.5	35.9	33.6	*36.2	-
import	outside former USSR	6.6	8.7	9.3	* 7.0	-
	within former USSR	38	40.7	39.9	*30.2	-
Kylgystan						
export	outside former USSR	0.9	0.7	0.6	0.3	* 2.3
	within former USSR	36.6	33.4	29.4	42.2	*37.4
import	outside former USSR	11.2	12.3	12.5	8.9	* 4.0
	within former USSR	42.8	44.1	34.4	35.1	*48.1
Tajikistan						
export	outside former USSR	5	5.2	4.3	2.9	-
	within former USSR	30.2	30.7	23.5	30.3	-
import	outside former USSR	7	9.1	10.8	2.8	-
	within former USSR	45	46.1	32.9	28.2	-

Source : IMF, "Economic Review, 1992" for each of CAS (referring to Transport & Econ.Cooperation Survey, IDCJ.1994)

Notes : * means estimated figures in the IMF report.
The figures are percent of export/import value in GDP of each country.

When the economies of CAS grow and related traffic using the Pakistani roads increase, civil works to grade up the following roads to accommodate international traffic movements will be necessary. In reality, economic development of CAS will require certain years because the problems cannot be mitigated immediately. However, the following roads are important in the future:

Baluchistan;
* Gwadar - Turbat - Panjgur - Khuzdar - Ratodelo
* Panjgur - Darbandin - Nushki - Mastung
* Gwadar - Omara - Uthal (Maklan Coastal Road)
* Quetta - Chaman

NWFP & Northern Territory;
* Maldan - Malakand - Dir - Chitral - Dorah pass
* PeshawaL - Khybar Pass
* Abbottabad - Mansehra - Gilgit - Khunjerab pass (N-35)

It is noted that NHA has been particularly implementing improvement of Karakoram Highway (N-35) beyond Mansehra to Khunjrab Pass (750km) in the 8th & 9th FYPs since it is the only one functioning international road to CAS via Kashgar (China) to Almaty (Kazakhustan) and to Tashkent (Uzbekstan).

CHAPTER 5 Road Transport Planning

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5.1 General

Commercial road transport service for passengers and cargo is operated by private owners/drivers, except the service of NLC and provincial passenger transport corporations. Government claims the service be shifted to the private enterprises and owners/drivers entirely with the minimum government intervention and investment. This policy should be realized and sound market mechanism should be developed through which supply can increase along with the demand growth.

Increases in vehicles on roads will continue in the future since the economy is forecasted to grow steadily. The problem of road traffic accidents is caused by poor traffic management by police force, poor & crude driving manner of drivers and poorly maintained roads. Urgent actions are necessary to reduce accidents. Private sector is in charge investment in the service. Subsidy to public corporations owned by federal/ provincial governments should be reduced. This chapter discusses those points and recommends policies to develop sound market mechanism and safe services.

5.2 Forecast of Vehicles on Roads

5.2.1. Vehicles on Roads 1983-1993

In Pakistan, vehicles paying annual tax are classified as "vehicles on roads", while there are other data for "vehicles registered" in which depleted vehicles and those not paying annual tax (which means they cannot run on roads for a particular year) are not cleared out. When the rate of increase of vehicles on roads in the 6th and 7th FYP periods are tabulated as in Appendix Table 5.2.1, the annual increase rate was 12% in the 6th and 9% in the 7th period. Table 5.2.1 shows the summarized figures to find growths of vehicles on roads from 1987 to 1990 and 1993. The average annual rate of increase in these years was stable at around 9% for all motorized vehicles. Trucks of various sizes increased at a high rate of 10% in the recent years, while regular buses increased at 6.1% per annum in the same period.

Table 5.2.1. Vehicles on Roads, 1987, 1990 and 1993

Vehicle				Annual Growth Rate	
	1987	1990	1993	1987-90	1990-93
Motor cycles	700,004	896,179	1,166,491	0.086	0.092
Cars, jeeps, etc.	475,181	617,810	810,200	0.091	0.095
Wagons	27,028	39,764	56,986	0.137	0.127
Buses	36,117	43,275	51,651	0.062	0.061
Trucks	66,120	82,678	109,358	0.077	0.098
Total	1,304,450	1,679,706	2,194,686	0.088	0.093

Source:NTRC, February, 1994

5.2.2. Forecast to 2006

In order to forecast the vehicles on roads, changes in vehicles by type should be related to the growth in GDP, population and per capita GDP from 1983 to 1993. Regression analysis was conducted to find the following parameters.

$$Veh = a + b * (GDP \text{ per capita})$$

Where Veh means Vehicles on roads

Two variables, GDP and population were also tested in the regression analysis, but they had a negative coefficient value. Accordingly a single variable was used to determine the relationship in those years. Using the parameters and estimated population and GDP in 1998 and 2006, the vehicles on roads were forecast as shown in Table 5.2.2 and Figure 5.2.1.

Table 5.2.2 Vehicles on Roads, 1983 - 2006

Years	M/C	Cars	Wagons	sub-total	Buses	Trucks	Total	Gr ratio
1983	424,215	350,713	13,284	788,212	27,361	42,761	803,549	1.00
1988	751,970	513,157	32,632	1,297,759	38,641	71,660	1,408,060	1.75
1993	1,166,491	810,200	56,986	2,033,677	51,651	109,358	2,194,686	2.73
1998	1,567,513	1,162,677	88,014	2,818,205	69,152	153,501	3,040,857	3.78
2006	2,317,676 *	1,956,544	157,870	4,432,090	106,975	255,472	4,794,337	5.97
gr 93-06 %	5.42	7.02	8.15	6.18	5.76	6.74	6.19	-

Notes Cars: cars, pickups, D/van, and taxis
Wagons; wagons & flying coaches
Trucks: articulate and rigid types, tankers and others
Agri-tractors are not included

Figure 5.2.1 Vehicles on Roads, 1983 - 2006

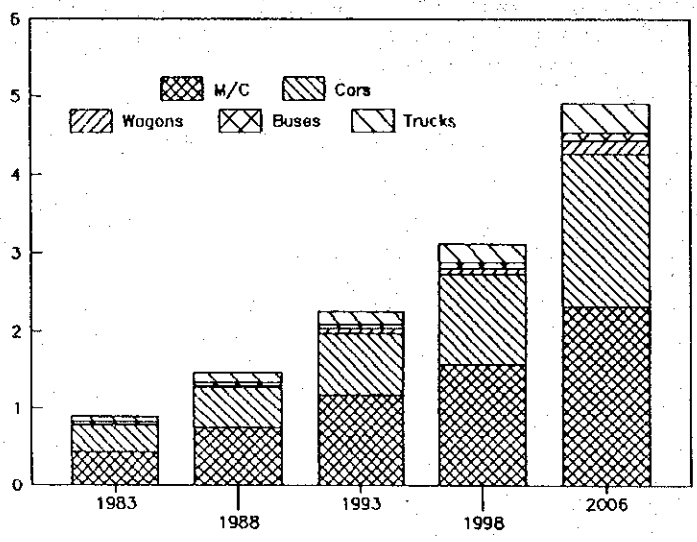


Table 5.2.2 indicates that the total vehicles will increase from 2.19 million in 1992-93 to 3.04 million in 1997-98, showing an annual growth rate of 9.3%. The number of vehicles on road will reach at 4.79 million in 2006. The average rate of increase in those years, 1983 - 2006, is 6.2 % per annum. Among those vehicle types, cars and wagons are estimated to have higher rate of increase at 7- 8 % per annum, while larger vehicles, buses and trucks, will have lower rates of increase at around 6 %. Appendix Table 5.2.1. shows the data and the parameters of regression analysis.

5.3. Passenger Transport Service

5.3.1. Service

The inter-city public passenger transport is served by :

1. Vehicles owned by private persons. The owner registers the service of his vehicle on a route and pays annual permit fee to Province.
2. Vehicles owned by Province Transport Corporation, a public corporation owned by Province and traditionally named as Provincial GTS. Routes and buses are determined by the Transport Corporation without paying annual permit fee.

The total numbers of routes and buses with renewed permit in 1993 are shown in Table 5.3.1, although statistical data are incomplete. Some air-conditioned vehicles are used on long distant routes.

Table 5.3.1. Route and Vehicles by Province Private Buses, 1993

	Punjab		Sind		NWFP		Baluch	
	routes	vehicle	routes	vehicle	routes	vehicle	routes	vehicle
Staged b,m,w								
Inter-Province	na	na	na	2,081	234	1,602+	na	na
Province	na	na	31	2,081	234	1,602+	na	na
Contract m,w								
Inter-Province	na	na	38	507	74	1,102	na	na
Province	na	na	23	240	45	2,567+	na	na
Air- Conditioned								
Coach / wagon	na	na	13	164	36	154	na	na
Bus	na	na	na	na	8	36	na	na
Total	na	na	105	8,868	461	6,136+	na	na

Source: PTA and RTAs of each province, February 1994

Remarks:
b. Buses with seats more than 40
m. mini-buses with 17-39 seats and
w. wagons up to 16 seats
*: Intra-city routes are not included in the table.
+: means some should be added, but exact numbers are not available.
Total is calculated by the available figures only.
In Sind, data are from PTA of Sind, but data from RTAs in the Sind Province are not yet.

5.3.2. Passengers

The number of users/passengers of public transport services are not able to be identified quantitatively since no statistical data nor revenue/cost information of private operators are filed in Provincial Transport Authority (PTA) of each Province.

5.3.3 Administration

(1) Private Service

In each Province, Provincial Transport Authority (PTA) having several Regional Transport Authorities (RTA) within its jurisdiction administers public passenger service by private operators. Route permit is renewed by those agencies on the payment of annual fee by private operators.

PTA: Inter-Provincial routes and air conditioned bus/coach /wagon services.
RTA: Routes within a Province

PTA and RTAs in NWFP have files to identify routes and number of vehicles with permit. However, no data were supplied to the study from other Provinces when the team visited in February 1994. Those authorities have not built up a filing system and the entry to a route is said free when all payments and vehicle permits are confirmed. However, inter-provincial routes have a limit in the number of vehicles in service under a quota system covering those Provinces. Table 5.3.2 shows the fees for registration and annual renewal in NWFP.

(2) Provincial Transport Corporation (GTS)

Provinces, except Baluchistan, have a public bus corporation each to run service competing with private operations under the same fare rates. However, due to the lack of entrepreneurship coupled with the fare regulation and social obligations, GTS has been reducing its service and fleet. Their poor financial performance are not able to recover the cost.

Summary of the operations is shown in Table 5.3.3. It is likely that each of those GTS receives a substantial amount of subsidy from Provincial Government. For example, in 1982-83, GTS of Punjab showed Rs. 179 million deficit (income-expenditures) on inter- city operations and GTS in NWFP showed Rs. 66 million deficit on inter-city service.

GTS of Punjab once had a fleet of 453 in 1983-84, but all were depleted without new acquisition in the past ten years. Now Punjab GTS leases routes and terminals to private operators, and bus service by its own fleet have disappeared. Although GTS is planning to restructure itself, by reducing excessive employees and purchase of new vehicles, it would be a tough task under the current social constraints and financial situation of the Province. NWFP has recruited some buses and the fleet in 1992-93 was 677, while it was 806 in 1988-89.

(3) Ministry of Communications

Routes determination, bus fleet allocation and revisions are made by PTA and RTA of respective province. Ministry of Communications is not involved in these matters. And the Ministry has no filing system of statistical data which may show performances of the public passenger transport service, nor has no division which would review the cost of service and fare level in the market. Those reviews should be utilized when the cabinet or Province needs to announce the revision of the fare rates.

Table 5.3.2 Fees by Commercial Vehicles

(Rs.-)

Vehicle	Regist. fee	Income tax &fee/Year	Transfer fee
Bus	1,000	188 per seat	1,000
St. Wag.			
up to cc 3000	650 +0.5% * cost	188 per seat	650
above cc 3000	800 +0.5% * cost	188 per seat	650
Pickup	650	828	650
Taxi			
up to cc 1000	550	168	-
above cc 1000	650 +0.5% * cost	672	-
Truck	1,000	6,000	1,000

Notes: 1) Government vehicles deposit Rs 1000.- to receive a registration number
2) Afghan refugee vehicle has been registered in NWFP. Special number as Temporary Registr. Permit is given under interim arrangement at Rs 1000.-
3) Transfer of route permit is Rs 250. - allowed by PTA

Source: PTA, NWFP (August, 1994)

Table 5.3.3 Provincial Transport Corporations, 1993

	Punjub		Sind		NWFP	
	Urb	Inter-c	Urb	Inter-c	Urb	Inter-c
1. Fleet and employees						
a. Buses: new						30
: deplete					11	36
: net Tot.	77	68	na	na	118	374
b. Employees 3)						
	6,164	5,318	na	na	623	2,927
c. Ratio b/a(net)	80	78	na	na	5.3	4.4
2. Revenue and cost in Rs million						
d. Expenditure	235.3	202.7	na	na	23.2	301.0
e. Income	26.3	23.7	na	na	42.5	235.1
f. e-d, surplus,	-209.1	-179	na	na	-19.3	-65.9

Source: PTA and RTAs of each province, February 1994

Notes: 1. Revenue by route leasing in Punjab is not included in income.
2. No provincial transport corporation (GTS) in Baluchistan
3. Employees in Punjab are for 1990/91
4. Data from Sind not arrived March 1994. No total tabulated.

(4) Fare Rates

There are minor differences in the fare rate (Rs./km per person) for the same service type among the Provinces, as shown in Table 5.3.4.

Table 5.3.4 Fare Rates (Inter-city)

	Punjub	Sind	NWFP	Baluch
Staged	0.165	0.140	m: 0.145	m: 0.180
			g: 0.155	g: 0.190
Contract	0.168	0.180	m: 0.160	m: 0190
			g: 0.160	g: 0.200
Air.Condi.		1)		
Contract	0.260	0.280	0.320	0.380

Source: PTA in each Province, February 1994

Remarks: m - means metal (surfaced) roads
g - means gravel/earth roads
1) In Sind the rate of 0.360 is applied for air-conditioned contract coaches running on gravel roads.

The fare rates are determined by Provincial Government and announced by PTA. But there are little documents which analyze the operation cost in relation to revenue and fare rates. Some owners insisted during the meeting with the Team that :-

- No compensation is given yet from Province nor Federal Government for discount service to students, handicapped and aged persons. The discount reaches around 30-50 % although the rate differs among the Provinces.
- Current fare rates are not sufficient to recover the costs including allowances for depreciation. Passengers are often asked to pay additional fares late in the evening, on the section where passengers in the vehicle are less, or forced to off the vehicle before arriving at the destination. But those vehicles violating the rules of route permit conditions are not regulated by PTA, RTA nor MOC.
- Loans to be used for vehicle purchase or replacement are difficult to get from banks. Private

funding sources require interest charges of 20-30 % per annum for a period of a few years.

- "Cut-throat competition" in passenger service was told to be dominant by Owners Association of Commercial Vehicles in Lahore, because those engaged in the service are difficult to find an alternate job opportunity in the domestic market. Thus excessive supply is seen in high demand routes in large urban areas. They are often not able to take into account the financial viability of the service including provisions for depreciation, through which a reproduction cycle of the service can be performed. Low wages, long hours of work and poor service are said to be common in the market.
- However on roads in NWFP, it was often seen that numerous passengers were transported by wagons and buses hanging on the sides and over the roof. Risk to be involved in accidents has not been controlled by police force. Those vehicles would have sufficient surplus through operation. In that case new entry to the market should be seen immediately because the market seems in short of supply and profitable. But, some insist they are not. One reason is that volumes of passengers are not stable over the year on inter-city routes, which makes the market not so attractive as in busy urban areas.

5.3.4. Policies of Passenger Road Transport Service

While demands on the public road transport service are expected to increase at a rate around 5-7 percent per annum as discussed in 'Growth Estimate of Vehicles on Roads', most of investment are expected from private sources. The 8th FYP proposes no investment of federal government on the sub-sector. The federal government pointed out the need for subsidizing transport of passenger in low income class in urban areas, but none was written for inter-city passenger and cargo services.

Currently Provinces are not positive in regulating and rationalizing the public transport service. However, Provinces should be active in the following points through which users can obtain better service :

- establishment of a statistical filing system of commercial service vehicles in PTA and RTAs of each province, through which distances of running, number of trips, revenue and expenditure should be reported by the vehicle in the permitted route.
- analysis of the cost of commercial service vehicles which should be utilized to determine the fare rate.
- market study (supply and demand analysis) which may initiate the adjustment of excessive supply (cut-throat competition), and restructuring of the route and network. Those are the responsibility of PTA and RTA.
- reclassify administrative functions among MOC, NHA, traffic police, RTAs and PTA of Provinces together with appropriate budgetary allocation to each function. It is considered that market, service and route organization need to be surveyed periodically, and with the result Provinces or MOC should conduct some adjustment of the functions such as to encourage / discourage the entry.
- strict enforcement by those administrations or by police force may be necessary.
- Provincial transport corporation should be converted to a private business in order to reduce the provincial subsidy to the deficit. If difficult, every effort should be poured in to maintain efficient management through which a burden of subsidy in the budget of the provincial government can be reduced. It can be liquidated without substantial disbenefit since passengers can use private buses doing their business on the same route.

5.4 Cargo Transport

5.4.1 Service

(1) Service

Cargo transport by commercial vehicles are conducted mostly by private operators. Trucking agencies have developed a combined system of line haul transport on major corridors and auxiliary local networks, on which various services including those from door to door have been developed. But their scale of operation is not large.

Most important function of those agencies is to organize a transport service using private trucks to meet the demand of shippers. However, no statistical data of service vehicles and volumes of commodities transported are filed in RTAs and PTA of Provinces. It is told about 200 agencies are in Islamabad/ Rawalpindi. In NWFP a total of 136 was identified by PTA in 1993, and Rs. 110 per agency per year is collected as Adda/Commission fee to NWFP. According to the data supplied by PTA of NWFP, about 10% of the ownership of commercial vehicles have been transferred in a year.

There is a government organization named National Logistic Cell (NLC) which is engaged in transport service of particular commodities which are earmarked by government. It transports a large volume of those commodities from ports of Karachi and Qasim to key inland urban centers, and export materials to those ports. Their activities are stated afterwards in 5.5 of this Chapter.

(2) Freight Rate

Freight rates are said to be determined by direct negotiation between shippers and transporters in the case of large volumes, while there are common freight rates prevailing in the market for small scale services. Both rates change easily depending on the demand, seasonally and/or regionally. No standard freight rates are indicated by agencies concerned. It is felt that the market mechanism is well functioning because so many agents and vehicle owners are supplying services, and transport tariff in a region changes in response to the demand.

5.4.2 Administration

(1) Province

There is an agency, exactly the same as the passenger service, to which cargo service vehicles are registered by paying registration and other annual fees. The agency is named Provincial Transport Authority (PTA) which has its regional branch offices, RTAs, in the province. If the service extends to a neighboring Province, the owner need to register a RTA or PTA in that Province. NLC does not register at these offices. NWFP has data files of vehicles in service as shown in Table 5.4.1, while other provinces seem to have a difficulty to show those data.

(2) Ministry of Communications (MOC)

MOC or province has not regulated nor guided the freight rates and services of cargo transport by trucks. Those matters are left to the competition mechanism of market. MOC has not gathered from Provinces statistical files including details of expenses of the operation which can be used to study growth, changes and problems of the service.

(3) Vehicles in Service

It is hard to find the number of commercial trucks separately from others in each province except NWFP who has a file of this classification. In addition, no province has statistical data indicating activities of truck service on roads. Table 5.4.1, although incomplete, shows the number of commercial trucks in NWFP in 1993.

Table 5.4.1 Commercial Private Trucks in 1993

	Punjub	Sind	NWFP	Baluch	Total
Trucks	-	-	-	-	
Pickups	-	-	-	-	
Others	-	-	-	-	
Total	na	na	3,801	na	

Source:PTA in each Province February 1994. NWFP supplied data in March 1994 but others did not.

5.4.3. Trucks and Drivers

In 1986 roadside interview surveys on truck drivers and other minor surveys were conducted and the results were compiled in "Pakistan Road Freight Industry : an overview" (NTRC, 1989). No other field surveys nor data filings have been conducted since then, and it is considered worthy to excerpt its major points to grasp the current market situations as they have likely been no substantial changes since then. The followings are the excerpts of the report, with some additional information when available.

(1) Fleet

Although three and multi axle trucks increased their percent shares, the two axle trucks have been still dominant in share in recent years. Traffic count data in 1986 and 1993 on national highways are summarized in Table 5.4.2. It is found around 69 % of trucks are under the two-axle classification in 1993, while it was 89 % in 1986.

In July 1994, an interview was conducted at a goods forwarding agency in Islamabad/ Rawalpindi who told that the use of two axle trucks depended on the volume of goods; whether large enough to use a trailer-type large vehicles.

Table 5.4.2 Trucks by Axles, Traffic Count Data on National Highways, 1993

	Axles2	Axles3	Axles3	Axles4	Axles5	Axles6	Total
In 1993.....							
Total	36,258	10,168	1,332	3,932	257	759	52,706
shares	0.69	0.19	0.03	0.07	0.00	0.01	1.00
In 1986.....							
Total	18,724	947	498	761	174	15	21,119
shares	0.89	0.04	0.02	0.04	0.01	0.00	1.00

Source: Summary of Traffic Data, National Highways 1986 and 1993 (NTRC, 1986 and 1993)

Notes: Count locations are not same in those two years. But the percent shares are calculated for the total of the selected count stations in each year.

Vehicle bodies are made locally and fixed on the engine-chassis frame after they leave the assembly plant. At the same time, trucks are strengthened by various ways. Most common ways are to strengthen chassis, springs, axles and tyres. According to the report (NTRC 1989), brakes were found untouched. Those modifications increase truck capacity by 50 % or more. For example, normal load of 11 tons is increased to 16/17 tons or more. Those mechanical works are done by groups of small shops with different types of technical services which are often located in an urban area/block.

(2) Loaded Trips and Performances

In the survey of 1986, 76 % of trucks traveling 'from Karachi' were loaded, while 63 % were 'to Karachi'. In summary 73 % were traveling with loaded cargoes. Empty ones going to Karachi

had a larger trip length than those in the opposite direction. The share of loaded trucks was 75 % as surveyed by PTA of NWFP in 1994.

Freight vehicles achieved a high degree of utilization by long working hours and night operation. It was common that they were away from the base town for two/three weeks looking for transport demand and thus they were able to minimize empty trips. Trailer type vehicles have less holidays than 2 axle trucks. But larger vehicles tend to run longer distances than 2 axle trucks. In this kind of long traveling, trucks can find a demand at freight agency located in most of large municipalities. An agency in Islamabad/Rawalpindi told those practice are still common in 1994. Those performances are shown in Table 5.4.3.

Table 5.4.3 Loaded Trips and Performances 1986

	2 axles	3 axles	tractor / trailer
Percent trips loaded %	69.5	75	74.1
Mean period before return to family	17.95	27.1	37.8
Days of rest / mo	2.3	1.7	1.6
Days under repair	41	42	51
Estimated km/year	121,000	125,000	131,000

source: Pakistan Road Freight Industry 'an overview' (NTRC, 1989)

(3) Revenue

Most prime drivers are responsible to find loads and receive the payments. Rate per km is determined by negotiation and no regulations are found. In general, rate per km decreases when the distance increases. Table 5.4.4 is the summary of mean values of selected subjects.

Table 5.4.4 Revenue and Travel, 1986

	2 axles	3axles	Tractor / Trailer
Mean tariff Rs	3,093	5,682	5,940
Mean Load km	761	1051	957
Mean road km	249	198	387
Revenue / Load km	4.0	5.4	6.2

Source: Pakistan Road Freight Industry 'an overview' (NTRC, 1989)

A comparison of tariff rates between rail and trucks was done for 1985 in the report. The rate was around 35 % higher for truck service, while it has been known that the high rate of truck service is generally offset by the entire time and cost of railways which require access transport from and to the rail station.

	Rails	Roads	Rails	Roads
	Commercial Revenue		Average Transport	
	Rs/ton-km		km	
Petroleum Prod.	0.41	0.63	571	647
Dry cargo	0.26	0.33	872	743

Source: Pakistan Freight Industry (NTRC, 1989)

As for the tariff difference between one direction and another, as discussed in the report (NTRC, 1989), the rate was much higher 'from Karachi' than 'to Karachi' in 1986. Similarly, differences of the rate between 'to and from Karachi' were substantial in 1994 according to the agency in Islamabad/Rawalpindi, who suggested that a 60 or 50 % reduction was practical on return trips. His quoted example is shown below:

		Karachi to Islamabad a full load		Islamabad to Karachi a full load
Bedford Tr.	9 ton	Rs 10000	Rs	4500
3 axles	16 ton	Rs 14000	Rs	7000
Trailer	25 ton	Rs 22000	Rs	10000

Also, a truck driver in Peshawar showed a reduced tariff for return trip from Karachi to inland cities.

	Peshawar to Lahore a full load		Peshawar to Karachi a full load	
2-axle truck (similar to Bedford Tr 9 ton)	Rs	2500	Rs	6000

(4) Drivers' Problems

Based on the answers from drivers, the biggest problem chosen from the listed problems was police harassment, followed by poor roads and robbery risk on roads. The police harassment was pointed by 2/3 of drivers in the 1986 survey. It was connected with payment to policemen on duty. The practice was widespread and was believed to be same in case of public passenger transport wagons/buses. Those replied "poor roads" were predominant for trucks in Baluchistan since the roads were in worse condition than at present. Drivers in Peshawar also pointed out the need of road betterment particularly in mountain areas.

(5) Accidents

In total, 9 % of drivers had experienced accidents in various types in one year. Of them 77 % involved no injury. Roll-over accidents, caused by high sided trucks, accounted for 39 % of the total. No other data have been available. Most minor accidents were solved by negotiation at the site and nothing has been reported to traffic police and statistical file.

5.4.4 Policies for Cargo Transport Service

In general, policies for the public passenger service mentioned in 5.3.4 are applicable to the commercial cargo transport service. However, a few points should be added.

Routes.

It is noted trucks and trailers have no defined route to operate. They travel to any place under the request of the client. No route permit is necessary.

Fare rate.

At present, the market mechanism is well working to determine the freight rate. The charges seem to be stable if there is no change in demand, as supply side is composed of many individuals and entry is not so frequent because of the cost of vehicles and difficulty to find the use in other sectors. The market is composed of transport agencies, owners & drivers, and clients. There is no government intervention nor enforcement. This is different from the passenger service where the rate is determined by Province.

This rate determination in the market mechanism should be maintained together with free entry to the market.

Excessive loading

Practice of strengthening chassis, axles, etc. of the vehicle is prevailing in the country. Those physical works are performed by repair/ workshops located in urban areas and provide substantial job opportunities. They are not new development but have many years of accumulated knowledge and technology. If regulation of overloading is executed by traffic police and road agency, there would be serious influence to those workshops and related various economic and social sectors.

However, over loaded trucks are the prime cause of quick road deterioration and actions to maintain roads in good conditions are absolutely necessary. It is recommended that alternate approaches should be studied to have good roads holding the job opportunities associated with vehicle workshops. An example is to charge a higher taxes on trucks and trailers or fuel, with the revenue used for road rehabilitation. At the same time design of road structure and surface should be altered taking into account those excessive loaded vehicles. A feasibility study should be conducted.

5.5 National Logistic Cell

5.5.1 Organization and Service

Since its establishment in 1978, a government owned corporation, NLC has participated in transporting key import and export cargoes between Karachi and major inland cities. Figure 5.5.1 presents locations of main organizations of NLC; headquarters, Afghan Refugee Units, Staging Sections, and others. In 1993, the total number of employees in NLC was 9400 and active fleet was approximately 1500 out of the owned vehicles of 2000 units.

5.5.2. Service

Cargoes transported by NLC are specialized by laws as fertilizer, wheat, rice, cotton, crude oil, and finished POL products; but in addition to those import/export cargoes NLC is engaged in carrying other cargoes including containers. NLC's service is given some advantages in service contract with government agencies, however its share in various cargo transport was said at 5.4% in 1988 and since then no percent shares are shown in statistical data. It is hard to define the share of NLC since majority of transport is handled by private trucks.

Annual reports provided by NLC indicate, in summary, their annual transported tonnage of dry cargo and liquid cargo in the past several years. Activities and vehicles on roads seem to be stable in those years and operating vehicles increased from 1249 in 1986-87 to 1455 in 1992-93. (Table 5.5.1 and Figure 5.5.2).

The unit rates per ton per km are different among dry cargo, liquid and container. However, in case of dry cargo, the rate difference is rather explicit among the corridors; flat road as N-5 (Grand Trunk Road) is cheaper than hilly road of Karachi - Quetta and Chitral area by 20 - 30%. Back load rate is proposed substantially low at a level of 30 - 40% of forward loading rates.

The average loading ton per veh-km is calculated at 16.4 tons, and if considered the share of back trip at 33%, the net loading would be 24 tons per veh-km.

Financial aspects of NLC in the past is summarized in Table 5.5.1. Annual net surplus has been

expanding as the total revenue increased from Rs. 883 million in 1986-87 to Rs. 1692 million in 1992-93; an increase of 92 % over 6 years.

Annual Report 14th by NLC claims that the most of the fleet was built during the initial years of 1978-82. Almost 60 % of them had become due for replacement by 1990. Under its modernization programme, NLC had invested a sum of Rs. 2228 million during 1991-93 on the purchase of vehicles and matching semi-trailers, and this became the factor to increase the depreciation allowance. Although the operation revenue increased by 9 % in 1992-93 from the previous year, the net surplus in the same year reduced at Rs. 272 million from Rs. 317 million in 1991-92. The report says NLC did its best in maintaining a reasonable financial position despite the pressure to reduce the rate and increase of price of fuel in 1993.

Table 5.5.1 NLC Works & Fleet

Year	1) Transport Dry cargo t	Liquid cargo t	Total t	Ton-km million	2) Fleet Year	Vehicles Nos	Run-km million
1980/81	1,852,139	-	1,852,139	-	1982/83	1,278	
1984/85	1,952,123	-	1,952,123	-	-	-	
1986/87	1,322,000	417,000	1,739,000	853.5	1986/87	1,249	51.673
1987/88	1,330,000	338,000	1,668,000	884.2	1987/88	1,333	56.722
1988/89	1,267,000	415,000	1,682,000	902.9	1988/89	1,262	53.984
1989/90	1,252,000	423,000	1,675,000	767.4	1989/90	1,242	48.000
1990/91	1,168,000	413,000	1,581,000	803.5	1990/91	1,186	48.499
1991/92	1,379,000	485,000	1,864,000	874.3	1991/92	1,248	52.069
1992/93	1,534,000	431,000	1,965,000	1,134.0	1992/93	1,455	69.097

3) Fare rate effective from 01 January 1993 Rs per ton/km

Distance in km	G T Road	Karachi-D I Khan	Karachi-Quetta	Chitral area	Back load all area
- 180 km	0.68	0.68	0.68	1.07	0.27
- 400	0.67	0.67	0.67	1.07	0.27
- 625	0.65	0.65	0.65	1.07	0.27
-1000	0.61	0.61	0.66	1.07	0.27
-1400	0.60	0.60	0.84	1.07	0.27
-1800	0.71	0.71	0.88	1.07	0.27

4) Financial Aspects (in Rs 000)

Year	Revenue	Expenses	Taxes to Gov'ment	Total expenses	Net surplus
1986/87	882,538	633,362	65,661	699,023	183,515
1987/88	903,906	702,333	66,268	768,601	135,305
1988/89	1,175,597	867,494	52,848	920,342	255,255
1989/90	1,475,133	1,186,081	64,571	1,250,652	224,481
1990/91	1,501,900	1,196,616		1,196,616	305,284
1991/92	1,574,370	1,257,880		1,257,880	316,490
1992/93	1,692,498	1,420,157		1,420,157	272,341

Source: NLC, February 1994

Figure 5.5.1 Operation Centers of National Logistic Cell (1992/1993)

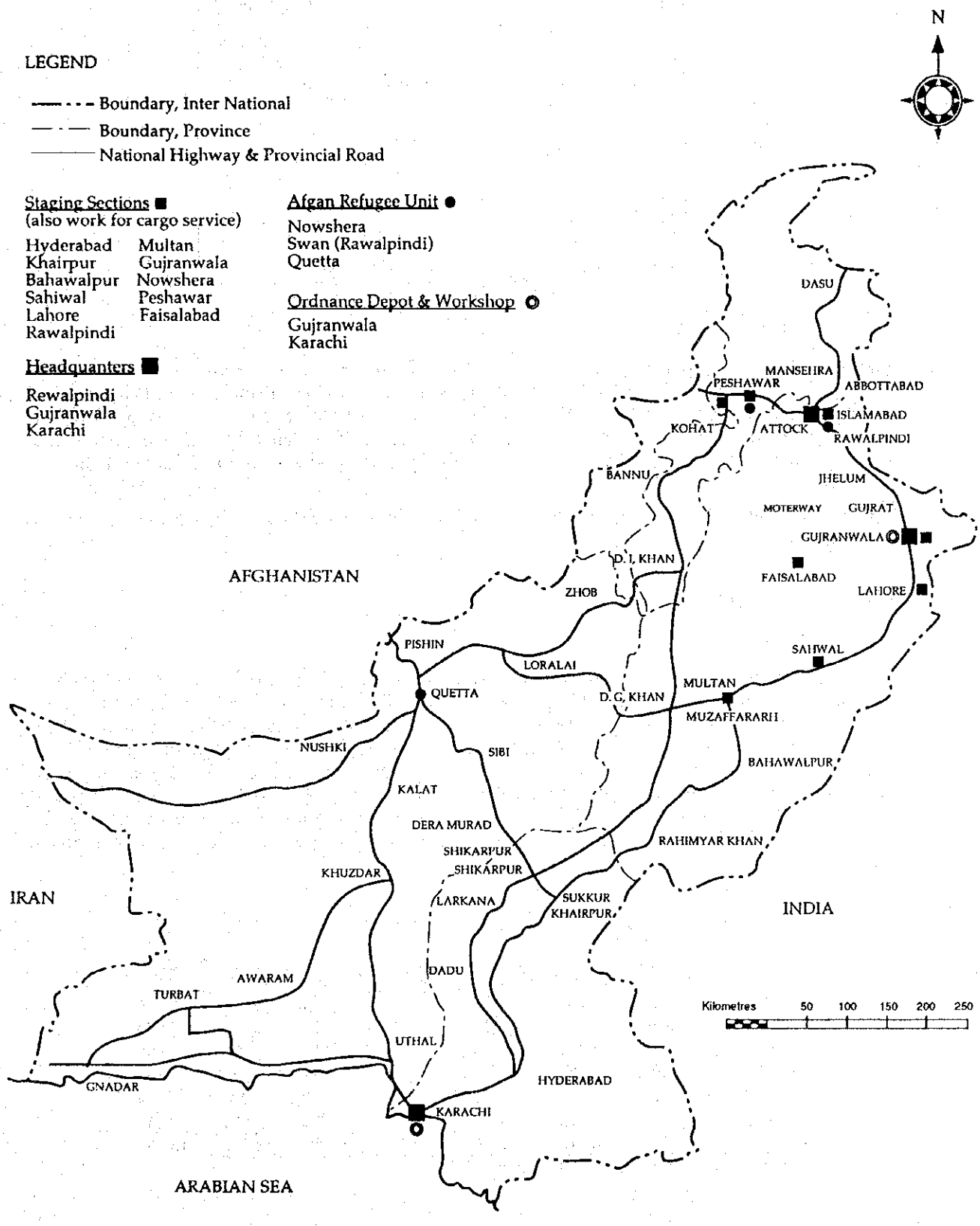
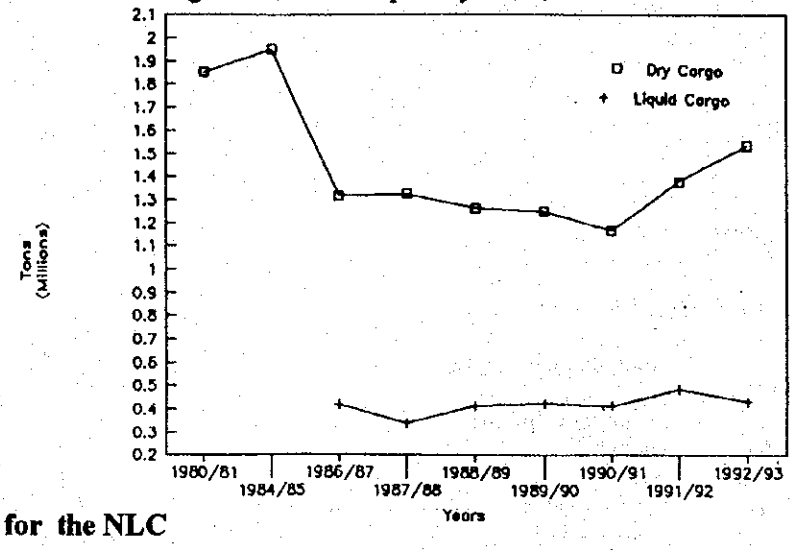


Figure 5.5.2. Transport by NLC, 1981 -1993



5.5.3 Policy for the NLC

It is said NLC will move toward a private organization and be involved in various services competing with private owners and transport agencies. While it is difficult to compare detailed content of transport service between NLC and private agencies, there is no reason to oppose their competition in the market. In that case NLC should be in the equal standing with the private sector; common rate in the market, no eventual subsidy nor support from governmental agencies, and so on.

MOC should collect basic statistical files of their operation every year in the same way as the private operators.

5.6 Accident Reduction

5.6.1. Accidents

Accident statistics registered in traffic police are in Tables 5.6.1 and 5.6.2. They do not include those minor ones not reported to traffic police. The first table shows accidents of death and injury by province in 1991 where Punjab had the largest number followed by NWFP. Sind and NWFP are mostly the same magnitude in casualties. The second table shows changes in number from 1982 to 1991, where accidents increased up to 1984, then decreased until 1988, and turned to increase afterward. Number of persons involved in accidents decreased from 1987 to 1990 and went up in 1991. Reasons of these variations are hard to identify. In those years vehicles on roads, population, and GDP increased steadily although rate of increase was different among those indexes.

Table 5.6.1 Traffic Accidents, 1991

	Fatal	Non-Fata	Others	Total	Killed	Injured	Total
Punjab	2,514	3,663	3,988	10,165	3,093	6,933	10,026
Sind	1,020	1,289	214	2,523	1,221	2,702	3,923
NWFP	577	1,439	3,243	5,259	732	2,868	3,600
Balluchistar	106	189	17	312	99	235	334
Islamabad	84	142	0	226	99	235	334
North Area	28	93	4	125	36	99	135
Total	4,329	6,815	7,466	18,610	5,280	13,072	18,352

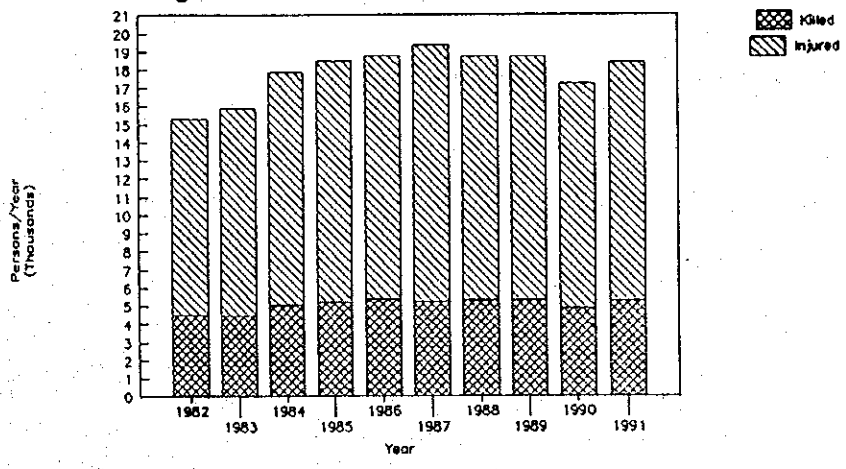
Source: Transport Bulletin Road Transport (NTRC, 1992)

Table 5.6.2 Traffic Accidents, 1982 - 1991

Year	Fatal	Non-Fata	Others	Total	Growth	Killed	Injured	Total	Growth
1982	3,750	6,728	1,285	11,763	1.00	4,502	10,806	15,308	1.00
1983	3,850	6,961	2,182	12,993	1.10	4,464	11,410	15,874	1.04
1984	4,418	7,451	5,555	17,424	1.48	5,064	12,796	17,860	1.17
1985	4,433	7,201	3,470	15,104	1.28	5,205	13,283	18,488	1.21
1986	4,556	7,097	171	11,824	1.01	5,351	13,398	18,749	1.22
1987	4,493	6,905	2,235	13,633	1.16	5,222	14,121	19,343	1.26
1988	4,520	6,725	1,767	13,012	1.11	5,313	13,396	18,709	1.22
1989	4,399	6,649	3,528	14,576	1.24	5,313	13,380	18,693	1.22
1990	4,093	5,475	4,115	13,683	1.16	4,846	12,368	17,214	1.12
1991	4,329	6,815	7,466	18,610	1.58	5,289	13,117	18,406	1.20

Source: Transport Bulletin Road Transport (NTRC, 1992)

Figure 5.6.1 Traffic Accidents, 1982 - 1991



Fatal accident rate per million vehicles on roads can be compared with other countries, which are quoted from Transport Statistics 1993 (MOT Japan, 1994). The high figure of Pakistan means that a number of urgent actions should be taken in order to avoid loss of valuable lives of the people.

Pakistan	1991	fatal	226
Japan	1993	fatal	49
The USA	1993	fatal	42
Australia	1993	fatal	62

The fatal accidents per million vehicles in Pakistan for the past 10 years are presented below in Table 5.6.3. It has a tendency of decrease although they are still at high levels when compared with the above examples.

Table 5.6.3 Fatal and Vehicles, Pakistan 1982 - 1991

Year	Vehicles on roads, (million)	Fatal accidents	Fatal/Veh.
1982	0.944	4,502	477
1983	1.138	4,464	392
1984	1.288	5,064	393
1985	1.441	5,205	361
1986	1.548	5,351	346
1987	1.674	5,222	312
1988	1.839	5,313	267
1989	1.989	5,313	251
1990	2.116	4,846	229
1991	2.359	5,289	226

Source: Vehicles on Roads from NTRC
Fatal accidents from Transport Bulletin, (NTRC,1992)

5.6.2. Traffic Management and Administration

(1) Police force and traffic police

Traffic on roads is managed by the traffic division of police department of each province. The police department has sub-departmental offices covering the all provinces, and traffic police is always attached to those offices.

Education and training of traffic police force are conducted in the general police force training courses of police college and schools in each Province, where no special traffic management and law-enforcement course for traffic police are provided. Only Traffic Training Institute at Lahore is specialized for the training of traffic police constables mainly in Punjab Province, where the capacity of training is 100 persons per one cycle of 2 months, but seems not supplying proper training since funds, staff, equipment and facilities are modest and unsatisfactory.

In Punjab there are one police college in Sehala and 8 police training schools in Sehala, Lahore, Rawalpindi and others, where majority is selected from the province police but a few come from other provinces. For example, the college has 15 - 20 courses with different periods varying 1 - 12 months and produces about 3000 trained persons per year. It has large open spaces for exercise and training. But, there is no explicit facilities for traffic regulation and management such as signal system, vehicle mechanic system exhibition, and a test driving course.

In other provinces, each has its own college and schools. A traffic training institute is under construction in Karachi of Sind Province.

(2) Police Research Bureau, MOI

Police Research Bureau of MOI located in Islamabad is engaged in filing crime-related statistics, leaving researches on traffic accidents to NTRC for many years.

(3) Highway Safety & Public Relations, NHA

Highway Safety & Public Relations of NHA has made occasional campaign to promote accident reduction. For example, it announced action plans on Muslims 18/May, 1994 to reduce the social cost of accidents estimated at Rs. 2 billion in 1992 in the country. Sign boards, information plates, lane marking, signal posts on national highways are included in the contract of works and maintained by branches of NHA. It is felt those are not sufficient, and particularly less on provincial roads. Those safety facilities should be taken care to be placed and maintained by NHA and Provinces.

(4) NTRC of MOC

NTRC had conducted researches of traffic accidents in the 1980's, but the research activities are reduced in the 1990's because of less funds and less data from traffic police. It held a workshop in 1985 where an accident report was advised to be used by provincial police force. NTRC intended to use those data in the booklets from police for analyzing accident reasons. Practically, NTRC received data of 344 accidents gathered for 29 months in 1986-87 and the result of analysis was published on a paper Road Accident Analysis (NTRC-137, 1990). The followings are excerpts of the paper:

a. Vehicles.

Motor cycle	39	(7%)
Car & pickup	127	(24%)
Wagon & bus	206	(42%)
Truck & trailer	110	(30%)
Bicycles & others	49	(6%)
Total	530	vehicles in 344 accidents.

b. Fatal

Of the total 344 accidents, 268 accidents (78%) were fatal and 74 accidents (22%) were injuries.

c. Timing

Of the total 344 accidents, 279 (81%) were in the daylight.

d. Spots

Of the total 344 accidents, 219 (64%) were away from the junction. It might indicate that accidents at junctions were not likely to be fatal because of slower movements than in trunk road sections. There are many accidents occurring at the junction, but not reported to police.

e. Speed

Of the total 530 vehicles, 247 (47%) were exceeding the speed limit.

f. Reasons

Reasons of accidents could be summarized as under

Crude and bad manners of drivers	99 %
Careless movements of pedestrians	1 %
Mechanical failures	-
Bad road conditions	0.3 %

5.6.3. Policies for Accident Reduction

Increases in vehicles and traffic on roads are forecast to continue in the coming years. While there are a number of urgent policies to be implemented, the followings are considered better to be taken up as one of actions toward reduction of accidents.

(1) Training of traffic police

Training facilities should be equipped in each of the police training schools or in the institute specialized for traffic police force training, such as signals and their control methods, handy talk sets and its use to communicate among police men on duty at roadsides, and so on. Instructors should utilize those facilities in the management of traffic movement in the course of training traffic police staff. Enforcement of traffic rules and ticketing to the violation should be taught with the aid of those facilities together with applicable laws and regulations.

Practical training with a document form to record the accident should be conducted, which can be used for filing and analysis by NTRC.

If a specialized training institute for the training of traffic police force can be constructed with qualified instructors and facilities/equipment, it will better serve for intensive retraining of police force on roads in the country.

A feasibility study should be conducted to explore the scale and quality of the facilities necessary for training traffic police force, to determine teaching staff qualifications, and to estimate the cost at the initial stage and annual budget. The study should recommend whether each province should have the traffic police training course or one or two institutes in the country.

(2) Accident analysis

NTRC has experiences in studying accident data to find causes and submitted recommendations to reduce accidents in the 1980's. MOC should give funds to NTRC with which they can resume researches as well as data collection, analysis, reporting and recommendations. It is believed that NTRC can prepare by itself a plan of reshaping the accident analysis after reviewing present and past situations.

(3) Road Plan and Engineering

When road formations are observed, it can be easily found that there are many cases that roads neglected spaces for pedestrian path which should be safely marked and separated from vehicles. Some junctions are not constructed properly taking into account traffic flows at the junction. Signal posts are constructed often in wrong angle and height, not appropriate sites, and maintenance/repairing is neglected often. In planning and designing a road, the basic policy to take into account accident reduction and to separate flows of motorized and pedestrian traffic should be fully adopted by NHA and province C&Ws.

(4) Coordination

Coordination between the traffic police force, road planning and maintenance, and traffic control is necessary at various levels in the administration. The new posting of a highway safety directorate in MOC, MOI, or in other agencies within the government is worthy to be studied. In reality rather than having the directorate, eventual coordination among the agencies concerned should be done initiated by NHA or NTRC at least for safety problems. MOC should allocate funds for researches and projects under the coordinated requests.

5.6.4 Other Urgent Actions

Reduction of traffic accidents cannot be achieved only by the above recommendations. The high rate of accidents is caused by social behaviors of the people, moral of people and policemen, general background including education system, etc. An unanimous and continuous efforts by every part of agencies, drivers, and people are necessary.

(1) General education and campaign

General education and campaigns through schools, TV, news papers and magazines to make every effort to minimize traffic accidents. Subjects should not only be vehicle drivers, but also animal carts and pedestrians as well.

(2) Strict evaluation of driving manner

Strict evaluation of driving manner at the drive permit examination should be practiced. Re-education of those who have drive permit already are urgent since unbelievable crude driving manner can be seen on streets.

(3) Signal, information board, lane marking, separation fence, etc.

Roadside facilities, such as signals, information boards, and others should be installed. and cares should be taken to repair and maintain them.

(4) Enforcement of rules and regulations

Enforcement of traffic rules and regulations at the road side by traffic police force should be restructured by various efforts. It is known that restructuring the behavior of policemen is quite difficult and complicate, but continuous efforts by agencies concerned are in urgent necessity in the society where vehicle ownership is forecast to grow steadily in the future.

5.7. Vehicle Operation Cost

5.7.1. General

NTRC has conducted a number of researches in vehicle operation costs (VOC), fuel consumption rate, travel speeds, and variation of VOC caused by surface roughness for the past 25 years. In those studies NTRC had incorporated the methodologies and studies conducted in other countries, thus the analysis in Pakistan can be regarded as one example of VOC studies in the world.

A full description of a study in VOC can be seen in studies of road feasibility and transport sector planning; for examples in the previous JICA study on National Transport Plan in 1988, Improvement of Indus Highways (N-55) in 1991, Lahore Bypass Study in 1990, and so on. Meanwhile NTRC issued "Vehicle Operation Cost" in 1985 and in 1991. Quite recently in the Road Maintenance and Management System Project, a study "Vehicle Operation Costs Guidelines" was shown by Kampsax Int. C. / Indus Ass. Consultants in 1992. Among those studies, the VOC study by NTRC in 1985 was based on the research data in Pakistan and is considered reasonable to be utilized in this JICA transport study 1994 after updating and necessary revision. (The excerpt of the NTRC's study is presented in Section 5.7.4 afterward.) The results are kept in NTRC. The followings are the framework of the VOC updating from the NTRC study.

5.7.2. VOC

(1) Financial and Economic Costs

VOCs are estimated both in terms of financial cost and economic cost. Financial costs include taxes, customs duties, subsidies, and other transfer elements within the national economy. Those financial costs are much related to cost accounting in such a way as revenue/expenditure comparison and ticket price differentiation between express service and local service in relation to the cost and subsidy. In general, they are shown in market prices. On the other side the economic costs are much in analytical features and not recognizable in the prices of market, since taxes, customs duties, subsidies need to be excluded from the market prices. They are used in economic evaluation of projects. Both economic and financial cost factors of vehicles and tyres are tabulated for main components in Table 5.7.1.

(2) Representative Vehicle Types

a. Motor cycle
b. Cars (sedan, pickup, jeep)
c. Wagon (public service wagon and other similar sizes)
d. Mini-bus (coach and mini-bus)
e. Bus (regular sized bus)
f. Truck (2 axles)
g. Truck (mxl 3 axles)
h. Trailers (3-6 axles)

For each of those types, the cost table is presented, but in the project assessment they are

grouped in accordance with OD trip table classification.

(3) Speeds

Speeds are shown by 10 k/h interval between 20 k/h to 90 k/h. However, it can be calculated for every 1 km if necessary. Travel speed on a certain road section is related to traffic volumes on the road. If the volume is high, the speed is low and much travel time is consumed. On the contrary if the traffic volume is low on the same road, vehicles run at a higher speed and arrive at the end of the road with less hours to travel. The speed at a 10 k/h interval is used to see changes in VOC as in Table 5.7.6 and Table 5.7.7.

(4) Surface conditions

Surface condition differs among road sections. They directly influence the level of VOC even under the same travel speed. Rehabilitation of the surface conditions is targeted to reduce the VOC of traffic. Those conditions are shown by measured roughness or by representative values which are selected in each range of roughness values. For each classification of roughness which shows a level in surface conditions, VOC is estimated.

a. very good	r= 2500	m per 1000 km
b. good	r= 3000	"
c. fair	r= 3500	"
d. poor/gravel	r= 5000	"
e. poor/earth	r= 7000	"

(5) VOC components

VOC for running a distance of one km is used in the assessment of financial and economic savings. However , for the convenience of presentation, a length of 1000 km is used in the tables. It means the cost in the tables should be divided by 1000 to have VOCs for one km.

Sub-classification of VOC is shown bellow, which is also often used in other countries.

a. fuel
b. lubricant oil
c. tyres
d. repair parts
labor hours
e. depreciation
f. interest charge
g. crew wages
h. passenger time

Tables 5.7.2 to 5.7.5 in the next section present input prices, financial and economic components of VOCs. Tables 5.7.6 and 5.7.7 shows the estimated VOC at 10 km interval.

Table 5.7.1 Price Composition, 1993

sno	component	mcy	car	pickup	wagon	minibus	bus	truck	3axle	tractor
VEHICLES 1)										
1	cost insurance	1	1	1	1	1	1	1	1	1
2	fix freight (1*.077)	0.0770	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
3	imp lic fee (1*2.5%)	0.0250	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
4	imp duty %	0.9693	0.9693	0.3231	0.3231	0.3231	0.3231	0.3231	0.3231	0.3231
5	s/charge (1+2)*5%	0.0539	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054
6	iqra (1+2)*5%	0.0539	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054
7	flood relief 1%	0.0108	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
8	octroi 1.5 %	0.0162	0.0162	0.0162	0.0162	0.0162	0.0162	0.0162	0.0162	0.0162
9	total	2.2059	2.2059	1.5597	1.5597	1.5597	1.5597	1.5597	1.5597	1.5597
10	markup 12.5 %	0.2757	0.2757	0.1950	0.1950	0.1950	0.1950	0.1950	0.1950	0.1950
11	Total	2.4817	2.4817	1.7547	1.7547	1.7547	1.7547	1.7547	1.7547	1.7547
12	sales tax 15%	0.3722	0.3722	0.2632	0.2632	0.2632	0.2632	0.2632	0.2632	0.2632
13	total cost	2.8539	2.8539	2.0179	2.0179	2.0179	2.0179	2.0179	2.0179	2.0179
14	income tax 2.5 %	0.0713	0.0713	0.0504	0.0504	0.0504	0.0504	0.0504	0.0504	0.0504
15	sale price	2.9253	2.9253	2.0683	2.0683	2.0683	2.0683	2.0683	2.0683	2.0683
15	tax comp.	1.5475	1.5475	0.7714	0.7714	0.7714	0.7714	0.7714	0.7714	0.7714
16	tax comp. %	52.90	52.90	37.29	37.29	37.29	37.29	37.29	37.29	37.29
17	market price	40,000	176,000	495,000	466,908	609,000	620,000	576,909	871,829	857,083
18	economic cost	18,839	82,892	310,393	292,777	381,877	388,775	361,754	546,685	537,439
19	cost of body	0	0	0	0	0	200,000	70,000	90,000	200,000
20	excise duty 5 %	0	0	0	0	0	10,000	3,500	4,500	10,000
21	sales tax 15 %	0	0	0	0	0	30,000	10,500	13,500	30,000
22	Financial Cost	40,150	176,000	495,000	466,908	609,000	860,000	660,909	979,829	1,097,083
23	Economic Cost	18,839	82,892	310,393	292,777	381,877	588,775	431,754	636,685	737,439
		yamaha 100cc	suzuki car/pup	mazda	toyota hiace	mazda	avg bdf & hino	isuzu kmpsx	hino kmpsx	hino kmpsx
TYRES										
1	size		5.65x12	600x14	600x14	600x14	8.25x20	8.25x20	9.00x20	10.00x20
2	fob/cif	1	1	1	1	1	1	1	1	1
3	import duty	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
4	sales tax 15 %	0.255	0.255	0.255	0.255	0.255	0.255	0.255	0.255	0.255
5	landed cost	1.955	1.955	1.955	1.955	1.955	1.955	1.955	1.955	1.955
6	markup 12.5 %	0.244	0.244	0.244	0.244	0.244	0.244	0.244	0.244	0.244
7	sale price	2.199	2.199	2.199	2.199	2.199	2.199	2.199	2.199	2.199
8	tax component	0.955	0.955	0.955	0.955	0.955	0.955	0.955	0.955	0.955
9	tax comp. %	43.42	43.42	43.42	43.42	43.42	43.42	43.42	43.42	43.42
10	market price	285	925	1,730	1,935	2,280	5,375	5,730	5,730	7,040
11	economic cost	161	523	979	1,095	1,290	3,041	3,242	3,242	3,983
12	No of tyres	2	4	4	4	6	6	6	10	14
13	cost - financial	570	3,700	6,920	7,740	13,680	32,250	34,380	57,300	98,560
14	cost - economic	322	2,093	3,915	4,379	7,740	18,247	19,452	32,420	55,764
cost of vehicles excl. tyre										
	financial	39,580	172,300	488,080	459,168	595,320	827,750	626,529	922,529	998,523
	economic	18,517	80,799	306,477	288,398	374,137	570,528	412,302	604,266	681,675

Source: 1) Customs and Duty Table (Customs Office, 1993)
2) Monthly Statistical Bulletin, Dec. 1993.
3) Ministry of Petroleum and Natural Resources, SRO 1071(I)/93 Dt:3-11-93.

5.7.3 Summary of VOCs

(1) Input prices for 1993

Table 5.7. 2 Vehicle Prices, 1993

(in Rs)

Vehicle	Financial		Economic	
typ	vehicle	tyres	vehicle	tyres
mcy	39,430	285	18,517	161
car	474,480	1,130	223,042	639
pup	488,080	1,730	306,477	979
wgn	445,408	1,935	288,398	1,095
mbs	576,750	2,280	374,137	1,290
bus	827,750	5,375	570,528	3,041
trk	626,529	5,730	412,302	3,242
mxl	922,529	5,730	604,266	3,242
trl	998,523	7,040	681,675	3,983

Source: JICA study team, 1994

Table 5.7.3 Fuel and Oil Prices, 1993

	Financial	Economic
petrol	14.27	6.74
diesel	6.12	4.95
oil	40.00	30.00

Source: JICA study team, 1994. Also Table A.

FUEL (Rs./Ltr)	Petrol	Diesel
CIF 2)	6.27	4.53
Distribution cost 3)	0.38	0.37
Dealers Commission	0.09	0.05
Econ. Cost	6.74	4.95
Retail Price	14.27	6.12
Tax element	7.53	1.17
% of price	52.77	19.12

Table 5.7.4 Life and Utilization

Vehicle	Average speed (k/h)	Avg yr utlzn	Life yrs	Lifetime utlzn (1000km)
mcy	40	12.0	10	120
car	50	16.0	12	192
pup	45	30.0	10	300
wgn	45	50.0	10	500
mbs	45	55.0	10	550
bus	50	60.0	10	600
trk	40	70.0	10	700
mxl	40	70.0	12	840
trl	40	70.0	12	840
oth	40	70.0	10	700

Source: JICA study team, 1994 referring to NTRC report 1985.

Table 5.7.5 Time Cost of Passengers and Crew in 1993

A. Passenger time cost in 1993			
	Cost/veh	Cost /person	
Car	Rs 20.-	Rs 20.-	1) 20 % for work valued at 1.00 80 % for non-work valued at 1/3. 2) 8 hrs/day & 25 days/mo 3) monthly income for main driver is 45*(0.2+0.8*1/3) = Rs 21.02 =Rs20.0 4) no cost for other occupants
M/C	Rs 10.-	Rs 10.-	1) Assumed a half of tha car Rs20*1/2=Rs 10.-
Wagon	Rs 24.-	Rs 3.-	1) 20 % for work valued at 1.00 80 % for non-work valued at 1/3. 2) 8 hrs/day & 25 days/mo 3) GDP per capita at Rs 10300. 10300/12/25/8= 42.92/hr 42.92*(0.2* 0.8/2)= 2.58= 3.00 valued occupants 8, Rs3.*8=24
Bus	Rs 105.-	Rs 3.-	1) 20 % for work valued at 1.00 80 % for non-work valued at 1/3. 2) 8 hrs/day & 25 days/mo 3) GDP per capita at Rs 10300. 10300/12/25/8= 42.92/hr 42.92*(0.2* 0.8/2)= 2.58= 3.00 valued occupants 35, Rs3.*35=105

B. Crew wages on commercial vehicles in 1993		
	Cost/veh	Cost/person
Wagon	6700/mo	driver Rs 4000 per month conductor Rs 2700 per month
	(Rs 33.5/hr pe veh)	
MBS	same as wagon	
Bus	8000/mo	driver Rs 4800 per month conductor Rs 3200 per month
	(Rs 40.2/hr per veh)	
Truk	8000/mo	two drivers 4000*2=Rs8000.-
	(Rs40.2/hr per veh)	
MXL	10000/mo	a 25% larger than truck
	(Rs 50.-/hr/veh)	
Trailer	12000/mo	a 20% larger than mxl
	(Rs60.0/hr per veh)	

Source: JICA study team, 1994

Figure 5.7.1 VOC and Speed (Economic Cost)

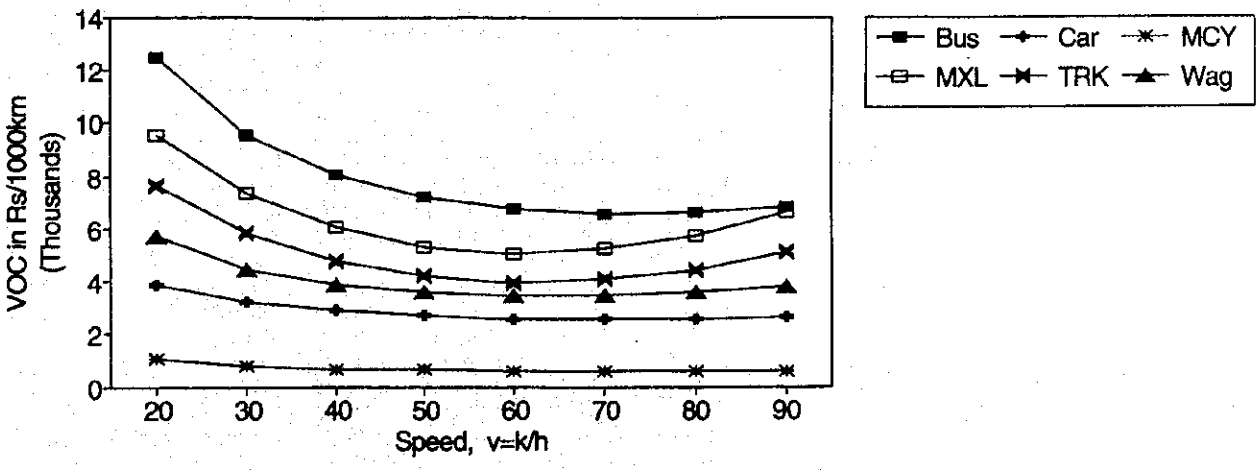


Table 5.7.6 Financial VOC

Financial Rs/1000km (prices in 1993)

spd kmh	veh typ	vgood r-2500	good r-3000	fair r-3500	poor ggrvl r-5000	vpoor g/rth r-7000
FINANCIAL COSTS						
20	MCY	1529.55	1537.08	1545.25	1631.99	1724.10
	CAR	7402.25	7455.77	8011.80	8396.09	8831.10
	WGN	6577.94	6717.50	6861.21	7468.06	8191.90
	BUS	13954.67	14270.72	14578.15	16025.32	17757.27
	TRK	9242.28	9339.69	9437.67	10825.00	12291.83
	MXL	11665.73	11809.94	11952.08	13696.04	15562.87
	TRL	13889.34	14057.02	14218.07	16352.05	18627.82
30	MCY	1244.99	1253.32	1262.37	1346.03	1435.94
	CAR	6395.53	6452.24	6845.09	7216.98	7643.07
	WGN	5270.13	5415.24	5563.72	6161.36	6881.22
	BUS	10869.70	11187.68	11496.40	12887.53	14564.73
	TRK	7207.58	7307.05	7406.40	8488.97	9652.41
	MXL	9154.70	9302.42	9446.90	10827.71	12333.73
	TRL	10882.02	11055.52	11220.45	12904.12	14733.45
40	MCY	1090.90	1100.15	1110.20	1195.56	1288.18
	CAR	5745.10	5805.47	6118.97	6495.92	6931.05
	WGN	4619.12	4771.68	4926.57	5527.98	6258.61
	BUS	9274.04	9595.76	9906.98	11278.32	12938.24
	TRK	5960.42	6063.88	6165.89	7039.97	7997.57
	MXL	7639.18	7793.68	7942.68	9078.29	10343.63
	TRL	9101.42	9286.19	9458.64	10842.79	12380.12
50	MCY	1007.99	1018.28	1029.47	1121.30	1221.52
	CAR	5331.74	5396.23	5664.23	6063.69	6525.83
	WGN	4295.30	4457.21	4620.13	5238.29	5994.45
	BUS	8385.61	8712.88	9027.79	10415.61	12095.69
	TRK	5252.97	5362.35	5468.30	6230.16	7079.49
	MXL	6804.02	6968.58	7124.28	8132.63	9277.41
	TRL	8174.08	8375.58	8559.17	9794.61	11194.37
60	MCY	974.68	986.13	998.58	1101.66	1214.39
	CAR	5100.65	5169.72	5409.38	5848.83	6355.95
	WGN	4183.48	4356.65	4529.25	5177.13	5973.58
	BUS	7935.75	8270.38	8590.20	10030.74	11768.45
	TRK	4997.15	5114.37	5225.56	5971.48	6810.10
	MXL	6536.44	6714.33	6878.93	7877.95	9022.30
	TRL	7967.18	8190.83	8389.20	9626.73	11043.35
70	MCY	980.94	993.66	1007.49	1126.60	1256.75
	CAR	5021.69	5095.80	5317.16	5814.05	6384.12
	WGN	4232.01	4418.32	4602.23	5292.80	6144.32
	BUS	7805.80	8149.59	8475.52	10005.04	11837.84
	TRK	5152.88	5279.87	5397.56	6223.82	7149.30
	MXL	6784.85	6979.34	7155.01	8262.65	9526.69
	TRL	8420.21	8671.48	8888.25	10278.67	11866.58
80	MCY	1021.36	1035.46	1050.81	1190.73	1343.19
	CAR	5076.50	5156.12	5365.62	5937.42	6588.41
	WGN	4413.87	4615.24	4812.10	5558.33	6479.66
	BUS	7934.62	8289.39	8622.63	10277.39	12242.74
	TRK	5698.94	5837.62	5963.12	6965.99	8075.88
	MXL	7521.84	7736.22	7925.14	9259.34	10763.20
	TRL	9501.24	9785.55	10024.36	11718.47	13632.11
90	MCY	1092.72	1108.34	1125.33	1290.82	1470.51
	CAR	5253.06	5338.65	5540.77	6204.95	6954.81
	WGN	4713.45	4931.77	5143.20	5958.09	6964.00
	BUS	8287.28	8654.82	8996.59	10812.84	12948.20
	TRK	6622.93	6775.24	6909.82	8185.58	9577.45
	MXL	8731.34	8968.88	9173.24	10851.95	12715.74
	TRL	11191.56	11514.38	11778.85	13927.45	16321.26

Table 5.7.7 Economic VOC

Economic Rs/1000km (prices in 1993)

spd kmh	veh typ	vgood r-2500	good r-3000	fair r-3500	poor ggrvl r-5000	vpoor g/rth r-7000
ECONOMIC COSTS						
20	MCY	1019.80	1024.76	1030.24	1077.76	1127.96
	CAR	3805.47	3833.63	4363.44	4558.09	4777.23
	WGN	5603.23	5700.61	5802.30	6255.55	6783.15
	BUS	12274.98	12494.41	12706.86	13769.16	15023.82
	TRK	7542.58	7607.14	7674.03	8755.77	9885.91
	MXL	9422.38	9516.66	9611.86	10958.27	12380.62
	TRL	11325.58	11437.56	11547.89	13207.76	14958.69
30	MCY	796.85	802.26	808.24	854.53	904.00
	CAR	3242.01	3271.98	3637.09	3826.80	4042.97
	WGN	4386.02	4486.54	4590.93	5032.96	5552.29
	BUS	9345.48	9566.00	9779.19	10794.98	12003.86
	TRK	5790.42	5856.15	5923.82	6757.80	7640.96
	MXL	7261.13	7357.39	7453.92	8504.48	9632.30
	TRL	8712.79	8828.07	8940.59	10232.70	11618.05
40	MCY	679.62	685.56	692.11	739.46	790.57
	CAR	2891.27	2923.32	3207.35	3400.50	3622.37
	WGN	3782.75	3887.49	3995.51	4435.52	4956.79
	BUS	7838.47	8061.10	8275.70	9273.22	10465.24
	TRK	4725.95	4793.93	4863.11	5526.03	6239.64
	MXL	5962.78	6062.88	6161.96	7010.08	7938.01
	TRL	7160.22	7281.88	7398.65	8441.65	9582.16
50	MCY	613.78	620.30	627.49	678.20	733.30
	CAR	2670.73	2705.11	2941.68	3146.66	3382.89
	WGN	3472.76	3582.79	3695.36	4142.55	4675.98
	BUS	6983.04	7208.81	7425.50	8432.97	9637.03
	TRK	4110.85	4182.18	4253.59	4822.15	5443.64
	MXL	5226.04	5331.83	5434.70	6173.78	6996.45
	TRL	6308.22	6439.33	6562.41	7474.97	8491.34
60	MCY	580.32	587.50	595.40	651.75	713.21
	CAR	2545.79	2582.76	2788.83	3014.00	3273.26
	WGN	3345.72	3462.11	3580.16	4043.74	4599.54
	BUS	6516.74	6746.68	6966.14	8011.79	9256.79
	TRK	3862.09	3937.86	4012.22	4563.13	5169.92
	MXL	4945.41	5058.74	5166.64	5890.08	6702.14
	TRL	6031.17	6174.83	6306.27	7207.05	8220.00
70	MCY	570.77	578.66	587.35	651.63	721.81
	CAR	2498.50	2538.31	2723.69	2977.45	3268.41
	WGN	3352.84	3476.68	3601.12	4090.29	4678.67
	BUS	6324.66	6559.78	6782.70	7894.74	9209.61
	TRK	3942.54	4023.83	4101.88	4711.83	5381.35
	MXL	5073.53	5196.26	5310.43	6111.63	7007.72
	TRL	6272.85	6432.12	6573.97	7581.64	8711.89
80	MCY	580.68	589.35	598.89	673.40	754.66
	CAR	2518.33	2561.26	2732.17	3022.89	3354.21
	WGN	3469.00	3601.35	3733.12	4257.08	4888.25
	BUS	6348.10	6589.43	6816.48	8023.16	9436.79
	TRK	4332.86	4420.78	4503.23	5248.93	6058.61
	MXL	5585.70	5719.68	5841.34	6813.70	7888.46
	TRL	7003.94	7181.91	7336.23	8569.45	9937.71
90	MCY	607.49	617.01	627.48	714.51	809.20
	CAR	2598.58	2644.88	2805.58	3141.66	3522.01
	WGN	3679.80	3821.75	3961.77	4529.72	5213.90
	BUS	6553.78	6802.34	7034.22	8363.74	9905.05
	TRK	5021.92	5117.54	5205.14	6163.28	7190.54
	MXL	6467.60	6614.69	6745.09	7982.02	9330.08
	TRL	8207.54	8407.30	8576.14	10153.57	11880.56

5.7.4. Excerpts of VOC Study in 1985

Description in the following paragraphs are excerpts from the "Vehicle Operation Costs (NTRC, 1985)." As stated in the above Section 2, all figures are revised and reedited to be appropriate for this Master Plan Study of 1994; the motor cycle is added, VOC are calculated in curves along speed and cost by using Lotus Macro, and prices are updated.

(1) Fuel and oil

The consumption rate of fuel and oil under different speeds on a level tangent paved road was tested by NTRC in 1981 and incorporated in VOCs. The basic rates could be adjusted to different conditions of roughness, rise and fall, curvature, and so on by applying the study results of MOC in 1977 which was used by the Third Highway Projects by World Bank.

(2) Tyre wear

Tyre wear was shown by percentages of the tyre life, where percent figures were quoted from other studies including MOC 1977. The wear percents had a tendency to increase with speed, roughness and curvature.

(3) Maintenance

Maintenance cost was composed of labor hours for repair/maintenance works and of spare parts to be replaced in, where parts were shown in percent of the new vehicle value. They were related to roughness of the road regardless to speed. The hours were used for wage cost of labors.

(4) Depreciation

Depreciation depended on time and usage in terms of speed and distance. Referring to the MOC study 1977, a table was developed as in the Table 5.7.8. The depreciation percent was determined without tyre cost by a combination of annual km, life time km, and life years.

Table 5.7.8 Usage and Life of Vehicle According to Speed

Vehicle	Item	Unit	Speed v=k/h						
			30	40	50	60	70	80	90
Car	Ann km	000 km	8.6	10.3	11.8	13.3	14.8	16.2	17.5
	Life km	000 km	130.0	141.0	151.0	160.0	169.0	177.0	184.0
	Life yrs	years	15.1	13.7	12.8	12.0	11.4	10.9	10.5
Wagon	Ann km	000 km	32.2	38.3	44.5	50.0	55.0	60.2	65.2
	Life km	000 km	324.0	353.0	378.0	400.0	422.0	442.0	460.0
	Life yrs	years	10.1	9.2	8.5	8.0	7.7	7.3	7.1
Bus	Ann km	000 km	40.3	48.3	55.6	62.5	68.8	75.2	81.4
	Life km	000 km	354.0	386.0	413.0	438.0	462.0	483.0	503.0
	Life yrs	years	8.8	8.0	7.4	7.0	6.7	6.4	6.2
Truck	Ann km	000 km	25.8	30.9	35.6	40.0	44.4	48.6	52.6
	Life km	000 km	324.0	353.0	378.0	400.0	422.0	442.0	460.0
	Life yrs	years	12.6	11.4	10.6	10.0	9.5	9.1	8.7

Source: Table 17, Vehicle Operation Costs (NTRC, 1985)

5) Interest charge

Dividing the life years by 2 at which the depreciable vehicle value is supposed a half of the purchased price and applying the annual rate of 12 %, annual interest cost was calculated, and percent per 1000 km by speed was tabulated since the annual travel distance differed among the travel speed.

(6) Wages

Wages of vehicle crew and of labors for maintenance were determined by their mean monthly earnings including travel allowance.

	Earning in 1985
Wagon driver	Rs. 1400 per month
conductor	Rs. 1200
Bus driver	Rs. 2000
conductor	Rs. 1500
Truck driver	Rs. 2000
assistant	Rs. 1500

Labor person Rs. 10 per hour (Rs. 2000/MO)

(7) Passenger time

Although comfort, safety, and other factors in traveling were difficult to quantify, hour of travel could be converted into money terms. This was because of the fact that a person or a vehicle may choose to travel high speed bus/train or toll expressway by paying extra fee in order to save travel time. High income families would be willing to pay for those fees, while lower income people would be tolerate to travel at longer hours with cheaper mode. The followings were the value of time used in 1985.

Table 5.7.9 Hourly Costs for Different Vehicle Types

Vehicle	Item	Earning pm or py	Percent of hours work	non-work	Cost Rs/hr	Remarks
Car	main Occ	3000/pm	20	80	7	
	others	1500/pm	20	80	7	two prs
total in Rs/hr					14	
Wagon	Pass	4530/py	20	80	0.88	GDP/pr
total Rs	8				7.05	
Bus	Pass	4530/py	20	80	0.88	GDP/pr
total Rs	30				26.44	

Source: Table 20, Vehicle Operation Costs (NTRC, 1985)

Remark: GDP per capita at Rs 4530/yr in 1985
GDP per capita/day 4530/12/25=Rs15.1/day
Rs 15.1*(0.2+0.8/3)/8hr= 0.881
wag. 0.881*8=Rs 7.05
bus 0.881*30= Rs 26.44