APPENDICES for CHAPTER 3

Appendix Table 3.1.1.1 List of Districts / Agencies by Zone

Zone	Districts/Agencies Included (with 1981 Census Code)
1. Mardan	131. Mardan
2. Peshawar	132. Peshawar, 211. Bajour Ag., 212. Mohammad Ag., 213. Khyber Ag., 218. T.A. ad. Peshawar
3. Kohat	133. Kohat/Karak, 214. Khurram Ag., 215. Orakzai Ag., 219. T.A. ad. Kohat
4. Abbottabad	121. Kohistan, 122. Mansehra, 123. Abbottabad
5. D.I. Khan	142. D.I. Khan, 217. South Waziristan Ag., 221. T.A. ad. D.I. Khan
6. Bannu	141. Bannu, 216. North Waziristan Ag., 220. T.A. ad. Bannu
7. Dir	111. Chitral, 112. Dir
8. Swat	113. Swat, 114. Malakand
9. Attock	311. Attock
10. Rawalpindi	312. Rawalpindi, 611. Islamabad
11. Jhelum	313. Jhelum
12. Gujrat	314. Gujrat
13. Sargodha	322. Sargodha/Khushab
14. Mianwali	321. Mianwali/Bhakkar
15. Faisalabad	323. Faisalabad/T.T. Singh
16. Jhang	324. Jhang
17. Lahore	334. Lahore, 335. Kasur
18. Sheikhupura	333. Sheikhupura
19. Gujranwala	332. Gujranwala
20. Sialkot	331. Sialkot
21. D.G. Khan	341. D.G. Khan/Rajampur
22. Muzaffargarh	342. Muzaffargarh/Leiah
23. Multan	343. Multan, 344. Vehari
24. Sahiwal	345. Sahiwal/Okara
25. Bahawalpur	351. Bahawalpur
26. Bahawalnagar	352. Bahawalnagar
27. Rahim Yar Khan	353. Rahim Yar Khan
28. Shikarpur	411. Jacobabad, 413. Shikarpur
29. Sukkur (Rohri)	412. Sukkur
30. Larkana	414. Larkana
31. Nawabshah	415. Nawabshah
32. Khairpur	416. Khairpur
33. Hyderabad	422. Hyderabad
34. Dadu	421. Dadu
35. Tharparkar	425. Tharparkar
36. Sanghar	424. Sanghar
37. Thatta	426. Thatta
38. Badin	423. Badin
39. Karachi	431. Karachi
40. Quetta	511. Quetta, 512. Pishin
41. Loralai	513. Loralai, 514. Zhob
42. Chagai	515. Chagai
43. Kalat	531. Kalat, 533. Kharan
44. Lasbela	534. Lasbela
45. Sibi	521. Sibi, 522. Nasirabad, 523. Kachhi, 524. Kohlu/Dera Bugti, 532. Khuzdar
46. Gwadar	541. Turbat, 542. Gwadar, 543. Panjgur

Appendix Table 3.1.2.1 Projected Population by Zone (000)

Zone	1980/81(Census)	1992/93	1997/98	2005/06
1.Mardan	1,507	2,053	2,316	2,702
2.Peshawar	3,229	4,087	4,578	5,389
3.Kohat	1,248	1,435	1,578	1,822
4.Abbottabad	2,701	3,873	4,486	5,456
5.D.I.Khan	981	1,249	1,399	1,652
6.Bannu	1,127	1,493	1,672	1,965
7.Dir	976	1,547	1,830	2,348
8.Swat	1,491	2,282	2,658	3,323
NWFP Total	13,260	18,019	20,517	24,657
9.Attock	1,144	1,415	1,548	1,746
10.Rawalpindi	2,461	3,360	3,861	4,798
11.Jhelum	1,167	1,350	1,434	1,546
12.Gujrat	2,255	2,866	3,168	3,640
13.Sargodha	2,553	3,340	3,732	4,353
14.Mianwali	1,378	1,888	2,152	2,593
15.Faisalabad	4,689	5,372	5,676	6,053
16.Jhang	1,978	2,741	3,139	3,806
17.Lahore	5,073	7,621	8,988	11,547
18.Sheikhupura	2,110	2,936	3,350	4,081
19.Gujranwala	2,676	3,832	4,426	5,497
20.Sialkot	2,712	3,299	3,557	3,957
21.D.G.Khan	1,583	2,484	2,990	3,852
22.Muzaffargarh	2,164	3,387	4,072	5,240
23.Multan	5,409	7,762	8,995	10,918
24.Sahiwal	3,612	5,445	6,442	8,082
25.Bahawalpur	1,454	2,219	2,639	3,442
26.Bahawalnagar	1,374	1,932	2,219	2,738
27.Rahim Yar Khan	1,841	2,695	3,149	3,991
Punjab Total	47,633	65,944	75,537	91,880
28.Shikarpur	1,632	2,369	2,751	3,398
29.Sukkur(Rohri)	1,098	1,580	1,814	2,186
30.Larkana	1,139	1,511	1,675	1,910
31.Nawabshah	1,647	2,136	2,349	2,638
32.Khairpur	981	1,477	1,730	2,149
33.Hyderabad	2,054	2,729	3,029	3,450
34.Dadu	1,077	1,587	1,840	2,247
35.Tharparkar	1,502	2,548	3,136	4,213
36.Sanghar	923	1,353	1,564	1,902
37.Thatta	761	883	925	961
38.Badin	777	1,077	1,215	1,423
39.Karachi	5,438	9,243	11,349	15,267
Sind Total	19,029	28,493	33,377	41,744
40.Quetta	760	1,288	1,498	1,840
41.Loralai	750	1,592	2,038	2,917
42.Chagai	120	233	287	388
43.Kalat	469	1,041	1,350	1,900
44.Lasbela	188	324	377	445
45.Sibi	1,392	2,424	2,837	3,493
46.Gwadar	653	1,597	2,157	3,221
Baluchistan Total	4,332	8,499	10,544	14,204
TOTAL	84,254	120,955	139,975	172,485

Appendix 3.1.2.2 (1) Projected Working Population by Zone - 1981 (Census) (000)

Zone Name	Agricul-ture	Mining/Quarrying	Manufac-turing	Electri-city/Gas	Construc tion	Wholesal e/Retail	Transpor t/Comm.	Banking/ Insure.	Pub. Ad. /Service	TOTAL
1.Mardan	277	2	15	7	18	27	15	2	36	399
2.Peshawar	467	1	35	7	34	84	37	7	155	826
3.Kohat	177	2	9	1	17	20	12	2	43	283
4.Abbottabad	514	0	16	6	22	40	29	3	87	716
5.D.I.Khan	178	0	4	1	9	20	7	1	46	267
6.Bannu	199	0	5	2	7	23	7	1	36	280
7.Dir	201	1	4	1	8	12	5	1	18	251
8.Swat	288	2	8	2	10	22	10	2	37	382
NWFP Total	2,302	7	97	27	127	247	123	17	457	3,404
9.Attock	158	1	18	3	20	25	15	1	39	279
10.Rawalpindi	160	3	52	6	38	67	35	9	181	551
11.Jhelum	118	12	24	1	20	24	10	3	45	258
12.Gujrat	277	1	79	4	30	50	25	4	88	557
13.Sargodha	363	12	60	4	30	76	30	5	114	694
14.Mianwali	235	3	26	2	16	25	15	2	46	368
15.Faisalabad	542	1	260	10	60	151	50	8	194	1,276
16.Jhang	383	1	41	3	21	41	20	2	76	588
17.Lahore	327	2	214	19	92	218	101	21	299	1,293
18.Sheikhupura	291	1	112	2	30	55	26	3	93	618
19.Gujranwala	288	1	148	3	33	87	36	6	109	710
20.Sialkot	302	1	151	4	37	74	31	5	98	703
21.D.G.Khan	309	1	19	1	13	32	12	2	47	435
22.Muzaffargarh	412	1	38	1	28	42	15	2	66	605
23.Multan	846	1	142	6	63	152	66	12	185	1,475
24.Sahiwal	673	1	88	4	35	97	35	9	139	1,081
25.Bahawalpur	245	0	27	2	20	35	15	2	64	410
26.Bahawalnagar	289	0	28	1	12	34	10	1	47	421
27.Rahim Yar Khan	344	1	34	2	17	34	14	2	65	513
Punjab Total	6,563	42	1,562	79	613	1,318	560	99	1,996	12,834
28.Shikarpur	374	0	8	1	13	24	10	2	33	464
29.Sukkur(Rohri)	180	0	19	1	22	29	20	1	36	309
30.Larkana	235	0	6	1	10	24	9	1	30	315
31.Nawabshah	328	0	9	3	12	23	9	2	40	425
32.Khairpur	197	0	6	2	7	21	4	2	23	262
33.Hyderabad	274	2	51	6	33	70	20	5	76	537
34.Dadu	233	9	19	1	7	20	8	1	30	328
35.Tharparkar	332	0	13	1	6	27	8	1	36	424
36.Sanghar	214	0	10	1	5	16	5	1	18	269
37.Thatta	182	0	5	1	6	14	3	0	16	229
38.Badin	192	0	7	0	2	7	3	0	20	232
39.Karachi	73	5	300	14	74	298	157	44	334	1,299
Sind Total	2,814	17	453	33	196	573	255	61	691	5,093
40.Quetta	47	4	7	2	6	44	13	1	31	155
41.Loralai	175	7	1	0	5	11	4	0	10	213
42.Chagai	15	3	0	0	4	2	2	0	2	28
43.Kalat	113	5	0	0	2	3	2	0	6	131
44.Lasbela	54	1	1	0	1	2	1	0	2	62
45.Sibi	339	7	5	1	8	11	5	0	16	392
46.Gwadar	131	0	3	0	18	7	11	0	6	177
Baluchistan Total	874	26	17	4	43	79	39	2	75	1,158
TOTAL	12,552	92	2,129	142	979	2,216	977	179	3,219	22,489

Appendix 3.1.2.2 (2) Projected Working Population by Zone - 1992/93 (Census) (000)

Projected Working Population by Zone - 1992/93
(000)

Zone Name	Agricul-ture	Mining/Quarrying	Manufac-turing	Electri-city/Gas	Construc tion	Wholesal e/Retail	Transpor t/Comm.	Banking/ Insure.	Pub. Ad. /Service	TOTAL
1.Mardan	378	3	21	9	25	36	21	3	48	544
2.Peshawar	548	1	48	9	47	116	52	9	215	1,045
3.Kohat	178	2	12	2	23	25	15	2	55	314
4.Abbottabad	861	0	18	7	25	46	33	4	101	1,096
5.D.I.Khan	221	0	6	2	13	27	9	1	64	343
6.Bannu	263	0	7	2	9	30	9	1	48	370
7.Dir	316	1	7	1	13	19	8	1	29	396
8.Swat	441	2	13	3	16	34	16	2	57	584
NWFP Total	3,206	10	131	35	171	335	163	24	618	4,693
9.Attock	195	1	22	3	24	30	19	2	48	345
10.Rawalpindi	216	3	72	8	51	90	49	14	251	755
11.Jhelum	137	14	28	1	23	27	12	4	53	298
12.Gujrat	353	1	100	6	38	63	32	5	112	708
13.Sargodha	475	15	79	5	39	100	39	6	149	908
14.Mianwali	321	4	36	3	22	34	20	3	62	504
15.Faisalabad	621	1	298	12	69	172	57	9	222	1,462
16.Jhang	531	1	56	4	29	57	28	3	106	815
17.Lahore	476	3	322	29	139	331	154	32	453	1,940
18.Sheikhupura	406	2	156	3	41	76	36	4	130	854
19.Gujranwala	412	1	213	4	48	124	52	8	156	1,017
20.Sialkot	368	1	184	5	44	91	38	6	119	855
21.D.G.Khan	485	1	29	2	20	50	18	3	74	683
22.Muzaffargarh	644	1	60	2	44	65	23	4	103	946
23.Multan	1,214	2	204	8	91	219	94	17	266	2,116
24.Sahiwal	1,015	2	132	7	52	147	52	13	210	1,629
25.Bahawalpur	373	1	42	3	31	53	23	3	97	625
26.Bahawalnagar	406	1	39	2	17	47	14	1	66	592
27.Rahim Yar Khan	503	1	50	2	25	50	21	3	95	751
Punjab Total	9,151	55	2,123	109	848	1,828	780	139	2,773	17,806
28.Shikarpur	547	0	11	1	18	34	13	2	47	674
29.Sukkur(Rohri)	259	0	28	2	32	41	29	2	51	445
30.Larkana	311	0	8	2	13	31	12	1	40	418
31.Nawabshah	426	0	11	4	15	29	11	2	52	551
32.Khairpur	297	0	9	2	10	32	6	2	34	394
33.Hyderabad	363	3	68	9	44	94	26	7	101	714
34.Dadu	343	13	28	2	10	30	12	2	44	484
35.Tharparkar	563	0	22	1	10	45	14	2	60	719
36.Sanghar	314	0	14	1	7	24	7	1	26	394
37.Thatta	212	0	6	1	7	17	3	1	19	266
38.Badin	266	0	10	0	3	10	4	1	27	321
39.Karachi	124	9	510	24	126	506	267	75	568	2,208
Sind Total	4,026	25	725	50	296	892	405	99	1,070	7,588
40.Quetta	79	7	11	3	10	74	23	2	53	263
41.Loralai	371	15	3	1	10	23	8	0	21	451
42.Chagai	28	5	0	0	7	3	5	0	5	54
43.Kalat	250	11	1	0	3	7	4	0	14	292
44.Lasbela	93	1	2	0	2	3	2	0	4	106
45.Sibi	591	10	8	1	14	18	8	1	28	678
46.Gwadar	321	0	6	0	45	15	27	1	14	430
Baluchistan Total	1,733	50	31	6	92	144	77	4	138	2,273
TOTAL	18,116	140	3,009	201	1,407	3,198	1,426	265	4,598	32,360

Appendix 3.1.2.2 (3) Projected Working Population by Zone - 1997/98 (Census) (000)

Zone Name	Agricul- ture	Mining/Q uarrying	Manufac- turing	Electri- city/Gas	Construc tion	Wholesal e/Retail	Transpor t/Comm.	Banking/ Insure.	Pub. Ad. /Service	TOTAL
1.Mardan	426	3	23	10	28	41	23	3	55	614
2.Peshawar	600	1	55	11	53	133	59	10	247	1,171
3.Kohat	188	2	13	2	27	28	17	3	62	342
4.Abbottabad	1,075	0	18	7	25	47	33	4	103	1,313
5.D.I.Khan	245	0	6	2	15	31	11	1	74	386
6.Bannu	294	0	8	3	10	34	10	1	54	415
7.Dir	373	2	9	1	16	22	10	1	34	468
8.Swat	514	3	15	3	19	40	18	3	66	680
NWFP Total	3,715	12	147	39	193	377	182	27	695	5,387
9.Attock	214	1	24	3	27	33	20	2	53	377
10.Rawalpindi	247	4	83	10	59	103	57	16	291	870
11.Jhelum	145	15	30	1	24	29	13	4	56	317
12.Gujrat	390	1	110	6	41	70	35	5	124	783
13.Sargodha	531	17	88	6	44	112	44	7	166	1,015
14.Mianwali	366	4	41	3	25	38	23	3	71	574
15.Faisalabad	656	2	315	12	73	182	60	9	235	1,544
16.Jhang	608	1	64	5	34	65	32	4	121	934
17.Lahore	553	4	381	35	165	392	183	38	536	2,287
18.Sheikhupura	463	2	178	3	47	87	41	5	148	975
19.Gujranwala	476	1	246	5	55	143	60	9	180	1,175
20.Sialkot	396	1	198	6	48	98	41	6	128	922
21.D.G.Khan	584	2	35	2	25	60	22	3	89	822
22.Muzaffargarh	775	1	72	2	53	78	27	5	124	1,138
23.Multan	1,406	2	237	10	105	253	109	20	309	2,453
24.Sahiwal	1,201	2	156	8	62	173	62	15	249	1,927
25.Bahawalpur	444	1	50	4	36	63	28	3	115	744
26.Bahawalnagar	466	1	45	2	19	54	16	1	76	680
27.Rahim Yar Khan	588	1	59	3	29	59	25	4	112	878
Punjab Total	10,509	62	2,412	125	971	2,095	896	161	3,182	20,414
28.Shikarpur	638	0	12	2	20	39	15	3	54	783
29.Sukkur(Rohri)	298	1	32	2	37	48	34	2	59	511
30.Larkana	345	0	9	2	14	35	13	1	44	463
31.Nawabshah	468	0	12	5	17	32	12	2	58	606
32.Khairpur	348	0	11	3	12	38	7	3	40	462
33.Hyderabad	403	3	75	10	48	104	29	8	112	793
34.Dadu	398	15	33	2	11	35	14	2	50	561
35.Tharparkar	693	0	27	2	12	56	18	3	74	884
36.Sanghar	363	0	16	1	8	27	8	1	31	455
37.Thatta	222	0	6	1	8	18	3	1	20	278
38.Badin	300	0	12	0	4	11	4	1	31	362
39.Karachi	152	11	626	30	155	621	328	92	697	2,711
Sind Total	4,628	30	871	59	347	1,062	486	119	1,269	8,870
40.Quetta	92	9	13	4	12	86	26	2	61	306
41.Loralai	474	19	3	1	13	29	11	0	27	578
42.Chagai	35	7	1	0	9	4	6	0	6	67
43.Kalat	324	14	1	0	4	10	6	0	19	378
44.Lasbela	108	1	2	0	2	3	2	0	4	124
45.Sibi	690	11	9	1	16	21	9	1	32	790
46.Gwadar	433	1	7	0	62	20	36	1	18	579
Baluchistan Total	2,157	61	36	7	118	173	96	5	167	2,821
TOTAL	21,010	164	3,467	231	1,629	3,707	1,660	311	5,314	37,492

Appendix 3.1.2.2 (4) Projected Working Population by Zone - 2005/06 (Census) (000)

Projected Working Population by Zone - 2005/06
(000)

Zone Name	Agricul-ture	Mining/Quarrying	Manufac-turing	Electri-city/Gas	Construction	Wholesale/Retail	Transport/Comm.	Banking/ Insure.	Pub. Ad. /Service	TOTAL
1.Mardan	498	4	27	12	33	48	27	4	64	716
2.Peshawar	689	1	67	13	64	161	71	13	299	1,378
3.Kohat	208	3	15	2	32	33	21	3	74	392
4.Abbottabad	1,466	0	16	6	22	44	30	4	96	1,685
5.D.I.Khan	286	0	8	3	18	38	13	2	90	457
6.Bannu	346	0	9	3	12	40	12	1	63	487
7.Dir	477	2	11	2	21	28	13	2	43	599
8.Swat	642	3	19	4	23	50	23	4	83	850
NWFP Total	4,612	14	172	45	225	442	210	32	812	6,563
9.Attock	241	1	27	4	30	37	23	2	60	425
10.Rawalpindi	302	5	104	13	74	126	72	22	369	1,086
11.Jhelum	157	16	32	1	26	31	14	4	60	342
12.Gujrat	448	1	127	7	48	80	40	6	142	899
13.Sargodha	619	20	103	7	51	130	51	8	194	1,184
14.Mianwali	442	5	49	3	30	46	28	3	86	692
15.Faisalabad	700	2	336	13	77	194	64	10	250	1,647
16.Jhang	737	1	78	6	41	79	38	5	147	1,132
17.Lahore	695	5	491	45	214	506	237	50	692	2,935
18.Sheikhupura	564	2	217	4	57	106	50	6	180	1,187
19.Gujranwala	591	1	305	6	69	178	74	12	223	1,459
20.Sialkot	441	1	220	6	53	109	45	7	143	1,025
21.D.G.Khan	752	2	46	3	32	77	29	4	114	1,059
22.Muzaffargarh	997	1	92	3	69	101	35	6	160	1,464
23.Multan	1,707	3	288	12	128	308	133	25	375	2,977
24.Sahiwal	1,506	2	196	10	77	218	77	19	312	2,418
25.Bahawalpur	579	1	65	5	48	82	36	4	150	970
26.Bahawalnagar	575	1	55	3	24	67	19	2	94	839
27.Rahim Yar Khan	746	1	75	3	37	75	31	4	141	1,113
Punjab Total	12,798	72	2,907	154	1,183	2,552	1,097	199	3,893	24,855
28.Shikarpur	792	0	15	2	25	47	18	3	66	967
29.Sukkur(Rohri)	359	1	39	2	44	57	41	2	71	616
30.Larkana	394	0	10	2	16	40	15	2	50	528
31.Nawabshah	526	0	14	5	19	36	14	3	65	681
32.Khairpur	432	0	13	3	15	47	9	3	50	574
33.Hyderabad	459	4	86	11	55	118	33	9	127	903
34.Dadu	486	18	40	3	14	42	17	3	62	685
35.Tharparkar	932	0	36	2	17	75	24	4	100	1,188
36.Sanghar	441	0	20	1	10	33	9	2	37	554
37.Thatta	230	0	6	1	8	18	3	1	21	289
38.Badin	351	0	14	0	4	13	5	1	36	424
39.Karachi	204	15	843	40	208	835	441	124	937	3,648
Sind Total	5,606	37	1,134	74	435	1,362	630	156	1,622	11,056
40.Quetta	113	11	16	5	15	106	32	3	75	375
41.Loralai	678	27	5	2	19	41	15	0	39	827
42.Chagai	47	9	1	0	12	5	8	0	8	90
43.Kalat	455	21	1	1	5	14	8	1	27	532
44.Lasbela	128	1	2	0	2	4	2	0	5	146
45.Sibi	848	12	11	1	21	25	11	1	38	968
46.Gwadar	646	1	10	1	93	30	54	1	26	862
Baluchistan Total	2,916	82	46	9	166	225	131	6	218	3,800
TOTAL	25,933	205	4,259	281	2,010	4,581	2,067	392	6,545	46,274

Appendix 3.2.2.1 Comparison of Commodity Transportation by PR between 1985/86 and 1992/93

Commodity : --- 1 : Wheat ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	800	0.1	4389	0.4
100- 199	2364	0.2	1418	0.1
200- 299	3829	0.3	3384	0.3
300- 399	15939	1.1	21235	2.1
400- 499	8202	0.6	15029	1.5
500- 599	94833	6.5	42959	4.2
600- 699	40340	2.8	25952	2.5
700- 799	117635	8.1	125781	12.2
800- 899	219249	15.1	67300	6.5
900- 999	60088	4.1	0	0.0
1000-1099	12682	0.9	6058	0.6
1100-1199	176070	12.1	36189	3.5
1200-1299	58416	4.0	89944	8.7
1300-1399	389492	26.8	382398	37.0
1400-1499	130462	9.0	210124	20.4
1500-	120343	8.3	0	0.0
T o t a l	1450744	100.0	1032160	100.0
Max. OD	39- 40(	11.7%)	37- 2(	23.6%)
Ave. kms	1111		1151	

Commodity : --- 2 : Rice ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	24	0.0	6649	2.0
100- 199	1640	0.2	119	0.0
200- 299	12639	1.7	8419	2.5
300- 399	50695	6.9	173405	52.4
400- 499	114134	15.6	117925	35.6
500- 599	17197	2.4	24	0.0
600- 699	20731	2.8	6206	1.9
700- 799	9313	1.3	13786	4.2
800- 899	57284	7.8	1126	0.3
900- 999	50465	6.9	144	0.0
1000-1099	42200	5.8	1489	0.5
1100-1199	103328	14.1	0	0.0
1200-1299	211500	28.9	124	0.0
1300-1399	39591	5.4	0	0.0
1400-1499	96	0.0	0	0.0
1500-	145	0.0	1411	0.4
T o t a l	730982	100.0	330827	100.0
Max. OD	19- 39(	9.0%)	30- 37(	52.3%)
Ave. kms	933		433	

Commodity : --- 3 : Cotton ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	0	0.0	0	0.0
100- 199	0	0.0	0	0.0
200- 299	10651	19.3	0	0.0
300- 399	0	0.0	418	42.5
400- 499	165	0.3	0	0.0
500- 599	0	0.0	0	0.0
600- 699	17458	31.6	0	0.0
700- 799	0	0.0	0	0.0
800- 899	8370	15.2	0	0.0
900- 999	340	0.6	0	0.0
1000-1099	18091	32.8	0	0.0
1100-1199	69	0.1	0	0.0
1200-1299	19	0.0	565	57.5
1300-1399	4	0.0	0	0.0
1400-1499	0	0.0	0	0.0
1500-	0	0.0	0	0.0
T o t a l	55167	100.0	983	100.0
Max. OD	26- 39(	32.1%)	39- 50(	51.9%)
Ave. kms	725		890	

Commodity : --- 4 : Edible Oil ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	0	0.0	0	0.0
100- 199	0	0.0	31	0.1
200- 299	506	0.3	0	0.0
300- 399	10	0.0	0	0.0
400- 499	21	0.0	8	0.0
500- 599	361	0.2	0	0.0
600- 699	17	0.0	0	0.0
700- 799	0	0.0	0	0.0
800- 899	47	0.0	0	0.0
900- 999	19324	12.1	0	0.0
1000-1099	126	0.1	0	0.0
1100-1199	56067	35.1	21010	69.0
1200-1299	35229	22.1	7	0.0
1300-1399	47802	30.0	9380	30.8
1400-1499	49	0.0	0	0.0
1500-	0	0.0	0	0.0
T o t a l	159559	100.0	30436	100.0
Max. OD	39- 15(	34.9%)	39- 15(	69.0%)
Ave. kms	1197		1215	

Commodity : --- 5 : Sugar ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	107	0.2	302	0.5
100- 199	0	0.0	136	0.2
200- 299	0	0.0	0	0.0
300- 399	229	0.5	0	0.0
400- 499	48	0.1	0	0.0
500- 599	0	0.0	0	0.0
600- 699	524	1.2	2478	3.7
700- 799	0	0.0	0	0.0
800- 899	2641	6.0	240	0.4
900- 999	12992	29.5	33188	50.0
1000-1099	3526	8.0	7309	11.0
1100-1199	10186	23.2	13416	20.2
1200-1299	6205	14.1	6064	9.1
1300-1399	6543	14.9	3267	4.9
1400-1499	716	1.6	40	0.1
1500-	253	0.6	0	0.0
T o t a l	43970	100.0	66440	100.0
Max. OD	31- 17(	26.1%)	31- 17(	47.2%)
Ave. kms	1111		1045	

Commodity : --- 6 : Cement ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	1287	0.2	1514	0.5
100- 199	5061	0.7	407	0.1
200- 299	42678	6.1	15560	5.2
300- 399	8432	1.2	683	0.2
400- 499	25218	3.6	1838	0.6
500- 599	1911	0.3	62	0.0
600- 699	13295	1.9	24	0.0
700- 799	61324	8.7	20	0.0
800- 899	29355	4.2	0	0.0
900- 999	26370	3.8	0	0.0
1000-1099	416216	59.3	273600	92.1
1100-1199	17000	2.4	146	0.0
1200-1299	24264	3.5	3137	1.1
1300-1399	27276	3.9	0	0.0
1400-1499	1834	0.3	0	0.0
1500-	90	0.0	0	0.0
T o t a l	701611	100.0	296991	100.0
Max. OD	33- 17(	56.9%)	33- 17(	92.1%)
Ave. kms	934		991	

Commodity : --- 7 : Fertilizer ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	17526	2.5	8033	1.3
100- 199	36045	5.1	6912	1.1
200- 299	56507	8.0	22359	3.6
300- 399	51269	7.3	19140	3.1
400- 499	202280	28.7	22817	3.7
500- 599	47551	6.7	44457	7.2
600- 699	70522	10.0	56227	9.1
700- 799	32323	4.6	31749	5.1
800- 899	17537	2.5	97178	15.7
900- 999	35921	5.1	119979	19.4
1000-1099	50834	7.2	82516	13.4
1100-1199	43978	6.2	43330	7.0
1200-1299	31715	4.5	41252	6.7
1300-1399	8350	1.2	14613	2.4
1400-1499	1917	0.3	7267	1.2
1500-	1055	0.1	0	0.0
T o t a l	705330	100.0	617829	100.0
Max. OD	29- 39(	20.6%)	39- 23(	11.2%)
Ave. kms	619		852	

Commodity : --- 8 : Iron & Steel ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	20	0.0	48	0.1
100- 199	189	0.2	30	0.1
200- 299	3122	3.0	0	0.0
300- 399	198	0.2	48	0.1
400- 499	550	0.5	333	0.6
500- 599	119	0.1	0	0.0
600- 699	8319	8.0	184	0.3
700- 799	26	0.0	3	0.0
800- 899	274	0.3	43	0.1
900- 999	1276	1.2	465	0.9
1000-1099	2469	2.4	25	0.0
1100-1199	48230	46.3	44	0.1
1200-1299	36899	35.4	47972	89.7
1300-1399	2082	2.0	4117	7.7
1400-1499	241	0.2	90	0.2
1500-	159	0.2	63	0.1
T o t a l	104173	100.0	53465	100.0
Max. OD	37- 17(	45.7%)	39- 17(	89.7%)
Ave. kms	1096		1207	

Commodity : --- 9 : Mining Products ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	7597	1.7	253026	51.6
100- 199	33603	7.3	2032	0.4
200- 299	59768	13.1	62623	12.8
300- 399	38692	8.5	67330	13.7
400- 499	106502	23.3	9147	1.9
500- 599	65111	14.2	15383	3.1
600- 699	25188	5.5	4638	0.9
700- 799	229	0.1	2684	0.5
800- 899	17017	3.7	3579	0.7
900- 999	1731	0.4	0	0.0
1000-1099	1891	0.4	4451	0.9
1100-1199	90647	19.8	47637	9.7
1200-1299	46	0.0	6578	1.3
1300-1399	9781	2.1	4131	0.8
1400-1499	0	0.0	218	0.0
1500-	0	0.0	6499	1.3
T o t a l	457803	100.0	489956	100.0
Max. OD	14- 39(	14.3%)	37- 37(	51.4%)
Ave. kms	587		299	

Commodity : --- 10 : Coal & Coke ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	0	0.0	872	0.5
100- 199	436	0.1	740	0.4
200- 299	335	0.1	1833	1.1
300- 399	58	0.0	37	0.0
400- 499	689	0.2	0	0.0
500- 599	12412	3.8	1932	1.1
600- 699	3977	1.2	15358	8.9
700- 799	5009	1.5	15402	9.0
800- 899	96752	29.9	70274	40.8
900- 999	115486	35.7	43977	25.6
1000-1099	74872	23.1	21524	12.5
1100-1199	8083	2.5	0	0.0
1200-1299	5627	1.7	0	0.0
1300-1399	0	0.0	90	0.1
1400-1499	53	0.0	0	0.0
1500-	0	0.0	0	0.0
T o t a l	323789	100.0	172039	100.0
Max. OD	45- 17(	20.2%)	40- 17(	25.2%)
Ave. kms	918		857	

Commodity : --- 11 : Petroleum ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	8726	0.4	15212	0.7
100- 199	175964	8.7	73108	3.2
200- 299	337824	16.7	326082	14.1
300- 399	420495	20.8	337174	14.6
400- 499	131383	6.5	169596	7.3
500- 599	171595	8.5	5886	0.3
600- 699	273	0.0	132	0.0
700- 799	1703	0.1	5642	0.2
800- 899	67706	3.3	549210	23.7
900- 999	213799	10.6	442627	19.1
1000-1099	30707	1.5	3939	0.2
1100-1199	223394	11.0	279255	12.1
1200-1299	139265	6.9	83376	3.6
1300-1399	41750	2.1	10842	0.5
1400-1499	41266	2.0	14938	0.6
1500-	19379	1.0	61	0.0
T o t a l	2025229	100.0	2317080	100.0
Max. OD	22- 15(14.2%)		39- 22(23.1%)	
Ave. kms	634		718	

Commodity : --- 12 : Firewood ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	3885	7.9	544	1.3
100- 199	4845	9.9	884	2.1
200- 299	18599	38.0	11606	27.0
300- 399	8165	16.7	4852	11.3
400- 499	5199	10.6	13209	30.7
500- 599	6189	12.6	425	1.0
600- 699	1615	3.3	137	0.3
700- 799	323	0.7	2533	5.9
800- 899	0	0.0	1166	2.7
900- 999	113	0.2	2754	6.4
1000-1099	0	0.0	935	2.2
1100-1199	0	0.0	3752	8.7
1200-1299	0	0.0	262	0.6
1300-1399	0	0.0	0	0.0
1400-1499	0	0.0	0	0.0
1500-	0	0.0	0	0.0
T o t a l	48933	100.0	43059	100.0
Max. OD	14- 2(23.8%)		14- 8(28.1%)	
Ave. kms	307		506	

Commodity : --- 13 : Sugarcane ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	0	0.0	0	0.0
100- 199	0	0.0	1144	49.9
200- 299	1056	45.9	0	0.0
300- 399	75	3.3	1099	48.0
400- 499	180	7.8	0	0.0
500- 599	0	0.0	0	0.0
600- 699	0	0.0	0	0.0
700- 799	0	0.0	0	0.0
800- 899	280	12.2	48	2.1
900- 999	0	0.0	0	0.0
1000-1099	709	30.8	0	0.0
1100-1199	0	0.0	0	0.0
1200-1299	0	0.0	0	0.0
1300-1399	0	0.0	0	0.0
1400-1499	0	0.0	0	0.0
1500-	0	0.0	0	0.0
T o t a l	2300	100.0	2291	100.0
Max. OD	45- 28(	45.5%)	40- 45(	49.9%)
Ave. kms	553		259	

Commodity : --- 14 : Fruits & Vegetable ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	0	-	0	0.0
100- 199	0	-	0	0.0
200- 299	0	-	0	0.0
300- 399	0	-	0	0.0
400- 499	0	-	0	0.0
500- 599	0	-	0	0.0
600- 699	0	-	686	100.0
700- 799	0	-	0	0.0
800- 899	0	-	0	0.0
900- 999	0	-	0	0.0
1000-1099	0	-	0	0.0
1100-1199	0	-	0	0.0
1200-1299	0	-	0	0.0
1300-1399	0	-	0	0.0
1400-1499	0	-	0	0.0
1500-	0	-	0	0.0
T o t a l	0	-	686	100.0
Max. OD	45- 28(	- %)	51- 40(	100.0%)
Ave. kms	-		675	

Commodity : --- 15 : Livestock ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	11	0.2	0	0.0
100- 199	14	0.3	86	9.9
200- 299	12	0.2	0	0.0
300- 399	14	0.3	0	0.0
400- 499	284	5.2	0	0.0
500- 599	0	0.0	95	10.9
600- 699	1831	33.6	0	0.0
700- 799	0	0.0	653	74.9
800- 899	1499	27.5	18	2.1
900- 999	153	2.8	3	0.3
1000-1099	1505	27.6	9	1.0
1100-1199	53	1.0	5	0.6
1200-1299	2	0.0	3	0.3
1300-1399	0	0.0	0	0.0
1400-1499	73	1.3	0	0.0
1500-	0	0.0	0	0.0
T o t a l	5451	100.0	872	100.0
Max. OD	27- 39(	33.5%)	25- 37(	74.5%)
Ave. kms	809		697	

Commodity : --- 16 : Rock Phosphate ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	0	0.0	0	0.0
100- 199	0	0.0	0	0.0
200- 299	0	0.0	0	0.0
300- 399	0	0.0	0	0.0
400- 499	0	0.0	0	0.0
500- 599	0	0.0	0	0.0
600- 699	0	0.0	0	0.0
700- 799	0	0.0	0	0.0
800- 899	0	0.0	0	0.0
900- 999	174575	78.6	140121	72.6
1000-1099	0	0.0	0	0.0
1100-1199	47603	21.4	38396	19.9
1200-1299	0	0.0	0	0.0
1300-1399	0	0.0	0	0.0
1400-1499	0	0.0	0	0.0
1500-	0	0.0	14554	7.5
T o t a l	222178	100.0	193071	100.0
Max. OD	39- 23(	78.6%)	39- 23(	72.6%)
Ave. kms	967		1008	

Commodity : --- 17 : Railway Material ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	216256	12.1	181086	31.3
100- 199	571188	32.1	94468	16.3
200- 299	418215	23.5	135649	23.4
300- 399	157655	8.8	36947	6.4
400- 499	117361	6.6	45163	7.8
500- 599	36507	2.0	8319	1.4
600- 699	64365	3.6	4297	0.7
700- 799	67752	3.8	10693	1.8
800- 899	39310	2.2	13261	2.3
900- 999	16567	0.9	3133	0.5
1000-1099	10815	0.6	6792	1.2
1100-1199	21817	1.2	7387	1.3
1200-1299	31469	1.8	19870	3.4
1300-1399	1598	0.1	5382	0.9
1400-1499	11130	0.6	5987	1.0
1500-	0	0.0	166	0.0
T o t a l	1782005	100.0	578600	100.0
Max. OD	23- 27(	3.7%)	13- 23(	10.3%)
Ave. kms		318		294

Commodity : --- 18 : Railway Oil ---

Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	7436	1.3	77254	33.7
100- 199	73549	12.5	29989	13.1
200- 299	56583	9.6	25421	11.1
300- 399	99353	16.9	24770	10.8
400- 499	51364	8.8	6298	2.7
500- 599	8609	1.5	0	0.0
600- 699	989	0.2	3679	1.6
700- 799	45123	7.7	4208	1.8
800- 899	107454	18.3	12079	5.3
900- 999	50323	8.6	13302	5.8
1000-1099	139	0.0	0	0.0
1100-1199	3804	0.6	18	0.0
1200-1299	81914	14.0	31373	13.7
1300-1399	0	0.0	0	0.0
1400-1499	10	0.0	662	0.3
1500-	0	0.0	0	0.0
T o t a l	586650	100.0	229053	100.0
Max. OD	39- 25(	18.1%)	39- 39(	30.7%)
Ave. kms		615		388

Commodity : --- 19 : Others ---

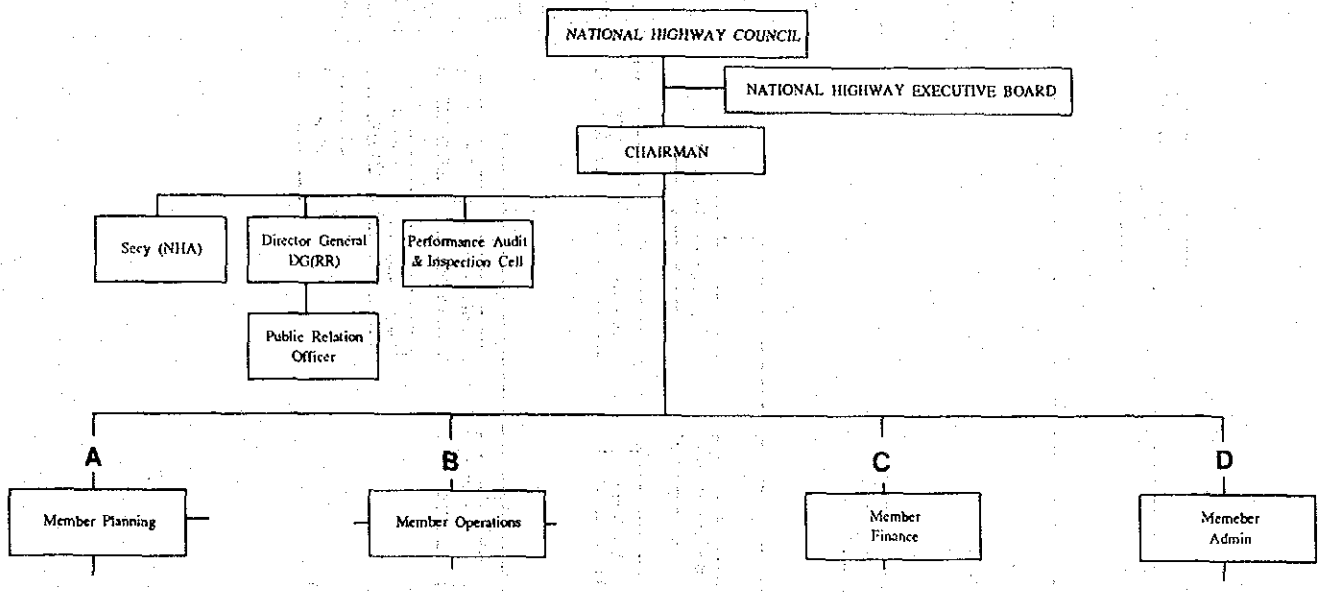
Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	64926	3.9	132023	8.5
100- 199	147917	9.0	82069	5.3
200- 299	104956	6.4	64142	4.1
300- 399	107300	6.5	36133	2.3
400- 499	66084	4.0	49140	3.2
500- 599	82387	5.0	20786	1.3
600- 699	100213	6.1	320726	20.7
700- 799	52034	3.2	26243	1.7
800- 899	104205	6.3	42771	2.8
900- 999	69686	4.2	38947	2.5
1000-1099	50558	3.1	23915	1.5
1100-1199	146251	8.9	61425	4.0
1200-1299	321397	19.5	514931	33.2
1300-1399	103315	6.3	100545	6.5
1400-1499	116369	7.1	34023	2.2
1500-	9982	0.6	4501	0.3
T o t a l	1647580	100.0	1552320	100.0
Max. OD	39- 17(15.6%)		39- 17(25.5%)	
Ave. kms	824		828	

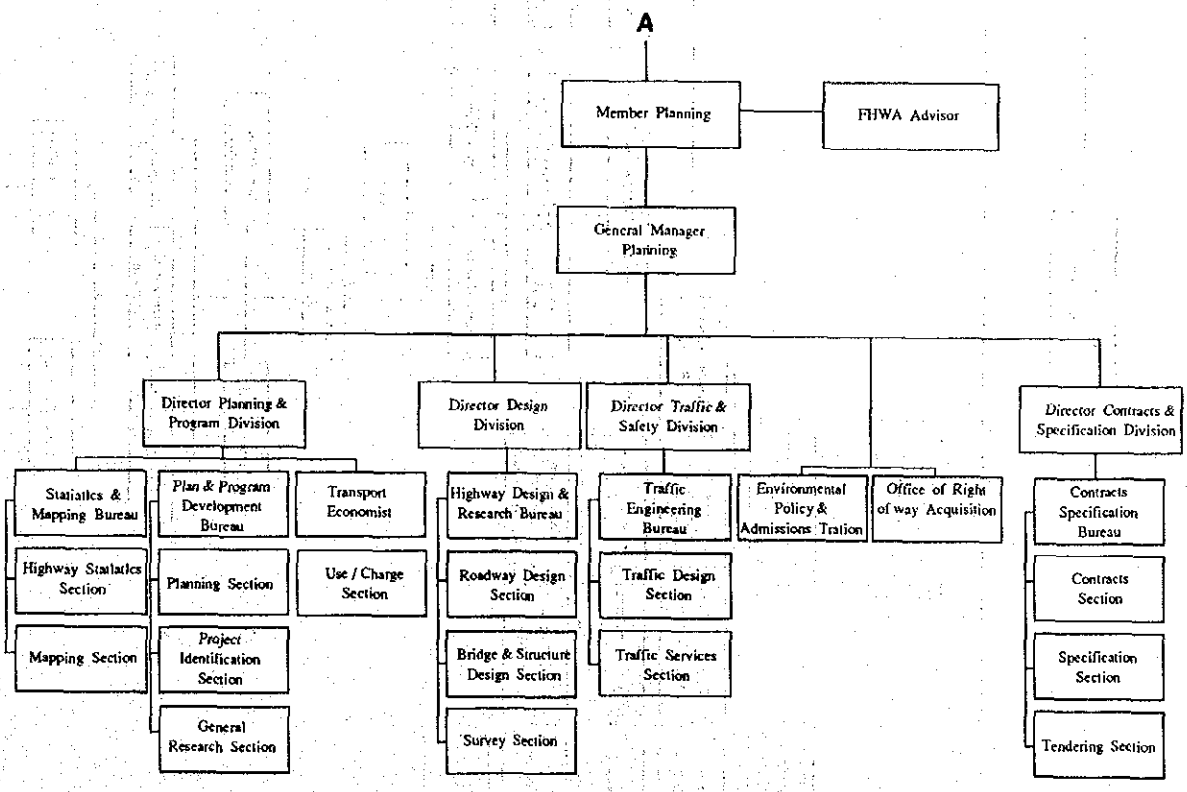
Commodity : --- Total ---

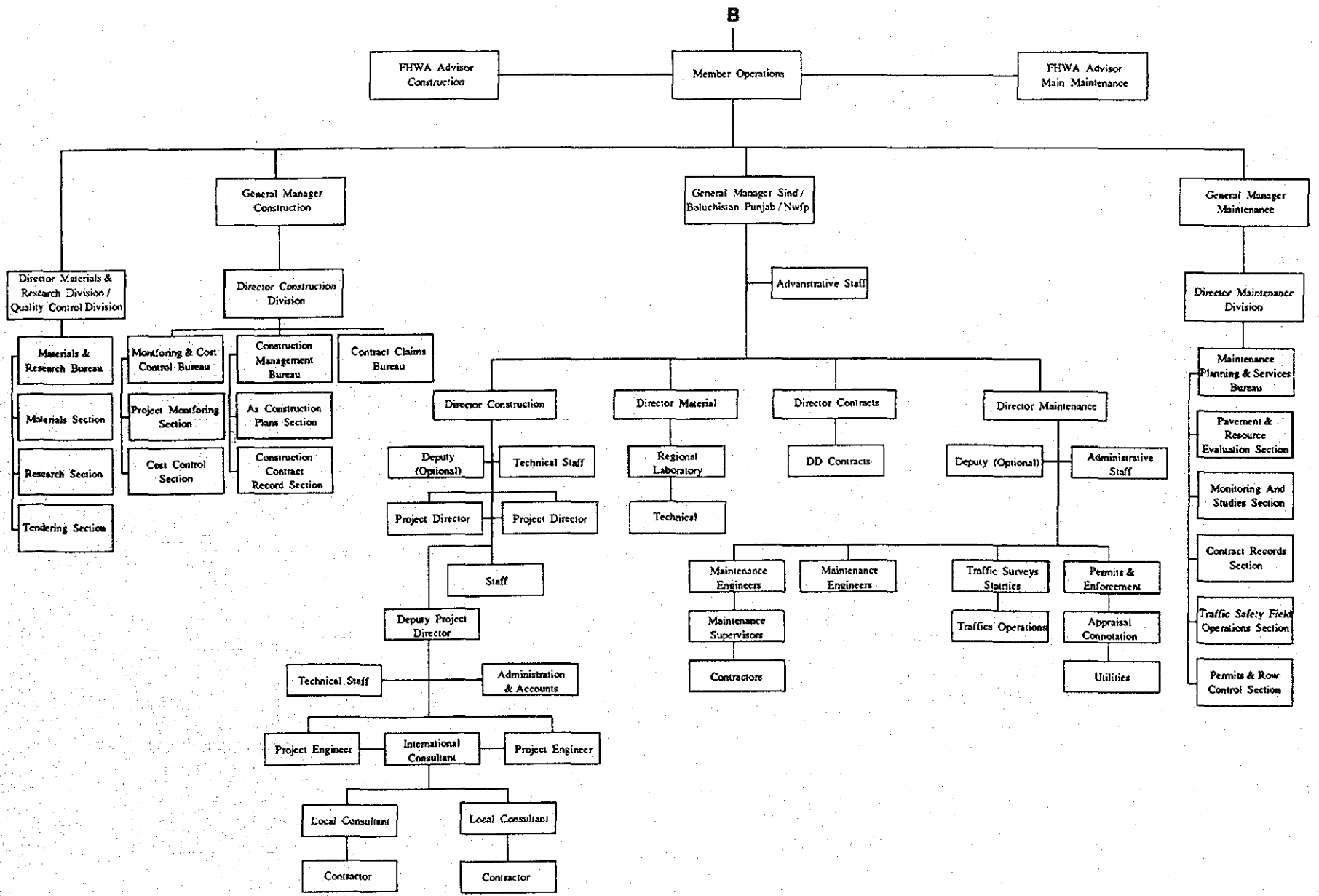
Distance (km)	1985/86 (ton)	(%)	1992/93 (ton)	(%)
1- 99	328601	3.0	680952	8.5
100- 199	1052815	9.5	293573	3.7
200- 299	1127280	10.2	677078	8.5
300- 399	958579	8.7	723271	9.0
400- 499	829664	7.5	450503	5.6
500- 599	544782	4.9	140328	1.8
600- 699	369657	3.3	440724	5.5
700- 799	392794	3.6	239397	3.0
800- 899	768980	7.0	858293	10.7
900- 999	849209	7.7	838640	10.5
1000-1099	717340	6.5	432562	5.4
1100-1199	996580	9.0	552010	6.9
1200-1299	983967	8.9	845458	10.6
1300-1399	677584	6.1	534765	6.7
1400-1499	304216	2.8	273349	3.4
1500-	151406	1.4	27255	0.3
T o t a l	11053454	100.0	8008158	100.0
Max. OD	39- 17(5.1%)		39- 23(8.4%)	
Ave. kms	737		755	

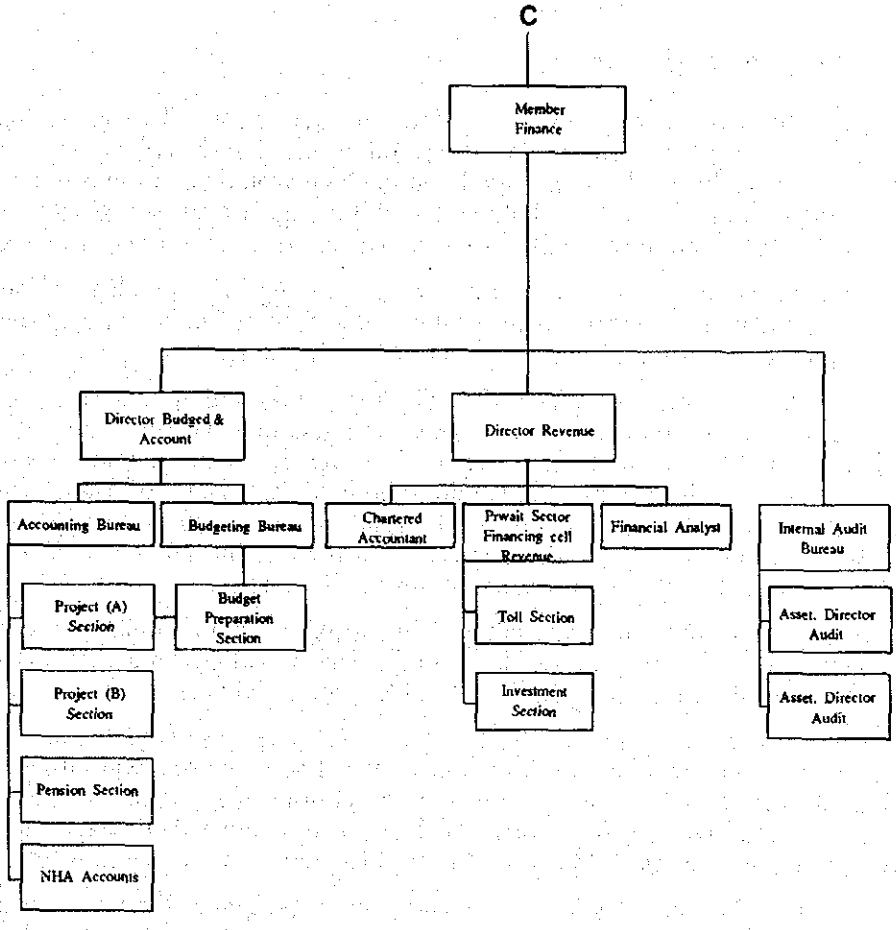
APPENDICES for CHAPTER 4

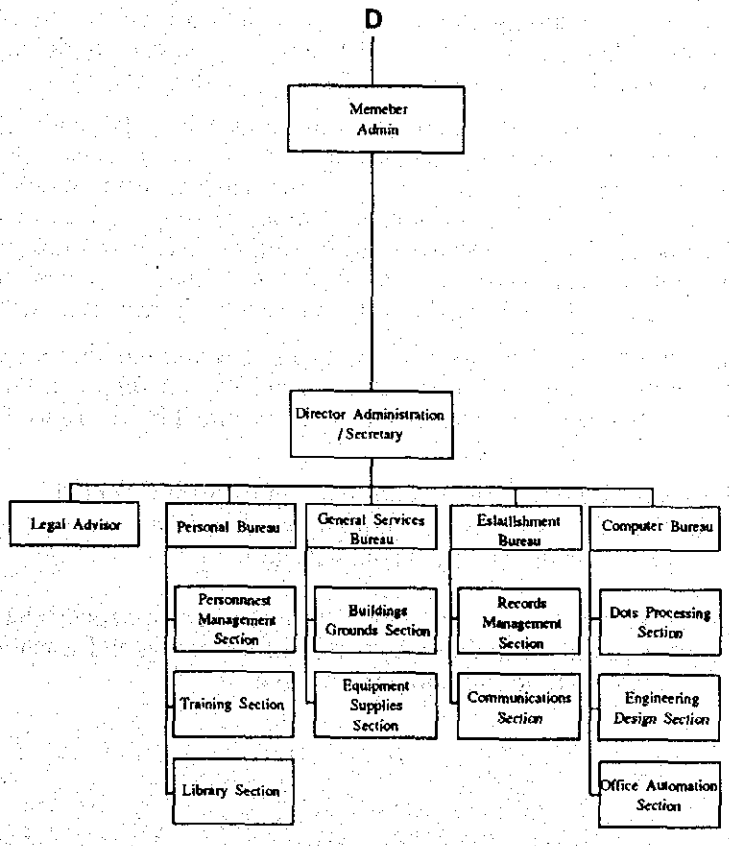
Appendix Figure 4.1.1 Organization of National Highway Authority






B
FHWA Advisor Construction
Member Operations
FHWA Advisor Main Maintenance
General Manager Construction
General Manager Sind / Baluchistan Punjab / Nwfp
General Manager Maintenance
Director Materials & Research Division / Quality Control Division
Director Construction Division
Advanstrative Staff
Director Maintenance Division
Materials & Research Bureau
Monitoring & Cost Control Bureau
Construction Management Bureau
Contract Claims Bureau
Maintenance Planning & Services Bureau
Materials Section
Project Monitoring Section
As Construction Plans Section
Pavement & Resource Evaluation Section
Research Section
Cost Control Section
Construction Contract Record Section
Monitoring And Studies Section
Tendering Section
Director Construction
Director Material
Director Contracts
Director Maintenance
Contract Records Section
Deputy (Optional)
Technical Staff
Regional Laboratory
DD Contracts
Deputy (Optional)
Administrative Staff
Traffic Safety Field Operations Section
Project Director
Project Director
Technical
Permits & Row Control Section
Staff
Maintenance Engineers
Maintenance Engineers
Traffic Surveys Statstics
Permits & Enforcement
Deputy Project Director
Maintenance Supervisors
Traffics Operations
Appraisal Connotation
Technical Staff
Administration & Accounts
Contractors
Utilities
Project Engineer
International Consultant
Project Engineer
Local Consultant
Local Consultant
Contractor
Contractor


C
Member
Finance
Director Budged &
Account
Director Revenue
Accounting Bureau
Budgeting Bureau
Chartered
Accountant
Prwait Sector
Financing cell
Revenue
Financial Analyst
Internal Audit
Bureau
Project (A)
Section
Budget
Preparation
Section
Toll Section
Asset. Director
Audit
Project (B)
Section
Investment
Section
Asset. Director
Audit
Pension Section
NHA Accounts


D
Memeber
Admin
Director Administration
/ Secretary
Legal Advisor
Personal Bureau
General Services
Bureau
Establishment
Bureau
Computer Bureau
Personnnest
Management
Section
Buildings
Grounds Section
Records
Management
Section
Dots Processing
Section
Training Section
Equipment
Supplies
Section
Communications
Section
Engineering
Design Section
Library Section
Office Automation
Section

Appendix Note 4.1.1 Road Disaster

Pakistan experienced natural disasters, namely, flooding and heavy rainfall, which occurred on two separate occasions during the monsoon of 1992 and resulted in heavy damage to public sector infrastructure. Initial estimates have indicated that damage would be in the order of RS. 35 billion, equivalent to approximately US$ 1.4 billion. The followings are survey results conducted by Flood / Rains Damage Restoration of NESPAK (National Engineering Services Limited, 1993)

The damaging flood in Pakistan are the result of storms originating in bay of Bengal during the monsoon from July to September. The storms originated in the Bay of Bengal, passed over lower Central India and Rajputana, enter Pakistan and continued North into Kashmir.

The first occurrence of heavy rains took place in Sindh during July and August, and resulted in inundation of vast areas, both in rural and urban. Roads were generally damaged due to the direct rainfall and local inundation. The main damage occurred on the Sehawan-Jehangira road and the Hussainabad-Puranabad road. The Sehawan-Jehangira road is in the vicinity of Manchar lake and inundation overflows from the lake have damaged the road at various locations, in addition to three cause-ways which were extensively damaged. In particular, the Hussainabad-Puranabad road has damage along its full length of approximately seven kilometers.

The second occurrence of heavy and widespread rains took place in Punjab covering river catchments in the north down to areas in the deep south. These also covered the north eastern part of North West Frontier Province, the whole of Azad Kashimir and northern areas.

In Punjab, the road network in the area falling to the right of Trimmu was inundated and the roads remained under as much as 2.5 meters of water for 2-3 weeks. The road crust was either damaged or washed away in many places and developed jumps or undulations after the flood water receded. These damages are deteriorating with the passage of time. The main roads damaged in the area were the Atharan Hazari-Wasawa, Garh Maharaja-Miranwala, Jhang- Bhakkar roads, etc.

In North Western Frontier Province (NWFP), the roads in Abbottabad district were damaged mainly due to land slides. Mansehara district has two major roads; the Mansehara-Daddar-Sachan road and the Mansehra-Balakot-Kaghan road which run parallel to the Siran and Kunhar rivers, respectively. These roads have been washed away in several places due to extensive bank erosion. A number of major bridges, including the Garhi Habibullah Bridge on the Kunhar, have been washed away while some others on the Siran and Kunhar were partially damaged. Two bridges on the Haro river downstream of the Khanpur Dam were partially damaged.

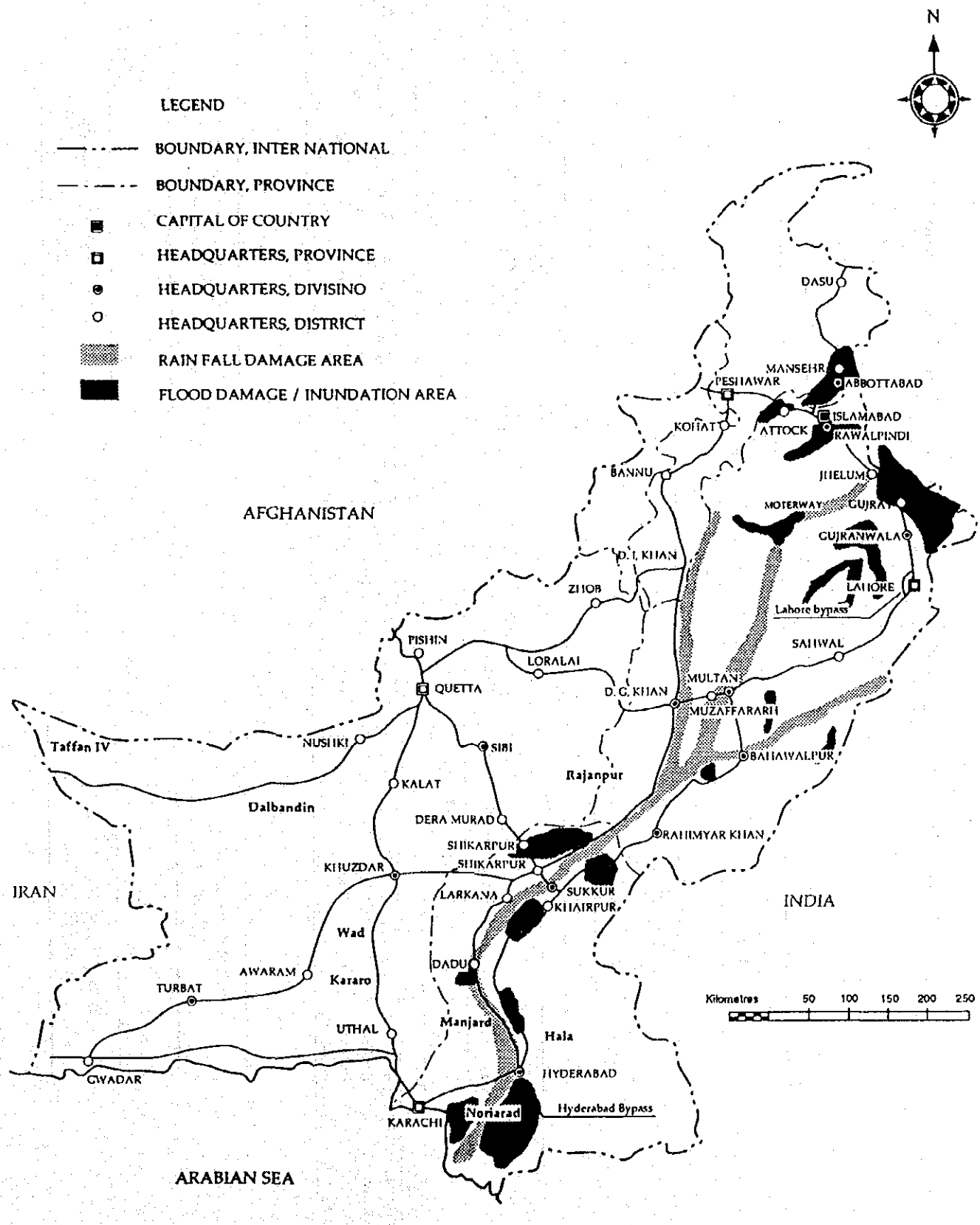
In the Peshawar and Mardan areas, the Nangman Bridge and Adezai Bridge were damaged. In the D.I. Khan area, causeways and culverts were damaged on the Dera-Tank and Tank-Pezu roads, while two bridges were completely washed away on the Tank-Manzai and Kulachi-Kaur roads. In Balochistan on October 4, 1992, the Cabinet Committee did not inform of any damage to infrastructure in Balochistan. The National Highway Authority (NHA), however, have included damages to highways; on N-40 near Noshki, on N-25 near Kalat, Khuzdar and Uthal, on N-65 near Dera Murad Jamali, on N-50 near Muslim Bagh and on N-70 near Rakhiri.

Appendix Figure 4.1.a shows the locations of rainfall damages and inundations during the flood of 1992. Although devastating floods such as the above 1992 are not frequent, Pakistan has suffered similar losses in 1988, 1976 and 1959. These causes are assumed by the followings :

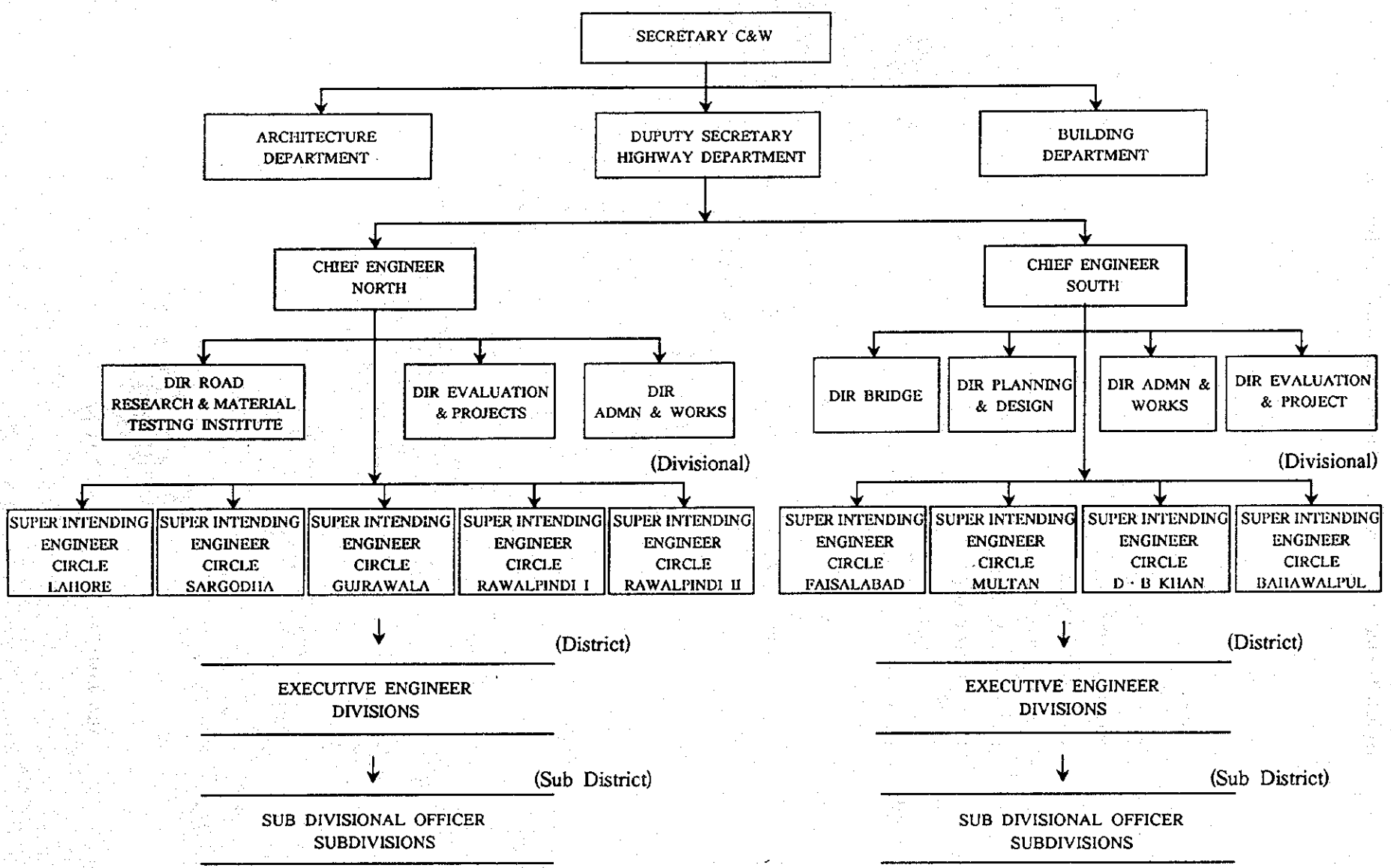
- Water retaining capacity of the river is not enough for heavy rainfall,
- Water flow capacity of the river is not enough because of narrow part by bridge site,
- Ground elevation of road site is low at some sections.

It is, therefore, essential that Pakistan undertakes measures to ensure road reliability in the future. Further to this, it is considered that capabilities for flood forecasting and warning to minimize loss of life and damage to highways / roads should be improved.

Appendix Figure 4.1.a Rainfall Damage and Inundation By 1992 - Flood / Rains

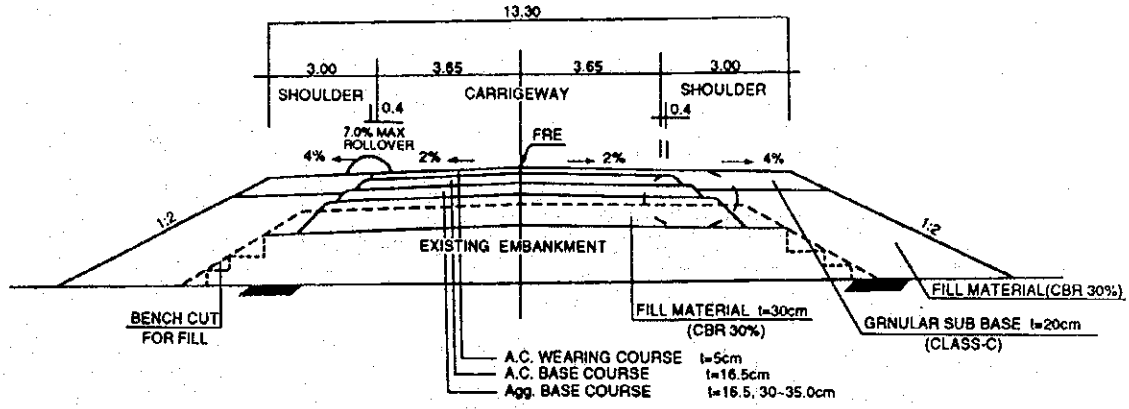


Appendix Figure 4.1.2 Organization Chart of Communication and Works Department / Highway Department of Punjab

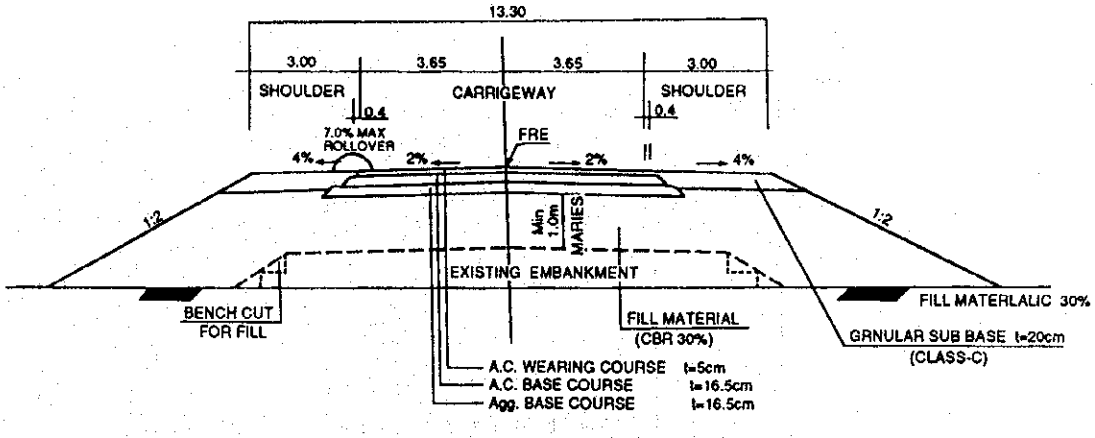


Appendix Figure 4.1.3 Improved Cross Section (1/4)

INDUS HIGHWAY (KOTRI - MANJHAND SECTION)
(Type A)

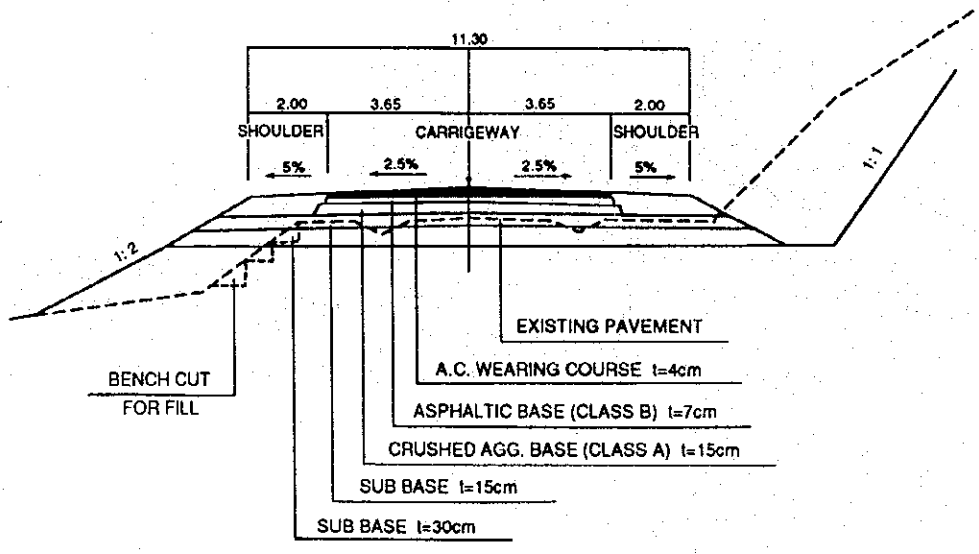


INDUS HIGHWAY (KOTRI - MANJHAND SECTION)
(Type B)

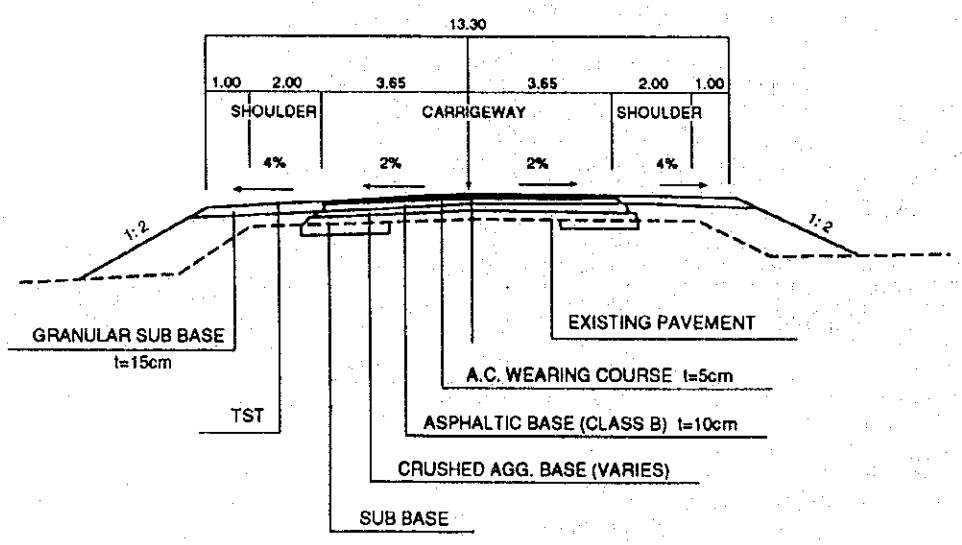


Appendix Figure 4.1.3 Improved Cross Section (2/4)

N - 25 (WADH-KALAT SECTION)



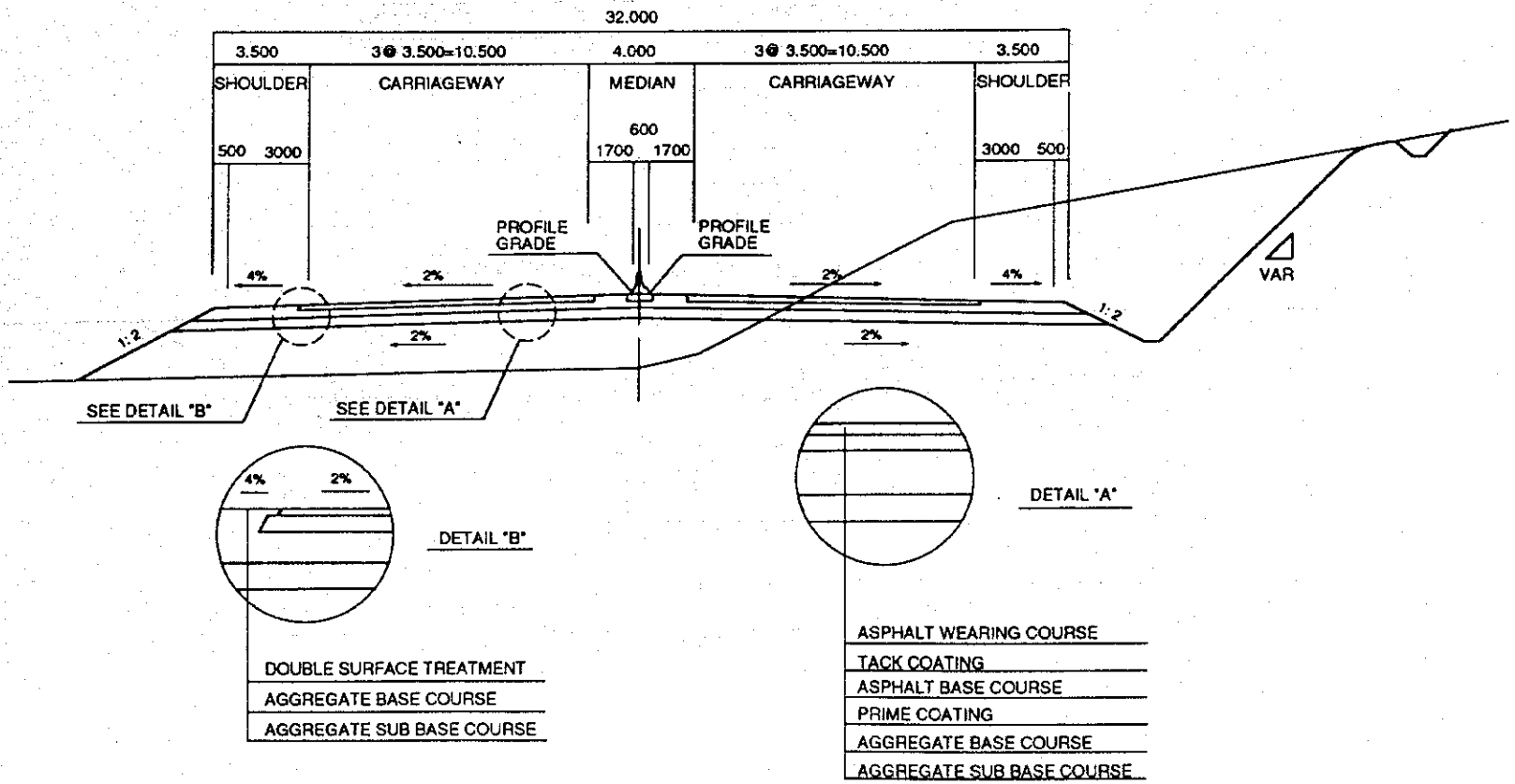
N - 25 (UTHAL-BELA SECTION)



Appendix Figure 4.1.3 Improved Cross Section (3/4)

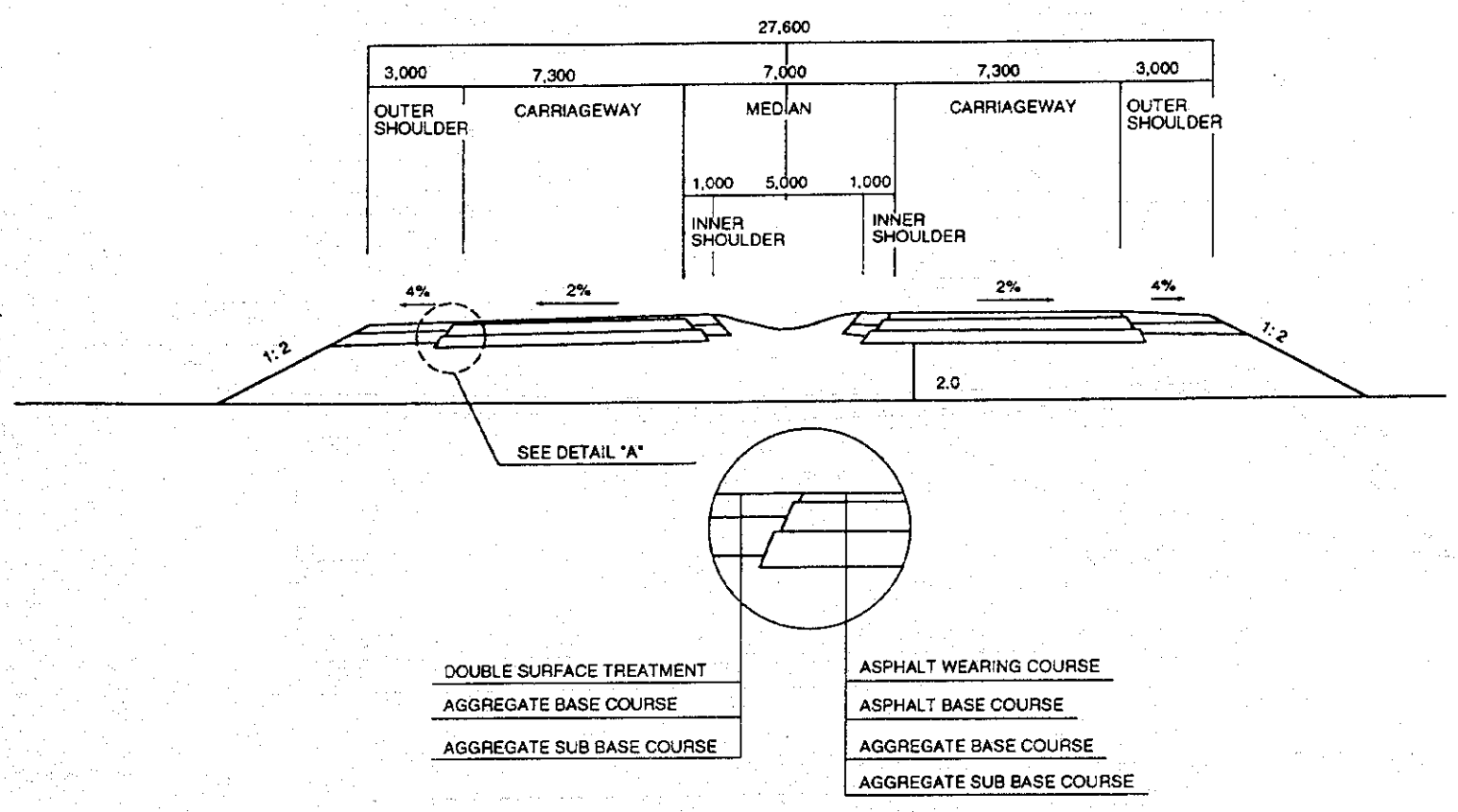
TYPICAL CROSS SECTION OF PAKISTAN MOTORWAY

(WITH MEDIAN BARRIER) S=1 : 200



Appendix Figure 4.1.3 Improved Cross Section (4/4)

TYPICAL CROSS SECTION OF UPGRADING OF NATIONAL HIGHWAY N-5



Appendix Table 4.1.1 Achievment of the National Highway Project (1/4)

Jan, 1994

Section	Length (Km)	Type of Improvement	Achievement	Cost (Rs million)	Completion Date
N-5 (Length 1746Km)					
Karachi - Nooriabad	68	Add.Lane (2 lane - Dual)	Complated	341	-
Nooriabad - Hyderabad	67	//	Under Construction	451	1996
Hyderabad - Bypass	14	New Road	//	600	//
Hyderabad - Hala	45	Add.Lane (2 lane - Dual)	Complated	196	-
Hala - Moro	110	//	Under Construction	1419	1996
Moro - Kotri Kabir	80	//	//	1354	//
Kotri Kabir - Baberlo	80	//	//	1584	//
Baberlo - Ghotki	70	//	//	1200	//
Ghotki - Ubaro	62	//	//	1284	//
Ubaro - Rahimyar Khan	81	//	//	1295	//
Rahimyar Khan - Bahawalpur	160	//	Planned	3200 (estimated)	-
Bahawalpur - Multan	81	//	Under Construction	1018	1996
Multan - Mianchunnu	86	//	//	1745	//
Mianchunnu - Chakbehnu	39	//	Complated	570	-
Chakbehnu - Sahiwal	43	//	//	445	-
Sahiwal - Okara	30	//	Under Construction	469	1996
Okara - Lahore	120	//	//	2070	-
Lahore Bypass Phase - I	18	New Road	//	2600	-
Lahore - Gujranwala	20	Rehabilitation	//	147	-
Lahore - Gujranwala	57	Add.Lane (2 lane - Dual)	Complated	101	Completed in 1978
Gujranwala - Chenab Bridge (7a)	49	//	Under Construction	457	-
Chenaab Bridge - Kharian (7b)	44	//	Complated	381	-
Gujranwala - Jhelum	-	Rehabilitation	Under Construction	884	1996
Jhelum - Rawalpindi	109	//	//	665	-
Kharian - Rawalpindi	107	Add.Lane (2 lane - Dual)	//	2264	-
Rawalpindi - Chablat	125	//	Complated	242	Completed in 1985
Chablat - Nowshera	72	//	Under Construction	1646	1996
Nowshera - Peshawar	37	//	Complated	216	Completed in 1985
Peshawar - Torkhan	57	//	Under Planning	1140 (estimated)	-

Appendix Table 4.1.1 Achievment of the National Highway Project (2/4)

Jan, 1994

Section	Length (Km)	Type of Improvement	Achievement	Cost (Rs million)	Completion Date
N-55 (Length 1245Km) (Indus Highway)					
Jamshoro - Manjand	65	Replacement (2 Lane Single)	Under Construction	835	1996
Manjand - Sehwan	79	//	Construct - Not yet awarded	1170 (estimated)	-
Sehwan - Pakho	100	//	Phase III	1750 (estimated)	-
Pakho - Ratodero	100	//	Phase III	1750 (estimated)	-
Ratodero - Gauspur	99	//	Under Construction	1079	1996
Gauspur - Shori Nullah	76	//	//	660	//
Shori Nullah - Rajanpur	95	//	//	1127	//
Rajampur - D.G. Khan	110	//	Phase III	1925 (estimated)	-
D.G. Khan - Retra Junction	108	//	Under Construction	1177	1996
Retra Janction - Malana Junction	98	//	//	1101	//
Malana Junction - Sarai Gambila	112	//	Phase III	1960 (estimated)	-
Sarai Gambila - Karak	59	//	Under Construction	1035	1996
Karak - Karappa	34	//	//	1258	//
Karappa - Peshawar	54	//	//	538	//
Kohat - Tunnel including approach road	26	//	Phase III	2000 (estimated)	-

Appendix Table 4.1.1 Achievment of the National Highway Project (3/4)

Jan, 1994

Section	Length (Km)	Type of Improvement	Achievement	Cost (Rs million)	Completion Date
N-25 (Length 820Km)					
Uthal - Bela	68	Raising, widening (2 Lanes Single), Strengthening	Under Construction	741	1996
Bela - Kararo	40	//	Completed	100	-
Kararo - Wad	89	//	Design in progress	890 (estimated)	-
Wad - Sorab	160	//	Under Constuction	1265	March '95
Sorab - Kalat	80	//	//	796	1996
Kalat - Mastung - Quetta	128	//	Design completed	1280 (estimated)	-
N-40 (Length 675Km)					
Mastung - Naushki - Dalbandin	307	//	Design in progress	3070 (estimated)	-
Dalbandin - Nokundi III A	85	//	Under Construction	1015	1996
Dalbandin - Nokundi III B	87	//	Under Construction	972	1996
Nokundi - Taftan IV A & IV B	83	//	Completed	200	1991
Nokundi - Taftan IV C	41	//	Under Construction	219	August '94
N-50 (Length 474Km)					
Zhob - Dhanasar	76	//	Completed	200	1992
Dhanasar - Mughalkot	13	//	Under Construction	195	August '94
Mughalkot - D.I. Khan	136	//	Design in Progress	1360 (estimated)	-
N-70 (Length 447Km)					
Qila Saifullah - Rakhni - D.G. Khan - Multan	447	//	Design in Progress	4470 (estimated)	-
N-35 (Length 813Km)					
Hassanabdal - Abbotabad	70	Widening (2 Lanes Single), Strengthing, Overlay	Almost completed	381	1994

Appendix Table 4.1.1 Achievment of the National Highway Project (4/4)

Jan, 1994

Section	Length (Km)	Type of Improvement	Achievement	Cost (Rs million)	Completion Date
Gwadar - Ratodero Highway (925Km)					
Gwadar - Khuzdar Section	663	New construction 2 lane highway	Design in progress	13260 (estimated)	-
Khuzdar - upto Km 35 Section	35	//	Under construction	420	1995
Km 35 - Quba Saida Khan Section	163	//	Design in progress	3260 (estimated)	-
Quba Saida Khan - Shahdadkot - Ratodero Section	64	Widening, raising & strengthening	Under construction	1130	1995
Makran Coatal Road					
Liari - Pasni - Ormara - Gwadar - Jivani Pak / Iran border	700	New construction	Design in progress	10500	-

ACHIEVEMENT OF THE PAKISTAN MOTORWAY

Section	Length (Km)	Type of Improvement	Achievement	Cost (Rs million)	Completion Date
Lahore - Islamabad	335	New construction	Under construction	23686	1995

Source : National Highway Authority, Feb. 1994.

Appendix Table 4.1.2 Traffic Volume at Selected Counting Stations on National Highways, 1989 and 1992

Route		1989 in Vehicles				1992 in Vehicles				Ratio			PCU	agr pa
	Loc. No.	Cars	Buses	Trucks	Total	Cars	Buses	Trucks	Total	92/89	PCU tot	PCU tot	92/89	89--92
N 5	- 03	3637	347	303	4287	2960	452	637	4049	0.94	6375	6946	1.09	0.029
	- 08	3667	687	2133	6487	4865	734	1149	6748	1.04	13287	11717	0.88	-0.041
	- 16	5726	943	3218	9887	6745	954	4780	12479	1.26	19998	26252	1.31	0.095
	- 27	10552	411	3584	14517	11076	1363	4320	16759	1.15	25364	31204	1.23	0.072
	- 31	2133	630	2570	5333	2327	715	3680	6722	1.26	12674	16713	1.32	0.097
	- 35	2343	729	1059	4131	3391	583	1220	5194	1.26	8387	9722	1.16	0.050
	- 39	958	270	2943	4171	1415	354	3871	5640	1.35	11377	15147	1.33	0.100
	- 44	424	305	3736	4465	922	300	4770	5992	1.34	13379	17270	1.29	0.089
	- 52	900	214	3831	4945	766	261	4843	5870	1.19	13981	17200	1.23	0.072
	- 58	3319	601	4884	8804	3666	772	4632	9070	1.03	21415	21538	1.01	0.002
	- 60	1294	490	3866	5650	1728	840	4689	7257	1.28	15394	19598	1.27	0.084
	Sub-t	34953	5627	32127	72677	39861	7328	38591	85780	1.18	161631	193308	1.20	0.061
N 25	- 01	3468	451	1630	5549	4431	521	2480	7432	1.34	10731	14816	1.38	0.114
	- 04	169	60	236	465	420	44	175	639	1.37	1138	1196	1.05	0.017
	- 07	445	77	336	858	414	97	436	947	1.10	1840	2183	1.19	0.059
	- 11	548	85	321	954	581	80	385	1046	1.10	1940	2169	1.12	0.038
	Sub-t	4630	673	2523	7826	5846	742	3476	10064	1.29	15649	20364	1.30	0.092
N 35	- 01	1743	428	508	2679	1998	445	576	3019	1.13	5001	5576	1.11	0.037
	- 07	642	18	140	800	581	39	279	899	1.12	1272	1707	1.34	0.103
	- 12	150	10	121	281	263	14	132	409	1.46	597	780	1.31	0.093
	Sub-t	2535	456	769	3760	2842	498	987	4327	1.15	6871	8063	1.17	0.055
N 40	- 04	272	25	31	328	448	15	80	543	1.66	501	839	1.68	0.188
	- 06	267	17	16	300	113	18	26	157	0.52	423	273	0.65	-0.136
	Sub-t	539	42	47	628	561	33	106	700	1.11	923	1111	1.20	0.064
N 50	- 02	518	61	363	942	584	31	266	881	0.94	1966	1645	0.84	-0.058
	- 07	24	2	10	36	73	3	11	87	2.42	67	132	1.97	0.254
	- 09	585	86	201	872	940	160	173	1273	1.46	1603	2162	1.35	0.105
	Sub-t	1127	149	574	1850	1597	194	450	2241	1.21	3636	3938	1.08	0.027
N 55	- 03	997	112	902	2011	986	129	741	1856	0.92	4419	3941	0.89	-0.037
	- 04	145	104	115	364	136	40	65	241	0.66	854	491	0.58	-0.168
	- 08	1273	283	551	2107	2209	268	615	3092	1.47	4140	5423	1.31	0.094
	- 13	137	43	95	275	223	71	276	570	2.07	597	1364	2.28	0.317
	- 16	961	106	209	1276	1193	173	282	1648	1.29	2140	2853	1.33	0.101
	- 18	682	117	1236	2035	640	49	1704	2393	1.18	5125	6368	1.24	0.075
	Sub-t	4195	765	3108	8068	5387	730	3683	9800	1.21	17275	20440	1.18	0.058
N 65	- 01	2324	438	927	3689	2474	223	1683	4380	1.19	7069	9023	1.28	0.085
	- 03	817	229	721	1767	1288	305	1653	3246	1.84	3975	7750	1.95	0.249
	- 08	567	88	1620	2275	833	97	1575	2505	1.10	6128	6331	1.03	0.011
	Sub-t	3708	755	3268	7731	4595	625	4911	10131	1.31	17172	23104	1.35	0.104
N 70	- 02	3737	577	1490	5804	3234	434	1848	5516	0.95	10983	11096	1.01	0.003
	- 07	385	25	297	707	397	12	257	666	0.94	1487	1335	0.90	-0.035
	- 10	812	43	286	1141	680	20	323	1023	0.90	2019	1910	0.95	-0.018
	Sub-t	4934	645	2073	7652	4311	466	2428	7205	0.94	14489	14341	0.99	-0.003
Ground total		56621	9112	44489	110192	65000	10616	54632	130248	1.18	237646	284670	1.20	0.062

Source: Edited by JICA study team from traffic count data "Summary of Traffic Data for National Highways (1992) by NTRC"

Notes : 1. Motorized vehicles only.
2. Cars include pickups, wagons, minibuses, rikishaws/MC, and buses include flying coaches. Trucks includes all trucks and others

Appendix Table 4.1.3 Traffis Volume at Selected Counting Stations on Provincial Highways in Punjab & NWFP, 1989 and 1992

	1989 in Vehicles				1992 in Vehicles				92/89	1989	1992	92/89	agr pa
	Cars	Buses	Trucks	Total	Cars	Buses	Trucks	Total	Total	PCU tot	PCU tot	PCU	89–92
Punjab 1)													
Rawalpindi	2779	173	480	3432	4101	182	441	4724	1.38	5390	6878	1.28	0.085
Attock	1646	14	242	1902	2029	31	254	2314	1.22	2792	3341	1.20	0.062
Jhelum e.	1040	96	210	1346	989	89	179	1257	0.93	2208	2027	0.92	−0.028
Chakwal	615	42	238	895	717	45	243	1005	1.12	1626	1773	1.09	0.029
Div Rawalpindi	6080	325	1170	7575	7836	347	1117	9300	1.23	12015	14019	1.17	0.053
Gujranwala f.	2453	625	1532	4610	3084	658	1927	5669	1.23	9721	11841	1.22	0.068
Gujrat	2332	384	253	2969	2605	364	185	3154	1.06	4760	4810	1.01	0.003
Sialkot	3563	844	583	4990	4653	507	684	5844	1.17	8673	9293	1.07	0.023
Narowal	609	244	269	1122	968	181	208	1357	1.21	2324	2370	1.02	0.007
Div Gujranwala	8957	2097	2637	13691	11310	1710	3004	16024	1.17	25478	28315	1.11	0.036
Lahore	2390	100	652	3142	2803	127	689	3619	1.15	5254	5949	1.13	0.042
Sheikhpura h.	3272	1218	1651	6141	4723	1261	2097	8081	1.32	12864	16161	1.26	0.079
Kasur	683	144	325	1152	1099	143	406	1648	1.43	2292	3047	1.33	0.100
Okara	1868	397	795	3060	2301	363	691	3355	1.10	5977	6061	1.01	0.005
Div Lahore	8213	1859	3423	13495	10926	1894	3883	16703	1.24	26386	31219	1.18	0.058
Sargodha d.	1695	310	637	2642	1938	399	780	3117	1.18	5002	6019	1.20	0.064
Khushab	1107	151	481	1739	1401	130	668	2199	1.26	3321	4209	1.27	0.082
Mianwali	1097	293	734	2124	1223	346	972	2541	1.20	4544	5616	1.24	0.073
Bhakkar	866	249	852	1967	1061	239	1373	2673	1.36	4513	6384	1.41	0.123
Div Sargodha	4765	1003	2704	8472	5623	1114	3793	10530	1.24	17380	22227	1.28	0.085
Faisalabad a.	2669	1222	1264	5155	4205	1616	1387	7208	1.40	10914	14332	1.31	0.095
Jhang	770	280	785	1835	822	313	957	2092	1.14	4276	4988	1.17	0.053
T.T.Singh c.	2916	262	451	3629	3032	306	692	4030	1.11	5728	6771	1.18	0.057
Div Faisalabad	6355	1764	2500	10619	8059	2235	3036	13330	1.26	20918	26091	1.25	0.076
Multan	2442	939	1813	5194	2858	648	2338	5844	1.13	11549	12855	1.11	0.036
Sahiwal	736	396	786	1918	1266	540	918	2724	1.42	4586	6077	1.32	0.098
Vehari	2159	544	1187	3890	2858	435	816	4109	1.06	8021	7346	0.92	−0.029
Khanewal	1183	245	1453	2881	1349	244	1465	3058	1.06	6804	7039	1.03	0.011
Pak–Pattan	678	221	464	1363	1153	205	470	1828	1.34	2961	3503	1.18	0.058
Lodhran b.	603	200	3418	4221	717	360	4212	5289	1.25	12261	15419	1.26	0.079
Div Multan	7801	2545	9121	19467	10201	2432	10219	22852	1.17	46183	52238	1.13	0.042
Bahawalpur	2018	172	330	2520	3398	175	329	3902	1.55	3994	5655	1.42	0.123
Rahim Yar Khan	1447	242	493	2182	1876	408	752	3036	1.39	4040	5882	1.46	0.133
Bahawalnagar	1008	270	364	1642	1485	340	367	2192	1.33	3184	3976	1.25	0.077
Div Bahawalpur	4473	684	1187	6344	6759	923	1448	9130	1.44	11218	15513	1.38	0.114
Rajanpur	608	130	293	1031	654	154	384	1192	1.16	2057	2476	1.20	0.064
Muzaffar Garh	636	71	176	883	632	65	296	993	1.12	1539	1901	1.23	0.073
Layyah g.	880	276	1199	2355	1302	335	1925	3562	1.51	5721	8727	1.53	0.151
Div D.G.Khan	3100	737	2553	6390	4126	791	3801	8718	1.36	14101	19487	1.38	0.114
Total	49744	11014	25295	86053	64840	11446	30301	106587	1.24	173679	209109	1.20	0.064

NWFP 2)	1989 in Vehicles				1992 in Vehicles								agr pa
	Cars	Buses	Trucks	Total	Cars	Buses	Trucks	Total	Total	PCU tot	PCU tot	PCU 92/89	–92
Mardan m.	1789	202	399	2390	1957	158	613	2728	1.14	4030	4784	1.19	0.059
Swabi n.	3248	524	710	4482	3182	469	1013	4664	1.04	7742	8467	1.09	0.030

Source : 1) From "Summary of Traffic Data for Punjab Highways" in 1989 and 1992 by Punjab Highway Department
: 2) From "Summary of Traffic Data for NWFP Highways" in 1989 and 1992 by C & W Department of NWFP

Notes :
1. Motorized vehicles only.
2. Cars include pickups, wagons, minibuses, rikishaws/MC and buses include flying coaches. Trucks includes all trucks and others

Appendix Table 4.1.4 Updated Road Inventory Data (1/6)

August 1994

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	TYPE OF SURFACE	WIDTH m (Lanes)	PAVEMENT CONDITION	STANDARD CLASS
0	91	10 - 155	72	M	TST	6.0 (2)	4	4
0	91	11 - 20	32	F	AC	3.8 (1)	3	5
0	91	13 - 208	95	F	"	6.5 (2)	3	4
0	91	13 - 209	43	F	"	6.5 (2)	3	4
0	91	13 - 62	47	F	"	7.3 (2)	3	3
0	91	14 - 210	41	F	"	5.5 (2)	3	5
0	91	14 - 58	99	F	TST	5.0 (2)	4	5
0	91	14 - 58	47	F	TST	6.1 (2)	3	4
0	91	14 - 21	100	F	TST	3.8 (1)	3	5
0	91	15 - 16	82	F	"	7.3 (2)	3	3
0	91	15 - 215	38	F	"	6.0 (2)	3	4
0	91	15 - 64	37	F	"	7.3 (2)	3	3
0	91	16 - 66	32	F	"	6.0 (2)	3	4
0	91	16 - 13	117	F	"	6.1 (2)	4	4
0	91	16 - 64	82	F	TST	6.0 (2)	3	4
0	91	16 - 67	64	F	TST	4.0 (2)	4	5
0	91	17 - 18	38	F	AC	14.6 (4)	3	1
0	91	17 - 50	68	F	"	14.6 (4)	3	1
0	91	18 - 15	97	F	TST	7.5 (2)	3	2
0	91	18 - 63	70	F	"	7.3 (2)	3	3
0	91	18 - 19	53	F	"	7.3 (2)	3	3
0	91	19 - 20	48	F	"	5.0 (2)	3	5
0	91	20 - 61	42	F	"	5.7 (2)	3	5
0	91	20 - 247	64	F	TST	6.9 (2)	3	4
0	91	21 - 85	34	F	"	7.3 (2)	4	3
0	91	22 - 101	63	F	TST	6.1 (2)	3	4
0	91	22 - 23	34	F	"	6.5 (2)	4	4
0	91	22 - 100	60	F	TST	6.1 (2)	3	4
0	91	23 - 120	40	F	"	6.0 (2)	3	4
0	91	24 - 21	42	F	AC	3.8 (1)	2	4
0	91	25 - 78	91	F	"	4.5 (1)	4	5
0	91	25 - 26	242	F	AC	3.8 (1)	3	5
0	91	26 - 76	40	F	"	6.0 (2)	3	4
0	91	26 - 73	130	F	"	3.7 (1)	3	5
0	91	56 - 117	30	F	"	6.0 (2)	3	4
0	91	58 - 68	82	F	TST	5.5 (2)	3	5
0	91	58 - 56	87	F	TST	6.0 (2)	4	4
0	91	60 - 92	58	H	"	6.1 (2)	4	4
0	91	62 - 60	46	M	"	6.1 (2)	4	4
0	91	63 - 19	99	F	TST	6.6 (2)	4	4
0	91	64 - 13	52	F	"	6.5 (2)	3	4
0	91	64 - 63	33	F	TST	6.5 (2)	3	4
0	91	65 - 213	20	F	"	4.5 (1)	3	5
0	91	65 - 211	40	F	TST	6.1 (2)	4	4
0	91	66 - 65	94	F	"	3.8 (1)	3	5
0	91	66 - 62	138	F	"	4.1 (1)	2	5
0	91	67 - 15	40	F	"	6.5 (2)	3	4
0	91	67 - 70	48	F	TST	6.0 (2)	3	4
0	91	67 - 71	57	F	TST	6.0 (2)	3	4
0	91	67 - 24	80	F	TST	3.8 (1)	3	4
0	91	68 - 56	40	F	"	6.0 (2)	3	4
0	91	68 - 9	81	H	TST	3.8 (1)	3	5
0	91	69 - 71	25	F	"	6.0 (2)	3	4

Appendix Table 4.1.4 Updated Road Inventory Data (2/6)

August 1994

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	TYPE OF SURFACE	WIDTH m (Lanes)	PAVEMENT CONDITION	STANDARD CLASS
0	91	69 - 17	138	F	TST	6.0 (2)	3	4
0	91	70 - 16	51	F	TST	6.0 (2)	3	4
0	91	72 - 70	40	F	TST	6.0 (2)	3	4
0	91	73 - 69	24	F	TST	6.0 (2)	3	4
0	91	74 - 99	29	F	TST	6.0 (2)	4	4
0	91	75 - 16	34	F	"	5.5 (2)	3	5
0	91	76 - 24	46	F	"	6.1 (2)	3	4
0	91	76 - 216	32	F	"	6.0 (2)	3	4
0	91	77 - 78	50	F	"	6.0 (2)	3	4
0	91	77 - 98	35	F	"	6.0 (2)	3	4
0	91	77 - 12	99	F	AC	3.8 (1)	2	5
0	91	78 - 26	78	F	"	6.0 (2)	3	4
0	91	79 - 22	129	F	"	6.0 (2)	2	4
0	91	80 - 231	82	F	TST	6.1 (2)	4	4
0	91	85 - 22	23	F	"	6.5 (2)	4	4
0	91	85 - 99	50	F	TST	5.5 (2)	2	5
0	91	92 - 57	62	F	"	6.0 (2)	3	4
0	91	92 - 58	46	F	TST	6.9 (2)	4	4
0	91	93 - 92	68	F	TST	6.9 (2)	4	4
0	91	95 - 14	48	F	"	4.5 (1)	3	5
0	91	97 - 21	92	M	"	4.5 (1)	2	5
0	91	98 - 76	40	F	"	6.0 (2)	3	4
0	91	98 - 72	48	F	TST	6.0 (2)	3	4
0	91	99 - 214	8	F	TST	5.5 (2)	4	5
0	91	100 - 65	104	F	TST	6.1 (2)	3	4
0	91	100 - 10	31	F	TST	3.8 (2)	3	5
0	91	101 - 66	92	F	"	6.1 (2)	3	4
0	91	119 - 12	31	F	"	6.5 (2)	3	4
0	91	120 - 12	57	F	"	6.0 (2)	3	4
0	91	120 - 77	57	F	"	6.0 (2)	3	4
0	91	156 - 95	54	F	"	4.5 (1)	2	5
0	91	157 - 95	27	M	AC	3.8 (1)	4	5
0	91	158 - 68	38	F	TST	3.8 (1)	3	5
0	91	161 - 212	12	F	"	4.5 (1)	3	5
0	91	204 - 207	51	F	TST	6.0 (2)	3	4
0	91	205 - 92	91	F	AC	4.6 (1)	2	5
0	91	205 - 208	31	F	TST	6.0 (2)	2	4
0	91	206 - 12	37	F	"	6.5 (2)	3	4
0	91	206 - 19	69	F	TST	6.0 (2)	3	4
0	91	207 - 20	21	F	"	6.5 (2)	3	4
0	91	207 - 209	70	F	G	3.8 (1)	3	5
0	91	208 - 20	18	F	"	6.5 (2)	3	4
0	91	209 - 63	20	F	"	7.3 (2)	3	3
0	91	210 - 62	48	F	"	5.5 (2)	3	5
0	91	211 - 14	87	F	TST	6.1 (2)	4	4
0	91	211 - 210	125	F	AC	5.5 (2)	3	4
0	91	212 - 213	16	F	"	4.5 (1)	3	5
0	91	212 - 211	50	F	AC	5.5 (2)	3	4
0	91	213 - 214	118	F	TST	3.8 (1)	3	4
0	91	214 - 10	9	F	TST	3.8 (2)	4	5
0	91	215 - 17	100	F	"	6.0 (2)	3	4
0	91	215 - 71	62	F	AC	3.8 (1)	2	5
0	91	216 - 73	22	F	TST	6.0 (2)	3	4

Appendix Table 4.1.4 Updated Road Inventory Data (3/6)

August 1994

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	TYPE OF SURFACE	WIDTH m (Lanes)	PAVEMENT CONDITION	STANDARD CLASS
0	91	217 - 33	60	F	AC	3.8 (1)	3	5
0	91	247 - 17	83	F	TST	6.1 (2)	3	4
0	91	249 - 24	116	F	TST	5.2 (2)	3	5
0	92	30 - 83	135	F	AC	5.0 (1)	3	5
0	92	30 - 25	98	F	TST	4.0 (1)	4	5
0	92	31 - 103	16	F	AC	3.8 (1)	3	5
0	92	33 - 105	34	F	AC	7.3 (2)	3	3
0	92	33 - 107	34	F	AC	7.3 (2)	4	3
0	92	34 - 102	24	F	AC	5.5 (2)	4	5
0	92	36 - 106	68	F	AC	5.5 (2)	3	5
0	92	37 - 33	100	F	AC	7.3 (2)	3	3
0	92	38 - 109	81	F	AC	6.4 (2)	4	4
0	92	39 - 37	102	F	AC	7.3 (2)	3	3
0	92	81 - 82	31	F	AC	5.5 (2)	4	5
0	92	81 - 25	22	F	TST	6.0 (2)	3	4
0	92	83 - 84	76	F	AC	5.5 (2)	2	5
0	92	86 - 31	21	F	AC	7.3 (2)	4	3
0	92	87 - 104	26	M	AC	5.5 (2)	4	5
0	92	88 - 38	52	F	AC	6.3 (2)	4	4
0	92	103 - 3	48	F	AC	5.5 (2)	3	5
0	92	103 - 1	30	F	AC	3.8 (1)	2	5
0	92	104 - 2	41	F	AC	5.5 (2)	3	5
0	92	104 - 3	40	F	AC	5.5 (2)	3	5
0	92	105 - 1	32	F	AC	6.5 (2)	3	4
0	92	105 - 1	45	F	AC	5.0 (1)	4	5
0	92	106 - 3	74	F	AC	5.0 (2)	3	5
0	92	106 - 1	40	F	AC	5.5 (2)	4	5
0	92	107 - 8	16	F	AC	7.3 (2)	3	3
0	92	107 - 1	77	F	AC	6.4 (2)	4	4
0	92	108 - 8	26	F	AC	5.5 (2)	4	5
0	92	108 - 1	13	F	AC	5.5 (2)	4	5
0	92	109 - 3	24	F	AC	5.5 (2)	4	5
0	92	122 - 3	45	F	AC	5.5 (2)	4	5
0	92	203 - 220	80	M	TST	3.8 (1)	2	5
0	92	217 - 1	14	F	AC	5.5 (2)	3	5
0	92	250 - 122	92	F	TST	4.0 (1)	3	5
0	93	1 - 52	66	H	TST	5.5 (2)	2	5
0	93	1 - 115	46	F	DST	7.3 (2)	2	3
0	93	2 - 91	29	F	DST	7.3 (2)	3	3
0	93	2 - 1	80	F	DST	7.3 (2)	3	3
0	93	3 - 202	186	M	TST	6.0 (2)	3	4
0	93	3 - 158	50	F	DST	6.0 (2)	1	4
0	93	5 - 203	105	F	TST	3.8 (1)	2	4
0	93	6 - 203	150	H	TST	3.8 (1)	2	4
0	93	7 - 233	170	M	DST	6.0 (2)	3	4
0	93	7 - 234	81	M	DST	3.7 (1)	4	5
0	93	8 - 89	82	M	TST	3.8 (2)	3	5
0	93	52 - 2	132	M	DST	6.5 (2)	2	4
0	93	52 - 8	35	F	TST	6.0 (2)	2	4
0	93	53 - 1	23	F	TST	6.0 (2)	2	4
0	93	54 - 48	18	M	AC	3.8 (1)	3	4
0	93	59 - 156	39	H	DST	5.0 (1)	3	5
0	93	91 - 1	28	F	DST	7.3 (2)	2	3

Appendix Table 4.1.4 Updated Road Inventory Data (4/6)

August 1994

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	TYPE OF SURFACE	WIDTH m (Lanes)	PAVEMENT CONDITION	STANDARD CLASS
0	93	94 - 157	37	M	TST	3.8 (1)	2	5
0	93	115 - 90	88	M	DST	7.0 (2)	3	3
0	93	116 - 115	33	F	DST	6.0 (2)	3	4
0	93	155 - 4	55	M	TST	5.5 (2)	2	5
0	93	161 - 5	8	F	TST	5.5 (2)	2	5
0	93	230 - 7	73	M	DST	3.8 (1)	3	4
0	93	235 - 236	56	H	DST	6.1 (2)	3	4
0	94	40 - 2	182	M	G	3.8 (1)	4	5
0	94	41 - 4	189	F	TST	3.8 (1)	4	5
0	94	41 - 96	72	M	TST	3.8 (1)	4	5
0	94	43 - 223	100	H	G	3.8 (1)	4	5
0	94	45 - 22	17	H	G	3.8 (1)	3	5
0	94	45 - 43	135	H	G	3.8 (1)	4	5
0	94	111 - 46	230	F	G	3.8 (1)	3	5
0	94	111 - 113	115	F	AC	3.8 (1)	3	5
0	94	112 - 228	155	F	G	3.8 (1)	3	5
0	94	112 - 111	118	F	G	3.8 (1)	3	5
0	94	112 - 225	405	H	G	3.8 (1)	3	5
0	94	113 - 46	169	F	G	3.8 (1)	3	5
0	94	114 - 113	372	F	G	3.8 (1)	3	5
0	94	218 - 41	35	M	G	3.8 (1)	4	5
0	94	219 - 237	104	H	TST	3.8 (1)	3	5
0	94	220 - 219	97	M	G	3.8 (1)	3	5
0	94	222 - 97	255	H	G	3.8 (1)	3	5
0	94	224 - 110	78	H	G	3.8 (1)	3	5
0	94	225 - 224	47	H	G	3.8 (1)	3	5
0	94	225 - 226	26	M	G	3.8 (1)	3	5
0	94	226 - 228	166	M	G	3.8 (1)	3	5
0	94	226 - 227	61	M	G	3.8 (1)	3	5
0	94	227 - 256	72	H	DST	3.8 (1)	3	5
0	94	228 - 44	173	F	G	3.8 (1)	3	5
0	94	228 - 243	170	M	G	3.8 (1)	3	5
0	94	238 - 41	163	M	G	3.8 (1)	3	5
0	94	238 - 254	226	H	"	5.5 (2)	3	5
0	94	239 - 154	125	F	"	3.8 (1)	3	5
0	94	240 - 241	69	F	DST	3.8 (1)	3	5
0	94	241 - 43	175	H	G	3.8 (1)	4	5
0	94	241 - 227	100	H	DST	3.8 (1)	3	5
0	94	242 - 224	105	M	G	3.8 (1)	3	5
0	94	242 - 42	160	H	G	3.8 (1)	4	5
0	94	243 - 255	297	F	DST	3.8 (1)	3	5
0	94	243 - 244	83	F	DST	3.8 (1)	3	5
0	94	245 - 246	142	F	DST	3.8 (1)	3	5
0	94	246 - 46	128	F	DST	3.8 (1)	3	5
5	91	10 - 117	12	F	AC	15.1 (4)	1	1
5	91	11 - 204	24	F	TST	8.4 (2)	2	3
5	91	11 - 93	40	H	"	8.4 (2)	3	3
5	91	17 - 19	73	F	"	15.0 (4)	3	1
5	91	19 - 61	39	F	TST/AC	8.0 (2)	4	3
5	91	23 - 75	29	F	"	6.4 (2)	2	4
5	91	24 - 71	34	F	AC	7.6 (2)	3	2
5	91	25 - 121	20	F	"	6.8 (2)	3	4
5	91	27 - 79	101	F	"	6.7 (2)	3	4

Appendix Table 4.1.4 Updated Road Inventory Data (5/6)

August 1994

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	TYPE OF SURFACE	WIDTH m (Lanes)	PAVEMENT CONDITION	STANDARD CLASS
5	91	55 - 9	44	H	TST	7.4 (2)	3	2
5	91	57 - 10	31	F	"	7.3 (2)	4	4
5	91	61 - 12	11	F	"	7.1 (2)	4	4
5	91	71 - 17	111	F	"	7.4 (2)	3	2
5	91	72 - 24	42	F	"	13.8 (4)	3	1
5	91	75 - 119	14	F	"	6.3 (2)	2	4
5	91	79 - 80	13	F	"	6.4 (2)	3	4
5	91	80 - 25	71	F	"	6.4 (2)	3	4
5	91	93 - 57	33	H	"	7.5 (2)	4	3
5	91	117 - 55	37	F	"	15.1 (4)	3	1
5	91	119 - 72	80	F	TST/AC	14.0 (4)	3	1
5	91	121 - 23	75	F	"	6.3 (2)	3	4
5	91	150 - 27	48	F	TST	6.4 (2)	2	4
5	91	204 - 12	38	F	"	8.2 (2)	3	3
5	92	29 - 82	112	F	TST	7.3 (2)	3	3
5	92	32 - 29	25	F	AC	7.4 (2)	3	3
5	92	33 - 87	46	F	AC	15.0 (4)	1	1
5	92	39 - 118	150	F	AC	14.8 (4)	1	1
5	92	82 - 150	13	F	TST	7.3 (2)	3	3
5	92	86 - 102	70	F	AC	7.4 (2)	3	3
5	92	87 - 86	39	F	AC	7.5 (2)	2	3
5	92	102 - 32	137	F	AC	7.3 (2)	3	3
5	92	118 - 33	15	F	AC	14.8 (4)	1	1
5	93	2 - 201	53	M	TST	7.4 (2)	3	3
5	93	9 - 116	9	F	AC	7.4 (2)	3	3
5	93	53 - 2	35	F	AC	14.8 (4)	2	1
5	93	116 - 5	22	F	AC	7.3 (2)	2	3
25	92	39 - 151	23	F	TST	7.3 (2)	3	3
25	94	40 - 2	130	H	TST	6.0 (2)	2	4
25	94	43 - 4	145	H	TST	5.3 (1)	2	5
25	94	44 - 2	196	M	TST	3.6 (2)	2	5
25	94	110 - 43	69	F	TST	3.5 (1)	3	5
25	94	114 - 44	76	F	TST	6.1 (2)	2	4
25	94	151 - 114	77	F	TST	6.1 (2)	2	4
25	94	227 - 110	104	M	TST	3.7 (2)	1	5
35	91	55 - 152	14	F	AC	7.3 (2)	1	2
35	93	4 - 54	24	M	AC	7.3 (2)	1	3
35	93	54 - 89	122	M	TST	7.3 (2)	3	3
35	93	89 - 229	157	M	TST	7.3 (2)	3	3
35	93	90 - 4	47	M	AC	7.3 (2)	2	3
35	93	152 - 90	19	H	TST	7.3 (2)	1	3
40	94	42 - 2	181	H	TST	3.7 (1)	1	5
40	94	42 - 5	365	F	TST	3.7 (1)	2	5
40	94	223 - 40	129	H	TST	3.6 (1)	4	5
50	93	5 - 153	90	H	TST	6.4 (2)	1	4
50	94	96 - 2	139	M	TST	3.8 (1)	3	5
50	94	96 - 4	175	F	TST	4.2 (1)	3	5
50	94	219 - 153	70	F	TST	3.6 (1)	3	5
55	91	21 - 74	51	F	"	4.9 (1)	3	5
55	91	74 - 160	106	F	"	3.6 (1)	3	5
55	91	156 - 231	109	F	"	3.8 (1)	3	5
55	91	231 - 21	109	F	"	6.3 (1)	2	4
55	92	28 - 84	64	F	TST	4.3 (1)	3	5

Appendix Table 4.1.4 Updated Road Inventory Data (6/6)

August 1994

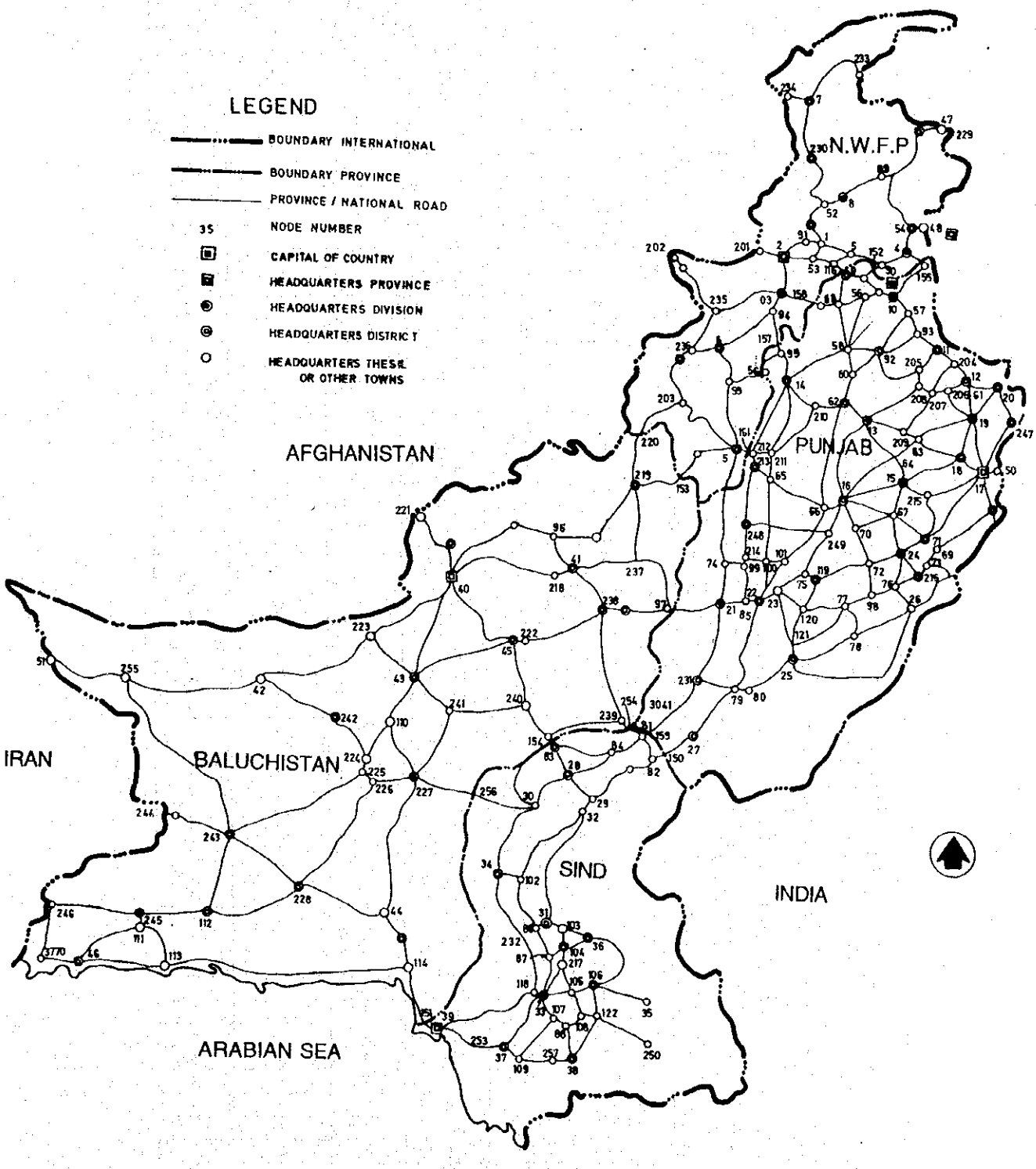
ROAD NO.	PROVIN-CIAL NO	NODE NO.	DISTANCE (Km)	TERRAIN	TYPE OF SURFACE	WIDTH m (Lanes)	PAVEMENT CONDITION	STANDARD CLASS
55	92	30 - 28	62	F	TST	3.7 (1)	2	5
55	92	34 - 30	119	F	TST	3.8 (1)	2	5
55	92	81 - 159	2	F	TST	4.3 (1)	3	5
55	92	84 - 81	47	F	TST	4.4 (1)	3	5
55	92	118 - 232	30	F	TST	4.8 (1)	3	5
55	92	232 - 34	165	F	TST	4.1 (1)	4	5
55	93	3 - 2	64	M	AC	7.3 (2)	3	3
55	93	5 - 59	94	F	TST	6.3 (2)	3	4
55	93	6 - 94	96	H	TST	6.5 (2)	3	4
55	93	59 - 6	47	F	TST	6.8 (2)	2	4
55	93	94 - 3	29	F	TST	7.1 (2)	3	4
55	93	160 - 5	51	F	TST	6.5 (2)	4	4
65	92	28 - 83	42	F	TST	7.2 (2)	2	4
65	92	29 - 28	31	F	TST	7.1 (2)	2	4
65	92	83 - 154	11	F	TST	6.2 (2)	2	4
65	94	45 - 4	148	M	TST	6.4 (2)	2	4
65	94	154 - 45	147	F	TST	6.5 (2)	3	4

Source : JICA Study Team, 1994, which edited in
Survey data from NHA and Baluchistan provinces.
Node number is in Appendix Figure 4.1.4.

Legend :

PROV. NO 91 : Punjab
92 : Sind
93 : NWFP
94 : Balochistan

Appendix Fugure 4.1.4 Node / Link Number to Use For Road Inventory Data



Appendix 4.1.5 Highway / Road Section to be Standardized (1/6)

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	EXISTING		PROPOSED	
					WIDTH m (Lanes)	DESIGN CLASS	FUNCTION CLASS	DESIGN CLASS
0	91	10 - 155	72	M	6.0 (2)	4	2	2
0	91	11 - 205	32	F	3.8 (1)	5	4	4
0	91	13 - 208	95	F	6.5 (2)	4	3	3
0	91	13 - 209	43	F	6.5 (2)	4	3	3
0	91	13 - 62	47	F	7.3 (2)	3	3	3
0	91	14 - 210	41	F	5.5 (2)	5	3	3
0	91	14 - 58	99	F	5.0 (2)	5	3	3
0	91	14 - 58	47	F	6.1 (2)	4	3	3
0	91	14 - 212	100	F	3.8 (1)	5	4	4
0	91	15 - 16	82	F	7.3 (2)	3	3	3
0	91	15 - 215	38	F	6.0 (2)	4	4	4
0	91	15 - 64	37	F	7.3 (2)	3	3	3
0	91	16 - 66	32	F	6.0 (2)	4	3	3
0	91	16 - 13	117	F	6.1 (2)	4	2	2
0	91	16 - 64	82	F	6.0 (2)	4	3	3
0	91	16 - 67	64	F	4.0 (2)	5	3	3
0	91	17 - 18	38	F	14.6 (4)	1	3	1
0	91	17 - 50	68	F	14.6 (4)	1	3	1
0	91	18 - 15	97	F	7.5 (2)	2	3	2
0	91	18 - 63	70	F	7.3 (2)	3	3	3
0	91	18 - 19	53	F	7.3 (2)	3	4	3
0	91	19 - 20	48	F	5.0 (2)	5	3	3
0	91	20 - 61	42	F	5.7 (2)	5	4	4
0	91	20 - 247	64	F	6.9 (2)	4	3	3
0	91	21 - 85	34	F	7.3 (2)	3	2	2
0	91	22 - 101	63	F	6.1 (2)	4	3	3
0	91	22 - 23	34	F	6.5 (2)	4	2	2
0	91	22 - 100	60	F	6.1 (2)	4	3	3
0	91	23 - 120	40	F	6.0 (2)	4	3	3
0	91	24 - 216	42	F	3.8 (1)	4	3	3
0	91	25 - 78	91	F	4.5 (1)	5	3	3
0	91	25 - 26	242	F	3.8 (1)	5	4	4
0	91	26 - 76	40	F	6.0 (2)	4	3	3
0	91	26 - 73	130	F	3.7 (1)	5	4	4
0	91	56 - 117	30	F	6.0 (2)	4	3	3
0	91	58 - 68	82	F	5.5 (2)	5	3	3
0	91	58 - 56	87	F	6.0 (2)	4	3	3
0	91	60 - 92	58	H	6.1 (2)	4	3	3
0	91	62 - 60	46	M	6.1 (2)	4	3	3
0	91	63 - 19	99	F	6.6 (2)	4	3	3
0	91	64 - 13	52	F	6.5 (2)	4	3	3
0	91	64 - 63	33	F	6.5 (2)	4	3	3
0	91	65 - 213	20	F	4.5 (1)	5	3	3
0	91	65 - 211	40	F	6.1 (2)	4	3	3
0	91	66 - 65	94	F	3.8 (1)	5	3	3
0	91	66 - 62	138	F	4.1 (1)	5	3	3
0	91	67 - 15	40	F	6.5 (2)	4	3	3
0	91	67 - 70	48	F	6.0 (2)	4	4	4
0	91	67 - 71	57	F	6.0 (2)	4	3	4
0	91	67 - 24	80	F	3.8 (1)	4	3	3
0	91	68 - 56	40	F	6.0 (2)	4	4	4
0	91	68 - 9	81	H	3.8 (1)	5	3	3
0	91	69 - 71	25	F	6.0 (2)	4	3	3
0	91	69 - 17	138	F	6.0 (2)	4	3	3

Appendix 4.1.5 Highway / Road Section to be Standardized (2/6)

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	EXISTING		PROPOSED	
					WIDTH m (Lanes)	DESIGN CLASS	FUNCTION CLASS	DESIGN CLASS
0	91	70 - 16	51	F	6.0 (2)	4	3	3
0	91	72 - 70	40	F	6.0 (2)	4	3	3
0	91	73 - 69	24	F	6.0 (2)	4	3	3
0	91	74 - 99	29	F	6.0 (2)	4	4	4
0	91	75 - 16	34	F	5.5 (2)	5	2	2
0	91	76 - 24	46	F	6.1 (2)	4	4	4
0	91	76 - 216	32	F	6.0 (2)	4	3	3
0	91	77 - 78	50	F	6.0 (2)	4	4	4
0	91	77 - 98	35	F	6.0 (2)	4	3	3
0	91	77 - 121	99	F	3.8 (1)	5	3	4
0	91	78 - 26	78	F	6.0 (2)	4	3	3
0	91	79 - 22	129	F	6.0 (2)	4	3	3
0	91	80 - 231	82	F	6.1 (2)	4	4	4
0	91	85 - 22	23	F	6.5 (2)	4	2	2
0	91	85 - 99	50	F	5.5 (2)	5	4	4
0	91	92 - 57	62	F	6.0 (2)	4	3	3
0	91	92 - 58	46	F	6.9 (2)	4	3	3
0	91	93 - 92	68	F	6.9 (2)	4	3	3
0	91	95 - 14	48	F	4.5 (1)	5	3	3
0	91	98 - 76	40	F	6.0 (2)	4	3	3
0	91	98 - 72	48	F	6.0 (2)	4	3	3
0	91	99 - 214	8	F	5.5 (2)	5	4	4
0	91	100 - 65	104	F	6.1 (2)	4	3	3
0	91	100 - 101	31	F	3.8 (2)	5	4	4
0	91	101 - 66	92	F	6.1 (2)	4	3	3
0	91	119 - 120	31	F	6.8 (2)	4	4	4
0	91	120 - 121	57	F	6.0 (2)	4	4	4
0	91	120 - 77	57	F	6.0 (2)	4	3	3
0	91	156 - 95	54	F	4.5 (1)	5	3	3
0	91	157 - 95	27	M	3.8 (1)	5	4	4
0	91	158 - 68	38	F	3.8 (1)	5	4	4
0	91	161 - 212	12	F	4.5 (1)	5	4	4
0	91	204 - 207	51	F	6.0 (2)	4	4	4
0	91	205 - 92	91	F	4.6 (1)	5	4	4
0	91	205 - 208	31	F	6.0 (2)	4	4	4
0	91	206 - 12	37	F	6.5 (2)	4	3	3
0	91	206 - 19	69	F	6.0 (2)	4	4	4
0	91	207 - 206	21	F	6.5 (2)	4	3	3
0	91	207 - 209	70	F	3.8 (1)	5	4	4
0	91	208 - 207	18	F	6.5 (2)	4	3	3
0	91	209 - 63	20	F	7.3 (2)	3	3	3
0	91	210 - 62	48	F	5.5 (2)	5	3	3
0	91	211 - 14	87	F	6.1 (2)	4	3	3
0	91	211 - 210	125	F	5.5 (2)	4	4	4
0	91	212 - 213	16	F	4.5 (1)	5	4	4
0	91	212 - 211	50	F	5.5 (2)	4	4	4
0	91	213 - 214	118	F	3.8 (1)	4	4	4
0	91	214 - 100	9	F	3.8 (2)	5	4	4
0	91	215 - 17	100	F	6.0 (2)	4	4	4
0	91	215 - 71	62	F	3.8 (1)	5	4	4
0	91	216 - 73	22	F	6.0 (2)	4	3	3
0	91	217 - 33	60	F	3.8 (1)	5	4	4
0	91	247 - 17	83	F	6.1 (2)	4	3	3
0	91	249 - 248	116	F	5.2 (2)	5	3	3

Appendix 4.1.5 Highway / Road Section to be Standardized (3/6)

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	EXISTING		PROPOSED	
					WIDTH m (Lanes)	DESIGN CLASS	FUNCTION CLASS	DESIGN CLASS
0	92	30 - 83	135	F	5.0 (1)	5	4	4
0	92	30 - 256	98	F	4.0 (1)	5	4	4
0	92	31 - 103	16	F	3.8 (1)	5	3	3
0	92	33 - 105	34	F	7.3 (2)	3	3	3
0	92	33 - 107	34	F	7.3 (2)	3	3	3
0	92	34 - 102	24	F	5.5 (2)	5	4	4
0	92	36 - 106	68	F	5.5 (2)	5	3	3
0	92	37 - 33	100	F	7.3 (2)	3	3	3
0	92	38 - 109	81	F	6.4 (2)	4	3	3
0	92	39 - 37	102	F	7.3 (2)	3	3	3
0	92	81 - 82	31	F	5.5 (2)	5	4	4
0	92	81 - 254	22	F	6.0 (2)	4	4	4
0	92	83 - 84	76	F	5.5 (2)	5	4	4
0	92	86 - 31	21	F	7.3 (2)	3	3	3
0	92	87 - 104	26	M	5.5 (2)	5	4	4
0	92	88 - 38	52	F	6.3 (2)	4	3	3
0	92	103 - 36	48	F	5.5 (2)	5	3	3
0	92	103 - 104	30	F	3.8 (1)	5	4	4
0	92	104 - 217	41	F	5.5 (2)	5	4	4
0	92	104 - 36	40	F	5.5 (2)	5	4	4
0	92	105 - 106	32	F	6.5 (2)	4	3	3
0	92	105 - 108	45	F	5.0 (1)	5	4	4
0	92	106 - 35	74	F	5.0 (2)	5	4	4
0	92	106 - 122	40	F	5.5 (2)	5	4	4
0	92	107 - 88	16	F	7.3 (2)	3	3	3
0	92	107 - 109	77	F	6.4 (2)	4	4	4
0	92	108 - 88	26	F	5.5 (2)	5	4	4
0	92	108 - 122	13	F	5.5 (2)	5	4	4
0	92	109 - 37	24	F	5.5 (2)	5	3	3
0	92	122 - 38	45	F	5.5 (2)	5	4	4
0	92	203 - 220	80	M	3.8 (1)	5	4	4
0	92	217 - 105	14	F	5.5 (2)	5	4	4
0	92	250 - 122	92	F	4.0 (1)	5	4	4
0	93	1 - 52	66	H	5.5 (2)	5	3	3
0	93	1 - 115	46	F	7.3 (2)	3	4	3
0	93	2 - 91	29	F	7.3 (2)	3	3	3
0	93	3 - 202	186	M	6.0 (2)	4	4	4
0	93	3 - 158	50	F	6.0 (2)	4	4	4
0	93	5 - 203	105	F	3.8 (1)	4	4	4
0	93	6 - 203	150	H	3.8 (1)	4	3	4
0	93	7 - 233	170	M	6.0 (2)	4	4	4
0	93	7 - 234	81	M	3.7 (1)	5	4	4
0	93	8 - 89	82	M	3.8 (2)	5	4	4
0	93	52 - 230	132	M	6.5 (2)	4	3	3
0	93	52 - 8	35	F	6.0 (2)	4	4	4
0	93	53 - 1	23	F	6.0 (2)	4	3	3
0	93	54 - 48	18	M	3.8 (1)	4	4	4
0	93	59 - 156	39	H	5.0 (1)	5	3	3
0	93	91 - 1	28	F	7.3 (2)	3	4	3
0	93	94 - 157	37	M	3.8 (1)	5	4	4
0	93	115 - 90	88	M	7.0 (2)	3	4	3
0	93	116 - 115	33	F	6.0 (2)	4	4	4
0	93	155 - 4	55	M	5.5 (2)	5	4	4
0	93	161 - 5	8	F	5.5 (2)	5	2	4

Appendix 4.1.5 Highway / Road Section to be Standardized (4/6)

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	EXISTING		PROPOSED	
					WIDTH m (Lanes)	DESIGN CLASS	FUNCTION CLASS	DESIGN CLASS
0	93	230 - 7	73	M	3.8 (1)	4	4	3
0	93	235 - 236	56	H	6.1 (2)	4	4	4
0	94	40 - 218	182	M	3.8 (1)	5	4	4
0	94	41 - 96	72	M	3.8 (1)	5	4	4
0	94	43 - 223	100	H	3.8 (1)	5	4	5
0	94	45 - 222	17	H	3.8 (1)	5	4	4
0	94	45 - 43	135	H	3.8 (1)	5	4	5
0	94	111 - 46	230	F	3.8 (1)	5	4	4
0	94	111 - 113	115	F	3.8 (1)	5	4	4
0	94	112 - 228	155	F	3.8 (1)	5	4	4
0	94	112 - 111	118	F	3.8 (1)	5	4	4
0	94	112 - 225	405	H	3.8 (1)	5	4	5
0	94	113 - 46	169	F	3.8 (1)	5	4	4
0	94	114 - 113	372	F	3.8 (1)	5	4	4
0	94	218 - 41	35	M	3.8 (1)	5	4	4
0	94	219 - 237	104	H	3.8 (1)	5	4	5
0	94	220 - 219	97	M	3.8 (1)	5	4	4
0	94	222 - 97	255	H	3.8 (1)	5	4	4
0	94	224 - 110	78	H	3.8 (1)	5	4	5
0	94	225 - 224	47	H	3.8 (1)	5	4	5
0	94	225 - 226	26	M	3.8 (1)	5	4	5
0	94	226 - 228	166	M	3.8 (1)	5	4	4
0	94	226 - 227	61	M	3.8 (1)	5	4	4
0	94	227 - 256	72	H	3.8 (1)	5	4	4
0	94	228 - 44	173	F	3.8 (1)	5	4	5
0	94	228 - 243	170	M	3.8 (1)	5	4	5
0	94	238 - 41	163	M	3.8 (1)	5	4	5
0	94	238 - 254	226	H	5.5 (2)	5	4	5
0	94	239 - 154	125	F	3.8 (1)	5	4	5
0	94	240 - 241	69	F	3.8 (1)	5	4	5
0	94	241 - 43	175	H	3.8 (1)	5	4	5
0	94	241 - 227	100	H	3.8 (1)	5	4	5
0	94	242 - 224	105	M	3.8 (1)	5	4	5
0	94	242 - 42	160	H	3.8 (1)	5	4	5
0	94	243 - 255	297	F	3.8 (1)	5	4	5
0	94	243 - 244	83	F	3.8 (1)	5	4	5
0	94	245 - 246	142	F	3.8 (1)	5	4	5
0	94	246 - 46	128	F	3.8 (1)	5	4	5
5	91	10 - 117	12	F	15.1 (4)	1	2	1
5	91	11 - 204	24	F	8.4 (2)	3	2	1
5	91	11 - 93	40	H	8.4 (2)	3	2	1
5	91	17 - 19	73	F	15.0 (4)	1	2	1
5	91	19 - 61	39	F	8.0 (2)	3	2	1
5	91	23 - 75	29	F	6.4 (2)	4	2	1
5	91	24 - 71	34	F	7.6 (2)	2	2	1
5	91	25 - 121	20	F	6.8 (2)	4	2	1
5	91	27 - 79	101	F	6.7 (2)	4	2	1
5	91	55 - 9	44	H	7.4 (2)	2	2	1
5	91	57 - 10	31	F	7.3 (2)	4	2	1
5	91	61 - 12	11	F	7.1 (2)	4	2	1
5	91	71 - 17	111	F	7.4 (2)	2	2	1
5	91	72 - 24	42	F	13.8 (4)	1	2	1
5	91	75 - 119	14	F	6.3 (2)	4	2	1
5	91	79 - 80	13	F	6.4 (2)	4	2	1

Appendix 4.1.5 Highway / Road Section to be Standardized (5/6)

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	EXISTING		PROPOSED	
					WIDTH m (Lanes)	DESIGN CLASS	FUNCTION CLASS	DESIGN CLASS
5	91	80 - 25	71	F	6.4 (2)	4	2	1
5	91	93 - 57	33	H	7.5 (2)	3	2	1
5	91	117 - 55	37	F	15.1 (4)	1	2	1
5	91	119 - 72	80	F	14.0 (4)	1	2	1
5	91	121 - 23	75	F	6.3 (2)	4	2	1
5	91	150 - 27	48	F	6.4 (2)	4	2	1
5	91	204 - 12	38	F	8.2 (2)	3	2	1
5	92	29 - 82	112	F	7.3 (2)	3	2	1
5	92	32 - 29	25	F	7.4 (2)	3	2	1
5	92	33 - 87	46	F	15.0 (4)	1	2	1
5	92	39 - 118	150	F	14.8 (4)	1	2	1
5	92	82 - 150	13	F	7.3 (2)	3	2	1
5	92	86 - 102	70	F	7.4 (2)	3	2	1
5	92	87 - 86	39	F	7.5 (2)	3	2	1
5	92	102 - 32	137	F	7.3 (2)	3	2	1
5	92	118 - 33	15	F	14.8 (4)	1	2	1
5	93	2 - 201	53	M	7.4 (2)	3	2	1
5	93	9 - 116	9	F	7.4 (2)	3	2	1
5	93	53 - 2	35	F	14.0 (4)	1	2	1
5	93	116 - 53	22	F	7.3 (2)	3	2	1
25	94	40 - 221	130	H	6.0 (2)	4	2	2
25	94	43 - 40	145	H	5.3 (1)	5	2	2
25	94	44 - 227	196	M	3.6 (2)	5	2	2
25	94	110 - 43	69	F	3.5 (1)	5	2	2
25	94	114 - 44	76	F	6.1 (2)	4	2	2
25	94	151 - 114	77	F	6.1 (2)	4	2	2
25	94	227 - 110	104	M	3.7 (2)	5	2	2
35	91	55 - 152	14	F	7.3 (2)	2	2	2
35	92	39 - 151	23	F	7.3 (2)	3	2	3
35	93	4 - 54	24	M	7.3 (2)	3	2	3
35	93	54 - 89	122	M	7.3 (2)	3	2	2
35	93	89 - 229	157	M	7.3 (2)	3	2	2
35	93	90 - 4	47	M	7.3 (2)	3	2	3
35	93	152 - 90	19	H	7.3 (2)	3	2	3
40	94	42 - 223	181	H	3.7 (1)	5	2	2
40	94	42 - 51	365	F	3.7 (1)	5	2	2
40	94	223 - 40	129	H	3.6 (1)	5	2	2
50	93	5 - 153	90	H	6.4 (2)	4	2	2
50	94	96 - 219	139	M	3.8 (1)	5	2	2
50	94	96 - 40	175	F	4.2 (1)	5	2	2
50	94	219 - 153	70	F	3.6 (1)	5	2	2
55	91	21 - 74	51	F	4.9 (1)	5	2	2
55	91	74 - 160	106	F	3.6 (1)	5	2	2
55	91	156 - 231	109	F	3.8 (1)	5	2	2
55	91	231 - 21	109	F	6.3 (2)	4	2	2
55	92	28 - 84	64	F	4.3 (1)	5	2	2
55	92	30 - 28	62	F	3.7 (1)	5	2	2
55	92	34 - 30	119	F	3.8 (1)	5	2	2
55	92	81 - 159	2	F	4.3 (1)	5	2	2
55	92	84 - 81	47	F	4.4 (1)	5	2	2
55	92	118 - 232	30	F	4.8 (1)	5	2	2
55	92	232 - 34	165	F	4.1 (1)	5	2	2
55	93	3 - 2	64	M	7.3 (2)	3	2	2
55	93	5 - 59	94	F	6.3 (2)	4	2	2

Appendix 4.1.5 Highway / Road Section to be Standardized (6/6)

ROAD NO.	PROVIN-CIAL NO.	NODE NO.	DISTANCE (Km)	TERRAIN	EXISTING		PROPOSED	
					WIDTH m (Lanes)	DESIGN CLASS	FUNCTION CLASS	DESIGN CLASS
55	93	6 - 94	96	H	6.5 (2)	4	2	2
55	93	59 - 6	47	F	6.8 (2)	4	2	2
55	93	94 - 3	29	F	7.1 (2)	4	2	2
55	93	160 - 5	51	F	6.5 (2)	4	2	2
65	92	28 - 83	42	F	7.2 (2)	4	2	3
65	92	29 - 28	31	F	7.1 (2)	4	2	3
65	92	83 - 154	11	F	6.2 (2)	4	2	3
65	94	45 - 40	148	M	6.4 (2)	4	2	2
65	94	154 - 45	147	F	6.5 (2)	4	2	2
70	91	97 - 21	92	M	4.5 (1)	5	2	2
70	94	41 - 47	189	F	3.8 (1)	5	2	2

Source : JICA Study Team, 1994, which edited in
Survey data from NHA and Highway Department of C&D in Punjab, NWFP, Sind and Baluchistan provinces.
Node nember is in Appendix Figure 4.1.4.

Legend :

PROV. NO 91 : Punjab
92 : Sind
93 : NWFP
94 : Baluchistan

ROAD NO. 0 : Provincial Road, 5 - 70 : National Highways

Appendix Table 4.2.1 Road Standards (Draft)

	Lanes number	Design speed	Planning guideline '(Traffic) pcu/day	Level service	Car'age -way,m	Lane m	Shoulder m each	Formation m	ROW m	Type of pavement
Motor-way	4	F 120 H 110 M 90	80,000	C(0.7)	7.3	3.65	3	29.6	63	AC or PC
P-1	4	F 110 H 100 M 80	60,000	C(0.7)	7.3	3.65	3	27.6	63	AC
P-2	2	F 100 H 80 M 60	34,000	C(0.7)	7.3	3.65	3	15.3	63	AC
P-3	2	F 100 H 80 M 60	24,000	C(0.7)	7.3	3.65	3	15.3	63	AC/ TST
Secondary	2	F 80 H 60 M 50	20,000	C(0.7)	6.0	3.00	3	14.0	33	AC/ TST
Tertiary	1	F 65 H 50 M 35	3,500	D(0.85)	3.65	3.65	2	9.7	25	TST/ ST

Notes: Guideline factors of average passenger car equivalents of trucks and buses are as follows [(3) Adjustment Factors in Appendix, Highway Vapacity Mannual, 1985]

Flat area 3.0 Hilly area 4.0 Mount. area 6.0

Abbreviation
F: Flat area
H: Hilly area
M: Mountainous area
ROW: Right of way
AC: Asphalt concrete
PC: Portland cement
TST: Triple surface treatment
ST: Single surface treatment

Source: Standards for Roads in Pakistan (NHA's Committee, 1992)

Appendix Note 4.2.1 Traffic Capacity

- comparison with the previous studies -

(1) General

In Pakistan road capacity is estimated by applying the method in AASHTO's Highway Capacity Manual (TRB, 1985), where different Pakistanese characteristics from the USA have been taken into consideration. However there is no common or explicit capacity standard table to be used in planning studies such as this JICA study 1994. In the previous National Transport Study (JICA, 1988) a table of standard road capacity was proposed which would be used in various agencies in the country. National Highway Authority has been examining basic road standards by classifying roads into several classes in 1992 being shown in Appendix Table 4.2.1, but they have not finalized yet the determination of factors of capacity calculation. Meanwhile NTRC has studied the road capacity analysis in the past of which an example is "Planning Standards for Roads in Pakistan (NTRC-157, 1992).

Since the start of this National Transport Planning Study in February 1994 discussions have been held with persons concerned in NHA, NTRC and Provincial C&Ws to make up a table showing basic capacities for different width roads. The following Appendix Table 4.2.a is the summary of those capacity by road class followed by the calculation process of capacities.

Appendix Table 4.2.a Standard Road Capacity

(in pcu)

Roads	Lane No.	vol/lane 1)both wys.	vi/hr	vol/day
■ Mway, Acs. Cotr	4 lanes	1,488	5,950	86,000
1 highway	4 lanes	1,313	5,250	75,000
2 highway, div	2 lanes	672	1,343	19,000
3 highway undiv	2 lanes	564	1,128	16,000
4 highway undiv	2 lanes	517	1,034	15,000
5 highway undiv	2 lanes	436	873	13,000
6 highway	1 lanes	-	224	3,200

JICA study team,1994

It should be noted that above analysis is applicable to intercity roads. When roads to be studied are in urban areas, different values should be applied for parameters such as fE, fP, etc. after checking local conditions and traffic data.

(2) Comparative Study of Road Capacity

Road capacity has been studied in association with road development plans in Pakistan, from which three examples are found as described above. All were based on the HCM'85, but had minor different factoring figures. Through discussions in the following, it is found a few modifications are considered better to add in as shown in the column 'JICA study 1994' with which typical capacity volume by road classified by width is proposed. The capacities are utilized in traffic assignment calculations, and also incorporated in a basic geometric road standard table in 4.2 of Chapter 4 in the main text. Of those examples, two are added in this discussion as under.

1) Basic Capacity

Basic capacity means the capacity under ideal conditions for highway elements and defined ere as : -

* Design speed more than 80/100 kmph (50/60mph) and free to pass over
* Flat terrain and rural area
* No traffic frictions due to turning movements
* 12 ft (3.7 m) width per lane and lateral clearance more than 6 ft (1.8 m)
* A 50/50 directional ratio of flows
* Good surface and shoulder conditions
* Capacity is by pcu per hour

Basic capacity

		JICA study'88	NTRC'92	JICA study'94
Multi-lane pcu/h per lane	C =	2500	2500	2500
Two-lane pcu/h per both Dirs.	=	2800	2800	2800

2) Capacity Equations

As shown below, the service flow rate SFi in terms of pcu per hour under a service level 'i' is tabulated, calculated to a full hourly volume 'vi', and converted to a full daily capacity in the total of both directions of the road 'CAPAi', using the methodology in HCM'85.

2.1 Multi-lane highways, divided

$SFi = C * (v/c)i * N * fW * fHV * fE * fP * fsl$
$vi = SFi * phf$
$CAPAi = vi * 1.00/k$ in both ways in total & pcu/day

2.2 Two-lane highways, undivided

$SFi = C * (v/c)i * fW * fHV * fD * fE * fsl$
$Vi = SFi * phf$
$CAPAi = vi * 1.00/k$ in both ways in total & pcu/day

2.3 Where:

Sfi : Service flow rate for service level i
C : Basic capacity per hour in pcu
(v/c)i : Service level i; here in this study, 0.70 is used for multi-lane roads and two lane roads. 0.84 is for a single lane road in both Dirs.

N : Number of lanes
fW : A factor for lane width and/or lateral clearance
fHV : A factor for the presence of heavy vehicles
Here traffic volumes are all converted to pcu. fHV = 1.0. fHV by traffic mix is not used since the mix varies section to section.
fE : An adjustment factor for development environs and type of multi-lane highways.
fP : A factor for driver population
fsl : A factor for influence of slow moving vehicles. Traffic count data on national highways and provincial highways are studied. In urban areas those slow moving traffic are substantial in number, but in rural areas they are not same as in urban areas. A factoring figures are decided by reviewing those data. Multi-lane national highways (N-5) 0.97, and other national and provincial highways 0.90.
vi : Maximum hourly volume under service level i
phf : Peak hour factor.
K : Design hour factor (30th hourly volume/ AADT). It is called as peak hour ratio in ADT, 7 % is used. In the NTRC-157 a review on hourly changes was conducted through which 0.07 was determined and the same figure is used.

CAPAi : capacity per day in both directions in pcu

pcu : In converting the traffic volume by OD trip tables and counting data, the followings are used.
M/C = 0.33 car = 1.00 wagon = 1.50 bus = 3.00
truck = 3.20 (pedal cycle = 0.22, animal cart = 6.00)

3) Parameters of the Equations

3.1 Multi-lane highways

Factor	JICA study' 88	NTRC' 92	JICA study' 94	Notes
C	2,500	2,500	2,500	
(v/c)i	0.7	0.7	0.7	
N	4	4	4	
fW	1.0	1.0	1.0	
fHV	traffic are converted to pcu, fHV = 1.0, otherwise it depends on traffic mix on the section.			
fE	0.9	0.9	0.9	
fP	1.0	0.95	0.95	
fsl	1.0	1.0	0.97	
phf	1.0	0.9	0.9	
K	0.07	0.07	0.07	
CAPAi	90000	77000	75000	in total of divided 4 lanes road

3.2 Two-lane highways

Factor		JICA syudy' 88	NTRC' 92	JICA study' 94	Notes
C		2,800	2,800	2,800	
(v/c)i		0.7	0.7	0.7	
fW		1.0-0.84	1.0-0.65	1.0-0.65	
fHV		traffic are converted to pcu, fHV = 1.0, othewise it depends on traffic mix on the section.			
fD		0.94	1.0	0.94	
fE		0.9	1.0	0.9	
fsl		1.0	1.0	0.9	
phf		1.0	0.9	0.9	
K		0.07	0.07	0.07	
CAPAi	1	24,000	28,000	19,000	fW = 1.0
	2	20,000	24,000	16,000	fW = 0.84
	3	18,000	22,000	15,000	fW = 0.77
	4	-	-	12,000	fW = 0.65

3.3 Single-lane highways

There is no equations and parameters for the calculation of a one-lane road in HCM'85. The JICA study'88 determined the parameters by studying available traffic data. For the paved single lane highway serving for two directions, the followings are shown ;

Factor	JICA study' 88	NTRC' 92	JICA study' 94	Notes
C	300	-	300	
(v/c)i	0.85	-	0.85	
fsl	1.0	-	0.9	
CAPAi	3,500	-	3,200	

3.4 Access controlled motorways

The completely access controlled highways have not been constructed yet in Pakistan. The Karachi super highway has tollgates at the both ends, but at mid points of the highway there are many points to out and in.

The motorway between Lahore and Islamabad will have several gates to collect toll fees from vehicles in and out, and is likely not allow vehicles and animals to penetrate in or out at mid points along the road because of the embankment amd fence. Under the circumstances, the factoring of slow moving vehicles (fsl), and the type of the highway (fE) are assumed 1.00, respectively. By those factors the capacity of the divided 4 lane road is modified to present the capacity of the access controlled and divided road.

Access controlled multi-lane highways

Factor	JICA study' 88	NTRC' 94	JICA study' 94	Notes
C			2,500	
(v/c)i			0.7	
N			4	
fW			1.0	
fHV	traffic are converted to pcu, fHV = 1.0, otherwise it depends on traffic mix on the section.			
fE			1.0	
fP			0.95	
fsl			1.0	
phf			0.9	
K			0.07	
CAPAi			86,000	in total of DIV 4 lanes/day pcu

(3) Summary

The summary of those capacity estimates are in Appendix Table 4.2.a. Those are standard cases applicable throughout the country, but would need adjustments which depend on the planning levels and local conditions. In the case of designing particular road sections, study of detailed factoring and other elements may be required.

Appendix Table 4.3.1 Recomended Projects for Mid / Short Proposal (1/3)

Road No.	Prov. No.	Link No.	Dist. (km)	Existing Condition					Func. Class	Future Design Class	Short Term		Mid Term		Remark
				Terrain	Surface	Width (m)	Pave. Condi.	Design Class			Comm.	Recom.	Comm.	Recom.	
0	91	4461	28.0	F	T	3.8	4	5	4	5-4		○			
0	91	4469	32.0	F	T	3.8	3	5	4	5-4		○			
0	91	5431	43.5	F	T	6.1	3	4	3	4-3				○	
0	91	5702	4.0	F	T	3.8	2	5	4	5-4				○	
0	91	5717	59.0	F	A	3.8	2	5	4	5-4				○	
0	91	5727	37.0	F	T	6.0	3	4	2	4-1				○	
0	91	5805	5.0	F	T	7.3	3	4	3	4-3				○	
0	91	5815	2.5	F	T	7.3	3	4	3	4-3				○	
0	91	6772	100.0	F	T	6.0	3	4	3	4-1				○	
0	91	6918	59.0	F	T	5.0	3	5	3	5-3				○	
0	91	7945	57.0	F	T	6.0	3	4	3	4-2				○	
0	91	8214	16.5	F	T	5.5	3	5	3	5-3				○	
0	91	8481	90.0	F	T	5.0	3	5	3	5-4		○			
0	91	8483	40.0	F	T	5.0	3	5	3	5-4		○			
0	92	2194	36.0	F	A	7.3	3	4	3	4-1				○	
0	92	2681	74.0	F	A	5.0	3	5	3	5-3				○	
0	92	7874	10.0	F	T	5.5	3	5	3	5-3				○	
0	94	3748	169.0	F	G	3.8	4	5	4	5-4			○		
0	94	4081	27.0	M	G	3.8	4	5	4	5-4		○			
0	94	4119	185.0	M	G	3.8	4	5	4	5-4		○			
0	94	7503	424.5	F	G	6.0	5	6	4	4	○				Coastal Rd.
0	94	8526	7.0	F	-	-	-	-	3	2	○				Lahore Bridge
0	94	8595	8.0	F	-	-	-	-	3	2			○		Kahat BP.
0	94	8599	18.0	H	-	-	-	-	3	2			○		Kahat BP.
5	91	2763	129.0	F	T	6.7	3	4	2	4-1			○		
5	91	4242	71.0	F	T	6.4	3	4	2	4-1			○		
5	91	4546	21.0	F	T	6.4	2	4	2	4-1	○				
5	91	4566	5.0	F	T	7.3	3	3	2	3-1	○				
5	91	4591	76.0	F	T	6.3	3	4	2	4-1	○				
5	91	4613	18.0	F	T	6.8	3	4	2	4-1	○				
5	91	4699	23.0	F	T	6.3	2	4	2	4-1	○				
5	91	4704	14.0	F	T	7.3	3	5	3	4-1	○				
5	91	5704	37.0	F	T	7.6	3	2	2	2-1	○				
5	91	5711	132.0	F	A	7.4	3	2	2	2-1	○				
5	91	5913	72.0	F	T	7.3	3	3	2	3-1	○				
5	91	5983	18.0	F	T	8.4	3	3	2	3-1	○				
5	91	6050	14.0	F	T	7.4	3	3	2	3-1	○				
5	91	6054	24.0	F	T	7.4	3	2	2	2-1	○				
5	91	6794	5.0	F	T	7.4	3	2	3	2-1	○				
5	91	6798	10.0	F	T	7.4	3	2	4	2-1	○				
5	91	6984	32.0	F	TA	15.0	4	1	2	2-1	○				
5	91	6991	15.0	F	T	7.4	4	2	2	2-1	○				
5	91	7034	19.0	F	T	8.4	2	3	2	3-1	○				
5	91	8514	7.0	F	-	14.6	-	-	2	1	○				Lahore BP. I
5	91	8522	10.0	F	-	14.6	-	-	2	1	○				Lahore BP. I
5	91	8602	5.0	F	-	14.6	-	-	2	1			○		Lahore BP. II

Source : JICA Study Team, 1994

Note : "F" and "D" indicate function and design classification, respectively.
Existing conditions are from Appendix Table 4.1.4.
"M" indicates potorway
Link is shown in Figure 4.3.1.

Appendix Table 4.3.1 Recomended Projects for Mid / Short Proposal (2/3)

Road No.	Prov. No.	Link No.	Dist. (km)	Existing Condition					Func. Class	Future Design Class	Short Term		Mid Term		Remark
				Terrain	Surface	Width (m)	Pave. Condi.	Design Class			Comm.	Recom.	Comm.	Recom.	
5	91	8605	6.0	F	-	14.6	-	-	2	1			○		Lahore BP. II
5	92	2009	91.5	F	A	6.9	3	1	2	3-1	○				
5	92	2167	11.0	F	T	7.3	3	3	2	3-1	○				
5	92	2214	39.0	F	A	7.5	2	3	2	3-1	○				
5	92	2376	20.0	F	A	7.4	3	3	2	3-1	○				
5	92	2380	21.0	F	T	7.2	3	3	2	3-1	○				
5	92	2400	110.0	F	T	7.3	3	3	2	3-1	○				
5	92	2431	69.0	F	A	7.4	3	3	2	3-1	○				
5	92	2702	108.0	F	T	7.3	3	3	2	3-1	○				
5	92	2746	68.0	F	T	7.3	3	3	2	3-1	○				
5	92	6096	6.5	F	A	7.4	3	3	2	3-1	○				
5	92	6461	23.0	F	A	7.3	2	3	2	3-1	○				
5	93	6099	7.0	F	T	7.1	3	3	2	3-1	○				
25	94	3105	113.0	H	T	5.3	2	5	2	5-2			○		
25	94	3127	69.0	F	T	3.5	3	5	2	5-2	○				
25	94	3223	72.0	F	T	6.1	2	4	2	4-2	○				
25	94	3558	71.0	M	T	3.7	1	5	2	5-2	○				
25	94	3623	228.0	M	T	3.6	2	5	2	5-2	○				
25	94	4046	31.0	H	T	5.0	3	5	2	5-1	○				
25	94	4125	4.0	H	T	5.3	2	5	2	5-2			○		
25	94	4823	192.0	H	T	5.3	4	5	2	5-2	○				
35	93	7311	285.0	M	T	5.5	4	4	2	2			○		
35	93	7229	322.0	H	T	6.3	4	4	2	2	○				
35	93	7221	122.0	H	T	6.3	4	3	2	2	○				
40	94	3901	350.0	F	T	3.7	2	5	2	5-2	○				
40	94	3938	183.0	H	T	3.7	1	5	2	5-2			○		
40	94	3975	114.0	H	T	3.6	4	5	2	5-2			○		
55	91	3054	40.0	F	T	3.8	3	5	3	5-4			○		
55	91	3143	129.0	F	T	6.3	2	4	2	4-2			○		
55	91	4409	51.0	F	T	4.9	3	5	2	5-2	○				
55	91	4423	87.0	F	T	3.6	3	5	2	5-2	○				
55	92	2466	26.0	F	T	3.8	2	5	2	5-2			○		
55	92	2493	97.0	F	T	3.8	2	5	2	5-2			○		
55	92	2525	28.0	F	T	4.1	4	5	2	5-2			○		
55	92	2565	167.0	F	T	4.8	3	5	2	5-2			○		
55	92	2837	47.0	F	T	4.4	3	5	2	5-2	○				
55	92	2854	64.0	F	T	4.3	3	5	2	5-2	○				
55	92	3041	51.0	F	T	4.3	3	5	2	5-2			○		
55	92	8360	65.0	F	T	3.7	2	5	2	5-2	○				
55	93	5108	70.0	F	T	6.5	4	4	2	4-2	○				
55	93	5216	94.0	F	T	6.3	3	4	2	4-2			○		
55	93	6146	55.0	F	T	7.1	3	4	2	4-2			○		
55	93	6291	33.0	M	A	7.3	3	3	2	3-2			○		
55	93	8563	59.0	H	T	6.5	4	4	2	4-2	○				
55	94	8371	3.0	F	T	3.8	2	5	2	5-2	○				
65	92	2709	12.0	F	-	14.6	-	5	3	2			○		Sukkur BP.

Source : JICA Study Team, 1994

Note : "F" and "D" indicate function and design classification, respectively.
Existing conditions are from Appendix Table 4.1.4.
"M" indicates potorway
Link is shown in Figure 4.3.1.

Appendix Table 4.3.1 Recomended Projects for Mid / Short Proposal (3/3)

Road No.	Prov. No.	Link No.	Dist. (km)	Existing Condition					Func. Class	Future Design Class	Short Term		Mid Term		Remark
				Terrain	Surface	Width (m)	Pave. Condi.	Design Class			Comm.	Recom.	Comm.	Recom.	
70	91	4344	23.0	F	T	6.5	4	4	1	4-1				○	
70	91	4357	37.0	F	T	7.3	4	3	1	3-1				○	
70	91	4564	34.0	F	T	6.5	4	4	1	4-1		○			
70	94	4059	179.0	F	T	3.8	4	5	2	5-2				○	
70	94	4067	72.0	H	T	3.8	4	5	2	5-2	○				
M	91	8530	25.0	F	-	-	-	-	1	M	○				Motorway
M	91	8534	85.0	F	-	-	-	-	1	M	○				Motorway
M	91	8539	41.0	F	-	-	-	-	1	M	○				Motorway
M	91	8542	35.0	F	-	-	-	-	1	M	○				Motorway
M	91	8546	51.0	F	-	-	-	-	1	M	○				Motorway
M	91	8550	40.0	H	-	-	-	-	1	M	○				Motorway
M	91	8553	33.0	H	-	-	-	-	1	M	○				Motorway
M	91	8554	25.0	F	-	-	-	-	1	M	○				Motorway

Source : JICA Study Team, 1994

Note : "F" and "D" indicate function and design classification, respectively.
Existing conditions are from Appendix Table 4.1.4.
"M" indicates potorway
Link is shown in Figure 4.3.1.

Appendix Note 4.4.1 Traffic Assignment

(1) Vehicle O D Matrices 1990 and 1993

NTRC conducted a nation-wide OD interview survey in 1990 at 65 roadside stations and produced OD trip matrices categorized as six trip vehicle types in 33 zones. The original NTRC 1990 origin destination tables were converted to SYSTEM II format. After this, the resulting 1990 33-zone tables were converted to the JICA 51-zone format and updated to result in 1993 trip tables. At present the seven original trip types included in the NTRC tables have been preserved. These trip types are shown in Appendix Table 4.4.a below with the eventual JICA trip types which will be used.

Appendix Table 4.4.a Trip Types

Vehicles in NTRC data	Trip Type in This study
Motorcycle	Motorcycle
Automobile	Automobile
Wagon	Wagon
Pick up	Automobile
Bus	Bus
Truck	Truck
Other	Truck

First, the NTRC tables were read into a SYSTEM II database using the LOADTAB program. The resultant 33 zone matrix was converted to the JICA 51 Zone format (47 internal zones, 4 external stations) using the SQUEEZE program and the Table of Equivalents shown in Appendix Table 4.4.b.

Appendix Table 4.4.b Zone Table of Equivalents

NTRC Zones	JICA Zones	NTRC Zones	JICA Zones
1	7,8	17	23
2	47	18	25,26
3	4	19	27
4	1	20	29
5	3	21	28
6	6	22	32
7	5	23	30
8	9,10,11	24	31,36
9	12,19,20	25	34
10	13	26	33,35,37,38
11	14	27	39
12	17,18	28	41
13	15,16	29	40
14	24	30	45
15	22	31	43,44,46
16	21	32	42
		33	48

A complicating factor concerning the Table of Equivalents shown in Appendix Table 4.4.b is the fact that JICA Zone 43 was not a subzone of any of the NTRC Zones, but in fact was split between NTRC Zone 31 and 32. The TOE assigned all of the trips ending in NTRC Zone 32 to JICA 42, but about one-half of all the NTRC 32 should go to JICA 43. This was done manually. In fact, the only significant trips from/to NTRC 32 have trip ends in Quetta (NTRC-29 and JICA 40). Thus the trips to and from Quetta ending in NTRC 32 were split as shown in Appendix Table 4.4.c.

Appendix Table 4.4.c Trips Redistributed to and from Quetta

JICA Zones		Number of Trips Distributed						
Origin	Dest	M/C	Auto	Wagon	Pickup	Bus	Truck	Other
40	42	10	44	42	86	41	70	0
42	40	7	45	46	74	46	78	0
40	42	-5	-22	-21	-43	-20	-34	0
40	43	5	22	21	43	20	34	0
42	40	-3	-22	-23	-37	-23	-39	0
43	40	3	22	23	37	23	39	0

An additional complication was the fact that trips which were wholly within NTRC zones or intrazonal trips would become interzonal trips in the JICA table. Thus, for example, the JICA matrix should show trips between JICA 9, 10, and 11. However, all of these trips were contained wholly within NTRC-8, and thus resulted in 0 trips for the three zone combination. These trips were filled in by multiplying all 1986 JICA trips between zones 9,10, and 11 by an annual factor appropriate for each trip type to update the matrix to 1990. This was (1.0459) for autos, (1.0428) for buses, and (1.0713) for trucks. These numbers are used to convert the annual factor to a multiplier for each trip type. The resulting adjustments to the JICA 1990 trip table are shown in Appendix Table 4.4.d.

Appendix Table 4.4.d Interzonal Trips Added to JICA 1990

From	To	Auto	Wagon	Pickup	Bus	Truck	Other
7	8	0	0	0	0	0	0
8	7	0	0	0	0	0	0
9	10	292	141	68	225	48	2
9	11	31	15	7	14	11	1
10	9	292	141	68	225	26	1
10	11	168	81	39	147	20	1
11	9	31	15	7	14	31	2

The final complication in the creation of the JICA 1990 matrix was the addition of trips in the JICA system which were outside the NTRC system. These were trips to and from Jammu and Kashmir which were in the 1986 JICA study. These trips are updated and shown in Appendix Table 4.4.e below. The table shows the new trips added to the 1990 JICA matrix, where the same annual factors described above was used to update the 1990 JICA matrix to 1993 levels.

Appendix Table 4.4.e Trips to and from Jammu/Kashmir, 1990

4	47	0	0	0	1	0	0
4	48	20	9	5	12	0	0
10	48	45	22	10	54	0	0
11	48	2	1	0	4	0	0
12	48	8	4	2	1	0	0
17	48	6	3	1	7	0	0
19	48	3	1	1	1	0	0
20	48	1	1	0	1	0	0
39	48	0	0	0	1	0	0
48	4	20	9	5	12	0	0
48	10	45	22	10	54	0	0
48	11	2	1	0	4	0	0
48	12	8	4	2	1	0	0
48	17	6	3	1	7	0	0
48	19	2	1	0	1	0	0
48	20	1	0	0	1	0	0
48	39	0	0	0	1	0	0

In order to create assignable matrices which were compatible with the 1986 JICA study, several of the matrices were combined. Matrices for automobile and pickup trips were combined into a single car trips matrix; wagon and bus trips remained as wagon and bus trips separately; trucks and other vehicles matrices were combined into a single truck trips matrix. Motorcycle trips were kept as they are. These matrices were then multiplied by conversion factors as shown in Appendix Table 4.4.f to translate the trips into PCUs. These factors were based on earlier PCU estimates for each vehicle type.

Appendix Table 4.4.f PCU Conversion Factors

Vehicles	PCU
Motor cycle	0.33
Automobile	1
Wagon	1.5
Bus	3
Truck	3.2
Bycycles	0.20 *
Animal cart	6.00 *

Notes:* those are not in trip tables but influence of those * are considered in "fsv" of the capacity analysis, as mentioned before.

The final PCU-based matrices are summarized in Appendix Table 4.4.g on the following page. The trip ends shown represent the number of trips produced in and attracted to each of the 51 JICA zones in 1993.

Appendix Table 4.4.g PCU Trip Ends, 1993

Zone	Small Veh. PCUs		Bus PCUs		Truck PCUs	
	Production	Attraction	Production	Attraction	Production	Attraction
1	3,688	3,706	2,352	2,349	2,714	2,881
2	5,057	5,102	2,955	2,967	4,352	4,731
3	2,294	2,298	1,062	1,098	2,158	1,969
4	5,166	2,038	831	870	1,942	1,776
5	1,096	1,108	303	303	1,265	1,378
6	1,117	1,099	354	321	1,668	1,376
7	394	400	126	117	365	340
8	1,566	1,586	498	450	1,450	1,408
9	2,107	2,270	1,626	1,620	2,625	2,560
10	5,113	4,900	3,696	3,675	7,315	7,900
11	2,064	2,030	1,497	1,512	3,665	2,857
12	2,672	2,780	1,788	1,821	2,997	2,845
13	1,941	1,966	1,992	2,187	8,153	8,683
14	1,608	1,665	840	771	3,068	3,197
15	2,847	2,964	4,023	4,134	7,667	8,268
16	1,710	1,772	2,700	2,769	4,479	4,563
17	9,651	8,806	8,370	7,905	16,399	14,552
18	1,410	1,299	1,281	1,218	2,206	1,834
19	3,809	4,174	2,454	2,511	4,179	3,946
20	2,532	2,708	2,085	2,127	2,706	2,644
21	970	959	663	636	3,142	3,675
22	2,245	2,363	915	957	6,324	5,983
23	5,001	4,866	4,575	4,398	10,554	10,909
24	3,332	3,476	2,079	2,319	7,807	7,438
25	1,624	1,663	1,545	1,566	2,496	2,325
26	1,021	1,030	987	996	1,415	1,445
27	943	1,013	1,299	1,302	3,132	3,563
28	2,180	2,180	1,149	1,164	2,902	2,631
29	2,987	3,036	1,524	1,458	4,750	5,757
30	914	895	516	543	1,765	1,535
31	715	706	459	555	1,246	1,610
32	1,366	1,235	192	222	1,742	1,659
33	2,742	2,900	2,511	2,655	6,700	7,241
34	824	846	255	249	1,688	1,713
35	1,370	1,423	1,452	1,488	2,445	2,430
36	1,084	1,077	645	630	2,088	2,776
37	410	443	626	561	1,190	1,369
38	482	502	699	714	735	1,038
39	2,571	2,394	2,292	2,103	19,750	18,474
40	1,204	1,145	567	600	3,594	3,475
41	291	272	153	138	917	705
42	120	120	75	72	162	149
43	446	453	225	210	651	604
44	442	449	201	189	673	631
45	829	833	498	477	1,261	1,809
46	29	28	12	18	43	37
47	39	43	27	30	214	146
48	304	306	294	303	663	587
49	0	0	0	0	0	0
50	0	0	0	0	0	0
51	0	0	0	0	0	0
Totals	90,824	90,824	67,167	67,167	171,955	171,955

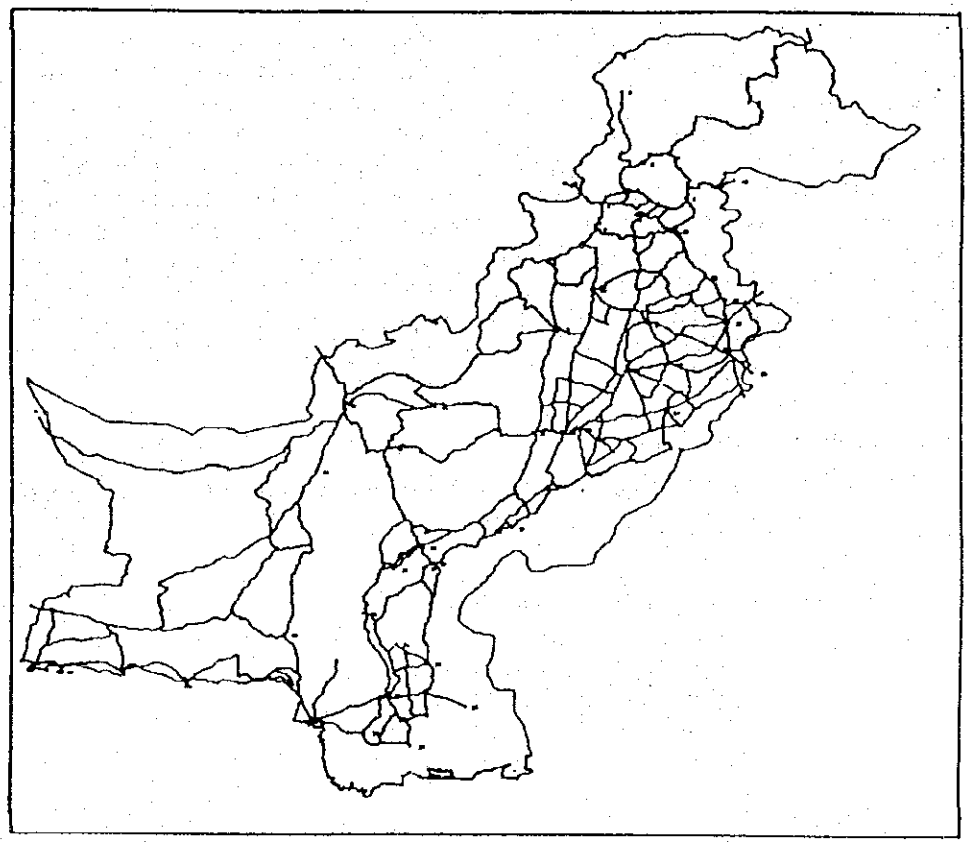
(2) Traffic Assignment on the network, 1993

1) Highway Centerline File

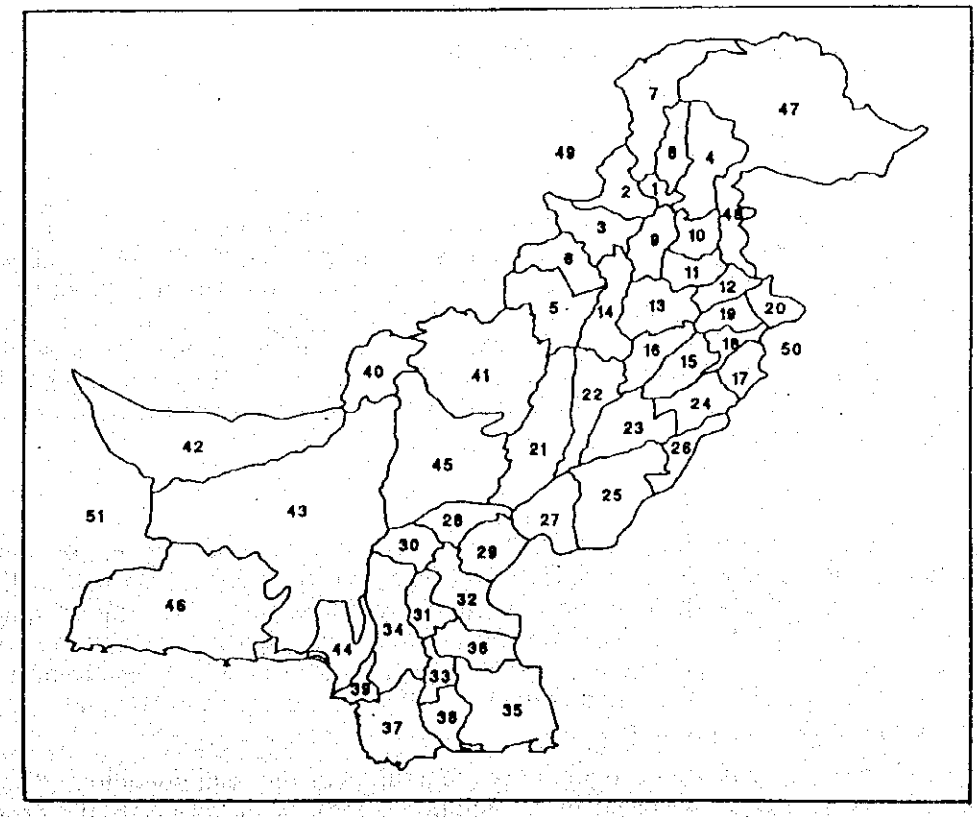
The original highway centerline file was created using a CADD software package and a 1:1,500,000 scale tourism map of Pakistan showing road and railways throughout the country. The resulting map consisted of numerous short line segments approximating the alignment of major highways. Each of the line segments was equal to less than 30 km (at scale) due to the limitation of the length of a link in SYSTEM II and due to the desire to closely approximate the shape of roads in Pakistan. The CADD line segments were then converted to a SYSTEM II link and node database through use of the GNET program. Since the database unit of the CADD system was inches, the SYSTEM II program GSCALE was used to adjust the link lengths and the X-Y node coordinates to metric units.

The basic network of 1993 consists of 5,036 roadway links covering 19,164 kilometers throughout Pakistan. There are also 51 zones in keeping with the zone system from the 1988 JICA Pakistan National Transport Study. Intercity distances were checked using the NETSKIM program and were found to be accurate to within 1.3% on the origin destination pairs which were checked. The road network and zones are in Appendix Figures 4.4.a and 4.4.b.

Appendix Figure 4.4.a System 2 Highway Network, 1993
(Showing Roads & Centroids)



Appendix Figure 4.4.b Zone Structure



2) Network Simplification to Conform to JICA Network

A few additional links were added to the network, which were in the 1988 JICA network but were not highlighted as being major highways on the tourist map. Numerous links which were digitized from the tourist map were deleted to simplify the network to the same level as the JICA map. This was done since the original network showed too much detail and was thus not consistent with the highly aggregated zones which are used in this JICA study. In other words, if additional links were coded, trips would not be assigned to them in a manner consistent with reality due to the very large zones which must be used in the model. The simplified network is in Appendix Figure 4.4.d (same as Figure 4.4.3 in Chapter 4) which is composed of 300 links approximately. It should be said here that although smaller zones would be desirable, there is insufficient data for origin / destination trips, population and employment data, as well as the belief of the author that further disaggregation of the 1990 NTRC origin destination study zones would be ill advised.

3) Data from 1986 JICA study

Link data which were available from the previous JICA study after updating included:

Roadway width (in meters)

Surface type (one of five treatments)
- Asphalt Concrete
- Triple Surface Treatment
- Double Surface Treatment
- Bituminous
- Gravel

Terrain
- Flat
- Hilly
- Mountainous

Surface Conditions (1 [Good] through 5 [Bad])

Classification - See Appendix Table 4.1.4

4) Creation of SYSTEM II Network

Number of lanes

All roads are considered to be two lane roads unless other information is available. Several sections of four lane roads (2-2 dual carriageway) were coded into the 1993 network. These sections were completed during the Seventh Five Year Plan on National Highway 5 connecting Karachi, Multan, Lahore, Rawalpindi/Islamabad, and Peshawar. One-lane roads do not exist in the resulting SYSTEM II network, as it would present a logic problem in the network. This is because each link in a SYSTEM II network has an A-node, a B-node, and number of lanes from A to B and number of lanes from B to A. The one-lane roads treated as the two ways after the capacity is halved.

5) Free flow travel speeds

Free flow travel speeds for the SYSTEM II network were developed by application of Appendix Table 4.4.h through a DATAEDIT program to change each link in the network. Numbers shown in the boxes show uncongested speeds in KPH by road condition for each type of terrain and each of the NTRC/JICA engineering classes. Speeds on roads in good condition (road condition equals 1) are based on a table from page RD 17 of the Final Report of the 1988 JICA study. For each level of road condition indicating poorer road conditions, the free flow speeds are progressively reduced by 5%.

For gravel roads, speeds are generally lower regardless of the road condition. Thus on gravel roads, all link speeds are reduced by an additional 10% in the DATAEDIT program. The

minimum speed recorded on any link was 30 KPH. The data for the Speed Limit field of the SYSTEM II database was set to equal the free flow speed.

Appendix Table 4.4.h Free Flow Travel Speeds

NTRC Class	Terrain	Road Condition 1	2	3	4	5
I	Flat	110	105	99	94	88
	Hilly	100	95	90	85	80
	Mountainous	80	76	72	68	64
II	Flat	100	95	90	85	80
	Hilly	80	76	72	68	64
	Mountainous	60	57	54	51	48
III	Flat	100	95	90	85	80
	Hilly	80	76	72	68	64
	Mountainous	60	57	54	51	48
IV	Flat	80	76	72	68	64
	Hilly	60	57	54	51	48
	Mountainous	50	48	45	43	40
V	Flat	60	57	54	51	48
	Hilly	50	48	45	43	40
	Mountainous	40	38	36	34	32

6) Link Capacities

Daily link capacities were based on work development for the JICA Study and detailed in the Appemdix Note 4.2.1 Road Capacity. For the purpose of the SYSTEM II analysis, the only variable applied was roadway width as all other variables described in the working paper were constant if no improvement is conducted. All link capacities in a SYSTEM II datebase are stored in terms of PCU per hour per lane (PCU/HPL). In order to convert to hourly capacities from the previously descrived daily capacities, all daily capacities were multiplied by the inverse of 7 percent as peaking of intercity trips is not nearly as pronounced as it might be in an urban setting where peak hour factors are closer to 10 to 12 percent. Resulting capacities are shown in Appendix Table 4.4.i

Appendix Table 4.4.i Link Widths and Capacities

Width	No. Lanes	Daily Capacity	Hourly Cap. per Lane
> 13.8 m	4	74,600	2,613
7.1 - 18.8 m	2	19,200	1,343
6.2 - 7.1 m	2	16,100	1,128
5.7 - 6.2 m	2	14,800	1,034
4.0 - 5.7 m	2	12,500	873
< 4.0 m	2	3,200	224

7) Base Year (1993) Assigment

Equations Used

The final converted PCU-based matrices were assigment to the 1993 Pakistan national network using the assigment routine listed in App. Table 4.4.j

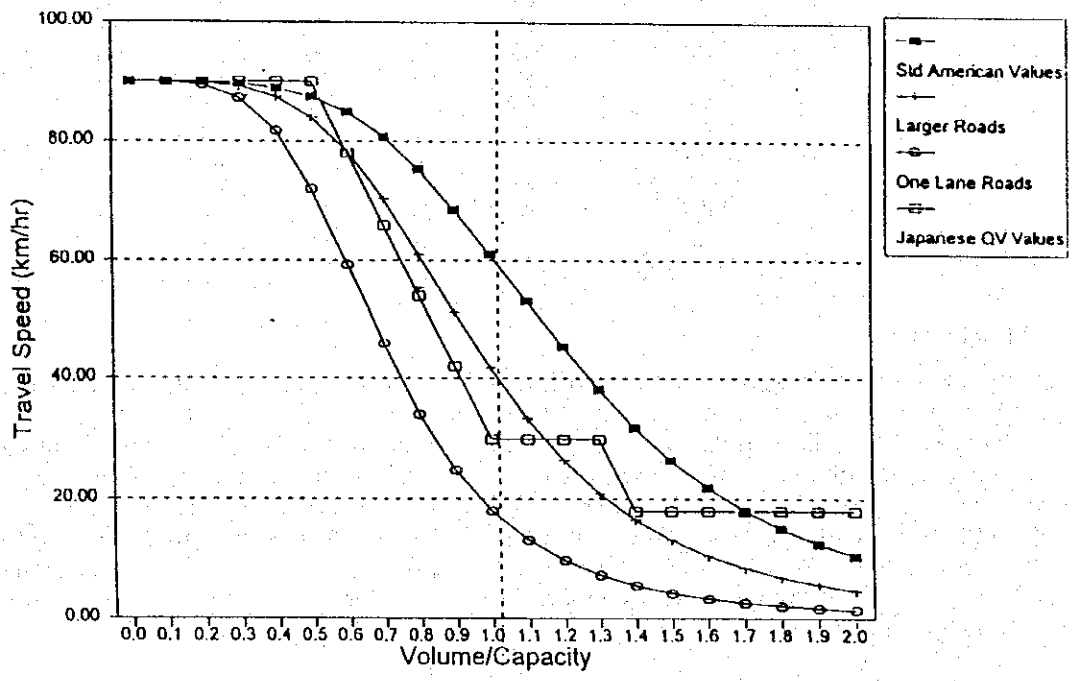
Appendix Table 4.4.j Asigment Iterations

Iteration	Percentage of Total Trips	Assignment Algorithm	Speed Updates
1	20%	Single Path	200 trips or 5 zones
2	20%	Single Path	200 trips or 5 zones
3	20%	Single Path	200 trips or 5 zones
4	20%	Single Path	200 trips or 5 zones
5	20%	Single Path	200 trips or 5 zones

In each of the five iterations, a single path assigment algorithm was used. In this algorithm, traditionally referred to as the all-nothing algorithm, minimum impedance paths are created between all origins and destinations. In the setup used for Pakistan, after 200 trips are loaded (whichever comes first) link speeds are recalculated and new minimum paths are calculated.

Speed - volume relationship is shown in Appendix Figure 4.4.c, where comparison of BPR curves and a Japanese Q-V curve is presented. In berief, parameter of BPR was determined to have the similar pattern with the Japanese Q-V setting as found in the Figure.

Appendix Figure 4.4.c Adjustments of BPR Formula



Count stations from the NTRC and Pumjab in 1992 / 93 were used to compare with the current assignment of 1993 and the results of that comparison are shown in Appendix Table 4.4.k on the next page. In summary, when only links with counts are considered, the total vehicles assigned were within 3.6% of the count volumes. In spite of the very encouraging results shown here, it should not be assumed that the network is in good calibration since there are so few counts on the network and intra-zonal traffics were not included in the assignment volumes.

Appendix Table 4.4.k Evaluation of Network Calibration

Screen Line		Num. Lnks	Total Volume	Total Count	Diff.	% Diff.
N-05:08	Nowahera Khan - Attock	2	16,666	11,992	4,674	39.0
N-05:16	Jhelum - Gujrat	2	25,882	27,202	-1,320	-4.9
N-05:27	Gujranwala - Lahore	2	88,082	31,831	1,251	3.9
N-05:31	Sahiwal - Okara	2	16,450	17,263	-813	-4.7
N-05:35	East of Multan	2	17,258	9,054	8,204	90.6
N-05:37	Multan - Bahawalpur	2	9,222	11,211	-1,989	-17.7
N-05:39	West of Abmadpur	2	16,028	15,487	541	3.5
N-05:44	Sindh - Punjab Border	2	17,480	17,983	-503	-2.8
N-05:52	North of Kandiaro	2	18,954	18,172	782	4.3
N-05:58	Hyderabad - Hala	2	18,507	21,916	-3,409	-15.6
N-05:60	Karachi - Hyderabad	2	40,177	29,638	10,541	35.6
N-25:01	Baluchistan - Sindh Border	2	4,505	14,855	-10,350	-69.7
N-25:04	South of Khudzur	2	3,915	1,018	2,897	284.6
N-25:07	Kalat - Mastung	2	4,265	2,228	2,037	91.4
N-35:01	Hasan Abdal - Haripur	2	5,257	5,690	-433	-7.6
N-35:07	North of Batgram	2	438	1,760	-1,322	-75.1
N-35:12	NWFP - Jammu & Kashmir Border	2	500	791	-291	-36.8
N-50:07	Baluchistan - NWFP Border	2	1,193	233	960	412.0
N-50:09	Daraban - DI Khan	2	0	1,728	-1,728	-100.0
N-55:03	South of Bannu	2	5,688	4,046	1,587	39.2
N-55:04	NWFP - Punjab Border	2	1,901	421	1,480	351.5
N-55:08	South of DG Khan	2	7,537	4,506	3,031	67.3
N-55:13	Sindh - Punjab Border	2	7,537	1,323	6,214	469.7
N-55:16	North of Larkana	2	5,379	2,399	2,980	124.2
N-55:18	South of Dadu	2	5,998	6,602	-604	-9.1
N-65:01	Shikarpur - Sukkur	2	6,361	9,264	-2,903	-31.8
N-65:03	Baluchistan - Sindh Border	2	4,966	7,730	-2,764	-35.8
N-65:08	West of Sibi	2	2,307	6,315	-4,008	-63.5
N-70:02	Indus River - Multan	2	16,278	11,133	4,145	37.2
N-70:07	Baluchistan - Punjab Border	2	2,508	1,265	1,243	98.3
N-70:10	Qila Saifullah - Loralai	2	1,445	1,829	-384	-21.0
a	Faisalabad	2	8,344	13,932	-5,588	-40.1
b	Lodhran	2	11,922	16,199	-4,277	-26.4
c	T.T. Singh	2	2,339	5,587	-3,248	-58.1
d	Sargodha	2	3,519	5,659	-2,140	-37.8
f	Gujranwala	2	4,219	11,201	-6,982	-62.3
g	Layyah	2	3,451	8,771	-5,320	-60.7
h	Shejkhupura	2	18,262	15,596	-2,334	-15.0
m	Mardan	2	1,162	4,695	-3,533	-75.3
Total			Total Vehicle Traveled	Total Count Traveled	Difference	% Diff.
			364,942	378,523	13,581	0.036

(3) Trips in 1993. 1998 and 2006

The vehicle trip matrices for 1998 and 2006 were estimated by using the fratar method. The results are summarized in App. Table 4.4.1.

Appendix Table 4.4.1 Summary of Trips in 1993, 1998, 2006

		1993	1998	2006
Vehicles				
	M/C	6,350	8,083	11,241
	Car	51,676	72,275	112,357
	Wagon	24,701	34,635	56,655
	Bus	22,389	29,254	42,002
	Truck	53,736	64,088	86,343
	Total	158,852	208,335	308,598
		(1.00)	(1.31)	(1.94)
PCU				
	M/C	2,096	2,667	3,710
	Car	51,676	72,275	112,357
	Wagon	37,052	51,953	84,982
	Bus	67,167	87,762	126,006
	Truck	171,955	205,082	276,298
	Total	329,946	419,739	603,353
		(1.00)	(1.27)	(1.81)

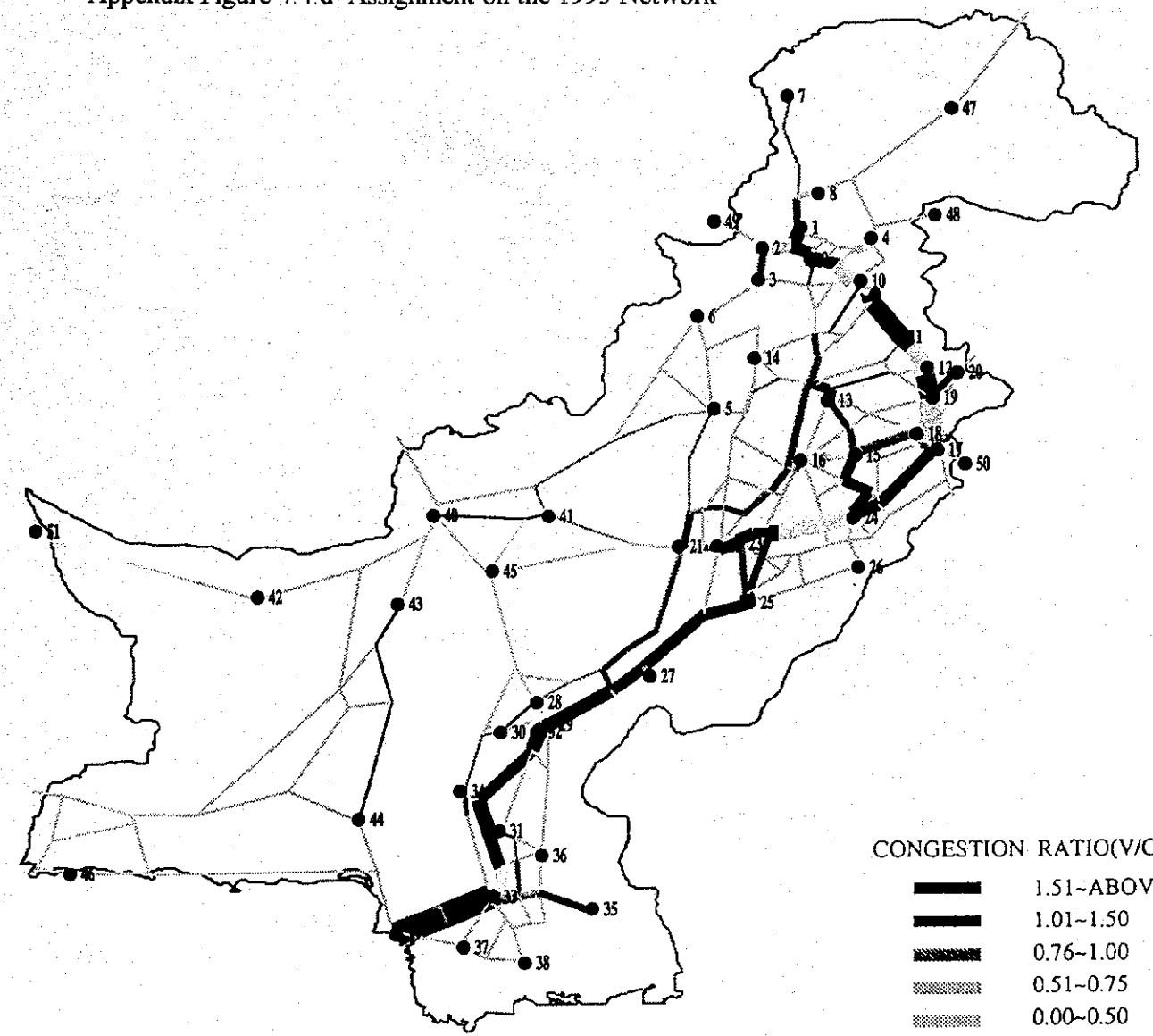
Notes: Intra-zone trips are not included.

(4) Traffic Assignments for 1998 and 2006

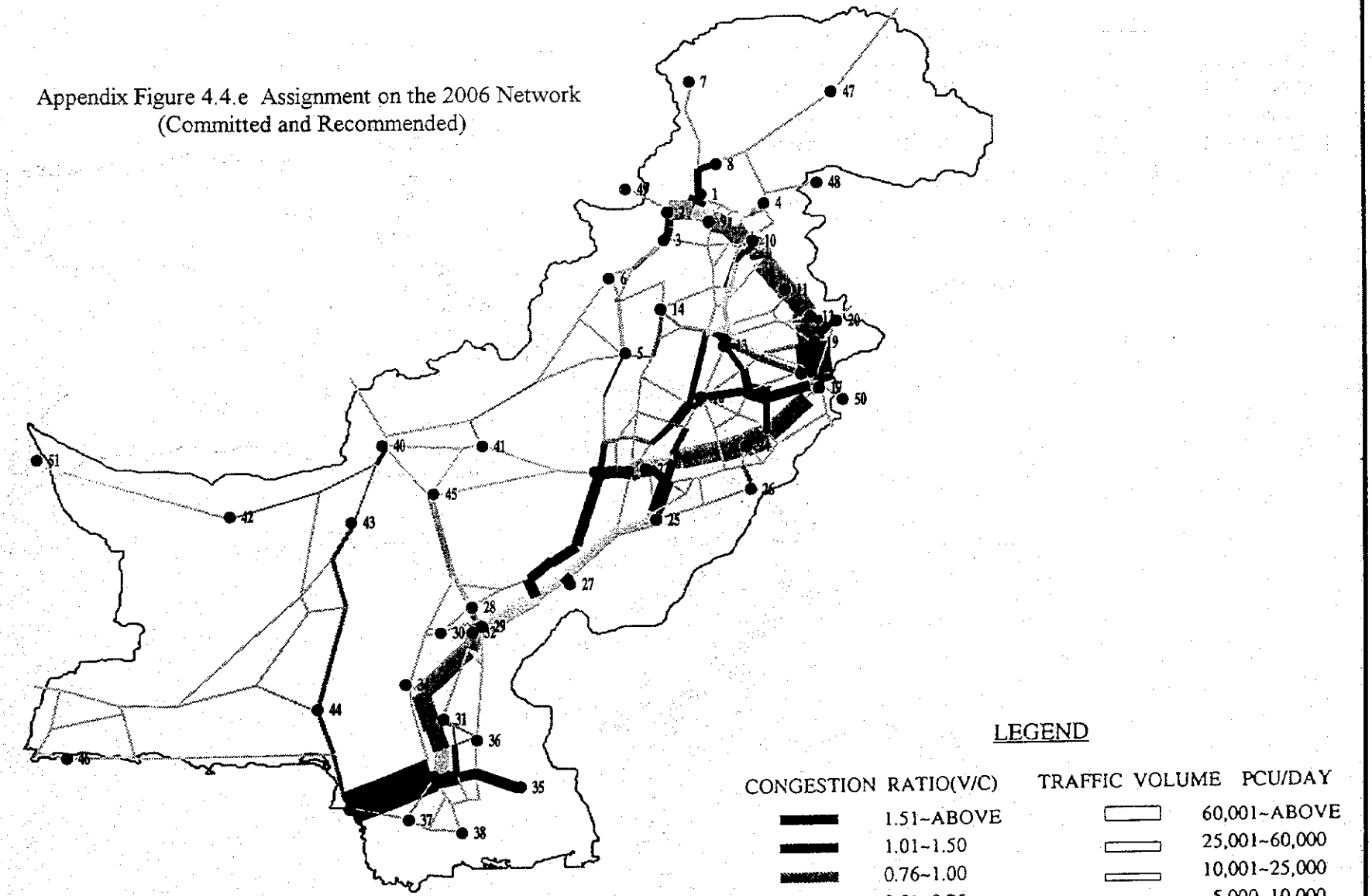
Traffic assignments were conducted by assuming alternative networks with committed and recommended projects for 1998 and 2006. Those formulations were discussed in 4.3 of Chapter 4 in the main report. The results selected are in the following tables and figures, all of them are also in the main text, 4.4 of Chapter 4. Appendix Figures 4.4.d and 4.4.e are the copy of the computer monitor screens showing the result of assignment by system II. They can be retrieved on the screen in the system II operation, which was installed in a desktop computer in NTRC of MOC in February, 1984. Appendix Tables 4.4.m and 4.4.n show the summary of changes in V/C ratio distribution after committed and recommended projects are taken into account in 1998 and 2006, respectively.

Assuming the completion of committed projects by 1998, the assignment was done in the computer, resulting the summary in Table A of Appendix Table 4.4.n. In Table A some sections are found to be in V/C > 1.00, which means the V/C > 1.00 should be V/C =< 1.00 by improvement works. Those sections identified need of improvement works are defined as recommended projects, which are incorporated in the traffic assignment network and the assignment results are in Table B, where all sections show V/C =<1.00 in 1998. The same simulation works are conducted for 2006 and shown in Table B of the case 2006.

Appendix Figure 4.4.d Assignment on the 1993 Network



Appendix Figure 4.4.e Assignment on the 2006 Network
(Committed and Recommended)



Appendix Table 4.4.m Summary of Assignment on the Network of 1993 with Trips in 1993, 1998,2006

(V/C ratio and length 1993,1998 and 2006)

	A.1993				B.1998				C.2006			
Rt		National Highways				National Highways				National Highways		
V/C	Prov	N-5	Other	Total	Prov	N-5	Other	Total	Prov	N-5	Other	Total
~0.25	8936	206	2188	11330	6888	142	1683	8713	8298	187	1848	10333
~0.50	1253	302	1539	3094	2336	64	754	3153	1693	239	1666	3597
~0.75	1025	169	477	1670	768	220	1213	2201	930	242	508	1679
~1.00	349	511	0	860	645	166	349	1159	454	308	182	944
~1.25	234	420	406	1060	423	76	26	525	401	578	4	982
1.25~	366	273	326	965	1105	1212	911	3229	389	327	728	1444
Total	12163	1878	4936	18976	12163	1878	4936	18976	12163	1878	4936	18976

Appendix Table 4.4.n Summary of Traffic Assignment on the Network of 1998 and 2006 with Committed & Recommended

A, Commited Case 1998

Rt / V/C	Prov	National Highway			Total
	O	MWY	5	Other	
~0.25	8416.5	335	349	2069.5	11170
~0.50	1810.9	-	1099	1859.2	4769.1
~0.75	1086.5	-	340.5	236	1663
~1.00	521.5	-	129	436	1086.5
~1.25	317	-	-	27	344
1.25~	558	-	-	34	592
Total	12710.4	335	1917.5	4661.7	19624.6

B, Recommended, 1998

Rt / V/C	Prov	National Highway			Total
	O	MWY	5	Other	
~0.25	8822	335	351	2264	11772
~0.50	1851.4	-	1133	2041.2	5025.6
~0.75	1092	-	338.5	405	1835.5
~1.00	642.5	-	129	220	991.5
~1.25					
1.25~					
Total	12407.9	335	1951.5	4930.2	19624.6

A, Commited Case 2006

Rt / V/C	Prov	National Highway			Total
	O	MWY	5	Other	
~0.25	7256	335	518.5	2108.5	10218
~0.50	2085.6	-	488	1027.2	3600.8
~0.75	1022.3	-	656	907	2585.3
~1.00	652	-	266	82	1000
~1.25	368.5	-	-	290	658.5
1.25~	1326	-	-	277	1603
Total	12710.4	335	1928.5	4691.7	19665.6

B, Recommended, 2006

Rt / V/C	Prov	National Highway			Total
	O	MWY	5	Other	
~0.25	7500.5	335	389.5	2357.5	10582.5
~0.50	2896.6	-	577	1125.2	4598.8
~0.75	1044.3	-	696	907	2647.3
~1.00	1269	-	266	302	1837
~1.25					
1.25~					
Total	12710.4	335	1928.5	4691.7	19665.6

(5) Toll Level and Traffic Diversion

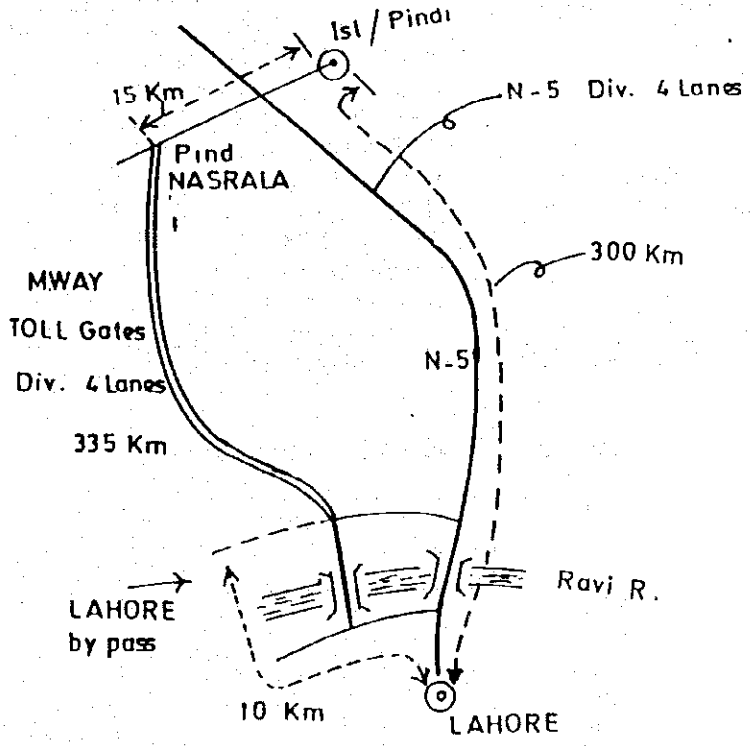
1) Objective

In order to incorporate the toll fee in the traffic assignment program, a case, using the financial VOC and the travel time, was studied for the M1 motorway project between Islamabad and Lahore of 335 km. The case using the travel time for comparison of the two routes in which toll fee can be converted to travel time is considered necessary to be incorporated in the traffic assignment simulation. A toll fee and no toll are studied as under.

2) Roads

The motorway will be completed in 1995/96. At that time N-5 will complete the improvement to a dual carriageway between Lahore and Islamabad. Vehicles on N-5 will be able to travel much smoothly and at higher speeds. Drivers are able to select the route either Motorway with a toll or N-5 without toll, depending on their assessment of travel cost, toll fee, time, comfort, etc. The two routes are sketched below in Appendix Figure 4.4.f.

Appendix Figure 4.4.f Motorway and N-5, Lahore - Islamabad



3) Travel Time Comparison between Motorway and N-5

The travel time between the two routes from Islamabad to Lahore is assumed as in the followings.

a. Motorway

335km / 80 = 4.19 hrs
25km / 60 = 0.42 hrs
Total 4.61 hrs

b. N-5
300km / 60 = 5.00 hrs

c. Balance
b - a = 0.39 hrs

This case indicates the travel time via Motorway is less than via N-5 by 0.39 hrs and to realize the time saving via Motorway some drivers may pay money as a toll fee if Motorway is managed as a toll road. In this comparison, the assumption is drivers may neglect other elements of choices in traveling.

4) Time cost

Time cost is discussed in 5.7 of Chapter 5, and a table is quoted in Appendix Table 4.4.o. If the time cost in Rs/vehicle is averaged by the percentages of vehicle composition at No.16 Jhelum on N-5, the value of Rs 32 is determined as in Appendix Table 4.4.p.

Appendix Table 4.4.o Time Cost of Passengers, 1993

Type	Cost/prs	Cost/Veh	Remarks
Car	Rs 20	Rs 20	20% for work valued at 1.0, 80% for non-work valued at 1/3 of the work hour. 8 hours/day and 25 days/month Monthly income for the main occupant Rs.9000 45*(0.2+0.8/3)= Rs21.02=Rs 20.
M/C	Rs 10	Rs 10	Assuming the half of a car
Wagon	Rs 3	Rs 36	GDP per capita at Rs 10300 in 1993 10300/(12*25*8)= Rs4.292/Hr 4.292*(0.2+0.8/2)=Rs2.6=Rs 3.0 Occupants 12* 3=Rs 36
Bus	Rs 3	Rs 120	Occupants 40*Rs3= Rs 120

Notes: A larger number of occupants are assumed in this corridor

Appendix Table 4.4.p Average Time Cost

Type	Ratio in Veh. composition at N.16	Time cost per Hr	Time cost per vehicle
M/C	0.04	10	0.40
Car	0.31	20	6.20
Wagon	0.19	36	6.84
Bus	0.08	120	9.60
Truck	0.38	24	9.12
Average	1		32.00

The toll fee on the Motorway was initially assumed for two cases referring to the current toll charge at Karachi Super highway. They are in Appendix Table 4.4.q. For example, if the same rate per km of Karachi Super Highway is used, the toll will be Rs 26 for 335km of Motorway. If a higher rate by 100% is assumed, Rs 53 can be used. Rs 53 can be converted to travel time using the above value:-

Rs 53 / Rs 32. = 1.66 Hr.

Appendix Table 4.4.q Assumed Toll Fee on Motorway

Type	Karach Sup Hiwy 145 km	Motorway 355Km Same as Karachi Sup. Hwy	Motorway 355Km 3 times higher than Kch Sup
M/C	3	7	14
Car	8	18	38
Wagon	8	23	46
Bus	15	35	70
Truck	15	35	71
Average Rs	12	26	53

If the toll of Rs 53 is charged it means an addition of travel time of 1.66 hours; and if a toll of Rs 78 is charged, an addition of 2.44 hours is calculated. Driver's evaluation of toll fee depends on his income level. If the time value is higher, then the addition of converted hours is less.

As calculated in 3.a above, the travel time of Motorway is less 0.39 hours than N-5. If the toll is charged on the Motorway, the aggregated travel time become as follows:

Motorway 4.61 hr + 1.66 hr = 6.27 hr
N-5 5.0 = 5.00 hr
Balance N-5 is shorter by 1.27 hr

N-5 is shorter by 1.27 hr, resulting in little users for the tolled Motorway from Islamabad to Lahore.

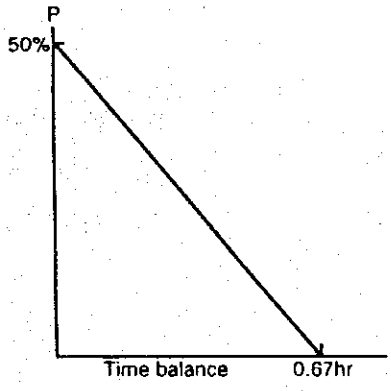
5) Toll and Diversion

a. Diversion model

If there are 2 routes between I and L and travel time and riding quality are same, a diversion 50% on the route A and 50% on the route B is a reasonable split. If the zoning system and the network are used, this kind of diversion decision is simple and applicable for the diverted traffic estimate on a new road. The problem is to determine the split at somewhere between 0% to 100% on one route, and here in this Motorway case the following is assumed.

"If the route A is longer in travel time by 2/3 hours (40 minutes) than the route B, there will be no users on route A. All traffic will use B route."

The concept and parameters are shown below



P(%) = 50 - 74.63 * x

Where:
P (%) : split in % to A, the longer time route
x : time balance as T long - T short
Susequently the percent to B, other route P'(%) can be by 100 - P(%) = P'(%)

b. Trips

The following zone pairs with large trip volume are selected for the diversion estimate for 1998.

-1. Lahore/Shakhupura - Sargoda/Miyanwali

No 17, 18 - No 13, 14 ....4950 pcu

-2. Rawalpindi/Islamabad - Sargoda, Jhang, Faisalabad
No 10 - No 13, 15, 16 ....2695 pcu

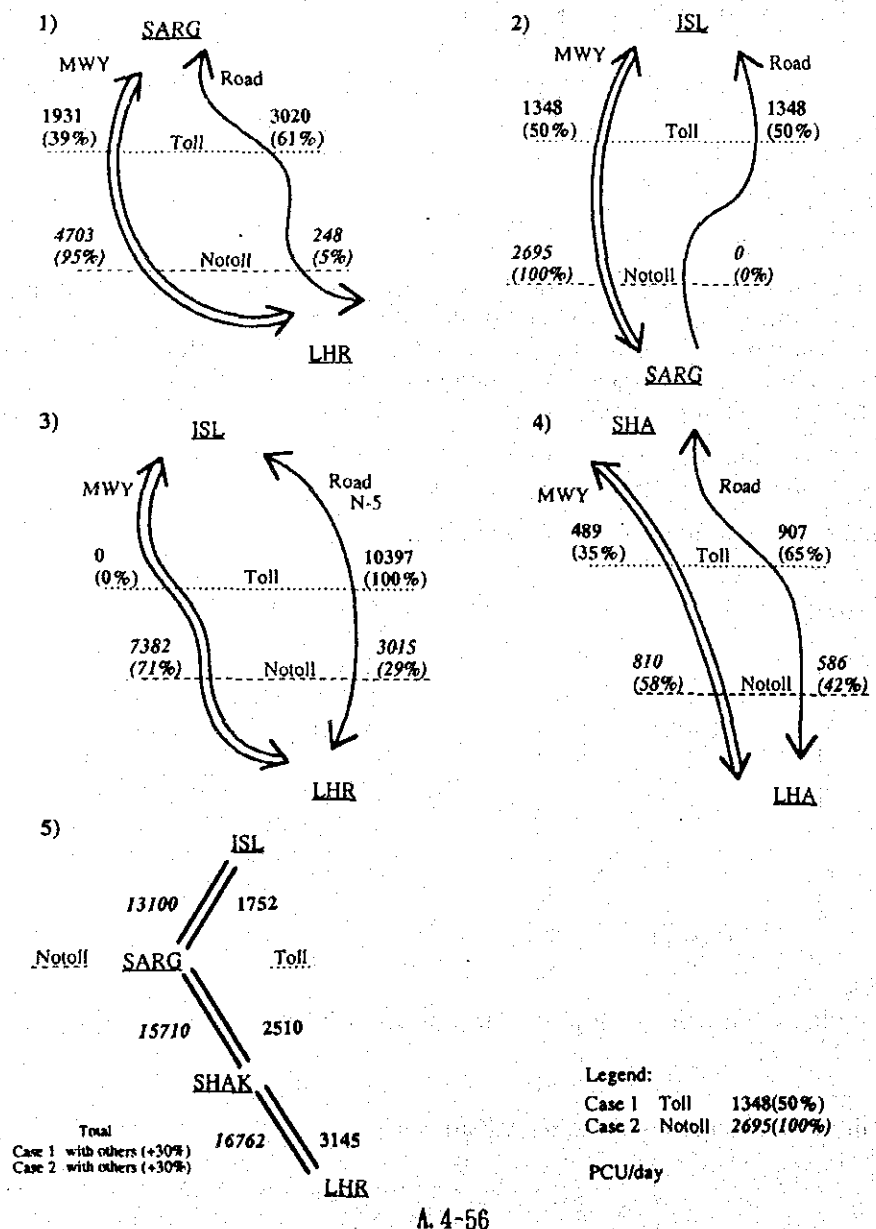
-3. Rawalpindi, Peshawar, Attock - Lahore
NO 10, 9, 2 - No 17 ....10397 pcu

-4. Lahore - Shakhupura
No 17 - No 18 ....1396 pcu

c. Diversion Ratio

Two cases were calculated: Toll is charged and No Toll charged. The toll case uses the rate per km at 2 times larger than Karachi Super Highway (Appendix Table 4.4.q). The toll is converted to travel hour by using the averaged time cost per vehicle (Appendix Table 4.4.p). The calculation detail are in Appendix Table 4.4.r. where distance, travel time, toll fee for the motorway running and its converted time are shown. The diversion ratio is calculated by the linear model in a above.

Appendix Figure 4.4.g Trafiic on Moterway, 1998 Case1 and Case2



d. Traffic on Motorway

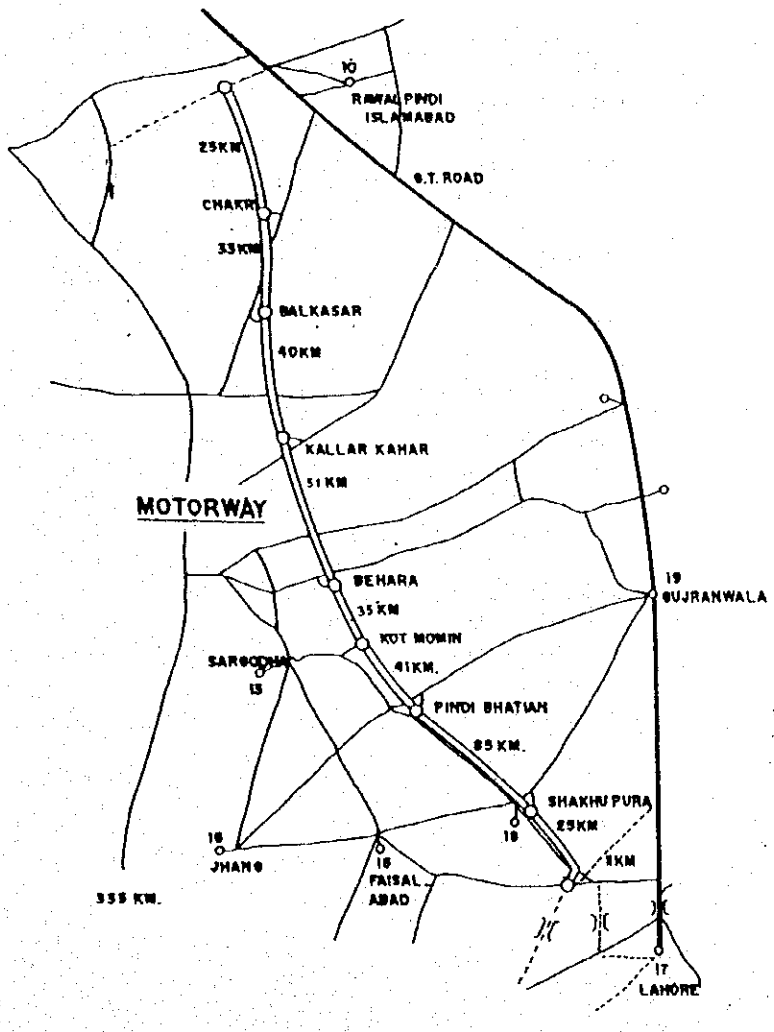
Traffic flows on Motorway in case 1, a toll is levied, is estimated and summarized on the Appendix Figure 4.4.g, where the diverted traffic and non-diverted traffic are shown in pcu and percentage of the split for major zone pairs. The figure 5) in Appendix Figure g shows the inclusion of 30% for minor pairs. If the toll is charged as case 1, majority will use the dualized N-5. Only 2500 pcu/day will use the Motorway in 1998. But, if no toll is levied, majority is using the Motorway in average 15,000 pcu per day.

e. Remarks

This study uses an assumed toll fee for Motorway, since there is no anouncement of the possible toll fee plan on the Motorway yet. Above a-d are a hypothetical example. Also route selection behavior by vehicle drivers, if the toll road is opened, is yet surveyed in Pakistan because the Motorway is the first toll road of 335 km. Karachi Super Highway is a toll road, but there is no alternative route in this coridor. No diversion analysis can be done by traffic on Karachi Super Highway. All diversion model parameters should be determined by surveys on traffic flows on the motorway and parallel roads.

In Japan, the toll road diversion model named "toll fee vs time difference method" was determined late in the 1960's and revised time to time by analyzing user's movement. The model and parameters in Pakistan can be explored after the opening of Motorway by intensive researches.

Appendix Figure 4.4.h Motorway Links



Appendix Table 4.4.r Diversion Calculation, 1998

Zone pair	Item		Case 1 Toll Mwy		Case 2 Non toll Mwy	
			Motorway	Roads	Motorway	Roads
1) Islamabad - Sargoda						
	Distance	Route km	184	202	184	202
		Access km	20	-	20	-
	Time	Route hr	2.3	3.37	2.3	3.37
		Access hr	0.33		0.33	
		Total hr	2.63	3.37	2.63	3.37
	Toll fee Rs23 to hr		0.74	-	-	-
	Total time	hr	3.37	3.37	2.63	3.37
	Shorter by	hr	0		0.74	
	Diversion	%	50	50	100	0
2) Lahore - Sargoda						
	Distance	Route km	151	170	151	170
		Access km	20	-	20	-
	Time	Route hr	1.89	2.83	1.89	2.83
		Access hr	0.33		0.33	
		Total hr	2.22	2.83	2.22	2.83
	Toll fee Rs 24 to hr		0.75	-	-	-
	Total time	hr	2.97	2.83	2.22	2.83
	Shorter by	hr	0	0.14	0.61	
	Diversion	%	39	61	95	5
3) Lahore - Shakepura						
	Distance	Route km	25	39	25	39
		Access km	14	-	14	-
	Time	Route hr	0.31	0.65	0.31	0.65
		Access hr	0.23		0.23	
		Total hr	0.54	0.65	0.54	0.65
	Toll fee Rs 4 to hr		0.13	-	-	-
	Total time	hr	0.67	0.65	0.54	0.65
	Shorter by	hr	0	0.2	0.11	
	Diversion	%	35	65	58	42
4) Islamabad - Lahore						
	Distance	Route km	335	300	335	300
		Access km	25	-	25	-
	Time	Route hr	4.19	5	4.19	5
		Access hr	0.42		0.42	
		Total hr	4.61	5	4.61	5
	Toll fee Rs 52 to hr		1.68	-	-	-
	Total time	hr	6.29	5	4.61	5
	Shorter by	hr	0	1.29	0.39	
	Diversion	%	0	100	71	29

Appendix Note 4.5.1 Road Unit Construction Costs

The estimate of unit costs of construction work were determined based on the current bid prices from the on-going or completed projects of NHA in 1993. Appendix Table 4.5.a shows a comparison of the unit rates consist of labor, material and equipment costs plus overhead and project. It can be estimated that the construction costs in 1994 are about 0.7 ~ 3.2 times higher than those in 1988. In addition, construction costs per kilometer being due to the on-going or finished road projects are shown in APPENDIX Table 4.5.b.

Appendix Table 4.5.a Comparison of Unit Rates

(Unit Rs.)

Item	Unit	1988	1994				
		Estimated by JICA (1988/89)	Province			Estimation of this study	Ratio 1994/88
			Punjab	Sind	Baluchistan		
Earth Work							
Clearing/Grubbing	m²	4.4	7.0	4.5	7.0	6	1.4
Embankment							
(Common Ex.)	m³	44.0	100.0	185.0	84.0	123	2.8
(Rock Ex.)	m³	128.0	-	-	-	-	-
(Borrow Ex.)	m³	58.3	115.0	140.0	106.0	120	2.1
Cutting							
(Common)	m³	72.0	50.0	48.0	43.0	47	0.7
(Rock)	m³	-	-	-	74.0	74	-
Pavement							
Wearing Course (Ac)		1170.2	3800.0	2950.0	4525.0	3758	3.2
Tack Coat	m²	4.9	10.0	14.0	13.0	12	2.5
Prime Coat	m²	13.9	40.0	26.0	32.0	33	2.4
Base Cource (Agg.)	m³	307.2	300.0	720.0	530.0	517	1.7
Sub Base (Agg.)	m³	262.4	200.0	500.0	360.0	353	1.3
D. Surface Treatment	m²	36.6	101.0	125.0	-	113	3.1
T. Surface Treatment	m²	-	-	-	84.0	84	-
Drainage/Structures	Ls/km	-	* 0.2	* 1	* 0.8	* 1	-
Bridges	m²	-					-
Safety/Traffic Facilities	Ls/km	-	* 0.4	* 1.1	* 0.1	* 0.5	-

Note : * indicate figures expressed by million Rs. unit.

Source : National Highway Authority (NHA), Feb 1994

The pavement costs for improvement road / new road projects were estimated by each design class and the cumulative number of standard axles on the road links. The equivalent standard axle load for trucks and buses for the pavement design used 2.5 and 0.75 respectively. (JICA Study Team, 1988). For the pavement design convenience, the estimated cumulative number of standard axles were divided into the following six group in Appendix Table 4.5.c.:

Appendix Table 4.5.b Construction cost of the On-going or Finished Road Projects, NHA

Project			Length	Cost	Unit Cost
Section	Condition	Item	(km)	(Million Rs.)	(Million Rs./km)
National Highway N - 40 Dalbandin - Nokkundi	Improvement	Earth Works	87.0	191.1	2.2
		Subbase & Base		108.3	1.2
		Surface Course & Pavement		606.3	7.0
		Structures & Drainage Works		67.9	0.8
		Ancillary Works		10.3	0.1
		Miscellaneous Item		31.0	0.4
		Total		1015.0	12.0
National Highway N - 25 Surab - Kalat	Improvement (Reconstruction) & Rehabilitation As. wearing 5cm As. base 10cm Carriage way 7.3m Shoulder 2+2m	Earth Works	80.0	108.0	1.4
		Subbase & Base		459.1	5.7
		Surface Course & Pavement		172.8	2.2
		Structures & Drainage Works		32.7	0.4
		Ancillary Works		5.7	0.1
		Miscellaneous Item		17.6	0.2
		Total		796.0	10.0
National Highway N - 5 Lahore - Okara	Improvement (Additional Carriage way / Reconstruction)	Earth Works	118.0	314.0	2.7
		Subbase & Base		1005.5	8.5
		Surface Course & Pavement		508.0	4.3
		Structures & Drainage Works		24.2	0.2
		Ancillary Works		49.9	0.4
		Miscellaneous Item		37.9	0.3
		Total		1940.0	16.0
National Highway N - 5 Moro - Katri Kabir	Improvement (Additional Carriage way / Reconstruction)	Earth Works	80.0	277.7	3.5
		Subbase & Base		770.4	9.6
		Surface Course & Pavement		188.9	2.4
		Structures & Drainage Works		77.4	1.0
		Ancillary Works		88.3	1.1
		Miscellaneous Item		-	-
		Total		1403.0	18.0

Source : National Highway Authority (NHA).

Appendix Table 4.5.c Category of Cumulative Standard Axles

Group	Cumulative number of Standard Standard Axles (10 years from 1996)		
A		-	0.1 (*10**6)
B	0.1	-	1.0
C	1.0	-	6.0
D	6.0	-	10.0
E	10.0	-	40.0
F	40.0	-	

The pavement design is made by Road Note 29 and 31 comparing with the AASHTO design method. Appendix Table 4.5.d shows the unit prices used for the cost estimation and the thickness of pavement structure adopted.

Appendix Table 4.5.d Unit Price and Pavement Structure

	Unit	(Rp.)	Width of Pavement (M)					Thickness of Pavement (M)					
		U. PRICE	w - I	w - II	w - III	w - IV	w - V	t - A	t - B	t - C	t - D	t - E	t - F
Subbase	M^3	353	17.00	8.50	8.50	7.20	4.85	0.15	0.15	0.20	0.20	0.25	0.25
Base (Agg.)	M^3	517	17.00	8.50	8.50	7.20	4.85	0.15	0.15	0.20	0.25	1.25	0.00
Shoulder (Agg.)	M^3	517	7.30	7.30	7.30	7.30	6.00	0.15	0.15	0.15	0.15	0.15	0.15
A.C Base	M^3	3180	17.00	8.50	8.50	7.20	4.85	0.00	0.00	0.00	0.00	0.06	0.20
Prime Coat	M^2	14	17.00	8.50	8.50	7.20	4.85	1.00	1.00	1.00	1.00	1.00	1.00
Tack Coat	M^2	5	14.60	7.30	7.30	6.00	3.65	1.00	1.00	1.00	1.00	1.00	1.00
Wearing (A.C)	M^3	3758	14.60	7.30	7.30	6.00	3.65	0.00	0.00	0.04	0.04	0.04	0.04
S.T	M^2	84	14.60	7.30	7.30	6.00	3.65	0.05	0.07	0.00	0.00	0.00	0.00
S.T Shoulder	M^2	84	5.50	3.65	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05

Abbreviation w - I : Pavement width of class - I Highway
t - A : Pavement thickness of cumulative number of standard Axles, Group. A
Source : JICA Study Team, 1994.

The unit construction cost per km for new roads is estimated shown in Appendix Table 4.5.e and Appendix Table 4.5.f shows the unit construction cost for each improvement category of projects by the group of cumulative number of standard axles. These financial unit costs for improvement roads and new roads are used for the proposed projects of the Mid/Short-Term (1998/2006) Proposals. For estimating economic cost from financial cost, a conversion factor of 0.80 estimated in the report, "Report on Cost Escalation, Indus Highway Project, June 1992 (NHA, Government of Pakistan)" is used.

Appendix Table 4.5.e Estimated Unit Construction Cost for Improvement Roads

Group	Classification	Design Class Exit. Prop.	C. Standard Axles	Unit Cost (Rs Million/km)
Construction due to Capacity Deficiency	Duel Carriageway / Widening and Rehabilitation	2 - 1	E	17.10
			F	22.48
			MEAN	19.79
		4 - 1	E	17.35
			F	22.73
			MEAN	20.04
		4 - 2	D	5.73
			E	7.51
			F	10.19
			MEAN	7.81
		4 - 3	D	5.43
			E	7.20
			F	9.89
			MEAN	7.51
		5 - 2	D	6.96
			E	8.74
			F	11.42
			MEAN	9.04
		5 - 3	D	6.54
			E	8.31
			F	11.00
			MEAN	8.62
		5 - 4	C	5.11
			D	5.54
			E	7.04
			MEAN	5.90
Rehabilitation due to Structural Deficiency	Resurfacing and Rehabilitation	1 - 1	E	2.96
		2 - 2	E	1.56
		3 - 3	E	1.25
		4 - 4	D	1.03
		5 - 5	C	0.63

Source : JICA Study Team, 1994

Note : The above figures are in case of flat terrain. These figures are multiplied by 1.15 and 1.30 are in case of rolling and mountainous terrain respectively.

Appendix Table 4.5.f Estimated Unit Construction Cost for New Roads

(Million Rs. / km)

	Classification of Highways / Roads				
ITEMS	I	II	III	IV	V
Clearing / Grubbing	0.20	0.12	0.12	0.11	0.09
Earth Work	6.09	3.69	3.69	3.32	2.68
Pavement					
C.S. AXLES - A	-	-	-	-	1.49
C.S. AXLES - B	-	-	-	-	1.49
C.S. AXLES - C	-	-	-	2.60	1.94
C.S. AXLES - D	-	3.82	3.52	3.03	2.07
C.S. AXLES - E	10.47	5.60	5.29	4.53	-
C.S. AXLES - F	15.85	8.28	7.98	-	-
Drainage / Structures	2.00	1.00	1.00	1.00	0.50
Safety / Traffic Facilities	1.00	0.50	0.50	0.50	0.25
Total					
C.S. AXLES - A	-	-	-	-	5.01
C.S. AXLES - B	-	-	-	-	5.01
C.S. AXLES - C	-	-	-	7.53	5.46
C.S. AXLES - D	-	9.13	8.82	7.96	5.59
C.S. AXLES - E	19.76	10.91	10.60	9.46	-
C.S. AXLES - F	25.14	13.59	13.29	-	-

Source : JICA Study Team, 1994.

Note : The above figure are in case of flat terrain. These figures are multi plied by 1.70 and 2.30 are in case of rolling and mountainious terrain, respectively.

Appendix Table 4.5.1 Economic Cost & Benefit Recommended Projects for Short Term Planning (1/3)

(unit Rs million, 1993 prices)

	Year	Total of recommended projects Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Link 4564 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Link 4081 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %
0	1993	660.26		-660.26	660.26	0.00	1993	109.02		-109.02	109.02		1993	39.04		-39.04	39.04	
1	1994	660.26		-660.26	589.52	0.00	1994	109.02		-109.02	97.34		1994	39.04		-39.04	34.86	
2	1995	660.26		-660.26	526.36	0.00	1995	109.02		-109.02	86.91		1995	39.04		-39.04	31.12	
3	1996	660.26		-660.26	469.96	0.00	1996	109.02		-109.02	77.60		1996	39.04		-39.04	27.79	
4	1997	660.26		-660.26	419.61	0.00	1997	109.02		-109.02	69.28		1997	39.04		-39.04	24.81	
5	1998	66.03	2478.12	2412.09	37.47	1406.15	1998	10.90	298.94	288.04	6.19	169.63	1998	3.90	143.08	139.18	2.22	81.19
6	1999	66.03	2577.24	2511.21	33.45	1305.71	1999	10.90	310.90	300.00	5.52	157.51	1999	3.90	148.80	144.90	1.98	75.39
7	2000	66.03	2680.33	2614.30	29.87	1212.45	2000	10.90	323.33	312.43	4.93	146.26	2000	3.90	154.76	150.85	1.77	70.00
8	2001	66.03	2787.55	2721.52	26.67	1125.84	2001	10.90	336.27	325.36	4.40	135.81	2001	3.90	160.95	157.04	1.58	65.00
9	2002	66.03	2899.05	2833.02	23.81	1045.43	2002	10.90	349.72	338.82	3.93	126.11	2002	3.90	167.38	163.48	1.41	60.36
10	2003	1567.80	3015.01	1447.21	504.79	970.75	2003	152.32	363.71	211.39	49.04	117.10	2003	100.27	174.08	73.81	32.28	56.05
11	2004	66.03	3135.61	3069.58	18.98	901.41	2004	10.90	378.25	367.35	3.13	108.74	2004	3.90	181.04	177.14	1.12	52.05
12	2005	66.03	3261.04	3195.01	16.95	837.03	2005	10.90	393.38	382.48	2.80	100.97	2005	3.90	188.28	184.38	1.00	48.33
13	2006	66.03	3391.48	3325.45	15.13	777.24	2006	10.90	409.12	398.22	2.50	93.76	2006	3.90	195.81	191.91	0.89	44.88
14	2007	66.03	3527.14	3461.11	13.51	721.72	2007	10.90	425.48	414.58	2.23	87.06	2007	3.90	203.65	199.74	0.80	41.67
	Total	5463.37	29752.57	24289.20	3386.33	10303.74	Total	795.54	3589.11	2793.57	524.83	1242.96	Total	330.61	1717.83	1387.23	202.66	594.91
	0.50			irr	b/c	npv	0.50			irr	b/c	npv				0.50	b/c	npv
			irr	0.36	3.04	6917.41				0.30	2.37	718.13				0.36	2.94	392.25

(2/3)

(unit Rs million, 1993 prices)

	Year	Link 4119 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	4461 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Link 4469 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %
0	1993	267.55		-267.55	267.55	0.00	1993	26.44		-26.44	26.44	0.00	1993	30.2		-30.20	30.20	0.00
1	1994	267.55		-267.55	238.88	0.00	1994	26.44		-26.44	23.61	0.00	1994	30.2		-30.20	26.96	0.00
2	1995	267.55		-267.55	213.29	0.00	1995	26.44		-26.44	21.08	0.00	1995	30.2		-30.20	24.08	0.00
3	1996	267.55		-267.55	190.44	0.00	1996	26.44		-26.44	18.82	0.00	1996	30.2		-30.20	21.50	0.00
4	1997	267.55		-267.55	170.03	0.00	1997	26.44		-26.44	16.80	0.00	1997	30.2		-30.20	19.19	0.00
5	1998	26.76	983.04	956.29	15.18	557.80	1998	2.64	229.95	227.31	1.50	130.48	1998	3.02	260.61	257.59	1.71	147.88
6	1999	26.76	1022.36	995.61	13.55	517.96	1999	2.64	239.15	236.50	1.34	121.16	1999	3.02	271.03	268.01	1.53	137.31
7	2000	26.76	1063.26	1036.50	12.10	480.96	2000	2.64	248.71	246.07	1.20	112.51	2000	3.02	281.88	278.86	1.37	127.51
8	2001	26.76	1105.79	1079.03	10.81	446.61	2001	2.64	258.66	256.02	1.07	104.47	2001	3.02	293.15	290.13	1.22	118.40
9	2002	26.76	1150.02	1123.26	9.65	414.71	2002	2.64	269.01	266.36	0.95	97.01	2002	3.02	304.88	301.86	1.09	109.94
10	2003	687.01	1196.02	509.01	221.20	385.09	2003	67.87	279.77	211.90	21.85	90.08	2003	77.57	317.07	239.50	24.98	102.09
11	2004	26.76	1243.86	1217.10	7.69	357.58	2004	2.64	290.96	288.32	0.76	83.64	2004	3.02	329.75	326.73	0.87	94.80
12	2005	26.76	1293.61	1266.86	6.87	332.04	2005	2.64	302.60	299.95	0.68	77.67	2005	3.02	342.94	339.92	0.78	88.03
13	2006	26.76	1345.36	1318.60	6.13	308.32	2006	2.64	314.70	312.06	0.61	72.12	2006	3.02	356.66	353.64	0.69	81.74
14	2007	26.76	1399.17	1372.42	5.47	286.30	2007	2.64	327.29	324.65	0.54	66.97	2007	3.02	370.93	367.91	0.62	75.90
	Total	2265.56	11802.48	9536.93	1388.85	4087.37	Total	223.87	2760.80	2536.94	137.24	956.11	Total	255.75	3128.91	2873.16	156.78	1083.59
	0.50			irr	b/c	npv	0.50			irr	b/c	npv	0.99			irr	b/c	npv
				0.36	2.94	2698.52				0.59	6.97	818.86				#NUM!	6.91	926.81

Appendix Table 4.5.1 Economic Cost & Benefit Recommended Projects for Short Term Planning (3/3)

(unit Rs million, 1993 prices)

	Link 8481 Year	Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Link 8483 Year	Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %
0	1993	130.16		-130.16	130.16	0.00	1993	57.85		-57.85	57.85	0.00
1	1994	130.16		-130.16	116.21	0.00	1994	57.85		-57.85	51.65	0.00
2	1995	130.16		-130.16	103.76	0.00	1995	57.85		-57.85	46.12	0.00
3	1996	130.16		-130.16	92.65	0.00	1996	57.85		-57.85	41.18	0.00
4	1997	130.16		-130.16	82.72	0.00	1997	57.85		-57.85	36.76	0.00
5	1998	13.02	411.94	398.92	7.39	233.75	1998	5.79	150.56	144.78	3.28	85.43
6	1999	13.02	428.42	415.40	6.59	217.05	1999	5.79	156.58	150.80	2.93	79.33
7	2000	13.02	445.55	432.54	5.89	201.55	2000	5.79	162.85	157.06	2.62	73.66
8	2001	13.02	463.38	450.36	5.26	187.15	2001	5.79	169.36	163.57	2.34	68.40
9	2002	13.02	481.91	468.90	4.69	173.78	2002	5.79	176.13	170.35	2.09	63.52
10	2003	334.22	501.19	166.97	107.61	161.37	2003	148.54	183.18	34.64	47.83	58.98
11	2004	13.02	521.24	508.22	3.74	149.84	2004	5.79	190.51	184.72	1.66	54.77
12	2005	13.02	542.08	529.07	3.34	139.14	2005	5.79	198.13	192.34	1.48	50.85
13	2006	13.02	563.77	550.75	2.98	129.20	2006	5.79	206.05	200.27	1.33	47.22
14	2007	13.02	586.32	573.30	2.66	119.97	2007	5.79	214.29	208.51	1.18	43.85
	Total	1102.16	4945.80	3843.63	675.66	1712.80	Total	489.86	1807.64	1317.78	300.30	626.01
	0.50			irr	b/c	npv	0.50			irr	b/c	npv
				0.32	2.54	1037.14				0.28	2.08	325.71

Appendix Table 4.5.2 Economic Cost & Benefit Recommended Projects for Medium Term Planning

(1/6)

(unit Rs million, 1993 prices)

	Year	N-70 Link 4344 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	N-70 Link 4357 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	N-70 link 4059 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %
0	1998	46.09		-46.09	46.09	0.00	1998	103.15		-103.15	103.15	0.00	1998	170.86		-170.86	170.86	
1	1999	46.09		-46.09	41.15	0.00	1999	103.15		-103.15	92.10	0.00	1999	170.86		-170.86	152.55	0.00
2	2000	46.09		-46.09	36.74	0.00	2000	103.15		-103.15	82.23	0.00	2000	170.86		-170.86	136.21	0.00
3	2001	46.09		-46.09	32.80	0.00	2001	103.15		-103.15	73.42	0.00	2001	170.86		-170.86	121.61	0.00
4	2002	46.09		-46.09	29.29	0.00	2002	103.15		-103.15	65.55	0.00	2002	170.86		-170.86	108.58	0.00
5	2003	46.09		-46.09	26.15	0.00	2003	103.15		-103.15	58.53	0.00	2003	170.86		-170.86	96.95	0.00
6	2004	46.09		-46.09	23.35	0.00	2004	103.15		-103.15	52.26	0.00	2004	170.86		-170.86	86.56	0.00
7	2005	46.09		-46.09	20.85	0.00	2005	103.15		-103.15	46.66	0.00	2005	170.86		-170.86	77.29	0.00
8	2006	7.37	299.30	291.93	2.98	120.88	2006	16.50	189.80	173.30	6.67	76.66	2006	27.34	1241.00	1213.66	11.04	501.22
9	2007	7.37	311.27	303.90	2.66	112.25	2007	16.50	197.39	180.89	5.95	71.18	2007	27.34	1290.64	1263.30	9.86	465.42
10	2008	7.37	323.72	316.35	2.37	104.23	2008	16.50	205.29	188.78	5.31	66.10	2008	27.34	1342.27	1314.93	8.80	432.17
11	2009	7.37	336.67	329.30	2.12	96.79	2009	16.50	213.50	197.00	4.74	61.38	2009	27.34	1395.96	1368.62	7.86	401.30
12	2010	7.37	350.14	342.76	1.89	89.87	2010	16.50	222.04	205.54	4.24	56.99	2010	27.34	1451.79	1424.46	7.02	372.64
13	2011	103.04	364.14	261.10	23.61	83.45	2011	152.32	230.92	78.60	34.91	52.92	2011	458.13	1509.87	1051.74	104.99	346.02
14	2012	7.37	378.71	371.34	1.51	77.49	2012	16.50	240.16	223.65	3.38	49.14	2012	27.34	1570.26	1542.92	5.59	321.31
15	2013	7.37	393.86	386.48	1.35	71.96	2013	16.50	249.76	233.26	3.02	45.63	2013	27.34	1633.07	1605.73	4.99	298.36
16	2014	7.37	409.61	402.24	1.20	66.82	2014	16.50	259.75	243.25	2.69	42.37	2014	27.34	1698.39	1671.06	4.46	277.04
17	2015	7.37	426.00	418.62	1.07	62.04	2015	16.50	270.14	253.64	2.40	39.35	2015	27.34	1766.33	1738.99	3.98	257.26
	Total	538.11	3593.43	3055.32	297.19	885.78	Total	1126.06	2278.76	1152.70	647.21	561.71	Total	2071.05	14899.58	12828.53	1119.22	3672.74
	0.5			irr	b/c	npv	0.5			irr	b/c	npv	0.5			irr	b/c	npv
				0.28	2.98	588.59				0.10	0.87	-85.50				0.28	3.28	2553.52

(unit Rs million, 1993 prices) (unit Rs million, 1993 prices) (2/6)

	Year	Link 2194 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Link 2681 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %
0	1998	72.10		-72.10	72.10	0.00	1998	63.77		-63.77	63.77	0.00
1	1999	72.10		-72.10	64.37	0.00	1999	63.77		-63.77	56.94	0.00
2	2000	72.10		-72.10	57.48	0.00	2000	63.77		-63.77	50.84	0.00
3	2001	72.10		-72.10	51.32	0.00	2001	63.77		-63.77	45.39	0.00
4	2002	72.10		-72.10	45.82	0.00	2002	63.77		-63.77	40.53	0.00
5	2003	72.10		-72.10	40.91	0.00	2003	63.77		-63.77	36.18	0.00
6	2004	72.10		-72.10	36.53	0.00	2004	63.77		-63.77	32.31	0.00
7	2005	72.10		-72.10	32.61	0.00	2005	63.77		-63.77	28.85	0.00
8	2006	11.54	176.65	165.11	4.66	71.35	2006	10.20	502.25	492.05	4.12	202.85
9	2007	11.54	183.72	172.18	4.16	66.25	2007	10.20	522.34	512.14	3.68	188.36
10	2008	11.54	191.06	179.53	3.71	61.52	2008	10.20	543.23	533.03	3.29	174.91
11	2009	11.54	198.71	187.17	3.32	57.12	2009	10.20	564.96	554.76	2.93	162.41
12	2010	11.54	206.66	195.12	2.96	53.04	2010	10.20	587.56	577.36	2.62	150.81
13	2011	161.28	214.92	53.64	36.96	49.25	2011	179.38	611.06	431.68	41.11	140.04
14	2012	11.54	223.52	211.98	2.36	45.74	2012	10.20	635.51	625.30	2.09	130.04
15	2013	11.54	232.46	220.92	2.11	42.47	2013	10.20	660.93	650.72	1.86	120.75
16	2014	11.54	241.76	230.22	1.88	39.44	2014	10.20	687.36	677.16	1.66	112.12
17	2015	11.54	251.43	239.89	1.68	36.62	2015	10.20	714.86	704.66	1.49	104.12
	Total	841.90	2120.88	1278.97	464.95	522.80	Total	781.37	6030.07	5248.70	419.65	1486.41
	0.5			irr	b/c	npv	0.5			irr	b/c	npv
				0.14	1.12	57.85				0.31	3.54	1066.76

Appendix Table 4.5.2 Economic Cost & Benefit Recommended Projects for Medium Term Planning

(3/6)

(unit Rs million, 1993 prices)

	Year	Link 5431 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Link 5702 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Link 5717 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %
0	1998	33.04		-33.04	33.04	0.00	1998	2.36		-2.36	2.36	0.00	1998	34.81		-34.81	34.81	
1	1999	33.04		-33.04	29.50	0.00	1999	2.36		-2.36	2.11	0.00	1999	34.81		-34.81	31.08	0.00
2	2000	33.04		-33.04	26.34	0.00	2000	2.36		-2.36	1.88	0.00	2000	34.81		-34.81	27.75	0.00
3	2001	33.04		-33.04	23.52	0.00	2001	2.36		-2.36	1.68	0.00	2001	34.81		-34.81	24.78	0.00
4	2002	33.04		-33.04	21.00	0.00	2002	2.36		-2.36	1.50	0.00	2002	34.81		-34.81	22.12	0.00
5	2003	33.04		-33.04	18.75	0.00	2003	2.36		-2.36	1.34	0.00	2003	34.81		-34.81	19.75	0.00
6	2004	33.04		-33.04	16.74	0.00	2004	2.36		-2.36	1.20	0.00	2004	34.81		-34.81	17.64	0.00
7	2005	33.04		-33.04	14.95	0.00	2005	2.36		-2.36	1.07	0.00	2005	34.81		-34.81	15.75	0.00
8	2006	5.29	302.95	297.66	2.14	122.36	2006	0.38	14.60	14.22	0.15	5.90	2006	5.57	709.56	703.99	2.25	286.58
9	2007	5.29	315.07	309.78	1.91	113.62	2007	0.38	15.18	14.81	0.14	5.48	2007	5.57	737.94	732.37	2.01	266.11
10	2008	5.29	327.67	322.38	1.70	105.50	2008	0.38	15.79	15.41	0.12	5.08	2008	5.57	767.46	761.89	1.79	247.10
11	2009	5.29	340.78	335.49	1.52	97.97	2009	0.38	16.42	16.05	0.11	4.72	2009	5.57	798.16	792.59	1.60	229.45
12	2010	5.29	354.41	349.12	1.36	90.97	2010	0.38	17.08	16.70	0.10	4.38	2010	5.57	830.08	824.52	1.43	213.06
13	2011	106.66	368.58	261.92	24.44	84.47	2011	9.70	17.76	8.06	2.22	4.07	2011	143.02	863.29	720.27	32.78	197.84
14	2012	5.29	383.33	378.04	1.08	78.44	2012	0.38	18.47	18.10	0.08	3.78	2012	5.57	897.82	892.25	1.14	183.71
15	2013	5.29	398.66	393.38	0.97	72.83	2013	0.38	19.21	18.84	0.07	3.51	2013	5.57	933.73	928.16	1.02	170.59
16	2014	5.29	414.61	409.32	0.86	67.63	2014	0.38	19.98	19.60	0.06	3.26	2014	5.57	971.08	965.51	0.91	158.40
17	2015	5.29	431.19	425.91	0.77	62.80	2015	0.38	20.78	20.40	0.05	3.03	2015	5.57	1009.93	1004.36	0.81	147.09
	Total	418.56	3637.25	3218.69	220.57	896.58	Total	31.98	175.29	143.31	16.23	43.21	Total	471.63	8519.05	8047.43	239.41	2099.94
	0.5			irr	b/c	npv	0.5			irr	b/c	npv	0.5			irr	b/c	npv
				0.34	4.06	676.01				0.27	2.66	26.98				0.46	8.77	1860.53

(4/6)

(unit Rs million, 1993 prices)

	Year	Link 5727 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Link 5805 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Link 5815 Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %
0	1998	74.15		-74.15	74.15	0.00	1998	3.75		-3.75	3.75	0.00	1998	5.26		-5.26	5.26	
1	1999	74.15		-74.15	66.21	0.00	1999	3.75		-3.75	3.35	0.00	1999	5.26		-5.26	4.70	0.00
2	2000	74.15		-74.15	59.11	0.00	2000	3.75		-3.75	2.99	0.00	2000	5.26		-5.26	4.19	0.00
3	2001	74.15		-74.15	52.78	0.00	2001	3.75		-3.75	2.67	0.00	2001	5.26		-5.26	3.74	0.00
4	2002	74.15		-74.15	47.12	0.00	2002	3.75		-3.75	2.38	0.00	2002	5.26		-5.26	3.34	0.00
5	2003	74.15		-74.15	42.07	0.00	2003	3.75		-3.75	2.13	0.00	2003	5.26		-5.26	2.98	0.00
6	2004	74.15		-74.15	37.57	0.00	2004	3.75		-3.75	1.90	0.00	2004	5.26		-5.26	2.66	0.00
7	2005	74.15		-74.15	33.54	0.00	2005	3.75		-3.75	1.70	0.00	2005	5.26		-5.26	2.38	0.00
8	2006	11.86	295.65	283.79	4.79	119.41	2006	0.60	51.10	50.50	0.24	20.64	2006	0.84	18.25	17.41	0.34	7.37
9	2007	11.86	307.48	295.61	4.28	110.88	2007	0.60	53.14	52.54	0.22	19.16	2007	0.84	18.98	18.14	0.30	6.84
10	2008	11.86	319.78	307.91	3.82	102.96	2008	0.60	55.27	54.67	0.19	17.80	2008	0.84	19.74	18.90	0.27	6.36
11	2009	11.86	332.57	320.70	3.41	95.60	2009	0.60	57.48	56.88	0.17	16.52	2009	0.84	20.53	19.69	0.24	5.90
12	2010	11.86	345.87	334.00	3.05	88.78	2010	0.60	59.78	59.18	0.15	15.34	2010	0.84	21.35	20.51	0.22	5.48
13	2011	165.76	359.70	193.94	37.99	82.43	2011	12.12	62.17	50.05	2.78	14.25	2011	16.97	22.20	5.23	3.89	5.09
14	2012	11.86	374.09	362.23	2.43	76.55	2012	0.60	64.66	64.06	0.12	13.23	2012	0.84	23.09	22.25	0.17	4.73
15	2013	11.86	389.06	377.19	2.17	71.08	2013	0.60	67.24	66.64	0.11	12.29	2013	0.84	24.02	23.17	0.15	4.39
16	2014	11.86	404.62	392.75	1.94	66.00	2014	0.60	69.93	69.33	0.10	11.41	0	0.84	24.98	24.13	0.14	4.07
17	2015	11.86	420.80	408.94	1.73	61.29	2015	0.60	72.73	72.13	0.09	10.59	1	0.84	25.98	25.13	0.12	3.78
	Total	865.74	3549.61	2683.87	478.14	874.98	Total	47.52	613.51	565.99	25.04	151.23	Total	66.62	219.11	152.49	35.11	54.01
	0.5			irr	b/c	npv	0.5			irr	b/c	npv	0.5			irr	b/c	npv
				0.21	1.83	396.83				0.40	6.04	126.19				0.15	1.54	18.90

Appendix Table 4.5.2 Economic Cost & Benefit Recommended Projects for Medium Term Planning

(5/6)

	Link 6772 (unit Rs million, 1993 prices)					Link 6918 (unit Rs million, 1993 prices)					Link 7874 (unit Rs million, 1993 prices)					
	Year	Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %
0	1998	75.10		-75.10	75.10	0.00	1998	50.86		-50.86	50.86		1998	8.62		-8.62	8.62	0.00
1	1999	75.10		-75.10	67.05	0.00	1999	50.86		-50.86	45.41	0.00	1999	8.62		-8.62	7.70	0.00
2	2000	75.10		-75.10	59.87	0.00	2000	50.86		-50.86	40.55	0.00	2000	8.62		-8.62	6.87	0.00
3	2001	75.10		-75.10	53.45	0.00	2001	50.86		-50.86	36.20	0.00	2001	8.62		-8.62	6.14	0.00
4	2002	75.10		-75.10	47.73	0.00	2002	50.86		-50.86	32.32	0.00	2002	8.62		-8.62	5.48	0.00
5	2003	75.10		-75.10	42.61	0.00	2003	50.86		-50.86	28.86	0.00	2003	8.62		-8.62	4.89	0.00
6	2004	75.10		-75.10	38.05	0.00	2004	50.86		-50.86	25.77	0.00	2004	8.62		-8.62	4.37	0.00
7	2005	75.10		-75.10	33.97	0.00	2005	50.86		-50.86	23.01	0.00	2005	8.62		-8.62	3.90	0.00
8	2006	12.02	638.75	626.73	4.85	257.98	2006	8.14	671.60	663.46	3.29	671.60	2006	6.85	102.20	95.35	2.77	41.28
9	2007	12.02	664.30	652.28	4.33	239.55	2007	8.14	698.46	690.33	2.93	698.46	2007	6.85	106.29	99.44	2.47	38.33
10	2008	12.02	690.87	678.86	3.87	222.44	2008	8.14	726.40	718.26	2.62	726.40	2008	6.85	110.54	103.69	2.21	35.59
11	2009	12.02	718.51	706.49	3.45	206.55	2009	8.14	755.46	747.32	2.34	755.46	2009	6.85	114.96	108.11	1.97	33.05
12	2010	12.02	747.25	735.23	3.08	191.80	2010	8.14	785.68	777.54	2.09	785.68	2010	6.85	119.56	112.71	1.76	30.69
13	2011	448.80	777.14	328.34	102.85	178.10	2011	143.02	817.10	674.08	32.78	817.10	2011	10.00	124.34	114.34	2.29	28.50
14	2012	12.02	808.22	796.21	2.46	165.38	2012	8.14	849.79	841.65	1.67	849.79	2012	6.85	129.32	122.47	1.40	26.46
15	2013	12.02	840.55	828.54	2.20	153.57	2013	8.14	883.78	875.64	1.49	883.78	2013	6.85	134.49	127.64	1.25	24.57
16	2014	12.02	874.17	862.16	1.96	142.60	2014	8.14	919.13	910.99	1.33	919.13	2014	6.85	139.87	133.02	1.12	22.82
17	2015	12.02	909.14	897.12	1.75	132.41	2015	8.14	955.90	947.76	1.19	955.90	2015	6.85	145.46	138.61	1.00	21.19
	Total	1157.74	7668.90	6511.16	548.65	1890.38	Total	623.14	8063.30	7440.16	334.68	8063.30	Total	140.61	1227.02	1086.42	66.19	302.46
	0.5			irr	b/c	npv	0.5			irr	b/c	npv	0.5			irr	b/c	npv
				0.32	3.45	1341.73				0.38	24.09	7728.62				0.37	4.57	236.27

(6/6)

	Link 7945 (unit Rs million, 1993 prices)					Link 8214 (unit Rs million, 1993 prices)					All links (unit Rs million, 1993 prices)					
	Year	Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %	Year	Cost	Benefit	Net Ben	Cost at 12 %	Benefit at 12 %
0	1998	42.81		-42.81	42.81		1998	14.65		-14.65	14.65	0.00	1998	801.41		-801.41	801.41	0.00
1	1999	42.81		-42.81	38.22	0.00	1999	14.65		-14.65	13.08	0.00	1999	801.41		-801.41	715.54	0.00
2	2000	42.81		-42.81	34.13	0.00	2000	14.65		-14.65	11.68	0.00	2000	801.41		-801.41	638.88	0.00
3	2001	42.81		-42.81	30.47	0.00	2001	14.65		-14.65	10.43	0.00	2001	801.41		-801.41	570.43	0.00
4	2002	42.81		-42.81	27.21	0.00	2002	14.65		-14.65	9.31	0.00	2002	801.41		-801.41	509.31	0.00
5	2003	42.81		-42.81	24.29	0.00	2003	14.65		-14.65	8.31	0.00	2003	801.41		-801.41	454.74	0.00
6	2004	42.81		-42.81	21.69	0.00	2004	14.65		-14.65	7.42	0.00	2004	801.41		-801.41	406.02	0.00
7	2005	42.81		-42.81	19.37	0.00	2005	14.65		-14.65	6.63	0.00	2005	801.41		-801.41	362.52	0.00
8	2006	6.85	644.30	637.45	2.77	260.22	2006	2.34	89.35	87.01	0.95	36.09	2006	128.24	5940.01	5811.77	51.79	2399.07
9	2007	6.85	670.07	663.22	2.47	241.63	2007	2.34	92.92	90.58	0.85	33.51	2007	128.24	6177.61	6049.37	46.24	2227.71
10	2008	6.85	696.87	690.03	2.21	224.38	2008	2.34	11.00	8.66	0.75	3.54	2008	128.24	6424.71	6296.47	41.29	2068.59
11	2009	6.85	724.75	717.90	1.97	208.35	2009	2.34	11.44	9.10	0.67	3.29	2009	128.24	6681.70	6553.46	36.87	1920.83
12	2010	6.85	753.74	746.89	1.76	193.47	2010	2.34	11.90	9.55	0.60	3.05	2010	128.24	6948.97	6820.73	32.92	1783.63
13	2011	138.17	783.89	645.72	31.66	179.65	2011	41.21	12.37	-28.84	9.44	2.84	2011	2303.02	7226.93	4923.91	527.79	1656.23
14	2012	6.85	815.25	808.40	1.40	166.82	2012	2.34	12.87	10.52	0.48	2.63	2012	128.24	7516.01	7387.77	26.24	1537.92
15	2013	6.85	847.85	841.01	1.25	154.90	2013	2.34	13.38	11.04	0.43	2.45	2013	128.24	7816.65	7688.41	23.43	1428.07
16	2014	6.85	881.77	874.92	1.12	143.84	2014	2.34	13.92	11.57	0.38	2.27	2014	128.24	8129.31	8001.07	20.92	1326.07
17	2015	6.85	917.04	910.19	1.00	133.56	2015	2.34	14.48	12.13	0.34	2.11	2015	128.24	8454.49	8326.25	18.68	1231.35
	Total	521.75	5088.87	4567.12	282.42	1474.51	Total	179.51	283.63	104.12	96.41	91.77	Total	9868.46	71316.40	61447.94	5285.02	17579.46
	0.5			irr	b/c	npv	0.5			irr	b/c	npv	0.5			irr	b/c	npv
				0.41	5.22	1192.09				0.11	0.95	-4.63				0.30	1.87	12294.44

Appendix Table 4.5.3 Expenditures of Federal Government (via NHA) 6th & 7th FYP
(in current prices '000)

		6th				7th					
		85/6	86/7	87/8	Total	88/9	89/0	90/1	91/2	92/3	Total
Punjab	1 N-5 W Carr	188,576	118,224	93,983	400,783	242,384	117,561	6,116	382		366,443
	2 n-5 Rehab	26,016	35,590	49,274	110,880	67,978	55,996	63,898	1,057		188,929
	Total	214,592	153,814	143,257	511,663	310,362	173,557	70,014	1,439	0	555,372
Sind	1 N-5 W Carr	105,586	107,000	40,000	252,586	102,146	13,823	87,657	21,000		224,626
	1 N-5 Rehab	153,899	38,612	71,750	264,261	19,255	0	5,000	3,000		27,255
	3 N-55 Impr.				0	14,000		8,000	2,000		24,000
	4 N-65 Impr			500	500	17,346	12,511	1,500	500		31,857
	Total	259,484	145,612	112,250	517,346	152,749	26,334	102,357	26,500	0	307,940
NWFP	1 N-5 W Carr	165,209	42,227	26,500	233,936	17,821	17,821	20,538			56,180
	2 N-5 Rehab	30,113	10,000	8,500	48,613	4,650	4,650	9,400			18,700
	3 N-55 Impr.		40,000	46,154	86,154	74,778					74,778
	5 N-35 Impr				0	9,570	1,000				10,570
	13 Provin Rds	381,121	107,000	26,000	514,121	1,900	1,900	12,000			15,800
	Total	576,443	199,227	107,154	882,824	108,719	25,371	41,938	0	0	176,028
Baluch'tan	6 N-25 Impr.	19,717	31,803	46,126	99,646	14,221	15,100	16,397	10,000		55,718
	4 N-65 Impr		32,000	98,128	130,128	28,337	14,863	1,060	2,000		46,260
	7 N-50 Impr.				0	50,000		6,100			56,100
	8 N-40 Impr		8,984	4,940	13,924	3,741	4,908	12,793	2,000		23,442
	13 Provin Rds				0			15,000	10,000		25,000
	Total	19,717	72,787	151,194	243,698	96,299	34,871	51,370	24,000	0	206,540
N H A	9 N-5 3rd HWP	1,008,883	12,000	13,000	1,033,883	92,650	6,650	10,000	0		109,300
	10 N-5 4th HWP			398,000	398,000	1,158,988	358,988	500,000	395,660	1,504,779	3,918,415
	1 N-5	16,987	3,634		20,621	2,356			50,000	3,950,000	4,002,356
	3 N-55		20,000	11,300	31,300	5,588	61,858	105,494	991,490	1,500,000	2,664,430
	13 Provin Rd	1,231	4,480	6,000	11,711	4,750		4,750	31,500		41,000
	11 N H A	2,030	8,466	3,700	14,196	6,429	5,311	4,161	3,000		18,901
	12 Maint. WB				0			436,451	173,000	580,649	1,190,100
	S Motorway				0				4,124,000	2,776,027	6,900,027
	Total	1,029,131	48,580	432,000	1,509,711	1,270,761	432,807	1,060,856	5,768,650	10,311,455	18,844,529
Total		2,099,367	620,020	945,855	3,665,242	1,938,890	692,940	1,326,535	5,820,589	10,311,455	20,090,409
Summary	1, 2, 10 N-5	686,385	355,267	688,007	1,729,679	1,615,560	568,839	692,809	471,099	5,454,770	8,803,106
	3 N-55	0	60,000	57,454	117,454	94,366	61,858	113,494	993,490	1,500,000	2,763,208
	4 N-65	0	32,000	98,628	130,628	45,683	27,374	2,580	2,500	0	78,137
	5 N-35	0	0	0	0	9,570	1,000		0	0	10,570
	6 N-25	19,717	31,803	46,126	99,646	14,221	15,100	16,397	10,000	0	55,718
	7 N-50	0	0	0	0	50,000	0	6,100	0	0	56,100
	8 N-40	0	8,984	4,940	13,924	3,741	4,908	12,793	2,000	0	23,442
	9 3rd HWP	1,008,883	12,000	13,000	1,033,883	92,650	6,650	10,000	0		109,300
	11 NHA	2,030	8,466	3,700	14,196	6,429	5,311	4,161	3,000	0	18,901
	12 Maint	0	0	0	0	0	0	436,451	173,000	580,649	1,190,100
	13 Prov	382,352	111,480	32,000	525,832	6,650	1,900	31,750	41,500	0	81,800
	S Motorwy	0	0	0	0	0	0	0	4,124,000	2,776,027	6,900,027
Total		2,099,367	620,020	945,855	3,665,242	1,938,890	692,940	1,326,535	5,820,589	10,311,455	20,090,409

Source:Planning Commission (Feb. 1994)