









8-6 Financial Analysis for the Delhi - Kanpur Railway Project - Case (C)

( UNIT : 1000 RS )

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
OPERATING PROFIT	0	0	0	44902	274285	503537	732770	959885	1305965	1852066
OPERATING REVENUE	0	0	0	329295	611929	894563	1177197	1459831	1861422	2263013
THE SECTION										
PASSENGER	0	0	0	134394	207407	280419	353432	426444	527902	629360
FREIGHT	0	0	0	194901	404523	614144	823705	1033387	1333520	1633653
TOTAL	0	0	0	329295	611929	894563	1177197	1459831	1861422	2263013
NEW CORRIDOR										
SUPER EXPRESS	0	0	0	0	0	0	0	0	0	0
LONG EXPRESS	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0
OPERATING EXPENSE	0	0	0	284303	337664	391026	444427	499988	555457	610947
THE SECTION										
WORKING COST	0	0	0	193515	237799	262083	326407	371788	417136	462477
MAINTENANCE COST	0	0	0	95907	102777	108647	116517	124401	132285	140169
PERSONNEL COST	0	0	0	6056	10700	15344	20028	24763	30588	38414
ELEC COST	0	0	0	91551	124321	157092	189682	222832	254263	285894
DEPRECIATION	0	0	0	90788	99865	108943	118020	126170	138320	148470
NEW CORRIDOR										
WORKING COST	0	0	0	0	0	0	0	0	0	0
MAINTENANCE COST	0	0	0	0	0	0	0	0	0	0
PERSONNEL COST	0	0	0	0	0	0	0	0	0	0
ELEC COST	0	0	0	0	0	0	0	0	0	0
DEPRECIATION	0	0	0	0	0	0	0	0	0	0
INVESTMENT	69530	1351945	1338471	272325	272325	272325	272325	2000120	4449408	6427461
FOREIGN TOTAL	0	149250	149850	0	0	0	0	0	393240	1098340
LOCAL TOTAL	69530	1202695	1187021	272325	272325	272325	272325	2000120	4056168	5329141
THE SECTION										
FOREIGN TOTAL	0	149250	149850	0	0	0	0	0	0	0
LOCAL TOTAL	69530	1202695	1187021	272325	272325	272325	272325	304500	304500	304500
ELECTRIFICATION	0	75888	75898	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	16280	16280	0	0	0	0	0	0	0
LOCAL CURRENCY	0	59628	59638	0	0	0	0	0	0	0
SIGNALS & TELECOM	0	597897	603503	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	132900	133590	0	0	0	0	0	0	0
LOCAL CURRENCY	0	464907	469913	0	0	0	0	0	0	0
CIVIL WORK	67080	170910	152220	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	67080	170910	152220	0	0	0	0	0	0	0
LAND ACQ & COMP	2450	2000	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	2450	2000	0	0	0	0	0	0	0	0
ROLLING STOCK	0	505250	505250	272325	272325	272325	272325	304500	304500	304500
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	505250	505250	272325	272325	272325	272325	304500	304500	304500
-SALVAGE VALUE INT. DURING CONST.	0	0	0	0	0	0	0	0	0	0
	4734	91778	212239	0	0	0	0	0	0	0

NEW CORRIDOR	0	0	0	0	0	0	0	0	1695620	4144906	8122981
FOREIGN TOTAL	0	0	0	0	0	0	0	0	0	393240	1098340
LOCAL TOTAL	0	0	0	0	0	0	0	0	1695620	3751666	5024641
ELECTRIFICATION	0	0	0	0	0	0	0	0	0	414140	769240
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0	79800
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	414140	689440
SIGNALS & TELECOM	0	0	0	0	0	0	0	0	0	1279716	1279716
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	393240	393240
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	886476	886476
CIVIL WORK	0	0	0	0	0	0	0	0	1540580	2234130	2234130
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	1540580	2234130	2234130
LAND ACQ & CONP	0	0	0	0	0	0	0	0	155040	216920	165240
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	155040	216920	165240
ROLLING STOCK	0	0	0	0	0	0	0	0	0	0	1674855
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0	625500
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	0	1049155
-SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0	0
INT. DURING CONST.	0	0	0	0	0	0	0	0	115456	428159	919685
<b>FINANCE PROGRAM</b>											
<b>FINANCE TOTAL</b>											
BORROWING	74264	1443723	1549110	0	0	0	0	0	1811076	4573065	7042666
REPAYMENT	0	0	0	0	0	0	0	0	0	0	0
BALANCE	74264	1517987	3087097	3067097	3067097	3067097	3067097	4878173	9451238	16493904	
INTEREST	4734	91778	212239	242897	242897	242897	242897	358353	671056	1162582	
<b>FINANCE IN FOREIGN CCY</b>											
BORROWING	0	152393	157285	0	0	0	0	0	0	401521	1132745
REPAYMENT	0	0	0	0	0	0	0	0	0	0	0
BALANCE	0	152393	309678	309678	309678	309678	309678	309678	711199	1843944	
INTEREST	0	3143	7435	8516	8516	8516	8516	8516	16798	42921	
<b>FINANCE IN LOCAL CCY 1</b>											
BORROWING	74264	1291330	1391825	0	0	0	0	0	1811076	4171543	5909921
REPAYMENT	0	0	0	0	0	0	0	0	0	0	0
BALANCE	74264	1385594	2757419	2757419	2757419	2757419	2757419	4568496	8740039	14649960	
INTEREST	4734	88635	204804	234381	234381	234381	234381	349837	654258	1119661	
<b>FINANCE IN LOCAL CCY 2</b>											
BORROWING	0	0	0	0	0	0	0	0	0	0	0
REPAYMENT	0	0	0	0	0	0	0	0	0	0	0
BALANCE	0	0	0	0	0	0	0	0	0	0	0
INTEREST	0	0	0	0	0	0	0	0	0	0	0
NET CASHFLOW	0	0	0	-379442	-141092	97258	335569	540838	896889	1253140	
CUM NET CASHFLOW	0	0	0	-379442	-520533	-423275	-87706	452932	1349821	2602961	
CASH IN	74264	1443723	1549110	135780	374130	612480	850790	2899111	6017350	8843202	
OPERATING PROFIT	0	0	0	44992	274285	503537	732770	959865	1305965	1652066	
DEPRECIATION	0	0	0	90788	99865	108943	118020	128170	138320	148470	
BORROWING	74264	1443723	1549110	0	0	0	0	1811076	4573065	7042666	
CASH OUT	74264	1443723	1549110	515222	515222	515222	515222	2358473	5120462	7590063	
INVESTMENT	69530	1351945	1336871	272325	272325	272325	272325	2000120	4448406	6427481	
INT. DURING CONST.	4734	91778	212239	0	0	0	0	115456	428159	919685	
REPAYMENT	0	0	0	0	0	0	0	0	0	0	
INTEREST	0	0	0	242897	242897	242897	242897	242897	242897	242897	
CF FOR FIRR	-69530	-1351945	-1336871	-136545	191805	340155	578465	-912085	-3005120	-4626945	
FIRR %	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
OPERATING PROFIT	1998166	2327454	3522223	3882697	4243171	4603644	4964053	5321172	5768292	6211412
OPERATING REVENUE	2684604	3086195	5979018	8418658	8858299	7287941	7737582	8177224	8706962	9238701
THE SECTION										
PASSENGER	730818	632276	18196	42874	67553	92231	118909	141587	169202	198818
FREIGHT	1933786	2233920	2534053	2772189	3010325	3248461	3486598	3724734	4014448	4304163
TOTAL	2684604	3086195	2552249	2815083	3077878	3340892	3803508	3868320	4183850	4500980
NEW CORRIDOR										
SUPER EXPRESS	0	0	2996796	3157029	3317263	3477497	3637731	3797964	3885099	4172235
LONG EXPRESS	0	0	428971	446566	463158	479752	496345	512939	538213	563488
TOTAL	0	0	3426767	3603594	3780422	3957249	4134076	4310903	4523312	4735721
OPERATING EXPENSE	668438	738741	2456793	2535961	2616128	2694296	2773529	2856952	2940871	3025269
THE SECTION										
WORKING COST	668438	738741	564102	602378	640653	678928	717288	756670	796646	836622
MAINTENANCE COST	507817	589970	422232	454609	486985	519362	551803	584736	618243	651751
PERSONNEL COST	148053	155838	134508	138754	143001	147248	151494	156209	160923	165637
ELEC COST	42239	48095	28222	31313	33404	35495	37651	39830	42250	44670
DEPRECIATION	317525	365968	258502	284541	310580	338619	362858	388697	415070	441444
NEW CORRIDOR	0	0	1892690	1933563	1974476	2015368	2056261	2099382	2144025	2188667
WORKING COST	0	0	1127710	1159254	1180797	1222341	1253885	1286406	1320449	1354491
MAINTENANCE COST	0	0	575599	582255	588912	595568	602224	609756	617288	624820
PERSONNEL COST	0	0	98309	99971	101633	103296	104958	106722	108381	110000
ELEC COST	0	0	453802	477027	500252	523477	546702	569927	594799	619671
DEPRECIATION	0	0	784980	774329	783678	793027	802376	812976	823576	834176
INVESTMENT	7909021	3125192	-434458	369620	369620	552475	369620	411740	411740	411740
FOREIGN TOTAL	1088340	170880	600	0	0	1210	0	0	0	0
LOCAL TOTAL	6810881	2954312	-435058	369620	369620	551265	369620	411740	411740	411740
THE SECTION										
FOREIGN TOTAL	0	0	600	0	0	1210	0	0	0	0
LOCAL TOTAL	304500	304500	-827718	176960	176960	358805	176960	194080	194080	194080
ELECTRIFICATION	0	0	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	0
SIGNALS & TELECOM	0	0	3336	0	0	182855	0	0	0	0
FOREIGN CURRENCY	0	0	600	0	0	1210	0	0	0	0
LOCAL CURRENCY	0	0	2736	0	0	181645	0	0	0	0
CIVIL WORK	0	0	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	0
LAND ACQ & COMP	0	0	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	0
ROLLING STOCK	304500	304500	-830454	176960	176960	176960	176960	194080	194080	194080
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	304500	304500	-830454	176960	176960	176960	176960	194080	194080	194080
-SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0
INT. DURING CONST.	0	0	0	0	0	0	0	0	0	0

NEW CORRIDOR	7604521	2820692	192660	192660	192660	192660	192660	217680	217680	217680
FOREIGN TOTAL	1098340	170880	0	0	0	0	0	0	0	0
LOCAL TOTAL	8506181	2840812	192660	192660	192660	192660	192660	217680	217680	217680
ELECTRIFICATION	751340	309630	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	79600	39800	0	0	0	0	0	0	0	0
LOCAL CURRENCY	671740	269830	0	0	0	0	0	0	0	0
SIGNALS & TELECOM	1279716	428572	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	393240	131080	0	0	0	0	0	0	0	0
LOCAL CURRENCY	886476	295492	0	0	0	0	0	0	0	0
CIVIL WORK	2389210	480150	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	2389210	480150	0	0	0	0	0	0	0	0
LAND ACQ & COMP	0	0	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	0
ROLLING STOCK	3184255	1604340	192660	192660	192660	192660	192680	217680	217680	217680
FOREIGN CURRENCY	625500	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	2558755	1604340	192660	192660	192660	192660	192680	217680	217680	217680
-SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0
INT. DURING CONST.	1588919	2088428	0	0	0	0	0	0	0	0
FINANCE PROGRAM										
FINANCE TOTAL										
BORROWING	9193440	4889120	0	0	0	0	0	0	0	0
REPAYMENT	0	0	0	15484	15484	15484	15484	15484	15484	15484
BALANCE	25887344	30576484	30576464	30580980	30545498	30530012	30514528	30499044	30483560	30468076
INTEREST	1831816	2311325	2411621	2411302	2410876	2410450	2410024	2409598	2409173	2408747
FINANCE IN FOREIGN CCY										
BORROWING	1184551	250259	0	0	0	0	0	0	0	0
REPAYMENT	0	0	0	15484	15484	15484	15484	15484	15484	15484
BALANCE	3008495	3258754	3258764	3243270	3227786	3212303	3198819	3181335	3165851	3150367
INTEREST	74727	87695	89916	89298	88871	88445	88019	87593	87167	86742
FINANCE IN LOCAL CCY 1										
BORROWING	8028889	4638861	0	0	0	0	0	0	0	0
REPAYMENT	0	0	0	0	0	0	0	0	0	0
BALANCE	22678849	27317709	27317709	27317709	27317709	27317709	27317709	27317709	27317709	27317709
INTEREST	1757088	2223430	2322005	2322005	2322005	2322005	2322005	2322005	2322005	2322005
FINANCE IN LOCAL CCY 2										
BORROWING	0	0	0	0	0	0	0	0	0	0
REPAYMENT	0	0	0	0	0	0	0	0	0	0
BALANCE	0	0	0	0	0	0	0	0	0	0
INTEREST	0	0	0	0	0	0	0	0	0	0
NET CASHFLOW	1609390	1948828	2451911	2008390	2384537	2577829	3136766	3469259	3931874	4394489
CUM NET CASHFLOW	4212351	6101179	8613089	10621479	13008018	15583845	18720611	22189871	26121744	30518233
CASH IN	11350228	7385345	4429074	4804795	5180517	5566238	5931894	6308082	6768270	7230459
OPERATING PROFIT	1998166	2327454	3522223	3882697	4243171	4603644	4964053	5321172	5768292	6211412
DEPRECIATION	158820	168770	908851	922098	937346	952594	967841	984910	1001979	1019947
BORROWING	9193440	4889120	0	0	0	0	0	0	0	0
CASH OUT	9740837	5436517	1977163	2796408	2795980	2978409	2795128	2836822	2836397	2835971
INVESTMENT	7909021	3125192	-434458	389820	369820	552475	369820	411740	411740	411740
INT. DURING CONST.	1588919	2088428	0	0	0	0	0	0	0	0
REPAYMENT	0	0	0	15484	15484	15484	15484	15484	15484	15484
INTEREST	242897	242897	2411621	2411302	2410876	2410450	2410024	2409598	2409173	2408747
CF FOR FIRR	-5752234	-628967	4863532	4435175	4810897	5003763	5562274	5894342	6356530	6818719
FIRR %	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
OPERATING PROFIT	858532	7101826	7383462	7383462	7383462	7383462	7383462	7383462	7383462	7383462
OPERATING REVENUE	9786439	10208178	10813508	10813508	10813508	10813508	10813508	10813508	10813508	10813508
THE SECTION										
PASSENGER	224433	252049	278664	278664	278664	278664	278664	278664	278664	278664
FREIGHT	4593877	4883591	5173308	5173308	5173308	5173308	5173308	5173308	5173308	5173308
TOTAL	4818310	5135840	5452970	5452970	5452970	5452970	5452970	5452970	5452970	5452970
NEW CORRIDOR										
SUPER EXPRESS	4359370	4548505	4548505	4548505	4548505	4548505	4548505	4548505	4548505	4548505
LONG EXPRESS	588760	614034	614034	614034	614034	614034	614034	614034	614034	614034
TOTAL	4948129	5180538	5180538	5180538	5180538	5180538	5180538	5180538	5180538	5180538
OPERATING EXPENSE	3109808	3184552	3250048	3250048	3250048	3250048	3250048	3250048	3250048	3250048
THE SECTION										
WORKING COST	878588	918599	945481	945481	945481	945481	945481	945481	945481	945481
MAINTENANCE COST	685258	718791	747673	747673	747673	747673	747673	747673	747673	747673
PERSONNEL COST	170352	175088	175088	175088	175088	175088	175088	175088	175088	175088
ELEC COST	47089	49535	52043	52043	52043	52043	52043	52043	52043	52043
DEPRECIATION	467817	494191	520584	520584	520584	520584	520584	520584	520584	520584
NEW CORRIDOR	181340	197808	197808	197808	197808	197808	197808	197808	197808	197808
WORKING COST	2233310	2277953	2304585	2304585	2304585	2304585	2304585	2304585	2304585	2304585
MAINTENANCE COST	1388534	1422576	1449189	1449189	1449189	1449189	1449189	1449189	1449189	1449189
PERSONNEL COST	832352	839884	839884	839884	839884	839884	839884	839884	839884	839884
ELEC COST	111838	113277	115018	115018	115018	115018	115018	115018	115018	115018
DEPRECIATION	644543	689415	694287	694287	694287	694287	694287	694287	694287	694287
INVESTMENT	411740	2219321	0	608438	0	0	0	182855	0	0
FOREIGN TOTAL	0	544800	0	192830	0	0	0	1210	0	0
LOCAL TOTAL	411740	1874421	0	415608	0	0	0	181645	0	0
THE SECTION										
FOREIGN TOTAL	194080	197398	0	608438	0	0	0	182855	0	0
LOCAL TOTAL	0	600	0	192830	0	0	0	1210	0	0
ELECTRIFICATION	0	0	0	78115	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	32520	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	45595	0	0	0	0	0	0
SIGNALS & TELECOM	0	3338	0	532321	0	0	0	182855	0	0
FOREIGN CURRENCY	0	800	0	160310	0	0	0	1210	0	0
LOCAL CURRENCY	0	2738	0	372011	0	0	0	181645	0	0
CIVIL WORK	0	0	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	0
LAND ACQ & COMP	0	0	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	0
ROLLING STOCK	194080	194080	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	194080	194080	0	0	0	0	0	0	0	0
-SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0
INT. DURING CONST.	0	0	0	0	0	0	0	0	0	0

NEW CORRIDOR	217680	2021925	0	0	0	0	0	0	0	0
FOREIGN TOTAL	0	544300	0	0	0	0	0	0	0	0
LOCAL TOTAL	217680	1477625	0	0	0	0	0	0	0	0
ELECTRIFICATION	0	0	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	0
SIGNALS & TELECOM	0	1804245	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	544300	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	1259945	0	0	0	0	0	0	0	0
CIVIL WORK	0	0	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	0
LAND ACQ & COMP	0	0	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0	0	0	0
ROLLING STOCK	217680	217680	0	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0	0	0	0
LOCAL CURRENCY	217680	217680	0	0	0	0	0	0	0	0
-SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0
INT. DURING CONST.	0	0	0	0	0	0	0	0	0	0
FINANCE PROGRAM										
FINANCE TOTAL										
BORROWING	0	0	0	0	0	0	0	0	0	0
REPAYMENT	15484	15484	162938	162938	162938	162938	162938	162938	162938	162938
BALANCE	30452593	30437109	30274171	30111233	29948296	29785358	28622420	29459482	28286545	29133807
INTEREST	2408321	2407895	2404428	2399947	2395467	2390986	2386505	2382024	2377543	2373063
FINANCE IN FOREIGN CCY										
BORROWING	0	0	0	0	0	0	0	0	0	0
REPAYMENT	15484	15484	162938	162938	162938	162938	162938	162938	162938	162938
BALANCE	3134883	3119399	2958461	2793524	2630588	2487648	2304711	2141773	1978835	1815897
INTEREST	86316	85890	82423	77942	73461	68981	64500	60019	55538	51057
FINANCE IN LOCAL CCY 1										
BORROWING	0	0	0	0	0	0	0	0	0	0
REPAYMENT	0	0	0	0	0	0	0	0	0	0
BALANCE	27317709	27317709	27317709	27317709	27317709	27317709	27317709	27317709	27317709	27317709
INTEREST	2322005	2322005	2322005	2322005	2322005	2322005	2322005	2322005	2322005	2322005
FINANCE IN LOCAL CCY 2										
BORROWING	0	0	0	0	0	0	0	0	0	0
REPAYMENT	0	0	0	0	0	0	0	0	0	0
BALANCE	0	0	0	0	0	0	0	0	0	0
INTEREST	0	0	0	0	0	0	0	0	0	0
NET CASHFLOW	4857103	3512111	5849281	5245326	5858242	5862723	5887204	5888830	5876165	5880846
CUM NET CASHFLOW	35373336	38885446	44734727	49980053	55838295	61701018	67568222	73257052	79133217	85013864
CASH IN	7892848	8154811	8416647	8416647	8416647	8416647	8416647	8416647	8416647	8416647
OPERATING PROFIT	6656532	7101628	7383462	7383462	7383462	7383462	7383462	7383462	7383462	7383462
DEPRECIATION	1036116	1053185	1053185	1053185	1053185	1053185	1053185	1053185	1053185	1053185
BORROWING	0	0	0	0	0	0	0	0	0	0
CASH OUT	2835545	4642700	2567368	3171321	2558404	2553924	2549443	2727817	2540481	2536000
INVESTMENT	411740	2219321	0	608436	0	0	0	182855	0	0
INT. DURING CONST.	0	0	0	0	0	0	0	0	0	0
REPAYMENT	15484	15484	162938	162938	162938	162938	162938	162938	162938	162938
INTEREST	2408321	2407895	2404428	2399947	2395467	2390986	2386505	2382024	2377543	2373063
CF FOR FIRR	7280908	5935490	8416647	7808211	8416647	8416647	8416647	8233792	8416647	8416647
FIRR %	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00

	2018	2019	2020	2021	2022	2023	2024
OPERATING PROFIT	7383482	7383482	7383482	7383482	7383482	7383482	7383482
OPERATING REVENUE	10813508	10813508	10813508	10813508	10813508	10813508	10813508
THE SECTION							
PASSENGER	278884	278884	278884	278884	278884	278884	278884
FREIGHT	5173306	5173306	5173306	5173306	5173306	5173306	5173306
TOTAL	5452970	5452970	5452970	5452970	5452970	5452970	5452970
NEW CORRIDOR							
SUPER EXPRESS	4548505	4548505	4548505	4548505	4548505	4548505	4548505
LONG EXPRESS	614034	614034	614034	614034	614034	614034	614034
TOTAL	5180538	5180538	5180538	5180538	5180538	5180538	5180538
OPERATING EXPENSE	3250048	3250048	3250048	3250048	3250048	3250048	3250048
THE SECTION							
WORKING COST	747873	747873	747873	747873	747873	747873	747873
MAINTENANCE COST	175088	175088	175088	175088	175088	175088	175088
PERSONNEL COST	52043	52043	52043	52043	52043	52043	52043
ELEC COST	520584	520584	520584	520584	520584	520584	520584
DEPRECIATION	197808	197808	197808	197808	197808	197808	197808
NEW CORRIDOR	2304585	2304585	2304585	2304585	2304585	2304585	2304585
WORKING COST	1449189	1449189	1449189	1449189	1449189	1449189	1449189
MAINTENANCE COST	839884	839884	839884	839884	839884	839884	839884
PERSONNEL COST	115018	115018	115018	115018	115018	115018	115018
ELEC COST	694287	694287	694287	694287	694287	694287	694287
DEPRECIATION	855376	855376	855376	855376	855376	855376	855376
INVESTMENT	1807581	0	8595120	1334995	334695	354825	334695
FOREIGN TOTAL	544900	0	1894090	0	0	0	0
LOCAL TOTAL	1282881	0	6701120	1334995	334695	354825	334695
THE SECTION							
FOREIGN TOTAL	600	0	0	0	0	0	0
LOCAL TOTAL	2736	0	0	1159375	159075	179005	159075
ELECTRIFICATION	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0
SIGNALS & TELECOM	3336	0	0	0	0	0	0
FOREIGN CURRENCY	600	0	0	0	0	0	0
LOCAL CURRENCY	2736	0	0	0	0	0	0
CIVIL WORK	0	0	0	0	0	19930	0
FOREIGN CURRENCY	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	19930	0
LAND ACQ & COMP	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0
ROLLING STOCK	0	0	0	1159375	159075	159075	159075
FOREIGN CURRENCY	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	1159375	159075	159075	159075
-SALVAGE VALUE	0	0	0	0	0	0	2808575
INT. DURING CONST.	0	0	0	0	0	0	0

NEW CORRIDOR	1804245	0	8595120	175620	175620	175620	175820
FOREIGN TOTAL	544300	0	1894000	0	0	0	0
LOCAL TOTAL	1259945	0	8701120	175620	175620	175620	175820
ELECTRIFICATION	0	0	887750	0	0	0	0
FOREIGN CURRENCY	0	0	199000	0	0	0	0
LOCAL CURRENCY	0	0	688750	0	0	0	0
SIGNALS & TELECOM	1804245	0	1231400	0	0	0	0
FOREIGN CURRENCY	544300	0	444000	0	0	0	0
LOCAL CURRENCY	1259945	0	787400	0	0	0	0
CIVIL WORK	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0
LAND ACQ & COMP	0	0	0	0	0	0	0
FOREIGN CURRENCY	0	0	0	0	0	0	0
LOCAL CURRENCY	0	0	0	0	0	0	0
ROLLING STOCK	0	0	8475970	175620	175620	175620	175820
FOREIGN CURRENCY	0	0	1251000	0	0	0	0
LOCAL CURRENCY	0	0	5224970	175620	175620	175620	175820
-SALVAGE VALUE	0	0	0	0	0	0	13063155
INT. DURING CONST.	0	0	0	0	0	0	0
<b>FINANCE PROGRAM</b>							
=====							
<b>FINANCE TOTAL</b>							
BORROWING	0	0	0	0	0	0	0
REPAYMENT	162938	162938	162938	147454	147454	147454	147454
BALANCE	28970689	28807732	28644794	28497340	28349886	28202432	28054979
INTEREST	2388582	2384101	2359620	2355459	2351404	2347349	2343294
<b>FINANCE IN FOREIGN CCY</b>							
BORROWING	0	0	0	0	0	0	0
REPAYMENT	162938	162938	162938	147454	147454	147454	147454
BALANCE	1852960	1490022	1327084	1179631	1032177	884723	737269
INTEREST	46577	42098	37615	33454	29399	25344	21289
<b>FINANCE IN LOCAL CCY 1</b>							
BORROWING	0	0	0	0	0	0	0
REPAYMENT	0	0	0	0	0	0	0
BALANCE	27317709	27317709	27317709	27317709	27317709	27317709	27317709
INTEREST	2322005	2322005	2322005	2322005	2322005	2322005	2322005
<b>FINANCE IN LOCAL CCY 2</b>							
BORROWING	0	0	0	0	0	0	0
REPAYMENT	0	0	0	0	0	0	0
BALANCE	0	0	0	0	0	0	0
INTEREST	0	0	0	0	0	0	0
NET CASHFLOW	4077546	5829608	-2791031	4578739	5583094	5587219	21480934
CUM NET CASHFLOW	89081410	94981017	92279988	98858725	102441819	108009037	129489971
CASH IN	8416647	8416647	8416647	8416647	8416647	8416647	8416647
OPERATING PROFIT	7363462	7363462	7363462	7363462	7363462	7363462	7363462
DEPRECIATION	1053185	1053185	1053185	1053185	1053185	1053185	1053185
BORROWING	0	0	0	0	0	0	0
CASH OUT	4339101	2527039	11117678	3837908	2833553	2849428	-13044287
INVESTMENT	1807581	0	8595120	1334985	334685	354825	-15535035
INT. DURING CONST.	0	0	0	0	0	0	0
REPAYMENT	162938	162938	162938	147454	147454	147454	147454
INTEREST	2388582	2384101	2359620	2355459	2351404	2347349	2343294
CF FOR FIRR	8609086	8416647	-178473	7081852	8081952	8082022	23951681
FIRR %	18.00	18.00	18.00	18.00	18.00	18.00	18.00

8-7 Increments of Railways Personnel by Kinds of Jobs

(Unit: persons)

Case (A)

Kind of job \ Year	Year		
	1995	2000	2024
Driver	88	268	268
Conductor	373	823	823
Station staff	114	364	364
Maintenance staff	374	570	570
Head office staff			
Total	949	2,025	2,025

Case (B)

Kind of job \ Year	Year		
	2005	2010	2024
Driver	144	174	174
Conductor	477	572	572
Station staff	176	210	210
Maintenance staff	3,127	3,267	3,267
Head office staff	196	211	211
Total	4,120	4,434	4,434

Case (C)

Kind of job \ Year	Year		
	2000	2010	2024
Driver	250	518	518
Conductor	474	931	931
Station staff	540	736	736
Maintenance staff	3,434	3,915	3,915
Head office staff	181	211	211
Total	4,879	6,311	6,311

8-8 Economic Price of Fuel and Tire

	Market Price	Economic price
Diesel oil	Rs 3.5/liter	Rs 2.27/liter
Engine oil	Rs 17/liter	Rs 11.56/liter
Air-craft fuel	Rs 6.03/liter	Rs 4.63/liter
Tire (bus)	Rs 4,300/unit	Rs 2,925/unit
Tire (truck)	Rs 4,850/unit	Rs 3,299/unit

Note: Excise duty - Rs. 1,000/K. liter for diesel oil and air-craft fuel, 40% for engine oil and tire.

Average sales tax - 7%

## 9-1 Determination of Guidelines for the Study

### 1. Objective

Two projects are to be studied for improvement of railway transport between Delhi and Kanpur, that is upgrading the existing Section and constructing a New high-speed Corridor. In addition, there is a possibility of two staged construction of the latter, because it passes through the big city of Agra. Therefore, as a preliminary step of the Study, it is necessary to select a optimum combination of the two projects through estimating their rough economy.

### 2. Assumption

- (1) The alternative plans shown in Table 1 are chosen for various combination of investment phase, the maximum speed, and fares. A comparison is to be made for the sample years of 1990, 1995, 2000 and 2015.
- (2) If the estimated railway demand exceeds its transport capacity even after implementing improvements, the railway shall continue transport operation within the limit of its capacity.
- (3) Induced traffic, which may be incurred by an increased train speed is not taken into account.

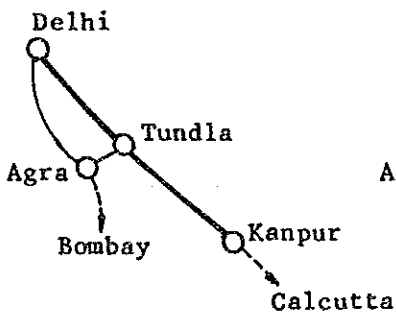
Table 1 Alternative Plans

Alternative plan	Project	Constructing a New Corridor								
	Section	Upgrading the existing Section	Delhi - Agra - (Tundla)				Delhi - Agra - Kanpur			
	Maximum speed	Delhi - Kanpur	200 km/h		250 km/h		200 km/h		250 km/h	
	Fare	Current level	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
I		○								
II-1		○	○							
II-2		○		○						
II-3		○			○					
II-4		○				○				
III-1		○					○			
III-2		○						○		
III-3		○							○	
III-4		○								○

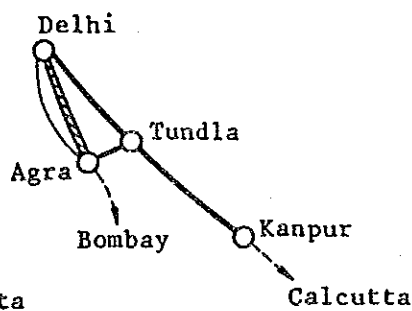
Case 1: 25% increase

Case 2: 50% increase

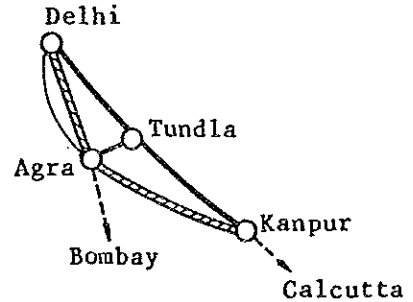
Phase I



Phase II



Phase III



Legend

- Existing Section
- Existing Section (max. 160 km/h)
- ▨ New Corridor (max. 200/250 km/h)



### 3. Selection Principle

The transport volume transferred from road and air to rail are calculated for each alternative plan by each sample year. An optimum alternative plan and its implementing year is set up by calculating cost difference in the Generalized Cost ( $\Delta E$ ) between each alternative plan and without the project case based on the transferred transport volume.

Difference of the Generalized Cost ( $\Delta E$ ) is given by the following formula.

$$\Delta E = WAT + \Delta C$$

where: W : Passenger time value

$\Delta T$ : Passenger time saving due to implementing the alternative plan

$\Delta C$ : Total cost saving (capital cost and operation cost) due to implementing the alternative plan

### 4. Assumption and Calculation Method for Estimating the Generalized Cost

#### 4-1 Assumption

##### (1) Capital cost

- 1) The capital cost for Without the Project case is the investment which would be required to carry the traffic volume, transferred to the railway in case of With the Project, by other transport modes, that is, the investment in buses and trucks for road transport and in airplanes for air transport.
- 2) The capital cost for With the Project case is the investment in railway facilities and rolling stock which is required to carry the traffic volume, transferred from bus, truck and airplane to the railway.
- 3) The capital cost for calculating the Generalized Cost is given by dividing the total capital cost by the number of years of useful life.

(Note: Land cost is excluded.)

(2) Operation cost

The operation cost is the sum of maintenance cost, fuel cost and personnel expenses required for carrying the transferred traffic volume, and is calculated on an annual basis for each sample year.

(3) Estimation of the passengers time value

Because there is no statistic data available for the income level of passengers of public transportation facilities, the average passenger income is assumed at the same level as earnings of workers employed in manufacturing industries, with reference to general statistical materials, fare level of the I.R. and information from relevant institutions.

4-2 Calculation Method

(1) Railway

1) Capital cost

The yearly capital cost is calculated by dividing the investment for each assets calculated in Chapter 4 (4-6) and Chapter 5 (5-7) by their useful lives. As for useful lives, the JR standard value are used.

2) Maintenance cost

The yearly maintenance cost (incl. replacement cost) is calculated by multiplying the investment cost by maintenance, and replacement rates. The JR standard value is used for the above two rates (see Table 2).

3) Electric power cost

The electric power cost is calculated as follows:

Annual electric power cost = Annual transport ton-km  
x Power consumption rate per ton-km  
x Unit price of electric power

Power consumption rate: (Unit: kwh/1,000 ton-km)

Super express	36.9
Long express	18.8
Express	18.8
Local	25.7
Freight	10.0

Note: The value of the S. Exp. is based on the JR data and those of L. Exp., Exp., Local and Freight trains on the data of IR.

Unit price of electric power: Rs.1.004/kwh

Note: Based on the IR data

Table 2 Maintenance & Replacement Rate and Useful Life of Assets

Items	Assets description	Maintenance rate	Replacement rate	Useful life (year)
Civil work	Roadbed	0.0004		57
	Road bridge	0.0027		50
	Platform	0.0041		32
	Overbridge	0.0051		32
	Station building	0.0067		45
	Building (workshop depot etc.)	0.0057		45
	Track	0.006669	0.04446	25
Signalling & telecommunication	Level crossing facilities	0.0292		12
	Signalling facilities	0.0210		20
	Telecommunication facilities	0.0312		9
	Signalling cable	0.0011114	0.0317571	35
	Telecommunication cable	0.0038108	0.0317571	35
	Track circuit	0.0020475	0.0585	19
	Electrification & power supply	Substation facilities	0.0008	
Substation building		0.0057		45
Overhead equipment		0.000741	0.0247	45
Power distribution line		0.0055575	0.03705	30
Rolling stock	Electric locomotive	0.0407		30
	EMU	0.035		20
	Coach	0.02178		30
	Wagon	0.0147		30
	Machinery at workshop	0.05		20
	Machinery at depot	0.05		20

Source: JR standard

#### 4) Personnel expense

The annual personnel expense for each job is calculated by multiplying the number of personnel added in the project by the average salary.

Average Salary of the Railway Employee for Each Job (Rs./month)

Driver	2,125
Conductor	1,975
Station staff	2,125
Maintenance staff	2,125
Head office staff	2,338

Note: Estimated from IR data

The added number of personnel for each job is estimated based on the performances of IR and the Shinkansen in Japan.

Table 5 shows the estimated number of added personnel when the existing Section is upgraded and the New Corridor is operated in the year 2000 between Delhi and Kanpur via Agra (with max. 250 km/h with fare 25% up).

(2) Bus, truck, and airplane

1) Capital cost

The capital cost in Without the Project case is calculated by calculating the number of trucks, buses, and airplanes which would be required for carrying the traffic volume transferred to the railway in each With the Project case, and dividing it by their useful lives.

Required number of vehicles (truck, bus, airplane)

= Annual transferred traffic volume (person-km or ton-km)

÷ Average annual transport volume per vehicle person-km or ton-km

(Note: Number of vehicles is rounded off)

Average annual transport volume per vehicle:

Bus	3,570,000 person-km
Truck	456,000 ton-km
Airplane (B737)	204,170,870 person-km

Table 6 shows the number of vehicles to be added to the individual traffic modes in case that the two projects of upgrading the Section and the New Corridor construction (Delhi - Agra - Kanpur max. 250 km/h, fare 25% up) are not implemented in 2000.

The following data for bus, truck, and airplane is based on references provided by the Road and Surface Transport Department, the Ministry of Civil Aviation/Indian Airlines and Rites as well as on the analysis report from the Operational Statistics of DTC (Delhi Transport Corporation) 1986 and the Annual Report 1984-85 of Indian Airlines and other information from pertinent institutions.

Bus:

Capacity	60 persons
Average occupancy ratio	84%
Useful life	8 years
Traveling distance	70,000 km/year
Price	Rs.325,000/unit

Truck:

Loading capacity	10 tons
Average load factor	76%
Useful life	10 years
Traveling distance	60,000 km/year
Price	Rs.214,000/unit

Airplane (B737):

Capacity	130 persons
Average load factor	70.4%
Useful life	10 years
Traveling distance	2,231,000 km/year
Price	Rs.327,500,000/unit

2) Operation cost

The following data concerning the average maintenance and fuel cost per vehicle-km of bus, truck and airplane (B737) and the

annual personnel expense per unit is also based on the source described above.

	Bus	Truck	Airplane
Maintenance cost	Rs.0.64/km	Rs.1.12/km	Rs.5.04/km
Fuel cost	Rs.0.906/km	Rs.0.959/km	Rs.39.22/km
Personnel expense per year	Rs.111,000/unit	50,000/unit	306,000/unit

Table 7 shows the difference in annual cost (cost saving benefit) calculated as above between With the Project and Without the Project cases.

(3) Benefit of passenger time saving

1) Evaluation of passenger time value

The assumption for calculation is as described in 4-1.

The passenger time value is calculated as follows:

Per capita average annual earning of a worker (earnings less than Rs.1,000 - per month) in manufacturing industries is Rs.7,470 - in 1982.

(Source: Indian Labour Year Book 1985)

The average annual earnings in 1987 per passenger is estimated to be Rs.12,000 (Rs.1,000/month) by adjusting the abovementioned value with the growth rate of the consumer price index as well as in consideration of other statistic data on earnings. (Source: Economic Survey 1986-1987) Based on this, the passenger time value is given below.

$$\text{Passenger time value} = \frac{\text{Monthly earnings per passenger}}{\text{Average monthly working time}} \times \text{Non-working time adjustment factor}$$

Monthly earnings per passenger: Rs.1,000

Average monthly working time : 182 hours

Note: Normal working hours of industrial workers are 8 hours a day for 273 days in a year.

(Source: Statistical Survey)

Non-working time adjustment factor: 0.75

Note: Assuming the activity time per day at 12 hours, the time value of non-working hours is assumed to be one fourth of that of working hours.

Accordingly, the time value of passengers is Rs.4.12.

Assuming that the time value goes up in proportion to the growth of per capita GDP, the passenger time value in sample years is given as follows:

Year	Passenger time value	Growth rate GDP per capita
1987	Rs.4.12	
1990	Rs.4.50	2.96%
1995	Rs.5.28	3.24%
2000	Rs.6.19	3.24%
2015	Rs.9.06	2.57%

Note: a) The Growth Rate per Capita up to the year 2000 is taken from the 7th Five Year Plan and that after 2000 for the year 2015 is calculated from the estimated population and GDP growth rate of 4%.

b) Sources of the statistic data concerning earnings used are as follows:

. Earnings of mine workers were Rs.760.3/month in 1984 and is estimated to be Rs.942/month in 1987 by adjustment with the consumer price index.

(Source: Pocketbook of Labour Statistics, 1986)

. Per capita emoluments of public sector employees were Rs.26.069 (Rs.2.172/month) in 1986.

(Source: Economic Survey 1986 - 87)

. Average annual cost per employee of the IR is Rs.16.883 (Rs.1.407/month).

(Source: Annual Report of Accounts 1985 - 86 IR)



## 2) Calculation of passenger time saving benefit.

The benefit of passenger time saving is given by the following equation.

$$\begin{aligned} & \text{Passenger time saving benefit} \\ & = \text{Passenger time value (W)} \times \text{Saving in passenger time (\Delta T)} \end{aligned}$$

The saving in passenger time, that is the reduction in transport time due to transfer from other transport modes to railway, is calculated based on the estimated traffic demand.

The passenger time saving benefit is calculated as shown below assuming the Section is upgraded and a New Corridor is operated in the year 2000 between Delhi and Kanpur via Agra (with max. 250 km/h and fare 25% up).

$$\text{Rs.}6.19 \times 406,695 \text{ thousand person-hour} = 2,517,442 \text{ thousand Rupees}$$

## 5. Optimum Alternative Plan.

### 5-1 Limit Year of the Transport Capacity

The estimated railway transport capacity is expected to be fully occupied at the following years as described in Chapter 4 (4-2) and Chapter 5 (5-3).

- (1) With upgrading the Section, the transport capacity will be fully occupied in 2000.
- (2) In the case where the New Corridor is constructed between Delhi and Agra, the existing line between Tundla and Kanpur reaches its maximum capacity in 2000.

Therefore, no increase in train operation can be expected after this time in the New Corridor as well.

- (3) If the New Corridor is constructed between Delhi and Kanpur via Agra, it can generally handle the railway traffic demand up to 2015.

However, the existing line between Delhi and Tundla is supposed to nearly reach its limit in 2000.

## 5-2 Comparison of the Generalized Cost Difference ( $\Delta E$ )

- (1) Table 3 shows the comparison in  $\Delta E$  for each sample year among alternative plans, based on the traffic volume transferred to the railway and in consideration of the transport capacity of the corresponding section.

To make easy the above comparison, Table 4 shows various indices in percentage figures, with those for upgrading-the-Section case (Case I) setting at 100.

The breakdown of the cost saving benefit and of the time saving benefit in each alternative plan is shown in Table 7 and 8, respectively.

Table 9 shows the comparison in  $\Delta E$  and in the traffic volume transferred from other traffic modes to the railway for each sample year.

- (2) Comparing the alternative plans for each sample years,  $\Delta E$  of the III case is greater than that of the II case after 2000.

In the III case, in the plan of maximum speed 250 km/h and fares up of 25%,  $\Delta E$  becomes the maximum due to increased time saving benefit attributed to the largest transferred traffic volume.

The effect of high speed operation is most significant in the plan where the entire New Corridor is constructed and it also becomes greater for later years. This is due to an increase in the total transport volume and growth of time value.

## 5-3 Selection of an Optimum Alternative Plan

The following plan is considered to be the optimum as a result of the comparison of  $\Delta E$  for each alternative plan by each sample year.

- (1) In 1990

Operating the upgraded existing Section between Delhi and Kanpur

- (2) In 2000

In addition to the above, operating the New Corridor between Delhi and Kanpur via Agra

The construction phase or schedule of the New Corridor at around 1995 should be studied based on more detailed economic and financial analysis.

Especially, a sensitivity analysis is required for assessment of the fare level in terms of the financial analysis.

Table 3 Comparison of the Generalized Cost Difference ( $\Delta E$ )

(Unit: million Rs)

Case	Year Benefit Plan	1990			1995			2000			2015		
		Time saving	Cost saving	Total $\Delta E$	Time saving	Cost saving	Total $\Delta E$	Time saving	Cost saving	Total $\Delta E$	Time saving	Cost saving	Total $\Delta E$
I	Upgrading the existing section	153	1,647	1,800	384	3,865	4,249	731	6,566	7,297	1,070	6,566	7,636
II	New corridor DLI-AG 200 km/h 25% up	210	1,163	1,373	546	3,372	3,918	1,051	6,143	7,194	1,538	6,143	7,681
	New corridor DLI-AG 200 km/h 50% up	188	1,191	1,379	505	3,432	3,937	983	6,228	7,211	1,439	6,228	7,667
	New corridor DLI-AG 250 km/h 25% up	246	1,093	1,339	612	3,325	3,937	1,160	6,071	7,231	1,698	6,071	7,769
	New corridor DLI-AG 250 km/h 50% up	205	1,133	1,338	538	3,373	3,911	1,041	6,142	7,183	1,523	6,142	7,665
III	New corridor DLI-CNB 200 km/h 25% up	683	668	1,351	1,091	2,913	4,004	1,931	5,684	7,615	4,539	6,071	10,610
	New corridor DLI-CNB 200 km/h 50% up	368	675	1,043	862	2,960	3,822	1,526	5,723	7,249	3,409	5,926	9,335
	New corridor DLI-CNB 250 km/h 25% up	739	572	1,311	1,456	3,000	4,456	2,517	5,799	8,316	5,285	5,948	11,233
	New corridor DLI-CNB 250 km/h 50% up	475	607	1,082	1,020	2,859	3,879	1,840	5,668	7,508	4,216	5,850	10,066

Note: DLI: DELHI, AG: AGRA, CNB: KANPUR  
 200 km/h 25% up: Maximum speed 200 km/h  
 Fare 25% up

Table 4 Comparison of the Generalized Cost Difference ( $\Delta E$ ) in Percentage Figures

(Unit: %)

Case	Plan	Benefit	1990			1995			2000			2015		
			Time saving	Cost saving	Total $\Delta E$	Time saving	Cost saving	Total $\Delta E$	Time saving	Cost saving	Total $\Delta E$	Time saving	Cost saving	Total $\Delta E$
I	Upgrading the existing section		8	92	100	9	91	100	10	90	100	14	86	100
			12	64	76	13	79	92	14	84	98	20	80	100
II	New corridor DLI-AG 200 km/h 50% up		11	66	77	12	81	93	14	85	99	19	81	100
			13	61	74	15	78	93	16	83	99	22	80	102
			11	63	74	13	79	92	14	84	98	20	80	100
III	New corridor DLI-CNB 200 km/h 25% up		38	37	75	26	68	94	26	78	104	59	80	139
			20	38	58	20	70	90	21	78	99	44	78	122
			41	32	73	34	71	105	35	79	114	69	78	147
			26	34	60	24	67	91	25	78	103	55	77	132

Note: Total  $\Delta E$  of Case I for each sample year is set at 100 percent.

Table 5 Additional Personnel by Job (With the Plan III-3)

(Unit: person)

Year	2000
Job	
Driver	460
Conductor	880
Station staff	210
Maintenance staff	6,800
Head office staff	420

Table 6 Number of Vehicles to be Acquired for Each Traffic Mode (Without the Plan III-3)

Year	2000
Traffic mode	
Bus	6,558 units
Truck	35,130 units
Airplane	1 unit

Table 7 Cost Difference due to Transferred Traffic

(Unit: million Rs)

Year	Transport mode Cost Plan	Railway		Bus		Truck		Airplane		Cost difference		Cost difference Total
		Invest- ment	Operation cost	Invest- ment	Operation cost	Invest- ment	Operation cost	Invest- ment	Operation cost	Invest- ment	Operation cost	
1990	Upgrading the existing Section	116	321	33	177	204	1,670			121	1,526	1,647
	New Corridor DLI-AG											
	200 km/h 25% up	423	540	41	219	204	1,670			Δ178	1,341	1,163
	50% up	404	517	37	201	204	1,670			Δ163	1,354	1,191
	250 km/h 25% up	470	604	46	247	204	1,670			Δ220	1,313	1,093
	50% up	432	560	39	212	204	1,670			Δ189	1,322	1,133
	New Corridor DLI-CNB											
	200 km/h 25% up	821	918	83	450	204	1,670			Δ534	1,202	668
50% up	769	820	61	329	204	1,670			Δ504	1,179	675	
250 km/h 25% up	921	1,070	108	581	204	1,670			Δ609	1,181	572	
50% up	824	906	72	391	204	1,670			Δ548	1,155	607	
1995	Upgrading the existing Section	145	615	70	379	456	3,720			381	3,484	3,865
	New Corridor DLI-AG											
	200 km/h 25% up	495	884	90	485	456	3,720			51	3,321	3,372
	50% up	455	832	85	459	456	3,720			85	3,347	3,432
	250 km/h 25% up	531	940	97	523	456	3,720			22	3,303	3,325
	50% up	487	879	88	475	456	3,720			57	3,316	3,373
	New Corridor DLI-CNB											
	200 km/h 25% up	912	1,297	149	798	456	3,720			Δ308	3,221	2,913
50% up	832	1,163	122	657	456	3,720			Δ254	3,214	2,960	
250 km/h 25% up	1,011	1,453	181	975	456	3,720	33	99	Δ341	3,341	3,000	
50% up	904	1,262	133	716	456	3,720			Δ315	3,174	2,859	
2000	Upgrading the existing Section	201	854	114	616	752	6,139			665	5,901	6,566
	New Corridor DLI-AG											
	200 km/h 25% up	560	1,133	148	797	752	6,139			340	5,803	6,143
	50% up	498	1,069	141	763	752	6,139			395	5,833	6,228
	250 km/h 25% up	614	1,209	157	846	752	6,139			295	5,776	6,071
	50% up	552	1,126	145	784	752	6,139			345	5,797	6,142
	New Corridor DLI-CNB											
	200 km/h 25% up	1,023	1,612	223	1,205	752	6,139			Δ48	5,732	5,684
50% up	914	1,430	184	992	752	6,139			22	5,701	5,723	
250 km/h 25% up	1,126	1,802	266	1,438	752	6,139	33	99	Δ75	5,874	5,799	
50% up	984	1,545	204	1,102	752	6,139			Δ28	5,696	5,668	
2015	Upgrading the existing Section	201	854	114	616	752	6,139			665	5,901	6,566
	New Corridor DLI-AG											
	200 km/h 25% up	560	1,133	148	797	752	6,139			340	5,803	6,143
	50% up	498	1,069	141	763	752	6,139			395	5,833	6,228
	250 km/h 25% up	614	1,209	157	846	752	6,139			295	5,776	6,071
	50% up	552	1,126	145	784	752	6,139			345	5,797	6,142
	New Corridor DLI-CNB											
	200 km/h 25% up	1,211	2,035	359	1,935	752	6,139	33	99	Δ67	6,138	6,071
50% up	1,039	1,721	281	1,514	752	6,139			Δ6	5,932	5,926	
250 km/h 25% up	1,321	2,198	382	2,062	752	6,139	33	99	Δ154	6,102	5,948	
50% up	1,163	1,923	320	1,725	752	6,139			Δ91	5,941	5,850	

Table 8 Transferred Traffic Volume and Time Saving Benefit

Year	1990						1995						2000						2015					
	Transferred volume to railway M.I. Person -km			Time saving benefit M.I. Rs	Transferred volume to railway M.I. Person -km			Time saving benefit M.I. Rs	Transferred volume to railway M.I. Person -km			Time saving benefit M.I. Rs	Transferred volume to railway M.I. Person -km			Time saving benefit M.I. Rs	Transferred volume to railway M.I. Person -km			Time saving benefit M.I. Rs				
	Bus	Airplane	Total		Bus	Airplane	Total		Bus	Airplane	Total		Bus	Airplane	Total		Bus	Airplane	Total		Bus	Airplane	Total	
I	Improvement of existing Section	2,878	3	2,881	4.50	153	6,177	7	6,184	5.28	384	10,027	12	10,039	6.19	731	10,027	12	10,039	9.06	1,070			
	New Corridor DL1-AG. 200 km/h 25% up	3,568	9	3,577	4.50	210	7,903	19	7,922	5.28	546	12,976	32	13,008	6.19	1,051	12,976	32	13,008	9.06	1,528			
II	New Corridor DL1-AG. 200 km/h 50% up	3,268	6	3,274	4.50	188	7,480	13	7,493	5.28	505	12,425	22	12,447	6.19	983	12,425	22	12,447	9.06	1,439			
	New Corridor DL1-AG. 250 km/h 25% up	4,022	11	4,033	4.50	246	8,513	23	8,536	5.28	612	13,774	37	13,811	6.19	1,160	13,774	37	13,811	9.06	1,698			
III	New Corridor DL1-AG. 250 km/h 50% up	3,659	8	3,467	4.50	205	7,755	17	7,752	5.28	538	12,765	28	12,793	6.19	1,041	12,765	28	12,793	9.06	1,523			
	New Corridor DL1-CNB 200 km/h 25% up	7,321	27	7,348	4.50	683	12,993	47	13,040	5.28	1,091	19,627	72	19,699	6.19	1,931	19,627	72	19,699	9.06	4,539			
III	New Corridor DL1-CNB 200 km/h 50% up	5,362	7	5,369	4.50	368	10,691	14	10,705	5.28	862	16,149	22	16,171	6.19	1,526	16,149	22	16,171	9.06	3,409			
	New Corridor DL1-CNB 250 km/h 25% up	9,458	61	9,519	4.50	739	15,873	103	15,976	5.28	1,456	23,411	152	23,563	6.19	2,517	23,411	152	23,563	9.06	5,285			
III	New Corridor DL1-CNB 250 km/h 50% up	6,368	11	6,379	4.50	475	11,660	20	11,680	5.28	1,020	17,939	31	17,970	6.19	1,640	17,939	31	17,970	9.06	4,216			



Table 9 Transferred Volume and Generalized Cost Difference (ΔE)

(Unit: million person-km)

Year	1990						2000						2015							
	R	Rn	B	A	ΔE	R	Rn	B	A	ΔE	R	Rn	B	A	ΔE	R	Rn	B	A	ΔE
I	2,881		Δ2,878	Δ3	1,800	6,184		Δ6,177	Δ7	4,249	10,039		Δ10,027	Δ12	7,297	10,039		Δ10,027	Δ12	7,636
II																				
	1,750	1,827	Δ3,568	Δ9	1,373	5,437	2,485	Δ7,903	Δ19	3,918	9,753	3,255	Δ12,976	Δ32	7,194	9,753	3,255	Δ12,976	Δ32	7,681
	1,871	1,603	Δ3,268	Δ6	1,379	5,585	1,908	Δ7,480	Δ13	3,937	9,948	2,499	Δ12,425	Δ22	7,211	9,948	2,499	Δ12,425	Δ22	7,667
	1,810	2,223	Δ4,022	Δ11	1,339	5,512	3,024	Δ8,513	Δ23	3,937	9,850	3,961	Δ13,774	Δ37	7,231	9,850	3,961	Δ13,774	Δ37	7,769
	1,820	1,647	Δ3,459	Δ8	1,338	5,513	2,239	Δ7,735	Δ17	3,911	9,859	2,934	Δ12,765	Δ28	7,183	9,859	2,934	Δ12,765	Δ28	7,665
III																				
	Δ1,025	8,373	Δ7,321	Δ27	1,351	1,653	11,387	Δ12,993	Δ87	4,004	4,781	14,918	Δ19,627	Δ72	7,615	4,781	26,852	Δ31,518	Δ115	10,610
	Δ606	5,975	Δ5,362	Δ7	1,043	2,579	8,126	Δ10,691	Δ14	3,822	5,526	10,645	Δ16,149	Δ22	7,249	5,526	19,161	Δ24,654	Δ33	9,335
	Δ1,248	10,767	Δ9,458	Δ61	1,311	1,332	14,644	Δ15,873	Δ103	4,456	4,380	19,183	Δ23,611	Δ152	8,316	4,380	29,414	Δ33,576	Δ218	11,233
	Δ755	7,134	Δ6,368	Δ11	1,082	1,978	9,702	Δ11,660	Δ20	3,879	5,260	12,710	Δ17,939	Δ31	7,508	5,260	22,878	Δ28,089	Δ49	10,066

Note: R : Existing Section

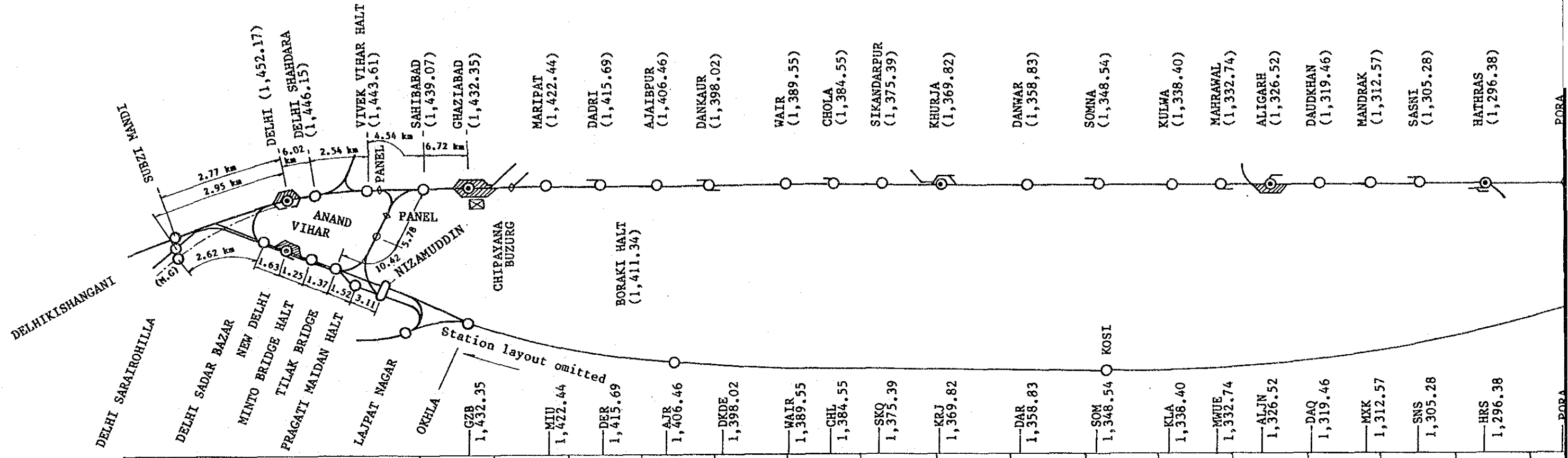
Rn: New Corridor

B : Bus

A : Airplane

ΔE: Unit: million Rs

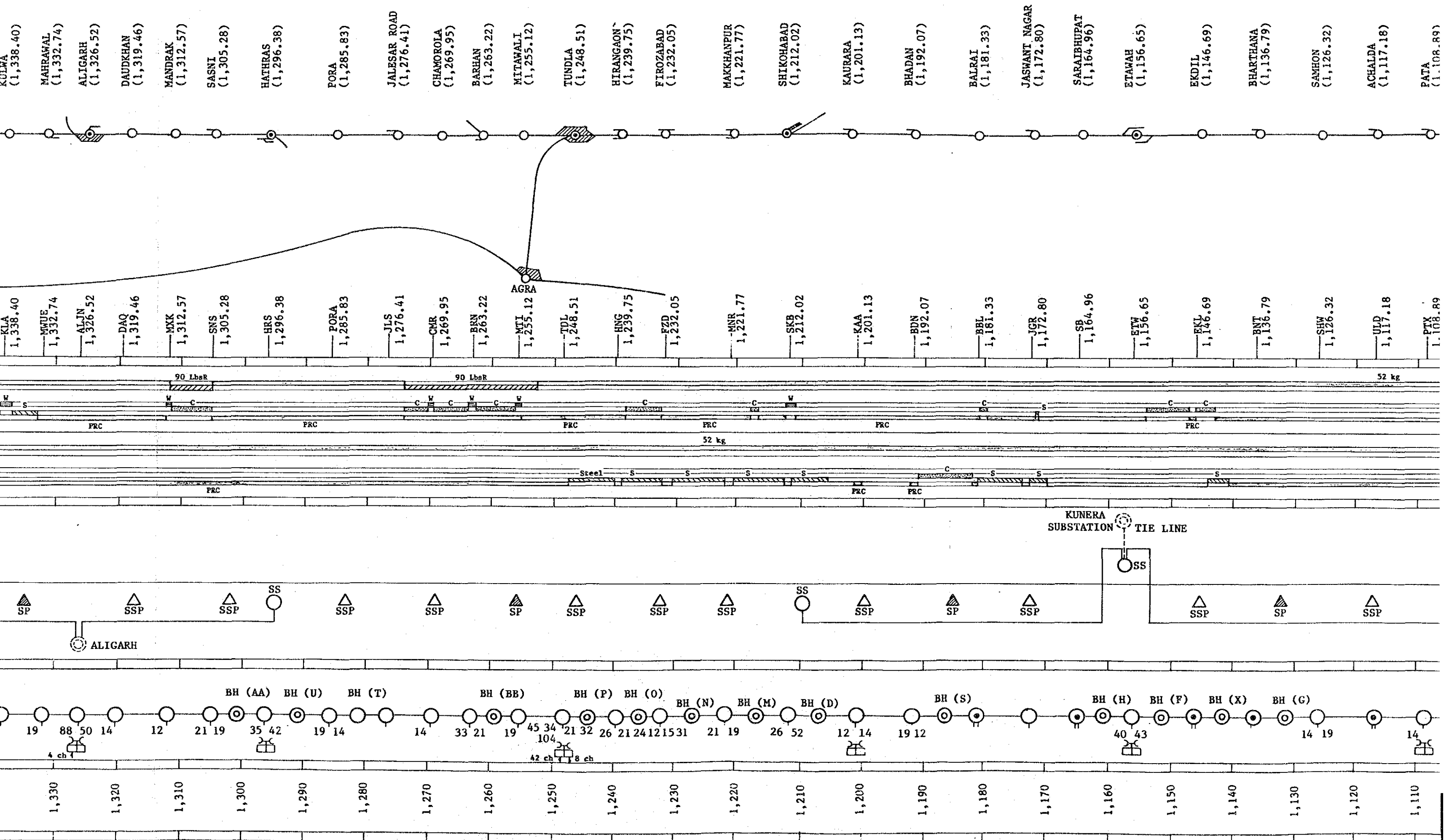




Track	DN	RAIL	52 kg 90 LbsR	90 LbsR										52 kg	90 LbsR	
	SLEEPER	Wooden CST/9 Steel FRC		FRC										FRC	FRC	
UP	RAIL	52 kg 90 LbsR	52 kg													
SLEEPER	Wooden CST/9 Steel FRC		FRC										FRC	FRC		
Power Supply																
Signalling & Telecommunication																
Km	<p>1,440    1,430    1,420    1,410    1,400    1,390    1,380    1,370    1,360    1,350    1,340    1,330    1,320    1,310    1,300    1,290</p>															

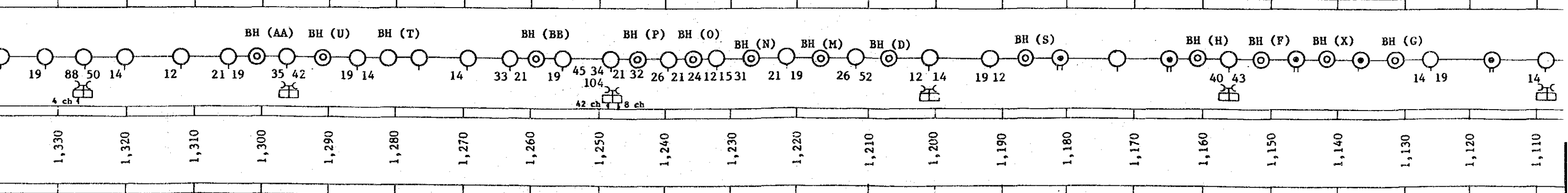
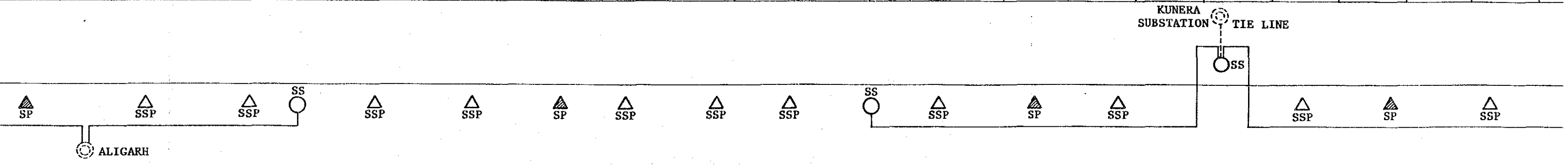
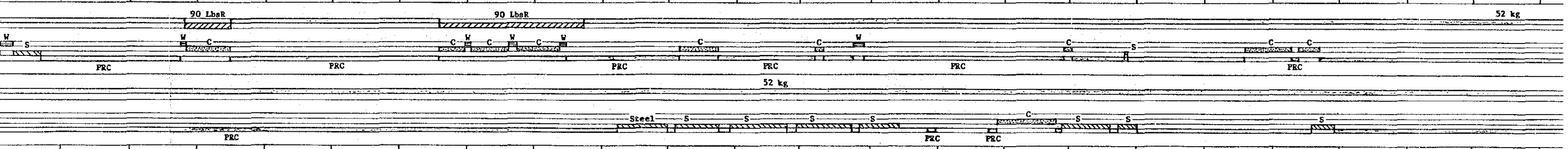
PORA

PORA



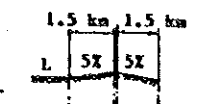
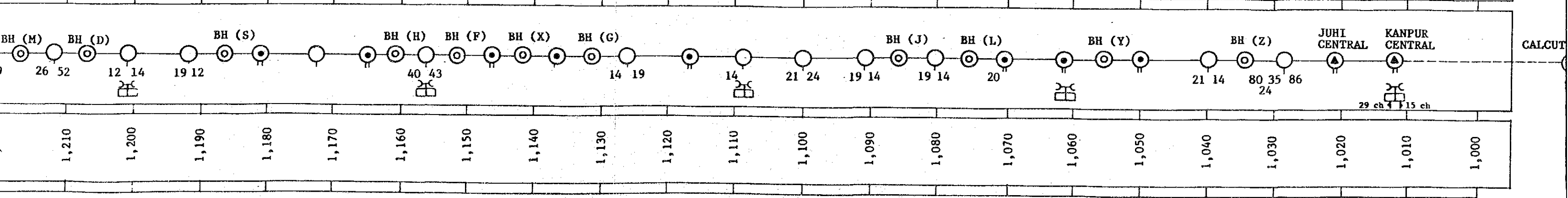
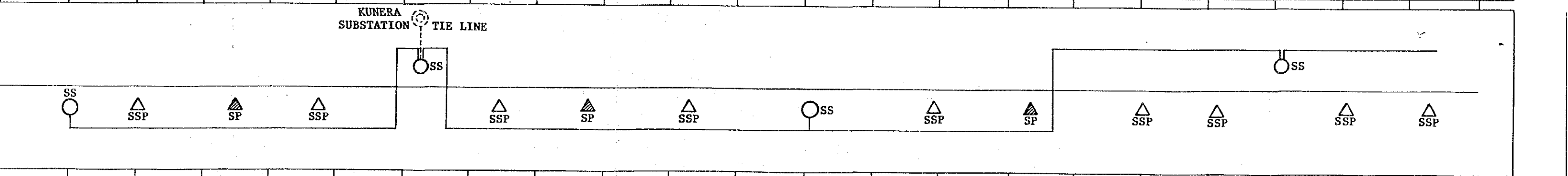
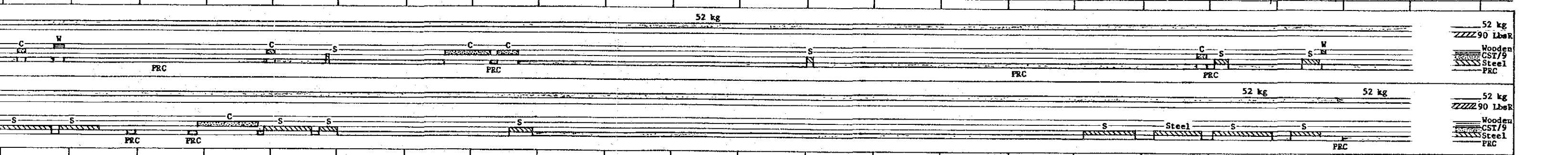
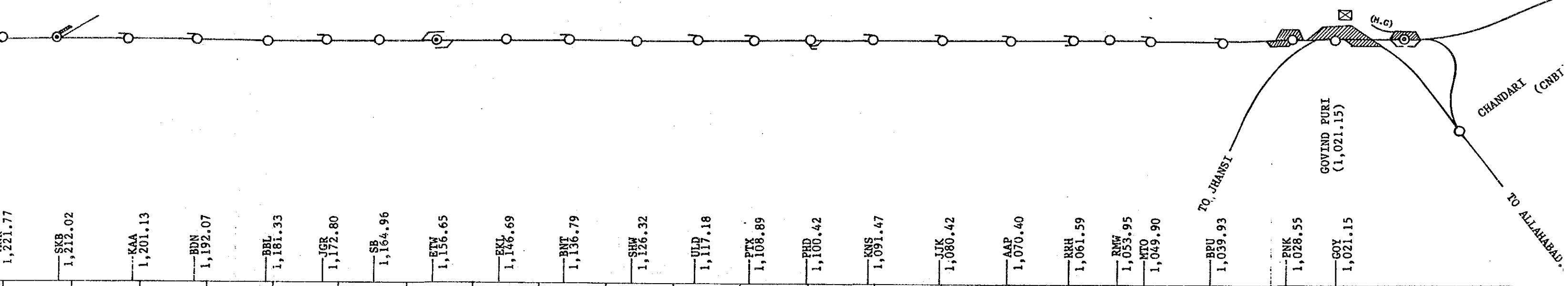
- KULWA (1,338.40)
- MAHRAWAL (1,332.74)
- ALIGARH (1,326.52)
- DAUDKHAN (1,319.46)
- MANDRAK (1,312.57)
- SASNI (1,305.28)
- HATHRAS (1,296.38)
- PORA (1,285.83)
- JALESAR ROAD (1,276.41)
- CHAMOROLA (1,269.95)
- BARHAN (1,263.22)
- MITAWALI (1,255.12)
- TUNDLA (1,248.51)
- HIRANGAON (1,239.75)
- FIROZABAD (1,232.05)
- MAKKHANPUR (1,221.77)
- SHIKHABAD (1,212.02)
- KAURARA (1,201.13)
- BHADAN (1,192.07)
- BALRAI (1,181.33)
- JASWANT NAGAR (1,172.80)
- SARAIHUPAT (1,164.96)
- ETAWAH (1,156.65)
- EKDIL (1,146.69)
- BHARTHANA (1,136.79)
- SAMHON (1,126.32)
- ACHALDA (1,117.18)
- PATA (1,108.89)

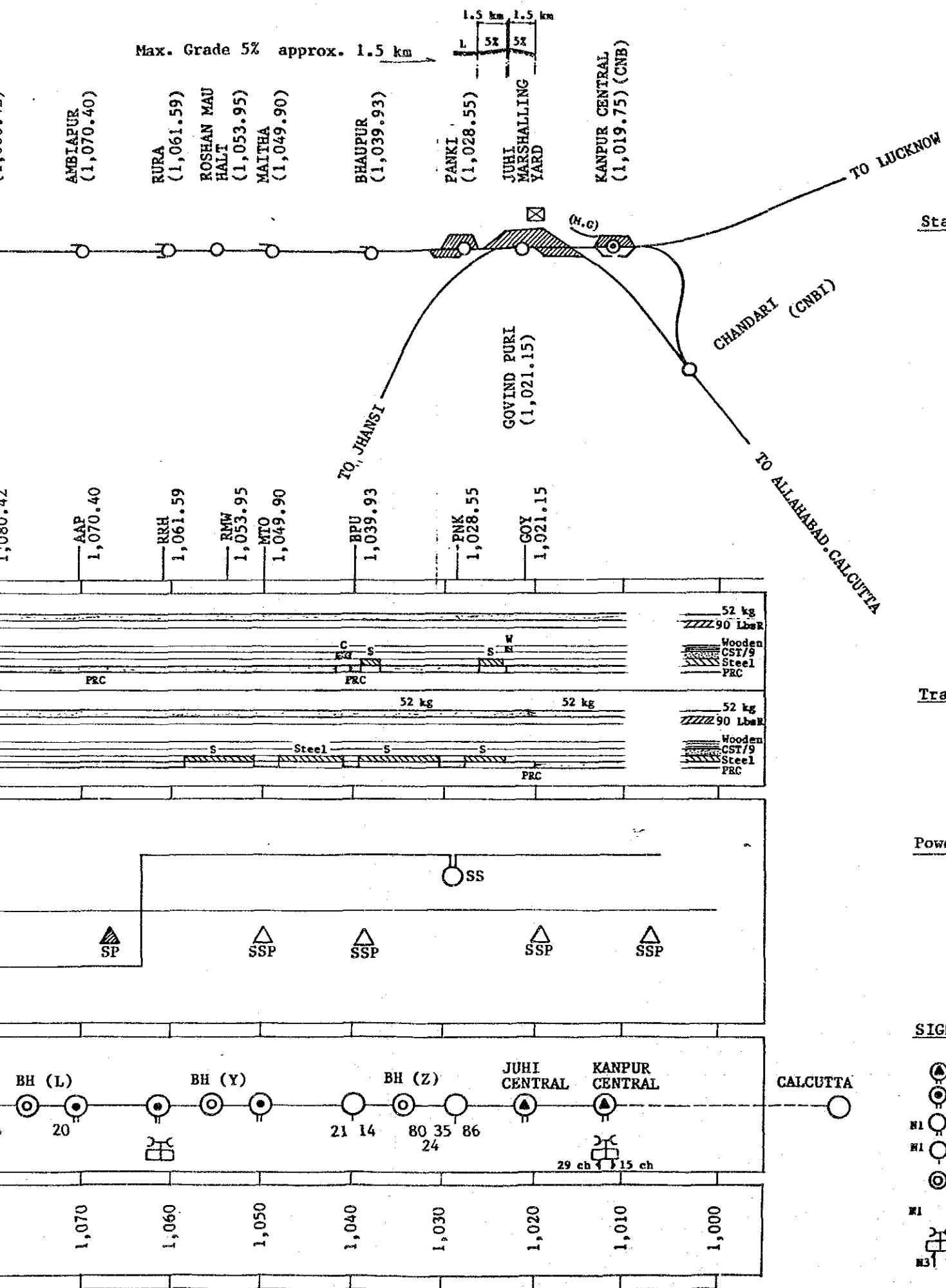
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- MMUE 1,332.74
- ALJN 1,326.52
- DAQ 1,319.46
- MXK 1,312.57
- SNS 1,305.28
- HRS 1,296.38
- PORA 1,285.83
- JLS 1,276.41
- CMR 1,269.95
- BRN 1,263.22
- MTI 1,255.12
- TDL 1,248.51
- HNG 1,239.75
- FZD 1,232.05
- MNR 1,221.77
- SKB 1,212.02
- CAA 1,201.13
- BDN 1,192.07
- BBL 1,181.33
- JGR 1,172.80
- SB 1,164.96
- ETW 1,156.65
- EKL 1,146.69
- BNT 1,136.79
- SHW 1,126.32
- ULD 1,117.18
- PTY 1,108.89



(1,221.77) SHIKOHABAD (1,212.02) KAURARA (1,201.13) BHADAN (1,192.07) BALRAI (1,181.33) JASHMANT NAGAR (1,172.80) SARAIHUPAT (1,164.96) ETAWAH (1,156.65) EKDIL (1,146.69) BHARTHANA (1,136.79) SAMHON (1,126.32) ACHALDA (1,117.18) PATA (1,108.89) PHAPHUND (1,100.42) KANCHHAUSI (1,091.47) JHINJHAK (1,080.42) AMBIAPUR (1,070.40) RURA (1,061.59) ROSHAN MAU HALT (1,053.95) MAITHA (1,049.90) BHAUPUR (1,039.93) FANKI (1,028.55) JUHI MARSHALLING YARD (1,021.15) KANPUR CENTRAL (1,019.75) (CNB)

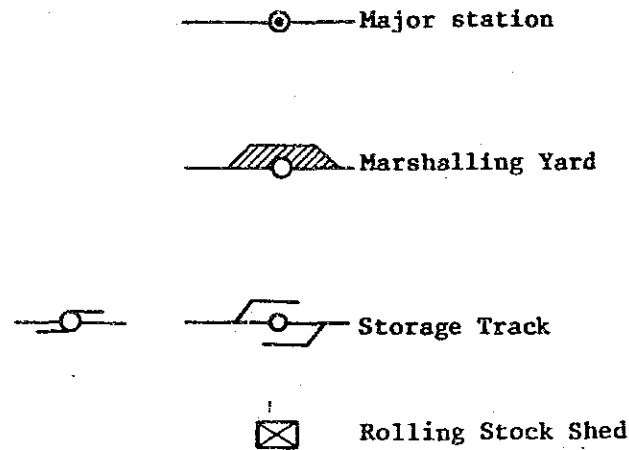
Max. Grade 5% approx. 1.5 km



10-1 Present Ground Facilities on the DELHI-KANPUR Section

Station



Track

Including the section scheduled to be upgraded by 1988

Power Supply

SIGNALLING & TELECOMMUNICATION

- ⊙ SELECTIVE ROUTE TYPE RELAY INTERLOCKING
- ⊙ PANEL TYPE RELAY INTERLOCKING
- N1 ⊙ N2 MECHANICAL INTERLOCKING (TRACK CIRCUITS IN THE WHOLE STATION COMPOUND)
- N1 ⊙ N2 MECHANICAL INTERLOCKING (PARTIALLY TRACK CIRCUITTED)
- ⊙ PANEL TYPE BLOCK HUT
- N1 N2 NUMBER OF LEVERS ON THE WEST OR EAST CABIN
- ⊙ Micro-wave station
- N3 N4 NUMBER OF CHANNELS DROPPED / NUMBER OF CHANNELS INSERTED

JICA