4) Residual value

As explained before, the 20 year period of the project life was defined only for the project evaluation. The remaining value of the assets was appropriated as the residual value at the last year of the project life, as shown in Table 6.3.1.8 by the alternative case.

The railway assets such as track, telecommunications and catenary are considered as replaceable assets, while the others as depreciable assets except land. The residual value of the former was appropriated as a half of the initial investment amount.

Table 6.3.1.8 Useful Life and Residual Value

(Years, Rp. 000000)

	Useful Life	Alternative		
		Track Elevation 1	Track Elevation 2	Flyover
Civil Engineering	50	142431	180769	96902
Station Building	45	17976	30900	4663
Track	-	11741	16309	3831
Signals	20	0	0	0
Telecommunications	-	1012	1489	0
Electric Power Facilities	30	3996	6301	0
Catenary	-	4142	5258	925
Machinery	20	0	0	0
Land Acquisition/Compensation	-	12418	16486	31366
Total		193714	257512	137688

(3) Economic benefit

1) Maintenance and operation cost difference

Maintenance and operation costs of the three alternatives against the "without" case were calculated as follows:

a. Track Elevation 1, 2

- Maintenance and operation cost of the elevated track
- Maintenance and operation cost of the remaining level crossings

b. Flyover

- Maintenance and operation cost of flyovers
- Maintenance and operation cost of remaining level crossings

c. "without" case

- Maintenance and operation cost of existing level crossings

The maintenance and operation cost of the elevated track were calculated according to the maintenance rates shown in Table 6.3.1.9. As for the cost of flyovers, the rate of 'civil engineering' was used.

Table 6.3.1.9 Maintenance Rates of Elevated Track

	Maintenance Rate
Civil Engineering	0.0027
Station Building	0.0067
Track	0.1500
Signals	0.0210
Telecommunications	0.1200
Electric Power Facilities	0.0130
Catenary	0.0130
Machinery	0.0500

The maintenance and operation cost of the existing railway level crossings is a cost to be saved by the execution of the projects.

The cost of a level crossing is Rp. 400,000 per year according to PJKA. Number of personnel to operate a level crossing is 6 for each crossing.

The maintenance and operation cost of the level crossings to be saved by the alternatives were calculated as shown in Table 6.3.1.10.

Table 6.3.1.10 Maintenance and Operation Cost Saving of Level Crossings by Alternative

(Rp. 000000/Year)

	Alternative		
	Track Elevation 1	Track Elevation 2	Flyover
Maintenance	4.4	6.0	3.6
Operation	113.1	154.2	92.5

2) Time saving benefit

In "without" case, road vehicles and pedestrians have to wait at the level crossings when trains pass by. By the execution of the project, road vehicles and pedestrians obtain the time saving benefit. An amount of benefit changes with the number of crossings by the track elevation or the construction of the floyovers.

a. Time saving benefit of pedestrians

A waiting time observation survey was conducted at the Eastern Line level crossings at the same time of the traffic count survey by the study team. The average duration time at the crossing for one train was one minute fifteen seconds.

The time saving benefits of pedestrians were calculated based on the future demand of pedestrians shown in chapter 2 and the number of trains described in chapter 3.

Time value of the pedestrians was assumed to a half of the public mode users. The time value in 1998 was estimated by interpolation.

b. Time saving benefit of road vehicle users

Average waiting time of road vehicles at the level crossings were estimated by using the following formula which is popular in traffic flow theory:

$$d = R * R / (2c(1-q/s)) + x * x /(2q(1-x))$$

where, d: Average waiting time of vehicles
R: Red interval
C: Cycle length
q: Arrival rate
s: Saturation flow rate
x: p/g<1
p: q/s
g: Split

Major parameters to calculate the above formula for this study are shown in Table 6.3.1.11. The number of lanes by the crossings were assumed based on the information from BAPPEDA DKI. The rates of large vehicle flow and the peak ratios was derived from the traffic counting survey.

Table 6.3.1.12 and 13 show the traffic volume by crossing in PCU, traffic flow at peak period and at off-peak period and the average waiting time at the crossings.

Table 6.3.1.14 and 15 describe the annual waiting time of vehicles at the level crossings in the year of 1998 and 2005. Time saving benefits were estimated by using time values shown in the Volume I. The estimated benefits are shown in Table 6.3.1.16 and 17 by crossing and by year. Table 6.3.1.18 summarizes the benefit by the alternatives.

Table 6.3.1.11 Major Parameters for Waiting Time Calculation

	Name of Road	No. of Lanes	Rate of Large Vehicles	Rate of Correction	Saturation Traffic	Peak Ratio (3 hrs)
1	Jl. Manggadua	10	28.04	0.83	14940	0.254229
2	Jl. Gunung Sahari	8	26.34	0.83	11952	0.220308
3	Jl. Industri	4	20.18	0.85	6120	0.215130
4	Jl. Angkasa	10	14.73	0.91	16380	0.234339
5	Gang Spoor	2	6.59	0.94	3384	0.252013
6	Jl. Garuda	10	16.93	0.88	15840	0.216917
7	Jl. Kepu Selatan	8	12.49	0.91	13104	0.238741
8	Jl. Jend.Suprapto	12	26.74	0.83	17928	0.226063
9	Jl. Tanah Tinggi	6	8.15	0.94	10152	0.217706
10	Jl. Kramat Sentiong	2	10.70	0.91	3276	0.249480
11	Jl. Percetakan Negara	4	9.30	0.94	6768	0.225574
12	Jl. Salemba Tengah	2	6.36	0.94	3384	0.248556
13	Jl. Pramuka	10	17.43	0.88	15840	0.218345
14	Jl. Tegalan	2	0.00	1.00	3600	0.251668
15	Jl. Achmad Dahlan	2	6.31	0.94	3384	0.219179

Table 6.3.1.12 Average Waiting Time Calculation in 1998 (Both Directions)

	Name of Road	PCU Total	Traffic Flow Peak	Traffic Flow Off Peak	Average Waiting Time(sec.) Peak	Average Waiting Time(sec.) Off Peak
1	Jl. Hanggadua	72343	6131	4150	36.18	14.77
2	Jl. Gunung Sahari	101075	7423	6062	56.29	43.29
3	Jl. Industri	28795	2065	1739	32.20	29.80
4	Jl. Angkasa	60745	4745	3578	30.03	27.30
5	Gang Spoor	1091	92	63	21.93	21.74
6	Jl. Garuda	76738	5549	4622	32.84	30.12
7	Jl. Kepu Selatan	51734	4117	3029	31.11	27.75
8	Jl. Jend.Suprapto	144057	10855	8576	54.08	40.90
9	Jl. Tanah Tinggi	18617	1351	1120	24.61	23.98
10	Jl. Kramat Sentiong	16116	1340	930	36.10	29.80
11	Jl. Percetakan Negara	38325	2882	2283	37.15	32.19
12	Jl. Salemba Tengah	12501	1036	723	30.74	27.13
13	Jl. Pramuka	148383	10800	8922	67.04	48.85
14	Jl. Tegalan	1725	145	99	22.23	21.94
15	Jl. Achmad Dahlan	17057	1246	1024	33.77	30.60

Table 6.3.1.13 Average Waiting Time Calculation in 2005 (Both Directions)

	Name of Road	PCU Total	Traffic Flow Peak	Traffic Flow Off Peak	Average Waiting Time(sec.) Peak	Average Waiting Time(sec.) Off Peak
1	Jl. Hanggadua	94982	8049	5449	57.82	20.99
2	Jl. Gunung Sahari	120212	8828	7210	102.02	67.21
3	Jl. Industri	32671	2343	1972	43.21	39.35
4	Jl. Angkasa	66686	5209	3928	39.10	35.08
5	Gang Spoor	1285	108	74	27.55	27.26
6	Jl. Garuda	96201	6956	5795	47.55	42.05
7	Jl. Kepu Selatan	63246	5033	3704	43.30	37.17
8	Jl. Jend.Suprapto	174936	13182	10415	100.74	63.63
9	Jl. Tanah Tinggi	22582	1639	1359	31.80	30.79
10	Jl. Kramat Sentiong	19655	1635	1135	53.22	40.80
11	Jl. Percetakan Negara	47959	3606	2857	57.08	46.15
12	Jl. Salemba Tengah	15673	1299	906	43.27	36.42
13	Jl. Pramuka	188408	13713	11328	198.56	93.63
14	Jl. Tegalan	2249	189	129	28.14	27.66
15	Jl. Achmad Dahlan	21541	1574	1294	49.85	43.17

Table 6.3.1.14 Waiting Time at Railway Crossings in 1998

(Hours/year)

	Name of Road	Pedest-rian	Motor-cycle	Sedan	Bus	Truck	Total
1	Jl. Manggadua	51854	30483	63508	4719	24670	123381
2	Jl. Gunung Sahari	19518	130541	264475	13130	60722	468868
3	Jl. Industri	35501	36231	53420	2806	7802	100259
4	Jl. Angkasa	18324	55448	100108	14408	10832	180796
5	Gang Spoor	26934	1742	1651	0	82	3475
6	Jl. Garuda	23122	96513	157057	6035	16827	276432
7	Jl. Kepu Selatan	26648	32771	68636	26456	7426	135289
8	Jl. Jend.Suprapto	74496	151928	374944	46587	51881	625341
9	Jl. Tanah Tinggi	25217	9507	9607	14952	1278	35343
10	Jl. Kramat Sentiong	71530	21612	34932	1024	2930	60499
11	Jl. Percetakan Negara	17942	40387	100202	547	6344	147480
12	Jl. Salemba Tengah	12693	19959	22496	1046	1832	45333
13	Jl. Pramuka	18915	215611	479929	31811	77245	804595
14	Jl. Tegalan	46616	10411	410	0	0	10821
15	Jl. Achmad Dahlan	40366	24638	29316	5443	2527	61923

Table 6.3.1.15 Waiting Time at Railway Crossings in 2005

(Hours/year)

	Name of Road	Pedest-rian	Motor-cycle	Sedan	Bus	Truck	Total
1	Jl. Manggadua	71523	48642	115348	8891	53798	226679
2	Jl. Gunung Sahari	26377	240335	491870	24746	125248	882199
3	Jl. Industri	43788	56718	79129	4408	11746	152001
4	Jl. Angkasa	21866	75620	135172	22375	16842	250010
5	Gang Spoor	34689	2559	2432	0	127	5118
6	Jl. Garuda	31512	168561	278798	9946	29675	486980
7	Jl. Kepu Selatan	35453	54317	114205	43147	12301	223969
8	Jl. Jend.Suprapto	98586	300287	741090	92080	102543	1236000
9	Jl. Tanah Tinggi	33314	14862	14982	23292	2007	55143
10	Jl. Kramat Sentiong	94314	36848	58519	1605	5431	102403
11	Jl. Percetakan Negara	24460	78341	179214	1007	12285	270847
12	Jl. Salemba Tengah	17435	35633	36497	1728	3692	77550
13	Jl. Pramuka	26161	613210	1233795	83916	252402	2183323
14	Jl. Tegalan	64477	17242	639	0	0	17881
15	Jl. Achmad Dahlan	55832	46060	51460	9252	5342	112113

Table 6.3.1.16 Time Saving Benefit at Railway Level Crossing in 1998

(Rp. 000000)

	Name of Road	Pede-strian	Motor-cycle	Sedan	Bus	Truck	Total
1	Jl. Manggadua	16	121	664	52	3	856
2	Jl. Gunung Sahari	6	519	2763	146	7	3441
3	Jl. Industri	11	144	558	31	1	745
4	Jl. Angkasa	6	221	1046	160	1	1433
5	Gang Spoor	8	7	17	0	0	32
6	Jl. Garuda	7	384	1641	67	2	2101
7	Jl. Kepu Selatan	8	130	717	293	1	1150
8	Jl. Jend.Suprapto	23	604	3917	517	6	5067
9	Jl. Tanah Tinggi	8	38	100	166	0	312
10	Jl. Kramat Sentiong	22	86	365	11	0	485
11	Jl. Percetakan Negara	6	161	1047	6	1	1220
12	Jl. Salemba Tengah	4	79	235	12	0	330
13	Jl. Pramuka	6	858	5014	353	9	6239
14	Jl. Tegalan	14	41	4	0	0	60
15	Jl. Achmad Dahlan	12	98	306	60	0	477

Table 6.3.1.17 Time Saving Benefit at Railway Level Crossing in 2005

(Rp. 000000)

	Name of Road	Pede-strian	Motor-cycle	Sedan	Bus	Truck	Total
1	Jl. Manggadua	33	295	1523	147	9	2007
2	Jl. Gunung Sahari	12	1458	6493	410	21	8395
3	Jl. Industri	20	344	1045	73	2	1484
4	Jl. Angkasa	10	459	1784	371	3	2627
5	Gang Spoor	16	16	32	0	0	64
6	Jl. Garuda	15	1022	3681	165	5	4887
7	Jl. Kepu Selatan	16	329	1508	716	2	2571
8	Jl. Jend.Suprapto	45	1821	9784	1527	18	13195
9	Jl. Tanah Tinggi	15	90	198	386	0	690
10	Jl. Kramat Sentiong	43	223	773	27	1	1067
11	Jl. Percetakan Negara	11	475	2366	17	2	2871
12	Jl. Salemba Tengah	8	216	482	29	1	735
13	Jl. Pramuka	12	3719	16288	1392	43	21454
14	Jl. Tegalan	30	105	8	0	0	143
15	Jl. Achmad Dahlan	26	279	679	153	1	1139

Table 6.3.1.18 Time Saving Benefit of Road Vehicle Users by Alternative

(Rp. 000000)

Year	Alternative		
	Track Elevation 1	Track Elevation 2	Flyover
1998	22597	23949	22252
2005	60245	63329	59492

Note: Time saving benefit of pedestrians is included.

c) Time saving benefit of road vehicles

The duration time at the level crossings also consumes the economic value of road vehicles and their drivers, conductors and assistants those are the scarce resources of the national economy.

Table 6.3.1.19 shows the time values of road vehicles by type. Table 6.3.1.20 and 21 describe the time saving benefits of road vehicles generated by the execution of the grade separation. The saved time is same as the road vehicle users. The benefits by the alternatives are presented in Table 6.3.1.22.

Table 6.3.1.19 Time Value by Road Vehicle Type

(Rp. 000000)

Vehicle Type	Economic Cost	Useful Life Hours	Personnel Cost/hour	Vehicle Cost/hour	Time Value per hour
Motorcycle	1740000	4000	-	435	435
Sedan	20640000	6000	-	3440	3440
Bus	58752000	10000	1974	5875	7849
Truck	42637000	10000	2011	4264	6275

Table 6.3.1.20 Time Saving Benefit of Road Vehicles in 1998

(Rp. 000000)

	Name of Road	Motor-cycle	Sedan	Bus	Truck	Total
1	Jl. Manggadua	13.3	218.5	37.0	154.8	423.6
2	Jl. Gunung Sahari	56.8	909.8	103.1	381.0	1450.7
3	Jl. Industri	15.8	183.8	22.0	49.0	270.5
4	Jl. Angkasa	24.1	344.4	113.1	68.0	549.6
5	Gang Spoor	0.8	5.7	0.0	0.5	7.0
6	Jl. Garuda	42.0	540.3	47.4	105.6	735.2
7	Jl. Kepu Selatan	14.3	236.1	207.7	46.6	504.6
8	Jl. Jend.Suprapto	66.1	1289.8	365.7	325.5	2047.1
9	Jl. Tanah Tinggi	4.1	33.0	117.4	8.0	162.6
10	Jl. Kramat Sentiong	9.4	120.2	8.0	18.4	156.0
11	Jl. Percetakan Negara	17.6	344.7	4.3	39.8	406.4
12	Jl. Salemba Tengah	8.7	77.4	8.2	11.5	105.8
13	Jl. Pramuka	93.8	1651.0	249.7	484.7	2479.1
14	Jl. Tegalan	4.5	1.4	0.0	0.0	5.9
15	Jl. Achmad Dahlan	10.7	100.8	42.7	15.9	170.1

Table 6.3.1.21 Time Saving Benefit of Road Vehicles in 2005

(Rp. 000000)

Name of Road	Motor-cycle	Sedan	Bus	Truck	Total
1 Jl. Manggadua	21.2	396.8	69.8	337.6	825.3
2 Jl. Gunung Sahari	104.5	1692.0	194.2	785.9	2776.7
3 Jl. Industri	24.7	272.2	34.6	73.7	405.2
4 Jl. Angkasa	32.9	465.0	175.6	105.7	779.2
5 Gang Spoor	1.1	8.4	0.0	0.8	10.3
6 Jl. Garuda	73.3	959.1	78.1	186.2	1296.7
7 Jl. Kepu Selatan	23.6	392.9	338.7	77.2	832.3
8 Jl. Jend.Suprapto	130.6	2549.4	722.8	643.4	4046.2
9 Jl. Tanah Tinggi	6.5	51.5	182.8	12.6	253.4
10 Jl. Kramat Sentiong	16.0	201.3	12.6	34.1	264.0
11 Jl. Percetakan Negara	34.1	616.5	7.9	77.1	735.6
12 Jl. Salemba Tengah	15.5	125.5	13.6	23.2	177.8
13 Jl. Pramuka	266.7	4244.3	658.7	1583.7	6753.4
14 Jl. Tegalan	7.5	2.2	0.0	0.0	9.7
15 Jl. Achmad Dahlan	20.0	177.0	72.6	33.5	303.2

Table 6.3.1.22 Time Saving Benefit of Road Vehicles by Alternative

(Rp. 000000)

Year	Alternative		
	Track Elevation 1	Track Elevation 2	Flyover
1998	8184	8593	8047
2005	16850	17551	16637

3) Travel Time Increase

As shown in Chapter 5, the road width at the level crossings will get narrow during the construction period of the flyovers. It will result travel time increase of road vehicles. Even after the completion, the number of lanes of the some flyovers are reduced compared with the road width before the flyover construction at the level crossings. It will also result travel time increase.

These travel time increase were appropriated as disbenefit of the project. The travel time increase was calculated by using the following Davidson's Formula:

$$t = t0 * (1 + J * y/(1 - y))$$

where, t : travel time per unit distance
t0: zero flow travel time
J : level of service parameter
y : flow capacity ratio (q/s)
q : arrival rate (traffic flow)
s : service rate (capacity)

The zero flow travel time t0 was calculated according to the design speed of 60 km/h. The level of service parameter J was assumed to 1.0. The other parameters were calculated as the same manner as given in the description of the time saving benefit calculation.

The results of the disbenefit calculation during construction period are shown in Table 6.3.1.23 - 25. The disbenefit after the completion of the flyovers are given in Table 6.3.1.26 and 27.

4) Utilization of Land

By the completion of the track elevation, the land under the elevated track can be utilized. The land was considered to be used as commercial, warehouse and car park purposes. The prevailing annual rent by purpose was adopted to evaluate the value of utilization. Table 6.3.1.28 shows the land utilization benefit by alternative. The benefit was considered to generate only for the track elevation alternatives.

5) Energy Saving

Road vehicles stop at the railway level crossings when they run across them. They consume additional fuel to stop, to idle and to restart at the crossings. When the crossings are taken away by the project execution, the cost of the additional fuel can be used for other purpose. Therefore, the amount of the cost is appropriated as the energy saving benefit. The additional quantity of the fuel by vehicle type are assumed as given as below:

Sedan : 7 cc
Motorcycle: 2 cc
Bus : 7 cc
Truck : 8 cc

Source: "Final Report of Feasibility Study on TRACK ELEVATION OF CENTRAL LINE", JICA 1982

(4) Result of Analysis

Table 6.3.1.29 - 31 show the results of the economic analysis by alternative. The EIRRs of the Track Elevation 1, 2, and Flyover were 12.87%, 11.26% and 13.28% respectively. These values are not sufficient enough to say the project viable. However, the project is considered to be urgent and indispensable in future. Because, traffic congestion along the roads of the crossings are thought to be severe more and more in future. It means that a further examination should be made.

Table 6.3.1.32 shows the result of sensitivity analysis. The values of B/C are smaller than 1.0 and the net present values are negative because the EIRRs are smaller than 15% which is the test discount rate of the country.

Table 6.3.1.23 Disbenefit caused by Increased Travel Time During Construction Period

Track Elevation 1

(1000000 hours, Rupiah)

	Time Increased		Disbenefit Users		Disbenefit Vehicles	
Vehicle Type	1995	1997	1995	1997	1995	1997
Motorcycle	0.405373	0.635581	1367.0	2393.7	176.3	276.5
Sedan	0.917724	1.413490	8607.7	14252.6	3157.0	4862.4
Bus	0.061354	0.095208	572.7	997.1	481.6	747.3
Truck	0.164855	0.271677	15.9	29.4	1034.4	1704.7
Total	1.549308	2.415957	10563.3	17672.7	4849.3	7590.9

Table 6.3.1.24 Disbenefit caused by Increased Travel Time During Construction Period

Track Elevation 2

(1000000 hours, Rupiah)

	Time Increased		Disbenefit Users		Disbenefit Vehicles	
Vehicle Type	1995	1997	1995	1997	1995	1997
Motorcycle	0.097687	0.121840	329.4	458.9	42.5	53.0
Sedan	0.190142	0.248399	1783.4	2504.7	654.1	854.5
Bus	0.013824	0.018334	129.0	192.0	108.5	143.9
Truck	0.065274	0.092999	6.3	10.1	409.6	583.5
Total	0.366929	0.481574	2248.2	3165.6	1214.7	1635.0

Table 6.3.1.25 Disbenefit caused by Increased Travel Time During Construction Period

Flyover

(1000000 hours, Rupiah)

	Time Increased		Disbenefit Users		Disbenefit Vehicles	
Vehicle Type	1995	1997	1995	1997	1995	1997
Motorcycle	1.059977	1.472609	3574.5	5546.0	461.1	640.6
Sedan	2.407807	3.324396	22583.8	33520.9	8282.9	11435.9
Bus	0.233876	0.315614	2183.2	3305.2	1835.7	2477.3
Truck	0.380969	0.554355	36.7	59.9	2390.5	3478.4
Total	4.082631	5.666975	28378.2	42432.0	12970.2	18032.2

Table 6.3.1.26 Disbenefit caused by Increased Travel Time After Completion of Flyovers

Track Elevation 1 & 2

(1000000 hours, Rupiah)

	Time Increased		Disbenefit Users		Disbenefit Vehicles	
Vehicle Type	1998	2005	1998	2005	1998	2005
Motorcycle	0.007997	0.017586	31.8	106.7	3.5	7.7
Sedan	0.016661	0.041703	174.1	550.5	57.3	143.5
Bus	0.001238	0.003214	13.7	53.3	9.7	25.2
Truck	0.006472	0.019450	0.7	3.3	40.6	122.0
Total	0.032368	0.081954	220.4	713.8	111.1	298.4

Table 6.3.1.27 Disbenefit caused by Increased Travel Time After Completion of Flyovers

Flyover

(1000000 hours, Rupiah)

Vehicle Type	Time Increased 1998	Time Increased 2005	Disbenefit Users 1998	Disbenefit Users 2005	Disbenefit Vehicles 1998	Disbenefit Vehicles 2005
Motorcycle	0.118742	0.349970	472.4	2122.6	51.7	152.2
Sedan	0.273210	0.839132	2854.4	11077.8	939.8	2886.6
Bus	0.036208	0.108569	401.6	1800.5	284.2	852.2
Truck	0.040457	0.128567	4.6	22.0	253.9	806.7
Total	0.468619	1.426240	3733.0	15022.8	1529.6	4697.8

Table 6.3.1.28 Land Utilization Benefit by Alternative

Alternative	Area (square meters) Commercial	Warehouse	Car Park	Benefit (Rp.000000/year) Commercial	Warehouse	Car Park	Total
Track Elevation 1	14000	3800	4200	3780.0	342.0	420.0	4542
Track Elevation 2	15500	3800	6250	4185.0	342.0	625.0	5152
Flyover	-	-	-	-	-	-	-

Table 6.3.1.29 Economic Analysis of Eastern Line Track Elevation
(Track Elevation 1)

EIRR (%) 12.87245 B/C 0.79 NPV -136980
(Million Rupiah) Benefit: 1.00 Cost: 1.00

Benefit and Cost	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Cost	6089	9132	33418	67387	96278	140181	84944	0	0	0	0	0	0	0
Track Elevation	6089	9132	32115	65433	71599	111589	57399	0	0	0	0	0	0	0
Initial Investment	6089	9132	32115	65433	71599	111589	57399							
Additional Investment														
Residual Value														
Flyover	0	0	1303	1954	24679	28592	27545	0	0	0	0	0	0	0
Initial Investment			1303	1954	24679	28592	27545							
Additional Investment														
Residual Value														
Benefit	0	0	0	0	-15413	-20338	-25264	37573	45606	53639	61672	69706	77739	85772
Time Saving	0	0	0	0	-10563	-14118	-17673	26896	33279	39663	46046	52430	58813	65197
Public/Private Mode Use	0	0	0	0	0	0	0	27116	33570	40024	46478	52932	59386	65840
Disbenefit	0	0	0	0	-10563	-14118	-17673	-220	-291	-361	-432	-502	-573	-643
Cost Saving	0	0	0	0	-4849	-6220	-7591	5562	7194	8826	10459	12091	13723	15356
Maintenance and Operatio	0	0	0	0	-4849	-6220	-7591	5562	7194	8826	10459	12091	13723	15356
Railway/Flyover								-5171	-5171	-5171	-5171	-5171	-5171	-5171
Road Vehicle	0	0	0	0	0	0	0	10843	12503	14162	15821	17480	19139	20798
Disbenefit	0	0	0	0	-4849	-6220	-7591	-111	-138	-165	-191	-218	-245	-272
Utilization of Land								4542	4542	4542	4542	4542	4542	4542
Energy Saving								573	590	608	625	643	660	678
Net Benefit	-6089	-9132	-33418	-67387	-111691	-160519	-110208	37573	45606	53639	61672	69706	77739	85772

Benefit and Cost	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cost	0	0	0	0	0	0	0	0	0	0	0	0	-193714
Track Elevation	0	0	0	0	0	0	0	0	0	0	0	0	-151827
Initial Investment													
Additional Investment													
Residual Value													-151827
Flyover	0	0	0	0	0	0	0	0	0	0	0	0	-41887
Initial Investment													
Additional Investment													
Residual Value													-41887
Benefit	93805	101839	109872	117905	125938	133971	142005	150038	158071	166104	174137	182171	190204
Time Saving	71580	77964	84347	90731	97114	103497	109881	116264	122648	129031	135415	141798	148182
Public/Private Mode Use	72294	78748	85202	91656	98110	104564	111018	117472	123926	130379	136833	143287	149741
Disbenefit	-714	-784	-855	-925	-996	-1066	-1137	-1207	-1278	-1348	-1419	-1489	-1560
Cost Saving	16988	18620	20253	21885	23517	25150	26782	28414	30047	31679	33311	34944	36576
Maintenance and Operatio	16988	18620	20253	21885	23517	25150	26782	28414	30047	31679	33311	34944	36576
Railway/Flyover	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171
Road Vehicle	22457	24116	25775	27434	29093	30752	32412	34071	35730	37389	39048	40707	42366
Disbenefit	-298	-325	-352	-379	-405	-432	-459	-486	-512	-539	-566	-593	-619
Utilization of Land	4542	4542	4542	4542	4542	4542	4542	4542	4542	4542	4542	4542	4542
Energy Saving	695	712	730	747	765	782	800	817	834	852	869	887	904
Net Benefit	93805	101839	109872	117905	125938	133971	142005	150038	158071	166104	174137	182171	383918

Table 6.3.1.30 Economic Analysis of Eastern Grade Separation (Track Elevation 2)

EIRR (%) 11.26120 B/C 0.67 NPV -289857
(Million Rupiah) Benefit: 1.00 Cost: 1.00

Benefit and Cost	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Cost	9385	14079	55182	101613	116722	187925	103136	0	0	0	0	0	0	0
Track Elevation	9385	14079	54636	100797	106961	176291	91211	0	0	0	0	0	0	0
Initial Investment	9385	14079	54636	100797	106961	176291	91211							
Additional Investment														
Residual Value														
Flyover	0	0	546	816	9761	11634	11925	0	0	0	0	0	0	0
Initial Investment			546	816	9761	11634	11925							
Additional Investment														
Residual Value														
Benefit	0	0	0	0	-3463	-4132	-4801	38251	46637	55023	63409	71795	80180	88566
Time Saving	0	0	0	0	-2248	-2707	-3166	28518	35199	41879	48560	55240	61920	68601
Public/Private Mode Use	0	0	0	0	0	0	0	28739	35490	42241	48991	55742	62493	69244
Disbenefit	0	0	0	0	-2248	-2707	-3166	-220	-291	-361	-432	-502	-573	-643
Cost Saving	0	0	0	0	-1215	-1425	-1635	3970	5657	7343	9030	10716	12403	14090
Maintenance and Operatio	0	0	0	0	-1215	-1425	-1635	3970	5657	7343	9030	10716	12403	14090
Railway/Flyover								-7288	-7288	-7288	-7288	-7288	-7288	-7288
Road Vehicle	0	0	0	0	0	0	0	11369	13082	14796	16509	18222	19936	21649
Disbenefit	0	0	0	0	-1215	-1425	-1635	-111	-138	-165	-191	-218	-245	-272
Utilization of Land								5152	5152	5152	5152	5152	5152	5152
Energy Saving								611	630	649	668	686	705	724
Net Benefit	-9385	-14079	-55182	-101613	-120185	-192057	-107937	38251	46637	55023	63409	71795	80180	88566

Benefit and Cost	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cost	0	0	0	0	0	0	0	0	0	0	0	0	-257512
Track Elevation	0	0	0	0	0	0	0	0	0	0	0	0	-240334
Initial Investment													
Additional Investment													
Residual Value													-240334
Flyover	0	0	0	0	0	0	0	0	0	0	0	0	-17178
Initial Investment													
Additional Investment													
Residual Value													-17178
Benefit	96952	105338	113724	122110	130496	138882	147267	155653	164039	172425	180811	189197	197582
Time Saving	75281	81961	88642	95322	102002	108683	115363	122044	128724	135404	142085	148765	155445
Public/Private Mode Use	75995	82746	89497	96247	102998	109749	116500	123251	130002	136753	143503	150254	157005
Disbenefit	-714	-784	-855	-925	-996	-1066	-1137	-1207	-1278	-1348	-1419	-1489	-1560
Cost Saving	15776	17463	19150	20836	22523	24209	25896	27583	29269	30956	32643	34329	36016
Maintenance and Operatio	15776	17463	19150	20836	22523	24209	25896	27583	29269	30956	32643	34329	36016
Railway/Flyover	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288
Road Vehicle	23363	25076	26789	28503	30216	31929	33643	35356	37070	38783	40496	42210	43923
Disbenefit	-298	-325	-352	-379	-405	-432	-459	-486	-512	-539	-566	-593	-619
Utilization of Land	5152	5152	5152	5152	5152	5152	5152	5152	5152	5152	5152	5152	5152
Energy Saving	743	762	781	800	818	837	856	875	894	913	932	950	969
Net Benefit	96952	105338	113724	122110	130496	138882	147267	155653	164039	172425	180811	189197	455094

Table 6.3.1.31 Economic Analysis of Eastern Line Grade Separation (Flyover)

EIRR (%) 13.27738 B/C 0.79 NPV -77247
(Million Rupiah) Benefit: 1.00 Cost: 1.00

Benefit and Cost	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Cost	0	0	4069	6106	89966	89587	82896	0	0	0	0	0	0	0
Station Improvement	0	0	545	818	11493	11744	8812	0	0	0	0	0	0	0
Initial Investment			545	818	11493	11744	8812							
Additional Investment														
Residual Value														
Flyover	0	0	3524	5288	78473	77843	74084	0	0	0	0	0	0	0
Initial Investment			3524	5288	78473	77843	74084							
Additional Investment														
Residual Value														
Benefit	0	0	0	0	-36239	-43761	-51284	31071	37049	43028	49006	54985	60963	66942
Time Saving	0	0	0	0	-24864	-30408	-35952	22969	27741	32512	37283	42054	46825	51596
Public/Private Mode Use	0	0	0	0	0	0	0	26702	33086	39470	45854	52238	58622	65006
Disbenefit	0	0	0	0	-24864	-30408	-35952	-3733	-5346	-6959	-8571	-10184	-11797	-13410
Cost Saving	0	0	0	0	-11374	-13353	-15332	7541	8731	9921	11112	12302	13492	14683
Maintenance and Operatio	0	0	0	0	-11374	-13353	-15332	7541	8731	9921	11112	12302	13492	14683
Railway/Flyover								-1570	-1570	-1570	-1570	-1570	-1570	-1570
Road Vehicle	0	0	0	0	0	0	0	10640	12283	13926	15569	17212	18855	20498
Disbenefit	0	0	0	0	-11374	-13353	-15332	-1530	-1982	-2435	-2887	-3340	-3793	-4245
Utilization of Land														
Energy Saving								561	578	595	612	629	646	663
Net Benefit	0	0	-4069	-6106	-126205	-133348	-134180	31071	37049	43028	49006	54985	60963	66942

Benefit and Cost	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cost	0	0	0	0	0	0	0	0	0	0	0	0	-137688
Station Improvement	0	0	0	0	0	0	0	0	0	0	0	0	-15088
Initial Investment													
Additional Investment													
Residual Value													-15088
Flyover	0	0	0	0	0	0	0	0	0	0	0	0	-122600
Initial Investment													
Additional Investment													
Residual Value													-122600
Benefit	72921	78899	84878	90856	96835	102813	108792	114770	120749	126727	132706	138684	144663
Time Saving	56368	61139	65910	70681	75452	80223	84995	89766	94537	99308	104079	108850	113622
Public/Private Mode Use	71390	77774	84158	90542	96926	103310	109694	116078	122462	128846	135230	141614	147998
Disbenefit	-15023	-16636	-18248	-19861	-21474	-23087	-24700	-26313	-27925	-29538	-31151	-32764	-34377
Cost Saving	15873	17063	18254	19444	20634	21825	23015	24205	25396	26586	27776	28967	30157
Maintenance and Operatio	15873	17063	18254	19444	20634	21825	23015	24205	25396	26586	27776	28967	30157
Railway/Flyover	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570
Road Vehicle	22141	23784	25426	27069	28712	30355	31998	33641	35284	36927	38570	40213	41856
Disbenefit	-4698	-5150	-5603	-6056	-6508	-6961	-7413	-7866	-8319	-8771	-9224	-9676	-10129
Utilization of Land													
Energy Saving	680	697	714	731	748	765	782	799	816	833	850	867	884
Net Benefit	72921	78899	84878	90856	96835	102813	108792	114770	120749	126727	132706	138684	282351

Table 6.3.1.32 Result of Sensitivity Analysis
- Track Elevation 1 -

Case	EIRR(%)	B/C	NPV
Base Case	12.87	0.79	-136980
Benefit -10%	11.98	0.71	-187111
Cost +10%	12.07	0.71	-200809
Benefit -10% & Cost + 10%	11.20	0.64	-250939

Table 6.3.1.33 Result of Sensitivity Analysis
- Track Elevation 2 -

Case	EIRR(%)	B/C	NPV
Base Case	11.26	0.67	-289857
Benefit -10%	10.37	0.60	-348152
Cost +10%	10.45	0.61	-377138
Benefit -10% & Cost + 10%	9.60	0.55	-435433

Table 6.3.1.34 Result of Sensitivity Analysis
- Flyover -

Case	EIRR(%)	B/C	NPV
Base Case	13.28	0.79	-77247
Benefit -10%	12.53	0.71	-105505
Cost +10%	12.60	0.71	-113230
Benefit -10% & Cost + 10%	11.85	0.64	-141487

(5) Further Examination

The results of the economic analysis which are shown above are not necessarily satisfactory for the implementation of the project. Therefore, a further examination on the results were carried out in relation to the construction and completion year of the project.

When the completion of the project is postponed, the benefit of the project grows larger as long as the annual benefit increases. The criteria of the analysis may change to be preferable. So, the further examinations on the viability of the project were done when the completion were postponed to 2002. The year of 2002 was defined considering the other railway improvement projects.

The results of the examination are shown in Table 6.3.1.35 - 37 and the results of sensitivity analysis are shown in Table 6.3.1.38 - 40 by each alternative. The EIRR of the Track Elevation 1 reached to the standard discount rate of 15%, and became the most viable alternative among the three. Although the three alternatives became better than the original programs, the two track elevation alternatives were improved remarkably. It seems that the disbenefit of time caused by decrease of road width at the flyovers affected seriously, and that the disbenefit grows faster than the other benefit items in future.

Table 6.3.1.38 Results of Sensitivity Analysis
- Track Elevation 1 -

Case	EIRR(%)	B/C	NPV
Base Case	15.22	1.02	8943
Benefit -10%	14.27	0.92	-28445
Cost +10%	14.36	0.93	-27551
Benefit -10% & Cost + 10%	13.43	0.84	-64939

Table 6.3.1.39 Results of Sensitivity Analysis
- Track Elevation 2 -

Case	EIRR(%)	B/C	NPV
Base Case	14.27	0.93	-33784
Benefit -10%	13.82	0.84	-80309
Cost +10%	13.31	0.85	-83687
Benefit -10% & Cost + 10%	12.29	0.76	-130211

Table 6.3.1.40 Results of Sensitivity Analysis
- Flyover -

Case	EIRR(%)	B/C	NPV
Base Case	14.52	0.93	-14449
Benefit -10%	13.82	0.84	-33577
Cost +10%	13.89	0.85	-35022
Benefit -10% & Cost + 10%	13.18	0.76	-54150

Table 6.3.1.35 Economic Analysis of Eastern Line Track Elevation
(Postponed Construction: Track Elevation 1)

EIRR (%) 15.22000 B/C 1.02 NPV 8943
(Million Rupiah) Benefit: 1.00 Cost: 1.00

Benefit and Cost	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Cost	6089	9132	33418	67387	96278	140181	84944	0	0	0	0	0	0	0
Track Elevation	6089	9132	32115	65433	71599	111589	57399	0	0	0	0	0	0	0
Initial Investment	6089	9132	32115	65433	71599	111589	57399							
Additional Investment														
Residual Value														
Flyover	0	0	1303	1954	24679	28592	27545	0	0	0	0	0	0	0
Initial Investment			1303	1954	24679	28592	27545							
Additional Investment														
Residual Value														
Benefit	0	0	0	0	-35115	-40040	-44966	69706	77739	85772	93805	101839	109872	117905
Time Saving	0	0	0	0	-24782	-28337	-31892	52430	58813	65197	71580	77964	84347	90731
Public/Private Mode Use	0	0	0	0				52932	59386	65840	72294	78748	85202	91656
Disbenefit	0	0	0	0	-24782	-28337	-31892	-502	-573	-643	-714	-784	-855	-925
Cost Saving	0	0	0	0	-10332	-11703	-13074	12091	13723	15356	16988	18620	20253	21885
Maintenance and Operatio	0	0	0	0	-10332	-11703	-13074	12091	13723	15356	16988	18620	20253	21885
Railway/Flyover								-5171	-5171	-5171	-5171	-5171	-5171	-5171
Road Vehicle	0	0	0	0				17480	19139	20798	22457	24116	25775	27434
Disbenefit	0	0	0	0	-10332	-11703	-13074	-218	-245	-272	-298	-325	-352	-379
Utilization of Land								4542	4542	4542	4542	4542	4542	4542
Energy Saving								643	660	678	695	712	730	747
Net Benefit	-6089	-9132	-33418	-67387	-131393	-180221	-129910	69706	77739	85772	93805	101839	109872	117905

Benefit and Cost	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cost	0	0	0	0	0	0	0	0	0	0	0	0	-193714
Track Elevation	0	0	0	0	0	0	0	0	0	0	0	0	-151827
Initial Investment													
Additional Investment													
Residual Value													-151827
Flyover	0	0	0	0	0	0	0	0	0	0	0	0	-41887
Initial Investment													
Additional Investment													
Residual Value													-41887
Benefit	125938	133971	142005	150038	158071	166104	174137	182171	190204	198237	206270	214303	222336
Time Saving	97114	103497	109881	116264	122648	129031	135415	141798	148182	154565	160949	167332	173716
Public/Private Mode Use	98110	104564	111018	117472	123926	130379	136833	143287	149741	156195	162649	169103	175557
Disbenefit	-996	-1066	-1137	-1207	-1278	-1348	-1419	-1489	-1560	-1630	-1701	-1771	-1842
Cost Saving	23517	25150	26782	28414	30047	31679	33311	34944	36576	38208	39840	41473	43105
Maintenance and Operatio	23517	25150	26782	28414	30047	31679	33311	34944	36576	38208	39840	41473	43105
Railway/Flyover	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171	-5171
Road Vehicle	29093	30752	32412	34071	35730	37389	39048	40707	42366	44025	45684	47343	49002
Disbenefit	-405	-432	-459	-486	-512	-539	-566	-593	-619	-646	-673	-700	-727
Utilization of Land	4542	4542	4542	4542	4542	4542	4542	4542	4542	4542	4542	4542	4542
Energy Saving	765	782	800	817	834	852	869	887	904	922	939	956	974
Net Benefit	125938	133971	142005	150038	158071	166104	174137	182171	190204	198237	206270	214303	416050

Table 6.3.1.36 Economic Analysis of Eastern Line Track Elevation
(Postponed Construction: Track Elevation 2)

EIRR (%)	14.27208	B/C	0.93	NPV	-33784
(Million Rupiah)		Benefit:	1.00	Cost:	1.00

Benefit and Cost	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Cost	9385	14079	55182	101613	116722	187925	103136	0	0	0	0	0	0	0
Track Elevation	9385	14079	54636	100797	106961	176291	91211	0	0	0	0	0	0	0
Initial Investment	9385	14079	54636	100797	106961	176291	91211							
Additional Investment														
Residual Value														
Flyover	0	0	546	816	9761	11634	11925	0	0	0	0	0	0	0
Initial Investment			546	816	9761	11634	11925							
Additional Investment														
Residual Value														
Benefit	0	0	0	0	-6138	-6807	-7476	71795	80180	88566	96952	105338	113724	122110
Time Saving	0	0	0	0	-4083	-4542	-5000	55240	61920	68601	75281	81961	88642	95322
Public/Private Mode Use	0	0	0	0				55742	62493	69244	75995	82746	89497	96247
Disbenefit	0	0	0	0	-4083	-4542	-5000	-502	-573	-643	-714	-784	-855	-925
Cost Saving	0	0	0	0	-2055	-2266	-2476	10716	12403	14090	15776	17463	19150	20836
Maintenance and Operatio	0	0	0	0	-2055	-2266	-2476	10716	12403	14090	15776	17463	19150	20836
Railway/Flyover								-7288	-7288	-7288	-7288	-7288	-7288	-7288
Road Vehicle	0	0	0	0				18222	19936	21649	23363	25076	26789	28503
Disbenefit	0	0	0	0	-2055	-2266	-2476	-218	-245	-272	-298	-325	-352	-379
Utilization of Land								5152	5152	5152	5152	5152	5152	5152
Energy Saving								686	705	724	743	762	781	800
Net Benefit	-9385	-14079	-55182	-101613	-122860	-194732	-110612	71795	80180	88566	96952	105338	113724	122110

Benefit and Cost	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cost	0	0	0	0	0	0	0	0	0	0	0	0	-257512
Track Elevation	0	0	0	0	0	0	0	0	0	0	0	0	-240334
Initial Investment													
Additional Investment													
Residual Value													-240334
Flyover	0	0	0	0	0	0	0	0	0	0	0	0	-17178
Initial Investment													
Additional Investment													
Residual Value													-17178
Benefit	130496	138882	147267	155653	164039	172425	180811	189197	197582	205968	214354	222740	231126
Time Saving	102002	108683	115363	122044	128724	135404	142085	148765	155445	162126	168806	175487	182167
Public/Private Mode Use	102998	109749	116500	123251	130002	136753	143503	150254	157005	163756	170507	177258	184009
Disbenefit	-996	-1066	-1137	-1207	-1278	-1348	-1419	-1489	-1560	-1630	-1701	-1771	-1842
Cost Saving	22523	24209	25896	27583	29269	30956	32643	34329	36016	37702	39389	41076	42762
Maintenance and Operatio	22523	24209	25896	27583	29269	30956	32643	34329	36016	37702	39389	41076	42762
Railway/Flyover	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288	-7288
Road Vehicle	30216	31929	33643	35356	37070	38783	40496	42210	43923	45636	47350	49063	50777
Disbenefit	-405	-432	-459	-486	-512	-539	-566	-593	-619	-646	-673	-700	-727
Utilization of Land	5152	5152	5152	5152	5152	5152	5152	5152	5152	5152	5152	5152	5152
Energy Saving	818	837	856	875	894	913	932	950	969	988	1007	1026	1045
Net Benefit	130496	138882	147267	155653	164039	172425	180811	189197	197582	205968	214354	222740	488638

Table 6.3.1.37 Economic Analysis of Eastern Line Track Elevation
(Postponed Construction: Flyover)

EIRR (%) 14.52239 B/C 0.93 NPV -14449
(Million Rupiah) Benefit: 1.00 Cost: 1.00

Benefit and Cost	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Cost	0	0	4069	6106	89966	89587	82896	0	0	0	0	0	0	0
Station Improvement	0	0	545	818	11493	11744	8812	0	0	0	0	0	0	0
Initial Investment			545	818	11493	11744	8812							
Additional Investment														
Residual Value														
Flyover	0	0	3524	5288	78473	77843	74084	0	0	0	0	0	0	0
Initial Investment			3524	5288	78473	77843	74084							
Additional Investment														
Residual Value														
Benefit	0	0	0	0	-66329	-73852	-81374	54985	60963	66942	72921	78899	84878	90856
Time Saving	0	0	0	0	-47040	-52584	-58128	42054	46825	51596	56368	61139	65910	70681
Public/Private Mode Use	0	0	0	0				52238	58622	65006	71390	77774	84158	90542
Disbenefit	0	0	0	0	-47040	-52584	-58128	-10184	-11797	-13410	-15023	-16636	-18248	-19861
Cost Saving	0	0	0	0	-19289	-21268	-23246	12302	13492	14683	15873	17063	18254	19444
Maintenance and Operatio	0	0	0	0	-19289	-21268	-23246	12302	13492	14683	15873	17063	18254	19444
Railway/Flyover								-1570	-1570	-1570	-1570	-1570	-1570	-1570
Road Vehicle	0	0	0	0				17212	18855	20498	22141	23784	25426	27069
Disbenefit	0	0	0	0	-19289	-21268	-23246	-3340	-3793	-4245	-4698	-5150	-5603	-6056
Utilization of Land														
Energy Saving								629	646	663	680	697	714	731
Net Benefit	0	0	-4069	-6106	-156295	-163439	-164270	54985	60963	66942	72921	78899	84878	90856

Benefit and Cost	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cost	0	0	0	0	0	0	0	0	0	0	0	0	-137688
Station Improvement	0	0	0	0	0	0	0	0	0	0	0	0	-15088
Initial Investment													
Additional Investment													
Residual Value													-15088
Flyover	0	0	0	0	0	0	0	0	0	0	0	0	-122600
Initial Investment													
Additional Investment													
Residual Value													-122600
Benefit	96835	102813	108792	114770	120749	126727	132706	138684	144663	150641	156619	162598	168576
Time Saving	75452	80223	84995	89766	94537	99308	104079	108850	113622	118393	123164	127935	132706
Public/Private Mode Use	96926	103310	109694	116078	122462	128846	135230	141614	147998	154382	160766	167150	173534
Disbenefit	-21474	-23087	-24700	-26313	-27925	-29538	-31151	-32764	-34377	-35990	-37603	-39215	-40828
Cost Saving	20634	21825	23015	24205	25396	26586	27776	28967	30157	31347	32537	33728	34918
Maintenance and Operatio	20634	21825	23015	24205	25396	26586	27776	28967	30157	31347	32537	33728	34918
Railway/Flyover	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570	-1570
Road Vehicle	28712	30355	31998	33641	35284	36927	38570	40213	41856	43499	45142	46784	48427
Disbenefit	-6508	-6961	-7413	-7866	-8319	-8771	-9224	-9676	-10129	-10582	-11034	-11487	-11939
Utilization of Land													
Energy Saving	748	765	782	799	816	833	850	867	884	901	918	935	952
Net Benefit	96835	102813	108792	114770	120749	126727	132706	138684	144663	150641	156619	162598	306264

6-4 Feeder Service and Station Facilities Improvement for 16 High Priority Stations

6-4-1 Economic Analysis

(1) Economic cost

1) Initial investment cost

The economic initial investment cost of the Project (Table 6.4.1.1) is derived from financial construction costs which is shown in Table 6.4.1.2 through the procedure described in chapter 5 of Volume I. Table 6.4.1.3 summarizes a construction program and the initial investment cost excluding initial rolling stock cost which is an additional cost to cope with the increased demand by the improvement in 1995.

2) Additional investment cost

Additional investment costs for rolling stocks to cope with the future increased demand were appropriated as shown in Table 6.4.1.4.

3) Reinvestment

The cost for reinvestment should be appropriated when useful life of asset expires within the project life. However, the project life of this study is defined as 20 years after the completion and the minimum useful life of the asset is not less than 20 years, no reinvestment is considered.

4) Residual value

The 20 year period of the project life is defined only for the project evaluation. The assets invested for the improvement remain even after the period. The remaining value of the assets is appropriated as residual value at the last year of the project life.

Table 6.4.1.5 shows the useful life and the residual value by asset.

Table 6.4.1.1 Economic Investment Cost of Feeder Service and Station Improvement
- 16 - stations -

(Million Rupiah)

Investment Item \ Year	1991/2	1992/3	1993/4	1994/5	Total
Bus Bay	0	0	1883	1883	3767
Foreign Portion	0	0	941	941	1882
Local Portion Labour Cost		0	167	166	333
Local Portion Others	0	0	775	776	1552
Pedestrian Cross	0	0	3	3	6
Foreign Portion	0	0	2	1	3
Local Portion Labour Cost	0	0	0	1	1
Local Portion Others	0	0	1	1	2
Bus Platform	0	0	0	0	0
Foreign Portion	0	0	0	0	0
Local Portion Labour Cost	0	0	0	0	0
Local Portion Others	0	0	0	0	0
Traffic Signal	0	0	1	2	3
Foreign Portion	0	0	1	1	2
Local Portion Labour Cost	0	0	0	0	0
Local Portion Others	0	0	0	1	1
Pedestrian Bridge	0	0	4191	4190	8380
Foreign Portion	0	0	2148	2147	4295
Local Portion Labour Cost	0	0	740	740	1480
Local Portion Others	0	0	1303	1303	2605
Over Track Station	0	0	2239	2239	4479
Foreign Portion	0	0	1377	1378	2755
Local Portion Labour Cost	0	0	276	276	552
Local Portion Others	0	0	586	585	1172
Station Building	0	0	760	761	1521
Foreign Portion	0	0	687	687	1374
Local Portion Labour Cost	0	0	24	24	48
Local Portion Others	0	0	49	50	99
Station Front Plaza	0	0	7493	7492	14986
Foreign Portion	0	0	7006	7006	14012
Local Portion Labour Cost	0	0	101	100	201
Local Portion Others	0	0	386	386	773
Station Bridge	0	0	2258	2258	4516
Foreign Portion	0	0	1409	1410	2819
Local Portion Labour Cost	0	0	249	249	498
Local Portion Others	0	0	600	599	1199
Under Pass	0	0	1897	1897	3795
Foreign Portion	0	0	990	991	1981
Local Portion Labour Cost	0	0	291	290	581
Local Portion Others	0	0	616	616	1233
Station Platform	0	0	5489	5489	10979
Foreign Portion	0	0	3332	3333	6665
Local Portion Labour Cost	0	0	691	691	1382
Local Portion Others	0	0	1466	1465	2932
Land Aquisition and Compensation	0	4071	0	0	4071
Foreign Portion	0	0	0	0	0
Local Portion Labour Cost	0	0	0	0	0
Local Portion Others	0	4071	0	0	4071
Subtotal	0	4071	26216	26216	56502
Foreign Portion	0	0	17893	17895	35788
Local Portion Labour Cost	0	0	2539	2537	5076
Local Portion Others	0	4071	5784	5784	15638
Contingency	0	0	3931	3932	7864
Foreign Portion	0	0	2684	2684	5368
Local Portion Labour Cost	0	0	380	381	761
Local Portion Others	0	0	867	867	1735
D/D and E/S	825	1237	1648	1649	5359
Foreign Portion	551	826	1101	1101	3579
Local Portion Labour Cost	274	411	547	548	1780
Local Portion Others	0	0	0	0	0
Total	825	5308	31795	31797	69725
Foreign Portion	551	826	21678	21680	44735
Local Portion Labour Cost	274	411	3466	3466	7617
Local Portion Others	0	4071	6651	6651	17373

Table 6.4.1.2 Financial Investment Cost of Feeder Service and Station Improvement
- 16 - stations -

(Million Rupiah)

Investment Item \ Year	1991/2	1992/3	1993/4	1994/5	Total
Bus Bay	0	0	1961	1961	3922
Foreign Portion			941	941	1882
Local Portion Labour Cost			167	166	333
Local Portion Others			853	854	1707
Pedestrian Cross	0	0	3	3	6
Foreign Portion			2	1	3
Local Portion Labour Cost			0	1	1
Local Portion Others			1	1	2
Bus Platform	0	0	0	0	0
Foreign Portion					0
Local Portion Labour Cost					0
Local Portion Others					0
Traffic Signal	0	0	1	2	3
Foreign Portion			1	1	2
Local Portion Labour Cost			0	0	0
Local Portion Others			0	1	1
Pedestrian Bridge	0	0	4321	4320	8641
Foreign Portion			2148	2147	4295
Local Portion Labour Cost			740	740	1480
Local Portion Others			1433	1433	2866
Over Track Station	0	0	2298	2298	4596
Foreign Portion			1377	1378	2755
Local Portion Labour Cost			276	276	552
Local Portion Others			645	644	1289
Station Building	0	0	765	766	1531
Foreign Portion			687	687	1374
Local Portion Labour Cost			24	24	48
Local Portion Others			54	55	109
Station front Plaza	0	0	7532	7531	15063
Foreign Portion			7006	7006	14012
Local Portion Labour Cost			101	100	201
Local Portion Others			425	425	850
Station Bridge	0	0	2318	2318	4636
Foreign Portion			1409	1410	2819
Local Portion Labour Cost			249	249	498
Local Portion Others			660	659	1319
Under Pass	0	0	1959	1959	3918
Foreign Portion			990	991	1981
Local Portion Labour Cost			291	290	581
Local Portion Others			678	678	1356
Station Platform	0	0	5636	5636	11272
Foreign Portion			3332	3333	6665
Local Portion Labour Cost			691	691	1382
Local Portion Others			1613	1612	3225
Land Aquisition and Compensation	0	4478	0	0	4478
Foreign Portion					0
Local Portion Labour Cost					0
Local Portion Others		4478			4478
Subtotal	0	4478	26794	26794	58066
Foreign Portion	0	0	17893	17895	35788
Local Portion Labour Cost	0	0	2539	2537	5076
Local Portion Others	0	4478	6362	6362	17202
Contingency	0	0	4018	4019	8037
Foreign Portion			2684	2684	5368
Local Portion Labour Cost			380	381	761
Local Portion Others			954	954	1908
D/D and E/S	825	1237	1648	1649	5359
Foreign Portion	551	826	1101	1101	3579
Local Portion Labour Cost	274	411	547	548	1780
Local Portion Others					0
Total	825	5715	32460	32462	71462
Foreign Portion	551	826	21678	21680	44735
Local Portion Labour Cost	274	411	3466	3466	7617
Local Portion Others	0	4478	7316	7316	19110

Table 6.4.1.3 Economic Investment Cost of Feeder Service and Station Facilities Improvement
- 16 stations -

(Rp. 000000)

Investment Item \ Year	1991/2	1992/3	1993/4	1994/5	Total
Bus Bay	0	0	1883	1883	3767
Pedestrian Cross	0	0	3	3	6
Bus Platform	0	0	0	0	0
Traffic Signal	0	0	1	2	3
Pedestrian Bridge	0	0	4191	4190	8380
Over Track Station	0	0	2239	2239	4479
Station Building	0	0	760	761	1521
Station Front Plaza	0	0	7493	7492	14986
Station Bridge	0	0	2258	2258	4516
Under Pass	0	0	1897	1897	3795
Station Platform	0	0	5489	5489	10979
Land Aquisition and Compensation	0	4071	0	0	4071
D/D, S/S and Contingency	825	1237	5579	5581	13223
Total	825	5308	31795	31797	69725

Table 6.4.1.4 Additional Investment of Rolling Stocks

(Rp. 000000)

Year	Number	Amount
1995	12	22416
1998	4	7472
2001	4	7472
2003	4	7472
2005	4	7472
2008	4	7472
2011	4	7472
2013	4	7472
Total	40	74720

Table 6.4.1.5 Useful Life and Residual Value

(Years, Rp. 000000)

	Useful Life	Residual Value
Bus Bay	30	1256
Pedestrian Cross	30	2
Traffic Signal	20	0
Pedestrian Bridge	35	3592
Over Track Station	35	1919
Station Building	35	652
Station Front Plaza	30	4995
Station Bridge	35	1935
Under Pass	45	2108
Station Platform	30	3660
Rolling Stock	25	37061
Land Acquisition	-	3470
Total	-	60650

(2) Economic benefit

1) Maintenance and operation cost difference

- Railway Operation, Feeder Service and Station Facilities

Maintenance cost of the project was estimated using the same method described in chapter 5 of Volume I. The maintenance rates by investment item are shown in Table 6.4.1.6. This table includes operating cost of the project except railway operation.

Table 6.4.1.6 Maintenance Rate by Investment Item

	Maintenance Rate
Bus Bay	0.0051
Pedestrian Cross	0.0041
Traffic Signal	0.0150
Pedestrian Bridge	0.0027
Over Track Station	0.0067
Station Building	0.0067
Station Front Plaza	0.0041
Station Bridge	0.0027
Under Pass	0.0041
Station Platform	0.0041
Rolling Stock(EC)	0.0137
Rolling Stock(DC)	0.0365

Railway operation cost increase for the increased passenger is summarized in Table 6.4.1.7.

Table 6.4.1.7 Operation Cost Increase

(Rp. 000000)

	1995	2005
Personnel	177.0	325.5
Electricity	74.8	157.3
Diesel Oil	33.8	66.0

Note: Personnel costs include the cost for rolling stocks maintenance.

- Road vehicle

The difference of road vehicle operating cost is appropriated as benefit in this project if the cost of "with" case is less than that of "without" case.

The cost components consist of vehicles, tires, fuels, engine oil, wage, interest, insurance and overhead. The methodology of estimation is same as described in chapter 5 of Volume I. The cost for 1995 target year was derived from an interpolation.

2) Time saving benefit

Time saving benefit caused by this project was calculated from the difference of the passenger hours between "with" and "without" cases.

In addition to the time saving of passengers, time savings of freight transportation by trucks were appropriated as same as option "b" evaluation.

The total time saving benefits in 1995 and 2005 were estimated as Rp. 39680 million and Rp. 64613 million respectively.

(3) Result of analysis

Table 6.4.1.8 shows the result of the economic analysis. The EIRR of the project is very high. It reached to more than 50%. The B/C, which was calculated according to the test discount rate of 15%, indicates 4.47. The net present value of this project was Rp. 421383 million.

The result shows a superior efficiency of the project. The reason why this project has such a high EIRR seems to that the cost of the project was relatively small and the effect was big as same as the case for the three station project described in 6.1.

Table 6.4.1.8 Economic Analysis of Feeder Service and Station Facilities Improvement

- 16 stations -

EIRR (%)	55.86869	B/C	4.47	NPV	421383
(Million Rupiah)		Benefit:	1.00	Cost :	1.00

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Cost	825	5308	31795	31797	22416	0	0	7472	0	0	7472	0
Initial Investment	825	5308	31795	31797								
Additional Investment					22416	0	0	7472	0	0	7472	0
Residual Value												
Benefit	0	0	0	0	57431	60840	64249	67484	70893	74302	77536	80945
Time Saving					39680	42173	44667	47160	49653	52147	54640	57133
Cost Saving	0	0	0	0	17751	18667	19583	20324	21240	22155	22896	23812
Railway & Feeder					-968	-987	-1006	-1200	-1220	-1239	-1433	-1452
Maintenance					-741	-741	-741	-915	-915	-915	-1090	-1090
Operation					-227	-246	-266	-285	-304	-324	-343	-362
Road Vehicle					18719	19654	20589	21524	22459	23394	24329	25265
Net Benefit	-825	-5308	-31795	-31797	35015	60840	64249	60012	70893	74302	70064	80945

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cost	7472	0	7472	0	0	7472	0	0	7472	0	7472	-60650
Initial Investment												
Additional Investment	7472	0	7472	0	0	7472	0	0	7472	0	7472	0
Residual Value												-60650
Benefit	84120	87529	90703	94112	97521	100756	104165	107574	110808	114217	117391	120801
Time Saving	59626	62120	64613	67106	69600	72093	74586	77080	79573	82066	84559	87053
Cost Saving	24493	25409	26090	27006	27922	28663	29578	30494	31235	32151	32832	33748
Railway & Feeder	-1707	-1726	-1980	-1999	-2019	-2213	-2232	-2251	-2445	-2465	-2719	-2738
Maintenance	-1325	-1325	-1560	-1560	-1560	-1735	-1735	-1735	-1910	-1910	-2145	-2145
Operation	-381	-401	-420	-439	-459	-478	-497	-517	-536	-555	-574	-594
Road Vehicle	26200	27135	28070	29005	29940	30875	31811	32746	33681	34616	35551	36486
Net Benefit	76648	87529	83231	94112	97521	93284	104165	107574	103336	114217	109919	181451

A sensitivity test was also carried out. The result is shown in Table 6.4.1.9. The EIRR of the most pessimistic case was 47.68%. The viability of this project can be also said very preferable from an economic point of view.

Table 6.4.1.9 Sensitivity Test Results

Case	EIRR(%)	B/C	NPV
Base case	55.87	4.47	421383
Benefit 10% down	51.44	4.03	367111
Cost 10% up	51.85	4.07	409249
Benefit 10% down & cost 10% up	47.68	3.66	354977

Note: NPV (Rp. 000000)

6-4-2 Financial Analysis

(1) Amount of investment

The investment process is assumed to be the same as in the economic assessment. However all the prices are financial expenses to which taxes etc., are carried back. The yearly amount of the initial investment of the financial expense base is given in Table 6.4.2.1.

The additional investment, reinvestment and residual value are assumed to be the same in the economic analysis (the prices are based on financial expenses). The residual value of assets by type is as shown in Table 6.4.2.2.

(2) Business income

The increased passenger fare income accompanying improvement in the feeder service and station facilities is appropriated. The passenger fare income is calculated by multiplying the number of railway passenger obtained by the traffic demand forecast by a fare rate. The fare rate is assumed to be Rp. 13.4/passenger km. The rate is the same used in Volume I. Note that the fare rate was assumed to be unchanged during the project life.

Table 6.4.2.1 Financial Investment Cost of Feeder Service and Station Improvement for 16 Stations

(Million Rp.)

Investment items	1991/2	1992/3	1993/4	1994/5	1995/6	Total
Feeder facilities						
Bus bay			1961	1961		3922
Foreign portion			941	941		1882
Local portion			1020	1020		2040
Pedestrian cross			3	3		6
Foreign portion			2	1		3
Local portion			1	2		3
Bus platform						
Foreign portion						
Local portion						
Traffic signal			1	2		3
Foreign portion			1	1		2
Local portion				1		1
Pedestrian bridge			4321	4320		8641
Foreign portion			2148	2147		4295
Local portion			2173	2173		4346
Under pass			1959	1959		3918
Foreign portion			990	991		1981
Local portion			969	968		1937
Land acquisition and compensation		1567				1567
Foreign portion						
Local portion		1567				1567
D/D and E/S	254	380	507	508		1649
Foreign portion	126	188	251	251		816
Local portion	128	192	256	257		833
Contingency			1236	1236		2472
Foreign portion			612	612		1224
Local portion			624	624		1248
Sub total	254	1947	9988	9989		22178
Foreign portion	126	188	4945	4944		10203
Local portion	128	1759	5043	5045		11975
Station facilities						
Over track station			2298	2298		4596
Foreign portion			1377	1378		2755
Local portion			921	920		1841
Station building			765	766		1531
Foreign portion			687	687		1374
Local portion			78	79		157
Station front plaza			7532	7531		15063
Foreign portion			7006	7006		14012
Local portion			526	525		1051
Station bridge			2318	2318		4636
Foreign portion			1409	1410		2819
Local portion			909	908		1817
Station platform			5636	5636		11272
Foreign portion			3332	3333		6665
Local portion			2304	2303		4607
Land acquisition and compensation		2911				2911
Foreign portion						
Local portion		2911				2911
Rolling stocks					22418	22418
Foreign portion					22190	22190
Local portion					228	228
D/D and E/S	571	857	1141	1141		3710
Foreign portion	425	638	850	850		2763
Local portion	146	219	291	291		947
Contingency			2782	2783		5565
Foreign portion			2072	2072		4144
Local portion			710	711		1421
Sub total	571	3768	22472	22473	22418	71702
Foreign portion	425	638	16733	16736	22190	56722
Local portion	146	3130	5739	5737	228	14980
Total	825	5715	32460	32462	22418	93880
Foreign portion	551	826	21678	21680	22190	66925
Local portion	274	4889	10782	10782	228	26955

Table 6.4.2.2 Residual Value

(Million Rp.)

Bus Bay	1,307
Pedestrian Cross	2
Traffic Signal	0
Pedestrian Bridge	3,703
Over Track Station	1,970
Station Building	656
Station Front Plaza	5,021
Station Bridge	1,987
Under Pass	2,177
Station Platform	3,757
Rolling Stock	40,050
Land Acquisition	3,817
Total	64,448

(3) Business expenditure

1) Maintenance expenses

The maintenance expenses are obtained by multiplying the cumulative amount of investment (financial expenses base = market price base after carrying back taxes etc.) by maintenance rates. As for the maintenance rates classified by work categories, refer to Table 6.4.1.6.

2) Operating expenses

The operating expenses consist of personnel expense and power expense (electricity and fuel).

(4) Results of analysis

The project's FIRR, which was calculated on the basis of the cash flow obtained from the above assumption is 2.37% (Refer to Table 6.4.2.3. for the details of the results).

The FIRR of 2.37% for this project can not be said to be of a sufficient level for PJKA, even when considering the present

Japanese OECF yen credits interest rate of 2.5% p.a., which is one of the lowest interest rate of foreign government loans. In order to make the project more surely feasible from PJKA's point of view, we have calculated FIRR under the hypothetical scenario of cost-sharing. The results are as shown in Table 6.4.2.4.

The project may become financially feasible for PJKA under the hypotheses from II to VI. However, the debt of commercial base may make management unfeasible under the FIRRs of the hypotheses from II to V, and it would be necessary to obtain loans at as low interest as possible and, above all, government grants which need not be repaid.

(5) Sensitivity analysis

A sensitivity analysis of the investment and revenue (fare income) was attempted. The results are shown in Table 6.4.2.5.

It can be seen from the result that a change in the amount of investment would have somewhat less effect on the FIRR than would a change in revenue.

Table 6.4.2.3 Financial Analysis of Feeder Service and Station Improvement for 16 Stations

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
OPERATING PROFIT	0	0	0	0	4001	4289	4577	4706	4994	5282	5411
OPERATING REVENUE	0	0	0	0	4995	5311	5626	5942	6257	6573	6888
OPERATING EXPENSE	0	0	0	0	995	1022	1049	1236	1264	1291	1478
WORKING COST	0	0	0	0	995	1022	1049	1236	1264	1291	1478
MAINTENANCE COST	0	0	0	0	699	699	699	858	858	858	1017
FEEDER	0	0	0	0	59	59	59	59	59	59	59
STATION	0	0	0	0	639	639	639	798	798	798	958
PERSONNEL COST	0	0	0	0	107	203	219	235	251	267	283
ELECTRICITY COST	0	0	0	0	75	83	91	100	108	116	124
FUEL COST	0	0	0	0	34	37	40	43	47	50	53
INVESTMENT	825	5715	32460	32462	22418	0	0	7473	0	0	7473
FEEDER	254	1947	9988	9989	0	0	0	0	0	0	0
STATION	571	3768	22472	22473	22418	0	0	7473	0	0	7473
-SALVAGE VALUE											
NET CASH FLOW	-825	-5715	-32460	-32462	-18418	4289	4577	-2767	4994	5282	-2062
CUM. NET CASH FLOW	-825	-6540	-39000	-71462	-89880	-85591	-81014	-83782	-78788	-73506	-75568
CASH IN	0	0	0	0	4995	5311	5626	5942	6257	6573	6888
CASH OUT	825	5715	32460	32462	23413	1022	1049	8709	1264	1291	8951
FIRR %	2.37%										

Table Continued

(Million Rupiahs)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
OPERATING PROFIT	5699	5771	6059	6131	6419	6707	6836	7124	7412	7541	7829
OPERATING REVENUE	7204	7519	7835	8150	8466	8781	9097	9412	9728	10043	10359
OPERATING EXPENSE	1505	1749	1776	2020	2047	2075	2261	2289	2316	2503	2530
WORKING COST	1505	1749	1776	2020	2047	2075	2261	2289	2316	2503	2530
MAINTENANCE COST	1017	1233	1233	1449	1449	1449	1608	1608	1608	1768	1768
FEEDER	59	59	59	59	59	59	59	59	59	59	59
STATION	958	1174	1174	1390	1390	1390	1549	1549	1549	1708	1708
PERSONNEL COST	299	315	331	347	363	379	395	411	427	443	459
ELECTRICITY COST	133	141	149	157	166	174	182	190	199	207	215
FUEL COST	56	60	63	66	69	72	76	79	82	85	89
INVESTMENT	0	7473	0	7473	0	0	7473	0	0	7473	0
FEEDER	0	0	0	0	0	0	0	0	0	0	0
STATION	0	7473	0	7473	0	0	7473	0	0	7473	0
-SALVAGE VALUE											
NET CASH FLOW	5699	-1702	6059	-1342	6419	6707	-637	7124	7412	68	7829
CUM. NET CASH FLOW	-69870	-71572	-65514	-66856	-60437	-53730	-54367	-47244	-39832	-39764	-31936
CASH IN	7204	7519	7835	8150	8466	8781	9097	9412	9728	10043	10359
CASH OUT	1505	9222	1776	9493	2047	2075	9734	2289	2316	9976	2530
FIRR %											

Table Continued

(Million Rupiahs)

	2013	2014
OPERATING PROFIT	7901	8189
OPERATING REVENUE	10675	10990
OPERATING EXPENSE	2774	2801
WORKING COST	2774	2801
MAINTENANCE COST	1984	1984
FEEDER	59	59
STATION	1924	1924
PERSONNEL COST	475	491
ELECTRICITY COST	223	232
FUEL COST	92	95
INVESTMENT	7473	-64452
FEEDER	0	0
STATION	7473	0
-SALVAGE VALUE		64452
NET CASH FLOW	428	72640
CUM. NET CASH FLOW	-31508	41132
CASH IN	10675	10990
CASH OUT	10247	-61650
FIRR %		

Table 6.4.2.4 Change of FIRR According to Cost Sharing on Railway Side

		Investment Cost		Maintenance Cost		Operation Cost		FIRR (%)
		Feeder	Station	Feeder	Station	Feeder	Station	
Cost Sharing on Railway Side (%)	I	100	100	100	100	100	100	2.37
	II	50	100	50	100	50	100	3.10
	III	20	100	20	100	20	100	3.62
	IV	90	90	90	100	90	100	3.13
	V	50	50	50	100	50	100	8.57
	VI	20	20	20	100	20	100	22.91

Table 6.4.2.5 Results of Sensitivity Analysis

	FIRR (%)					
	I	II	III	IV	V	VI
1) Base Case	2.37	3.10	3.62	3.13	8.57	22.91
2) Revenue 10% down	1.48	2.12	2.57	2.16	7.10	20.21
3) Investment 10% up	1.62	2.27	2.73	2.31	7.33	20.63
4) 2) + 3)	0.78	1.35	1.76	1.40	5.94	18.08

CHAPTER 7 COMPREHENSIVE EVALUATION

CHAPTER 7 Comprehensive Evaluation

7-1 Comprehensive Evaluation of the Feeder Service and Station Improvement Project

7-1-1 Importance and Urgency of the Project

As stated in the analysis of the current status of the JABOTABEK railway in the Volume I of the report "Master Plan", the railway's utilization rate is an extremely low 1 percent or less. Consequently, there is an overreliance on road transport, especially buses and cars, which results in round-the-clock road congestion and a remarkable loss in urban functions. Therefore, in order to remedy this situation, it is necessary to realize a balance in transport modes that would include improvements in both the road and rail systems. In this connection, the JICA Study Team has described what JABOTABEK's transportation systems should look like in the year 2005 from a comprehensive viewpoint, with one important aspect being the recognition of the necessity to improve feeder service that links the modes of road and rail, together with upgrading of stations and passenger convenience.

7-1-2 Points to be Considered in Preparing Plans

Of the stations in JABOTABEK, 21 were selected on the basis of requiring immediate attention and formed into the Feeder Service and Station Improvement Project. From a technical standpoint there are no problems concerning the projects's execution; however, it is necessary to device a detailed plan of execution for work in station yards and at places where trains are operating.

Of the 21 stations selected, there are ones such as Kemayoran and Pasar Senen whose surrounding areas are the target of large-scale development, making it necessary for the planners to be in close contact with city authorities in order to avoid discord between the trends in this development and the project. Furthermore, in addition to these two stations, there are others, as mentioned in chapter 4 of the Volume II of the Report, that are slated to have primary centers, sub-centers, and roads newly built or existing ones improved in their vicinities, as well as

housing development projects carried out. Similar coordinating efforts with city authorities will be necessary with respect to the improvement of those stations.

As for the execution of work at plazas in front of stations, bus and car traffic will be controlled during the work, and close contact with the construction supervisor and vehicle operators should be effected, with the intention to minimize inconvenience to users as well as insure the public safety. Also, along with the feeder service improvement, offices and shops in the vicinities of stations will be affected by the locations of pedestrian decks and new or used bus bays. Careful consideration will especially be needed for the relocation of Kemayoran station, since the effects from moving it will be large.

7-1-3 Economic and Financial Evaluation

The total construction cost of the three stations of Pasar Senen, Kemayoran, and Jatinegara selected for consideration by the F/S is 65,190 million RP (domestic currency portion 31,448 million RP, foreign currency portion 33,742 million RP). As for the remaining 18 stations to be examined in the prefeasibility study (actually 16 since two need not any investment), the total construction cost is 71,462 million RP. (domestic currency portion 26,727 million RP, foreign currency portion 44,735 million RP). The EIRR of the former is 34.8 percent and that of the latter 55.9 percent, and so it can be said that they are both sufficiently feasible from an economic standpoint. Regarding the FIRR, it is -2.92 percent and +2.37 percent, respectively, in the case where the railway supplies all the capital.

This disparity in the EIRR and FIRR figures means that the city receives a much larger benefit than the railway against the expenditures for construction. As Tables 6.2.2.5 and 6.4.2.4 indicate, a lesser burden for the railway results in a higher FIRR. Other benefits that are not counted include the stimulation in business activity new stations brought about by a rise in the number of railway passengers. Therefore, in order to carry out this project, consideration should be given to construction and maintenance costs being borne not only by the railway side but by the city

side as well, based on the fact that urban transport would benefit the city as a whole.

7-1-4 Comprehensive Evaluation

As stated above, the feeder service and station improvement of the three stations receiving urgent consideration and of the 16 stations to be taken up in the prefeasibility study are sufficiently feasible from an economic standpoint. Also, in order to insure the financial self-sufficiency of the railway side, it is necessary to contemplate an appropriate burden to be borne by the city side in respect to investment and operating costs. Lastly, to bring about the results desired, the realization of the project should be achieved quickly while giving consideration to the burden the city side should bear.

7-2 Comprehensive Evaluation of the Grade Separation of the Eastern Line

7-2-1 Importance and Urgency of the Project

As for the importance and urgency of the project, as mentioned in Volume I of the Report "Master Plan" and also in this Volume of the Report, completion of the project by 1998 is desirable to sufficiently deal with the traffic at level crossings and the number of trains, since both will increase in the future. As made clear in this study, however, the start of construction should be carefully studied since the project's construction cost will be very high.

7-2-2 Economic Evaluation

The EIRR values for Track Elevation 1, 2, and for the Flyover are 12.9%, 11.3%, and 13.3%, respectively, when the completion date is 1998. It can not be said then that the economic feasibility of these cases are entirely sufficient. Accordingly, an economic evaluation was conducted for the case where construction is to be completed in 2002, or four more years of delay of start of investment. This resulted in EIRR values of 15.23%, 14.27%, and 14.52%, respectively.

The amounts for investment are as follows:

448,121 million RP (Domestic currency portion 168,602 Mil RP,
Foreign currency portion 279,519 Mil RP)

601,921 million RP (Domestic 219,226 Mil RP,
Foreign 382,695 Mil RP)

283,282 million RP (Domestic 149,818 Mil RP,
Foreign 133,414 Mil RP)

7-2-3 Evaluation from the Viewpoint of City Planning, the Environment, etc.

Table 7.2.3.1 compares the effects of the track elevation and flyover from the viewpoint of city planning, transport, environment considerations, etc.

Some explanation regarding the table follows. In the case of the flyover, traffic will make detours upon the flyover's completion, since it will cause cars originating from places near the former level crossings to go out of their way to enter the flyover.

On the other hand, maintenance cost for the railway will decrease in the case of track elevation, since facilities will be renewed and strengthened in the construction work and tracks will be laid on concrete structures.

As for the sources of noises and vibration in the case of flyover, there will be no change. In the case of track elevation, however, it is known that noise and vibration will decrease, since the sources of noise and vibration will be shifted on the firm structures. In this case, the area to be affected by noise will expand due to the relocation of the noise source to a higher place. However, this problem can be sufficiently solved by installing a noise-barrier wall.

Table 7.2.3.1 Comparison of Effects of Track Elevation and Flyover

Classification of effects			Effects	Track elevation	Flyover
Effects on transport conditions	Traffic functions	Safety	Eliminates losses from level-crossing accidents	o	o
		Reduction of travel time	Time saved in elimination of level crossing		
			(Elimination of slow train operation)	o	o
			(Elimination of waiting time of motor vehicles at crossing)	o	o
		Reduction of operating expense of motor vehicles	Fuel saved		
			(Occurrence of detour traffic)	o	x
			(Use of slope lanes)	o	x
	Reduction of maintenance cost		Reduction of maintenance cost		
			(Renewal of facilities)	o	x
			Cost reduction via elimination of level crossings		
			(Level crossing personnel)	o	o
			(Level crossing maintenance)	o	o
	Increase in cost to reinforce neighboring roads		Increase in investment for reinforcing neighboring roads owing to the occurrence of detouring traffic	o	x
Effects on the environment along the route	Environment		Noise and vibration		
			(Reduction of noise and vibration)	o	x
Effects on city activities	Higher utilization of land		Spaces under elevated tracks		
			(Utilization for public purposes	o	x
			(Utilization for commercial purposes	o	x
			(Use as crossing roads)	o	x
			Improvement of land utilization around elevated tracks	o	x
	Improvement of connections between city areas on both sides of the railway		Integration of intra-city areas	o	x
Effects on city development	Reinforcement of transport facilities		Reinforcement and rationalization of station facilities	o	x
			Expansion of spaces for passenger flows in stations	o	x
			Promotion of station plaza reinforcement	o	x
	Reinforcement of city areas		Promotion of redevelopment around stations	o	x

Regarding connections between the city areas on both sides of the railway, the track elevation will greatly improve it, because it will enable the removal, from the ground level, of tracks that have been hampering traffic between the eastern and western regions. This will lead to a smoother commuter flow near stations, an efficient road network, and creation of spaces for pedestrians, eventually promoting a uniform and balanced development of the intra-city areas.

As for the items in the reinforcement of transport facilities column, together with the track elevation, station offices will be relocated under the elevated track. This will promote reinforcement of station facilities for internal use and for passengers and station plazas.

In the case of the Eastern Line, many offices and shops have been developed along the roads, that is to say, in a direction at right angles to the railway. In view of this, the flyover would result in heavier damage to city areas than the track elevation.

Generally, track elevation is superior to a flyover and, especially in respect to city planning, track elevation is strongly recommended.

7-2-4 Comprehensive Evaluation

In Track Elevation 2, the investment amount is the largest and the EIRR the smallest. Accordingly, this alternative should be excluded from the subjects for selection. Track Elevation 1 and the Flyover are almost the same in terms of EIRR, but the track elevation is far superior to the flyover in respect to city planning. In view of these considerations, Track Elevation 1 is recommended as the optimum among the alternatives for the grade separation of the Eastern Line. In this connection, it is considered desirable to set a target year for completion at 2002 in view of economic feasibility.

APPENDIX

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Minutes of meeting on Interim Report II

JICA Study Team for the "Study on Integrated Transportation System Improvement by Railway and Feeder Service in Jabotabek Area (herein-after referred to as "the Study") submitted and explained the Interim Report II to the Ministry of Communication. Ministry of Communication, considering the major points included in the Report, accepted it in principle.

The economic and financial analysis and overall evaluation of the Feasibility Studies will be presented in the Draft Final Report with due consideration on the discussion on the Interim Report II between the counterparts and the Study Team.

Jakarta, January 23, 1990

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