6. Design Standard and Project Cost Estimates

6.1 Geometric Design Standard

(1) Design Classification

Indonesian standards were used to a maximum extent where available. The American and Japanese standards were referred to for items not covered by the Indonesian standards.

Table 6.1 shows design classifications, where roads are divided into two types, i.e. Type I is a full access control road, and Type II is a partial or non access control road. Further, the Type I and Type II roads are categorized into two classes and four classes respectively, according to their functions and design traffic volumes(DTV).

Table 6.1 Design Classes

Type	Function		DTV(pcu/day)	Class
I (Full Access Control)	Primary	Arterial	-	I
		Collector	-	II
	Secondary	Arterial	-	II
II (Partial or No Access Control)	Primary	Arterial	-	I
		Collector	10,000 or more	I
			less than 10,000	II
	Secondary	Arterial	20,000 or more	I
			less than 20,000	II
		Collector	6,000 or more	II
			less than 6,000	III
		Local	500 or more	III
			less than 500	IV

Note: In calculating design traffic volume(DTV) for determining the highway design classification, un-motorized vehicles (including bicycle/becak) are not taken into consideration.

Since the planned roads in the Study Area consist of primary arterial, primary collector and secondary arterial roads, design classes should be confined to Type I/Class I, Type I/Class II, Type II/Class I or Type II/Class II. However, Type I (Full access control) is only applied to a tall road in reality.

(2) Design Speed

Design speeds of the planned roads are recommended as presented in Table 6.2, according to the road types and classes of the Geometric Standard.

Table 6.2 Design Speed

(unit: km/hr)

Type	Class	Design Standard	Recommendation
I	I	100 or 80	100
II	I	60	60
II	II	60 or 50	60

(3) Geometric Design Standard for Throughway

Recommended geometric design standard for throughway is presented in Tables 6.3 and 6.4, together with typical cross sections in Figures 6.1 through 6.3, which are based on a typical ROW situation in the Study Area.

Table 6.3 Superelevation over Range of Curves

Superelevation (%)	Curve Radius (R m)		
	100 km/hr	60 km/hr	30 km/hr
10	380 ≧ R > 430	-	-
9	430 ≧ R > 480	-	-
8	480 ≧ R > 550	-	-
7	550 ≧ R > 640	-	-
6	640 ≧ R > 760	-	30 ≧ R > 35
5	760 ≧ R > 930	-	35 ≧ R > 37
4	930 ≧ R > 1,210	150 ≧ R > 160	37 ≧ R > 40
3	1,210 ≧ R > 1,700	160 ≧ R > 165	40 ≧ R > 42
2	1,700 ≧ R > 5,000	165 ≧ R > 220	42 ≧ R > 55

Source: Standard Specifications for Geometric Design of Urban Roads 1992

Table 6.4 Geometric Design Standard for Throughway of Planned Roads

Item	Unit	Design Standard				Recommendation			
Design Classification	-	Type I Class I	Type II Class I	Type II Class II	Busway	Type I Class I	Type II Class I	Type II Class II	Busway
Design Speed	km/hr	100	60	60	-	100	60	60	60
Cross Section Element									
Lane Width	m	3.50	3.50	3.25	-	3.50	3.50	3.25	3.50
Median									
Standard Minimum	m	2.50	2.00	1.50	-	5.00	5.00	2.00	-
Exceptional Minimum	m	2.50	1.00	1.00	-	-	-	-	-
Right Shoulder Width									
Standard Minimum	m	1.00	0.50	0.50	-	1.00	0.50	0.50	-
Exceptional Minimum	m	0.75	0.50	0.25	-	-	-	-	-
Left Shoulder Width									
Desirable Width	m	3.25	2.50	2.50	-	3.25	-	-	-
Standard Minimum	m	2.00	2.00	2.00	-		2.00	2.00	-
Exceptional Minimum	m	1.75	1.50	1.50	-	-	-	-	-
With Sidewalk	m	-	0.50	0.50	-	-	-	-	0.50
Parking Lane (with out frontage road)									
Standard Minimum	m	-	2.50	2.50	-	-	-	-	-
Exceptional Minimum	m	-	2.00	2.00	-	-	2.00	2.00	-
Sidewalk									
Standard Minimum	m	-	3.00	3.00	-	-	3.00	3.00	-
Exceptional Minimum	m	-	1.50	1.50	-	-	-	-	-
Crossfall of Traveled Way	%	Refer to Table 6.4			-	Refer to Table 6.4			
Super Elevation Runoff									
2-Lane 2-Way	-	1/225	1/175	1/175	-	1/225	1/175	1/175	1/175
3-Lane 2-Way	-	1/270	1/210	1/210	-	1/270	1/210	1/210	1/210
Maximum Super Elevation	%	10.00	6.00	6.00	-	10.00	6.00	6.00	6.00
Crossfall of Right Shoulder	%	Same as Traveled Way			-	Same as Traveled Way			
Crossfall of Left Shoulder	%	-	-	-	-	4.00	Same as Traveled Way		
Vertical Clearance	m	5.10	5.10	5.10	-	5.10	5.10	5.10	5.10
Minimum Stopping Sight Distance	m	160	75	75	-	160	75	75	75
Horizontal Alignment									
Minimum Radii	m	380	150	150	-	380	150	150	150
Desirable Minimum Radii	m	700	200	200	-	700	200	200	200
Min. Radii for Normal Crossfall	m	5,000	220	220	-	5,000	220	220	220
Minimum Curve Length									
Standard Minimum	m	1,200/ θ	700/ θ	700/ θ	-	1,200/ θ	700/ θ	700/ θ	700/ θ
Exceptional Minimum	m	170	100	100	-	170	100	100	100
Min. Transition Curve Length	m	85	50	50	-	85	50	50	50
Min. Radius Without Transition Curve	m	1,500	600	600	-	1,500	600	600	600
Vertical Alignment									
Maximum Grade	%	3.00	5.00	5.00	-	3.00	5.00	5.00	5.00
Maximum Vertical Curve Radii									
Crest	m	6,500	1,400	1,400	-	6,500	1,400	1,400	1,400
Sag	m	3,000	1,000	1,000	-	3,000	1,000	1,000	1,000
Desirable Vertical Curve Radii									
Crest	m	10,000	2,000	2,000	-	10,000	2,000	2,000	2,000
Sag	m	4,500	1,500	1,500	-	4,500	1,500	1,500	1,500
Minimum Vertical Curve Length	m	85	50	50	-	85	50	50	50

Note : θ shows intersect angle (degree), when θ is less than 2 degree, θ = 2 shall be used for the calculation

Source: Standard Specifications for Geometric Design of Urban Roads 1992

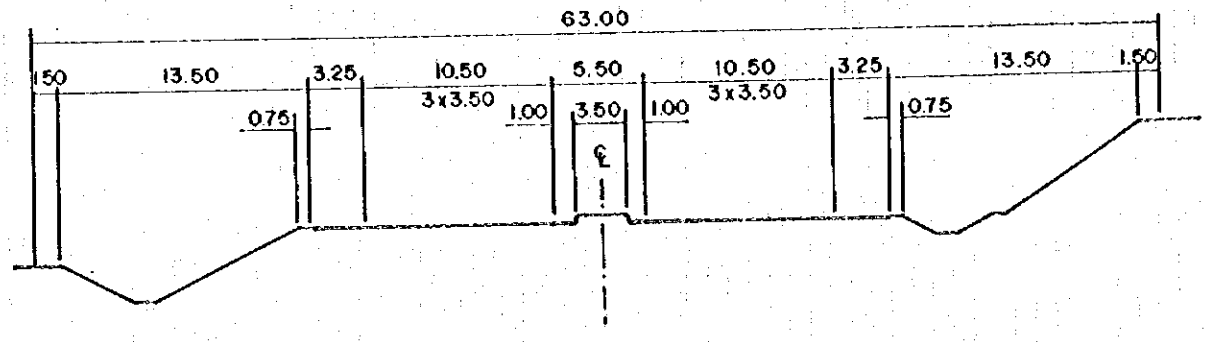


Figure 6.1 Typical Cross Section of Toll way (Type I/Class I)

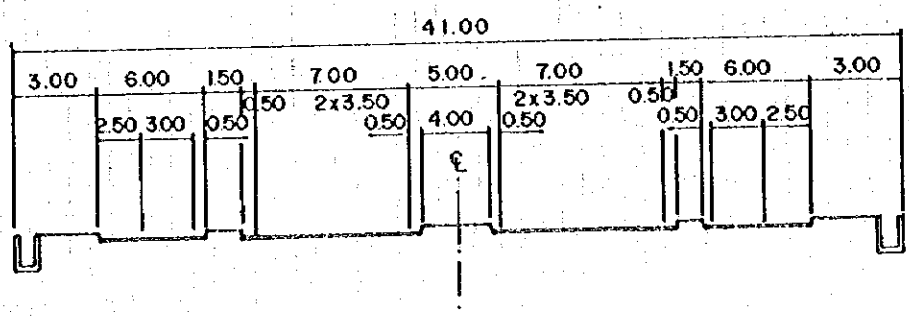


Figure 6.2 Typical Cross Section of Primary Arterial Road & Secondary Major Arterial Road (Type II/Class I)

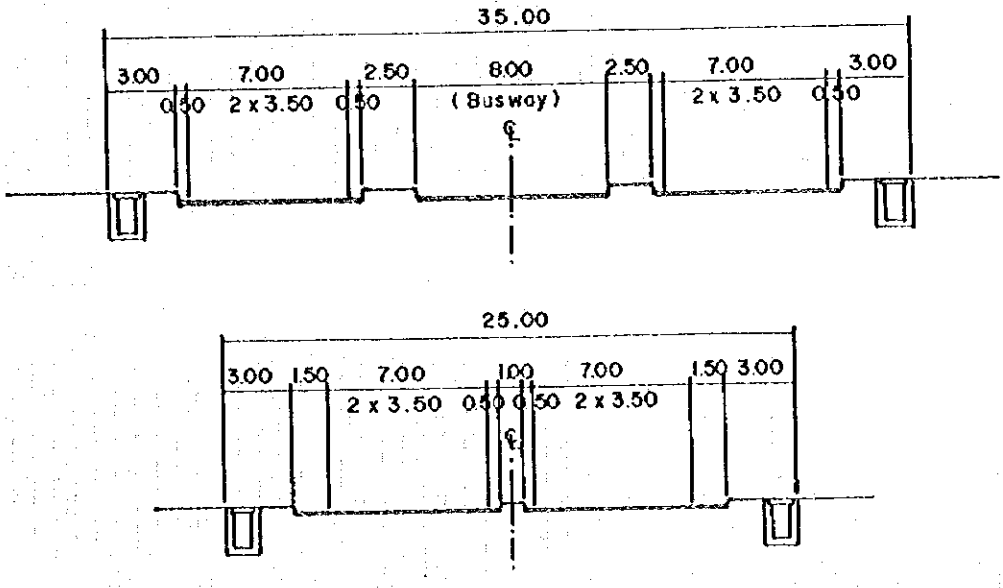


Figure 6.3 Typical Cross Section of Secondary Major Arterial Road (Type II/Class I)

6.2 Preliminary Project Cost Estimates

Preliminary project costs were estimated including the following breakdowns:

- Construction costs,
- Land acquisition and compensation costs, and
- Engineering cost and Contingency cost.

Basic premises in estimating the project cost are as follows:

- All the construction works will be executed by contractor(s) to be employed by a joint venture company for development of the project roads;
- Unit price of each cost component was based on the economic conditions prevailing in August 1996 and a reference to current similar project costs;
- For the construction works, Indonesian taxes and duties on import equipment and materials will be imposed. Indonesian value added tax (10%) will be imposed on the contractor;
- Engineering cost was assumed to be 10% of the construction cost; and
- Physical contingency was estimated to be 15% of the total of construction cost, land acquisition and compensation cost, and engineering cost.

As a result, the project costs were estimated as summarized in Table 6.5.

Table 6.5 Preliminary Project Cost Estimates

Sub-Code No.	Road Function	Road Type		Length (km)	Construction Cost (Million Rp.)		Land Acquisition Cost		Total (Million Rp.)	Contingency 15% of Total	Grand Total (Million Rp.)
		Number of Lanes	ROW (m)		Unit Cost per km	Amount	Unit Cost per m^2 (1,000 Rp.)	Amount (Million Rp.)			
Non Toll Road											
1	P.A	4 + Frontage	50	54.0	12,950	699,286	200	270,000	969,286	145,393	1,114,679
2	P.C	2	20	42.0	4,742	199,181	200	84,000	283,181	42,477	325,658
3	P.A	4 + Frontage	50	26.5	12,950	343,168	250	165,625	508,793	76,319	585,112
4	P.A	4 + Frontage	50	50.8	12,950	657,847	200	254,000	911,847	136,777	1,048,624
5	P.A	4 + Frontage	50	13.8	12,950	178,706	250	86,250	264,956	39,743	304,700
6	P.A	Under Construction by SUDP/OECF									
8	S.A	4	25	6.5	6,750	43,877	300	24,375	68,252	10,238	78,490
9	S.A	4	25	11.0	6,750	74,253	250	34,375	108,628	16,294	124,922
10	P.C	2	20	21.5	4,742	101,961	200	43,000	144,961	21,744	166,706
11	S.A	4	25	13.8	6,750	93,154	250	43,125	136,279	20,442	156,721
12	S.A	4	25	5.5	6,750	37,127	300	20,625	57,752	8,663	66,414
13	S.A	4	25	2.7	6,750	18,226	300	10,125	28,351	4,253	32,603
14	S.A	4	25	6.3	6,750	42,527	300	23,625	66,152	9,923	76,074
15	P.C	2	20	3.1	4,742	14,701	200	6,200	20,901	3,135	24,037
16	S.A	4 + Busway	35	8.5	10,072	85,609	250	37,188	122,797	18,420	141,216
17	S.A	4 + Busway	35	5.4	10,072	54,387	300	28,350	82,737	12,411	95,148
18	S.A	4 + Busway	35	6.6	10,072	66,473	300	34,650	101,123	15,168	116,292
19	S.A	4 + Busway	35	7.2	10,072	72,516	300	37,800	110,316	16,547	126,864
20	S.A	4	25	17.3	6,750	116,780	300	64,875	181,655	27,248	208,903
21	S.A	4	25	4.2	6,750	28,351	300	15,750	44,101	6,615	50,716
22	S.A	4 + Busway	35	11.1	10,072	111,796	250	48,563	160,358	24,054	184,412
23	S.A	4 + Busway	35	11.2	10,072	112,803	300	58,800	171,603	25,740	197,343
24	S.A	4	25	5.4	6,750	36,451	300	20,250	56,701	8,505	65,207
25	S.A	4	25	2.4	6,750	16,201	250	7,500	23,701	3,555	27,256
26	S.A	4	35	11.3	10,072	113,810	250	49,438	163,248	24,487	187,735
27	P.A	D/D Completed, Land acquisition is on going, SUDP/OECF									
29	S.A	4	25	33.7	6,750	227,484	300	126,375	353,859	53,079	406,938
30	P.C	2	20	15.5	4,742	73,507	200	31,000	104,507	15,676	120,183
31	P.A	4 + Frontage	50	68.1	12,950	881,878	200	340,500	1,222,378	183,357	1,405,734
32	P.A	Completed									
33	P.A	4 + Frontage	50	78.1	12,950	1,011,375	200	390,500	1,401,875	210,281	1,612,156
36	P.A	4 + Frontage	50	26.9	12,950	348,348	200	134,500	482,848	72,427	555,275
37	P.C	2	20	12.7	4,742	60,228	200	25,400	85,628	12,844	98,473
38	S.A	4	25	14.7	6,750	99,229	250	45,938	145,167	21,775	166,941
39	S.A	4	25	14.6	6,750	98,554	250	45,625	144,179	21,627	165,806
41	S.A	4 + Frontage	35	20.6	10,072	207,477	250	90,125	297,602	44,640	342,242
42	S.A	Completed SUDP/OECF									
43	S.A	4 + Busway	35	2.9	10,072	29,208	300	15,225	44,433	6,665	51,098
44	S.A	4 + Busway	35	2.8	10,072	28,201	300	14,700	42,901	6,435	49,336
45	S.A	4 + Busway	35	6.6	10,072	66,473	300	34,650	101,123	15,168	116,292
47	S.A	2 + 2	20 + 20	16.5	9,485	156,499	300	99,000	255,499	38,325	293,824
48	P.A	4 + Frontage	50	83.0	12,950	1,074,829	200	415,000	1,489,829	223,474	1,713,303
49	S.A	Maintenance									

Table 6.5 Preliminary Project Cost Estimates (Continued)

Sub-Code No.	Road Function	Road Type		Length (km)	Construction Cost (Million Rp.)		Land Acquisition Cost		Total (Million Rp.)	Contingency 15% of Total	Grand Total (Million Rp.)
		Number of Lanes	ROW (m)		Unit Cost per km	Amount	Unit Cost per m^2 (1,000 Rp.)	Amount (Million Rp.)			
50	S.A	Maintenance									
51	S.A	Maintenance									
52	P.A	Completed									
54	S.A	4 + Busway	35	15.2	10,072	153,090	300	79,800	232,890	34,933	267,823
56	S.A	4	25	9.5	6,750	64,128	300	35,625	99,753	14,963	114,715
57	S.A	Under construction SUDP/OECF									
59	P.A	4 + Frontage	50	13.9	12,950	180,001	300	104,250	284,251	42,638	326,889
60	P.A	4 + Frontage	50	7.9	12,950	102,303	250	49,375	151,678	22,752	174,430
61	P.C	2	20	28.0	4,742	132,787	200	56,000	188,787	28,318	217,105
62	P.A	4 + Frontage	50	32.0	12,950	414,392	200	160,000	574,392	86,159	660,551
64	P.C	2	20	46.3	4,742	219,573	200	92,600	312,173	46,826	358,999
65	P.C	2	20	64.9	4,742	307,781	200	129,800	437,581	65,637	503,219
66	P.C	2	20	33.6	4,742	159,344	200	67,200	226,544	33,982	260,526
67	S.A	4	25	13.5	6,750	91,129	200	33,750	124,879	18,732	143,610
68	P.C	2	20	21.6	4,742	102,436	200	43,200	145,636	21,845	167,481
69	P.C	2	20	28.2	4,742	133,735	200	56,400	190,135	28,520	218,656
70	S.A	Maintenance									
71	S.A	Maintenance									
72	S.A	Maintenance									
73	S.A	Maintenance									
74	S.A	Maintenance									
75	S.A	4	25	13.5	6,750	91,129	200	33,750	124,879	18,732	143,610
76	S.A	4	25	3.8	6,750	25,651	300	14,250	39,901	5,985	45,886
77	S.A	4	25	3.0	6,750	20,251	300	11,250	31,501	4,725	36,226
78	S.A	4	25	10.0	6,750	67,503	200	25,000	92,503	13,875	106,378
79	S.A	4	25	9.0	6,750	60,752	200	22,500	83,252	12,488	95,740
Total of P.A				455.0		5,892,134		2,370,000	8,262,134	1,239,320	9,501,454
Total of P.C				317.4		1,505,236		634,800	2,140,036	321,005	2,461,041
Total of S.A				317.3		2,611,097		1,286,975	3,898,072	584,711	4,482,782
Total of Non Toll Road				1,089.7		10,008,467		4,291,775	14,300,242	2,145,036	16,445,278
Toll Road											
7	P.A	Completed									
28	P.A	D/D Completed by the private investor									
34	P.A	Under planning by the private investor									
35	P.A	6	60	42.0	16,950	711,920	200	252,000	963,920	144,588	1,108508
40	P.A	6	60	20.6	16,950	349,180	250	154,500	503,680	75,552	579,232
46	P.A	Completed, Widening D/D will start 1997									
53	P.A	Under P/D by private investor									
55	P.A	Under planning by private investor									
58	P.A	Under planning by private investor									
63	P.A	6	60	32.0	16,950	542,415	200	192,000	734,415	110,162	844,577
Total of Toll Road				94.6		1,603,514		598500	2,202,014	330,302	2,532,316
Grand Total				1,184.3		11,611,981		4,890,275	16,502,256	2,475,338	18,977,594

7. Project Implementation Program

7.1 Priority Factors and Evaluation Criteria

Road projects identified in the master plan network were prioritized for scheduling their implementation by the target year of 2018. Factors selected for project prioritization are as follows:

- Land availability and social impact, which were evaluated by the percentage length of different land uses and extent of population density where the project road is planned to lie.
- Conformity with National, Regional and Urban Development Policies, which were evaluated by the degree of contribution to the planned national, regional and urban development policies
- Necessity and Urgency, which were evaluated by the significance of traffic demand and higher traffic congestion ratios.
- Cost Efficiency, which was evaluated by the cost performance that can be indicated by the estimated traffic volume and average construction cost per kilometer.

7.2 Ranking System and Priority Project List

A ranking system was employed to determine the project priority, i.e. the evaluation criteria were ranked "Very Good", "Good", "Fair", "Poor" and "Very Poor". For the comprehensive evaluation the respective ranks were given scores 5, 4, 3, 2 and 1. The scores were totaled to evaluate the comprehensive evaluation result.

Eventually, the priority project list was prepared as shown in Table 7.1.

Table 7.1 Project Priority List (1/3)

Code No.	Sub-Code No.	Road Length (km)	Project Route	Compre-hensive Evaluation	Current Project Status
1-1)	46	43.8	Surabaya-Gempol Toll Road	Very Good (18)	Widening of Existing Toll Road, D/D will start Jan. 1997.
1-3)	28	33.8	Surabaya-Mojokerto Toll Road	Very Good (16)	Private Investor (Toll Road), D/D Completed
1-4)	58	30.9	Eastern Middle Ring Road (Toll Road)	Very Good (16)	Private Investor(Toll Road)
1-8)	40	20.6	Gresik-Driyorejo Toll Road	Very Good (16)	**<< Road Proposed for Feasibility Study>>**
4-7)	22 & 23	25.6	Kedamen-Sumur Welut-Jemur Sari-Prapen	Very Good (16)	**<< Road Proposed for Feasibility Study>>**
4-15)	47	15.5	Jl. Kali Anak-Waru	Very Good (16)	**<< Road Proposed for Feasibility Study>>**
2-4)	33	78.1	Gresik Ring Road-Tuban	Good (15)	Sector Loan 3712 Phase 3/IBRD, Processing for Tender
2-6)	5	13.8	Surabaya(Jl. Gresik)-Gresik	Good (15)	Heavy Loaded Road Project/OECF, Busway proposed by SITNP
2-9)	27	6.4	Eastern Middle Ring Road(Arterial Road), Stage 1	Good (15)	SUDP/OECF, D/D completed
2-12)	32	5.2	Access to Juanda Air Port	Good (15)	Under road improvement(widening)
2-13)	52	41.6	Waru-Sidoarjo Ring Road-Gempol	Good (15)	Sector Loan 3712 Phase 2/IBRD, to be completed in Sep. '97
4-5)	16, 17, 18 & 19	27.7	O.R.R.(near Cerme)-Raya Darmo Permai-Sunkono-Wonokromo-Raya Panjang Jiwo-Eastern Sub-center	Good (15)	**<< Road Proposed for Feasibility Study>>**
4-13)	41	20.6	Gresik-Driyorejo	Good (15)	**<< Road Proposed for Feasibility Study>>**
4-26)	57	11.1	Eastern Middle Ring Road(Arterial Road), Stage 2	Good (15)	Land for road development is being acquired. SUDP/OECF
1-5)	53	20.2	Perak-Waru Toll Road	Good (14)	Private Investor(Toll Road), Preliminary Design Stage
1-6)	55	-	Surabaya Madura Toll Bridge	Good (14)	Private Investor(Toll Bridge), complete within 7th 5-year plan
2-2)	48	83.0	Kamal -Bangkalan Ring Road-Ketapang	Good (14)	Sector Loan 3712 Phase 3/IBRD, Processing for Tender
2-7)	6	8.5	Jl. Rajawali-Jl. Kenjeran	Good (14)	To be improved by SUDP/OECF
2-8)	59	13.9	Frontage Road of Eastern Middle Ring Road(Toll Road)	Good (14)	
4-8)	24 & 25	7.8	Jl. Jemur Andayani-Jl. Rungkut Industri-Eastern Middle Ring Road Stage 2	Good (14)	
4-9)	26	11.3	Banjaran-Sumur Welt	Good (14)	

Table 7.1 Project Priority List (2/3)

Code No.	Sub-Code No.	Road Length (km)	Project Route	Compre-hensive Evaluation	Current Project Status
4-14)	42, 43, 44 & 45	15.7	Jl. Margomulyo-Jl.Mastrip	Good (14)	Pre-FS completed as Western Middle Ring Road
4-25)	56	9.5	Jl. Raya Rungkut-Jl. J. Suprapto-Juanda Airport	Good (14)	**<< Road Proposed for Feasibility Study>> Proposed by Steering Committee**
1-2)	7	20.7	Surabaya-Gresik Toll Road	Fair (13)	Private Investor (Toll Road), Already open to the public
2-5)	4	50.8	Gresik-Lamongan-Babat	Fair (13)	ADB Loan 1428, Tender is on going. Construction work will start in Jan.'97.
4-1)	67	13.5	Labang-Burneh	Fair (13)	
4-2)	8	6.5	Jl. Dupak-Jl. Kapas Kampung	Fair (13)	
4-4)	11,12,13 & 14	13.8	O.R.R.(near Cerme)-Raya Tandes-Banyu Urip-Pandegiling-Kertajaya	Fair (13)	
4-6)	20 & 21	21.5	Menganti-Jajar Tunggal-Margorejo	Fair (13)	Rural Road/IBRD
4-24)	54	11.9	Jl.Raya Nginden-Sura/Madu Bridge IC	Fair (13)	SUDP/IBRD
4-27)	75	13.5	Airport Access	Fair (13)	
4-28)	76	2.4	Jl.Girilaya - Jl. Raya Dukuh Kupang	Fair (13)	
4-30)	78	15.0	Socah - East Labang	Fair (13)	
1-7)	34	75.0	Gresik-Tuban Toll Road	Fair (12)	Private Investor(Toll Road)
1-9)	35	59.0	Outer Ring Road (Toll Road)	Fair (12)	Private Investor(Toll Road)
2-3)	3	26.5	Gresik Ring Road	Fair (12)	Planned by Kab. Gresik, partly completed
3-4)	30	15.5	Legundi-Mlirip	Fair (12)	
3-7)	64	46.3	Lamongan-Mojokerto	Fair (12)	
4-10)	29	33.7	Wonokromo-Gunung Sari-Jl. Mastrip (Outer Ring Road)	Fair (12)	
4-29)	77	4.4	Jl. Tanjung Sari - Jl. Kali Butuh	Fair (12)	
2-1)	1	54.0	Bangkalan-Torjun	Poor (11)	
2-10)	31	68.1	Waru-Krian Bypass-Mojokerto-Jombang	Poor (11)	Heavy Loaded/ OECF(Candidates)
2-11)	36	26.9	Gresik-Legundi-Krian	Poor (11)	Planned by Kab. Gresik
2-14)	62	32.0	Mojokerto-Gempol	Poor (11)	Sector Loan 3712 Phase 2/IBRD, Sep. '97 Complete
3-1)	2	42.0	Kamal-Labang-Blega	Poor (11)	
3-2)	10	21.5	Mantup-South of Cerme (Outer Ring Road)	Poor (11)	

Table 7.1 Project Priority List (3/3)

Code No.	Sub-Code No.	Road Length (km)	Project Route	Compre-hensive Evaluation	Current Project Status
3-3)	15	3.1	Benjeng-Further South of Cerme (Outer Ring Road)	Poor (11)	
3-5)	37	12.7	Krian-Mojosari	Poor (11)	
3-6)	61	28.0	Babat-Mantup	Poor (11)	
3-8)	65	64.9	Babat-Ploso-Gedeg	Poor (11)	
3-10)	68	21.6	Deket-Karang Binagang	Poor (11)	
3-11)	69	28.2	Pucuk-Brondong	Poor (11)	
3-12)	79	9.0	East Fringe of Labang	Poor (11)	
4-3)	9	11.0	Benowo-A. A. Watangrejo(Gresik)	Poor (11)	
4-11)	38	14.7	Pengalengan-Tanjungan	Poor (11)	
4-12)	39	14.6	Gempolkurung-Supmut	Poor (11)	
1-10)	63	32.0	Mojokerto-Gempol Toll Road	Poor (10)	Toll Road
3-9)	66	33.6	Mojosari-Pacet-Gemekan	Poor (10)	

8. Conclusion and Recommendations

8.1 Project Priority and Financial Constraint

As the conclusion of the study the arterial road network should be implemented with reference to Table 8.1, where the priority projects are enumerated in descending order. The total amount of funds required for the arterial road development in GKS is estimated to be 11,515 billion Rupiah during the period between Repelita VII and X, provided that all the toll road projects committed by private investors will be completed by themselves and projects committed by foreign aid programs will be executed during Repelita VI.

Comparing the required fund with the estimated budgetary availability, the budget can only afford to cover 20% of the total required fund, unless a development fund such as SUDP for Kotamadya Surabaya is reserved for the future. Since it is national policy to reduce the dependence on foreign loans, efforts should be made to create new fund sources and to utilize private investment for the infrastructure development. An enlarged tax basis for road development, especially for local governments, is urgently required, as the financial responsibility of local governments will become heavier for the development and improvement of roads.

8.2 Routes Selected for Feasibility Studies

Among the priority projects, excluding those committed to by the Government or private investors, the following 5 routes were selected and are shown in Figure 8.1.

1. Gresik - Driyorejo Toll Road and the parallel Arterial Roads (Route-1),
2. Frontage Arterial Road along Tg. Perak - Waru Toll Road (Route-2),
3. Jl. Raya Rungkut - Jl. J. Suprapto Route (Route-3),
4. South of Cerme - Jl. R. Darmo Permai - Wonokromo - Jl. Jagir Wonokromo - Jl R. P. Jiwo - New Road Route (Route-4), and
5. Kedamen - Jl. Jemur Sari Route (Route-5).

Table 8.1 Prioritized Road Projects and Development Costs

Code No.	Sub-Code No.	Road Function	Project Route	Length (km)	Road Type		Evaluation	Development Cost				
					Number of Lanes	ROW (m)		Construction Cost (million Rp.)	Land Acquisition Cost (million Rp.)	Contingency (million Rp.)	Total (million Rp.)	Accumulation (million Rp.)
1-8)	40	P.A. (Toll)	Gresik-Driyorejo Toll Road	20.6	6	60	Very Good	349,180	154,500	75,552	579,232	579,232
4-7)	22	S.A.	Kedamen-Sumur Welut-Jemur Sari-Prapen	11.1	4 + Busway	35	Very Good	111,796	48,563	24,054	184,413	763,645
4-7)	23	S.A.	Kedamen-Sumur Welut-Jemur Sari-Prapen	14.5	4 + Busway	35	Very Good	112,803	58,800	25,740	197,343	960,988
4-15)		S.A.	Jl. Kali Anak-Waru	15.5	2 + 2	20 + 20	Very Good	156,499	99,000	38,325	293,824	1,254,812
4-5)	16	S.A.	O.R.R.(near Cerme)-Raya Darmo Permai-Sunkono-Wonokromo-Raya Panjang Jiwo-Eastern Sub-center	8.5	4 + Busway	35	Good	85,609	37,188	18,420	141,217	1,396,029

Table 8.1 Prioritized Road Projects and Development Costs (Continued)

Code No.	Sub-Code No.	Road Function	Project Route	Length (km)	Road Type		Evaluation	Development Cost				
					Number of Lanes	ROW (m)		Construction Cost (million Rp.)	Land Acquisition Cost (million Rp.)	Contingency (million Rp.)	Total (million Rp.)	Accumulation (million Rp.)
4-5)	17	S.A.	O.R.R (near Cerme)-Raya Darmo Permai-Sunkono-Wonokromo-Raya Panjang Jiwo-Eastern Sub-center	5.4	4 + Busway	35	Good	54,387	28,350	12,411	95,148	1,491,177
4-5)	18	S.A.	O.R.R.(near Cerme)-Raya Darmo Permai-Sunkono-Wonokromo-Raya Panjang Jiwo-Eastern Sub-center	6.6	4 + Busway	35	Good	66,473	34,650	15,168	116,291	1,607,468
4-5)	19	S.A.	O.R.R.(near Cerme)-Raya Darmo Permai-Sunkono-Wonokromo-Raya Panjang Jiwo-Eastern Sub-center	7.2	4 + Busway	35	Good	72,516	37,800	16,547	126,863	1,734,331
4-13)	41	S.A.	Gresik-Driyorejo	20.6	4 + Frontage	35	Good	207,477	90,125	44,640	342,242	2,076,573
2-8)	59	P.A.	Frontage Road of Eastern Middle Ring Road(Toll Road)	13.9	4 + Frontage	50	Good	180,001	104,250	42,638	326,889	2,403,462
4-8)	24	S.A.	Jl. Jemur Andayani-Jl. Rungkut Industri-Eastern Middle Ring Road Stage 2	5.4	4	25	Good	36,451	20,250	8,505	65,206	2,468,668
4-8)	25	S.A.	Jl. Jemur Andayani-Jl. Rungkut Industri-Eastern Middle Ring Road Stage 2	2.4	4	25	Good	16,201	7,500	3,555	27,256	2,495,924
4-9)	26	S.A.	Banjaran-Sumur Welt	11.3	4	25	Good	113,810	49,438	24,487	187,735	2,683,659
4-14)	43	S.A.	Jl. Margomulyo-Jl.Mastrip	2.9	4 + Busway	35	Good	29,208	15,225	6,665	51,098	2,734,757
4-14)	44	S.A.	Jl. Margomulyo-Jl.Mastrip	2.8	4 + Busway	35	Good	28,201	14,700	6,435	49,336	2,784,093
4-14)	45	S.A.	Jl. Margomulyo-Jl.Mastrip	6.6	4 + Busway	35	Good	66,473	34,650	15,168	116,291	2,900,384
4-25)	56	S.A.	Jl. Raya Rungkut-Jl. J. Suprapto-Juanda Airport	9.5	4	25	Good	64,128	35,625	14,963	114,716	3,015,100
4-1)	67	S.A.	Labang-Burneh	13.5	4	25	Fair	91,129	33,750	18,732	143,611	3,158,711
4-2)	8	S.A.	Jl. Dupak-Jl. Kapas Kampung	6.5	4	25	Fair	43,877	24,375	10,238	78,490	3,237,201
4-4)	11	S.A.	O.R.R.(near Cerme)-Raya Tandes-Banyu Urip-Pandegiling-Kertajaya	13.8	4	25	Fair	93,154	43,125	20,442	156,721	3,393,922
4-4)	13	S.A.	O.R.R.(near Cerme)-Raya Tandes-Banyu Urip-Pandegiling-Kertajaya	2.7	4	25	Fair	18,226	10,125	4,253	32,604	3,426,526
4-4)	14	S.A.	O.R.R.(near Cerme)-Raya Tandes-Banyu Urip-Pandegiling-Kertajaya	6.3	4	25	Fair	42,527	23,625	9,923	76,075	3,502,601
4-6)	21	S.A.	Menganti-Jajar Tunggal-Margorejo	4.2	4	25	Fair	28,351	15,750	6,615	50,716	3,553,317
4-27)	75	S.A.	Airport Access	13.5	4	25	Fair	91,129	33,750	18,732	143,611	3,696,928
4-28)	76	S.A.	Jl. Girilaya-Jl. Raya Dukuh Kupang	3.8	4	25	Fair	25,651	14,250	5,985	45,886	3,742,814
4-30)	78	S.A.	Socah-East Labang	10.0	4	25	Fair	67,503	25,000	13,875	106,378	3,849,192
1-9)	35	P.A. (Toll)	Outer Ring Road (Toll Road)	59.0	6	60	Fair	711,920	252,000	144,588	1,108,508	4,957,700
2-3)	3	P.A.	Gresik Ring Road	26.5	4 + Frontage	50	Fair	343,168	165,625	76,319	585,112	5,542,812
3-4)	30	P.C.	Legundi-Mlirip	15.5	2	20	Fair	73,507	31,000	15,676	120,183	5,662,995
3-7)	64	P.C.	Lamongan-Mojokerto	46.3	2	20	Fair	219,573	92,600	46,826	358,999	6,021,994

Table 8.1 Prioritized Road Projects and Development Costs (Continued)

Code No.	Sub-Code No.	Road Function	Project Route	Length (km)	Road Type		Evaluation	Development Cost				
					Number of Lanes	ROW (m)		Construction Cost (million Rp.)	Land Acquisition Cost (million Rp.)	Contingency (million Rp.)	Total (million Rp.)	Accumulation (million Rp.)
4-10)	29	S.A.	Wonokromo-Gunung Sari-Jl. Mastrip (Outer Ring Road)	33.7	4	25	Fair	227,484	126,375	53,079	406,938	6,428,932
4-29)	77	S.A.	Jl. Tanjung Sari-Jl. Kali Butuh	3.0	4	25	Fair	20,251	11,250	4,725	36,226	6,465,158
2-1)	1	P.A.	Bangkalan-Torjun	54.0	4 + Frontage	50	Poor	699,286	270,000	145,393	1,114,679	7,579,837
2-11)	36	P.A.	Gresik-Legundi-Krian	26.9	4 + Frontage	50	Poor	348,348	134,500	72,427	555,275	8,135,112
3-1)	2	P.C.	Socah-Labang-Blega	42.0	2	20	Poor	199,181	84,000	42,477	325,658	8,460,770
3-2)	10	P.C.	Mantup-South of Cerme (Outer Ring Road)	21.5	2	20	Poor	101,961	43,000	21,744	166,705	8,627,475
3-3)	15	P.C.	Benjeng-Further South of Cerme (Outer Ring Road)	3.1	2	20	Poor	14,701	6,200	3,135	24,036	8,651,511
3-5)	37	P.C.	Krian-Mojosari	12.7	2	20	Poor	60,228	25,400	12,844	98,472	8,749,983
3-6)	61	P.C.	Babat-Mantup	28.0	2	20	Poor	132,787	56,000	28,318	217,105	8,967,088
3-8)	65	P.C.	Babat-Ploso-Gedeg	64.9	2	20	Poor	307,781	129,800	65,637	503,218	9,470,306
3-10)	68	P.C.	Deket-Karang Binagang	21.6	2	20	Poor	102,436	43,200	21,845	167,481	9,637,787
3-11)	69	P.C.	Pucuk-Brondong	28.2	2	20	Poor	133,735	56,400	28,520	218,655	9,856,442
3-12)	79	P.C.	East Fringe of Labang	9.0	4	25	Poor	60,752	22,500	12,488	95,740	9,952,182
4-3)	9	S.A.	Benowo-A. A. Watangrejo(Gresik)	11.0	4	25	Poor	74,253	34,375	16,294	124,922	10,077,103
4-11)	38	S.A.	Pengalengan-Tanjungan	14.7	4	25	Poor	99,229	45,938	21,775	166,942	10,224,046
4-12)	39	S.A.	Gempolkurung-Supmut	14.6	4	25	Poor	98,554	45,625	21,627	165,806	10,409,852
1-10)	63	P.A. (Toll)	Mojokerto-Gempol Toll Road	32.0	6	60	Poor	542,415	192,000	110,162	844,577	11,254,429
3-9)	66	P.C.	Mojosari-Pacet-Gemekan	33.6	2	20	Poor	159,344	67,200	33,982	260,526	11,514,955

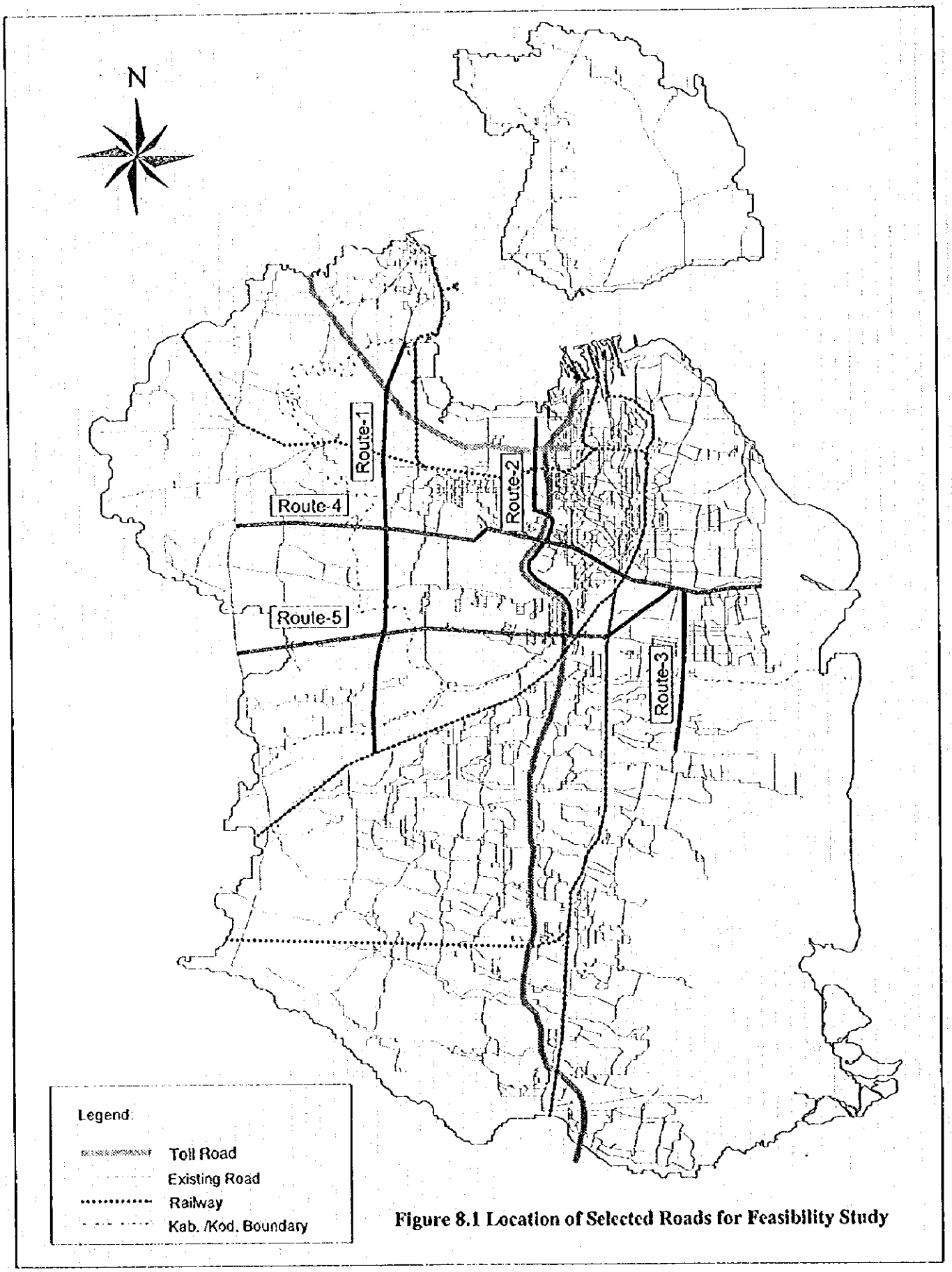


Figure 8.1 Location of Selected Roads for Feasibility Study

9. The Project Roads

The project roads, the locations of which are presented in Figure 9.1, have several significant features important for carrying out the preliminary design work as shown in Table 9.1.

Table 9.1 Significant Features of Project Roads

Project Road			Length (km)	Road Function	Type and Class of Road	Design Speed (km/h)
Route-1	Toll Road	Surabaya	8.9	Primary Artery	Type I Class I	100
		Gresik	6.1			
		Sidoarjo	0.5			
	Arterial Road	Surabaya	13.7		Type II Class I	60
		Gresik	6.1			
		Sidoarjo	1.0			
Route-2		Surabaya	13.3	Secondary Artery	Type II Class I	60
Route-3		Surabaya	3.5			
		Sidoarjo	4.6			
Route-4		Gresik	6.4			
		Surabaya	21.2			
Route-5		Gresik	9.2			
		Surabaya	13.4			

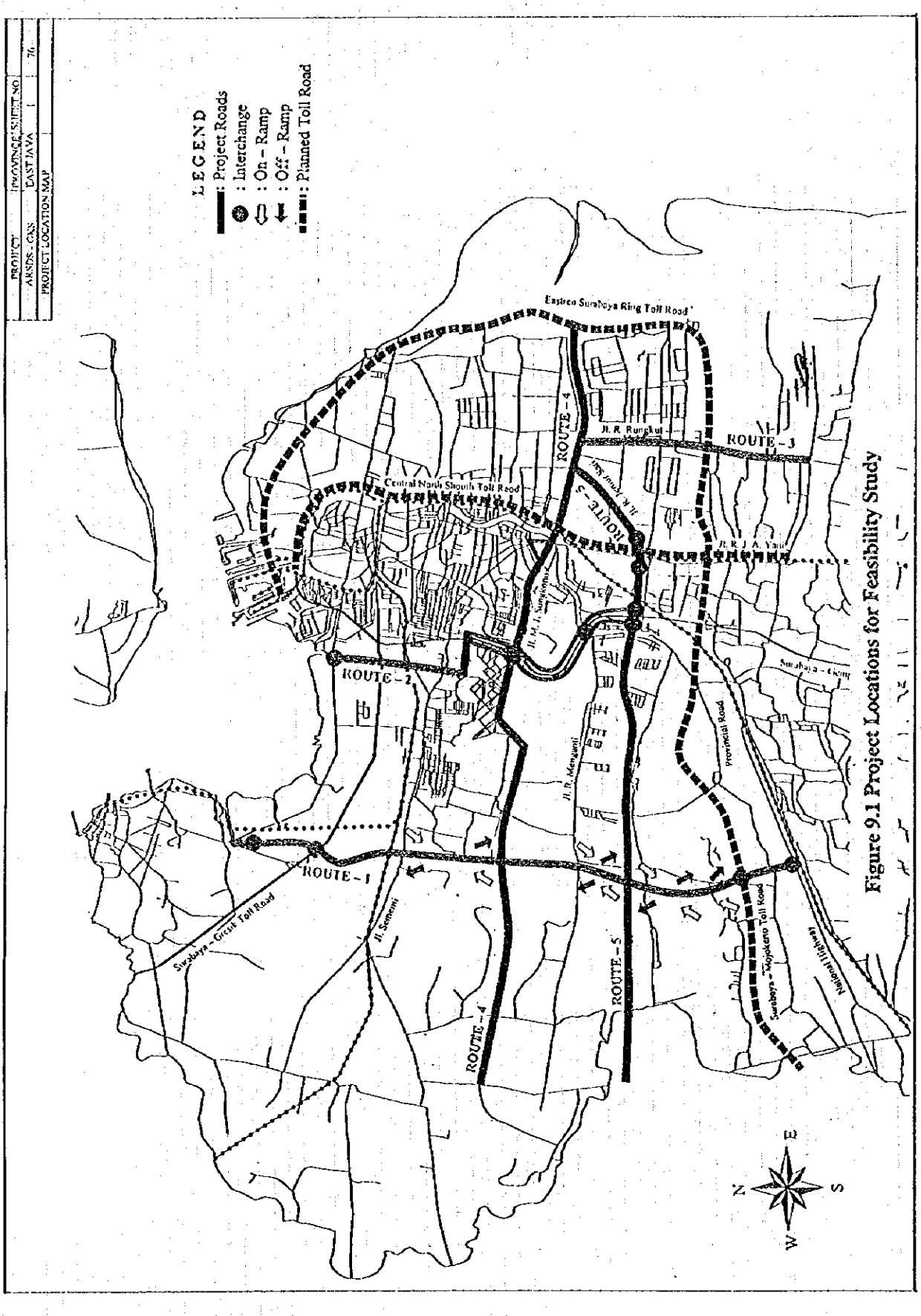


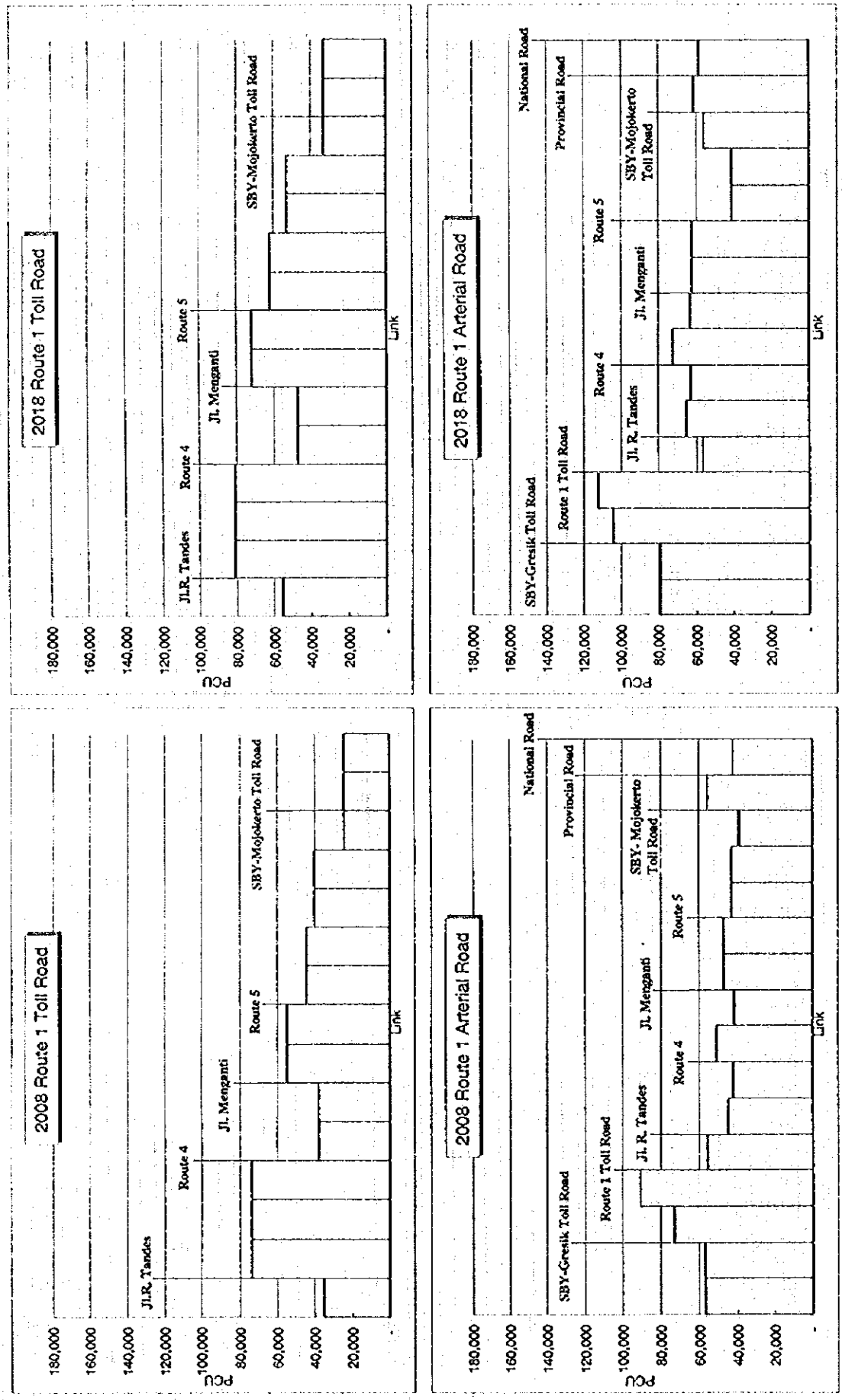
Figure 9.1 Project Locations for Feasibility Study

10. Future Traffic Demand Projection

Future road networks in 2008 and 2018 were established to follow the priority order of the proposed road master plan in GKS.

The toll collection system of the planned toll roads was determined to be a flat tariff for the intra-urban toll roads with independent collection systems by respective investors, and a distance proportional tariff for the inter-regional toll roads. A flat tariff of Rp.2500/vehicle of Category I was applied to the Gresik-Driyorejo Toll Road of Route-1 project.

Traffic assignment has been made by the minimum time path method and the future traffic demand on the respective project roads was estimated as shown in Figure 10.1.



Source: JICA Study Team

Figure 10.1 Estimated Traffic Volume on Project Roads (1/3)

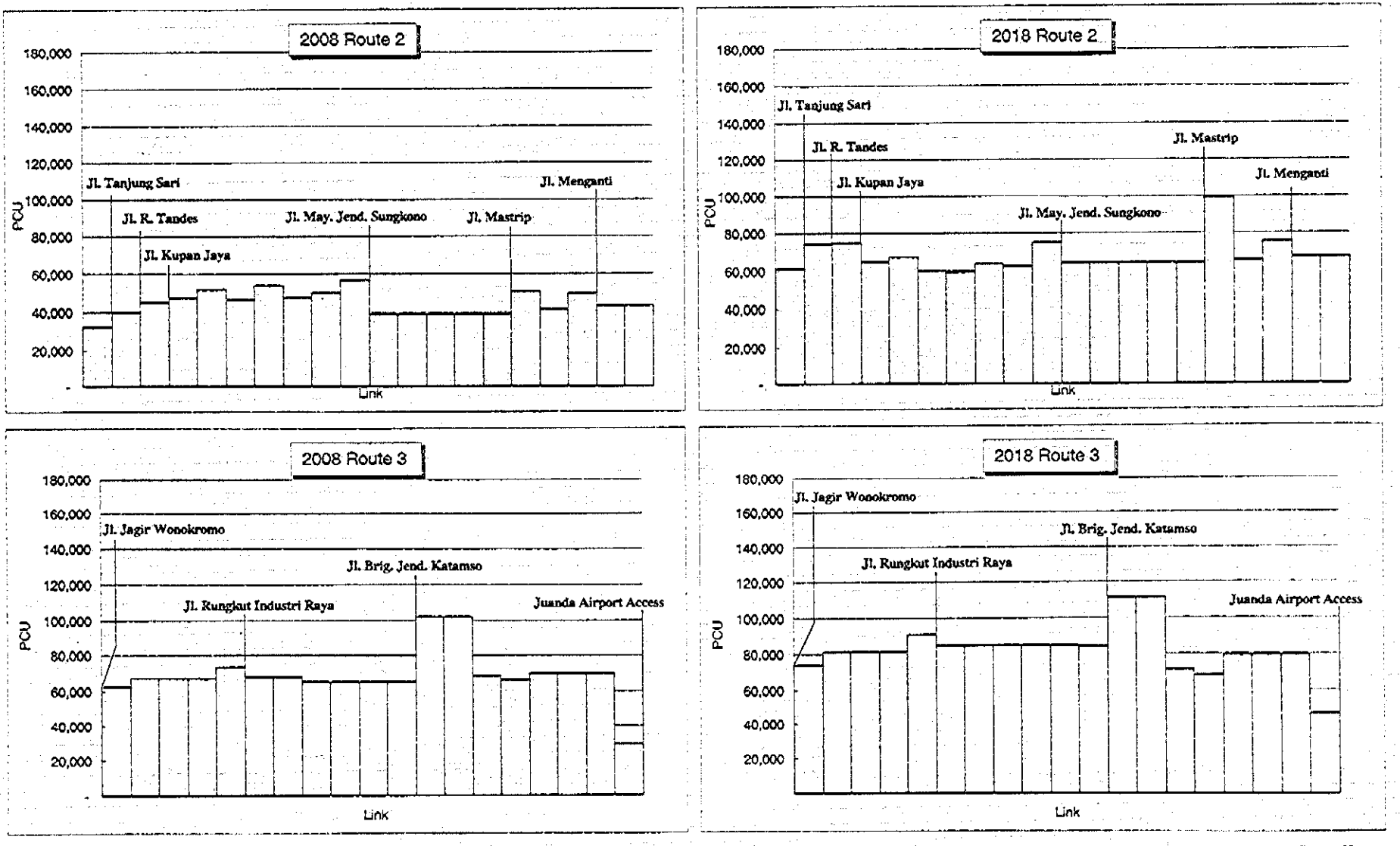


Figure 10.1 Estimated Traffic Volume on Project Roads (2/3)

Source: JICA Study Team

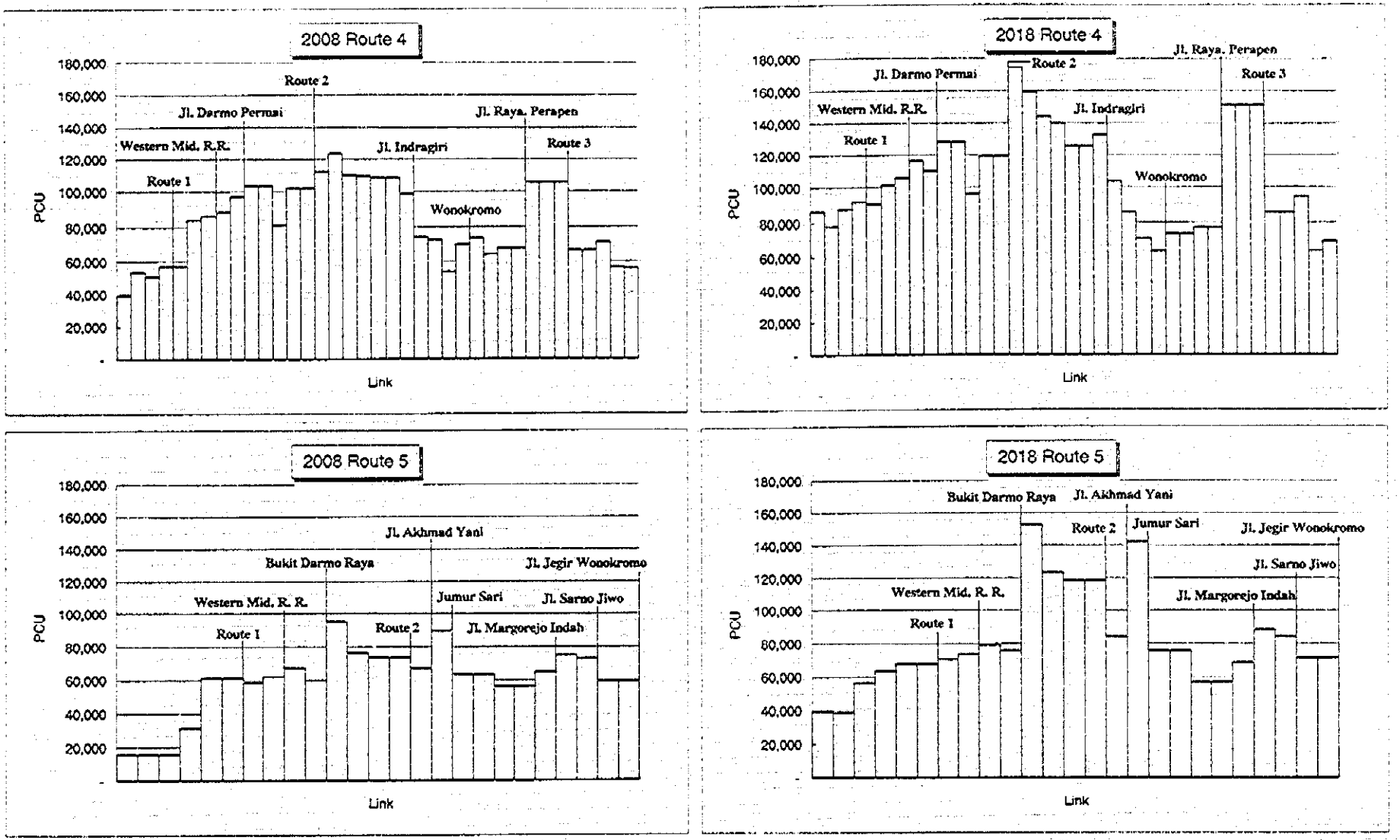


Figure 10.1 Estimated Traffic Volume on Project Roads (3/3)

Source: JICA Study Team

11. Preliminary Engineering Design

11.1 Design Standard

This section discusses the design standards to be applied for the design of the project roads.

The design standards are divided into the following four sections:

- Geometric Design Standard
- Structural Design Standard
- Pavement Design Standard
- Drainage Design Standard

The Government's standards are used to a maximum extent where available. The USA and Japanese standards are referred to for items not covered in the Government's standards.

11.1.1 Geometric Design Standard

The geometric design standard used shall be the Urban Road Design Standard since the project roads are located in Surabaya Metropolitan area.

Table 11.1 Type and Class for the Project Roads

Project Roads		Road Function	Type	Class
Route-1	Toll Road	Primary Arterial	I	I
	Arterial Road		II	
Route-2 Route-3 Route-4 Route-5		Secondary Arterial		

11.1.2 Structure Design Standard

(1) Loading

The loading specifications for the design of structures are as follows :

- Peraturan Perencanaan Teknik Jembatan May 1992 BINA MARGA (BMS) (Bridge Design Code)
- Design Manual, December 1992 BINA MARGA

11.1.3 Material and Strength for Structures

(1) Concrete Strength

Table 11.2 Class of Concrete and Application

Class of Concrete	Compressive Strength	Application
A - 1	40 Mpa	Precast prestressed concrete structure
A - 2	35 Mpa	Cast insitu prestressed concrete structure
B - 1	30 Mpa	Deck slab, pier head and column
B - 2	30 Mpa	Cast insitu reinforced concrete pile
C	21 Mpa	Abutment, footing, retaining wall
D	13 Mpa	Gravity type retaining wall
E	8 Mpa	Leveling concrete
AA	50 Mpa	Prestressed concrete pile

(2) Reinforcement

Table 11.3 Designation and Strength of Reinforcement

Type	JIS G 3112		ASTM A 615		Indonesian Standard
	Designation	Yield Strength	Designation	Yield Strength	
Round Bar	SR 24	24	Grade 40	2800	as applicable
Deformed Bar	SR 24	24	Grade 40	2800	as applicable

(3) Prestressing Steel

Table 11.4 Strength of Prestressing Steel

Notation	Utilization	Nominal Diameter (mm)	Yield Strength (kg/mm^2)	Breaking Strength (kg/mm^2)	Applicable Standard	
					JIS	ASTM
PC Wire SWPR 1	PC Pile	Ø 7	135	155	G 3536	A 421
PC Wire SWPR 1	Diaphragm for PC Box Girder	Ø 8	130	150	G 3536	A 421
PC 7 - Wire Strand SWPR 7A	PC Box Girder PC Hollow Slab and Diaphragm for PC Box Girder	T 12.4	150	175	G 3536	A 416
PC 7 - Wire Strand SWPR 7B	PC Hollow Core Slab Unit, PC I-Girder and PC T-Girder	T 12.7	160	190	G 3536	A 416
PC 7 - Wire Strand SWPR 7B	PC I-Girder	T 15.3	160	190	G 3536	A 416
PC 19 - Wire Strand SWPR 19	Diaphragm for PC I-Girder, Diaphragm for PC T-Girder	T 19.3	162	189	G 3536	A 416
PC Bar SBPR 80 / 95	Diaphragm for PC Box Girder	Ø 23	80	95	G 3109	A 722

11.2 Highway Capacity and Number of Lanes

11.2.1 Highway Capacity Analysis

The highway capacity of the project roads was examined based on "Indonesian Highway Capacity

Manual (HCM) Draft Final Report : October 1996 Directorate General BINA MARGA, Directorate of Urban Road Development (BINKOT)"

The results of the highway capacity analysis are shown in Figure 11.1 to Figure 11.6.

11.3 Cross Section Design

Typical cross sections determined for the project roads are shown in Figure 11.7 to Figure 11.11

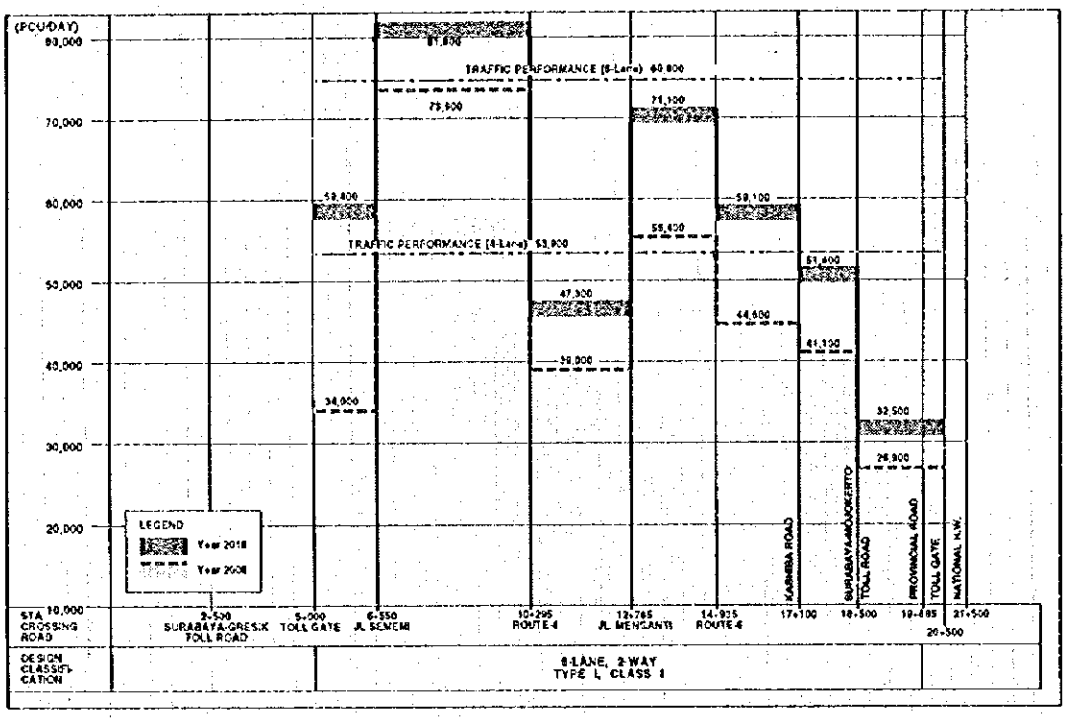


Figure 11.1 Traffic Demand and Highway Capacity for Route-1; Toll Road

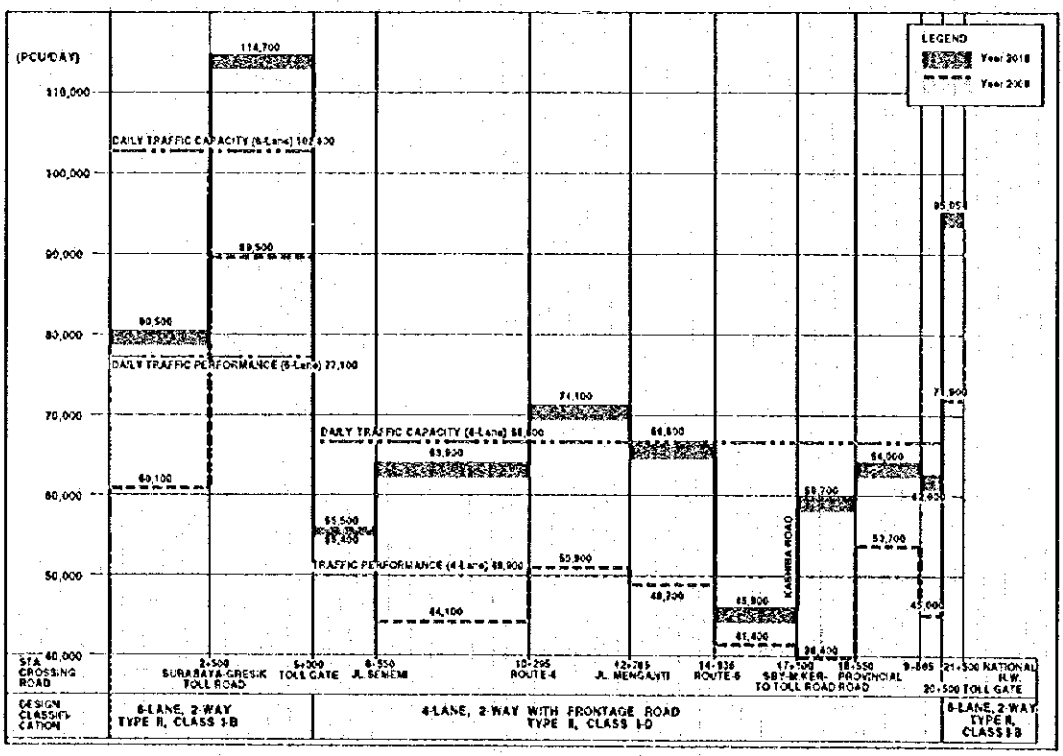


Figure 11.2 Traffic Demand and Highway Capacity for Route-1; Arterial Road

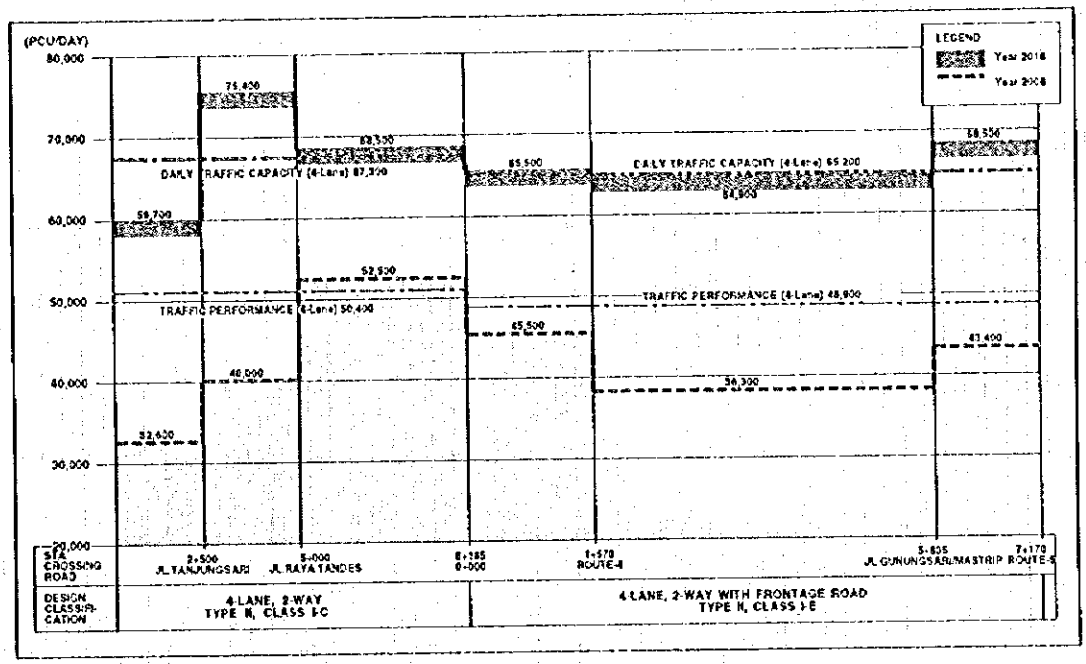


Figure 11.3 Traffic Demand and Highway Capacity for Route-2

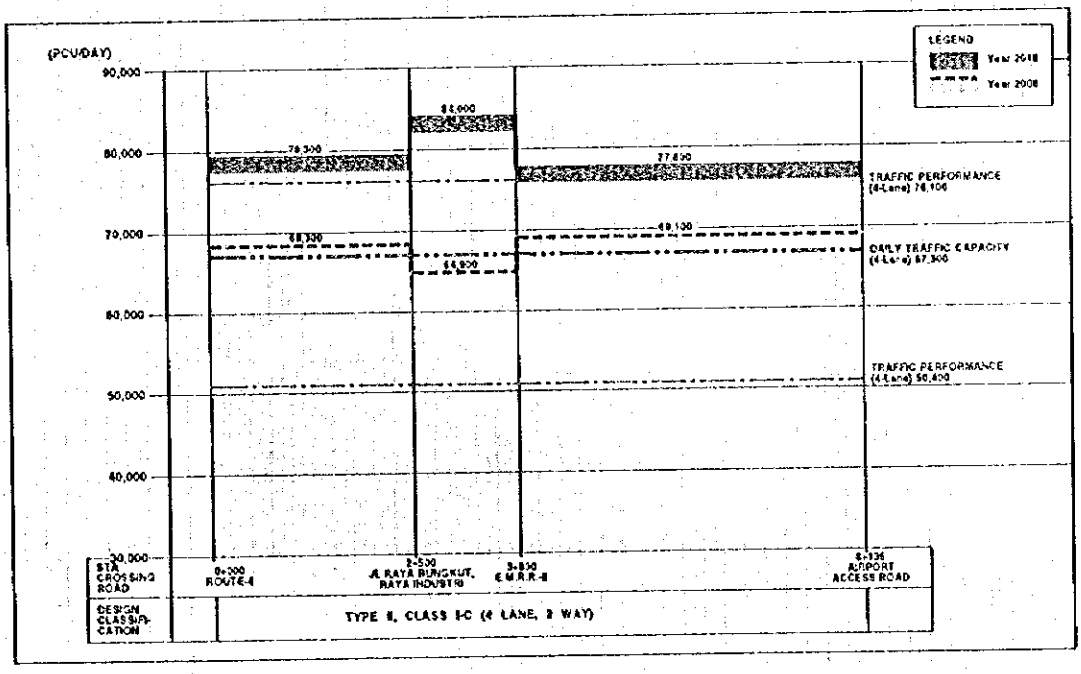


Figure 11.4 Traffic Demand and Highway Capacity for Route-3

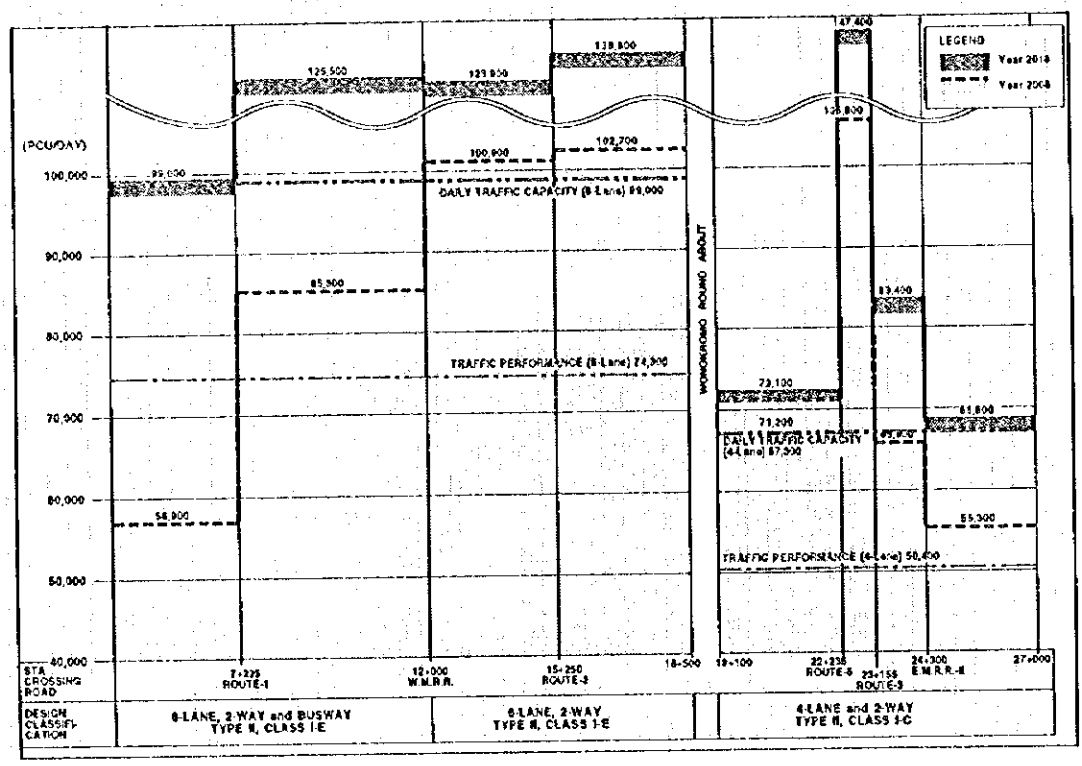


Figure 11.5 Traffic Demand and Highway Capacity for Route-4

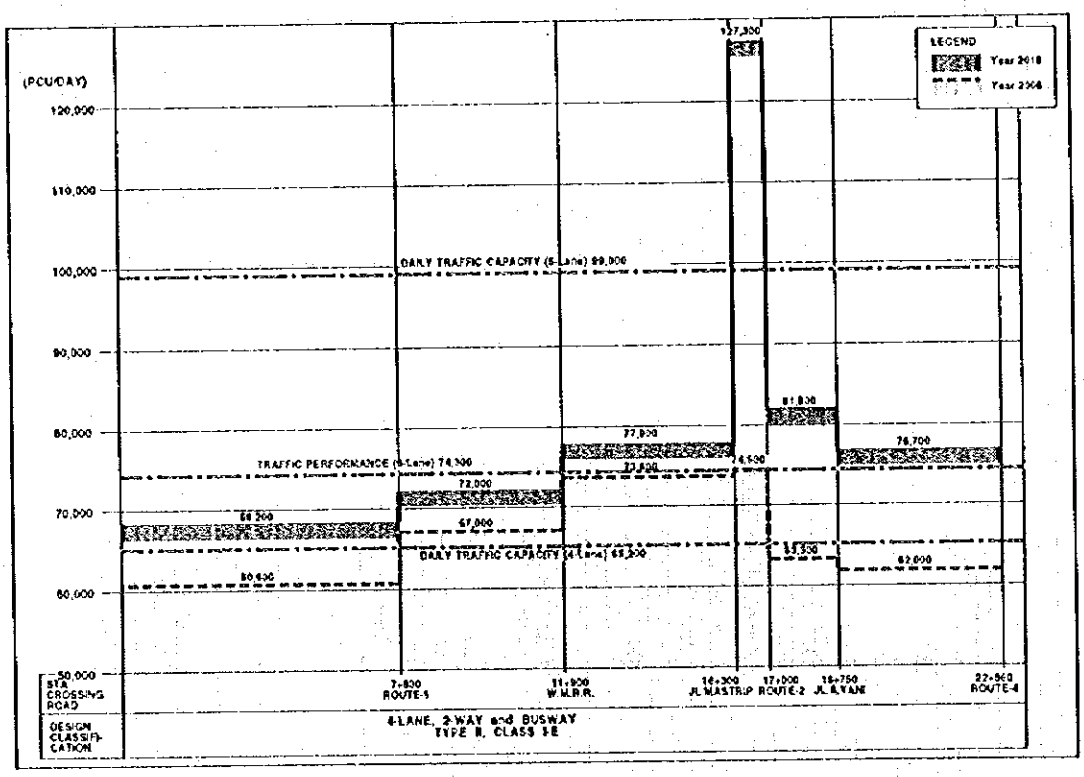


Figure 11.6 Traffic Demand and Highway Capacity for Route-5

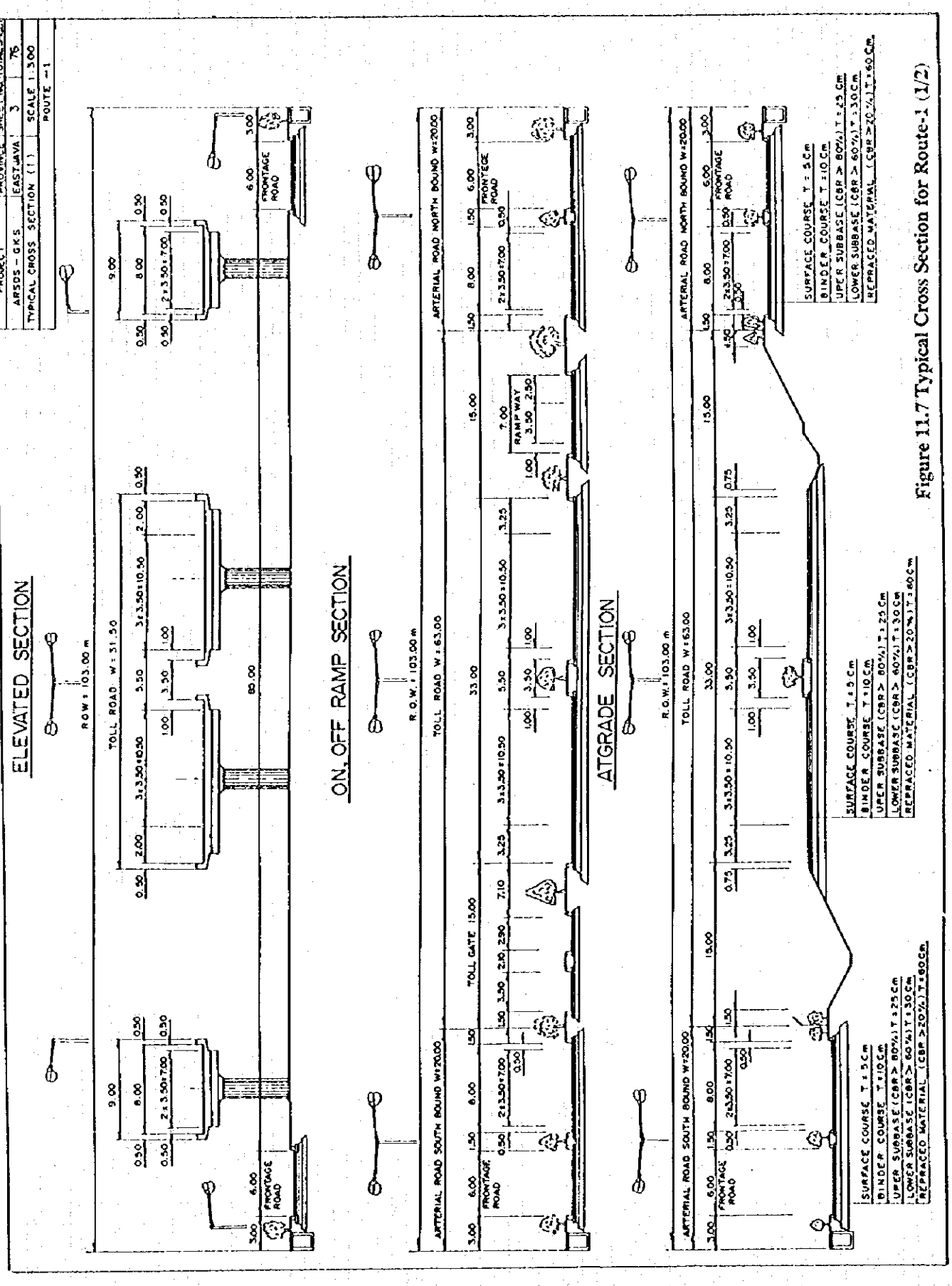


Figure 11.7 Typical Cross Section for Route-1 (1/2)

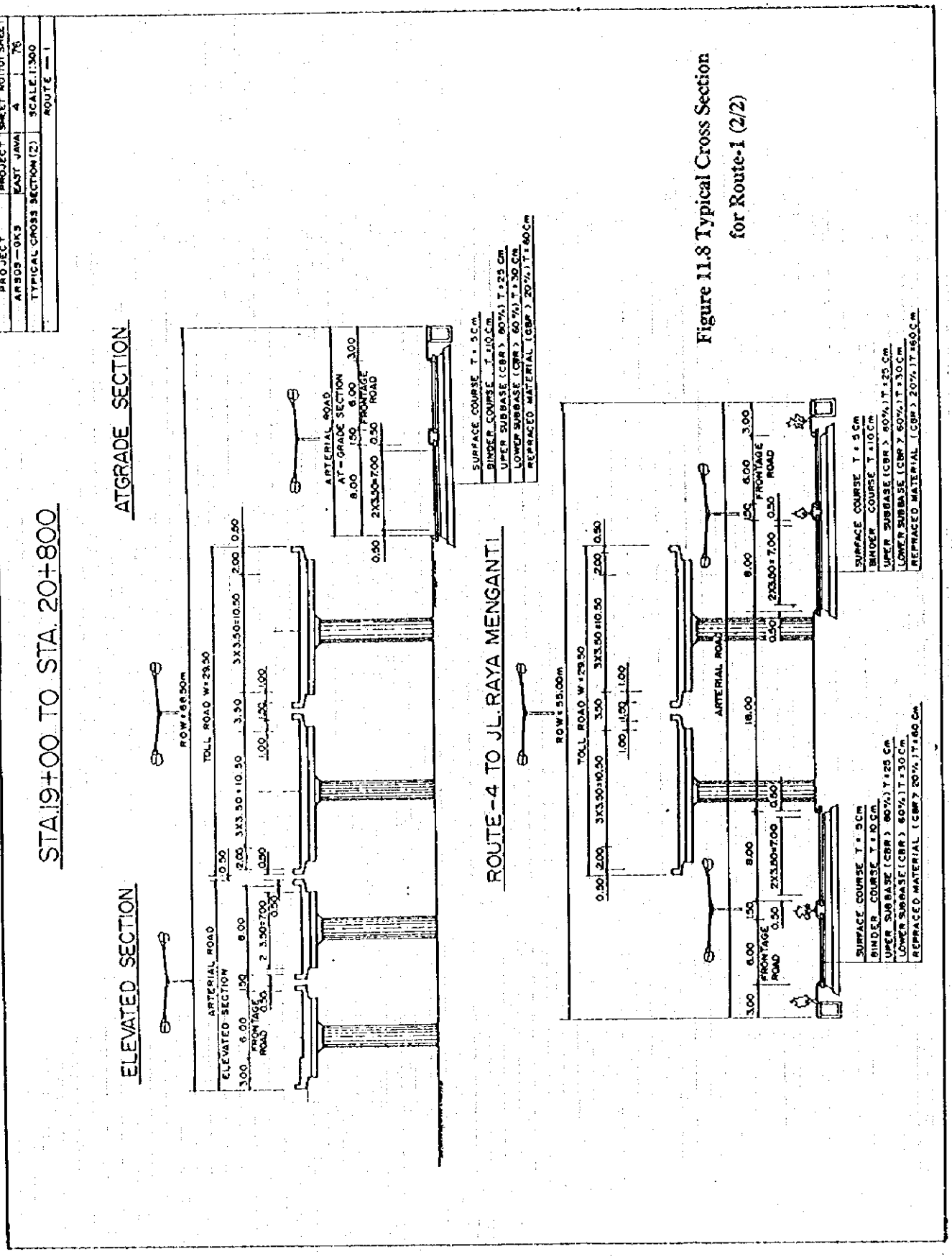


Figure 11.8 Typical Cross Section for Route-1 (2/2)

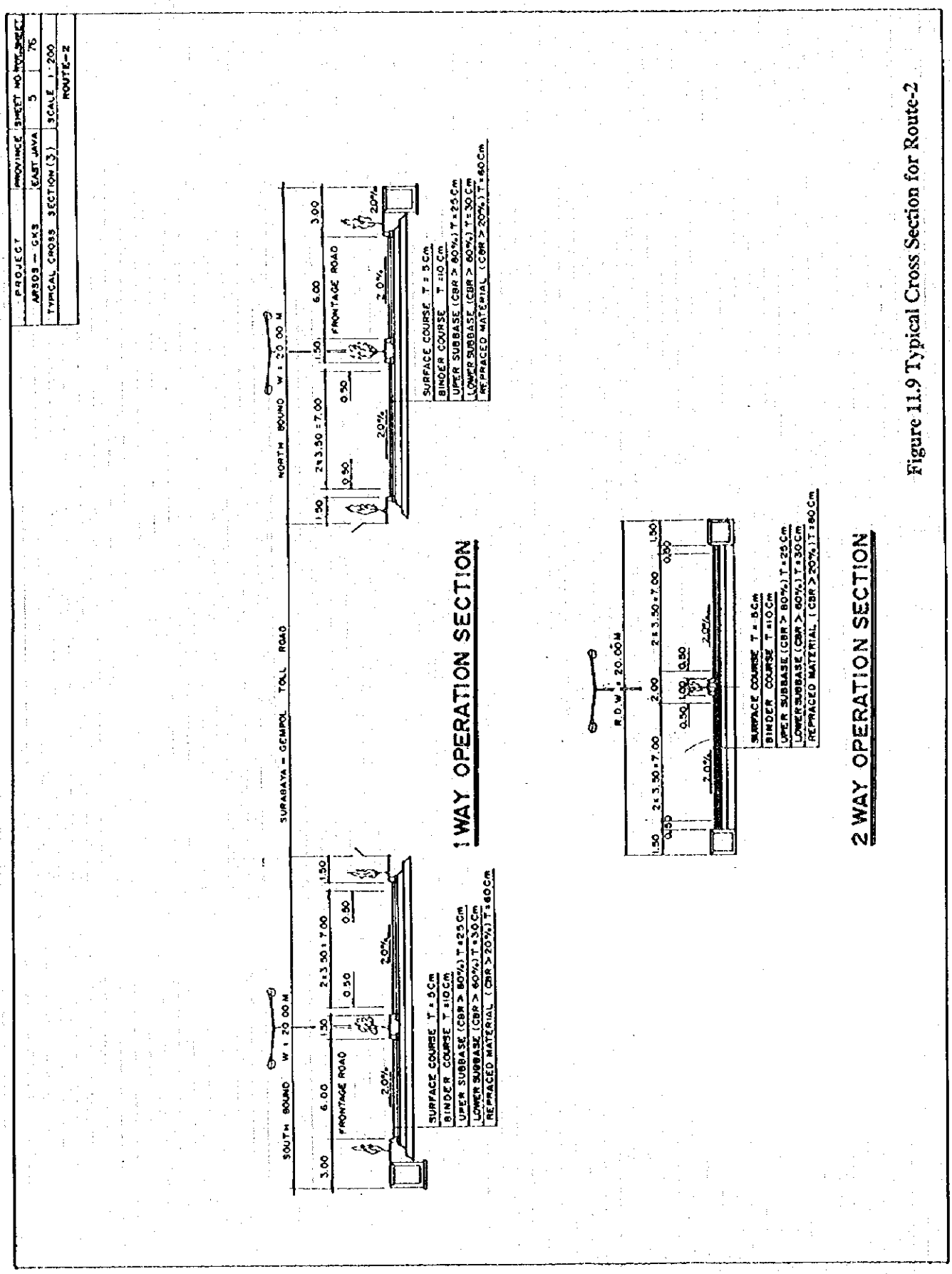


Figure 11.9 Typical Cross Section for Route-2

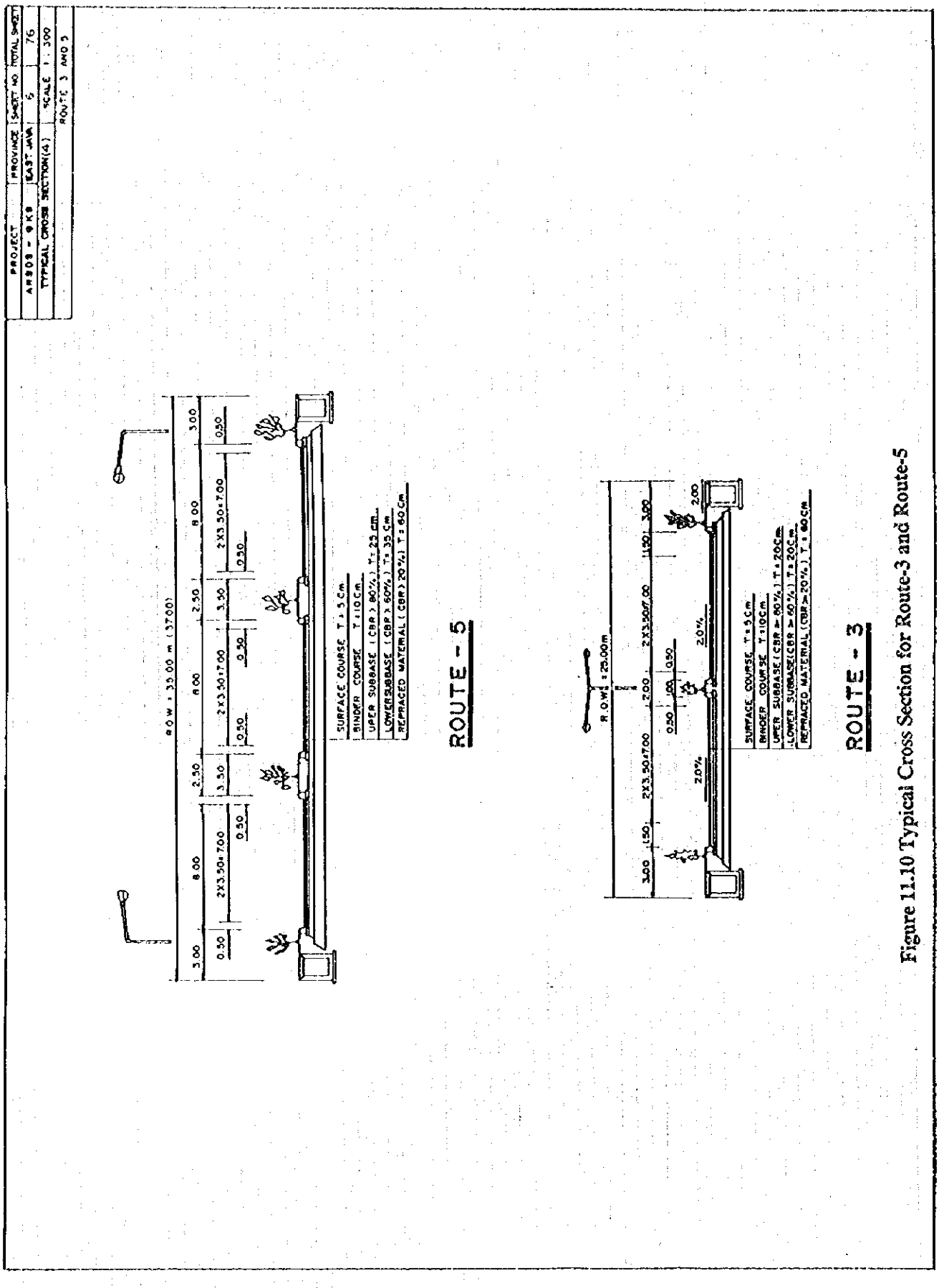


Figure 11.10 Typical Cross Section for Route-3 and Route-5

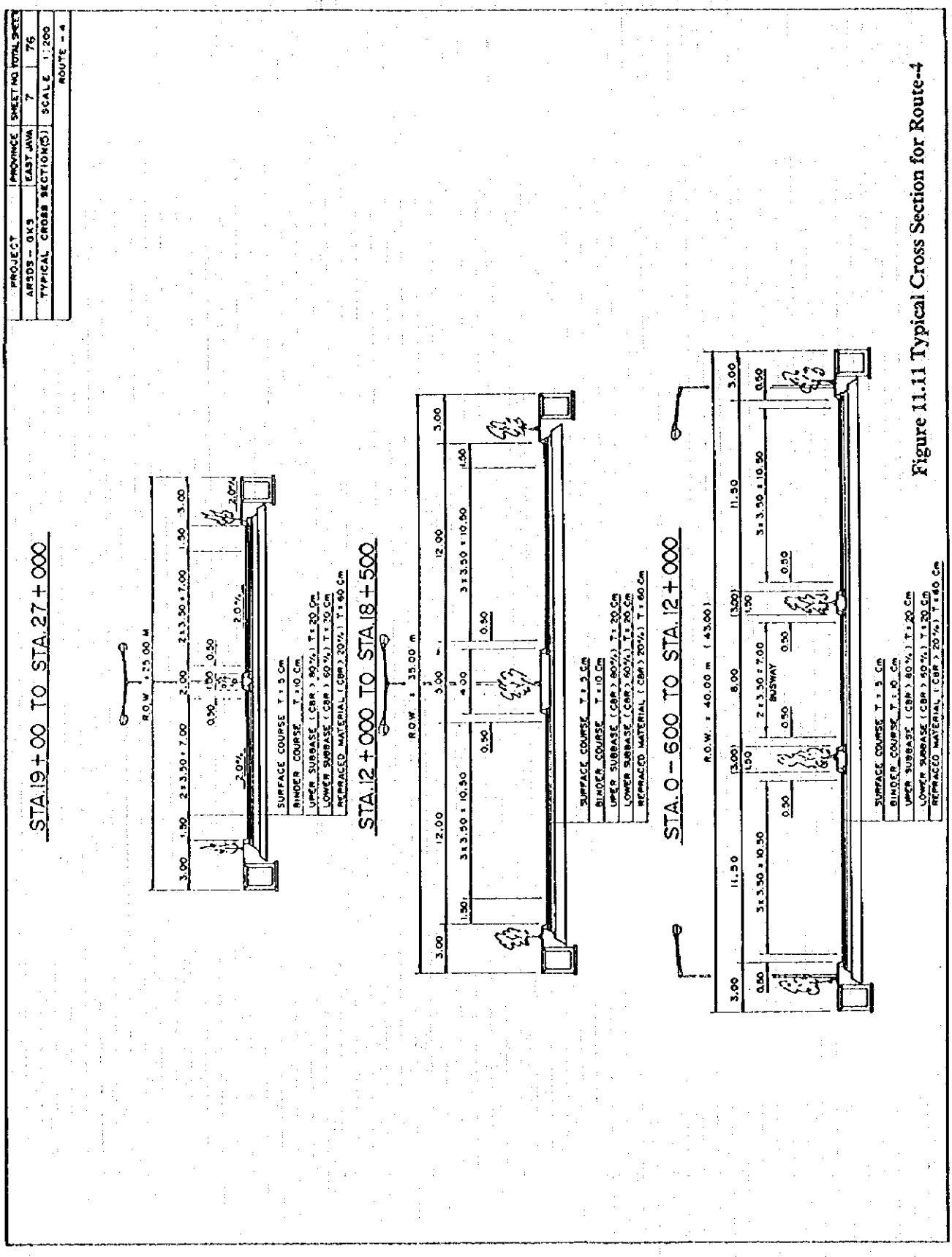


Figure 11.11 Typical Cross Section for Route-4

11.4 Route Selection

11.4.1 Basic Policies for Route Selection

The existing Right of Way (ROW) and resettlement are the most critical matters for selection of the alignment of the Project Roads. Where the ROW situation does not allow widening, sub-standard cross-sections are applied to meet the current ROW. Even where there is sufficient ROW, if the social impact is big because many resettlements are required, the new alignment is selected so as to minimize the resettlement as much as possible.

11.5 Preliminary Design of Interchanges and Bridges

11.5.1 Toll Levy System

The Project Toll Road will constitute a part of the Surabaya Urban Toll Road System. Therefore, it is understood that basically the Toll Road will be operated under a flat tariff toll levy system.

11.5.2 Location of Interchanges and ON/OFF Ramps

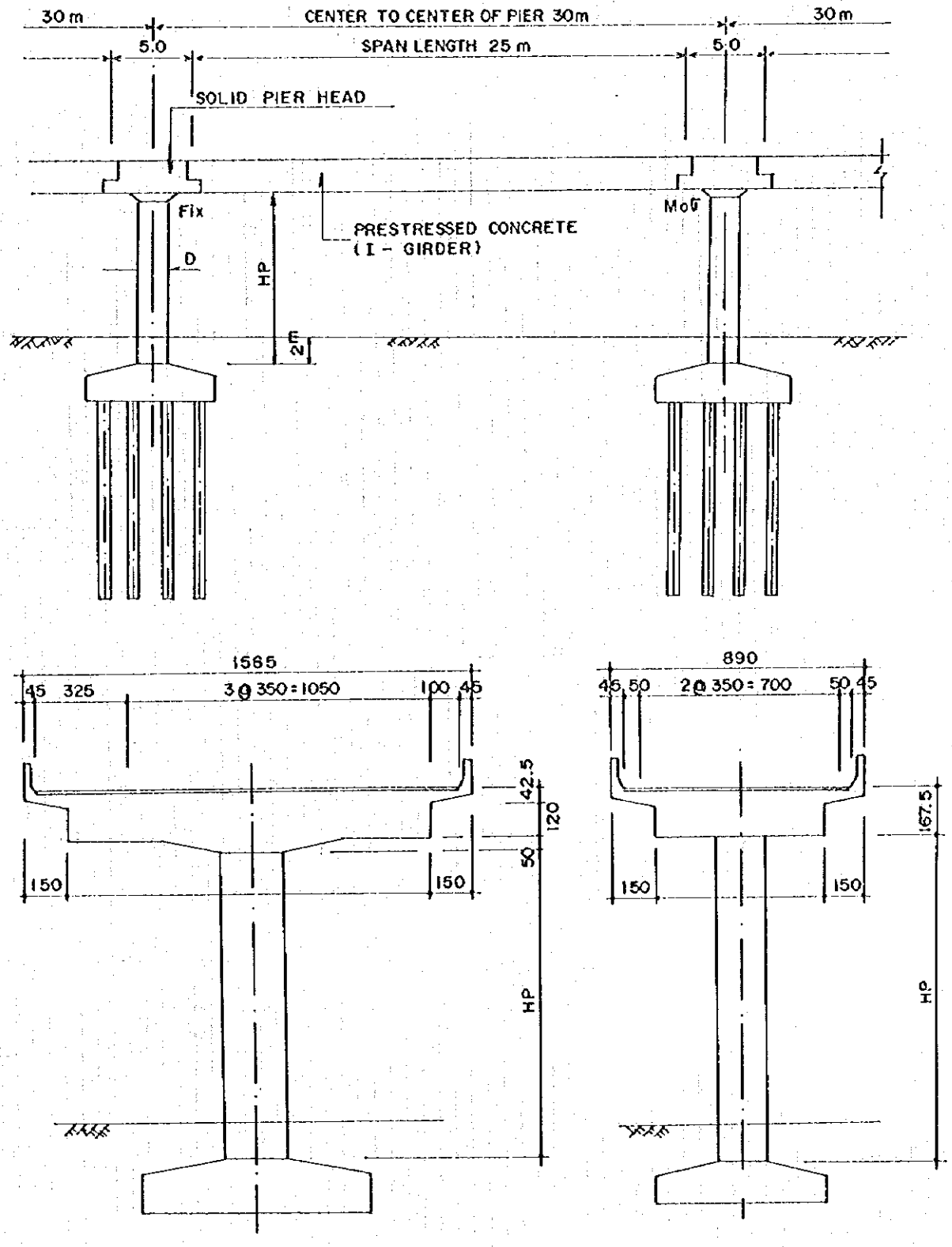
Two interchange (toll to toll interchange) , six ON/OFF ramps and seven interchange (artery to artery) are planned on the Project Roads. The name of each interchange and the ON/OFF ramps are shown in Table 11.5.

Table 11.5 Name of Interchange and On/Off Ramps

Route No.	Name of Interchanges and ON/OFF Ramps	STA	Distance (km)	Name of Connecting Road	Remarks
1	Benowo IC	1+000		Jl. Tambak Osowilangon	
	Romo Kalisari IC	2+500	1.50	Surabaya Gresik Toll	T to T
	Jl. Sememi ON/OFF	6+800	4.30	Jl. Sememi from South	
	Route-4 ON/OFF	9+800	3.00	Route-4 from North	
	Jl. Menganti ON/OFF	13+400	3.60	Jl. Menganti form South	
	Route-5 ON/OFF	14+250	0.85	Route-5 from North	
	Kesamben ON/OFF	15+200	1.30	Route-5 from South	
		16+500		Planned Trunk Road	
	Tenaiu ON/OFF	18+100	1.60	Surabaya Mojokerto Toll	T to T
	Driyorejo IC	18+920	0.82	Surabaya Mojokerto Toll	
	Torosobo IC	21+015	2.10	NH Surabaya Mojokerto	
2	Kali Anak IC	0+000		Jl. Kali Anak	
4	Kota Satelit IC	15+500		Sby-Gmp Toll	
5	Jambangan IC	16+600	1.10	Route-2	
	Kebonsari IC	17+300	0.70	Route-2	
	Ketintang IC	18+000	0.70	Jl. A. Yani	
	Rungkut IC	18+850	0.85	Jl. Jemur Sari	

11.5.3 Preliminary Design of Bridges

The standard span and cross section of the bridges are shown in Figure 11.12.



A STUDY FOR ARTERIAL ROAD SYSTEM DEVELOPMENT IN GERBANG KERTOSUSILO REGION

Figure 11.12 Standard Span and Cross Section of Bridge

11.6 Preliminary Design of Pavement

Pavement design thicknesses for the Project Roads have been determined as shown in Table 11.6.

Table 11.6 Pavement Design Thickness

	Route-1		Route-2	Route-3	Route-4		Route-5	Remarks
	Toll Road	Arterial			Western part	Eastern part		
Surface Course	5	5	5	5	5	5	5	Marshall Stability min. 750 kg
Binder Course	10	10	10	10	10	10	10	Marshall Stability min. 750 kg
Aggregate Base A	25	25	25	20	20	20	25	CBR min. 80 %
Aggregate Base B	30	30	30	20	20	20	35	CBR min. 60 %
Selected Fill (cm)	60	60	60	60	60	60	60	CBR min. 20 %

11.7 Current Right of Way Situation and Required Right of Way

The Project Roads cover three administrations which are Kotamadya Surabaya (Kod. Surabaya), Kabupaten Gresik (Kab. Gresik) and Kabupaten Sidoarjo (Kab. Sidoarjo). Current Right of Way (ROW) situations and required ROW are shown in Table 11.7 and Figure 11.13.

Table 11.7 Current ROW Situations and Required ROW

Project Road	Administration	Length (km)	Current ROW (m)	Required ROW (m)	Remarks
Route-1	Surabaya	13.7	55	103	Partly 55 m
	Gresik	6.1	0	103	Agreed by Local Government
	Sidoarjo	1.0	0	103	Agreed by Local Government
Route-2	Surabaya	6.2	20	20	With Sub-Standard
		7.1	2×20	2×20	
Route-3	Surabaya	3.5	25	25	
	Sidoarjo	4.6	0	25	Agreed by Local Government
Route-4	Gresik	6.4	0	40	Agreed by Local Government
	Surabaya	6.2	40	40	With Busway
		6.5	35	35	With Traffic Management
		8.5	25	25	Without Busway
Route-5	Gresik	9.2	0	35	Agreed by Local Government
	Surabaya	6.6	0	35	West Border to Jl. Mastrip
		6.8	35	35	Jl. Mastrip to Jl. Jemur Sari

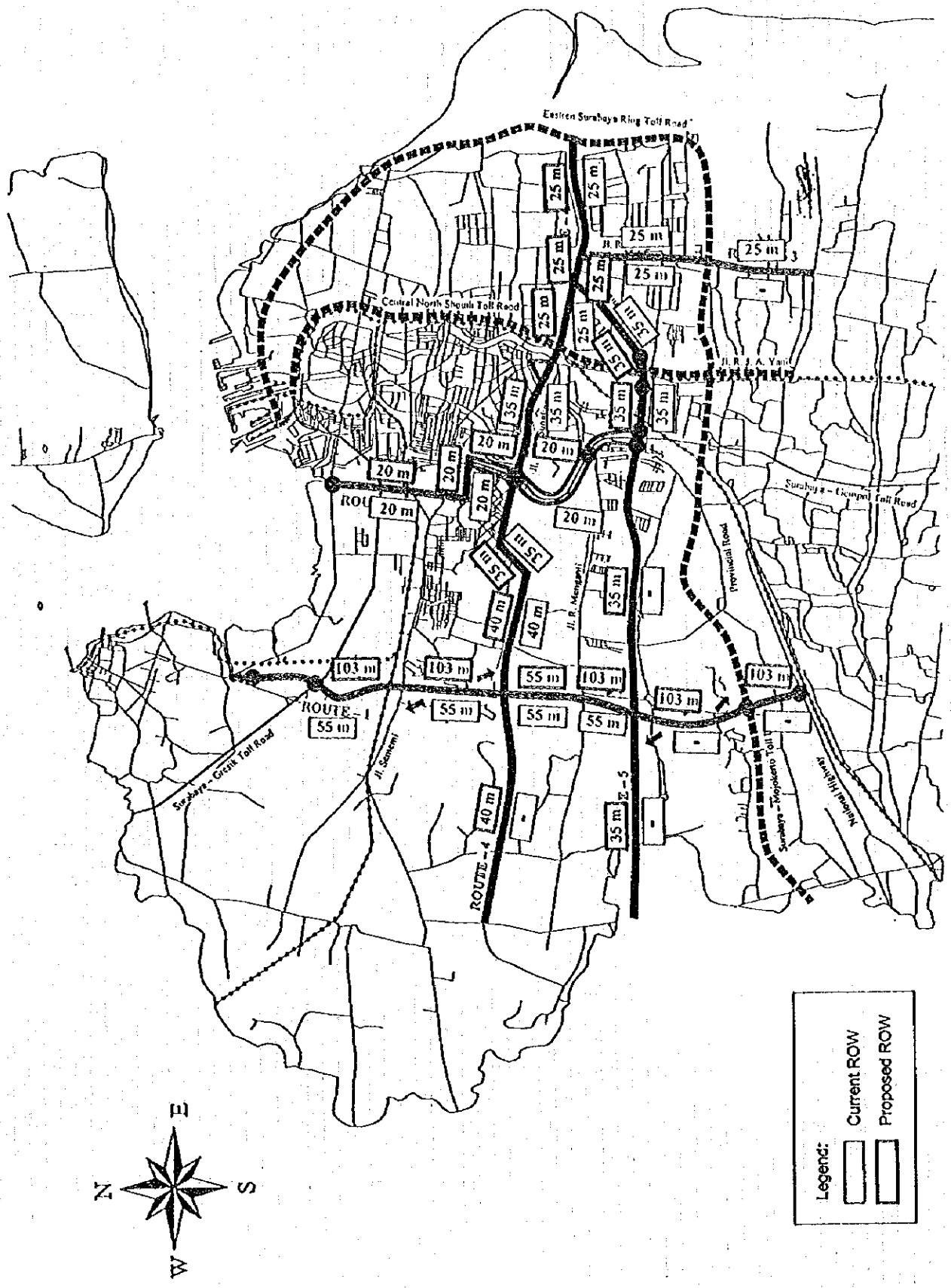


Figure 11.13 Current ROW Situation and Requirement for the Project Roads

12. Construction Planning, Operation and Maintenance and Project Cost Estimate

12.1 Construction Planning

12.1.1 Outline of the Construction Work

An outline of the construction work for the Project Roads is as follows.

(1) Route – 1 : Toll Road (20.80 km length)

The Toll Road construction is a new road construction and consists of a structure section of 12.5 km (piled slab section 5.35 km, bridge section 7.15 km) and an earth work section of 8.3 km. It is noted that the light of the structure section takes up 60.1 % of the grand total.

(2) Route – 1 : Arterial Road (15.50 km length)

This route consists of new road construction (8.06 km, 52.0 %) and an overlay construction section (7.44 km, 48.0 %).

(3) Route – 2 : Arterial Road (13.30 km length)

This route consists of new road construction (10.64 km, 80.0 %) and an overlay construction section (2.66 km, 20.0 %).

(4) Route – 3 : Arterial Road (8.22 km length)

This route consists of widening and overlay. It is noted that bridge construction length is only 0.15 km.

(5) Route – 4 : Arterial Road (27.60 km length)

This route consists of a new road construction section (9.34 km, 33.9 %) and an overlay / widening construction section (18.26 km, 66.1 %). It is noted that the bridge construction section is only 1.51 km length.

(6) Route – 5 : Arterial Road (22.60 km length)

This route consists of a new road construction section (19.42 km, 85.0 %) and an overlay / widening construction section (3.38 km, 15.0 %). It is noted that the bridge construction section is only 0.71 km length.

No major problems are anticipated in the construction of the Project Roads.

12.1.2 Hauling Roads for Construction Materials

Construction of the Project Roads involves the hauling of a large quantity of embankment / pavement / concrete materials. National and Provincial Roads will be used as hauling roads. These roads are used as hauling roads for the current road improvement projects in the Surabaya region.

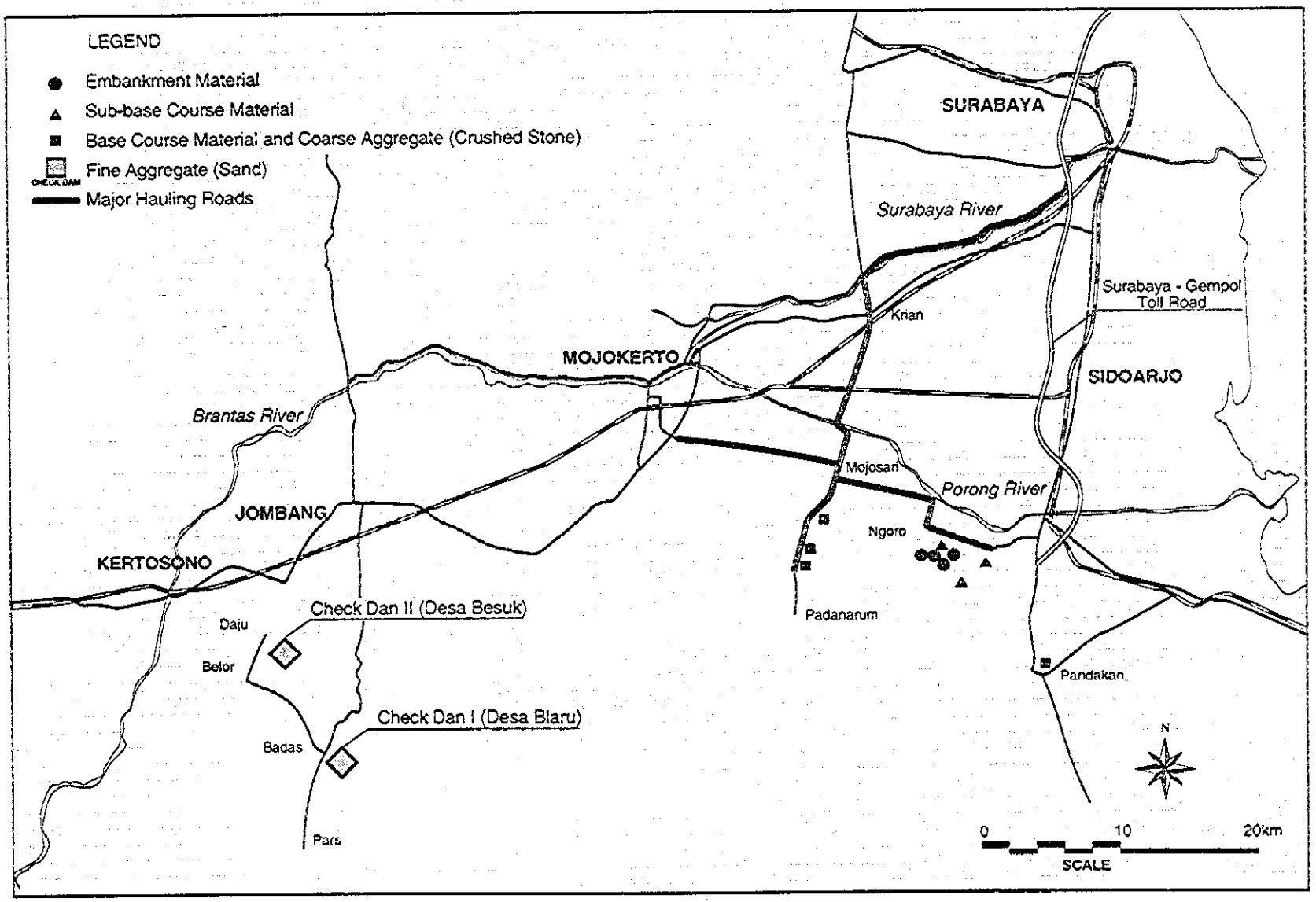


Figure 12.1 Material Sources and Major Hauling Roads

12.1.3 Construction Time Schedule

A construction time schedule for each of the Project Roads was assumed as shown in Table 12.1.

Table 12.1 Time Schedule

Description	1 st. year	2 nd. year	3 rd. year	4 th. year	5 th. year	6 th. year	7 th. year
Final Engineering Design							
Land Acquisition							
Construction							
Opening to Traffic							

12.2 Operation and Maintenance

12.2.1 Operation and Maintenance of the Toll Road

Private sector participation is assumed for construction and operation of the Toll Road. The participation of P.T. Jasa Marga (Persero) (Indonesian Highway Corporation) is an essential requirement in all toll road development and private investor participation should be implemented in the form of a joint venture or joint operation with P.T. Jasa Marga.

12.2.2 Scope of Operation and Maintenance Works

The scope of operation and maintenance works is broadly divided into i) toll road maintenance, ii) traffic management and iii) toll collection.

(1) Toll Road Maintenance

Toll road maintenance together with traffic management has the three basic goals of providing traffic safety, smooth traffic flow and user comfort.

The maintenance function can be divided into routine maintenance, periodic maintenance and incidental maintenance.

Routine maintenance is based on routine (daily) inspection of the condition of the pavement, cut and fill slopes, drainage, bridges and other structures and facilities to monitor any defects or damage to them. The results of routine inspection should be promptly reported to the regional operation office for follow-up maintenance works as required.

Periodic maintenance is based on detailed inspections to be performed at certain time intervals such as weekly, monthly or yearly depending on the type and kind of facilities, including checking and testing the condition of various structures and facilities. Defects and damage should be reported for repairs or remedies. Periodic maintenance also covers such works as cleaning of pavement, guardrails and sign boards, mowing and maintenance of landscape plantation areas, and road marking and painting.

Incidental maintenance is basically the work to be carried out to restore the toll road and the related facilities to their normal operating conditions after they are damaged by road accident or natural causes.

Maintenance works except for inspections are executed basically by contractors under the supervision of the regional operation office, and will include:

- Cleaning of pavement
- Mowing and maintenance of plantation areas
- Cleaning of drainage facilities
- Pavement repair such as patching and resurfacing
- Repair of expansion joints of bridges and viaducts
- Repair of fill and cutting slopes
- Repair of damage to road facilities caused by traffic accident
- Betterment work including pavement overlay, construction of additional facilities etc.

(2) Traffic Management

Traffic management means traffic control, removal of disable cars which have been involved in accidents, and furnishing users with expressway and traffic information.

Highway patrols are conducted to locate damage to road facilities, traffic accidents, illegal parking, disabled cars and other extraordinary conditions which disturb traffic safety. Information and reports are dispatched to the regional operation office through radio communication installed in the patrol cars.

Such services as rescue, ambulance and emergency treatment to those injured due to traffic accidents, and towing of disabled cars are executed.

Traffic control includes general control of speed, overloading and emergency lane use (under unusual conditions such as traffic accident, adverse weather and operation of maintenance works). Control and prohibition of illegally overloaded trucks are conducted in cooperation with traffic police. Axle load meters will be installed at entries to interchanges for weighing.

Traffic surveillance including information collection and dissemination is also an important part of traffic management especially when the traffic volume is approaching the toll road capacity. Installation of facilities such as CCTV, radio broadcasts, variable message signs and emergency telephones will be programmed in the future.

(3) Toll Collection

The Toll Road will be operated under an open system of toll levy as a regional toll road.

12.2.3 Organization for Operation and Maintenance

For private investor participation in the Toll Road, the organization for operation and maintenance should be self-sufficient, separate from that of other Toll Roads. Its basic organization will be composed of a Head Office, a Regional Office and Toll Gate Offices.

(1) Head Office

The head office will be responsible for overall management of the organization including decision making related to the activities of operation and maintenance of the Toll Road, budgetary control, etc.

(2) Regional Operation Office

The regional operation office will be responsible for operation and maintenance works for the Toll Road. Since the operational length of the Toll Road is only 15.5 km, the establishment of one office is sufficient. It is recommended that the office is located beside the throughway barrier gate.

(3) Toll Gate Offices

A toll gate office will be provided at every on-ramp and at the throughway toll barriers. The office space provided will depend on the number of toll booths.

12.3 Project Cost Estimate

12.3.1 Premises for Cost Estimate

The basic premises in estimating the project cost were as follows:

1) All the construction works will be executed by contractor(s) to be employed by a private investor or the government for development of the project roads.

2) The unit price of each cost component was determined based on the economic conditions prevailing in 1996/1997.

3) For the construction works, Indonesian taxes and duties on import equipment and materials (tax percentage depending on type/kind of equipment and materials) will be imposed. Indonesian value added tax (10 %) will be also imposed on the contractor.

4) Engineering cost was assumed to be 10 % of the construction cost, consisting of 4 % for detailed design and 6 % for construction supervision.

5) Physical contingency was estimated to be 10 % of the total of construction cost, purchase cost of maintenance equipment, land acquisition and compensation costs, and engineering cost.

The project cost has been estimated as the financial cost and the economic cost.

12.3.2 Estimated Project Cost and Source of Finance

(1) Estimated Project Cost

The project cost was estimated by the following items.

- Initial Investment Cost
  - -Construction cost
  - -Purchase cost of maintenance equipment
  - -Land acquisition and compensation cost
  - -Engineering cost
  - -Contingency
- Additional Initial Investment Cost
  - -Overlay cost
- Operation and maintenance cost

The estimated initial investment costs for the project roads are summarized in Table 12.2. The estimated additional investment costs are summarized in Table 12.3.

Table 12.2 Summary of Initial Investment Cost

Description	Route - 1 Toll Road		Route - 1 Arterial Road		Route - 2 Arterial Road		Route - 3 Arterial Road		Route - 4 Arterial Road		Route - 5 Arterial Road	
	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)
Construction Cost	545,557	495,961	158,297	143,907	130,873	118,975	23,476	21,342	138,550	125,955	136,021	123,655
Land Acquisition and Compensation	48,305	48,305	22,716	22,716	34,760	34,760	27,561	27,561	34,497	34,497	47,064	47,064
Purchase of Maintenance Equipment	3,025	2,400	1,120	783	797	557	441	309	1,486	1,039	1,217	851
Engineering	54,556	49,595	15,830	14,391	13,087	11,898	2,348	2,134	13,855	12,595	13,602	12,366
Sub - Total	651,443	596,262	197,963	181,797	179,517	166,190	53,826	51,346	188,388	174,087	197,904	183,936
Contingency	65,144	59,626	19,796	18,180	17,952	16,619	5,383	5,135	18,839	17,409	19,790	18,394
Total	716,587	655,888	217,759	199,976	197,469	182,809	59,209	56,480	207,227	191,495	217,694	202,330

Source: Estimated by JICA Study Team

Table 12.3 Summary of Additional Investment Cost

Description	Route - 1 Toll Road		Route - 1 Arterial Road		Route - 2 Arterial Road		Route - 3 Arterial Road		Route - 4 Arterial Road		Route - 5 Arterial Road	
	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)
Overlay Cost	8,143	7,403	6,378	5,798	4,582	4,166	1,090	991	11,398	10,361	3,039	2,762

Source: Estimated by JICA Study Team

(2) Source of Finance

Project loans from international lending agencies may be inevitable such as from the Overseas Economic Cooperation Fund of Japan (OECF), the World Bank (IBRD) and the Asian Development Bank (ADB) as official development aids (ODA). The terms and conditions of loans are as follows:

OECF Loan

The loan proceeds shall be appropriated according to whichever case is smaller, i) or ii).

i) 85 % of total construction costs including land acquisition and property compensation cost, and administration costs.

ii) 100 % of direct construction costs excluding land acquisition and property compensation cost, and including administration cost.

IBRD/ADB Loan

The loan proceeds shall cover only the foreign currency portion. The local currency portion is usually appropriated by a loan from the Export-Import Bank of Japan.

12.3.3 Operation and Maintenance Cost

The annual operation and maintenance costs of the Toll Road at 1996/1997 prices are estimated to be Rp. 4,642 mil., based on data from the administrative office of the Surabaya-Gempol Toll Road.

The annual maintenance cost of the Arterial Road at 1996/1997 prices is estimated to be Rp. 22.6 mil. per km.

12.3.4 Yearly Cash Flow of the Project Cost

A yearly cash flow of the project cost has been prepared as shown in Table 12.4 to Table 12.9, assuming the following implementation schedule.

Detailed Design	1 year
Land Acquisition	2 years
Construction	3 years

Table 12.4 Yearly Cash Flow of the Project Cost for Route – 1 : Toll Road

Unit: Million Rp.

Route – 1 Toll Road	Initial Invetment							Overlay	
	1 st. year	2 nd. year	3 rd. year	4 th. year	5 th. year	6 th. year	Total	16 th. year	26 th. year
Financial Cost									
Construction Cost				181,852	181,852	181,852	545,557	8,143	8,143
Land Acquisition and Compensation		24,153	24,153				48,305		
Perchase of Maintenance Equipment						3,025	3,025		
Engineering	16,367			12,730	12,730	12,730	54,556	814	814
Sub – Total	16,367	24,153	24,153	194,582	194,582	197,607	651,443	8,958	8,958
Contingency	1,637	2,415	2,415	19,458	19,458	19,761	65,144	896	896
Total	18,003	26,568	26,568	214,040	214,040	217,368	716,587	9,854	9,854
Economic Cost									
Construction Cost				165,320	165,320	165,320	495,961	7,403	7,403
Land Acquisition and Compensation		24,153	24,153				48,305		
Purchase of Maintenance Equipment						2,400	2,400		
Engineering	14,879			11,572	11,572	11,572	49,596	740	740
Sub – Total	14,879	24,153	24,153	176,893	176,893	179,292	596,262	8,143	8,143
Contingency	1,488	2,415	2,415	17,689	17,689	17,929	59,626	814	814
Total	16,367	26,568	26,568	194,582	194,582	197,221	655,888	8,957	8,957

Source: Estimated by JICA Study Team

Table 12.5 Yearly Cash Flow of the Project Cost for Route – 1 : Arterial Road

Unit: Million Rp.

Route – 1 Arterial Road	Initial Invetment							Overlay	
	1 st. year	2 nd. year	3 rd. year	4 th. year	5 th. year	6 th. year	Total	16 th. year	26 th. year
Financial Cost									
Construction Cost				52,766	52,766	52,766	158,297	6,378	6,378
Land Acquisition and Compensation		11,358	11,358				22,716		
Purchase of Maintenance Equipment						1,120	1,120		
Engineering	4,749			3,694	3,694	3,694	15,830	638	638
Sub – Total	4,749	11,358	11,358	56,459	56,459	57,579	197,963	7,016	7,016
Contingency	475	1,136	1,136	5,646	5,646	5,758	19,796	702	702
Total	5,224	12,494	12,494	62,105	62,105	63,337	217,759	7,718	7,718
Economic Cost									
Construction Cost				47,969	47,969	47,969	143,907	5,798	5,798
Land Acquisition and Compensation		11,358	11,358				22,716		
Purchase of Maintenance Equipment						783	783		
Engineering	4,317			3,358	3,358	3,358	14,391	580	580
Sub – Total	4,317	11,358	11,358	51,327	51,327	52,110	181,797	6,378	6,378
Contingency	432	1,136	1,136	5,133	5,133	5,211	18,180	638	638
Total	4,749	12,494	12,494	56,460	56,460	57,321	199,976	7,016	7,016

Source: Estimated by JICA Study Team

Table 12.6 Yearly Cash Flow of the Project Cost for Route – 2

Unit: Million Rp.

Route – 2 Arterial Road	Initial Invetment							Overlay	
	1 st. year	2 nd. year	3 rd. year	4 th. year	5 th. year	6 th. year	Total	16 th. year	26 th. year
Financial Cost									
Construction Cost				43,624	43,624	43,624	130,873	4,582	4,582
Land Acquisition and Compensation		17,380	17,380				34,760		
Purchase of Maintenance Equipment						797	797		
Engineering	3,926			3,054	3,054	3,054	13,087	458	458
Sub – Total	3,926	17,380	17,380	46,678	46,678	47,475	179,517	5,040	5,040
Contingency	393	1,738	1,738	4,668	4,668	4,747	17,952	504	504
Total	4,319	19,118	19,118	51,346	51,346	52,222	197,469	5,544	5,544
Economic Cost									
Construction Cost				39,658	39,658	39,658	118,975	4,166	4,166
Land Acquisition and Compensation		17,380	17,380				34,760		
Purchase of Maintenance Equipment						557	557		
Engineering	3,569			2,776	2,776	2,776	11,898	417	417
Sub – Total	3,569	17,380	17,380	42,434	42,434	42,992	166,190	4,582	4,582
Contingency	357	1,738	1,738	4,243	4,243	4,299	16,619	458	458
Total	3,926	19,118	19,118	46,678	46,678	47,291	182,809	5,040	5,040

Source: Estimated by JICA Study Team

Table 12.7 Yearly Cash Flow of the Project Cost for Route – 3

Unit: Million Rp.

Route – 3 Arterial Road	Initial Investment							Overlay	
	1 st. year	2 nd. year	3 rd. year	4 th. year	5 th. year	6 th. year	Total	16 th. year	26 th. year
Financial Cost									
Construction Cost				7,825	7,825	7,825	23,476	1,090	1,090
Land Acquisition and Compensation		13,781	13,781				27,561		
Purchase of Maintenance Equipment						441	441		
Engineering	704			548	548	548	2,348	109	109
Sub – Total	704	13,781	13,781	8,373	8,373	8,815	53,826	1,199	1,199
Contingency	70	1,378	1,378	837	837	881	5,383	120	120
Total	775	15,159	15,159	9,210	9,210	9,696	59,209	1,319	1,319
Economic Cost									
Construction Cost				7,114	7,114	7,114	21,342	991	991
Land Acquisition and Compensation		13,781	13,781				27,561		
Purchase of Maintenance Equipment						309	309		
Engineering	640			498	498	498	2,134	99	99
Sub – Total	640	13,781	13,781	7,612	7,612	7,921	51,346	1,090	1,090
Contingency	64	1,378	1,378	761	761	792	5,135	109	109
Total	704	15,159	15,159	8,373	8,373	8,713	56,480	1,199	1,199

Source: Estimated by JICA Study Team

Table 12.8 Yearly Cash Flow of the Project Cost for Route – 4

Unit: Million Rp.

Route – 4 Arterial Road	Initial Investment							Overlay	
	1 st. year	2 nd. year	3 rd. year	4 th. year	5 th. year	6 th. year	Total	16 th. year	26 th. year
Financial Cost									
Construction Cost				46,183	46,183	46,183	138,550	11,398	11,398
Land Acquisition and Compensation		17,249	17,249				34,497		
Purchase of Maintenance Equipment						1,486	1,486		
Engineering	4,157			3,233	3,233	3,233	13,855	1,140	1,140
Sub – Total	4,157	17,249	17,249	49,416	49,416	50,902	188,388	12,538	12,538
Contingency	416	1,725	1,725	4,942	4,942	5,090	18,839	1,254	1,254
Total	4,572	18,973	18,973	54,358	54,358	55,992	207,227	13,792	13,792
Economic Cost									
Construction Cost				41,985	41,985	41,985	125,955	10,361	10,361
Land Acquisition and Compensation		17,249	17,249				34,497		
Purchase of Maintenance Equipment						1,039	1,039		
Engineering	3,779			2,939	2,939	2,939	12,596	1,036	1,036
Sub – Total	3,779	17,249	17,249	44,924	44,924	45,963	174,087	11,397	11,398
Contingency	378	1,725	1,725	4,492	4,492	4,596	17,409	1,140	1,140
Total	4,157	18,973	18,973	49,416	49,416	50,559	191,495	12,537	12,537

Source: Estimated by JICA Study Team

Table 12.9 Yearly Cash Flow of the Project Cost for Route – 5

Unit: Million Rp.

Route – 5 Arterial Road	Initial Investment							Overlay	
	1 st. year	2 nd. year	3 rd. year	4 th. year	5 th. year	6 th. year	Total	16 th. year	26 th. year
Financial Cost									
Construction Cost				45,340	45,340	45,340	136,021	3,039	3,039
Land Acquisition and Compensation		23,532	23,532				47,064		
Purchase of Maintenance Equipment						1,217	1,217		
Engineering	4,081			3,174	3,174	3,174	13,602	304	304
Sub – Total	4,081	23,532	23,532	48,514	48,514	49,731	197,904	3,342	3,342
Contingency	408	2,353	2,353	4,851	4,851	4,973	19,790	334	334
Total	4,489	25,885	25,885	53,366	53,366	54,704	217,694	3,677	3,677
Economic Cost									
Construction Cost				41,219	41,219	41,219	123,656	2,762	2,762
Land Acquisition and Compensation		23,532	23,532				47,064		
Purchase of Maintenance Equipment						851	851		
Engineering	3,710			2,885	2,885	2,885	12,366	276	276
Sub – Total	3,710	23,532	23,532	44,104	44,104	44,955	183,936	3,039	3,039
Contingency	371	2,353	2,353	4,410	4,410	4,495	18,391	304	304
Total	4,081	25,885	25,885	48,514	48,514	49,450	202,330	3,342	3,342

Source: Estimated by JICA Study Team

13. Environmental Impact Analysis

13.1 Background and Objectives

The Master Plan of the Arterial Road Development System in Surabaya Metropolitan Area was carried out by a series of activities designed to formulate how to enhance the road transportation network targeted at the year 2018. The plan consequently settled on five priority routes to be constructed urgently from the view point of regional economic growth.

Following the Master Plan study, a feasibility study was carried out of the five priority routes, with a total length of approximately 100 km shown in the following figure. The five routes include one toll road with an arterial road parallel to the toll road, and 4 arterial roads. The five routes pass mainly through urbanized areas in SMA region.

Referring to the Indonesian environmental legislation system as defined by Law No.4 (Article 16) of 1982, an Environmental Impact Assessment shall be carried out for proposed road projects of a certain scale in order to conserve the living environment. The Environmental Impact Assessment (Analisis Mengenai Dampak Lingkungan) is composed an Environmental Impact Analysis (Analisis Dampak Lingkungan: ANDAL), Environmental Management Plan (Rencana Pengelolaan Lingkungan: RKL) and Environmental Monitoring Plan (Rencana Pemantauan Lingkungan: RPL).

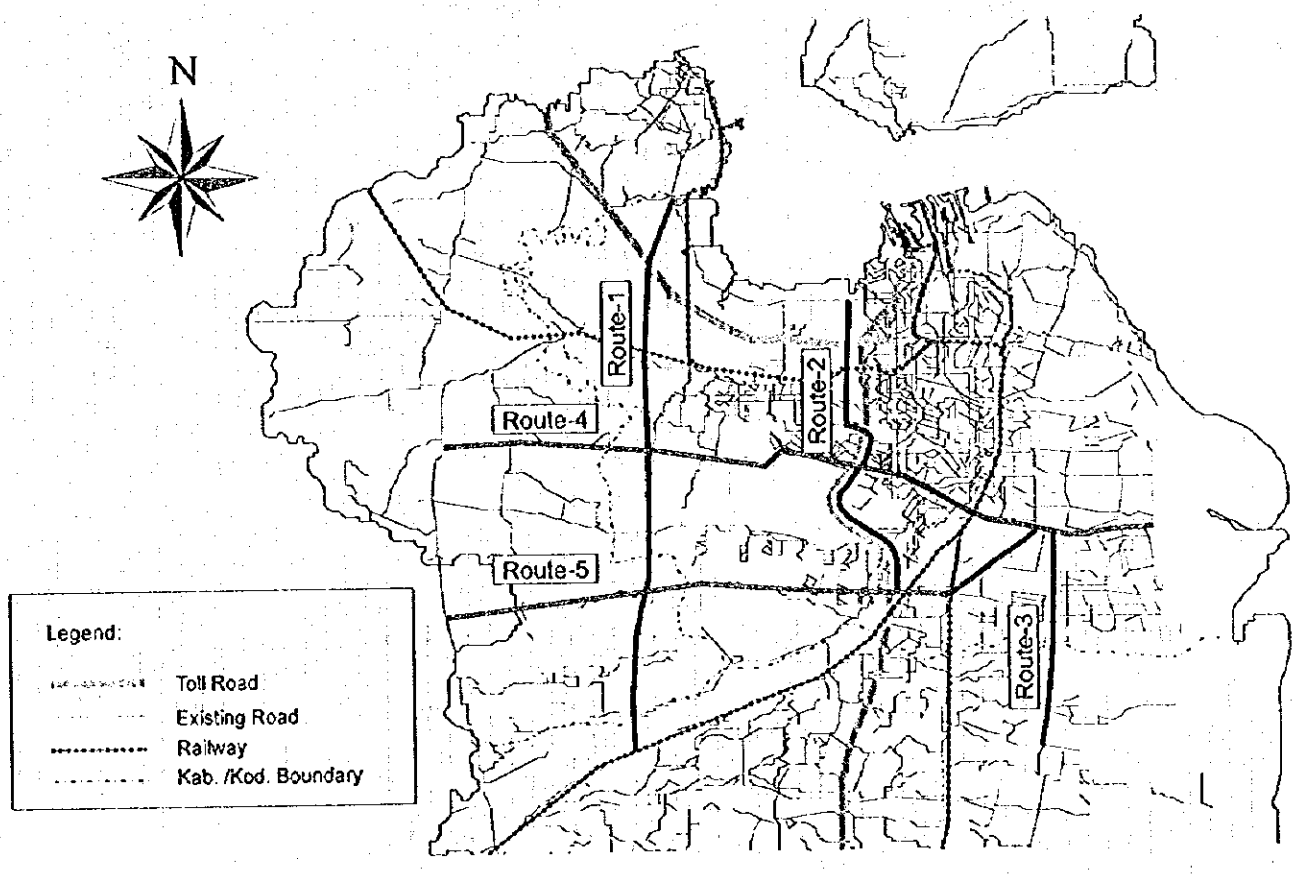


Figure 13.1 Location map of Subject Routes

13.2 Contents of Environmental Impact Analysis (AMDAL)

13.2.1 Legal Basis of Environmental Impact Analysis (AMDAL)

The Indonesian Government has an Environmental Impact Assessment System. In 1982, the principle of Environmental Management, which is prescribed in Law No. 4 "Basic Provisions for the Management of Living Environment", was established. An Environmental Impact Assessment (AMDAL) is prescribed in the Government Regulation "The Analysis of Environmental Impact" No. 29, 1986. The Regulation No. 29, 1986 was amended to Government Regulation No. 51, 1993.

An environmental impact study has the following objectives :

- to identify the proposed project activities which may have significant impact on the environment.
- to identify the existing environmental conditions which may be impacted by the proposed project.
- to estimate and evaluate the significant environmental impacts.
- to provide recommendations on environmental management and monitoring.

According to Government Regulation No. 51, the following activities and projects require an environmental impact assessment :

- change in land structure and landscape,
- exploitation of renewable and non-renewable natural resources,
- processes and activities which can potentially create depletion, degradation, and deterioration of natural resources,
- processes and activities which may affect the social and cultural environment,
- processes and activities which can interfere with the protection of natural resources or the conservation of natural heritage,
- introduction of plants, animals, and micro-organisms,
- production and use of biotic and non-biotic materials,
- application of technology which is predicted to have a potential effect on the environment,
- high risk activities which affect the defense of the state.

According to Regulation No. 51, 1993, environmental impact studies at the feasibility phase can be divided three categories: "need AMDAL study", "need Standard Operation Procedure", and "no need of environmental study". The subject Toll Road and Arterial Roads improvement projects in this feasibility study require an Environmental Impact Assessment in accordance with The Guidelines of AMDAL, Ministry of Public Works, by the project proponent.

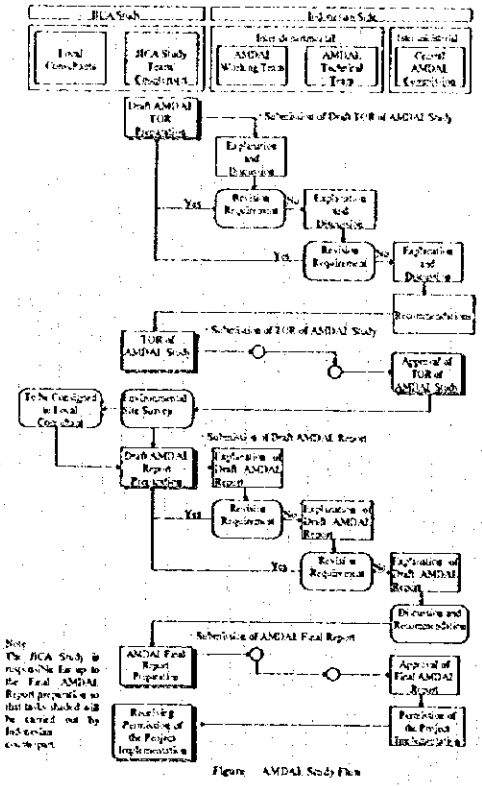
13.2.2 Implementation of Environmental Impact Analysis Study (AMDAL)

The procedure for an AMDAL Study is described in Management Guideline for Environmental Impact Assessment, Ministry of Public Works (58/KPTS/1995), Technical Guideline TOR Compilation (147/KPTS/1995), Technical Guideline Preparation of Environmental Management Plan and Environmental Monitoring Plan (148/KPTS/1995), and environmental and other related regulations. The AMDAL study requires the following steps:

- the project proponent presents TOR of AMDAL study to Working Group / Technical Team and Central AMDAL Commission.
- the project proponent carries out AMDAL study.

- the project proponent presents result of AMDAL study to Working Group / Technical Team and Central AMDAL Commission.

The JICA Study Team entrusted the execution of the AMDAL Study including internal administrative procedures, environmental condition survey for the subject projects area and environmental impact analysis, to a local consultant, PT. Wiratman & Associates recommended by the Directorate General of Highways, who worked under the supervision of the JICA Study Team in accordance with the JICA agreement. The local consultant began the AMDAL Study in December 1993.



	Member Organizations	
	Indonesian	English
1. Central AMDAL Commission	Badan Perencanaan Pembangunan Daerah Kantor Lingkungan Hidup Badan Pertanahan Nasional Universities Direktorat Bina Jalan Kota	Regional Development & Planning Agency Environment Agency National Land Agency Universities Ministry of Public Works
2. AMDAL Technical Team (Ministry of Public Works)	Inspektorat Jenderal Sekretariat Jenderal Ditjen Pengairan Ditjen Bina Marga Ditjen Cipta Karya Badan Litbang Pu	Inspector General Secretary General, Directorate General of Irrigation, Directorate General of Highways, Directorate General of Human Settlement Research and Development Agency
3. AMDAL Working Team (Directorate General of Highways Ministry of Public Works)	Bina Program Bina Teknik Bina Jalan Kota Bina Pelaksanaan Wilayah Tengah Bina Pelaksanaan Wilayah Timur	Directorate of Road Development Program, Directorate of Technical, Directorate of Urban Road Development Directorate of Implementation of Central Region Directorate of Implementation of Eastern Region

Figure 13.2 AMDAL Procedure and Members of Administrative Committee

13.2.3 The Study Contents

Items to be considered in the AMDAL can be classified under three components: a Physical and Chemical Component, a Biological Component and a Social Economic and Cultural Component. In accordance with the AMDAL Guidelines of the Ministry of Public Works, the items are as follows :

Physical-Chemical Environment Components

- Climate
- Topography / Geology / Soil
- Hydrology and Water Quality
- Air Quality
- Noise

Biological Components

- Flora / Fauna

Social - Economic and Social Cultural

- Demography and Community
- Economic Activities
- Land Use
- Transportation
- Public Facilities and Infrastructure
- Archaeology and Cultural Property

13.3 Important Environmental Impacts

Identification of impacts is aimed at understanding the impact potential that might be caused due to the relationship between project activities and environmental components. Utilizing matrix of project activities classified by project phase and environmental components, characteristics and the importance of the impacts are assessed based on the following:

Impact Characteristics

The impact characteristics are distinguished by positive and negative impacts. Positive impacts are defined beneficial to the environment while negative impacts are defined unfavorable.

Important Impacts

The criteria for importance of the impact referred to in the Guideline of Importance of Impact (Head of Bapedal Decree No. 056/1994) is defined as follows:

a. Total people affected by the impact

b. Area of impact significance

c. Duration of the impact

d. Impact intensity

e. Other environmental components affected by the impact

f. Cumulative impact characteristics, and

g. Reversible or irreversible nature of the impact

As a result of possible environmental impact identification and prediction, important impacts, both positive and negative, are assessed as follows:

Table 13.1 Summary of Possible Environmental Impact

Project Activity	Environmental Impact Prediction				
	R-1	R-2	R-3	R-4	R-5
1. Pre-construction Phase					
(1) Site Exploratory Survey					
1) Social Instability	N	N	N	N	N
(2) Land Acquisition					
1) Resettlement	N+	N+	N+	N+	N+
2) Social Instability	N	N	N	N	N
(3) Employment of Labor					
1) Economic Activities and Employment	P	P	P	P	P
2. Construction Phase					
(1) Mobilization of Heavy Equipment Activity					
1) Air quality and noise	N	N	N	N	N
2) Road Facilities	N	N	N	N	N
3) Traffic Congestion	N	N	N	N	N
(2) Material Transportation Activity					
1) Impact on Air Quality and Noise	N	N	N	N	N
2) Impact on Traffic Condition	N	N	N	N	N
3) Impact on Road Facility	N	N	N	N	N
(3) Demolition of Existing Structure					
1) Impact on Air Pollution and Noise	N	N	N	N	N
(4) Land Preparation					
1) Impact on Air Quality and Noise	N	N	N	N	N
2) Impact on Hydrology	N	N	N	N	N
3) Impact on Biology Aspect	N	N	N	N	N
(5) Road Construction Work					
1) Impact on Air Quality and Noise	N	N	N	N	N
2) Hydrology	N	N	N	N	N
3. Operation and Maintenance Phase					
(1) Existence of Road Structure					
1) Landscape and Land Use Pattern	P+	P+	P+	P+	P+
2) Economic Activities	P+	P+	P+	P+	P+
(2). Road Operation					
1) Air Quality and Noise	P/N	P/N	P/N	P/N	P/N
2) Traffic Flow	P	P	P	P	P
(3) Maintenance of Road					
1) Aesthetic	P	P	P	P	P
2) Amenity	P	P	P	P	P
3) Hydrology	P	P	P	P	P

Note: P: Positive Impact, N: Negative Impact, Intensity: no mark; insignificant, +; significant

13.4 Evaluation of Important Environmental Impacts

(1) Criteria of Impact Evaluation

One impact evaluation approach is to examine the characteristics and importance of predicted impacts.

The impacts defined as negative and positive, and significance and insignificance will be examined as direct or indirect impacts, and the relationship between project activities and the environmental condition. In particular significant negative impacts will be clarified in consideration of the source of the impacts and the structure.

(2) Evaluation and Handling of Impact

1) Pre-Construction Stage

Predicted impacts on the environment in the pre-construction stage are community unrest, resettlement, and public restlessness and perception caused by project preparation activities such as exploratory

survey and land acquisition for road construction. Resettlement is predicted as a significant negative impact, and community unrest and public restlessness and perception are also predicted as a insignificant negative impact. Evaluation of each impact is examined as follows:

Resettlement is quite a critical matter of social impact categorized in significant negative impact by the land acquisition activity. Households and buildings which are located in the project area are required to be resettled to alternative locations with appropriate compensation. Based on interview result, about 50 to 90% of respondents agreed to the project, however, they require compensation with market land price. At a similar project in the north-eastern part of Surabaya, some parts of a project have been suspended due to inappropriate compensation for land acquisition.

Community unrest and public restlessness and perception are predicted, and also social impact, in accordance with the initial activities of the project. These impacts affect the inhabitants in the project area and in the surrounding area. Once the project is announced, compensation for the related people and anxiety regarding their new environment will be discussed among them. According to project information, market land price will increase due to land speculation. Thus, the compensation process will be disturbed and an economic impact will result. Therefore public restlessness will be increased.

2) Construction Stage

As explained in the previous section, commencement of construction activity will involve heavy equipment mobilization, labor mobilization and construction of project offices. These activities will cause various impacts on the physical and social economic cultural environmental component.

Most of the impacts are categorized as insignificant negative and significant positive. They have local characteristics and occur over relatively short periods, and each impact has partial characteristic (not cumulative).

Environmental impacts are caused by a series of construction activities such as material transportation, land preparation and the construction work.

Other activities will accumulate such operation of heavy equipment, mobilization of laborers from their homes to the project location and operation of the project offices, where the air quality component will decrease, caused by pollutant gas emitted from heavy equipment, and also an increase in noise and dust affected by material transportation. Also the water flow pattern is disturbed due to filling activity and the surface water become turbid because of the fill material.

The mobilization of laborers and road construction activities will generally result in an impact on the business opportunity and economic activity. The existence of buildings such as small shops and residences, both temporary and semi-permanent, along the proposed road will cause a problem later, particularly the existence of unauthorized buildings.

Besides the above mentioned impacts, at the same time material transportation by heavy vehicles will increase traffic congestion and damage the road facilities.

After the road construction is completed, the supporting activities such as operation of heavy equipment, land preparation and operation of the base camp, also the frequency and intensity of market activity, will decrease. Thus the impact on air quality and the noise component will also be decreased. However construction of drainage channels and other auxiliaries will cause positive impacts on both the hydrology environment and the aesthetic environment components.

Part of the road alignment passes through a periodical flood area, thus the construction of drainage channels will decrease the flood area. Other auxiliary constructions will result in improvement of the environment such as green plants which will conserve the environmental aspects.

3) Post Construction Stage

The operation of the road will start after completion of the road construction. This will encourage various economic activities because of smooth transportation of freight and accessibility to economic centers. However, negative impacts such as air pollution and noise, change of land space and land use pattern in the project area are predicted.

Regarding air pollution and noise, a negative aspect is not only predicted but also a positive aspect. Travel speed will increase because of road improvement so that level of emissions will be decreased. Therefore, the road improvement can be a positive impact which encourages improvement of air pollution along the road.

13.5 Environmental Management Plan and Environmental Monitoring Plan

13.5.1 Efforts of These Plans

The projects will affect some significant impacts evaluated through impact identification and prediction in each project stage. It is necessary to mitigate the negative impacts and to encourage the positive impacts. It is therefore necessary that a comprehensive environmental management strategy be formulated. The impacts from each project activity are as follows :

(1) Pre-Construction Stage

During this stage, the following negative impacts are examined.

- Community unrest by exploratory survey
- Resettlement during the land acquisition activity which causes impact on loss of business place and livelihood.
- Public restlessness caused by incompatibility in compensation price that finally will obstruct the land acquisition.

(2) Construction Stage

During the construction stage, the following impacts are examined.

- Decreasing ambient air quality and increasing of noise level
- Water flow obstruction
- Existence of illegal semi-permanent buildings which will disturb the land use pattern.
- Disturbance of traffic
- Damage of road facilities
- Jealousy and social conflict
- Job opportunity
- Increasing economic and business opportunity

(3) Post Construction

During the post construction stage, the following impacts are predicted.

- Decreasing of air quality and increase of noise level
- Increasing of traffic flow
- Changing of landscape and land use pattern
- Increasing of economic/business opportunity activity

13.5.2 Environmental Mitigation

Impact mitigation will be carried out by using technological, social economic and institutional approaches as follows:

(1) Technological approach in the form of a technological system that is used to minimize negative impact and maximize positive impact. The approach in accordance with significant impacts covers :

- Provision of road marks and traffic signs in the area surrounding the location of activity to decrease the traffic congestion and to smooth traffic flow during the implementation activity.
- Selective methods and construction systems which are appropriate to decrease the air pollutant and noise level in the area surrounding the project location, such as bore pile system.
- Installation of drainage channels with appropriate dimension and fixed locations to prevent floods in the area surrounding the project activities.

(2) Social economic approach in the form of participation by local government, inhabitants and related agencies to initiate significant impacts, so that activity management could mitigate significant impact in accordance with proper requirements, such as :

- Determine the compensation system which is beneficial for local government
- Use local labor and materials to increase the project benefit for the local population.
- Environmental management will pay attention to the economic feasibility.

(3) Institutional approach in the form of increasing cooperation and coordination with various related institutions for mitigation of significant impacts. Thus the environmental management could be carried out effectively and efficiently.

- To handle problems which occur in the land and building compensation process, it is necessary to coordinate with BPN, related institutions at the local government of Pemda TK II Kod. Surabaya, Sidoarjo and Gresik provincial government and others.
- To prevent a negative perception by the local population at the stage of determination of compensation it is necessary to coordinate with various related institutions.

13.5.3 Environmental Management Plan

For significant impact mitigation, an Environmental Management Plan is proposed as a strategy to minimize the negative impact. Each planned activity is described by project stage as follows :

(1) Pre-Construction Stage

- Counseling and giving transparent information about the project activities to the population.
- Good coordination with local government and related institutions discussing the compensation process.
- Compensation to be given in visible and appropriate amount.
- Alternative business place to be provided for the subject inhabitants.

(2) Construction Stage

- Arranged appropriate execution of the construction, based on valid stipulations and local conditions.
- Trucks to cover soil and other construction material being transported.
- Remove public facilities and utilities from the project activity location, and be improve public utilities damaged by the project activity.
- A schedule of construction material transportation to be arranged taking into consideration traffic conditions around the project activity location.
- Temporary drainage channels to be constructed at fixed locations.

(3) Post Construction Stage

- Counseling and giving information to the population regarding traffic awareness and land utilization at the side of the road.
- Installing traffic signs and good traffic arrangements.
- Landscaping such as planting shade trees at the side of the road.
- Preparation of supporting facilities for social economic activities needed by the population.

13.5.4 Environmental Monitoring Plan

The environmental monitoring plan will be continued periodically during and after the project in order to audit quality of the environment in the project site.

(1) Pre-Construction Stage

- Complaints, responses and reactions of the population that are affected by the land and building acquisition to be examined.
- Land and building acquisition process to be observed at the project location.
- Economic activity to be observed at the area surrounding the project location.

(2) Construction Stage

- Air quality and noise parameter to be monitored.
- Drainage channel condition that exist in the area surrounding the project location to be observed.
- Traffic volume at the main road and in the area surrounding the project location to be observed.
- Road condition at the main road and in the area surrounding the project location to be observed.
- Possibility of jealousy and social conflict to be observed.
- Priority of job opportunities in the project area to be observed.
- Responses from road users and the population in the area surrounding the project to be observed.

(3) Post Construction Stage

- Air quality and noise level to be monitored.
- Land utilization to be periodically identified and monitored.
- Development and economic activities in the project area to be observed.
- Condition and flow of traffic in the main road and access roads to be observed.
- Attention to be paid to the response from the road users and the population in the area surrounding the project location.

13.6 Next Steps to be Taken

As a result of the environmental impact analysis study, significant negative impacts, such as resettlement in the pre-construction stage, impact on existing road facilities in the construction stage and deterioration of ambient air quality and noise in the operation stage, are pointed out. The following recommendations are considered for implementation of the projects.

(1) Smooth Implementation of Land Acquisition and Relocation

An additional social interview survey should be carried out in order to obtain detailed information about the inhabitants. A similar project nearby the proposed alignment in Kenjeran - Rangkhan Street and Banyu Urip Street in the eastern part of Surabaya which are loan projects by OECF and the World Bank have been suspended due to the land acquisition process because the compensation budget was incompatible with the market land price. The result will be used for a detailed examination of the social impact in the subject area in order to achieve smooth implementation of the project. The appropriate organization should be paying careful attention to this matter.

(2) Application of New Institutional Infrastructure Development System

Due to the difficulty of land acquisition, an alternative institutional infrastructure system should be examined taking into consideration equal economic distribution. For the encouragement of proper economic development, the infrastructure is a basis for investment so that a new concept of the development system should be adopted.

(3) Mitigation of Poor Ambient Air and Noise Abatement During Construction

The implementation program should make efforts to mitigate poor ambient air quality and to abate noises by the construction activities affecting the inhabitants in the surrounding area. Mobilization of heavy equipment and transportation of materials will cause various negative impacts related to air and noise. It is recommended that comprehensive implementation taking into consideration environmental conservation will be examined.

(4) Landscaping for the Roads to Enhance the Environment

Green plants which can mitigate air pollution by biological and physical aspects should be utilized. These plants will effect not only the aesthetic factor but will also effect mitigation of air pollution by the plant absorbing carbon dioxide. In addition, group planting by vertical and hierarchical methods in consideration of detailed climatic conditions is highly effective in preventing mitigation of direct emission flow from roads to the road side. Thus this aspect should be examined in the detailed design stage.

14. Project Economic and Financial Analysis

14.1 Project Economic Analysis

(1) General

The main purpose of the project economic analysis is to show the effect of the "Arterial Road System Development in GERBANG KERTOSUSILA Region" from the nation's economic well-being viewpoint and to estimate the expected economic internal rate of return on the resources invested. The evaluation is an assessment of the economic viability of the following five selected arterial roads as priority routes (objectives of the feasibility study) out of the proposed routes in the master plan.

1) Route-1 (combination of arterial road and toll road)
2) Route-2
3) Route-3
4) Route-4
5) Route-5

The evaluation for the above five routes will be made independently for each project in this economic analysis. For evaluation purposes, the net present value (NPV) and the benefit-cost ratio (B/C ratio) under certain discount rate, as well as the economic internal rate of return (EIRR), will be demonstrated.

(2) Economic Benefits

The economic benefits quantified for the analysis were the savings in travel costs composed of vehicle operating costs and vehicle time costs, when comparing the "With" and "Without" project conditions.

1) Vehicle Operating Costs

Unit vehicle operating costs were estimated for 9 categories of vehicles, i.e., sedan, minibus (private), van (private), pick-up, small/medium trucks, large truck, minibus (public), large bus (public) and motorcycle, based on the analysis of the cost components of the representative vehicles selected for each category.

The unit vehicle operating costs of the 9 vehicle categories were then combined into 5 vehicle categories of private passenger car, truck, public minibus, public large bus and motorcycle, following the classifications for traffic assignment, based on the vehicle composition rates obtained from the traffic survey conducted by the Study Team. The unit vehicle operating costs by vehicle category and by traveling speed are summarized in Table 14.1.

Table 14.1 Unit Vehicle Operating Costs

(Rp. Vehicle-km)

Speed (Km/Hour)	Private Passenger Car	Mini Bus	Large Bus	Truck	Motorcycle
10	785	595	1,566	804	109
15	596	475	1,307	627	84
20	495	407	1,180	533	70
25	429	361	1,109	474	61
30	383	329	1,068	434	55
35	349	305	1,047	406	50
40	322	287	1,038	385	46
45	302	274	1,040	370	43
50	285	266	1,050	360	40
55	273	262	1,066	355	39
60	264	261	1,089	352	37
65	257	264	1,116	352	37
70	253	270	1,148	355	37
75	251	280	1,185	360	37
80	250	292	1,225	367	37
85	252	307	1,269	377	38
90	255	325	1,317	388	40
95	260	346	1,369	402	41
100	266	370	1,423	417	43

Note: Economic costs in 1997 prices.
Source: Estimated by the Study Team.

2) Unit Vehicle Time Costs

The estimation method of unit vehicle time costs of passenger car, motorcycle and buses (public mini bus and public large bus) for this study is based on an income approach. The unit vehicle time cost of truck is estimated based on the time cost of commodities and crews.

For passenger car and motorcycle, an income approach to estimate car owner's time value was adopted. For the estimation of monthly income of car owners (passenger car and motorcycle), the results of the traffic survey conducted by the Study Team were utilized. For buses, an income approach to estimate non-car owner's time value was adopted.

The estimated unit vehicle time costs are summarized in Table 14.2.

Table 14.2 Unit Vehicle Time Costs

(Rp. / Vehicle-hour)

	Economic Price
Passenger Car	9,270
Motorcycle	2,210
Mini Bus	6,430
Large Bus	32,110
Truck	2,120

Note: Economic costs in 1997 prices.
Source: Estimated by the Study Team.

(3) Estimation of Economic Benefits

Based on the daily vehicle-kilometers and vehicle-hours by vehicle type in the "with" and "without" project conditions calculated through the traffic assignment process in traffic forecast and the unit vehicle operating costs and unit vehicle time costs obtained as described above, the economic benefits (savings in travel costs) were estimated as summarized in Table 14.3.

Table 14.3 Estimated Economic Benefits for Each Route

(Billion Rp. / Year)

	Year	Economic Benefits of Saving in :		Total Benefits
		Vehicle Operating Costs	Time Costs	
Route-1	2008	157.1	181.0	338.1
	2018	240.4	288.6	529.0
Route-2	2008	26.9	49.4	76.3
	2018	46.4	66.4	112.8
Route-3	2008	11.1	12.7	23.8
	2018	14.9	18.7	33.6
Route-4	2008	39.1	60.8	99.9
	2018	52.3	66.7	119.0
Route-5	2008	53.1	49.3	102.4
	2018	77.0	60.8	137.8

Source: Estimated by the Study Team.

(4) Economic Costs

The initial project costs for engineering services, construction and land acquisition costs of the project for each route are estimated in constant 1997 prices as shown in Table 14.4.

Table 14.4 Initial Project Costs in 1997 Prices

(Billion RP.)

	Financial Price	Economic Price
Route-1	934.3	855.9
Route-2	197.5	182.8
Route-3	59.2	56.5
Route-4	207.2	191.5
Route-5	217.7	202.3

Source: Estimated by the Study Team.

(5) Economic Cost-Benefit Analysis

1) Basic Assumptions

The implementation schedule in this economic analysis was assumed as below considering the equalization of evaluation results for each route:

a) The implementation of each project (Route-1 to Route-5) is assumed to be carried out independently of each other.

b) The implementation schedule is assumed similarly for each Project to be 1998 to 2003:

Design :1 year

Land acquisition	:2 years
Construction	:3 years
Total	:6 years

The economic project costs in constant 1997 prices are phased according to the implementation schedule and the above assumptions.

2) Results of Economic Cost-Benefit Analysis

The economic analysis results are shown in Table 14.5.

Table 14.5 Economic Analysis Results at Discount Rate of 15% Per Annum

	Route-1	Route-2	Route-3	Route-4	Route-5
EIRR	26.7%	26.5%	23.9%	31.0%	29.5%
NPV (Billion Rp.)	595.0	134.1	37.5	185.6	194.7
B/C Ratio	2.3	2.3	2.1	2.7	2.7

Source: Estimated by the Study Team.

The above results indicate that all the projects of the five routes are economically feasible.

(6) Sensitivity Analysis

Altering benefit and cost (initial investment cost), the effect on the EIRR was analyzed and the results are shown in Table 14.6.

Table 14.6 EIRR by Altered Benefit and Cost

	Route-1	Route-2	Route-3	Route-4	Route-5
Base Case	26.7%	26.5%	23.9%	31.0%	29.5%
Cost +10%	25.1%	25.0%	22.6%	29.1%	27.8%
Cost +20%	23.7%	23.6%	21.4%	27.5%	26.3%
Benefit -10%	24.9%	24.8%	22.5%	28.9%	27.6%
Benefit -20%	23.0%	23.0%	20.9%	26.7%	25.6%
Cost +10% and Benefit -10%	23.4%	23.3%	21.2%	27.2%	26.0%
Cost +20% and Benefit -20%	20.3%	20.4%	18.6%	23.6%	22.7%

Source: Estimated by the Study Team.

14.2 Project Financial Analysis

(1) General

The principal objective of the project financial analysis is to evaluate the financial viability of the implementation of the construction and operation of the proposed Gresik - Driyorejo Toll Road Project (a part of the toll road in Route-1).

This analysis has been performed based on estimations in terms of revenues and construction and

operation / maintenance costs. Additionally, financial conditions of the required funds have been examined and assumed.

Based on the said estimations and assumptions, the profit and loss statement and the cash flow were tabulated, and the first year of continuous annual surplus and continuous accumulated surplus were examined. As the evaluation indicators of financial viability, the financial internal rate of return (FIRR) and net present value (NPV) are demonstrated.

For calculation of FIRR, Return on Investment (ROI) and Return on Equity (ROE) were examined. ROI is an indicator which measures return on the total investment regardless of fund raising conditions, while ROE is an indicator in which a return on equity invested is estimated taking fund raising conditions into account.

(2) Basic Assumptions

The following assumptions were made:

1) Management Body

The construction and operation of the Toll Road will be performed by a joint venture corporation comprising private investors and Jasa Marga with a BOT (Build, Operate and Transfer) scheme.

2) Implementation Schedule

The implementation schedule is assumed to be 1998 to 2003:

Design	: 1 year
Land acquisition	: 2 years
Construction	: 3 years
Total	: 6 years

3) Project Life

The start of operation of the whole of the Toll Road is scheduled to be 2004. The project life is assumed to be 30 years after inauguration of the whole operation of the Toll Road.

(3) Toll Revenues

1) Toll Rates

Taking the current information of toll tariffs concerning the existing toll roads (Surabaya - Gempol Toll Road and Surabaya - Gresik) and the planned toll roads (Eastern Surabaya Ring Toll Road and Central North - South Toll Road) into consideration, the toll tariffs of the proposed Gresik - Driyorejo Toll Road are assumed at a flat tariff system as below:

Vehicle Type	Weighted Average Toll Tariff (at 1997 price)
Sedan / Minibus	Rp. 2,500
Truck	Rp. 4,000
Large Bus	Rp. 3,750

The growth ratio of tariff increase was assumed to be 17% every two years.

Based on the results of traffic assignment and the assumed tariff, the toll revenues for the planning years

were estimated as below:

Unit: Million Rp. (Vehicle)

Year	:	Passenger Car		Truck		Total Revenue	
2008	:	135,877	(63,096)	16,443	(4,793)	152,320	(67,889)
2018	:	359,382	(75,739)	90,993	(12,043)	450,375	(87,782)

Note: Figures in ( ) stand for the number of toll users (vehicle basis).

(4) Financial Project Costs

1) Project Cost

Based on the results of the cost estimates, the financial project cost related to the initial investment at 1997 constant price was estimated as summarized in Table 14.7.

In this financial analysis, a price escalation rate of 6% per annum was assumed for each cost item, and the financial escalated annual initial investment costs are phased in accordance with the implementation schedule.

2) Assumption on Options for Initial Investment Costs

Some options regarding the initial investment costs are assumed.

The Gresik - Driyorejo Toll Road has sections of access roads as below:

a) Northern part :about 4.8 Km
b) Southern part:about 0.5 Km

These access roads function both as the access road to the toll road and as an arterial road itself. The management of the access roads will be transferred to the proper authority concerned after completion.

The option regarding the initial investment costs is the case in which the initial investment costs (construction and land acquisition costs) related to such access roads are excluded from the Project cost. (The Project costs as a cost base case means the costs including the section of such access roads.) In this financial analysis, two options are assumed as below:

a) Option case-1 : Excluding half of the costs of construction and land acquisition related to the sections of access roads (arterial roads) to the toll road.

b) Option case-2 : Excluding all the costs of construction and land acquisition related to the sections of access roads (arterial roads) to the toll road.

A comparison of initial investment costs between base case, option case-1 and option case-2 is summarized in Table 14.7.

Table 14.7 Comparison of Initial Investment Costs between Base Case, Option Case-1 and Option Case-2 at 1997 Constant Prices

(Million Rp. at 1997 Prices)

	Base Case	Option Case-1	Option Case-2
Design	18,003	15,543	13,082
Construction	600,113	518,087	436,061
Toll Equipment	3,328	3,328	3,328
Supervision	42,008	36,266	30,524
(Subtotal)	(663,452)	(573,224)	(482,995)
Land Acquisition	53,136	48,486	43,836
(Total)	(716,588)	(621,710)	(526,831)

Source: Estimated by the Study Team.

(5) Cash Flow Analysis

Six cases are examined in the financial analysis for the combination of three cases for the initial investment costs and two cases for the equity / loan ratio as below:

Cases of Financial Analysis

Cost	Equity / Loan Ratio	Case No.
Cost Base Case	40% : 60% 30% : 70%	(a) (b)
Cost Option Case-1	40% : 60% 30% : 70%	(c) (d)
Cost Option Case-2	40% : 60% 30% : 70%	(e) (f)

The loan is assumed to comprise off-shore loan and on-shore loan, and the weighted average interest rate is estimated to be approximately 11%.

(6) Financial Analysis Results

Table 14.8 shows a summary of the financial analysis results for the above cases.

Table 14.8 Summary of Financial Analysis Results

		Cost Base Case		Cost Option Case-1		Cost Option Case-2	
Equity / Loan Ratio		40%:60%	30%:70%	40%:60%	30%:70%	40%:60%	30%:70%
Case No.		(a)	(b)	(c)	(d)	(e)	(f)
FIRR	ROI (%)	16.9%	16.9%	18.2%	18.2%	19.9%	19.9%
	NPV (Million RP.) (15% discount rate)	118,010	118,010	182,597	182,597	247,186	247,186
FIRR	ROE (%)	16.7%	17.4%	18.4%	19.1%	20.6%	21.5%
	NPV (Million Rp.) (15% discount rate)	65,591	85,708	117,875	129,435	170,206	178,823
First Year of Surplus (Year)							
1) Annual Surplus in Profit & Loss		2009	2011	2008	2009	2007	2008
2) Accumulated Surplus in Profit & Loss		2013	2016	2011	2013	2009	2010

Source: Estimated by the Study Team.

(7) Financial Evaluation

1) Consideration of Cost Option Cases

As shown in Table 14.8 above, to improve the financial soundness of the Project, "cost option case-2" is the most desirable, followed by "cost option case-1" and "cost base case".

When considering the characteristics of the access roads of the proposed Toll Road, which also function as arterial roads, it is regarded unreasonable that the joint venture corporation will bear all the costs related to the said access roads ("cost base case"). On the other hand, it is considered unrealistic that all the costs related to the access roads will be exempted for the joint venture corporation ("cost option case-2").

Accordingly, cost halving such as "cost option case-1" is considered practical. Consequently, "cost option case-1" is recommended from a financial soundness viewpoint.

2) Sensitivity Analysis

a) Sensitivity to Cost and Revenue

i) Cases for Sensitivity Analysis

A sensitivity analysis was carried out for variations of the cost (initial investment cost) and revenue for the case of equity / loan ratio of 30%:70% in the cost option case-1, that is Case No. (d). The following cases are assumed:

Case 1 : A cost overrun of 10%.

Case 2 : A 10% decrease in revenue.

Case 3 : Combination of Case 1 and Case 2 above.

ii) Analysis Results

The results of the sensitivity analysis are summarized in Table 14.9. As can be seen, a 10% decrease in revenue would have a slightly greater effect than a 10% increase in cost.

b) Sensitivity to Interest Rate

i) Cases for Sensitivity Analysis

A sensitivity analysis was carried out altering the weighted average interest rate of long-term loan to 15% and 20% by changing the composition ratio of on-shore loan and off-shore loan for the case of equity / loan ratio of 30%:70% in the cost option case-1, that is Case No. (d).

ii) Analysis Results

The results of the sensitivity analysis are summarized in Table 14.9. In case of interest rate of 15%, the first year of accumulated surplus in the profit and loss statement and the first year of annual surplus in the cash flow appear in 2016 and 2017, respectively.

In case of interest rate of 20%, the first year of accumulated surplus in the profit and loss statement and the first year of annual surplus in the cash flow both appear in 2023.

Table 14.9 Summary of Financial Sensitivity Analysis Results

		Cost Option Case-1					
Equity / Loan Ratio		30%:70%	30%:70%	30%:70%	30%:70%	30%:70%	30%:70%
		Base Case of (d)	Cost +10%	Revenue -10%	Cost +10% and Revenue -10%	Weighted Average Interest Rate = 15%	Weighted Average Interest Rate = 20%
Case No.		(d)	(d-s1)	(d-s2)	(d-s3)	(d-s4)	(d-s5)
FIRR	ROI (%)	18.2%	17.4%	17.2%	16.4%	18.2%	18.2%
	NPV (Million RP.) (15% discount rate)	182,597	144,052	117,679	79,134	182,597	182,597
FIRR	ROE (%)	19.1%	18.1%	17.8%	16.8%	17.3%	15.4%
	NPV (Million Rp.) (15% discount rate)	129,435	103,401	85,441	61,156	78,024	14,480
First year of Surplus (Year)							
1) Annual Surplus in Profit & Loss		2009	2010	2010	2012	2011	2016
2) Accumulated Surplus in Profit & Loss		2013	2015	2015	2018	2016	2023

Source : Estimated by the Study Team.

3) Financial Evaluation

The FIRR calculations for the "cost base case" and "cost option case-1" are about 17 - 18% for ROI and about 17 - 19% for ROE. Only in the "cost option case-2", is FIRR about 20% for ROI and 21% for ROE. These figures are similar to or lower than the prevailing level of interest rates on loans in commercial banks in Indonesia which range from 18% to 20%.

The above comparison shows that the results of the financial analysis are not so optimistic while the prevailing level of interest rates remains.

Consequently, it is required to raise a loan fund with a possibly lower level of interest rate. To achieve this, the most likely alternative way is fund raising not domestically but off-shore.

For promoting the above, it is recommended that the Government arranges a more incentive investment environment for encouraging foreign investors.

For BOT (Build, Operate and Transfer) projects, one of the ways to achieve the above is "including a security package" in the BOT contract.

The concept of a "security package" is summarized below:

In a BOT contract, both private investors and Jasa Marga make an agreement regarding such conditions as land acquisition, tariff formula, tariff approval and approval from the Indonesian Offshore Borrowing Committee.

In the case that some items of agreement are not satisfied, the private investor can request some compensation from Jasa Marga.

15. Conclusion and Recommendations

15.1 Feasibility of the Projects

The selected project roads are technically and economically feasible. Gresik-Driyorejo Toll Road in Route-1 is not so optimistic in financial viability, indicating an ROI (Return on Investment) of 18.2%, ROE (Return on Equity) of 19.1%, and the annual surplus in profit and loss falling in the 5th year from the opening year of 2004. Efforts to reduce the cost, such as sharing the cost of access road construction with housing developers adjacent to the Toll Road, or to prepare a security package to attract more foreign investors/bankers are essential to keep the toll road operation financially sound in the long term.

15.2 Implementation Plan

Most important elements for implementation of implement the projects are fund sources and executing agencies. These elements are summarized for the respective projects as follows:

Project Roads	Fund Source	Executing Body
Route-1 (Toll Road)	Private Sector / Housing Developer	Private Sector
(Artery)	APBN / Housing Developer	DGH
Route-2	APBD / Two-step Loan	Kotamadya Surabaya
Route-3	APBN / Foreign Loan	DGH
Route-4	APBD / Foreign Loan / Housing Developer / (APBN)*	DINAS PU-Bina Marga / DGH
Route-5	APBD / Foreign Loan / Housing Developer / (APBN)	DINUS PU-Bina Marga / DGH

Note: (APBN)*: The Project can be supported by APBN

GERBANGKERTOSUSILA REGION (SURABAYA METROPOLITAN AREA) SUMMARY