CHAPTER 15 ENVIRONMENTAL IMPACT STUDY

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ENVIRONMENTAL IMPACT STUDY

15.1 Background and Objectives

A 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 for the five priority routes, with a total length of approximately 100 km as shown in Figure 15.1.1. The five routes are including one toll road with a parallel arterial road, and other 4 arterial roads. The five routes pass mainly through urbanized area in the Surabaya Metropolitan Area (SMA).

According 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: AMDAL) is composed of an Environmental Impact Analysis (Analisis Dampak Lingkungan: ANDAL), Environmental Management Plan (Rencana Pengelolaan Lingkungan: RKL) and Environmental Monitoring Plan (Rencana Pemantauan Lingkungan: RPL).

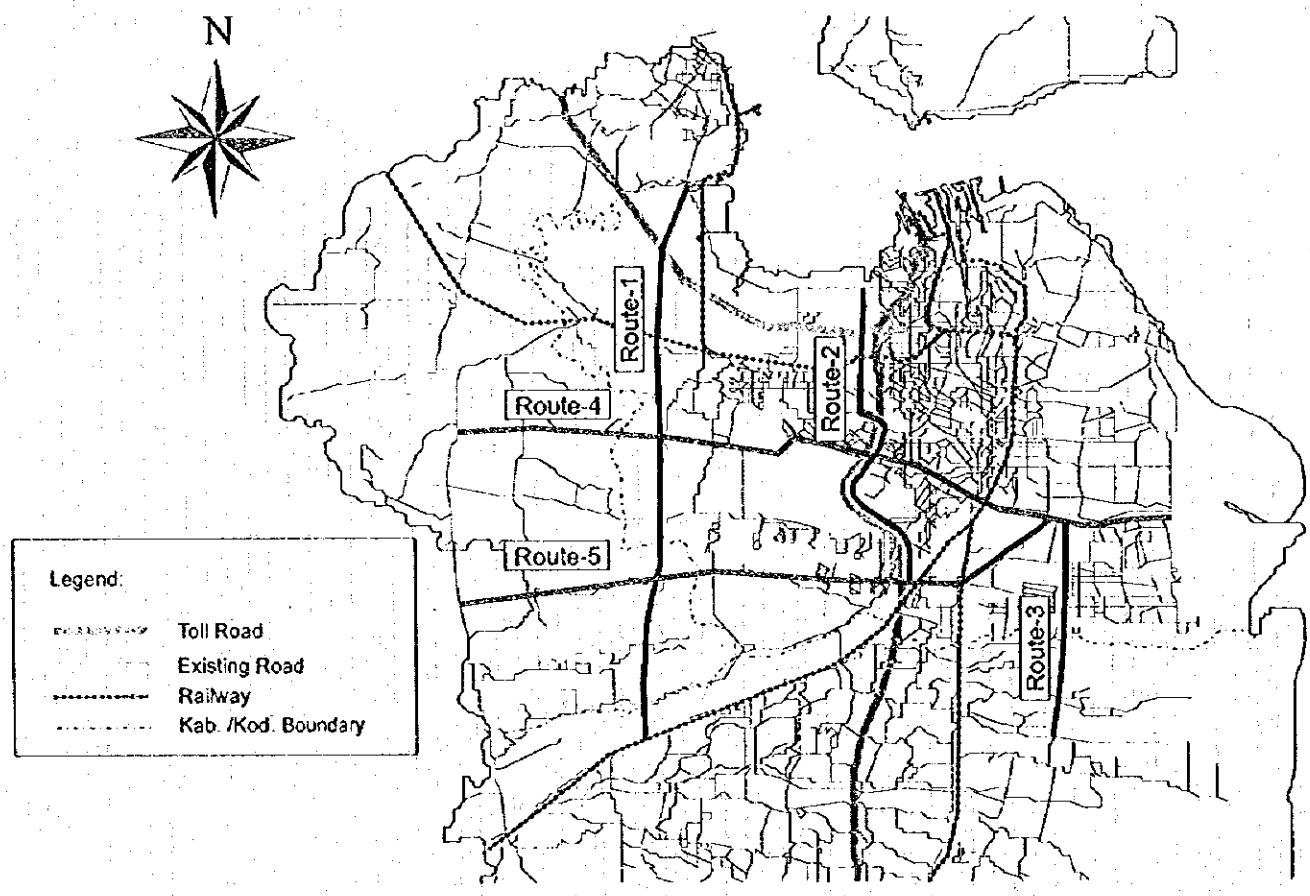


Figure 15.1.1 Location Map of Subject Routes

15.2 Contents of Environmental Impact Assessment

15.2.1 Legal Basis of Environmental Impact Assessment

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 the 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.

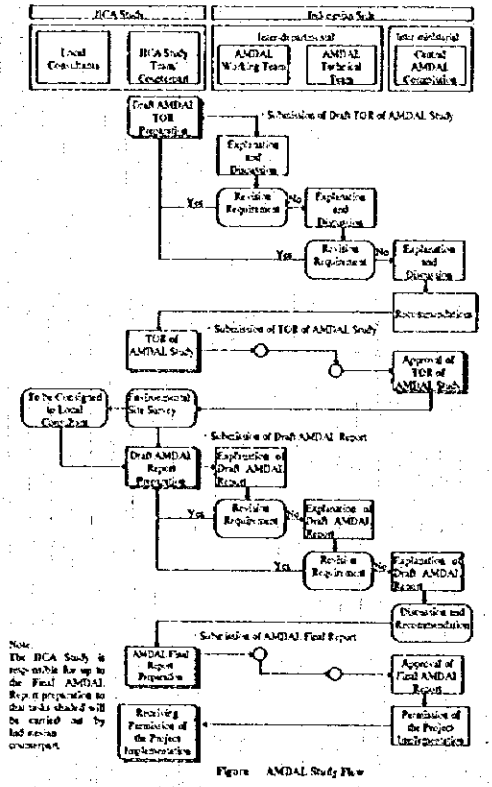
According to the Regulation No. 51, 1993, environmental impact studies at the feasibility phase can be divided into three categories: "need AMDAL study", "need Standard Operation Procedure", and "no need of environmental study". The subject Toll Road and Arterial Roads Improvement Projects in this Feasibility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

15.2.2 Implementation of Environmental Impact Assessment

The procedure for a Environmental Impact Assessment (AMDAL) 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) of Environmental and other related regulations. The AMDAL study requires the following steps:

- the project proponent presents Terms of Reference (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 to the execution of the AMDAL Study (including internal administrative procedures, environmental condition survey for 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 1996.



	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 15.2.1 AMDAL Procedure and Member of Administrative Committee

15.2.3 The Study Contents

Items to be considered in the AMDAL can be classified under three components: 1) Physical and Chemical Components; 2) Biological Component; and 3) Social, Economic and Cultural Components. In accordance with the AMDAL Guidelines of Ministry of Public Works, the study items are as follows :

Physical-Chemical Environment Components
- Climate
- Topography / Geology / Soil
- Hydrology and Water Quality
- Air Quality
- Noise

Biological Components
- Flora / Fauna

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

15.2.4 Environmental Management Plan and Environmental Monitoring Plan

(1) Environmental Management Plan (RKL)

The RKL consists of a basic guidance on environmental management, based on environmental study

results. The RKL should be prepared in detail and as completely as possible, covering:

- Type of impact that should be managed.
- Approach of arrangement, control and management for minimizing negative impacts and maximizing positive impacts.
- Duty and responsibility of the project owner and related institutions in the management implementation.

(2) Environmental Monitoring Plan (RPL)

The RPL consists of a basic guidance on environmental monitoring, based on environmental study results. The RPL should be prepared in detail and as completely as possible, covering:

- Type of environmental components that should be monitored.
- Approach of arrangement, control and monitoring of the environment components, location, period/duration and the responsible agency.
- Duty and responsibility of the project owner and related institutions in the monitoring implementation.

15.3 Profile of Subject Projects

15.3.1 Route -1

Route-1 comprises a toll road and an arterial road. Route-1 is designed on a North-South axis which is located in the western part of Surabaya close to the municipal boundary of Gresik and Surabaya, and it runs from North-West Surabaya to South-West Surabaya close to the municipal boundary of Sidoarjo and Surabaya. A total a length of the route is 21 km with 103 m ROW (Right of Way). Surabaya municipality has set 55 m ROW on a proposed alignment, but Gresik and Sidoarjo have not set it yet. A few parts of this route is rehabilitated, while most parts of this route is newly developed. The Route-1 crosses the proposed Route-4 at STA 10+300 and connects with Route -5 at STA 21+015, i.e. end of the Route-1.

Table 15.3.1 Route Description Route-1

Station	Length (km)	ROW (m)
STA 0+200 (Boundary of Kod. Surabaya and Gresik) - STA 2+700	2,500	103 (55)
STA 2+700 (Romo Kalisari IC) - STA 6+550 (Jl Sememi)	3,850	103 (55)
STA 6+550 (Jl Sememi) - STA 10+300 (Route-4)	3,750	103 (55)
STA 10+300 (Route-4) - STA 12+800 (Jl. Raya Menganti)	2,500	103 (55)
STA 12+800 - STA 13+900 (Boundary of Kod. Surabaya and Gresik)	1,100	103 (55)
STA 13+900 - STA 15+280 - STA 17+450 (Kota Baru Driyorejo)	3,550	103 (55)
STA 17+450 - STA 19+970 (Boundary of Gresik and Sidoarjo)	2,520	103 (55)
STA 19+970 (Boundary of Gresik and Sidoarjo) - STA 21+015	1,045	103 (55)
TOTAL	20,815	

Note: Required ROW (Existing ROW)

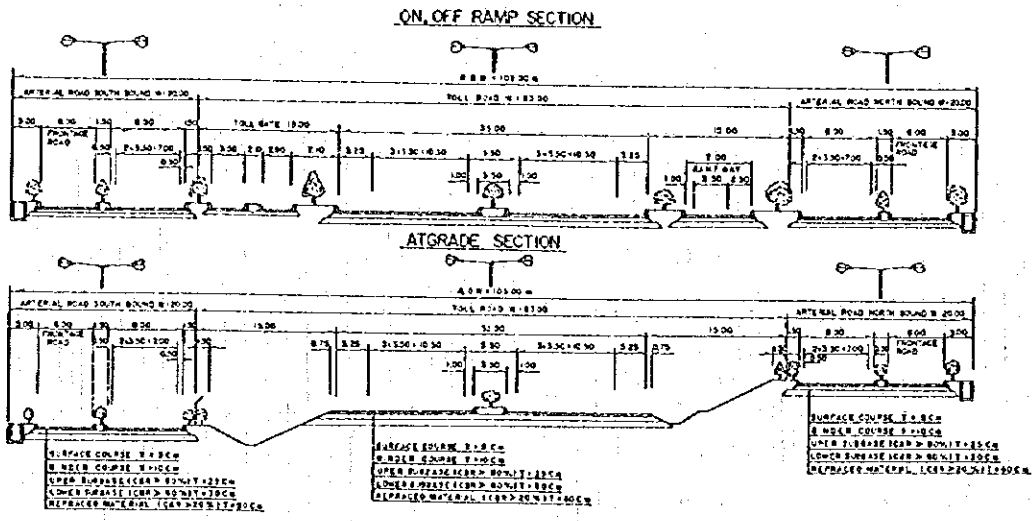


Figure 15.3.1 Typical Cross Section of Route -1

15.3.2 Route -2

Route-2 alignment runs from Jl.Gresik near the port to Waru in the southern part of Surabaya. The total proposed length is about 13 km and most of the Route-2 alignment is parallel to the existing toll road connecting north and south as does the toll road. The northern part of the route is designed for two-way traffic, while the southern part of the route has been split into the eastern and western sides of the existing toll road, each carrying in a single traffic direction to constitute a two-way road configuration linking to the northern section. Surabaya municipality has set 20 m ROW with 4 lanes, and 6.2 km length in the northern part; and it has also set two 20 m ROWs with 2 lanes in each ROW, and 7.1 km length in the southern part.

Table 15.3.2 Route Description Route-2

Station	Length (km)	ROW (m)
STA 0+000 - STA 6 +160	6,160	20 (20)
STA 0+000 - STA 7+150 (Route-2 North Bound)	7,150	20 (20)
STA 0+000 - STA 7+117 (Route-2 South Bound)	7,117	20 (20)
Total	13,310(13,277)	

Note: Required ROW (Existing ROW)

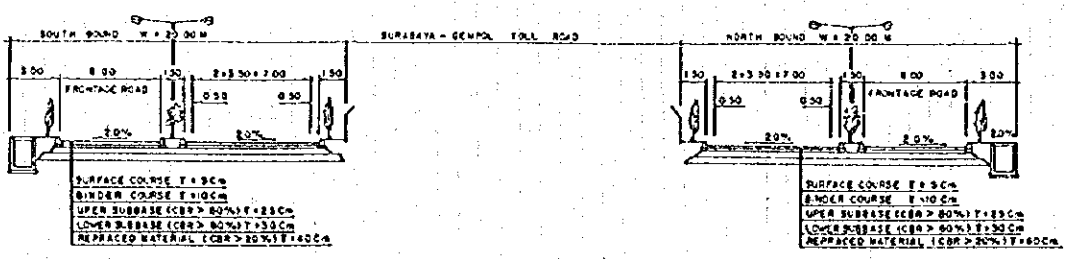


Figure 15.3.2 Typical Cross Section of Route -2 (One-way Section)

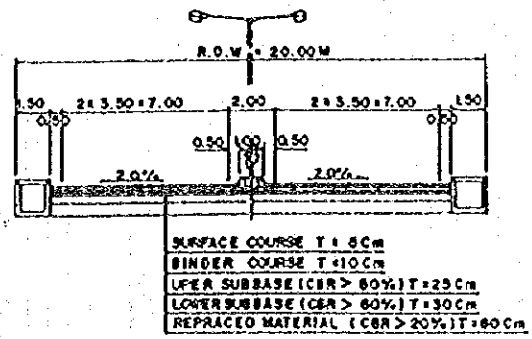


Figure 15.3.3 Typical Cross Section of Route -2 (Two-way Section)

15.3.3 Route -3

Route-3 is 25 m wide with 4 lanes and 8 km length. The alignment expands from the south-eastern part of Surabaya to the northern part of Sidoarjo, in the direction of Juanda Airport. A proposed area lies along the existing road, and the ROW has been set at 25 m in Surabaya area, while it has not been set yet in Sidoarjo area.

Table 15.3.3 Route Description Route-3

Station	Length (km)	ROW (m)
STA 0+000 - STA 3+550 (Boundary of Kod. Surabaya and Sidoarjo)		25 (25)
STA 3+550 (Boundary of Kod. Surabaya and Sidoarjo) - STA 8+125		25 (25)
TOTAL	8.125	

Note: Required ROW (Existing ROW)

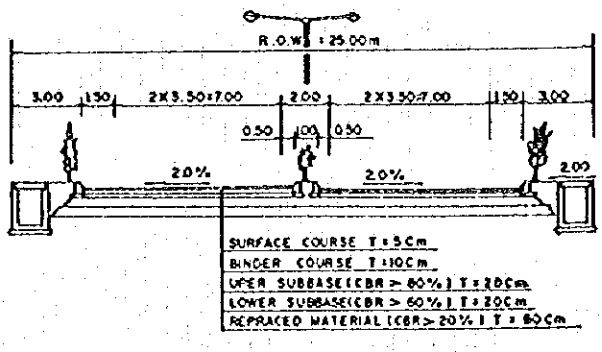


Figure 15.3.4 Typical Cross Section of Route -3

15.3.4 Route-4

Route- 4 alignment runs from the eastern part of Surabaya to the western suburban area of Surabaya through the traffic center of Wonocro area. The route is 27 km long, and either 35 m or 40 m wide. A busway is proposed in the central part of the road.

Table 15.3.4 Route Description Route-4

Station	Length (km)	ROW (m)
STA 0-600 - STA 5+800 (Boundary of Gresik and Kod. Surabaya)		40 (0)
STA 5+800 - STA 7+220 (Crossing point with Route-1)		40 (0)
STA 7+220 - STA 12+000		40 (0)
STA 12+000 - STA 13+060		35 (0)
STA 13+060 - STA 18+750		35 (0)
Jl. Kutai and Jl. Bengawan		35 (0)
STA 18+750 - STA 20+000		35 (25)
STA 20+000 - STA 27+000		35 (25)
TOTAL	27.00	

Note: Required ROW (Existing ROW)

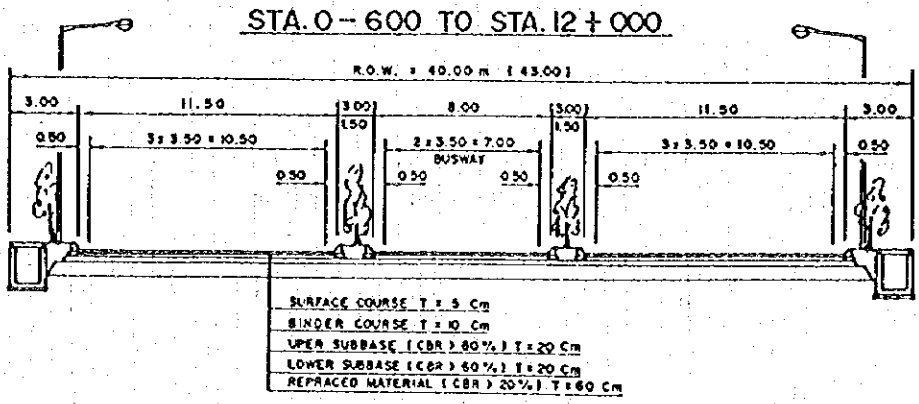


Figure 15.3.5 Typical Cross Section of Route-4

15.3.5 Route -5

Route-5 alignment runs from the eastern part of Surabaya to the western suburban area of Surabaya through the traffic center of Wonokromo area. The total proposed is 22.9 km long, and either 35 m or 40 m wide. A busway is proposed in the central part of the road. Surabaya municipality has set 35 m ROW with 6.8 km in length form Jl.Mastrip to Jl.Jemur Sari, while remaining proposed alignment has not been set yet.

Table 15.3.5 Route Description Route-5

Station	Length (km)	ROW (m)
STA 0+300 - STA 9+530 (Boundary of Gresik and Kod. Surabaya)		35 (0)
STA 9+530 - STA 16+270 (Surabaya River)		35 (0)
STA 16+270 (Surabaya River) - STA 19+500 (Jl. Raya Jemur Sari)		35 (0)
STA 19+500 - STA 22+890		35 (35)
TOTAL	22.89	

Note: Required ROW (Existing ROW)

Table 15.3.6 Summary of Project Description

	Route -1		Route -2	Route -3	Route -4	Route -5
Road Category	Primary Artery	Primary Artery	Secondary Artery	Secondary Artery	Secondary Artery	Secondary Artery
Type / Class	II/I	I/I	II/I	II/I	II/I	II/I
Ordinary / Highway	Ordinary	Highway	Ordinary	Ordinary	Ordinary	Ordinary
Urban/Rural	Urban	Urban	Urban	Urban	Urban	Urban
Site	Plain	Plain	Plain	Plain	Plain	Plain
Executing Agency	Directorate General of Highways	Directorate General of Highways (BOT)	Directorate General of Highways	Directorate General of Highways	Directorate General of Highways	Directorate General of Highways
Location	Surabaya, Gresik, Sidoarjo	Surabaya, Gresik, Sidoarjo	Surabaya, Gresik, Sidoarjo	Surabaya, Sidoarjo	Surabaya, Gresik,	Surabaya, Gresik,
PJ Type	New and Improvement	New	New and Improvement	Improvement	New and Improvement	New and Improvement
Length (km)	21.015	21.015	13,310	8.125	27.0	22.89
Width (m)	103	103	20/20*2	25	40/35	40/35
Traffic Demand (year 2018)	65,000 PCU/day	65,000 PCU/day	75,000 PCU/day	90,000 PCU/day	1,120,000 PCU/day	93,000 PCU/day
Lane	4	6	4	4	6+Busway/4	4 +Busway
Interchange and On/Off Ramp	Interchange (4), On/Off Ramp (6)	-	Interchange (1)	-	Interchange (1)	Interchange (4)
Incidental facilities	-	-	-	-	Busway	Busway
Section	at grade	at grade	at grade	at grade	at grade	at grade
Accessibility	uncontrolled	controlled	uncontrolled	uncontrolled	uncontrolled	uncontrolled
Design Speed	60 km/h	100 km/h	60 km/h	60 km/h	60 km/h	60 km/h
Project Cost (Billion Rp.)	719.3	217.3	213.2	59.2	222.5	217.7
Schedule	Design 1 yr Land 1 yr Constr. 3 yr	Design 1 yr Land 1 yr Constr. 3 yr	Design 1 yr Land 1 yr Constr. 3 yr	Design 1 yr Land 1 yr Constr. 3 yr	Design 1 yr Land 1 yr Constr. 3 yr	Design 1 yr Land 1 yr Constr. 3 yr
Opening Year	year 2004	year 2004	year 2004	year 2004	year 2004	year 2004

Source: JICA Study Team

15.4 Impact Identification and Prediction

15.4.1 Project Activities and Source of Environmental Impacts

(1) Project Activities

The major activities of the road projects are classified by project phase as follows:

Pre-Construction Phase

- Design and procurement
- Site exploratory survey
- Land acquisition / Property compensation
- Removal and installation of utility network
- Employment of labor

Construction Phase

- Haulage of heavy equipment and construction materials

- General haulage
- Construction of site office
- Demolition of existing structures
- Site preparation
- Construction of main structures
- Road excavation and pavement
- Construction of access road
- Construction of accessory structures
- Installation of new drainage system

Operation and Maintenance Phase

- Existence of road structures
- Traffic operations
- Maintenance

(2) Sources of Environmental Impact

Project activities will cause environmental impact that is not only negative impacts, but also positive impacts. These impacts depend on project location, size and shape of structure, traffic capacity, work schedule, etc.. Sources of environmental impacts are described in the following three phases:

Pre Construction Phase

Sources of environmental impact from preparation for construction work are as follows :

- Increasing employment opportunities of labor
- Increasing social instability
- Resettlement of residents
- Removing of social facilities

Construction Phase

Sources of environmental impacts from the construction work are as follows :

- Increasing traffic volume around the access road by haulage of construction equipment and materials
- Changing of existing land use pattern in the proposed road area
- Generating noise, vibration and air pollution by operation of heavy equipment and haulage of construction materials
- Discharging waste water
- Generating construction waste
- Temporary occupation of existing road for construction work

Operation and Maintenance Phase

A purpose of the road development project is to increase traffic capacity for smooth traffic flows. It may cause a positive environmental impact. However, if road structures exist, structures and activities may cause adverse environmental impacts.

It is expected that project implementation activities at the operation and maintenance phase will cause the following environmental impacts :

- Changing existing land use pattern
- Generating noise and vibration by traffic vehicles
- Increasing traffic volume around interchanges
- Increasing drainage of rain water

15.4.2 Impact Identification and Prediction

Identification of impacts is to understand the potential impact that might be caused due to the project implementation. Table 15.4.1 shows the results of impact identification at each project phase. Figure 15.4.1 shows the impact evaluation flow. The impact evaluation flow are assessed as follows:

Significance of Impacts

Based on the Guideline of Importance of Impact (Head of Bapedal Decree No. 056/1994), the criteria of significance of impact is defined as follows:

a. The number of people affected by the impact
b. Scale of the impact
c. Duration of the impact
d. Impact intensity
e. Cumulative impact, and
f. Irreversibility of the impacts for the nature

Major environmental impacts at each phase were examined, based on the following analysis:

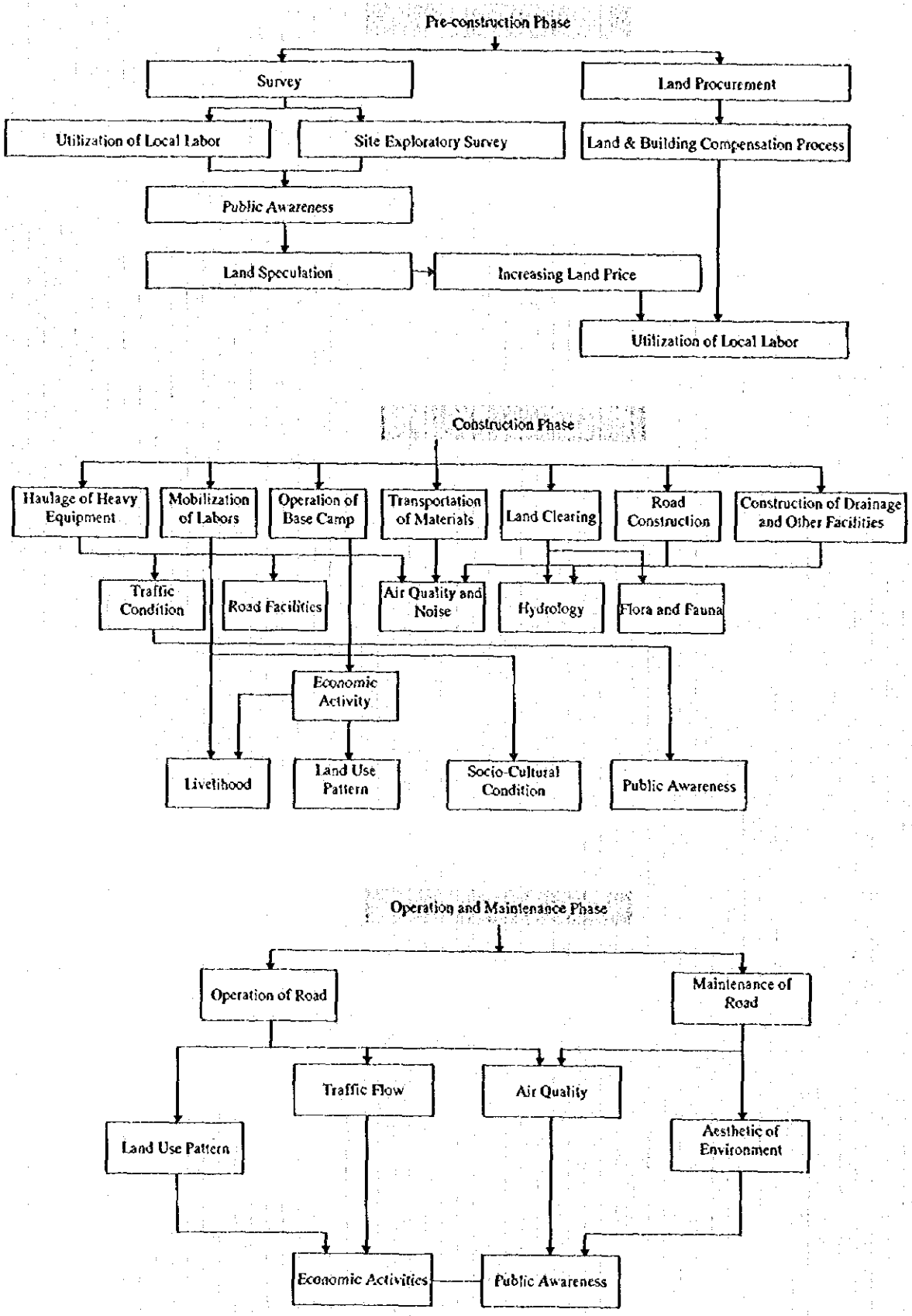


Figure 15.4.1 Impact Identification Flow by Phases

Table 15.4.1 Possible Environmental Impact Matrix

	Environmental Elements / Project Activities	Physical and Chemical Component													Bio-logical		Socio-economic Component											
		Climate	Slope Stability	Ground Substances	Soil Erosion	Hydrology	Water Quality	Ground Water Use	Water Resource	Air Pollution	Noise	Vibration	Offensive Odor	Disaster	Aesthetic	Flora	Fauna	Local Administration	Community Unrest	Split of Community	Resettlement	Land Use	Economic Activities	Employment	Traffic	Infrastructure	Public Health	Cultural Heritage	Human Safety	Amenity
I.	**Pre-Construction Phase**																												
	1. Design and Procurement																												
	2. Site Exploratory Survey																		N										
	3.Land Acquisition																		N		N								
	4. Removal and Installation of Utility Network																								N				
	5. Employment of Labor																						P	P					
II.	**Construction Phase**																												
	1.Haulage of Heavy Equipment / Construction Materials									N	N														N				
	2. General Haulage																								N				
	3. Construction of Site Office																								N				
	4. Demolition of Existing Structure									N	N				N														
	5. Site Preparation					N				N	N				N														
	6. Construction of Main Structures									N	N				N														
	7. Road Excavation and Pavement					N	N			N	N																		
	8. Construction of Access Road																												
	9. Construction of Accessory Structures																												
	10. Installation of New Drainage System					P																							
III.	**Operation and Maintenance Phase**																												
	1. Existence of Road Structures																			N		P	P						P
	2. Increasing Traffic Volume									N	N												P		P				
	3. Maintenance																												

Note: N; Negative Impact, P; Positive Impact

(1) Pre-construction Stage

The important potential impacts at Pre-construction stage are predicted in accordance with the initial stage of activities such as Site Exploratory Survey and Land Acquisition. The expected impact of each activity is described as follows :

1) Site Exploratory Survey

a. Social Instability

During the Site Exploratory Survey, community unrest is predicted at first rumors of the project. People who live in the proposed area will be affected by changes in their environment which has not been changed for a long time. In addition, the project announcement will cause arguments about compensation for affected people who live in the district shown in Table 15.4.2 and anxiety related to new environment for these and surrounding people.

Table 15.4.2 Subject District and Estimated Subject Household

	Route-1	Route-2	Route-3	Route-4	Route-5
Subject Area (Districts)	**Surabaya:** Benowo, Lakarsantri, **Gresik:** Driyorejo, Menganti, **Sidoarjo:** Taman	**Surabaya :** Asemrowo, Sukomanunggal, Dukuh Pakis, Wiyung, Jambrangan, Gayungan	**Surabaya:** Rungkut, Trenggilis Mejoyo, Gunung Anyar, **Sidoarjo:** Waru, Sedati	**Surabaya:** Lakarsantri, Dukuh Pakis, Sukomanunggal, Wonokromo, Wonocolo, Trenggilis Mejoyo, Rungkut, **Gresik:** Menganti	**Surabaya:** Lakarsantri, Wiyung, Karang Pilang, Gayungan, Wonocolo, Trenggilis Mejoyo, **Gresik:** Kedamean,
Subject Households Number	630 households	350 households	580 households	1150 households	403 households

Moreover, another kind of instability was predicted that the impact will spread outside the project area with effects such as land speculation. Finally the land price will increase in the proposed plan area, and this will disturb the compensation process.

It is considered that expected impact will spread to a wider area surrounding the projects. A duration of the impact will continue even after the construction stage. It will cause cumulative impact in addition to related parties such as land speculation. In this regard, the social instability impact caused by the Site Exploratory Survey will be categorized in as an insignificant negative impact.

2) Land Acquisition for Road Construction

a. Resettlement

The proposed land acquisition area is estimated at 4,385,285 m^2 in total. The land acquisition area and the number of households affected by the project are summarized in Table 15.4.3.

Table 15.4.3 Summary of Proposed Land Acquisition Area and Number of Affected Household

Route	Number of Households	Land Acquisition Area (m^2)	Remark
Route-1	630	1,716,260	commercial area 40,200 m^2 residential area 170,370 m^2
Route-2	350	478,775	residential area 73,400 m^2 industrial area 25,750 m^2
Route-3	580	205,500	commercial area 33,675 m^2 industrial area 20,925 m^2 residential area 50,550 m^2
Route-4	1150	1,095,800	commercial area 52,500 m^2 industrial area 6,450 m^2 residential area 108,275 m^2
Route-5	403	888,950	industrial area 71,575 m^2 residential area 108.925 m^2
TOTAL	3113	4,385,285	

Source: Environmental Condition Survey by JICA Study Team

Table 15.4.4 Proposed Land Acquisition Area Classified by Land Use

	Route-1 Toll		Route-1 Arterial		Route-2		Route-3		Route-4		Route-5	
Commercial Area	0	0.0%	11,000	2.1%	0	0.0%	33,675	16.4%	52,500	4.8%	0	0.0%
Residential Area	120,170	10.0%	50,200	9.7%	73,400	15.3%	50,550	24.6%	108,275	9.9%	108,925	12.3%
Industrial Area	0	0.0%	0	0.0%	25,750	5.4%	20,925	10.2%	6,450	0.6%	71,575	8.1%
Rice Field Area	438,495	36.6%	200,800	38.7%	165,650	34.6%	18,150	8.8%	196,000	17.9%	332,900	37.4%
Field Area	44,520	3.7%	0	0.0%	20,800	4.3%	0	0.0%	170,800	15.6%	180,600	20.3%
Salt Farm Area	49,335	4.1%	36,800	7.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Fish Pond Area	75,285	6.3%	0	0.0%	43,500	9.1%	0	0.0%	0	0.0%	0	0.0%
Forest Area	26,145	2.2%	16,200	3.1%	19,900	4.2%	0	0.0%	20,400	1.9%	66,150	7.4%
Road/River	443,350	37.0%	203,960	39.3%	129,775	27.1%	82,200	40.0%	541,375	49.4%	128,800	14.5%
TOTAL	1,197,300	100.0%	518,960	100.0%	478,775	100.0%	205,500	100.0%	1,095,800	100.0%	888,950	100.0%

Source: JICA Study Team

The proposed land acquisition area is classified by land use pattern as shown in Table 15.4.4. From the viewpoint of direct impact, resettlement will be caused along the proposed road alignment. Based on this, some economic activities will be moved to alternative areas. In addition, employment structure may change due to new economic activities.

Thus, the impact of resettlement caused by land acquisition for road construction is categorized as a significant negative impact.

Table15.4.5 Summary of Condition of Buildings in the Proposed Project Area

	Route-1	Route-2	Route-3	Route-4	Route-5
Land Ownership	Petok D 94%	Petok D 45% HGB 24%	Petok D 67% HGB 24%	Petok D 46% HGB 31%	Petok D 48% HGB 23 %
Average Land/ building Area	372m^2/130 m^2	225 m^2/170 m^2	302 m^2/168 m^2	178 m^2/98 m^2	270 m^2/117 m^2
Building Structure	masonry 80%	masonry 93%	masonry80%	masonry 79%	masonry87%
Building Condition	good 62% medium 36%	good 76% medium 36%	good 60% medium 36%	good 68%	good 63%
Market Land Price (Rp.)	50,000 - 250,000	50,000 - 100,000	100,000 - 800,000	50,000- 150,000	50,000- 150,000

Source: Environmental Condition Survey by JICA Study Team Note: Petok D: Citified Own Land, HGB: Rented Land from the Government

b. Social Instability

In terms of land acquisition activity, any uncertain information of land prices causes land speculation which will disturb the compensation process. The sorely land prices will affect public awareness for the compensation price.

Table 15.4.6 Present Public Awareness

	Route-1	Route-2	Route-3	Route-4	Route-5
Agreed on the Project	68 %	71.4%	87.4%	72.7%	53.4%
Reason: Compensation with Market price	36 %	46.8%	30.5%	33.7%	24.5%
Not agreed	14 %	2.6 %	9.8 %	11.6 %	14.5 %
No objection	18 %	27.3 %	2.8 %	15.7 %	32.1 %

Source: Environmental Condition Survey by JICA Study Team

For the acquisition of both land and buildings, the people will agree to the project on condition of being compensated at market prices. According to the result of the interview survey in the route-2 area, nearly half of the interviewed inhabitants agreed to the project on condition that they are compensated at market price. Also in the other subject areas, more than 1/3 of the respondents stated the condition with the market price. In this regard, the people showed lively concern in the activity.

Thus, the impact is categorized as an insignificant negative impact, if the compensation is made at market prices.

c. Economic Activities and Employment

Positive impact on both economic activities and employment opportunities are predicted by mobilization of labor. The labor force is sufficient in the project area. Mobilization of labor will obviously contribute to increase employment opportunities. Present labor force situations and employment opportunities are shown in Table 15.4.7. In terms of the mobilization of labor, accommodation facilities and general consumer goods are required. The economic activities may be affected in a relatively large area.

Table 15.4.7 Present Labor Force and Employment Opportunity in 1996

(Unit: ×1,000 persons)

	Population	Labor Force	Ratio (%)	Employment	Ratio (%)
Surabaya	2,672	1,153	43 %	1,125	42 %
Gresik	910	433	48 %	423	46 %
Sidoarjo	1,316	569	43 %	555	42 %

The impact by increasing employment opportunity is relatively large, and the activity will continue for a long time. Therefore, this impact is classified as an insignificant positive impact.

(2) Construction Stage

Various kinds of construction activities will affect the traffic condition, hydrology, air and water quality, noise and aesthetic factors as follows:

1) Haulage of Heavy Equipment

The haulage of heavy equipment has an impact on air quality and noise, traffic conditions and existing road facilities.

a. Impact on air quality and noise

Deterioration of air quality and noise level are predicted by the haulage of heavy equipment. Because this equipment utilizes diesel fuel which exhausts such emission gases as NOx, CO, SOx, SPM and HC. The air quality and the noise level will deteriorate in the vicinity of project sites.

The impacts of heavy equipment haulage on the air quality based on the number of people affected is not so significant. The people who live in surrounding project areas will be affected only during the construction, and the impact intensity is not so high, because the construction work moves from one segment to another. Thus, this impact is categorized as having an insignificant negative impact.

b. Impact on Road Facilities

The heavy construction equipment runs at slow speed passing along existing roads, so that service on these roads will deteriorate. In addition, the heavy equipment will damage the existing road facilities.

Considering that, the duration of impact is relatively short and limited to the area along the project route, the impact intensity of the heavy equipment haulage is classified as an insignificant negative impact.

c. Impact on Traffic Conditions

The traffic congestion is predicted by routing the heavy equipment to the project site from the base camp along the existing road. Slow speeds of the traffic flow by the heavy vehicles will cause traffic congestion.

Table 15.4.8 Present Condition of Traffic Volume in Existing Road Near by Proposed Alignment

Route-1	Route-2	Route-3	Route-4	Route-5
Jl.Gresik 29,657 PCU	Tambak Asri - Kali Anak 5,412 PCU	Jl. Rungkut - Panjang Jiwo 77,561 PCU	Jl. Domas - Made Kidul 8,093 PCU	Jalan Driyorejo - Kedamean 8,005 PCU
Jl.Sememit 9,789 PCU	Jl.Dupak (Gerbang Toll Surabaya - Gresik) 64,541 PCU	Jl. Sedati - Rungkut 43,734 PCU	Jl. Darmo - Wonokromo 174,480 PCU	Jl. Jemursari Prapen 58,846 PCU
Jl.Driyorejo 5,198 PCU	H.R. Mohammad - Mayjen Sungkono 78,053 PCU	-	Jl. Panjang Jiwo - Jagir 38,846 PCU	-
Surabaya - Krian 39,523 PCU	Surabaya - Waru 52,946 PCU	-	-	-
-	Jl. A. Yani 66,049 PCU	-	-	-

Source: Environmental Condition Survey by JICA Study Team

From consideration of the significance of impact, based on the duration of impact which is relatively short and limited to the passed location, the impact is categorized as an insignificant negative impact.

2) Haulage of Construction Materials

a. Impact on Air Quality and Noise

It is planned that borrow materials will be transported from Mojosari and Jombang about 50 km from the proposed project location. The volume of material is estimated at about 45,000-600,000 m^3 and the haulage will be made by around 12 trucks per day and which will generate dust and

emission of exhaust gas. Impacts on air quality and noise are predicted, particularly in the vicinity of the transportation routes.

Taking the case of a truck with 6 wheels at a speed of 40 km/hour, it will generate a noise level of around 80-90 dB(A), while the present noise level is around 60-70 dB(A). The estimated noise level exceeds noise standards, but it occurs only for short periods. Thus, the impact is categorized as an insignificant negative impact.

b. Impact on Traffic Condition

The transport of materials is predicted to disturb the existing traffic condition by causing congestion and road pollution by wasting soil and sand from the truck. The transport of materials will start from the borrow area, Mojosari and Jombang, around 40 - 50 km from the project location.

This impact is considered relatively short periods and limited areas, so that the impact is classified as an insignificant negative impact.

c. Impact on Road Facility

Transportation of materials such as sand and gravel from South of Mojosari and South of Jombang to the project site will have an effect on the road facility. A large number of 18-ton capacity trucks will pass through existing roads during the construction, and which will decrease a service level of roads. Since the impact is limited to a short period and area, it will be classified as an insignificant negative impact.

3) Demolition of Existing Structures

a. Impact on Air Pollution and Noise

Dust and noise will be generated by the demolition of existing structures such as buildings, roads and other concrete structures. Since the dust affects a relatively narrow area, surrounding the project sites, and its duration is relatively short, thus the impact is categorized as an insignificant negative impact.

4) Site Preparation

Site preparation activity is comprised of land clearing, excavation and filling. Further, a road paving is predicted to have an impact on air quality and noise, hydrology and biology.

a. Impact on Air Quality and Noise

Land preparation is predicted to have an adverse impact on air quality and noise due to the heavy equipment and dry soil. The operation of heavy equipment is predicted to cause a noise level of about 70-90 dB(A) within a radius of 50 m; and compared to the present condition, the change in noise level is small. The impact is considered to spread over a relatively narrow area around the project site, and its duration is relatively short, so that the impact is categorized as an insignificant negative impact.

b. Impact on Hydrology

Land preparation by excavation and fill activities is predicted to have an impact on hydrology such as disturbance of flow patterns and increase of surface water volume.

The obstruction of flow patterns caused by excavation and fill activity will result in flooding at the upstream area around the project site, particularly in flat and swampy areas, and low or flat roadsides (Benowo and Asemrowo District).

The impact can be categorized as an insignificant negative impact, because the duration of impact is relatively short. Particularly, if the work is done before rainy season, the impact may be considered positive, as the drainage facility will function better than before.

c. Impact on Flora and Fauna

Land preparation will give an impact on the existing flora and fauna. However, the subject areas are already developed, so that the condition of flora and fauna is secondary. There are human habitants in the entire subject area, thus there are no inhabitants of protected species of flora and fauna.

The impact, therefore, can be categorized as an insignificant negative impact. This is based on a relatively narrow spreading of impact which is not cumulative.

5) Construction of Main Structure

a. Air Pollution and Noise

During the road construction of the toll and arterial roads, a negative impact is predicted on air quality and noise levels. The cause of impact on air quality and noise comes from the utilization of heavy equipment. The noise level within a radius 50 m is predicted at around 70 - 90 dB(A) or an increase of about 10%.

The impact is predicted to spread along a relatively narrow area along the roadside, and the duration of impact is relatively short. This impact is, therefore, categorized as an insignificant negative impact.

b. Hydrology

Paving the road is predicted to have the impact of increasing the surface run off, and turgidity of the surface water. Road areas to be paved for the respective routes (Route-1 - Route-5) cover about 20 to 180 ha, this similarly with change of land vegetation to plain area that can increase the run-off volume.

This impact can be categorized as an insignificant negative impact, because it is considered neither to spread widely nor to be cumulative.

Table 15.4.9 Water Quality Sampling Results

	Location	Date	Temperature (°c)	Cl (mg/l)	pH	DO (mg/l)	BOD (mg/l)	COD (mg/l)	SS (mg/l)
Class B				600	6-8.5	4	6	6.21	1,500
W5	Surabaya River	Sep.16,96	30	70.56	6.5	3.3	6.21	14.8	230
Class C				0.003	6-9	-	-	-	2,000
W2	Asem Rowo River (Jl.Dupak)	Sep.19,96	30	-	7.8	-	213.5	403	535
W3	Jemursari River (Jl.Jemursari)	Sep.19,96	30	-	6.8	3.1	6.21	15.7	231
W4	Kebonsari River (Jl.Gayung Kebonsari)	Sep.16,96	30	-	6	2.5	9.15	8.1	
Class D				-	6-9	-	-	-	1,000-2,500
W1	Busem River (Jl.Gresik)	Sep.16,96	32	-	2	-	328.4	611.5	4,670
W6	Benowo River	Sep.17,96	32	-	7.4	2.6	10.22	22.5	1,840

Note. Class B: water treatment, Class C: Fishery and animal husbandry, Class D: Agriculture, Industry and Hydropower (East Java Government Regulation)

(3) Post Construction Stage

1) Existence of Road Structure

a. Landscape and Land Use Pattern

The operation of Route-1 through Route-5 will cause impacts on landscape and land use pattern, because of the increasing economic value and opportunity in the project area. This activity will have positive impacts on the regional structure, transportation network for the regional development. In the scope of Gerbang Kertosusila (GKS) region , the operation of the toll and arterial roads will also have positive impacts on road network development. A direct impact is brought about by the improvement of accessibility from the project area to Surabaya City, and which will encourage vigorous land use development such as residential, industrial and other economic development.

The impact will spread from the urban area to the sub regional and regional areas; the total population affected by the impact is large, and the impact will continue during the operation of the project routes, and it will have a secondary impact to support the economic growth. The operation of the project routes, therefore, can be categorized as a significant positive impact on landscape and land use patterns.

c. Economic Activities

The operation of Routes-1 and Route-2 during the post construction stage will increase the mobility of inhabitants, goods and services in the project areas. Besides, they will open up the project area and will connect the Northern and Southern parts of Surabaya which were not directly connected previously. This will enlarge business opportunities as well as new center development in the project areas.

The Route-3, Route-4 and Route-5 are planned along the existing roads, and therefore, during the post construction stage, the existing economic and industrial activity centers will become more effective, and traffic congestion will worsen during peak hours.

The increase of economic activity will be indicated by new kiosks, shops and other new places of business which can be predicted to establish economic activities such as transportation,

commercial and service industries in the areas around the project routes.

This will directly or indirectly increase local economic activity which will further develop the study area. The intensity of impact will become insignificantly large and will have cumulative and irreversible characteristic, and give a positive impact on other related factor components (job opportunities, income, and livelihood). Thus, the impact of the road operation on economic altitude and business opportunities can be categorized as a significant positive impact.

2) Road Operation

The operation of the project routes can be predicted to have an impact on air quality and noise, changing the landscape and land use patterns, economic activities and traffic flows.

a. Air Quality and Noise

Opening the project routes can be predicted to increase the traffic flow on the road. The increase in number of motor vehicles will continue for a long period, and it will have an impact on noise. Increasing motor vehicle traffic will also deteriorate air quality.

Regarding air pollution, not only negative aspects but positive aspects can be conceived. Travel speed may increase, because of the road improvement. A level of the emission, therefore, will decrease. The road improvement can have either positive or negative impact on the environment, depending on its surrounding conditions.

Table 15.4.10 Noise Sampling Results

Sampling Location	Morning 7:00 - 9:00 dB(A)	Noon 12:00 - 13:00dB(A)	Evening 17:00 - 19:00dB(A)
R 1-1	72 - 86	72 - 85	73 - 86
R 1-2	72 - 86	56 - 66	73 - 86
R 1-3	72 - 86	53 - 55	73 - 86
R 1-4	72 - 86	58 -61	73 - 86
R 1-5	72 - 86	61 - 64	73 - 86
R 1-6	75 - 86	76 - 85	76 - 85
R 2-1	69 - 75	73 - 82	74 - 85
R 2-2	71 - 76	69 - 75	72 - 76
R 2-3	72 - 75	72 - 75	72 - 75
R 2-4	66 - 70	65 - 70	68 - 73
R 2-5	72 - 82	75 - 84	74 - 81
R 3-1	68 - 76	68 - 77	-
R 3-2	65 - 72	-	-
R 4-1	-	60 - 68	-
R 4-2	69 - 73	73 - 77	71 - 74
R 4-3	70 - 75	71 -75	68 - 71
R 5-1	72 - 79	67 - 72	-
R 5-2	67 - 83	69 - 82	69 - 81

Source : Environmental Condition Survey by JICA Study Team

Table 15.4.11 Noise Standard for Vehicle

No.	Location	Permitted Noise (dBA)
1.	Commercial Area	80
2.	Transportation Area	70
3.	Residential Area	50
4.	Industry Area	70
5.	Recreation Area	70

Source: Government Decree of East Java No.188 (May 19, 1988)

The noise caused by road operation in peak hours is around 70 - 90 dB(A), and the average ambient air quality is 0.02613 ppm for SO_2, 0.01118 ppm for NO_2, and 0.00164 mg/m^3 for Pb.

Because not all of the project routes are new, it was assumed that a background noise level is 50 - 85 dB(A), and the impact will affect relatively narrow area. Thus, the impact of noise by the road operation can be categorized as an insignificant negative impact.

Table 15.4.12 Ambient Air Quality Sampling Results of Route-1

Parameter	Unit	Standard	R 1 -1	R 1 - 2	R 1 - 3	R 1 - 4	R 1 - 5	R 1 - 6
Sulfur dioxide (SO_2)	PPM	0.10	0.04800	0.00850	0.02060	0.01380	0.03220	0.04710
Carbon monoxide (CO)	PPM	20.00	4.28000	0.00000	0.00000	0.00000	3.28000	2.16000
Nitrogen oxide (NOx)	PPM	0.05	0.00640	0.00270	0.00018	0.00038	0.00930	0.00920
Dust	mg/m^3	0.26	0.57000	0.18200	0.15200	0.30400	0.57000	0.82800
Lead (Pb)	mg/m^3	0.06	0.00037	0.00084	0.00590	0.00000	0.00046	0.00680
Hydrocarbon (HC)	PPM	0.02	0.22000	0.00000	0.00000	0.00000	0.18000	0.40000

Source : Environmental Condition Survey by JICA Study Team

Table 15.4.13 Ambient Air Quality Sampling Results of Route-2

Parameter	Unit	Standard	R 2 -1	R 2 - 2	R 2 - 3	R 2 -4	R 2 - 2
Sulfur dioxide (SO_2)	PPM	0.10	0.04780	0.02570	0.02220	0.04590	0.03450
Carbon monoxide (CO)	PPM	20.00	2.18000	5.20000	1.60000	0.00000	3.40000
Nitrogen oxide (NOx)	PPM	0.05	0.01440	0.05970	0.02050	0.00990	0.01780
Dust	mg/m^3	0.26	0.84300	1.49800	0.70600	0.03070	0.08700
Lead (Pb)	mg/m^3	0.06	0.00223	0.00135	0.00119	0.00330	0.00470
Hydrocarbon (HC)	PPM	0.02	0.00000	0.63000	0.23000	0.00000	0.68000

Source : Environmental Condition Survey by JICA Study Team

Table 15.4.14 Ambient Air Quality Sampling Results of Route -3

Parameter	Unit	Standard	R3 -1	R3 - 2
Sulfur dioxide (SO_2)	PPM	0.10	0.0159	0.0180
Carbon monoxide (CO)	PPM	20.00	0.040	0.0000
Nitrogen oxide (NOx)	PPM	0.05	0.0093	0.0053
Dust	mg/m^3	0.26	2.660	0.960
Lead (Pb)	mg/m^3	0.06	0.00181	0.0014
Hydrocarbon (HC)	PPM	0.02	0.0000	0.0000

Source : Environmental Condition Survey by JICA Study Team

Table 15.4.15 Ambient Air Quality Sampling Results of Route-4

Parameter	Unit	Standard	R 4 - 1	R 4 - 2	R 4 - 3
Sulfur dioxide (SO_2)	PPM	0.10	0.1300	0.0345	0.0298
Carbon monoxide (CO)	PPM	20.00	0.0400	3.40	0.08
Nitrogen oxide (NOx)	PPM	0.05	0.0113	0.0178	0.0060
Dust	mg/m^3	0.26	0.169	0.087	0.190
Lead (Pb)	mg/m^3	0.06	0.00077	0.0048	0.00050
Hydrocarbon (HC)	PPM	0.02	0.0000	0.68	0.0000

Source : Environmental Condition Survey by JICA Study Team

Table 15.4.16 Ambient Air Quality Sampling Results of Route-5

Parameter	Unit	Standard	R 5 - 1	R 5 - 2
Sulfur dioxide (SO2)	PPM	0.10	0.1420	0.0238
Carbon monoxide (CO)	PPM	20.00	0.000	0.34
Nitrogen oxide (NOx)	PPM	0.05	0.0113	0.0105
Dust	mg/m3	0.26	0.169	1.037
Lead (Pb)	mg/m3	0.06	0.00078	0.00277
Hydrocarbon (HC)	PPM	0.02	0.0000	0.0400

Source: Environmental Condition Survey by JICA Study Team

b. Traffic Flow

The operation of the project routes will increase a smooth flow of traffic on the five routes as well as access to the proposed roads.

3) Maintenance of Roads

a. Aesthetic and Amenity

Road maintenance activities such as cleaning, landscaping, road rehabilitation, etc., will contribute to improving the aesthetic and amenity aspects and have a positive impact. Planting with greenery will increase aesthetic quality of the environment, and plants also have the function of absorbing emissions from vehicular traffic.

Thus, the impact is categorized as an insignificant positive impact.

b. Drainage Channel and Facility Construction

The construction of drainage channel and facilities has an positive impact on surface water movement, especially on drainage pattern to prevent flooding. Flood areas that can usually be seen in the Benowo and Asemrowo Districts will be decreased by the construction of this facility.

Based on this, the impact of drainage facility construction can be categorized as an insignificant positive impact. A number of inhabitants affected by the drainage facility is relatively large and the impact will remain continuously.

Table 15.4.17 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, No Mark: Insignificant, +: Significant

15.5 Evaluation of Significant Environmental Impacts

(1) Criteria of Impact Evaluation

The impact evaluation approach is to examine the significance of expected impacts. The impacts are defined as both negative and positive aspects, as well as the significance of the impact is examined. The relationship between project activities and the environmental element is also examined. Especially significant negative impacts will be described, taking into consideration their sources.

(2) Evaluation and Environmental Impacts

1) Pre-Construction Phase

Expected impacts on the environment at the pre-construction stage are social instability and anxiety caused by project preparation activities such as exploratory surveys and land acquisition for road construction. As a result of the prediction, resettlement is considered to have a significant negative impact, and social instability is predicted as an insignificant negative impact. Evaluation of each impact is examined as follows:

Resettlement has quite a critical social impact categorized by significant negative impact caused by the land acquisition activity. Households and buildings which are located in the project area are required to relocate alternative places with appropriate compensation. Based on the results of interviews, about 50 to 90% of respondents agreed on the project. However, they required compensation based on the market price of land. From the experience of a similar project in north-eastern Surabaya, some part of that project had to be suspended due to inappropriate compensation for the land acquisition.

Social instability is predicted, and will have social impact, in accordance with the initiation of project activities. Those impacts affect the inhabitants in the project and surrounding area. Once the project is announced, compensation for the affected people and anxiety about their new environment will be disputed among them. According to the project information, the market price of land will increase due to land speculation. Thus, the compensation process will be disturbed and this will have an economic impact.

2) Construction Phase

As explained in the previous Chapter the construction activity will start with the haulage of heavy equipment and mobilization of labor. These activities will have various impacts on the environment.

Most of these impacts are categorized as insignificant negative and significant positive ones. Because they are a local phenomena occurring for relatively short periods and have separate, not cumulative, characteristics.

The environmental impacts are caused by a series of construction activities such as material transportation, land preparation and road construction.

These activities cumulate the operation of heavy equipment, mobilization of labor from residential areas to project locations and operation of the project base. The air quality will deteriorate because of polluting gases emitted by heavy equipment; also the noise and dust caused by material transportation will increase. In addition, a water flow pattern will be disturbed, because of fill activities; and the surface water will become turbid, because of a fill material.

The mobilization of labor and road construction activities generally will have an impact on business opportunities and economic activity. The existence of buildings such as small shops and residences both temporary and semi-permanent along the proposed road will cause problems later, particularly the existence of unauthorized buildings.

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

After the road construction is completed, other supporting activities such as operation of heavy equipment, land preparation and operation of base camp, as well as the frequency and intensity of project activity will decrease. Thus the impact on air quality and noise levels will also decrease. Further activities are construction of drainage channels and other ancillary services will have a positive impact on both the hydrological and aesthetic components of the environment.

A part of the road alignment passes through an area of periodical floods, thus the construction of the drainage channel will decrease the flooding area. The completion of ancillary construction like planting of green will result in the improvement of the environment.

3) Operation and Maintenance Phase

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

Regarding air pollution and noise, not only negative aspects but positive aspects are predicted. Travel speed will increase, because of the road improvement, so that the level of emissions will decrease. Therefore, road improvement can have a positive impact which alleviate air pollution along the road.

15.6 Environmental Management Plan and Environmental Monitoring Plan

15.6.1 Identification of Impacts

The projects will have some significant impact evaluated through the impact identification and prediction activities at each project stage. It is necessary to mitigate the negative impacts and encourage the positive impacts. It is therefore essential that a comprehensive environmental management strategy be formulated. Impacts by each project activity are identified as follows :

(1) Pre-Construction Phase

- Social instability by exploratory survey
- Resettlement during the land acquisition activity which has an causes impact due to loss of business place and livelihood.
- Public awareness caused by unacceptable prices that finally will obstruct the land acquisition.

(2) Construction Phase

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

(3) Operation and Maintenance Phase

- Deteriorating air quality and increasing of noise levels
- Increasing traffic flows
- Change land use patterns
- Increasing of economic/business opportunities

15.6.2 Environmental Mitigation

The following mitigation measures can be proposed through technological approaches as well as socio-economic and institutional approaches.

(1) Technological approach: in the form of using technological systems to minimize negative impacts

and maximize positive impacts. The approach in accordance with significant impacts covers :

- The provision of road marks and traffic signs surrounding the location of construction activity to decrease the traffic congestion and to smooth the traffic flow during the project implementation.
- Selection of construction methods which decrease air pollution and noise level surrounding the project location such as the bored pile rather than driven pile system.
- Installation of drainage channels on appropriate dimensions and locations to prevent flooded areas surrounding the project activities.

(2) Socio-economic approach: in the form of participation of local government, residents and related agency is to mitigate significant impacts from the following steps:

- To determine compensation system which is beneficial local government
- To use local labor and material to increase project benefits for the local population.
- To pay attention to the economic feasibility in environmental management.
- To coordinate with BPN, related institutions of the local government of Pemda TK II Kod. Surabaya, Sidoarjo, Gresik provincial government and others so as to manage the land and building compensation process appropriately.
- To coordinate with various related institutions to prevent a negative perception from the local population at the stage of determining compensation.

15.6.3 Environmental Management Plan

In an effort to realize significant impact mitigation, an Environmental Management Plan is proposed as a strategy to minimize negative impacts. Each activity plan is described by project phase as follows :

(1) Pre-Construction Phase

- Counseling and giving transparent information about the project activity to the population.
- Good coordination with local governments and related institutions involved in the compensation process.
- To give compensation in visible and appropriate amount
- To provide alternative business opportunities for the subject inhabitants

(2) Construction Phase

- To arrange appropriate execution of construction based on valid stipulation and local conditions.
- To use trucks equipped with covers for transportation of soil and construction materials
- To remove public facilities and utilities in the project activity location, and to restore any damage to public utilities caused by the project activity
- To arrange a schedule for construction material transportation in consideration of traffic conditions around the project activity location.
- To construct temporary drainage channels at fixed locations.

(3) Operation and Maintenance Phase

- Counseling and giving information to the population regarding traffic awareness and land utilization along the roadside.
- Installing traffic signs insure good traffic arrangements.
- Landscaping such as planting of shade trees along the roadside.

15.6.4 Environmental Monitoring Plan

An environmental monitoring plan will be carried out periodically during and after completion of the project in order to audit the quality of the environment in the project site.

(1) Pre-Construction Phase

- To examine the complains, response and reaction of the population affected by land and building acquisition
- To monitor the land and building acquisition process at the project location.
- To monitor economic activities in the area surrounding the project location.

(2) Construction Phase

- To monitor air quality and noise parameters
- To monitor the drainage channels existing in the vicinity of the project location.
- To monitor traffic volume at the main road and surrounding the project location.
- To monitor road conditions at the main road and surrounding the project location.
- To consider expected social conflict.
- To monitor the priority of job opportunities in the project area.
- To monitor response from road users and the population surrounding the project activity.

(3) Operation and Maintenance Phase

- To monitor air quality and noise level
- To monitor development and economic activity in the project area
- To monitor conditions and flow of traffic on main access roads.
- To pay attention to the response from road users and the population surrounding the project location.

15.7 Environmental Considerations

As a result of the environmental impact analysis study, significant negative impacts, resettlement at pre-construction phase, impact on existing road facilities at the construction phase and deterioration of ambient air quality and noise in the operation and maintenance phase have been pointed out. The following recommendations are made for the implementation stage of the project.

(1) Smooth implementation of land acquisition and relocation

Additional social interview surveys should be carried out in order to obtain detailed information on the inhabitants. A similar projects near the proposed alignment in Kenjeran - Rangkhan street and Banyu Urip Street in eastern Surabaya which is a loaded project under the OECF and the World Bank, has been suspended due to land acquisition problems. The compensation budget for the land acquisition was incompatible with the market land price. The results will be used for detail examination of the social impact in the project area in order to facilitate smooth implementation of the project. The proponent organizations should be paid careful attention to this matter.

(2) Application of New Institutional Infrastructure Development System

Due to the difficulty of land acquisition, alternative institutional infrastructure development systems such as Land Readjustment should be examined in consideration of smooth implementation of the project and equitable economic distribution by the project benefits.

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

The implementation program should included efforts to mitigate ambient air quality and to abate noise from construction activities affecting the surrounding inhabitants. Haulage of heavy equipment and transportation of materials will have various negative impacts related to air and noise. It is recommended that careful implementation in consideration to environmental conservation be examined.

(4) Replanting along the Road

Utilizing green plants which have the function of mitigation of air pollution through biological and physical means. Green plants will affect not only aesthetic factors but also air pollution in that the plants absorb carbon dioxide. In addition, planting in groups with shrubs planting trees in hierarchical mode as the distance from the roadside is highly effective in mitigating direct emission flow from the road to the countryside areas. Thus this aspect should be examined in the detail design stage.

CHAPTER 16 PROJECT COST ESTIMATE

CHAPTER 16

PROJECT COST ESTIMATE

16.1 General

The estimate of the project cost was based on the results of the preliminary engineering design and quantity take-off for each work item, a study on the construction method, and a study on operation and maintenance of the project roads as described in the proceeding chapters.

The project cost discussed in this chapter consists of the following items (operation and maintenance cost of the project roads is discussed separately in Chapter 14).

- 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 basic premises used 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 is 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 is assumed to be 10% of the construction cost, consisting of 4% for detailed design and 6% for construction supervision.
5. Physical contingency is 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 was estimated as the financial cost and the economic cost. The economic project cost for economic analysis was estimated by deducting such transfer items as tax and duties from the financial project cost.

16.2 Estimated Construction Cost

The unit prices of construction works were determined based on current bid prices and adjusted as required to obtain the most realistic prices.

(1) Construction Cost (Initial Stage Construction)

The estimated construction costs (initial stage construction) for the project roads are shown in Table 16.2.1. And breakdown of estimated construction costs are shown in Appendix 16.1.

1) Route–1 : Toll Road

It is noted that non toll road sections which are between Lamong river bridge and Benowo toll gate (4.8 km length), and between Torosobo toll gate and Torosobo interchange (0.54 km length) will be constructed by Toll Road investor.

The estimated construction cost (initial stage construction) is Rp. 545,557 million. In the grand total of the construction cost, bridge/viaduct/piled slab construction takes up the largest part, 65.8% of the grand total. The remaining 34.2% is taken up by earthwork (2.0%), drainage work (1.2%), pavement work (3.7%), miscellaneous work (6.2%) and general items including mobilization and protection of traffic, strengthening / widening / maintenance of hauling roads (11.6%). Table 16.2.1 Construction Cost (Initial Stage Construction).

2) Route–1 : Arterial Road

The estimated construction cost (initial stage construction) is Rp. 158,297 million. In the grand total of the construction cost, bridge/viaduct/piled slab construction takes up the largest part, 55.4% of the grand total. The remaining 44.6% is taken up by earthwork (2.8%), drainage work (4.6%), pavement work (9.4%), miscellaneous work (6.8%) and general items including mobilization and protection of traffic, strengthening / widening / maintenance of hauling roads (11.9%).

3) Route–2 : Arterial Road

The estimated construction cost (initial stage construction) is Rp. 130,873 million. In the grand total of the construction cost, bridge/piled slab construction takes up the largest part, 34.5% of the grand total. The remaining 65.5% is taken up by earthwork (4.5%), drainage work (6.2%), pavement work (12.9%), miscellaneous work (20.9%) and general items including mobilization and protection of traffic, strengthening / widening / maintenance of hauling roads (11.9%).

4) Route–3 : Arterial Road

The estimated construction cost (initial stage construction) is Rp. 23,476 million. In the grand total of the construction cost, bridge construction takes up, 18.2% of the grand total. The remaining 81.8% is taken up by earthwork (6.2%), drainage work (12.0%), pavement work (19.6%), miscellaneous work (24.6%) and general items including mobilization and protection of traffic, strengthening / widening / maintenance of hauling roads (10.3%).

5) Route-4 : Arterial Road

The estimated construction cost (initial stage construction) is Rp. 138,550 million. In the grand total of the construction cost, bridge construction takes up the largest part, 24.4% of the grand total. The remaining 75.6% is taken up by earthwork (5.2%), drainage work (9.5%), pavement work (24.5%), miscellaneous work (16.6%) and general items including mobilization and protection of traffic, strengthening / widening / maintenance of hauling roads (10.7%).

6) Route-5 : Arterial Road

The estimated construction cost (initial stage construction) is Rp. 136,021 million. In the grand total of the construction cost, bridge construction takes up the largest part, 30.1% of the grand total. The remaining 69.9% is taken up by earthwork (9.4%), drainage work (7.4%), pavement work (16.3%), miscellaneous work (25.7%) and general items including mobilization and protection of traffic, strengthening / widening / maintenance of hauling roads (12.3%).

Table 16.2.1 Construction Cost (Initial Stage Construction)

DESCRIPTION	Unit	Unit Price Rp.	Route – 1 Toll Road L = 20.8 km		Route – 2 Arterial Road L = 15.5 km		Route – 2 Arterial Road L = 13.3 km		Route – 3 Arterial Road L = 8.2 km		Route – 4 Arterial Road L = 27.6 km		Route – 5 Arterial Road L = 22.6 km		TOTAL L = 108.0 km	
			Quantity	Amount Rp.x 1, 000	Quantity	Amount Rp.x 1, 000	Quantity	Amount Rp.x 1, 000	Quantity	Amount Rp.x 1, 000	Quantity	Amount Rp.x 1, 000	Quantity	Amount Rp.x 1, 000	Quantity	Amount Rp.x 1, 000
1. GENERAL	L.S		1	63,216,380	1	18,770,431	1	15,518,518	1	2,417,501	1	14,765,828	1	16,781,890	1	131,470,547
2. EARTHWORK																
Clearing and Grabbing	m2	1,700	757,342	2,008,443	295,370	502,129	388,150	659,855	102,750	174,675	432,500	735,250	672,000	1,142,400	2,648,112	5,222,752
Common Excavation	m3	5,200	214,458	1,295,984	107,136	557,107	181,587	944,252	44,388	230,818	221,790	1,153,308	403,200	2,096,640	1,172,559	6,278,109
West Excavation	m3	5,200	214,458	1,295,984	107,136	557,107	181,587	944,252	44,388	230,818	221,790	1,153,308	403,200	2,096,640	1,172,559	6,278,109
Borrow Material	m3	18,600	414,848	8,010,624	148,465	2,761,449	182,097	3,387,004	44,388	825,617	221,790	4,125,294	403,200	7,499,520	1,414,788	26,609,508
SUB–TOTAL				11,050,745		4,377,792		5,935,364		1,461,927		7,167,160		12,835,200		42,828,190
3. BRIDGES																
Precast Prestressed I–Girder	m2	1,235,000	224,439	277,176,606	53,132	65,618,020	24,017	29,660,995	2,765	3,414,775	19,191	23,700,885	21,680	26,774,800	345,220	426,346,080
Precast Reinforced–Beam	m2	988,800	7,860	7,771,968	2,220	2,195,136	1,280	1,265,664	862	852,840	0	0	0	0	12,222	12,085,608
Castin Site Concrete Box Girder	m2	1,560,000	0	0	0	0	0	0	0	0	3,825	5,967,000	0	0	3,825	5,967,000
Steel Box Girder	m2	2,450,000	0	0	0	0	0	0	0	0	1,725	4,226,250	5,760	14,112,000	7,485	18,338,250
Piled Slab	m2	483,000	153,828	74,299,117	41,329	19,961,907	29,506	14,251,398	0	0	0	0	0	0	224,663	108,512,422
SUB–TOTAL				359,247,693		87,775,063		45,178,057		4,267,615		33,894,135		40,886,800		571,249,363
4. DRAINAGE																
Pipe Culvert ø= 0.6 m	m	169,700	11,220	1,904,034	14,890	2,526,833	10,008	1,698,273	0	0	20,500	3,478,850	0	0	56,618	9,607,990
Pipe Culvert ø= 1.0 m	m	555,200	0	0	0	0	0	0	0	0	1,498	831,690	1,344	746,189	2,842	1,577,878
U–Ditch	m	170,800	1,070	182,756	14,890	2,543,212	37,540	6,411,832	16,440	2,807,952	44,600	7,617,680	38,400	6,558,720	152,940	26,122,152
Paved Ditch	m	71,000	41,670	2,958,570	14,890	1,057,190	0	0	0	0	0	0	0	0	56,560	4,015,760
Box Culvert (4.5 x 2.5 m)	m	1,422,000	427	606,753	298	423,472	0	0	0	0	313	445,086	672	955,584	1,709	2,430,895
Box Culvert (2@ 4.0x2.0 m)	m	2,626,000	427	1,120,488	298	782,023	0	0	0	0	313	821,938	672	1,764,672	1,709	4,489,121
SUB–TOTAL				6,772,601		7,332,729		8,110,105		2,807,952		13,195,244		10,025,165		48,243,796
5. PAVEMENT																
Subgrade Preparation	m2	1,300	272,562	354,339	184,320	239,616	249,798	324,737	90,420	117,546	557,200	724,360	556,800	723,840	1,911,107	2,484,438
Lower Subbase	m3	38,000	81,771	3,107,281	55,296	2,101,248	82,941	3,151,765	18,084	687,192	115,950	4,406,100	201,600	7,660,800	555,642	21,114,390
Uper Subbase	m3	40,300	66,101	2,663,860	43,200	1,740,960	65,784	2,651,080	16,440	662,532	110,645	4,458,994	129,600	5,222,880	431,769	17,400,306
Asphalt Tretmant Base Coarse	ton	74,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Binder Course	ton	77,000	56,180	4,325,886	37,901	2,918,362	53,406	4,112,262	17,385	1,338,668	119,568	9,206,736	46,080	3,548,160	330,520	25,450,063
Surface Course	ton	77,900	62,931	4,902,339	52,895	4,120,519	35,101	2,734,403	8,693	677,157	86,868	6,766,998	24,240	1,888,296	270,728	21,089,712
Asphalt Cement	ton	515,300	7,776	4,006,974	5,977	3,079,792	6,433	3,314,935	1,652	851,071	13,255	6,830,210	3,977	2,049,245	39,069	20,132,227
Prime/Tack Coat	kg	1,200	849,864	1,019,837	615,230	738,276	540,963	649,156	221,940	266,328	1,248,100	1,497,720	945,600	1,134,720	4,421,697	5,306,037
SUB–TOTAL				20,380,517		14,938,772		16,938,333		4,600,495		33,891,117		22,227,941		112,977,174
6. MISCELLANEOUS																
Road Marking	m2	17,100	25,163	430,279	23,250	397,575	18,401	314,649	7,398	126,506	36,893	630,862	21,210	362,691	132,314	2,262,561
Concrete Curb	m	36,900	44,880	1,656,072	59,560	2,197,764	69,430	2,561,967	32,880	1,213,272	112,500	4,151,250	121,200	4,472,280	440,450	16,252,605
Guardrail	m	150,000	1,120	168,000	0	0	0	0	0	0	480	72,000	700	105,000	2,300	345,000
Street Lighting	km	468,000,000	21	10,001,160	15	6,968,520	20	9,568,260	8	3,846,960	21	9,594,000	40	18,907,200	126	58,886,100
Trees	each	1,200	1,229	1,475	2,978	3,574	2,449	2,939	1,233	1,480	3,838	4,605	4,040	4,848	15,767	18,920
Sodding	m2	3,200	136,765	437,648	67,005	214,416	63,255	202,416	32,880	105,216	112,500	360,000	161,600	517,120	574,005	1,836,816
Retaining Wall	m	13,418,000	1,120	15,028,160	0	0	1,000	13,418,000	0	0	480	6,440,640	700	9,392,600	3,300	44,279,400
Concrete Slop Protection	m2	66,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROW Fence	m	43,500	40,600	1,766,100	0	0	0	0	0	0	0	0	0	0	40,600	1,766,100
Toll Gate	each	95,000,000	40	3,800,000	0	0	0	0	0	0	0	0	0	0	40	3,800,000
Traffic Control Signs	km	60,000,000	21	1,250,100	16	930,000	20	1,226,700	8	493,200	30	1,788,000	20	1,212,000	115	6,900,000
SUB–TOTAL				33,818,814		10,711,849		27,294,931		5,786,633		23,041,357		34,973,739		135,627,322
7. TOTAL				496,960,926		143,906,636		116,975,307		21,342,123		125,954,841		123,655,652		1,029,795,485
8. V.A.T (PPN 10 %)				49,596,093		14,390,664		11,897,531		2,134,212		12,595,484		12,365,569		102,979,549
9. GRAND TOTAL				545,557,019		158,297,299		130,872,838		23,476,335		138,550,325		136,021,217		1,132,775,034

(2) Pavement Overlay Cost

The project roads will require pavement overlay as periodic maintenance. It is assumed that overlays will be executed at 10 years intervals. The costs were estimated for the purpose of economic and financial project evaluations. The estimated construction cost is shown in Table 16.6.2 as an additional investment cost.

16.3 Purchase Cost of Maintenance Equipment and Maintenance/Operation Office for Toll Road

The maintenance works will be performed mostly by contractors under the supervision of the maintenance agency, therefore, it is estimated that the maintenance office will be equipped only with limited types of maintenance equipment. The purchase cost of such maintenance equipment and maintenance/operation office cost were estimated with reference to the Surabaya-Gempol Toll Road. The estimated cost is shown in Table 16.3.1.

Table 16.3.1 Purchase Cost of Maintenance Equipment and Maintenance and Operation Office

	DESCRIPTION	Unit	Quantity	Unit Cost (Rp.)		Amount (Rp. x 1,000)	
	Maintenance Equipment			Unit Price	Tax/Duty Included	Total	Tax/Duty Included
1	Dump Truck, 6-ton	each	1	67,600,000	96,668,000	67,600	96,668
2	Flat Bed Truck, 6-ton	each	1	42,000,000	60,060,000	42,000	60,060
3	Tank Truck, 2,000 lt.	each	2	103,380,000	147,833,400	206,760	295,667
4	Tank Truck, 1,000 lt.	each	1	60,000,000	85,800,000	60,000	85,800
5	Lift Car, 2-ton	each	1	177,200,000	253,396,000	177,200	253,396
6	Stamper	each	1	92,800,000	132,704,000	92,800	132,704
7	Vibrating Plate Compactor	each	1	96,800,000	138,424,000	96,800	138,424
8	Generator, 175KVA	each	1	20,000,000	28,600,000	20,000	28,600
9	Paving Breaker	each	1	2,100,000	3,003,000	2,100	3,003
10	Concrete Cutter, 22"	each	1	24,200,000	34,606,000	24,200	34,606
11	Concrete Cutter, 60 cm	each	1	1,330,000	1,901,900	1,330	1,902
12	Lawn Mower, 11 ph	each	2	9,060,000	12,955,800	18,120	25,912
13	Lawn Mower, 3.5 ph	each	2	2,940,000	4,204,200	5,880	8,408
14	Rotary Cutter	each	2	3,340,000	4,776,200	6,680	9,552
15	Air Compressor, 57 S/D	each	3	11,440,000	16,359,200	34,320	49,078
16	Air Grease Gun	each	1	92,200	131,846	92	132
17	Crane, 2.5 ton	each	1	30,000,000	42,900,000	30,000	42,900
18	Battery Charger, 8 A	each	1	630,000	900,900	630	901
19	Battery Tester, 100 A	each	1	1,130,000	1,615,900	1,130	1,616
20	Cutting Machine Set, 300 mm	each	1	1,056,000	1,510,080	1,056	1,510
21	Electric Drill Set	each	1	264,000	377,520	264	378
22	Electric Saw	each	1	506,000	723,580	506	724
23	Jack Hammer Set	each	1	700,000	1,001,000	700	1,001
24	Gas Welding Machine Set	each	1	280,000	400,400	280	400
25	L.P.G Gas, 50 kg	each	1	380,000	543,400	380	543
26	Oxygen Gas, 50 kg	each	1	632,000	903,760	632	904
27	Tile Cutter, 100 mm	each	1	336,000	480,480	336	480
28	Tool Kit	each	85	617,600	883,168	52,496	75,069
29	Generator, 1.5 kva	each	1	2,700,000	3,861,000	2,700	3,861
30	Portable Generator, 2 kva	each	1	3,800,000	5,434,000	3,800	5,434
31	Tractor, 34 ph	each	3	71,580,000	102,359,400	214,740	307,078
32	Water Pump, 15 ph	each	2	820,000	1,172,600	1,640	2,345
Sub-Total						1,167,172	1,669,056
Maintenance/Operation Office		L.S	1			1,232,828	1,356,111
Total						2,400,000	3,025,167

16.4 Land Acquisition and Compensation Cost

Land acquisition and compensation cost was estimated based on the area of required land acquisition estimated in the preliminary engineering design and the unit price of land acquisition and compensation obtained from the office of BAPPEDA of the related regencies (Kotamadya Surabaya, Kabupaten Gresik and Kabupaten Sidoarjo) for each land category. No tax component is included in these unit costs. The estimated land acquisition and compensation cost is shown in Table 16.4.1. And breakdown of land acquisition and compensation costs are shown in Appendix 16.2.

Table 16.4.1 Land Acquisition and Compensation Quantity and Cost

Description	Route – 1 Toll Road L= 20.8 km		Route – 1 Arterial Road L= 15.5 km		Route – 2 Arterial Road L= 13.3 km		Route – 3 Arterial Road L= 8.2 km		Route – 4 Arterial Road L= 27.6 km		Route – 5 Arterial Road L= 22.6 km		TOTAL L= 108.0 km	
	Area (m2)	Amount Rp.x1,000	Area (m2)	Amount Rp.x1,000	Area (m2)	Amount Rp.x1,000	Area (m2)	Amount Rp.x1,000	Area (m2)	Amount Rp.x1,000	Area (m2)	Amount Rp.x1,000	Area (m2)	Amount Rp.x1,000
Commercial Area	0	0	11,000	1,925,000	0	0	33,675	9,063,750	39,500	7,110,000	0	0	84,175	18,098,750
Housing Area	120,170	14,187,350	50,200	5,705,000	68,400	11,970,000	50,550	10,661,250	90,925	15,457,250	108,925	18,517,250	489,170	76,498,100
Industrial Area	0	0	0	0	17,000	2,720,000	20,925	4,882,500	6,450	999,750	71,575	11,809,875	115,950	20,412,125
Rice Field Area	464,955	20,597,513	200,800	12,071,500	164,050	13,944,250	18,150	2,953,125	196,000	7,696,500	332,900	12,954,500	1,376,855	70,217,388
Field Area	44,520	3,450,300	0	0	40,700	3,133,900	0	0	170,800	2,989,000	180,600	3,782,625	436,620	13,355,825
Salt Farm Area	49,335	3,823,463	36,800	2,852,000	0	0	0	0	0	0	0	0	86,135	6,675,463
Fish Pond Area	75,285	6,022,800	0	0	37,400	2,992,000	0	0	0	0	0	0	112,685	9,014,800
Forest Area	22,365	223,650	16,200	162,000	0	0	0	0	20,400	244,800	0	0	58,965	630,450
Road/River	443,350	0	203,960	0	129,775	0	82,200	0	540,375	0	128,800	0	1,528,460	0
TOTAL	1,219,980	48,305,075	518,960	22,715,500	457,325	34,760,150	205,500	27,560,625	1,064,450	34,497,300	822,800	47,064,250	4,289,015	214,902,900

16.5 Operation and Maintenance Cost

The annual operation and maintenance costs of the Toll Road in 1996/1997 price are estimated at 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 in 1996/1997 price is estimated at Rp. 22.6 mil. per km.

16.6 Estimated Project Cost and Source of Finance

(1) Initial Investment Cost and Additional Investment Cost

The estimated initial investment costs for the Project Roads are summarized in Table 16.6.1 while the estimated additional investment costs are summarized in Table 16.6.2.

(2) Yearly Cash Flow of the Project Cost

A yearly cash flow of the Project Roads cost has been prepared as shown in Table 16.6.3 to Table 16.6.8, assuming the following implementation schedule of the initial stage development.

Detailed Design	1 year
Land Acquisition	2 years
Construction	3 years

(3) 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).

1. 85% of total construction costs including land acquisition and property compensation cost, and administration costs.
2. 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.

Table 16.6.1 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	123,656
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	49,596	15,830	14,391	13,087	11,898	2,348	2,134	13,855	12,596	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

Table 16.6.2 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

Table 16.6.3 Yearly Cash Flow of the Project Cost for Route-1 : Toll Road

Route – 1 Toll 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				181,852	181,852	181,852	545,557	8,143	8,143
Land Acquisition and Compensation		24,153	24,153				48,305		
Purchase 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

Table 16.6.4 Yearly Cash Flow of the Project Cost for Route-1 : Arterial Road

Route – 1 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				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

Table 16.6.5 Yearly Cash Flow of the Project Cost for Route-2

Route – 2 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				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

Table 16.6.6 Yearly Cash Flow of the Project Cost for Route-3

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

Table 16.6.7 Yearly Cash Flow of the Project Cost for Route-4

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

Table 16.6.8 Yearly Cash Flow of the Project Cost for Route-5

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	18,394	301	304
Total	4,081	25,885	25,885	48,514	48,514	49,450	202,330	3,342	3,342

CHAPTER 17 PROJECT ECONOMIC ANALYSIS

CHAPTER 17

PROJECT ECONOMIC ANALYSIS

17.1 Economic Analysis

The main purpose of the economic project 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 as individual projects in this economic analysis. For the evaluation purpose, 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.

17.2 Economic Benefits

17.2.1 General

Benefits are classified into two types, one is the direct benefit and the other is the indirect benefit or intangible benefit.

(1) Direct Benefits

The direct benefits which would be realized from implementation of the Project are defined as the saving in travel costs, composed of vehicle operating cost and vehicle time cost, when comparing the "With" and "Without" project conditions.

The benefit of vehicle operating cost is estimated as the difference of vehicle operating cost between the "With Project Case" and "Without Project Case". The vehicle operating cost is derived from the computed daily vehicle-kilometers for each operating speed and the unit vehicle operating cost for each speed by vehicle type.

The benefit of vehicle time cost is estimated as the difference of vehicle time cost between the "With Project Case" and "Without Project Case". The vehicle time cost is derived from the computed daily vehicle-hours for each operating speed and the unit vehicle time cost for each vehicle type.

The promotion of traffic safety and the savings in accident costs are not counted as benefits in this case.

As mentioned above, the savings are calculated as the savings of the whole network to examine the effect of the projects.

The direct benefits are:

1. Vehicle operating cost saving in the whole network, and
2. Vehicle time cost saving in the whole network.

The calculations are made for Year 2008 and Year 2018.

(2) Indirect Benefits

Indirect benefits would be many possible intangible benefits of the project, e.g. additional employment, multiplier effects, etc.

Additional employment (job creation) can be expected during the period of the construction stage and the period of the operation stage especially for the toll road. The realization of the road development will lead to not only better and easier access between each area (residential area to central business district, etc.), but it will also induce the so-called development effect such as the inducement of new and/or renewal urban development along the corridor. Especially for the east - west corridors, such a development effect can be foreseen.

(3) Benefits to be Treated

In this economic analysis, the above-mentioned direct benefits, e.g. the vehicle operating cost saving and the vehicle time cost saving are computed.

17.2.2 Computation of Economic Benefits

The quantified economic benefits in travel costs are defined as the savings in economic travel costs when comparing the "with" and "without" project situations. Travel costs are divided into vehicle operating cost and time cost.

The "with" project situation means the "with" project traffic assignment in vehicle-kilometers and the vehicle-hours on vehicles' route between origin and destination, including the proposed road. The "without" project condition is the traffic assignment on vehicles' travel routes "without" the proposed road.

The total daily economic vehicle operating costs, in both the "with" and "without" conditions, are calculated by taking the daily vehicle-kilometers of the traffic assignment computed under Q-V conditions of road links and multiplying them by the respective unit vehicle operating costs by speed. These daily costs are then converted to total annual costs by multiplying by 300 days.

The economic benefit in operating costs is then taken as the saving in operating costs when comparing the total "with" and "without" project vehicle operating costs.

A similar method is followed in estimating the economic benefits in time costs where the total vehicle-hours are applied directly to the time costs per hour in the "with" and "without" project conditions. After converting from total daily time costs to yearly time costs the costs are netted out to arrive at the savings in time costs.

(1) Unit Vehicle Operating Cost (VOC)

1) General

The estimation of vehicle operating cost is based on the method in previous similar studies on arterial/toll road projects in Indonesia. All cost components (i.e. unit prices of vehicle, tire, fuel, oil and etc.) were up-dated according to the latest information collected in Surabaya city for this study.

2) Representative Vehicles

Since a major factor of vehicle operating cost is the cost and the type of vehicles, it is necessary to establish representative vehicles for the vehicle categories of the traffic assignment.

The vehicle categories are assumed to be a) private passenger car, b) truck c) public mini bus d) public large bus, and e) motorcycle. Considering the traffic characteristics of many motorcycle users in Surabaya City, the motorcycle is treated as one of the vehicle category in this analysis. Based on the classification in the traffic count survey conducted by the Study Team, the above-mentioned five vehicle categories are assumed to respectively consist of the following vehicle types:

Private passenger car	:	Sedan, Minibus (private) and Van (private)
Truck	:	Pick-up, Small/Medium truck and Large truck
Public mini bus	:	Minibus (public)
Public large bus	:	Large bus (public)
Motorcycle	:	Motorcycle

The representative vehicles for each category are discussed below and their specifications are summarized in Table 17.2.1.

a) Private Passenger Car

Recent sales data of passenger car by model/maker in the area of Surabaya city are not available. According to interviews with some car dealers in Surabaya, the popular model of sedan in the area of Surabaya is judged to be the Toyota Corolla 1600.

In Surabaya, many so-called recreational type vehicles such as private minibus (Kijang type) and van are commonly used as sedan substitutes. After interviewing car dealers and observations on the road, the Toyota Kijang Minibus was selected as the representative private minibus, and the Mitsubishi Colt L300 Van was selected as the representative private van.

Table 17.2.1 Specification of Representative Vehicles

Specification	1) Sedan	2) Minibus (Private)	3) Van	4) Pick-up	5) Small Truck	6) Medium Truck	7) Large Truck	8) Mini Bus (Public)	9) Mini Bus (Public)	10) Large Bus	11) Motor-cycle
	Toyota Corolla 1600 Xli	Toyota Kijang Minibus (SSX)	Mitsubishi Colt L300	Toyota Kijang Pick-up	Mitsubishi Colt FE114	Mitsubishi Fuso FM517H	Mitsubishi Fuso FN517	Toyota Kijang Minibus (SX)	Suzuki Carry 1300	Mercedes Bentz OH 1581	Honda Astrea Impressa C 100
1) Length (m)	4.285	4.155	4.315	4.625	5.805	7.535	8.260	4.155	3.875	11.170	1.854
2) Width (m)	1.690	1.670	1.880	1.715	1.870	2.385	2.385	1.670	1.570	2.500	0.667
3) Height (m)	1.385	1.785	1.970	1.820	2.045	2.710	2.725	1.790	1.915	-	1.043
4) Number of Axles	2	2	2	2	2	2	3	2	2	2	-
5) Number of Wheels	4	4	4	4	6	6	10	4	4	6	2
6) Weight (Kg)	990	1,265	1,090 (Chassis)	1,145	1,865 (Chassis)	3,970 (Chassis)	5,070 (Chassis)	1,205	1,050	3,970	91
7) Capacity (persons)	4	5	8	3	3	3	3	1+10	1+10	1+55	2
8) Load Capacity (ton)	-	-	-	-	3.5 - 5.0	7.0 - 12.0	20.0 - 25.0	-	-	-	-
9) Tyre Size	175/65HR-14	185/80R-14	7.00 - 14	6.00-13-6PR	7.00-16-14PR	9.00-20-14PR	9.00-20-14PR	6.00-13-6P	165R13-8PR	10.00-20	-
10) Engine Capacity (cc)	1,587	1,781	2,477	1,781	3,298	7,545	7,545	1,781	1,300	5,958	100
11) Number of Cylinders	4	4	4	4	4	6	6	4	4	6	1
12) Gross Horse Power	115 HP	80 HP	80 HP	80 HP	100 PS	190 PS	190 PS	80 HP	73 HP	190 PS	-
13) Fuel Type	Gasoline	Gasoline	Diesel	Gasoline	Diesel	Diesel	Diesel	Gasoline	Gasoline	Diesel	Gasoline

Source : Information Obtained from Car Dealers in Surabaya City.

Recently, in the sedan car market in Indonesia there can be seen some new trends. Several economical-priced oriented passenger cars of sedan type have emerged in the market, represented by such as the Timor S515. At present, so far, the actual sales activity in the sedan type car market is still not evident, and the future market trend is reported to be fluid. However, it seems that as a result of the emergence of several such economical-priced cars, the price level as a whole in the car market, not only of sedan cars but also of all passenger cars, will be influenced in the future.

b) Truck

Many models of pick-up are used for light-weight cargo transportation in Surabaya city. Based on observations on the road, the Toyota Kijang Pick-up was selected as the representative pick-up.

The Mitsubishi Colt FE114 and the Mitsubishi Fuso FM517H were selected as the representative vehicles of the small and medium truck, respectively. The Mitsubishi Fuso FN517 was selected as the representative vehicle of the large truck with more than 3-axles.

In the traffic count survey conducted by the Study Team in April 1996, the type of small and medium trucks were counted together, therefore the share ratio of both types of truck is unknown. Consequently, for the estimation of unit vehicle operating cost, a combined vehicle type of small truck and medium truck is assumed as a small/medium truck, and an average value of unit price of these two trucks was applied for the cost calculation.

c) Public Mini Bus

Many models of minibus type vehicle are used for public passenger transportation services especially in the rather narrow roads in Surabaya city. According to observations in some city bus terminals, both the Toyota Kijang Minibus (public bus mode) and the Suzuki Carry 1300 (public bus mode) are selected as the representative vehicles of the public mini bus. For the estimation of unit vehicle operating cost, an average value of unit price of these two vehicles was applied for the cost calculation.

d) Public Large Bus

Large size of bus is used for public passenger transportation services on the arterial roads in Surabaya city. The Mercedes Benz OH 1581 was selected as the representative vehicles of the public large bus.

e) Motorcycle

In Surabaya city there are many models of motorcycles with a variety of engine sizes mainly from 80cc class to 125cc class from makers such as Honda, Yamaha, Suzuki, etc. After interviewing motorcycle dealers and observations on the road, the Honda Astrea Impressa C100 was selected as the representative motorcycle.

3) Unit Price of Operating Cost Components

The financial and economic unit prices of the major cost components were up-dated with 1997 prices collected in Surabaya for the study. The details are discussed below and summarized in Table 17.2.2.

a) Vehicles

The current 1997 market prices for vehicles were obtained through an interview survey with the major car dealers in Surabaya. Taxes related to vehicles are import duty, luxury goods sales tax, value added tax and the registration fee. The tax ratio of vehicles for estimating the economic price of vehicles is discussed below and summarized in Table 17.2.3.

In Indonesia, recently the tax system of import duty has been largely changed. Due to the recent trend of free trade policy (deregulation for import trade) in Indonesia, the ratio of import duty related to vehicles has been reduced. Before December 1993 the import duty ratio of sedan vehicles was 100% regardless of the ratio of domestic products in CKD (complete knock-down). However, at present the import duty ratio of sedan vehicles ranges from 65% to 0% in accordance with the degree of the ratio of domestic products in CKD. According to information from car dealers, the import duty ratio of sedans is estimated to be 50% and the import duty ratio of commercial vehicles is estimated to be 0%.

The ratios of luxury goods sales tax are estimated to be 35%, 25% and 0% for sedans, commercial vehicles (van/minibus) and commercial vehicles (pick-up/truck/bus) respectively, according to information obtained by interview from some car dealers.

Table 17.2.2 Unit Price of Vehicle Operating Cost Component (Constant 1997 Prices)

(Unit: Rp.)

PRICE OF VEHICLES		Financial Price	Economic Price
Sedan	: Toyota Corolla 1600	72,450,000	37,674,000
Minibus (Private)	: Toyota Kijang Minibus (SSX)	39,700,000	27,393,000
Van	: Mitsubishi Colt L300	42,000,000	28,980,000
Pick-up	: Toyota Kijang Pick-up (Gasoline)	27,450,000	22,784,000
Small Truck	: Mitsubishi Colt FE114	44,000,000	36,520,000
Medium Truck	: Mitsubishi Fuso FM517H	84,700,000	70,301,000
Large Truck	: Mitsubishi Fuso FN517	108,350,000	89,931,000
Minibus (Public)	: Toyota Kijang Minibus (SX)	31,300,000	21,597,000
Minibus (Public)	: Suzuki Carry 1300	23,350,000	16,112,000
Large Bus (Public)	: Mercedes Benz OH1581	157,500,000	130,725,000
Motorcycle	: Honda Astrea Impressa C100	4,600,000	3,677,000

Source : Financial Price : Interview from Car Dealers in Surabaya City.
Economic Price : Estimated by Study Team.

(Unit: Rp.)

PRICE OF ONE SET OF TYRE/TUBE		Financial Price	Economic Price
Sedan	: Toyota Corolla 1600	128,500	116,818
Minibus (Private)	: Toyota Kijang Minibus (SSX)	100,000	90,909
Van	: Mitsubishi Colt L300	109,000	99,091
Pick-up	: Toyota Kijang Pick-up (Gasoline)	94,500	85,909
Small Truck	: Mitsubishi Colt FE114	165,000	150,000
Medium Truck	: Mitsubishi Fuso FM517H	370,000	336,364
Large Truck	: Mitsubishi Fuso FN517	370,000	336,364
Minibus (Public)	: Toyota Kijang Minibus (SX)	94,500	85,909
Minibus (Public)	: Suzuki Carry 1300	79,000	71,818
Large Bus	: Mercedes Benz OH1581	497,500	452,273
Motorcycle	: Honda Astrea Impressa C100 (for 2 Wheels)	33,000	30,000

Source : Financial Price : Interview from Tyre Shop in Surabaya City.
Economic Price : Estimated by Study Team.

(Unit: Rp.)

PRICE OF FUEL/ENGINE OIL (PER LITER)	Financial Price	Economic Price
Gasoline	700	636
Diesel Fuel	380	345
Engine Oil for Sedan	9,000	8,182
Engine Oil for Gasoline Minibus/Pick-up	8,000	7,273
Engine Oil for Diesel Minibus	5,000	4,545
Engine Oil for Diesel Truck/Bus	5,000	4,545

Source : Financial Price : Interview from Gasoline Station in Surabaya City.
Economic Price : Estimated by Study Team.

(Unit: Rp.)

WAGE RATES (PER HOUR)	Financial Price	Economic Price
Mechanics	1,174	1,174
Bus Driver	1,607	1,607
Truck Driver	1,666	1,666
Bus Conductor	866	866
Truck Assistant	713	713

Source : Estimated based on Statistical Data.

Table 17.2.3 Estimated Tax Component of Market Sales Price of Vehicles

<1> Taxes on Sedan

			Costs	Taxes
(1)	CIF Price of CKD Parts		1.0000 A	
(2)	Import Duty	(1) x 50%	0.5000 A	0.5000 A
(3)	Assembly and Other Costs		0.7000 A	
(4)	PPnBM	((1)+(2)+(3))x35%	0.7700 A	0.7700 A
(5)	PPN	((1)+(2)+(3))x10%	0.2200 A	0.2200 A
(6)	Dealer/Distributor Price	Sum((1)-(5))	3.1900 A	
(7)	Dealer Commision	(6)x10%	0.3190 A	
(8)	Sales Price	(6)+(7)	3.5090 A	
(9)	Registration Fee	(8)x10%	0.3509 A	0.3509 A
(10)	Total Price	(8)+(9)	3.8599 A	1.8409 A

Tax Ratio = 1.8409 / 3.8599 = 48%

<2> Taxes on Commercial Vehicles (Van/Minibus)

			Costs	Taxes
(1)	CIF Price of CKD Parts		1.0000 A	
(2)	Import Duty		0.0000 A	0.0000 A
(3)	Assembly and Other Costs		4.5000 A	
(4)	PPnBM	((1)+(2)+(3))x25%	1.3750 A	1.3750 A
(5)	PPN	((1)+(2)+(3))x10%	0.5500 A	0.5500 A
(6)	Dealer/Distributor Price	Sum((1)-(5))	7.4250 A	
(7)	Dealer Commision	(6)x10%	0.7425 A	
(8)	Sales Price	(6)+(7)	8.1675 A	
(9)	Registration Fee	(8)x10%	0.8168 A	0.8168 A
(10)	Total Price	(8)+(9)	8.9843 A	2.7418 A

Tax Ratio = 2.7418 / 8.9843 = 31%

<3> Taxes on Commercial Vehicles (Truck/Pick-up/Bus)

			Costs	Taxes
(1)	CIF Price of CKD Parts		1.0000 A	
(2)	Import Duty		0.0000 A	0.0000 A
(3)	Assembly and Other Costs		4.5000 A	
(4)	PPnBM	((1)+(2)+(3))x0%	0.0000 A	0.0000 A
(5)	PPN	((1)+(2)+(3))x10%	0.5500 A	0.5500 A
(6)	Dealer/Distributor Price	Sum((1)-(5))	6.0500 A	
(7)	Dealer Commision	(6)x10%	0.6050 A	
(8)	Sales Price	(6)+(7)	6.6550 A	
(9)	Registration Fee	(8)x10%	0.6655 A	0.6655 A
(10)	Total Price	(8)+(9)	7.3205 A	1.2155 A

Tax Ratio = 1.2155 / 7.3205 = 17%

Source: Estimated Based on Interview from Car Dealers in Surabaya City.
Note: PPnBM = Pajak Penjualan Barang Mewah (Luxurious Goods Sales Tax)
PPN = Pajak Pertambahan Nilai (Value Added Tax, VAT)

As a result of the reduction of the above-mentioned tax portions, tax ratios on the market price of vehicles on the road are estimated to be 48%, 31% and 17% for sedan, commercial vehicles (van/minibus) and commercial vehicles (pick-up/truck/bus) respectively.

b) Tires

The market price of tires for the various vehicle types were up-dated to 1997 prices based on information from some tire shops in Surabaya. The portion of value added tax is adjusted for estimating the economic unit prices.

c) Fuel

For this economic analysis, no fuel subsidy is assumed for the gasoline and diesel fuels. The portion of value added tax is adjusted for estimating the economic unit prices.

d) Wage Rates

For estimating the wage rates of transport workers, i.e. drivers, assistants, conductors and mechanics, the statistical data of wages by kind of job by industrial sector (Upah Buruh Menurut Jenis Pekerjaan) were used. By applying the estimated annual average growth rate of consumer price index in East Java (about 9% per annum), the 1997 wage rates were estimated. Considering the wage levels of transport workers, their wages are assumed not to be subject to any income taxes. Therefore, the economic values are estimated to be equivalent to their market wage rates.

e) Interest Costs

A rate of 15% per annum was assumed. The interest costs in relation to speed were calculated from the annual running speed.

f) Insurance Costs

The average insurance premiums from previous and other studies were reviewed and incorporated into this analysis as below:

Private passenger car and pick-up	: 3.5% of vehicle price
Bus	: 4.0% of vehicle price
Truck	: 6.0% of vehicle price

The average insured vehicle rate was assumed to be 50%, and insurance costs were equated in consideration of the annual running distance by speed.

g) Wage Costs of Crew and Overhead Costs

The average crew size by vehicle type was obtained from field survey results, and their wage costs were derived from their traveling hours equated by average running speed. The overhead costs of commercial vehicles were assumed to be 10% of the total of other cost items.

h) Cost Equation of Vehicle Operating Costs

The various operating elements discussed above were individually expressed in terms of

vehicle average running speed, in order that costs at different speeds on a level tangent road could be derived. The equations with speed variables used in this study are based on those applied in previous similar studies in Indonesia.

Regarding "motorcycle", the cost equation is not available in previous similar studies. Consequently, the unit vehicle operating cost of motorcycle was obtained on the basis of equation of "sedan category" due to data limitation.

The equations for vehicle operating costs are shown in the Appendix 17.1.

4) Unit Vehicle Operating Cost by Vehicle Type

Based on the cost components and the equations of vehicle operating cost described above, unit vehicle operating costs by speed, by vehicle type in terms of financial and economic prices were calculated. Table 17.2.4 shows the unit vehicle operating costs in both financial and economic prices.

The above unit price vehicle operating costs were calculated for the nine representative vehicle types described earlier. The costs were then combined into five vehicle categories based on the vehicle composition rates shown in Table 17.2.5.

Table 17.2.4 Estimated 1997 Unit Vehicle Operating Costs

(1) 1997 Financial Vehicle Operating Costs (Rp./Km)

	Passenger Car			Bus		Pick-up	Truck		Motor-cycle
Speed (Km /Hour)	Sedan	Minibus (Private)	Van (Private)	Minibus (Public)	Large Bus	Pick-up	Small/ Medium Truck	Large Truck	
10	1799	1034	1040	687	1809	748	1082	1715	132
15	1353	784	782	553	1516	572	857	1373	102
20	1115	650	646	478	1372	476	741	1199	85
25	964	563	559	428	1292	414	671	1095	74
30	857	502	498	393	1246	370	625	1030	66
35	778	456	453	366	1222	336	595	989	60
40	717	420	418	347	1213	311	575	964	55
45	668	393	391	334	1216	291	562	951	51
50	630	371	369	325	1227	275	556	947	49
55	598	354	352	321	1246	264	554	951	46
60	574	341	338	321	1272	255	556	962	45
65	554	331	327	325	1303	250	561	978	44
70	539	325	319	333	1340	247	570	1000	44
75	527	321	313	344	1381	246	581	1026	44
80	520	320	308	358	1427	248	595	1057	44
85	515	322	306	376	1478	251	611	1092	45
90	514	325	306	396	1532	257	630	1130	47
95	515	331	307	420	1590	264	651	1173	48
100	518	339	309	448	1652	274	673	1219	51

(2) 1997 Economic Vehicle Operating Costs (Rp./Km)

	Passenger Car			Bus		Pick-up	Truck		Motor-cycle
Speed (Km /Hour)	Sedan	Minibus (Private)	Van (Private)	Minibus (Public)	Large Bus	Pick-up	Small/ Medium Truck	Large Truck	
10	978	737	731	595	1566	629	953	1499	109
15	742	563	552	475	1307	483	751	1195	84
20	615	468	457	407	1180	402	647	1041	70
25	534	406	396	361	1109	350	585	950	61
30	476	363	354	329	1068	313	544	893	55
35	433	330	322	305	1047	285	517	857	50
40	400	305	298	287	1038	263	500	835	46
45	375	285	279	274	1040	246	488	824	43
50	354	270	264	266	1050	233	483	821	40
55	339	258	253	262	1066	224	481	825	39
60	327	250	244	261	1089	217	483	835	37
65	318	244	237	264	1116	213	488	850	37
70	312	241	232	270	1148	211	495	869	37
75	309	240	229	280	1185	211	506	893	37
80	308	241	227	292	1225	212	518	921	37
85	310	244	227	307	1269	216	533	953	38
90	313	248	228	325	1317	222	549	988	40
95	319	255	230	346	1369	229	568	1026	41
100	326	263	233	370	1423	238	588	1067	43

Table 17.2.5 Vehicle Composition Rate

Vehicle Category	Vehicle Type	Composition Rate (%)	
Passenger Car	Sedan	(30%)	20.5%
	Minibus Private	(70%)	47.8%
		(100%)	68.3%
	Van		31.7%
Truck	Pick-up		61.9%
	Small/Medium Truck		28.6%
	Large Truck		9.5%
Mini Bus Public	Mini Bus		100%
Large Bus Public	Large Bus		100%
Motorcycle	Motorcycle		100%

Source: Based on traffic survey results at the several selected locations conducted by the Study Team in April 1996. The share ratio between Sedan and Minibus Private is based on another field survey on the road.

As a result, the weighted average of the unit vehicle operating costs by speed, by vehicle category in financial and economic prices were obtained as shown in Table 17.2.6.

(2) Unit Vehicle Time Cost

1) General

The estimation method of unit vehicle time cost of passenger car, motorcycle and bus (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.

2) Time Value of Passenger Car

For passenger car an income approach to estimate car owner's time value was adopted.

In the traffic survey conducted by the Study Team, an interview survey concerning the monthly income of car owner (passenger cars and motorcycle) was included. According to the result of this interview survey, the weighted average monthly household income of passenger car owner was estimated to be approximately Rp. 1,750,000. Assuming the monthly working hours to be 170 hours, the household income per hour was estimated to be Rp. 10,270.

Table 17.2.6 Estimated 1997 Composite Unit Vehicle Operating Costs

(1) 1997 Financial Vehicle Operating Costs (Rp./Km)

Speed (Km /Hour)	Private Passenger Car	Mini Bus	Large Bus	Truck	Motorcycle
10	1,193	687	1,809	935	132
15	900	553	1,516	730	102
20	744	478	1,372	620	85
25	644	428	1,292	552	74
30	574	393	1,246	506	66
35	521	366	1,222	472	60
40	480	347	1,213	449	55
45	449	334	1,216	431	51
50	423	325	1,227	419	49
55	403	321	1,246	412	46
60	388	321	1,272	408	45
65	375	325	1,303	408	44
70	367	333	1,340	411	44
75	361	344	1,381	416	44
80	357	358	1,427	424	44
85	356	376	1,478	434	45
90	358	396	1,532	447	47
95	361	420	1,590	461	48
100	366	448	1,652	478	51

(2) 1997 Economic Vehicle Operating Costs (Rp./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

Source: Estimated by JICA Study Team

The trip purpose composition for passenger car is given by the results of the same traffic survey by the Study Team. The coefficient factors for time value in the trip purpose are assumed 100% for "work and business" (60.4%) and "others" (30.7%), and 0% for "school" (8.8%). As a result, the unit time value for passenger car is estimated to be Rp. 9,360 per hour in 1996 financial price.

According to statistical data of the recent trend of the consumer price index in Surabaya, the estimated annual inflation rate during 1992 - 1996 is about 9.3%. Therefore, the escalation factor during 1996 - 1997 to be applied for adjustment of 1996 price is roughly assumed to be 9%.

Thus, the 1997 financial price of unit time value for passenger car is estimated to be Rp. 10,200 per hour. The economic price unit time value for passenger car is estimated to be Rp. 9,270 per hour, by assuming a conversion factor of 0.9 (financial price / 1.1).

3) Time Value of Motorcycle

For motorcycle an income approach to estimate motorcycle owner's time value was adopted.

For estimating the time value of motorcycle, a similar method to passenger car was applied. According to the result of the interview survey, the weighted average monthly household income of motorcycle owner was estimated to be approximately Rp. 732,700. Assuming the monthly working hours to be 170 hours, the household income per hour was estimated to be Rp. 4,310. The trip purpose composition for motorcycle is given by the results of the same traffic survey by the Study Team. The coefficient factors for time value in the trip purpose are assumed 100% for "work and business" (51.8%), and 0% for "school" (24.8%) and "others" (23.4%). As a result, the unit time value for motorcycle is estimated to b Rp. 2,230 per hour in 1996 financial price.

Similarly to the case of passenger car, the escalation factor during 1996 - 1997 to be applied for adjustment of 1996 price is roughly assumed to be 9%.

Thus, the 1997 financial price of unit time value for motorcycle is estimated to be Rp. 2,430 per hour. The economic price unit time value for motorcycle is estimated to be Rp. 2,210 per hour, by assuming a conversion factor of 0.9 (financial price / 1.1).

4) Time Value of Bus

For bus an income approach to estimate non-car owners' time value was adopted.

The estimation of unit bus time value was made according to the following process:

a) The 1997 per capita GRDP (gross regional domestic product) at current price in Surabaya city is estimated to be approximately Rp. 6,893,500.

b) Assuming the annual working hours to be 2,040 hours (170 hours per month x 12), the per capita GRDP for one hour is estimated as Rp. 3,380.

c) The trip purpose composition for bus is given by the results of the traffic survey by the Study Team. The coefficient factors for time value in the trip purpose are assumed 100% for "business and work" and 0% for other purposes.

d) The average number of bus passengers is assumed based on observation at the roads and at some city bus terminals; 6 and 30 persons for mini bus and large bus respectively.

e) As a result, the unit time value for bus is estimated to be Rp. 7,140 and Rp. 35,680 per hour in 1997 financial price for mini bus and large bus respectively. The 1997 economic prices are estimated to be Rp. 6,430 and Rp. 32,110 per hour for mini bus and large bus respectively, by assuming a conversion factor of 0.9 (financial price / 1.1).

The estimation process is given in Table 17.2.7.

5) Time Value of Truck

The unit vehicle time cost of truck comprises the component of the time cost of the loaded commodities and the time cost of crews.

a) Time Cost of Loaded Commodities

The hourly time cost of loaded commodities is estimated as below:

Average weighted price of loaded commodities
× Average weight of loaded commodities
× Interest rate per hour (Interest rate per annum / (365×7))

Average weighted price of loaded commodities per ton was estimated using the data of composition rate of commodities per ton and the data of corresponding commodity prices. Due to the limitation of data availability the data of composition rate of commodities per ton were based on the study results of the 1990/1991 Indonesia National O/D Survey. According to these survey results the information of composition rate of commodities per ton was obtained by type of commodity group and by vehicle type of "pick-up, small / medium truck" and "large truck".

Table 17.2.7 Estimation of Unit Vehicle Time Value for "Bus"

(1) Per Capita GRDP at Current Price in Surabaya City (Rp. 1,000)

1990	1991	1992	1993	1994	Average Annual Growth Ratio 90-'94	Assumed Applied Average Annual Growth Ratio	Estimated 1997
1,670.7	1,962.4 (17.5%)	2,211.8 (12.7%)	3,998.6 (80.8%)	4,652.9 (16.4%)	29.2%	14.0%	6,893.5

Source: SURABAYA DALAM ANGKA 1994 and 1995

(2) Assumption on Annual Working Hour

Monthly Working Hour	170 (Hours)
Annual Working Hour	2,040 (Hours)

(3) Per Capita GRDP Per Working Hour 3,379 (Rupiah Per Hour)

(4) Trip Purpose Composition for "Bus" and Assumed Effective Factor

	Trip Purpose Composition	Assumed Effective Factor	Time Value Per Passenger
1) Business and Work	35.2%	100.0%	1,189
2) School	37.6%		
3) Others	27.6%		
(Total)	100.0%		1,189 (Rupiah Per Passenger/Hour)

Source: Trip Purpose Composition ..... Traffic Survey Results by the Study Team, April 1996

(5) Assumed Load Factor of Passengers Per "Bus"

Mini Bus :	6 (Persons)
Large Bus :	30

Note: Assumed Based on the road observation.

(6) Estimated Unit Time Value for Vehicle of "Bus" in 1997

Mini Bus :	7,140 (Rupiah Per Bus Vehicle/Hour, 1997 Financial Price)
	6,430 (Rupiah Per Bus Vehicle/Hour, 1997 Economic Price)
Large Bus :	35,680 (Rupiah Per Bus Vehicle/Hour, 1997 Financial Price)
	32,110 (Rupiah Per Bus Vehicle/Hour, 1997 Economic Price)

Source: Estimated by the Study Team.

The 1995 wholesale prices for each commodity group in the area of East Java province were obtained from statistical data (Statistik Harga Perdagangan Besar, Feb. 1996), and the 1997 wholesale prices were estimated by applying an estimated growth factor. As a result, the weighted average prices of commodities per ton were estimated to be Rp. 3,425,700 and Rp. 3,021,400 for "pick-up, small / medium truck" and "large truck", respectively.

The average weight of loaded commodities were assumed based on the above National O/D Survey and observations at the road (0.5 ton, 2.9 tons and 5.0 tons for pick-up, small / medium truck and large truck respectively). The interest rate is assumed to be 20% per annum.

As a result, hourly costs of loaded commodities were estimated to be Rp. 134, Rp. 536 and Rp. 1,182 for pick-up, small / medium truck and large truck respectively.

b) Time Cost of Crews

The unit personnel costs per hour were estimated based on statistical data of wages of transport workers. The number of crews are assumed as shown in Table 17.2.8.

As a result, the 1997 economic unit time value of truck vehicle was estimated to be Rp. 2,120 per hour, by applying the vehicle composition rate of pick-up, small / medium and large trucks. (See Table 17.2.8.)

Table 17.2.8 Estimation of Time Cost of Truck Vehicle

			Pick-up	Small / Medium Truck	Large Truck	Average of Truck
(a)	Commodity Price (Rp./hour)		134	536	1,182	
(b)	Crew Cost (Assumed Number of Crew)	(Driver)	1	1	1	
		(Assistant)	0	1	2	
	(Unit Cost (Rp./hour))	(Driver)	1,666	1,666	1,666	
		(Assistant)	713	713	713	
	(Crew Cost (Rp./hour)	(Driver)	1,666	1,666	1,666	
		(Assistant)	0	713	1,426	
		(Total)	1,666	2,379	3,092	
(c)	Total		1,800	2,915	4,274	
(d)	Vehicle Composition Rate		61.9%	28.6%	9.5%	100.0%
(e)	Weighted Average (Rp./hour) (Financial Price)		1,114	834	406	2,354
(f)	Weighted Average (Rp./hour) (Economic Price)					2,120

Note : Vehicle composition rate is based on traffic survey results by the Study Team in April 1996.

The results of the vehicle time costs are summarized in the following Table 17.2.9.

Table 17.2.9 Vehicle Time Value in 1997 Prices

(Rp. / Vehicle-Hour)

	Financial Price	Economic Price
Passenger Car	10,200	9,270
Motorcycle	2,430	2,210
Mini Bus	7,140	6,430
Large Bus	35,680	32,110
Truck	2,354	2,120

Source : Estimated by the Study Team.

(3) Computation of Economic Benefits

As a result of traffic assignment simulation, the saving in vehicle operating costs and time costs are summarized for the planning years of 2008 and 2018 by each route as shown in Table 17.2.10.

Table 17.2.10 Estimated Economic Benefits

(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

17.3 Economic Evaluation of the Project

17.3.1 Project Economic Costs

The initial project cost for engineering services, construction and land acquisition of each Project route are estimated in constant 1997 prices as shown in Table 17.3.1. (details are in Chapter 16.)

Table 17.3.1 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.

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

The implementation of each Project (Route-1 to Route-5) is assumed to be carried out

independently of the others.

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

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

The project economic costs in constant 1997 prices are phased according to the implementation schedule (refer to Chapter 16) and the above assumptions. The annual allocated costs are shown in Table 17.3.2.

Table 17.3.2 Phased Annual Costs in 1997 Economic Prices

(Billion Rp.)

	Route-1	Route-2	Route-3	Route-4	Route-5
1998	21.1	3.9	0.7	4.2	4.1
1999	39.1	19.1	15.1	19.0	25.9
2000	39.1	19.1	15.1	19.0	25.9
2001	251.0	46.7	8.4	49.4	48.5
2002	251.0	46.7	8.4	49.4	48.5
2003	254.6	47.3	8.7	50.5	49.4
TOTAL	855.9	182.8	56.5	191.5	202.3

Source : Estimated by the Study Team.

The annual operation and maintenance costs in 1997 economic prices are shown in Table 17.3.3.

Table 17.3.3 Annual Operation and Maintenance Costs in 1997 Economic Prices

(Million Rp.)

	Route-1	Route-2	Route-3	Route-4	Route-5
O/M Costs	4,647	273	166	542	464

Source : Estimated by the Study Team.

17.3.2 Economic Evaluation of the Projects

The analysis follows the conventional discounted cash flow methodology in determining the EIRR (Economic Internal Rate of Return), NPV (Net Present Value) and B/C (Benefit Cost Ratio) with a project life of 30 years. These efficiency measures establish the economic viability of the Projects, and indicates the sensitivity of the Projects' economic viability to the changes of costs and benefits.

In Indonesia, for project appraisal the Government of Indonesia has been utilizing a 1.50 Benefit Cost ratio (B/C) at a 12% per annum discount rate as the preliminary screening rate against project proposals in Java. As the project roads are proposed in Surabaya city area, the discount rate of 15% per annum is applied for this project evaluation.

The results are shown in Table 17.3.4. The details of the cash flow of economic analysis for each Project are shown through Appendices 17.2 - 17.6.

Table 17.3.4 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.

17.3.3 Sensitivity Analysis

(1) Sensitivity to Benefit and Cost

Altering benefit and cost (initial investment cost), the effect on the EIRR was analyzed and the results are shown in Table 17.3.5.

Table 17.3.5 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.

Even in the worst case (cost +20% and benefit -20%), the value of EIRR is over 20% for Route-1, Route-2, Route-4 and Route-5; and over 18% for Route-3.

(2) Sensitivity to Delay in Implementation

The sensitivity about the effect of delay in project implementation was examined for the cases of one year delay and three year delay, and the results of changes of the net present value compared to Base Case were summarized in Table 17.3.6. The details are shown in Appendix 17.7.

Table 17.3.6 Changes of Net Present Value Compared to Base Case

(Billion Rp.)

	Net Present Value			Changes to Base Case	
	Base Case	One Year Delay	Three Year Delay	One Year Delay	Three Year Delay
	(a)	(b)	(c)	(a) - (b)	(a) - (c)
Route-1	595.0	557.8	479.9	37.2	115.1
Route-2	134.1	124.3	105.0	9.8	29.1
Route-3	37.5	34.6	29.1	2.9	8.4
Route-4	185.6	165.1	130.0	20.5	55.6
Route-5	194.7	176.5	143.8	18.1	50.8

Source: Estimated by the Study Team.

The net present values in the cases of implementation delay are small compared to those in the base case for each route. This shows that the delay in project implementation causes the decrease in the amount of net present value.