- Ministerial Decree of Minister of Public Works Number 779/KPTS/1990 pertaining to Technical Guidelines on the Environmental Impact Analysis for Highway and Bridge Projects (hereinafter called the "EIA Guidelines").

12.2 Study Purpose

The purpose of the environmental study is to ensure that the planning of the Toll Road has given careful consideration to possible environmental effects, so that the plan will, to the extent practicable, minimize adverse effects, and also achieve beneficial effects or enhance environmental values, especially for the purpose of offsetting any unavoidable adverse effects. To this end, the preliminary identification of environmental impacts was carried out by the Study Team.

12.3 Basic Premises of the Environmental Study

12.3.1 Environmental Quality Standards and Research Data

Prior to the preliminary identification of environmental impacts, the Study Team looked into the existing environmental quality standards and past research data. However, it was found that these standards and research data are still in the adjustment or development stage and do not treat the matters at length.

12.3.2 Preliminary Identification of Environmental Impacts and Environmental Impact Analysis (ANDAL)

(1) Preliminary Identification of Environmental Impacts

A preliminary environmental analysis was carried out to a certain extent, however the analysis is limited to a case study only. The case study aimed at the identification of problems which should be clarified and assessed in the framework of the preparation of the following environmental documents which are to be prepared by the execution body of the Project:

- Environmental Impact Analysis (ANDAL);
- Proposed environmental management plan (RKL); and
- Proposed environmental monitoring plan (RPL).

(2) Environmental Impact Analysis (ANDAL)

Since the environmental impact analysis (ANDAL) is not included in the Study the execution body of the Project will be required to prepare a Supplement Type ANDAL (*ANDAL Susulan) .

The Supplement Type ANDAL may be prepared based on the available socio-economic data and information described in the Feasibility Study Report. However, additional data needed to clarify the intensity of potential impact, especially concerning the social aspect, must be collected by thorough investigations at the site (refer to Paragraph 4.4.2.b of the EIA Guidelines).

12.4 Environmental Background in the Direct Influence Zone

12.4.1 Outline of Environmental Condition

Environment as used herein refers to the totality of the surroundings of the population: social manmade, physical and natural. No preserved forest, important vegetation or wildlife is found in the Toll Road corridor. Basically no estuary or mud flat or marine ecosystem will experience impacts from the Project since the Toll Toad is planned in an inland region.

Monuments of historical value exist in the vicinity of Trowulan, south of Mojokerto. These are temples and candies constructed in the era of the Mojopahit Kingdom in the thirteenth century. The route of future extension of the Toll Road leading to the west of Mojokerto should avoid the Trowulan area.

The most significant environmental condition which affects the planning/design of the Toll Road is the social settings especially displacement of residents and loss of agricultural land. The Brantas Delta spread out in Sidoarjo and Mojokerto regencies is the most densely populated area (more than 1,000 person/km^2) in the region and irrigation canal networks are maintained by modern agricultural development technology. While, in the northern areas of the Surabaya river, in Gresik and Mojokerto regencies, the land remains still undeveloped because of poor soil capability for agricultural development.

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* Note: According to the Subsection 4.4 of EIA Guidelines, there are two types of ANDAL, namely ANDAL in due form (i.e. which shall be incorporated in the feasibility study) and ANDAL in supplement form which is separated from the feasibility study.

12.4.2 Social Environment

(1) General Information

Population, landuse, socio-economic features, road network and road traffic, etc. have been discussed and analyzed in the following respective sections:

Description	Section/Subsection
• Population in East Java and the Study Area	Subsection 2.2.2
• Landuse	Section 2.2
• GRDP by Kabupaten	Subsection 4.4.2
• Military Facilities and Housing/ Industrial Areas	Subsection 7.1.7
• Road Transportation	Section 3.1

(2) Population in the Direct Influence Zone

The past population trend in the Direct Influence Zone is shown below:

Population in the Direct Influence Zone (1980 - 1990)

Kab./Kodya	1980	1985	1990	Growth Rate (% p.a.)	
				1980-1985	1985-1990
Kod. Surabaya	2,017,527	2,340,311	2,651,394	3.01%	2.53%
Kab. Mojokerto	705,547	752,646	808,501	1.30%	1.44%
Kab. Sidoarjo	853,685	975,556	1,094,004	2.70%	2.32%
Kab. Gresik	728,570	800,378	864,003	1.90%	1.54%

Population density by Regency/Municipality is shown in Table 2.3 and diagrammatically in Fig. 2.2 in Chapter 2. Population density in the Study Area based on population density by Kecamatan is shown in Fig. 12.1.

(3) Landuse in the Direct Influence Zone

Landuse in the Direct Influence Zone is shown in Tables 2.7 - 2.10 in Chapter 2. Important landuse from the viewpoint of environmental impacts due to the right-of-way acquisition for the Project is considered to be developed areas and technical irrigation areas.

It is noted that Kab. Sidoarjo is mostly comprised of developed areas and technical irrigation areas, 22.1% and 46.1% of the total area, respectively. In case of Kab. Gresik, these percentages are only 9.1% and 0.6% of the total area, respectively.

(4) Road Traffic

The rapid urban expansion in the Surabaya area has inevitably entailed various urban problems and these have become increasingly serious. Inadequacy of basic infrastructures, inappropriate landuse, housing shortage and the great need to improve the transportation network are the main problems.

The necessity to strengthen the road network in the GKS Region by providing a toll road network is primarily due to the recent increase in vehicle traffic demand accompanying the development of the area. The Surabaya-Gempol Toll Road was thus planned to link Surabaya and the southern hinterland and was opened to traffic in July 1986. For the Surabaya-Gresik Toll Road, an agreement for private sector participation has been concluded and the review of detailed design has started.

The traffic between Mojokerto and Surabaya increases as the national/provincial roads approach Surabaya city, that is about 18,400 veh/day near Mojokerto and 43,700 veh/day near Surabaya/Waru (refer to Section 3.1.2 in Chapter 3 for further descriptions).

12.4.3 Manmade Environment

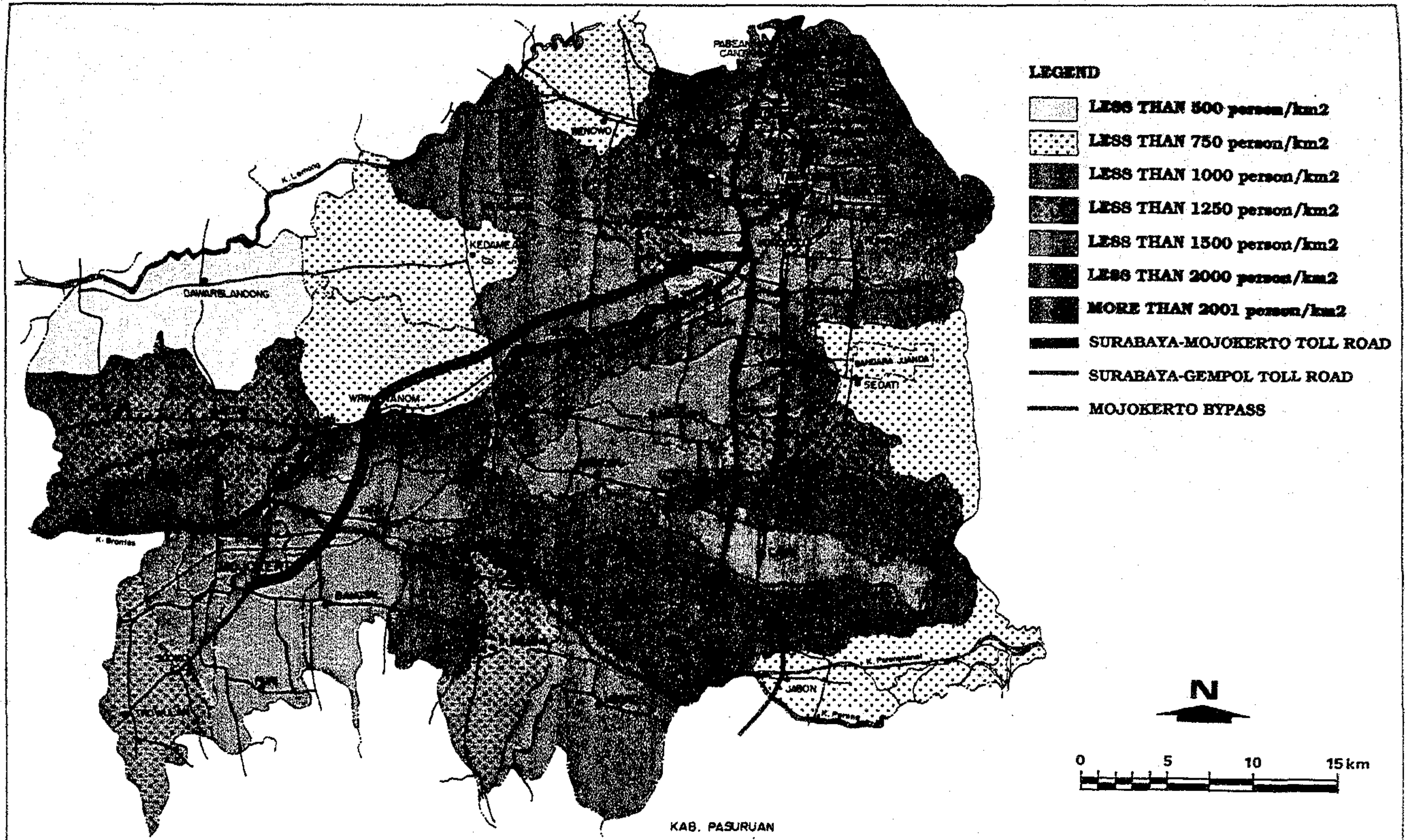
(1) Road Network

The road network in the Project Area consists of 2 national roads and 3 provincial roads (refer to Fig. 3.2 in Chapter 3).

i) Surabaya-Mojokerto

There are two trunk roads. A national road which is situated in the south of the Surabaya river starts from Waru and leads to Mojokerto via Krian and further extends to the west. A provincial road which runs in close proximity to the Surabaya river is situated in the north of the river as far as Joyoboyo-Mojokerto section.

The national road has a 6 m wide paved carriageway which is well maintained but is congested especially near Waru and Krian. The provincial road has a 5.5 m wide paved carriageway between Joyoboyo and Krian and has relatively high traffic volume. The surface condition has deteriorated in many locations by heavy trucks usage. The provincial road between Krian and Mojokerto has a narrow carriageway width of less than 5 m and is paved for light vehicles. Traffic volume is very small.



SURABAYA-MOJOKERTO TOLL ROAD PROJECT

Fig. 12.1 Population Density by Kecamatan

ii) Surabaya-Sidoarjo

There are two major trunk roads: a national road and the Surabaya-Gempol Toll Road. They are located parallel to each other keeping a 2-4 km distance and run from Surabaya city to the south passing Waru. The national road is 4-lane 2-way, divided in the urban area. Because of serious traffic congestion, one-way traffic is enforced near Sidoarjo city center. The carriageways are paved and well maintained. The Surabaya-Gempol Toll Road is divided 4-lane with full access control.

iii) Surabaya-Gresik

There is a national road leading to the west via Gresik which has a 7 m wide carriageway, fully paved and well maintained. Traffic is heavy and is comprised largely by heavy trucks. The road is congested in its entire section, and to a serious extent near Gresik city center.

For further descriptions (i.e. road network in East Java) refer to Subsection 3.1.1 in Chapter 3.

(2) Railway Line

The Surabaya-Madiun Line is the only railway line in operation which is crossed by the Toll Road. Refer to Section 3.2 for further descriptions.

(3) Irrigated Paddy Field

The Brantas Delta is one of the most highly developed irrigation areas in the region. Sidoarjo regency occupies the most part of the Brantas Delta and Sidoarjo Regional Irrigation Office maintains the entire irrigation systems in the Delta. Irrigation water is taken at the Lengkong Dam and the following facilities are involved in the irrigation system:

1) Voor Canal as a sedimentation pond	1,300 m
2) Main Canal (Mangetan/Porong)	75,350 m
3) Intake Structure	432 in number
4) Secondary Canal	297,690 m
5) Tertiary Canal	838,724 m

Each irrigation canal and its irrigated area via Voor Canal, Mangetan Canal and Porong Canal Irrigation Areas are shown in Table 7.2 in Chapter 7.

(4) Public Utility Lines

There are no underground public utility lines which affect the planning of the Toll Road. There are, however, 11 electric power transmission lines at 5 locations which will be crossed by the Toll Road.

12.4.4 Physical Environment

(1) Topography

The topography in the Project Area is divided into 2 terrain conditions, flat and rolling. The flat terrain area spreads out in the Brantas Delta with an altitude of less than 25 m. The rolling terrain area is situated in the north of the Surabaya river in Gresik regency, with an altitude of less than 70 m.

(2) Geology

Geologically the flat terrain area is of Alluvium Formation of Holocene Age composed of alluvial soil of loam, silt and clay. Soft ground areas are common in the eastern part of the Brantas Delta.

The rolling terrain area is mainly of Pucangan and Kabuh Formation in Middle to Lower Pleistocene Age. The soils in the Pucangan Formation are composed of clay, tuffaceous clay and tuffaceous sandy clay which are unsuitable as embankment materials because of their swelling nature even if the dried condition resembles clay stone.

The sources for embankment materials are found in the hilly areas in the south of Gempol to Mojoagung.

Refer to Section 6.3 for further descriptions.

(3) Hydrology

i) Climate

The seasons are influenced by the monsoons which blow in a general direction from the east from May to October and from the west from November to April. During the east monsoon, the average rainfall in Surabaya is around 50 mm per month with August usually the driest. The west monsoon brings heavy rainfalls which average over 235 mm per month. The heaviest rainfalls occur mostly in January and average about 340 mm per month. In the Project Area, rainfall varies area by area, total yearly rainfall is about 1,700 mm in Surabaya, about 1,950 mm in Krian and about 1,680 mm in Mojokerto. The maximum temperature in Surabaya recorded in 1988 was 36.2°C in October and the minimum was 20.0°C in July. The average humidity is in the range of 65% to 85%.

ii) River System

The Project Area is situated downstream of the Brantas river, the second largest river in Java Island. At Mojokerto, the Brantas river branches into the Porong river and the Surabaya river. The Porong river is the main drainage of the lowermost Brantas into the Madura strait. The Surabaya river is a branch of the Brantas river, being separated from the main stream at Mlirip Sluice near Mojokerto, and flows into the sea north of Surabaya city.

iii) Flood Conditions

The Brantas Delta has not experienced flood conditions in the recent decade after implementation of the Porong River and the Surabaya River Improvement Projects. There are still some small retained water areas, 40 cm depth in maximum, for 2 - 3 days after heavy rain. This occurs because of depressed terrain conditions.

12.4.5 Natural Environment

In the Direct Influence Zone of the Toll Road, no specific areas are observed having an important natural environment such as:

- Natural ecosystem;
- Preserved forest;
- Important vegetation and wildlife; and
- Fishpond culture.

However, the bridge construction (i.e. Porong River Bridge, Surabaya River Bridge and Mas River Bridge) will entail certain impacts on the downstream natural ecosystem (i.e. estuary, mud flat and marine) if appropriate countermeasures are not exercised in the planning/designing phase and during the construction phase.

12.5 Description of Favorable Environmental Impacts

12.5.1 General

Environmental impact is divided into favorable impact and adverse impact. The former is an important factor in deciding whether the Project is to be implemented or not. The impact is evaluated in the form of direct and indirect benefit to the Project. The aspects producing a large magnitude of favorable impact are discussed in the following subsections.

12.5.2 Result of Economic Impact Analysis

The "Without Project" alternative would involve the use of existing road networks which are clearly inadequate at present and for the future development of the GKS Region, resulting in serious traffic congestion throughout the corridor. The economic evaluation of the Project revealed that the benefit of the development of the Toll Road would far outweigh the costs to be incurred.

12.5.3 Favorable Impact on Socio-Economic and Traffic

(1) Increase of Transport Mobility and Accessibility

The Toll Road, together with the Surabaya-Gempol Toll Road, will greatly enhance and strengthen the function of the road network in GKS Region. The development of the Toll Road will improve the traffic condition in the Surabaya-Mojokerto corridor. Accordingly, the transport mobility and accessibility in the corridor will be greatly improved and bring about a striking reduction of traffic cost. Realization of the Toll Road will create great impact to the development of the Trans Java Tollway System since the Toll Road constitutes the easternmost section of the said system.

The existing national road is, without the presence of the Toll Road, not capable of efficiently meeting 1900 travel demands and is clearly unable to accommodate 1995 travel demands.

(2) Realization of Landuse Potential and Increase of Land Value

The improvement in accessibility will greatly enhance the landuse potential in the corridor. It will cause an increase in development demand due to favorable location and conditions and thus increase land value. Inefficient concentrations of population and socio-economic activities can be decentralized.

(3) Better Community Cohesion

The overcrowded condition of the existing community will be modified by the provision of the Toll Road. Growth of new communities will be promoted by investors and inhabitants and the establishment of better communities will enhance the living standards.

(4) Creation of Employment Opportunities

The Toll Road passes nearby the existing industrial development area in the north of the Surabaya River between Surabaya and Krian. Realization of the Toll Road will contribute to the generation of employment when the industrialization in the areas will be successfully promoted.

12.6 Description of Possible Adverse Impacts and their Mitigation

12.6.1 General

Adverse environmental impacts concerned with the implementation of the Project are to be examined in the viewpoint of preservation of the totality of the surroundings of the population and enhancing living quality.

A study of probable outstanding adverse environmental impacts and their mitigation was carried out in the framework of a case study. The study was divided into the following three phases of the execution of the Project as mentioned before, in accordance with the EIA Guidelines:

- Pre-construction Phase;
- Construction Phase; and
- Operation and Maintenance Phase

12.6.2 Pre-Construction Phase

(1) Selection of Optimum Route of the Toll Road

1) Environmental Study Approach

To minimize adverse impacts on social environment, intensive route study was carried out at the early stage of the Study. To obtain more precise data concerning environmental conditions in the Study Area, an uncontrolled aerial photo mosaic to a scale of 1:10,000 was prepared by the Study Team.

2) Comparison of Social Impacts of Short-Listed Alternative Routes

Six route alternatives were established initially, and these were narrowed down to three short-listed route alternatives (B1, D1 and D2, refer to Fig. 7.11) considering various aspects of environmental, technical, socio-economic and transportation conditions inherent to each route alternative.

Since monuments of historical value, preserved forest, important vegetation and wildlife (i.e. flora and fauna) are not found in the Direct Influence Zone, social impact was considered to be the most important environmental element. As significant adverse social impact is population displacement of residents, which was analyzed based on the 1:10,000 scale aerial photo mosaic.

For comparison of the displacement situation of the residents, parametric values were measured for each route alternative by the length of the Toll Road which passes through developed and inhabited areas.

The result of the comparison found that the selection of Route Alternative-B1 is most advantageous in view of minimization of adverse social impact (indexes of resident displacement were 1.00, 1.73 and 1.44 for Route Alternative-B1, -D1 and -D2, respectively).

For further descriptions concerning the route selection, refer to Chapter 7.

(2) Displacement of Residents

1) Preparation of Supplement Type ANDAL

Further study is necessary based on detailed demographic data and site visit to meet the requirement of the EIA Guideline. Staking-out of the Toll Road centerline may be necessary to obtain more precise data (i.e. number of families affected).

2) Mitigation Measure

The displaced families will be sufficiently compensated and/or resettled to suitable areas.

(3) Right-Of-Way Acquisition

1) Summary of Right-of-Way Acquisition Requirement

The required right-of-way acquisition for the construction of the Toll Road was estimated at 2,733,500 m2 (refer to Table 9.15 in Chapter 9). The right-of-way width varies from 50 to 80 m depending on the embankment height and cutting depth in earthwork section. A 40 m constant right-of-way width having 3.0 m allowance from the edge of structure on both sides will be secured for bridge/viaduct sections where the provision of a buffer zone is not required. Along the bridge/viaduct sections passing through housing areas in Surabaya, a wider right-of-way width keeping 10.0 m allowance from the edge of structure will be secured for the provision of a buffer zone of green belt, pedestrian path, etc. in connection with the preservation of the environment.

2) Mitigation Measures

Since the sub-corridor of the Toll Road is sensitive to right-of-way acquisition, right-of-way aspects were studied very carefully and were considered as an integral part of the Toll Road planning process. Continued effort is necessary, when the Projects will proceed to the preparation of definitive plan and detailed engineering design, to identify the right-of-way edge lines and to prepare an accurate right-of-way plan.

After the preparation of definitive plans, a number of meetings will be held between Bina Marga and the local government agencies to mitigate adverse impact of the Project in the pre-construction phase.

It is noted that if the land for side slopes is minimized or excluded, the condition results in an unusually expensive disposition in the construction due to long retaining walls construction. Moreover, elimination of side slopes will bring about various adverse physical environmental impacts (i.e. air, noise and drainage) on neighboring inhabitants.

(4) Severance of Villages and Farms

1) Minimization of Severance

In the route locating process and in preliminary alignment design, attention was paid to minimize severance of villages and well-developed farmland.

2) Mitigation Measure

Severance of local communities will be avoided by proper provision of box culverts and overbridges. The function of the existing irrigation and drainage canals should be maintained by proper design of culverts with relocation as required.

12.6.3 Construction Phase (Preparation Stage)

(1) General

The occurrence of environmental impacts in the preparation stage of the construction phase are foreseen mainly in the following activities.

- Mobilization of heavy equipment and handling of materials for temporary construction;
- Construction/operation of base camp, workshop, motor pools, warehouses, etc; and
- Exploitation of gravel pits and construction/operation of crushing and aggregates processing plant.

(2) Mobilization of Heavy Equipment and Handling of Materials for Temporary Construction

1) Possible Environmental Effects

a. Deterioration of air quality (dust) and noise impact along hauling roads.

b. Damage to existing road.

2) Mitigation Measures

a. Carry out proper watering in case of gravel road and enforce reasonable running speed to avoid disturbance of education, health care and cultural activities particularly sensitive to noise, such as schools, hospitals and mosques.

b. Enforce loading regulation and restore road damage by trucks and construction equipment.

3) Monitoring

a. Note community's complaints.

b. Inspect conditions of existing road.

(3) Construction/Operation of Base Camp, Workshop and Motor Pools, Etc.

1) Possible Environmental Effects

a. Water quality impact due to inadequate sewerage and solid waste disposal (base camp).

b. Water quality impact and oil matters on vegetation by oil/tar/fuel (workshop and motor pools).

2) Mitigation Measure

Provide adequate sanitary waste treatment systems and oil/tar/fuel trap devices.

3) Monitoring

Note fauna and flora conditions in the vicinity of the facilities.

(4) Exploitation of Gravel Pits and Construction/Operation of Crushing and Aggregates Processing Plant

1) Possible Environmental Effects

a. Turbidity, erosion and silting of adjacent streams.

b. Inadequate disposal of waste topsoil layers.

c. Air quality impact (Crushing/screening plant and temporary road).

d. Noise impact.

e. Disturbance of water quality downstream.

2) Mitigation Measures

a. Prohibit exploitation of gravel pits in river/water course and select proper location of gravel pits at river terrace.

b. Provide adequate sedimentation basins for the treatment of aggregates wash water.

c. Protect waste topsoil disposal areas from erosion.

d. Provide dust filter devices for crushing/screening plant and enforce adequate watering on the temporary road.

e. Equip heavy equipment and generators with effective silencers.

3) Monitoring

a. Note the conditions of exploitation/construction/operation of aggregates production including the inspection result of gravel pits.

b. Test the sediment materials in river/water courses.

c. Note the slope stability and landscaping of topsoil disposal areas.
d. Note the silting/erosion conditions together with fauna and flora conditions.
e. Note the complaints concerning water quality by downstream water users.

12.6.4 Construction Phase (Implementation Stage)

(1) General

The occurrence of environmental impacts in the implementation stage of the construction phase are foreseen mainly in the following activities.

- Site clearing and diversion of public utilities/facilities
- Earthwork (i.e. cut and fill and embankment with borrow material);
- Paving work; and
- Bridge construction.

Almost all construction activities will entail environmental impacts associated with transportation matters. The hauling of a huge volume of embankment and paving materials is the main problem. Therefore this matter is dealt with separately in Subsection 12.6.5 considering air (dust) and noise impact, traffic congestion/ accidents and damage to existing roads.

(2) Site Clearing and Diversion of Public Utilities/Facilities

1) Possible Environmental Effects

a. Loss of vegetation
b. Transient suspension of electric power (diversion of 70 /150 KVA transmission lines at 5 locations).
c. Relocation of sugarcane rail tracks
d. Diversion of waterways
e. Noise impact of construction equipment

2) Mitigation Measures

a. Plant trees at alternate locations and sod all cut and fill slopes to eliminate erosion.
b. Replace existing electric power transmission lines with new material to avoid long suspension time.
c. Relocate existing sugarcane tracks to new satisfactory location in a timely fashion.

d. Construct new waterways in a timely fashion with satisfactory design to eliminate local flooding and stoppage of irrigation water supply.

e. Equip construction equipment with effective silencers.

3) Monitoring

a. Periodical inspection and repair of planted/sodded areas.

b. Note smooth supply of electric power.

c. Note complaints of communities.

(3) Earthwork (Cut and Fill and Embankment with Borrow Materials)

1) Possible Environmental Effects

a. Settlement of embankment may result in destruction of neighboring houses and community roads in soft ground areas.

b. Impairment of fisheries/aquatic ecology.

c. Erosion and siltation.

d. Drainage problems at roadside areas.

e. Noise impact of earth moving and compaction equipment.

2) Mitigation Measures

a. Careful design considering application of vertical drain technology.

b. There is no significant fisheries/aquatic ecology in the Direct Influence Zone.

c. Extensive erosion and siltation control measures during design and construction implementation stages.

d. Provision of paved side ditches and intercepting ditches.

e. Equip earth moving and compaction equipment with effective silencers.

3) Monitoring

a. Check construction drawings (vertical drain) and note side slope stability together with embankment construction speed.

b. Note the cut slopes and their stability.

c. Inspect siltation in ditches.

d. Note complaints of the communities.

(4) Paving Work

Paving work consists of i) subgrade preparation; ii) subbase course construction; iii) base course construction; iv) prime/tack coat spraying; and v) binder/surface course construction. The setup and operation of a central asphaltic concrete (AC) mixing plant is assumed for the construction of binder/surface course.

1) Possible Environmental Effects

a. Noise impact of spreading/grading/compaction equipment.
b. Noise impact of AC mixing plant.
c. Air quality impact of AC mixing plant.

2) Mitigation Measures

a. Equip spreading/grading/compaction equipment with effective silencers.
b. Provide noise suppressors for burners (central AC mixing plant).
c. Provide dust collection unit (central AC mixing plant).
d. Adopt low-noise type burner in dryer unit (central AC mixing plant).
e. Regulate running speed of dump trucks to reduce noise and exhaust emission (central AC mixing plant yard).

3) Monitoring

a. Note complaint of the communities.
b. Record quality of exhaust air (central AC mixing plant).

(5) Bridge Construction

Bridge structure is divided into substructure and superstructure. The setup and operation of a concrete batching/mixing plant (concrete plant) is considered for the construction of substructure and superstructure.

1) Possible Environmental Effects

a. Refer to paragraph 12.6.5 for the environmental effects associated with traffic.
b. Noise/vibration impacts in urbanized area during piling work for bridge foundations (substructures in urbanized area; Karang Pilang Viaduct, Mas River Bridge and Wonocolo Viaduct).
c. Erosion (disturbance of water flow) in river courses (substructures for Porong River Bridge and Surabaya River Bridge).

d. View from the crossing roads and from communities (esthetics).

2) Mitigation Measures

a. Adoption of cast-in-place concrete piles.
b. Adoption of wall type piers.
c. Use of continuous girders or Gerber beam structure with constant sectional element will provide lighter, more coherent and attractive features.

3) Monitoring

a. Note complaint of the communities.
b. Note the erosion and siltation of river courses.

12.6.5 Traffic Related Matters during the Implementation Stage of the Construction Phase

(1) General

Construction of the Toll Road requires the hauling of a huge volume of construction materials as shown below:

QUANTITIES OF MAJOR CONSTRUCTION MATERIALS

Item	Unit	Quantity In-place
Embankment	m^3	5,115,500
Sand mat and sand piling	m^3	466,200
Subbase and base	m^3	292,400
Binder/surface course	ton	433,600

Since the material sources are at places somewhat distant from the construction site (i.e. southeast of Mojosari for embankment and subbase course materials, south of Mojosari for base course materials and coarse aggregates and south of Jombang for sand), significant transportation problems are foreseen in the implementation of the construction. The increase of traffic volume on the existing roads is a major problem which will be divided into the following areas:

- Traffic;
- Road facilities; and
- Physical environment.

(2) Traffic

1) Possible Environmental Effects

It is estimated that the traffic increase, due to haulage of embankment, subbase and base courses materials, on the existing provincial road between Ngoro and Mojosari will be approximately 4,000 veh/day and this situation will continue for 2 years. The traffic increase on the existing provincial road between Mojosari and Krian is foreseen as similar to the case of the Ngoro-Mojosari road. In addition to the above road network, several provincial and kabupaten roads will be affected by the haulage of major construction materials, however the traffic increase is foreseen to be rather minor (i.e. 2,000 veh/day). Possible environmental effects are as follows:

a. Economic loss due to traffic congestion.
b. Increase of traffic accidents.

2) Mitigation Measures

a. Increase capacity of road network, see the following paragraph 12.6.5. (3).
b. Enforce proper traffic control (diversion) and limit the hauling peak hours as necessary.
c. Regulate traffic speed.

3) Monitoring

a. Note traffic flows.
b. Note occurrence of traffic accidents.
c. Conduct traffic survey regularly.

(3) Road Facilities

1) Possible Environmental Effects

a. Shortage of capacity of cross sectional elements of road structure.
b. Lack of strength of pavement structure.
c. Necessity of modification of existing intersections and provision of traffic signals.
d. Damage to existing road facilities.

2) Mitigation Measures

a. Widen and strengthen existing pavement to accommodate existing traffic and the additional traffic for hauling of major construction materials.

b. Improve existing intersections and install traffic signals where necessary.

c. Restore all the road facilities damaged by the implementation of the construction.

d. Execute routine maintenance for the road network used for major construction materials haulage.

e. Enforce loading regulation.

3) Monitoring

a. Periodical inspection of road conditions

b. Note overloaded trucks.

(4) Physical Environment

1) Possible Environmental Effects

a. Air quality impact.

b. Noise impact.

2) Mitigation Measures

a. Proper watering in case of gravel road and periodical cleaning of asphalt paved road.

b. Enforce reasonable running speed to avoid disturbance of educational, health care and cultural activities such as schools, hospitals and mosques.

c. Provide noise barriers as necessary.

3) Monitoring

a. Note complaint of the communities.

b. Daily inspection of main roads used for haulage of construction materials.

12.6.6 Operation and Maintenance Phase

(1) Operation of the Toll Road

1) Possible Environmental Effects

a. Increase of air pollution in the Direct Influence Zone.
b. Noise impact along the Toll Road.
c. Community severance.
d. Pollution to roadside area by the Toll Road runoff.
e. Highway spills of hazardous materials (i.e. health/safety hazards to travellers and adjacent residents).
f. Erosion and siltation.

2) Mitigation Measures

a. Control of motor vehicle emission.
b. Provision of buffer strip/noise barriers.
c. Provision of overbridges/undercrossing roads.
d. Maintenance of roadway and roadside drainage ditches.
e. Careful planning of operation and management system and competent emergency clean up.
f. Extensive erosion control measures.

3) Monitoring

a. Note complaints from the communities and promote air quality survey and analysis.
b. Note complaints from the communities and test noise levels.
c. Note occurrence of pedestrians crossing on the Toll Road.
d. Record drainage, erosion and siltation conditions in accordance with predetermined toll road maintenance and management system.
e. Note occurrence of traffic accidents.

(2) Maintenance and the Second Stage Construction of the Toll Road

1) General

"Maintenance" will cover routine and periodical maintenance of all elements of the Toll Road including pavement, shoulders, structures, drainage, road furniture and ground conditions in the right-of-way. Resurfacing (i.e. overlay of pavement) is a major task among the various maintenance activities. Second stage construction of the Toll Road mainly consists of widening of pavement which includes the subgrade preparation, and construction of subbase and base courses and binder/surface courses.

It is considered that possible environmental effects, mitigation measures and monitoring for the maintenance and the second stage construction of the Toll Road (hereinafter called the "Second Stage Construction") are similar to the descriptions introduced in Subsections 12.6.3 and 12.6.4. The most noteworthy environmental impacts are air quality, noise, water quality and traffic related matters, in particular damage to the existing roads. However these impacts are foreseen as minor and occurring in limited areas since maintenance and the Second Stage Construction are not expected to include embankment construction which requires haulage of a considerable volume of borrow materials. The following describes the recommended mitigation measures which aim at further reduction of possible environmental effects.

2) Policy of Stage Construction

Initial construction is scheduled to construct 4-lane carriageways and the Second Stage Construction is intended to widen the carriageways to 6-lane. Adoption of the following stage construction policy is recommended from an environmental point of view.

a. All embankment construction shall be completed in the initial stage construction to avoid traffic hazards on the Toll Road and damage to existing irrigation systems by uneven settlement of embankment structure.
b. Pavement widening in the Second Stage Construction shall be at the inner lanes to avoid traffic hazards near ramp terminals.

3) Widening of Pavement in the Second Stage Construction and Pavement Overlay

Widening of pavement in the Second Stage Construction will result in an increase of traffic of approximately 2,500 veh/day at Mojosari when subbase and base courses materials and coarse aggregates for binder/surface course are obtained in the Mojosari-Ngoro area. Adoption of the following measure is considered to be effective in reducing the environmental effects along hauling roads.

a. Utilize only Ngoro - Mojokerto provincial road together with the Toll Road for hauling of paving materials.
b. Rehabilitate Ngoro-Mojokerto provincial road after construction.

12.7 Summary and Conclusion for Important Environmental Effects and their Mitigation

12.7.1 Pre-construction Phase

(1) Displacement of Residents

The displaced families will be sufficiently compensated or resettled to suitable areas.

(2) Displacement of Farms

Sufficient compensation will be provided for the farms (i.e. agricultural land) acquired for the right-of-way.

12.7.2 Construction Phase

(1) Increased Traffic on Public Roads (Road Damages)

Hauling roads, particularly for embankment and paving materials, will be improved before the start of construction and proper maintenance shall be carried out.

(2) Traffic Flows During Construction

Increased traffic congestion during construction compared with before-construction is anticipated due to the yearly increase in traffic volume and the operation of trucks and other construction equipment. To mitigate this condition, certain existing provincial road(s) will be widened to meet the transportation demand during construction and strict traffic management will be enforced to provide smooth traffic flows.

(3) Temporary Dust, Noise and Water Pollution

Nuisance and inconvenience during construction will be significantly reduced by the introduction of strict construction management, adoption of proper construction methods and selection of proper construction equipment and mixing plant(s).

12.7.3 Operation and Maintenance Phase

(1) Noise Barrier

Traffic noise may be an objectionable feature of a highway in an urban environment, particularly in residential areas. Where the Toll Road is constructed on viaduct, solid parapets are more effective than open railings in shielding adjacent developed areas from traffic noise. Where there are adjacent facilities which are particularly sensitive to traffic noises, the parapets should be high enough to block the line of sight between the vehicles and the sensitive facilities.

(2) Air Quality Impact

In order to improve the air quality it is necessary to consider comprehensive measures including regulations for the manufacture and maintenance of vehicles. On the other hand, it is essential to promote air quality surveys and their analysis as well as establishing a method of forecasting.

(3) Noise and Vibration Impacts

Automobile noise is mainly emitted from engines, air intakes, exhaust pipes, cooling fans, drive trains, tires and so on. Also, various factors, such as traffic volume, type of automobile vehicle, speed, structure of road, etc. are directly related to the creation of automobile noise at roadsides. Accordingly, in order to minimize these problems effectively, it is necessary that measures such as regulation of noise emitted from vehicles, the improvement of operating conditions of vehicles and improvement of road structure should be introduced in addition to the measures taken at roadsides.

Problems of traffic vibration in the areas along highways are caused by the combination of various factors, such as vehicle weight, running speed and road conditions (evenness of road surface, pavement structure, roadbed conditions, etc.). It is essential to promote various fundamental surveys and the preparation of research data.

(4) Damage to Public Roads and Temporary Pollution during the Second Stage Construction

The Toll Road will be effectively utilized as a hauling road for pavement materials to reduce damage to public roads, refer to paragraph 12.7.2. (3) for temporary dust, noise and water pollution.

Chapter 13

PROJECT COST ESTIMATE

CHAPTER 13

PROJECT COST ESTIMATE

13.1 General

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

The project cost discussed in this chapter consists of the following items (operation and maintenance cost of the project is discussed separately in Chapter 11).

- Initial Investment Cost
  - Construction cost
  - Purchase cost of maintenance equipment
  - Land acquisition and compensation cost
  - Utility relocation cost
  - Engineering cost
  - Contingency
- Additional Investment Cost
  - Overlay cost
  - Widening cost
  - Construction cost of additional interchanges

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

1) All the construction works will be executed by contractor(s) to be employed by the joint venture company for the development of the project toll road.

2) The unit price of each cost component was determined based on the economic conditions prevailing in March 1991.

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

4) Engineering cost was assumed to be 5% of construction cost, consisting of 2% for detailed design and 3% for construction supervision.

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

The project cost was estimated in financial cost and in economic cost. The economic project cost for economic analysis was estimated by deducting such transfer items as taxes and duties from the financial project cost.

13.2 Construction Cost

13.2.1 Unit Prices of Construction Works

The unit prices of construction works were determined based on the analysis of labor cost, material cost, equipment cost and overhead and profit for major work items. The analyzed unit prices were compared with current bid prices and adjusted as required to obtain the most realistic prices.

(1) Unit Cost of Labor

Table 13.1 shows the unit costs of labor applied in the construction cost estimate, which include such allowances as social benefits, insurance, etc., and are based on 7 hours working time per day. There is no tax component in the unit costs of labor.

(2) Unit Cost of Materials

Table 13.2 shows the unit costs of major construction materials. The cost of imported materials are based on the CIF Surabaya price including port handling and clearance charges and import duties, while those of local materials are based on the market prices in Surabaya area.

Table 13.1 Unit Costs of Labor

Classification	Unit Cost per Hour (Rp.)
Superintendent	790
Foreman	750
Operator	715
Driver	535
Carpenter	715
Mechanic	715
Skilled Labor	570
Heavy Labor	500
Common Labor	430

Table 13.2 Unit Costs of Major Materials

Description	Unit	Unit Cost (Rp.)	Tax/Duty Included (Rp.)
Portland cement	bag	6,600	600
Reinforcing steel	kg	1,265	115
Structural Steel	kg	1,650	150
Prestressing strand	kg	4,500	1,040
Wood Plank	m3	247,500	22,500
Asphalt cement	ton	381,700	88,200
Coarse aggregate	m3	26,400	2,400
Fine aggregate	m3	28,600	2,600
Crushed stone	m3	26,400	2,400
Gasoline	liter	450	41
Diesel oil	liter	245	22

Note : Prestressing strand and asphalt cement are imported materials in the above table.

(3) Unit Cost of Equipment

An assessment of hourly costs was made for major plant and equipment which are likely to be used in the construction of the project toll road. The hourly cost is composed of depreciation cost, operation and maintenance cost (fuel, lubricants, spare parts, etc.) and management cost. A life year and usable hours per year were examined to reflect local conditions.

(4) Overhead and Profit

Overhead and profit were estimated as 15% of the sum of labor, material and equipment costs.

(5) Unit Prices of Construction Works

The unit prices by work item estimated as described above are shown in Table 13.3, construction cost estimate.

13.2.2 Estimated Construction Cost

(1) Construction Cost (Initial Stage Construction)

The estimated construction cost (initial stage construction) is Rp. 263,194 mil. at March 1991 price as shown in Table 13.3. In the total construction cost, bridge/viaduct construction takes up the largest part, 47.3% of the total. The remaining 52.7% is taken up by earthwork (24.4%), pavement work (11.5%), ditches and culverts (3.0%), miscellaneous works (4.7%) and general items including mobilization and protection of traffic, strengthening/widening/ maintenance of hauling roads (9.1%). It is noted that this estimate is about 18% higher than that estimated in the comparative study of route alternatives (the construction cost estimated for Alternative-B1 was Rp. 223 bil.), however, such increase does not mean a change to the conclusion in the route study.

(2) Widening and Overlay Cost

The project road will be widened from 4-lane of the initial stage construction to 6-lane in ultimate stage development, presumed in 2010 according to the results of traffic demand forecast (refer to Chapter 8). For pavement overlay it is assumed that overlays will be executed twice in the 25-year life span of the project, the first overlay in 2005 for 4-lane and the second overlay in 2015 for 6-lane. Their costs were estimated for the purpose of economic and financial project evaluations. The estimated construction costs are Rp. 24,190 mil. for widening, Rp. 15,413 mil. for overlay in 2005 and Rp. 16,099 mil. for overlay in 2015, as shown in Appendix A-13.1.

(3) Additional Interchanges

The construction of Lakarsantri IC, Driyorejo IC and the second interchange of Krian IC is related to the future development of the Inner Ring Road, the Middle Ring Road and the Outer Ring Road, respectively. The estimated construction costs of these additional interchanges are Rp. 12,050 mil. for Lakarsantri IC, Rp. 4,850 mil. for Driyorejo IC and Rp. 1,567 mil. for the second interchange of Krian IC, as detailed in Appendix A-13.2.

Table 13.3 Construction Cost (Initial Stage Construction)

DESCRIPTION	UNIT	WORK QUANTITY	UNIT PRICE (Rp.) TOTAL	UNIT PRICE (Rp.) TAX/DUTY INCLUDED	AMOUNT (1,000 Rp.) TOTAL	AMOUNT (1,000 Rp.) TAX/DUTY INCLUDED
1. GENERAL	L.S				23,926,701	2,916,904
2. EARTHWORK						
Clearing & Grubbing	m2	1,622,200	750	70	1,216,650	113,554
Common/Waste Excavation	m3	556,600	3,400	310	1,892,440	172,546
Borrow Material, L=5km	m3	578,000	5,100	460	2,947,800	265,880
Borrow Material, L=25km	m3	2,883,100	9,900	890	28,542,690	2,565,959
Borrow Material, L=29km	m3	646,000	10,800	980	6,976,800	633,080
Borrow Material, L=36km	m3	674,600	12,400	1,130	8,365,040	762,298
Sand Mat	m3	330,000	16,400	1,490	5,412,000	491,700
Sand Drain Pile, D=40cm	m	1,084,600	8,200	750	8,893,720	813,450
SUB-TOTAL					64,247,140	5,818,467
3. BRIDGES						
Superstructure						
Continuous Box Girder	m2	8,720	930,000	170,000	8,109,600	1,482,400
PC I-Girder, S>30m	*m2*	*96,700*	*370,000*	*64,000*	*35,779,000*	*6,188,800*
PC I-Girder, S≤30m	m2	18,090	320,000	54,000	5,788,800	976,860
Overbridge, W=7.0m	m2	1,740	370,000	55,000	643,800	95,700
Overbridge, W=6.0m	m2	3,600	420,000	62,000	1,512,000	223,200
Substructure						
Abutment	m3	17,540	200,000	21,000	3,508,000	368,340
Pier	m3	83,390	320,000	32,000	26,684,800	2,668,480
Foundation						
PC Pile, D=0.6m	m	194,080	83,000	7,600	16,108,640	1,475,008
Steel Pipe Pile, D=0.6m	*m*	*88,200*	*188,000*	*17,000*	*16,581,600*	*1,499,400*
Caisson Foundation	m3	8,410	1,150,000	105,000	9,671,500	883,050
SUB-TOTAL					124,387,740	15,861,238
4. DITCHES AND CULVERTS						
Drainage						
Paved Ditch	m	82,000	8,100	700	664,200	57,400
Pipe Culvert, D=0.6m	m	2,815	116,000	10,500	326,540	29,558
Pipe Culvert, D=1.0m	m	3,325	240,000	22,000	798,000	73,150
Box Culvert, 2x(3.0m x 3.0m)	m	315	2,370,000	220,000	746,550	69,300
Box Culvert, 4.5m x 2.5m	m	510	1,880,000	180,000	958,800	91,800
Box Culvert, 3.0m x 2.0m	m	581	1,060,000	100,000	615,860	58,100
Box Culvert, 2.0m x 1.5m	m	715	640,000	60,000	457,600	42,900
Roadway/Utility Protection						
Box Culvert, 6.0m x 3.5m	m	615	3,250,000	310,000	1,998,750	190,650
Box Culvert, 3.0m x 3.0m	m	845	1,280,000	120,000	1,081,600	101,400
Portal Culvert, 8.0m x 5.5m	m	35	6,400,000	600,000	224,000	21,000
SUB-TOTAL					7,871,900	735,258
5. PAVEMENT						
Subgrade Preparation	m2	1,055,100	240	20	253,224	21,102
Subbase	m3	110,200	25,000	2,300	2,755,000	253,460
Granular Base	m3	182,200	34,000	3,100	6,194,800	564,820
Prime/Tack Coat	kg	2,588,400	690	200	1,785,996	517,680
Binder/Surface Course	ton	433,600	18,200	1,700	7,891,520	737,120
Asphalt Cement	ton	28,200	390,000	105,000	10,998,000	2,961,000
Concrete Pavement, T=30cm	m2	12,000	41,000	5,300	492,000	63,600
SUB-TOTAL					30,370,540	5,118,782
6. MISCELLANEOUS						
Relocation of Sugarcane Railway	m	585	123,000	11,200	71,955	6,552
Relocation of Waterway	m	965	39,000	3,500	37,635	3,378
Sodding	m2	1,026,400	480	40	492,672	41,056
Concrete Block Slope Protection	m2	16,550	23,000	2,600	380,650	43,030
Guardrail	m	28,300	59,000	5,400	1,669,700	152,820
Delineator	m	153,300	5,100	600	781,830	91,980
Marking	m2	36,700	11,500	1,000	422,050	36,700
Guide Signs	each	24	14,400,000	3,050,000	345,600	73,200
Regulatory & Warning Signs	*km*	*38.3*	*240,000*	*53,000*	*9,192*	*2,030*
ROW Fence and ROW Pegs	m	76,600	29,000	5,300	2,221,400	405,980
Kilometer Post	each	38	37,000	3,400	1,406	129
Tollway Lighting	m	18,600	71,000	6,400	1,320,600	119,040
Toll Booths	each	30	75,300,000	8,300,000	2,259,000	249,000
Tollgate Office	m2	1,200	880,000	152,000	1,056,000	182,400
Operation & Maintenance Office	m2	1,500	880,000	152,000	1,320,000	228,000
SUB-TOTAL					12,389,690	1,635,295
CONSTRUCTION COST					263,193,711	32,085,943

13.3 Purchase Cost of Maintenance Equipment

As stated in Section 11.3, the maintenance works will be performed mostly by contractors under the supervision of the Regional Operation Office, therefore, the office will be equipped only with limited types of maintenance equipment. The purchase cost of such maintenance equipment was estimated at Rp. 1,141 mil. (refer to Appendix A-13.3).

13.4 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 costs of land acquisition and compensation obtained from the offices of Bappeda of the related regencies for each land category. No tax component is included in these unit costs.

Land acquisition and compensation cost for the first stage construction was estimated at Rp. 75,433 mil. (refer to Appendix A-13.4). For the construction of additional interchanges of Lakarsantri IC , Driyorejo IC and the second interchange of Krian IC, estimated costs are Rp. 4,675 mil., Rp. 428 mil. and Rp. 153 mil., respectively.

13.5 Utility Relocation Cost

The major public utilities which will be crossed by the project toll road are categorized into electric power transmission lines, electric cables and telephone lines. Their relocations are required for the construction of the Toll Road. Electric power transmission lines will be raised at the crossings by provision of additional pylons (29 m high) on the side(s) of the Toll Road or by pulling the cables. Electric cables and telephone lines will be relocated to cross the Toll Road by underground cables. Based on the unit costs obtained from the relevant agencies, the utility relocation cost was estimated at Rp. 3,215 mil. in financial cost and Rp. 2,923 mil. in economic cost (refer to Appendix A-13.5).

13.6 Estimated Project Cost

13.6.1 Initial Investment Cost

The estimated initial investment cost is Rp. 391,757 mil. in financial cost and Rp. 354,123 mil. in economic cost, as summarized in Table 13.4.

Table 13.4 **Summary of Initial Investment Cost**

Description	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)
Construction cost	263,194	231,108
Purchase of maintenance equipment	1,141	911
Land acquisition and compensation	75,433	75,433
Utility relocation	3,215	2,923
Engineering	13,160	11,555
Sub-Total	356,143	321,930
Contingency	35,614	32,193
Total	391,757	354,123

13.6.2 Additional Investment Cost

Additional investment cost was estimated as summarized in Table 13.5.

Table 13.5 Summary of Additional Investment Cost

Description	Assumed Year of Const.	Financial Cost (mil. Rp.)	Economic Cost (mil. Rp.)
Overlay cost (4-lane)	2005	17,463	14,026
Overlay cost (6-lane)	2015	18,240	14,754
Widening cost	2010	27,408	23,680
Lakarsantri IC	2003	18,796	17,236
Driyorejo IC	2008	5,966	5,310
Krian IC (2nd interchange)	2015	1,944	1,746

13.6.3 Yearly Cash Flow of the Project Cost

A yearly cash flow of the project cost was prepared as shown in Table 13.6, assuming the following implementation schedule of the initial stage development.

Detailed Design	Late 1991 - Late 1992 (1 year)
Land Acquisition	Mid. 1992 - End 1993 (1.5 years)
Construction	Beginning 1993 - End 1995 (3 years)

Table 13.6 Yearly Cash Flow of the Project Cost

	INITIAL INVESTMENT						OVERLAY	OVERLAY	WIDENING	Lakarsantri IC	Driyorejo IC	Krian 2nd IC
	1991	1992	1993	1994	1995	TOTAL	2005	2015	2010	2003	2008	2015
FINANCIAL COST												
Construction Cost			78,958	105,278	78,958	263,194	15,413	16,099	24,190	12,050	4,850	1,567
Maintenance Equip.					1,141	1,141						
Land Acquisition		37,717	37,716			75,433				4,675	428	153
Utility Relocation		1,608	1,607			3,215						
Engineering	1,579	3,685	2,369	3,158	2,369	13,160	462	483	726	362	146	47
SUB-TOTAL	1,579	43,010	120,650	108,436	82,468	356,143	15,875	16,582	24,916	17,087	5,424	1,767
Contingency	158	4,301	12,065	10,843	8,247	35,614	1,588	1,658	2,492	1,709	542	177
TOTAL	1,737	47,311	132,715	119,279	90,715	391,757	17,463	18,240	27,408	18,796	5,966	1,944
ECONOMIC COST												
Construction Cost			69,333	92,443	69,332	231,108	12,380	13,022	20,900	10,674	4,271	1,392
Maintenance Equip.					911	911						
Land Acquisition		37,717	37,716			75,433				4,675	428	153
Utility Relocation		1,462	1,461			2,923						
Engineering	1,387	3,235	2,080	2,773	2,080	11,555	371	391	627	320	128	42
SUB-TOTAL	1,387	42,414	110,590	95,216	72,323	321,930	12,751	13,413	21,527	15,669	4,827	1,587
Contingency	139	4,241	11,059	9,522	7,232	32,193	1,275	1,341	2,153	1,567	483	159
TOTAL	1,526	46,655	121,649	104,738	79,555	354,123	14,026	14,754	23,680	17,236	5,310	1,746

Chapter 14

ECONOMIC PROJECT ANALYSIS

CHAPTER 14

ECONOMIC PROJECT ANALYSIS

14.1 General

The major objectives of the economic project analysis are to examine the effect of the Surabaya-Mojokerto Toll Road from the nation's economic viewpoint and to assess the economic viability of the Project.

The evaluation of quantified economic costs and benefits follows the conventional discounted cash flow methodology in determining the economic internal rate of return (EIRR), net present value (NPV) and benefit cost ratio (B/C ratio).

Aside from these efficiency measures, positive effects of the Toll Road on industrial developments are examined and likely development types in the proposed interchange areas are discussed.

14.2 Economic Project Cost

14.2.1 Economic Investment Cost

The economic investment costs are estimated in constant 1991 prices. The financial investment costs in terms of market price include the component of import duties and taxes. The economic cost for economic analysis are obtained by subtracting the portion of transfer payment such as taxes and duties from financial costs. The financial and economic investment costs (initial investment) are summarized in Table 14.1. The implementation schedule follows the analyses in Chapter 10. Construction is scheduled over three years from 1993 to 1995. The economic investment costs in constant 1991 prices are phased according to the implementation schedule as shown in Appendix A-14.1.

14.2.2 Economic Operation and Maintenance Costs

The financial annual operation and maintenance costs for the Toll Road in 1991 constant prices are estimated to be Rp. 4,676 million and Rp. 5,144 million for 2-way 4-lane and 6-lane highways respectively. (Refer to Section 11.4 in Chapter 11).

The economic operation and maintenance costs were estimated by applying a conversion factor of 0.9 to the financial costs, based on a recent similar study on toll road projects in Indonesia. The yearly economic operation and maintenance costs are shown in Appendix A-14.1.

Table 14.1 Summary of Financial and Economic Project Costs (Initial Investment)

(Million Rp. at 1991 prices)

	Financial Costs	Economic Costs
Construction Costs	289,513	254,219
Maintenance Equipment	1,255	1,002
Land Acquisition/ Compensation and Relocation	86,513	86,191
(Engineering Service (D/D)	5,790	5,084
Engineering Service (Supervision)	8,686	7,627
Grand Total	391,757	354,123

14.3 Economic Benefits

The economic benefits which would be realized from the implementation of the Project are defined as the savings 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 costs is estimated as the difference of vehicle operating costs between "With" Project and "Without" Project. 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 costs between "With" Project and "Without" Project. The vehicle time cost is derived from the computed daily vehicle-hours and the unit vehicle time cost by vehicle type.

14.4 Unit Vehicle Operating Cost

14.4.1 General

The estimation of vehicle operating cost is based on the method used in previous similar studies on toll road projects in Indonesia.

All cost components (i.e. unit prices of vehicle, tyre, fuel/oil, etc.) were updated according to the latest information collected in Surabaya for the Study.

14.4.2 Representative Vehicles

The vehicle categories of the traffic assignment are; i) passenger vehicle consisting of sedan, minibus (private) and minibus (public); ii) pick-up; iii) truck consisting of medium truck and large truck; and iv) large bus. The representative vehicles for each category are discussed below and their specifications are summarized in Appendix A-14.2.

(1) Passenger Vehicle

Recent sales data of sedan cars by model/make in the area of East Java Province or Surabaya city, were not available.

According to the interviews with some car distributors/dealers in Surabaya, popular models of sedan car in the area of East Java Province and Surabaya city are the Honda Civic Grand 1500 and the Toyota Corolla 1600.

Since the market share of both models are evenly matched, it is difficult to determine only one model as a representative car. Accordingly, the two models of Honda Civic Grand 1500 and Toyota Corolla 1600 were used as the representative passenger vehicles, and an average value of unit prices of these two models were applied for cost calculation.

In Surabaya city, many minibuses are commonly used as sedan substitutes. After interviewing car distributors/dealers, the Toyota Kijang Minibus was selected as the representative private minibus.

In the suburb areas of Surabaya, minibuses are used for short/medium distance inter-city public transportation. According to observations in some bus terminals located in the suburb area of the Surabaya-Mojokerto corridor, the Mitsubishi Colt Solar was selected as the representative public minibus.

(2) Pick-up

The Toyota Kijang Pick-up was selected as the representative pick-up.

(3) Truck

The Mitsubishi Colt FE104 and Mitsubishi Fuso FM517H were selected as the representative medium and large trucks respectively.

(4) Bus

The Mercedes Benz OH 306S was selected as the representative large bus.

14.4.3 Unit Prices of Operating Cost Components

The financial and economic unit prices of the major cost components were estimated based on the 1991 prices collected in Surabaya for the Study. The tax and duties structures utilized in estimating the economic unit prices incorporate the factor of luxury taxes.

The financial and economic unit prices are discussed below and summarized in Table 14.2.

(1) Vehicles

The 1991 market prices of vehicles were obtained through interview surveys with the major distributors/dealers in Surabaya.

In Indonesia, a 100% import duty on the CIF (cost, insurance and freight) value of CKD (complete knocked down) parts is imposed on sedans, while import duty is not applied to commercial vehicles.

After adjusting transfer payments such as the PPN tax and value added tax (VAT), the tax ratios on the market prices of vehicle were estimated at 55% and 23% for sedans and commercial vehicles respectively (refer to Appendix A-14.3).

(2) Tyres

The market prices of tyres for the various vehicle types were estimated in 1991 prices (refer to Table 14.2), and a total tax ratio was assumed at 19.4% of the actual market sales prices for determining the economic unit prices.

(3) Fuels

Bahan Bakar Minyak, or BBM (petroleum fuels) refer to the eight fuel products which are produced, processed and marketed in Indonesia by Pertamina.

Table 14.2 Unit Prices of Vehicle Operating Cost Components (Constant 1991 Price)

(Unit : Rp.)

PRICE OF VEHICLES			FINANCIAL PRICE	ECONOMIC PRICE
Sedan	:	Honda Civic Grand 1500	57,900,000	26,055,000
	:	Toyota Corolla 1600	52,900,000	23,805,000
Minibus (Private)	:	Toyota Kijang Minibus	25,000,000	19,250,000
Minibus (Public)	:	Mitsubishi Colt Solar	27,500,000	21,175,000
Pick-up	:	Toyota Kijang Pick-up	19,000,000	14,630,000
Large Bus	:	Mercedes Benz OH306S	161,000,000	123,970,000
Medium Truck	:	Mitsubishi Colt FE104	34,000,000	26,180,000
Large Truck	:	Mitsubishi Fuso FM517H	82,000,000	63,140,000

Note: Depreciable value of vehicle = 90% of price

(Unit : Rp.)

PRICE OF ONE SET OF TYRES/TUBES			FINANCIAL PRICE	ECONOMIC PRICE
Sedan	:	Honda Civic Grand 1500	92,000	74,152
	:	Toyota Corolla 1600	86,500	69,719
Minibus (Private)	:	Toyota Kijang Minibus	53,000	42,718
Minibus (Public)	:	Mitsubishi Colt Solar	80,250	64,682
Pick-up	:	Toyota Kijang Pick-up	53,000	42,718
Large Bus	:	Mercedes Benz OH306S	262,000	211,172
Medium Truck	:	Mitsubishi Colt FE104	135,750	109,415
Large Truck	:	Mitsubishi Fuso FM517H	262,000	211,172

(Unit : Rp.)

PRICE OF FUEL/ENGINE OIL (PER LITER)	FINANCIAL PRICE	ECONOMIC PRICE
Gasoline	450	409
Diesel Fuel	245	223
Engine Oil for Sedan	3,100	2,818
Engine Oil for Gasoline Minibus/Pick-up	3,100	2,818
Engine Oil for Diesel Minibus	2,900	2,636
Engine Oil for Diesel Truck/Bus	2,900	2,636

(Unit : Rp.)

WAGE RATES (PER HOUR)	FINANCIAL PRICE	ECONOMIC PRICE
Mechanic	773	773
Bus Driver	1,040	1,040
Truck Driver	1,040	1,040
Bus Conductor	588	588
Truck Assistant	410	410

The Government of Indonesia sets the prices of these products, and if sales do not generate enough revenue to cover costs (including crude, refining, storage, transport and marketing), the Government pays Pertamina to cover the difference, thereby creating a domestic fuel subsidy.

The Petroleum Report Indonesia, September 1988, published by the Embassy of the United States of America, Jakarta, reported that the domestic fuel subsidy was temporarily eliminated in fiscal year 1986/87 as a result of the combined effect of lower procurement prices for crude oil and the marginally lower retail prices. For fiscal year 1987/88, however, there was a domestic fuel subsidy totalling Rp. 401.2 billion.

The said Report dated June 1990, reported that there were subsidies totalling Rp. 255.2 and Rp. 705.9 billion for fiscal year 1988/89 and 1989/90 respectively, and a subsidy totalling Rp. 626.5 billion was prepared for the fiscal year 1990/91 budget. However, it is difficult to clarify the breakdown of distribution of the above mentioned subsidies for each fuel type.

The Government of Indonesia increased domestic fuel prices by an average of about 15% effective May 25 1990 to encourage more efficient use of energy and to reduce pressures on the state budget.

Based on the rough estimation by the Embassy, increased revenues for Pertamina by this price escalation is sufficient to eliminate the need of a fuel subsidy in fiscal year 1990/91 for automotive gasoline and diesel fuels, unless Indonesian's crude price averages more than US$ 17.5 per barrel. The Government has indicated that the average production cost for all fuel products is Rp. 227 per liter when crude is US$ 16.5 per barrel.

It is probable that any subsidy for the fiscal year 1990/91 budget is aimed mainly at kerosene which is generally used for home cooking in Indonesia.

The governmental policy expressed in the President's Introduction Speech of National Budget Planning for Fiscal Year 1991/92 dated January 7, 1991, has stated that although there still exist a fuel subsidy, the subsidy has to be decreased step by step, and in due time it will be eliminated. (In the 1991/92 budget planning, the crude oil price is assumed to be US$ 19 per barrel.)

Considering the current price level of diesel fuel, it can be assumed that depending on the crude price trend there still remains the possibility of a subsidy for diesel fuel.

However, when supposing a crude price of US$ 19 per barrel, the subsidy amount for diesel fuel is estimated to be small.

Taking the above considerations into account, it is assumed that there is no fuel subsidy for gasoline and diesel fuels for this economic analysis. Therefore, by adjusting for a 10% value added tax, the economic price of gasoline and diesel fuel was obtained.

(4) Wage Rates

The 1988 wage rates of transport workers, i.e. drivers, assistant drivers, conductors and mechanics in East Java Province were obtained from the Central Bureau of Statistic (Upah Buruh menurut Jenis Pekerjaan). The annual average growth rate of the consumer price index in Surabaya city for the period from 1985 to 1989 (about 8% per annum) was adopted to estimate the wage rates in 1991. Considering the wage levels of transport workers, these rates are assumed to be not subject to any income taxes. Therefore the economic values are taken to be equivalent to their market wage rates (Refer to Table 14.2).

(5) Interest Costs

Interest costs were calculated based on an interest rate of 15% per annum.

(6) Insurance Costs

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

Passenger Vehicle 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.

(7) Wages 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 travelling hours equated by average running speed. The overhead costs of commercial vehicles were assumed to be 10% of the total of other cost items.

(8) Cost Equation of Vehicle Operation Costs

The various operating elements discussed above were individually expressed in terms of a vehicle average running speed, in order that costs at different speeds on a level tangent road could be derived. Equations with a speed variable used in the Study are based on those applied in previous similar studies in Indonesia. The equations for vehicle operating costs are shown in Appendix A-14.4.

14.4.4 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 were calculated. Appendix A-14.5 shows the unit vehicle operating costs for 7 representative vehicles in both financial and economic prices.

The above unit vehicle operating costs were then combined into the four vehicle categories of the traffic assignment based on the vehicle composition rate shown in Table 14.3.

Table 14.3 Vehicle Composition Rate

Vehicle Category	Vehicle Type	Composition Rate (%)
Passenger Vehicle	Sedan Minibus (Private) Minibus (Public)	40 37 23
Pick-up	Pick-up	100
Truck	Medium Truck Large Truck	48 52
Bus	Bus	100

Source : *Based on traffic survey result by the Study Team in 1990 at* Location No. 1113, 1115 and 2214.

As a result, the weighted averages of the unit vehicle operating costs of 4 vehicle categories by speed, by vehicle category were obtained as shown in Table 14.4.

Table 14.4 1991 Composite Unit Vehicle Operating Costs

Financial Vehicle Operating Costs (Rp./Km)

Speed (Km/Hour)	Passenger Vehicle	Pick-up	Truck	Bus
10	908	510	922	1,724
15	687	389	731	1,436
20	570	323	632	1,293
25	495	280	571	1,211
30	443	250	530	1,163
35	405	227	503	1,135
40	375	209	483	1,121
45	352	195	471	1,117
50	334	185	463	1,121
55	320	176	460	1,131
60	309	170	460	1,147
65	301	166	463	1,168
70	295	164	469	1,193
75	292	163	477	1,222
80	291	163	487	1,254
85	291	165	500	1,289
90	293	168	514	1,327
95	296	172	531	1,368
100	301	178	549	1,412

Economic Vehicle Operating Costs (Rp./Km)

Speed (Km/Hour)	Passenger Vehicle	Pick-up	Truck	Bus
10	555	402	766	1,403
15	423	308	604	1,160
20	352	256	519	1,039
25	307	222	467	970
30	275	198	432	928
35	252	180	409	903
40	233	166	392	889
45	220	155	381	884
50	209	147	374	886
55	202	140	370	894
60	196	136	370	906
65	192	133	373	922
70	190	131	378	941
75	190	131	384	964
80	190	132	393	990
85	193	134	403	1,018
90	196	137	416	1,050
95	201	141	430	1,083
100	207	146	446	1,120

14.5 Unit Vehicle Time Cost

14.5.1 General

The estimation method of unit vehicle time cost applied for the Study is based on the toll road diversion equations derived from the traffic survey conducted by the Study Team in 1990.

The toll road diversion model explains the percentage of toll road traffic among the potential users against the factor of the toll divided by travel time difference comparing "via project toll road" with "via alternative existing road".

14.5.2 Time Values by Vehicle Type

The time value (λ) for each vehicle was estimated based on the following Toll Road diversion equations estimated as described in Section 8.2.2 in Chapter 8.

$$P = \frac{K}{1 + \alpha \cdot T^{\beta}}$$

Therefore,

$$\lambda = T = \frac{1}{\alpha}\left(\frac{K}{P} - 1\right)^{1/\beta}$$

where,

P : Diversion Rate (%)

T : Toll per travel time difference (Rp./min.) between "via toll road" and "via alternate route"

α,β,K : Parameters of the diversion equation model

The calculated diversion rates using the above equation for differentiated factors of toll per travel time difference produce a probability density distribution. Based on the probability density distribution obtained, the corresponding diversion rate to the median of distribution was estimated at 50% for passenger vehicle, 40% for pick-up and 30% for truck.

Applying the above diversion rate, the time values for each vehicle type were estimated as shown below:

Passenger vehicle (P = 50%)

$$
\begin{aligned}
\lambda &= \{1/\alpha(K/P - 1)\}^{1/\beta} \\
&= \{1/\alpha(1.0/0.5 - 1)\}^{1/\beta} \\
&= (1/\alpha)^{1/\beta} \\
&= (1/1.454219 \times 10^{-5})^{(1/2.229036)} \\
&= 148 \quad \text{(Rp./min.)} \\
&= 8,880 \quad \text{(Rp./hour)}
\end{aligned}
$$

Pick-up (P = 40%)

$$
\begin{aligned}
\lambda &= \{1/\alpha(K/P - 1)\}^{1/\beta} \\
&= \{1/\alpha(0.9/0.4 - 1)\}^{1/\beta} \\
&= (1.25/\alpha)^{1/\beta} \\
&= (1.25/2.623553 \times 10^{-5})^{(1/2.279117)} \\
&= 113 \quad \text{(Rp./min.)} \\
&= 6,780 \quad \text{(Rp./hour)}
\end{aligned}
$$

Truck (P = 30%)

$$
\begin{aligned}
\lambda &= \{1/\alpha(K/P - 1)\}^{1/\beta} \\
&= \{1/\alpha(0.8/0.3 - 1)\}^{1/\beta} \\
&= \{(1.67/\alpha)^{1/\beta} \\
&= (1.67/3.330657 \times 10^{-4})^{(1/1.741448)} \\
&= 133 \quad \text{(Rp./min.)} \\
&= 7,980 \quad \text{(Rp./hour)}
\end{aligned}
$$

With regard to buses, a toll road diversion model was not satisfactorily estimated from the traffic data collected. Accordingly, an income approach to the estimated non-car owners was adopted. The bus time cost was obtained based on the average occupancy per bus.

The estimated unit vehicle time costs are summarized in Table 14.5.

Table 14.5 Unit Vehicle Time Cost

Vehicle Type	Time Cost (Rp./hr.)
Financial/Economic Costs:	
Passenger Vehicle	8,880
Pick-up	6,780
Truck	7,980
Bus	7,960

14.6 Estimation of Economic Benefits

14.6.1 General

The quantified economic benefits which would be realized from implementation of the Project are defined as the saving in travel costs when comparing the "with" and "without" project conditions. The toll revenue created by the Project is regarded as a transfer payment, and is therefore excluded from the benefits, because the toll is paid by the toll road users in return for the expected savings in travel costs and/or increase in safety and comfort of travel.

Other economic benefits would also be realized from the implementation of the Project. The Project would create additional short-term employment in the construction of the Toll Road and this would have a multiplier effect in the Project Area. Long-term jobs would also be created through the staff requirements for operation and maintenance. The Toll Road could also be expected to have a positive effect on industrial development. Increased efficiency in the transportation of goods should benefit both producers and consumers. In addition, the Toll Road would have a favorable influence on tourism development, by providing faster and more comfortable travel services. These benefits have not been quantified for the economic analysis, therefore, the estimated project benefits can be considered to be on the conservative side.

14.6.2 Economic Benefits in Travel Costs

As mentioned above, 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 is the "with" project traffic assignment of toll road users on the road network including the Toll Road. The "without" project condition is the traffic assignment of the above toll road users on the road network without the Toll Road.

The total daily economic vehicle operating costs, in both the "with" and "without" conditions, were calculated based on the daily vehicle-kilometers of the traffic by vehicle type on each road link and the respective unit vehicle operating costs by speed. These daily costs were then converted to total annual costs by multiplying by 365. The economic benefit in operating costs was then taken as the savings in vehicle operating costs when comparing the total "with" and "without" project vehicle operating costs.

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

The savings in vehicle operating costs and time costs are summarized for the planning years of 1995, 2005 and 2015 as shown in Table 14.6.

Table 14.6 Estimated Economic User Benefits of the Toll Road

(Million Rp./Year)

Year	Economic Benefits of Savings in:		Total Benefits
	Vehicle Operating Costs	Time Costs	
1995	13,767	46,671	60,438
2005	78,159	174,144	252,303
2015	216,336	284,481	500,817

14.7 Economic Cost-Benefit Analysis and Project Returns

14.7.1 Basic Assumptions and Methodology

The analysis follows the conventional discounted cash flow methodology in determining the EIRR, NPV and B/C ratio. These efficiency measures establish the economic viability of the Toll Road and indicate the sensitivity of the project's economic viability to the changes in project costs and benefits.

The economic costs in the "without" project condition have conservatively been defined as the travel costs that are expected in the absence of the Toll Road. Additional "without" project costs could be allocated as a result of higher maintenance and repair costs on the alternative routes, which would occur due to higher traffic volumes. Since these additional "without" project costs would directly increase the project benefit, the practical exclusion of these costs adds another conservative factor into the analysis of the project's viability.

Apart from the elements previously discussed, the basic assumptions for the economic project analysis are described below:

Base Year	:	1991
Project Life	:	25 years after the completion of the full length between Surabaya and Mojokerto
Prices	:	Constant 1991 prices
Residual Value	:	None

The NPV and B/C ratio were calculated based on a discount rate of 15 percent.

14.7.2 Economic Cost-Benefit Analysis

The economic project costs were previously discussed in Section 14.2. The economic benefits from the savings in vehicle operating costs and time costs for the planning years were discussed previously in Section 14.6. The benefits in the intermediate years were interpolated and those beyond the year 2015 were held constant.

The total economic project costs and benefits streams are presented in Table 14.7. The net cash flow stream is the basis for the calculation of EIRR. The project costs and benefits streams at their net present values are the basis for the calculation of B/C ratio.

Following the conventional discounted cash flow methodology, the efficiency measures were calculated and the results are as follows:

EIRR	=	27.88%
NPV at 15%	=	457,541 Million Rp. at 1991 constant price
B/C ratio	=	2.68

These results indicate that the Project is economically feasible.

14.7.3 Sensitivity Analysis

Assuming that the benefit and cost stream might alter ±10%, ±20% and ±30%, the effect on the EIRR was analyzed and the results are summarized in Table 14.8.

The results show that even the most severe case of -30% benefit and +30% cost still maintains EIRR of 19%.

Table 14.7 Economic Project Analysis

EIRR = 27.88%
NPV = 457,541 Million Rp.
B/C = 2.68
(Discount Rate Used = 15.00%)

(Unit: Million Rp.)

	Year	Benefit	Cost			Net Cash
			Const.Cost	O&M Cost	Total Cost	Flow
1	1991		1,526	0	1,526	-1,526
2	1992		46,655	0	46,655	-46,655
3	1993		121,649	0	121,649	-121,649
4	1994		104,738	0	104,738	-104,738
5	1995		79,555	0	79,555	-79,555
6	1996	79,625	0	4,209	4,209	75,416
7	1997	98,812	0	4,209	4,209	94,603
8	1998	117,998	0	4,209	4,209	113,789
9	1999	137,185	0	4,209	4,209	132,976
10	2000	156,371	0	4,209	4,209	152,162
11	2001	175,558	0	4,209	4,209	171,349
12	2002	194,744	0	4,209	4,209	190,535
13	2003	213,931	17,236	4,209	21,445	192,486
14	2004	233,117	0	4,209	4,209	228,908
15	2005	252,303	14,026	4,209	18,235	234,068
16	2006	277,154	0	4,209	4,209	272,945
17	2007	302,006	0	4,209	4,209	297,797
18	2008	326,857	5,310	4,209	9,519	317,338
19	2009	351,708	0	4,209	4,209	347,499
20	2010	376,560	23,680	4,209	27,889	348,671
21	2011	401,411	0	4,630	4,630	396,781
22	2012	426,262	0	4,630	4,630	421,632
23	2013	451,114	0	4,630	4,630	446,484
24	2014	475,965	0	4,630	4,630	471,335
25	2015	500,817	16,500	4,630	21,130	479,687
26	2016	500,817	0	4,630	4,630	496,187
27	2017	500,817	0	4,630	4,630	496,187
28	2018	500,817	0	4,630	4,630	496,187
29	2019	500,817	0	4,630	4,630	496,187
30	2020	500,817	0	4,630	4,630	496,187
	Tota	8,053,583	430,875	109,435	540,310	7,513,273

Table 14.8 EIRR by Altered Benefit and Cost

(Unit : %)

Cost	Benefit			
	Base	-10%	-20%	-30%
Base	27.88	26.22	24.47	22.59
+10%	26.38	24.80	23.12	21.31
+20%	25.07	23.55	21.93	20.19
+30%	23.91	22.44	20.88	19.20

14.8 Impact of the Toll Road on the Development in the Direct Influence Zone

14.8.1 Impact of Toll Road Development

Generally, the development of a toll road will bring about favorable impact to the areas along the toll road (i.e. Direct Influence Zone), in particular, in the vicinity of interchanges. By utilizing a toll road, the required time for transportation of materials and products between factories and seaports/airports/markets will be shortened, thus factories can be located at distant areas from seaports/airports/ markets.

For agricultural and fishery industries, toll roads will provide benefits of better conditions to keep the freshness of goods and punctuality of products delivery. In the areas near interchanges, there will be great potential to develop distribution centers of agricultural and fishery products.

Toll roads will also create favorable effects for the tourism sector. Shorter travel time by using toll roads will increase the preference of remote resort sites. Potentialities for tourism in areas remote from major cities will be developed. Tourism development in consideration of preservation of the natural environment and monuments of historical value will contribute to the improvement of regional welfare.

Recently, industrial and housing development has become active in the vicinity of existing interchanges of the Jakarta-Tangerang and the Jakarta-Cikampek Toll Roads. In particular, in the areas near the Cikarang and Cibitung interchanges of the Jakarta-Cikampek Toll Road, the construction of several industrial parks intended for export-oriented foreign enterprises are on-going. These industrial parks are located about 2-3 km from the interchanges.

In order to realize orderly and effective development along the Toll Road corridor, the following actions will be required.

- Preparation of a proper landuse plan in the Direct Influence Zone
- Provision of proper legislations for landuse and land price control

14.8.2 Development Impact of Planned Interchanges

(1) Mojokerto Interchange

At present, a number of factories related to agro-industries and fertilizer plants are located near Mojokerto city.

At Mojokerto Interchange, the Toll Road connects with the existing Mojokerto Bypass. The interchange will provide superior access to the existing bus terminal and future housing estates, production center (i.e. industrial estates) and distribution center (i.e. wholesale markets).

Besides the above impacts, Mojokerto Interchange will contribute to the stimulation of tourism development related to ancient historical remains located near Mojokerto city.

(2) Krian Interchange

Krian Interchange is planned at approximately 3.5 Km north of Krian city. Krian city is currently serving as a commercial center of consumer goods and agricultural products to/from circumferential areas. Along the provincial road in the north of the Surabaya river, many factories have been established. Recently the development of new industrial and residential estates is planned near the area at the north of the provincial road.

Krian Interchange will serve as a collection/distribution facility for the south-bound traffic (Krian direction) and north-bound traffic (newly planned industrial/residential estates direction).

(3) Driyorejo Interchange (Connection with Middle Ring Road)

Development of Driyorejo New Town is planned along the planned Middle Ring Road. Driyorejo Interchange will connect the Toll Road with the Middle Ring Road and will contribute to the large-scale residential estates development.

(4) Lakarsantri Interchange (Connection with Inner Ring Road)

The area between Lakarsantri Interchange and Surabaya Junction has a number of existing and planned residential estates as a suburban area of Surabaya city. Lakarsantri Interchange will function as a facility for traffic collection /distribution to/from the existing residential area together with, in the future, the Inner Ring Road.

Chapter 15

FINANCIAL PROJECT ANALYSIS

CHAPTER 15

FINANCIAL PROJECT ANALYSIS

15.1 General

15.1.1 Methodology

The principal objective of the financial project analysis is to evaluate the financial viability of the implementation of the construction and operation of the proposed Surabaya-Mojokerto Toll Road.

This analysis was performed based on estimations in terms of revenue and construction and operation/maintenance costs. Additionally, financial conditions of required funds were examined and assumed.

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

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

15.1.2 Assumptions

The following assumptions were made:

1) Project Life

The start of operation of the whole of the Toll Road (in 4-lane) is scheduled to be 1996. The project life is assumed to be 25 years after the inauguration of the whole operation of the Toll Road.

2) Salvage Value

The project life of 25 years is the period for the purpose of this analysis. The facility of the toll road will continue to have value for a much longer period. Accordingly, the salvage value (undepreciated value) is assumed as a negative cost in the final year of the project life.

3) Investment Cost

The construction and operation of the Toll Road is programmed to be performed by a joint venture or joint operation between Jasa Marga and private investors.

According to the legislation of Section 41 in Government Decree No. 8/1990, costs for land acquisition and compensation for toll road projects in Indonesia are the government's responsibility.

Taking the above conditions into account, the investment cost excluding land acquisition and compensation costs was applied for the financial analysis.

4) Prices

For financial analysis, two price bases were assumed as follows:

- Constant 1991 price basis
- Current price basis

In the case of constant price basis, an annual 3% increase of toll rate was assumed according to the targeted growth ratio of Gross Domestic Product (GDP) per capita in Indonesia, while the escalation of investment and operation/ maintenance costs was not considered.

In the case of current price basis, an increase of toll rate by 40% in every three years (about 12% increase per annum) was assumed based on an interview with Jasa Marga. An annual 8% increase of costs was assumed according to statistical data of the recent trend of consumer prices in Surabaya city.

15.2 Financial Project Cost

Based on the study results of cost estimates (refer to Chapter 13), and the above assumption about land acquisition and compensation costs , the financial project cost related to the initial investment in 1991 constant prices was estimated as summarized in Table 15.1. The estimated financial annual operation and maintenance costs in 1991 constant prices are Rp. 4,676 million and Rp. 5,144 million for 4-lane and 6-lane 2-way respectively (refer to Chapter 11).

The annualized financial project costs for the constant price basis and the current price basis are shown in Appendix A-15.1 and A-15.2 respectively.

Table 15.1 Financial Project Costs (Initial Investment)

(Million Rp. in 1991 prices)

Construction Costs	289,513
Maintenance Equipment	1,255
Utility Relocation	3,537
Engineering Service (D/D)	5,790
Engineering Service (Supervision)	8,686
Grand Total	308,781

15.3 Revenue Estimation

15.3.1 Toll Rate

The toll rates for the revenue estimation for financial analysis were based on the current tariff system of the Surabaya-Gempol Toll Road (i.e. Rp.60 per vehicle-kilometer for passenger vehicle and pick-up and Rp.100 per vehicle-kilometer for bus and truck).

As a result of the traffic assignment, the financial benefit per vehicle-kilometer was obtained for each vehicle type. Then, the obtained financial benefit per vehicle-kilometer and the toll per vehicle-kilometer for each vehicle type were compared, and the ratio of toll to financial benefit in terms of vehicle-kilometer was estimated as shown in Table 15.2. The ratio ranges from 0.13 to 0.51.

According to an interview with Jasa Marga, it was suggested that the guideline for toll structure is recovery of 70% of the benefit which the toll users receive ordinarily from the usage of the toll road. Only from the viewpoint of benefit, it can be said that there is a room to increase the toll rate.

Table 15.2 Ratios of Toll and Financial Benefit

(Unit : Rp.)

Year	Vehicle Type	Financial Benefit per Vehicle-Km (a)	Toll per Vehicle-Km (b)	Ratio (b)/(a)
1995	Passenger Vehicle	540	68	0.13
	Bus	222	113	0.51
	Pick-up	365	68	0.19
	Truck	370	113	0.31
2005	Passenger Vehicle	619	91	0.15
	Bus	404	151	0.37
	Pick-up	425	91	0.21
	Truck	482	151	0.31
2015	Passenger Vehicle	652	122	0.19
	Bus	666	203	0.30
	Pick-up	425	122	0.29
	Truck	554	203	0.37

Note : in 1991 prices

15.3.2 Estimated Revenue

Based on the results of traffic assignment and the assumed tariff, the revenue was estimated as shown in Table 15.3.

In the case of constant price basis, the toll rates (in 1991 price) adopted were assumed to increase at 3% per year escalation rate and to be revised every three years, while in the case of current price basis, they were assumed to increase at about 12% per year escalation rate and to be revised every three years.

Table 15.3 Estimated Toll Revenue

(Unit : Mil. Rp.)

Price Basis	1995	2005	2015
Constant Price	15,483	59,580	153,995
Current Price	19,834	162,299	1,150,591

15.4 Financial Internal Rate of Return

Based on the estimated construction cost and operation/maintenance costs and the estimated revenues, the FIRR and the NPV were calculated in terms of constant price and current price as shown in Table 15.4. In calculating the NPV, a discount rate of 15% was used. Appendix A-15.3 and A-15.4 show details of the calculation of FIRR (ROI) and NPV for constant price basis and current price basis, respectively.

Table 15.4 Summary of FIRR (ROI) and NPV

Price Basis	FIRR (ROI) (%)	NPV (Million Rp.)
Constant Price	12.88	-44,642
Current Price	21.96	362,435

15.5 Cash Flow Analysis

15.5.1 Profit and Loss Statement

For the cash flow analysis of the Project, the profit and loss statement was estimated based on the following assumptions:

a) Revenue

Refer to Section 15.3.2.

b) Operation and Maintenance Costs

Refer to Section 15.2. The operation and maintenance costs were decided considering the number of lanes for each operation year of the proposed toll road.

c) Property Tax

In the analysis, a property tax for the right-of-way acquisition related to the Project was applied. The annual value of the property tax was estimated based on the actual data of property tax of the existing Surabaya-Gempol Toll Road.

According to information from Jasa Marga, the actual 1990 property tax of the Surabaya-Gempol Toll Road (total length of 43 Km) was Rp. 588 million, that is Rp. 14 million per kilometer. Applying this unit rate of property tax per kilometer, the property tax of the Surabaya-Mojokerto Toll Road is estimated at Rp. 536 million for 1990 price. The 1991 property tax was estimated at Rp. 563 million, applying the assumed average annual growth ratio of 5%.

d) Interest (Long-Term Loan and Short-Term Loan)

Payments of interest for the long-term and short-term loans were assumed to be made for the remaining balance of loans. Details of loan conditions are described later in this section.

e) Depreciation

Depreciation follows the straight line method. The life expectancy of the toll road is assumed to be 50 years.

f) Depreciation of Interest during Construction Period

The interest during construction period is assumed to be treated as a depreciable asset. The term of depreciation is assumed to be 25 years in accordance with the project life.

g) Corporate Tax

Corporate tax is assumed to be charged after the accumulated profit (after depreciation) becomes positive. In this case, an annual loss amount is assumed to be carried over for the ensuing five years. The tax ratio is assumed to be 35 percent of the profit after depreciation.

15.5.2 Financial Cash Flow Analysis

1) Assumption of Financial Source and Use

a) Financial Source

The items of financial source were assumed as below:

- Profit after tax
- Depreciation
- Depreciation of interest during construction period
- Equity, and
- Long-term loan

In this analysis, the financial source for the interest during the construction period is assumed to be from a short-term loan.

b) Financial Use

The items of financial use were assumed as below:

- Investment cost
- Interest during construction period
- Repayment of long-term loan, and
- Repayment of short-term loan

In the financial analysis, the interest during the construction period was assumed to be included into the total initial project cost.

c) Examination of Alternatives of Financial Source

The initial investment cost was assumed to be financed from equity and long-term loan. In the analysis, several alternatives varying the fund raising conditions (i.e. the equity/loan (long-term loan) ratio and the interest rate of long-term loan) were assumed and examined.

2) Equity/Loan Ratio

The following cases for the equity/loan ratio are assumed:

a) Equity 30% : Loan 70%
b) Equity 35% : Loan 65%

3) Long-Term Loan Condition

The following three cases of of long-term loan conditions were assumed:

a) Interest rate : 10%
Grace period : 5 years and
Repayment period : 15 years
b) Interest rate : 15%
(Grace period and repayment period is the same as a))
c) Interest rate : 20%
(Grace period and repayment period is the same as a))

4) Cases to be examined

Twelve cases were examined in the financial analysis for the combinations of the above two cases of loan/equity ratio and three cases of loan conditions as shown below:

Cases of Financial Analysis

Price Basis	Equity/Loan Ratio	Interest Rate of Loan	Case No.
a) Constant Price	a) 30 : 70	a) 10%	1)
		b) 15%	2)
		c) 20%	3)
	b) 35 : 65	a) 10%	4)
		b) 15%	5)
		c) 20%	6)
b) Current Price	a) 30 : 70	a) 10%	7)
		b) 15%	8)
		c) 20%	9)
	b) 35 : 65	a) 10%	10)
		b) 15%	11)
		c) 20%	12)

5) Assumption of Short-Term Loan

It was assumed that in the case of cash flow deficit of the total financial source against the total financial use, the deficit is financed by a short-term loan. In particular, the interest during the construction period was assumed to be financed by a short-term loan. The repayment of principal and payment of interest was assumed to be made in the year following the borrowing.

The interest rate of the short-term loan was assumed to be the same as that applied for the long-term loan used for each case above.

15.5.3 Analysis Results

Table 15.5 shows a summary of the analysis results for each alternative case.

a) Constant Price Basis

The 30%:70% equity/loan ratio case shows a severe deficit in cash flow. The deficit in cash flow requires the raising of a short-term loan, and this causes a high increase in payment on interest which then in turn leads to a further deficit. Only the 10% interest rate case shows a sound financial condition.

The 35%:65% equity/loan ratio with the 20% interest rate case shows a deficit in cash flow. The 35%:65% equity/loan ratio with the 15% interest rate case shows that the first year of accumulated surplus in the profit and loss

Table 15.5 Summary of Financial Analysis Results

	Equity /Loan Ratio	Interest Rate	(No.)	FIRR (ROI) (%)	NPV (Million Rp.)	FIRR (ROE) (%)	NPV (Million Rp.)	First Year of Surplus: Annual Surplus in Profit & Loss (Year)	First Year of Surplus: Accum. Surplus in Profit & Loss (Year)	First Year of Surplus: Annual Surplus in Cash Flow (Year)	Maximum Annual Short-term Loan Amount (Million Rp.)	Year of Maximum Short-term Loan (Year)
1. (Constant Price)	30%:70%	10%	(1)	12.87	-44,752	14.33	-8,622	2001	2006	2010	107,655	2005
(a) Toll Rate: 3% up / year		15%	(2)	12.87	-44,752	11.68	-48,791	2012	*)	*)	578,353	2011
		20%	(3)	12.87	-44,752	9.62	-88,962	*)	*)	*)	-	-
(b) Cost: Constant	35%:65%	10%	(4)	12.87	-44,752	14.19	-10,891	2001	2005	2009	83,054	2003
		15%	(5)	12.87	-44,752	11.81	-48,191	2009	2017	2018	420,425	2010
		20%	(6)	12.87	-44,752	9.90	-85,490	*)	*)	*)	-	-
2. (Current Price)	30%:70%	10%	(7)	21.95	361,845	26.87	421,608	2000	2001	2003	70,037	1999
(a) Toll Rate: 40% up / 3year		15%	(8)	21.95	361,845	24.37	371,507	2002	2006	2007	220,707	2002
		20%	(9)	21.95	361,845	22.37	321,405	2006	2011	2012	769,245	2005
(b) Cost: 8% up / year	35%:65%	10%	(10)	21.95	361,845	26.35	418,779	1999	2001	2002	55,281	1999
		15%	(11)	21.95	361,845	24.17	372,255	2001	2005	2007	178,714	2001
		20%	(12)	21.95	361,845	22.37	325,732	2006	2010	2011	620,749	2005

Note: *) .... Nil first year of surplus within the project life.

statement is 2017, which is 23 years after the opening of the toll road operation.

b) Current Price Basis

On the other hand, the current price basis shows favorable results, mainly because of a high level of revenue. There is no considerable difference in calculation of the results between the 30%:70% equity/loan ratio case and the 35%:65% equity/loan ratio case.

In the 35%:65% equity/loan ratio with the 15% interest rate case, the first year of accumulated surplus in the profit and loss statement is 2005, while in the 20% interest rate case it is 2010 (10 years and 15 years after the opening of the Toll Road respectively).

As an example, the calculation results for the case of equity/loan ratio of 35%:65% and interest rate of 15% are tabulated for both the constant price basis and the current price basis. Appendix A-15.5 - A-15.8 show the tabulations of the debt service of long-term loan, the profit and loss statement, the cash flow and the FIRR (ROE) for the constant price basis, and Appendix A-15.9 - A-15.12 show the tabulations for the current price basis.

15.5.4 Sensitivity Analysis

1) Sensitivity to Cost and Revenue

a) Cases for Sensitivity Analysis

A sensitivity analysis was conducted for variations of the cost and revenue for the case of equity/loan ratio of 35%:65% with the interest rate of 15% and 20% of long-term loan for the current price basis .

The following cases are assumed:

Case 1: A cost overrun of 10 percent.

Case 2: A 10 percent decrease in revenue.

Case 3: Combination of Case 1 and Case 2.

Table 15.6 Summary of Sensitivity Analysis Results

For Case of Equity/Loan Ratio ≈ 35%:65% in Current Price Basis

	Interest Rate	FIRR (ROI) (%)	NPV (Million Rp.)	FIRR (ROE) (%)	NPV (Million Rp.)	First Year of Surplus: Annual Surplus in Profit & Loss (Year)	First Year of Surplus: Accum. Surplus in Profit & Loss (Year)	First Year of Surplus: Annual Surplus in Cash Flow (Year)	Maximum Annual Short-term Loan Amount (Million Rp.)	Year of Maximum Short-term Loan (Year)
1. (Sensitivity to Cost and Revenue)										
1-a. (Base Case)	15.0%	21.95	361,845	24.17	372,255	2001	2005	2007	178,714	2001
1) Cost +10%	15.0%	20.99	329,582	22.92	341,034	2002	2006	2007	244,861	2002
2) Revenue -10%	15.0%	20.89	293,398	22.79	303,808	2003	2006	2008	228,856	2002
3) Combination of 1) and 2)	15.0%	19.96	261,135	21.59	272,587	2003	2007	2009	323,306	2005
1-b. (Base Case)	20.0%	21.95	361,845	22.37	325,732	2006	2010	2011	620,749	2005
1) Cost +10%	20.0%	20.99	329,582	21.18	289,858	2006	2012	2012	846,960	2005
2) Revenue -10%	20.0%	20.89	293,398	21.06	257,285	2006	2012	2013	787,655	2005
3) Combination of 1) and 2)	20.0%	19.96	261,135	19.91	221,411	2009	2014	2015	1,140,933	2008
2. (Sensitivity to Interest Rate)										
1) Interest Rate: 22.5%	22.5%	21.95	361,845	21.58	302,471	2009	2014	2014	1,213,963	2008
2) Interest Rate: 25.0%	25.0%	21.95	361,845	20.86	279,209	2015	*)	*)	4,024,560	2015

Note: *) .... Nil first year of surplus within the project life.

b) Analysis Results

The results of the sensitivity analysis are summarized in Table 15.6. As can be seen, a 10% decrease in revenue would have a slightly greater effect than a 10% increase in costs .

2) Sensitivity to Interest Rate

a) Cases for Sensitivity Analysis

A sensitivity analysis was conducted altering the interest rate of long-term loan to 22.5% and 25.0% for the case of equity/loan ratio of 35%:65% in the current price basis.

b) Analysis Results

The results of the sensitivity analysis are summarized in Table 15.6.

In the case of interest rate of 22.5%, the first year of accumulated surplus in the profit and loss statement and the first year of annual surplus in the cash flow both appear in 2014 (i.e. 19 years after the opening of the toll road operation).

On the other hand, in the case of interest rate of 25.0%, the first year of annual surplus in the profit and loss statement is 2015, however, the first year for the accumulated surplus in the profit and loss statement and the first year of annual surplus in the cash flow do not appear within the period of the project life.

15.6 Conclusion

The FIRR calculations for the current price basis are about 22% for ROI and about 22-27% for ROE varying according to the interest rates of loan. They are similar to or lower than the prevailing level of interest rates on deposit in commercial banks in Indonesia which range from 23% to 28%, and which increased greatly from last year as a result of a financial squeeze in Indonesia.

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

Furthermore, the results of sensitivity analysis to interest rate suggest that the interest rate of 22% is the maximum level, as the average interest rate of loans applied for the Project, in order to maintain a financial viability (the first year of accumulated surplus is 2014, which is 19 years after the opening, leaving 6 years in the Project life span).

An effort to introduce loans with lower interest rate wherever possible is therefore advisable to improve the financial viability.

Besides the above measure on the interest rate, the possibility of increasing the toll level (such possibility is suggested in subsection 15.3.1) should be pursued as another way to improve the financial viability of the Project.

Chapter 16

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 16

CONCLUSIONS AND RECOMMENDATIONS

16.1 Conclusions

16.1.1 Necessity of the Project

The Project, which is to construct one of the three radial toll roads in the major transportation and development corridors leading from Surabaya to the southwest, is of great importance for development of the GKS (Surabaya Metropolitan) region and is expected to play the following important roles:

- To improve and strengthen the road network in the GKS region to cope with the recent increase in vehicle traffic demand and rapid development in the region which will support the development of industrial and housing areas along the corridor ;
- To solve traffic congestion on the national/provincial roads in the southwestern corridor between Surabaya and Mojokerto which could become a major problem in the very near future; and
- To contribute to the development of the Trans Java Tollway System since the Toll Road constitutes the easternmost section of the said system.

16.1.2 Future Traffic

The present traffic between Mojokerto and Surabaya increases as the national/provincial roads approach Surabaya city, that is about 18,400 vehicles/day near Mojokerto and 43,700 vehicles/day near Surabaya.

The analysis of the socio-economic framework predicts that in the direct influence area along the Surabaya-Mojokerto corridor (including Kod. Surabaya, Kab. Gresik, Kab. Sidoarjo, Kab. Mojokerto and Kod. Mojokerto), population in 2005 and 2015 will become 1.38 times and 1.64 times the 1990 population respectively and GRDP in 2005 and 2015 will become 2.54 times and 4.64 times the 1990 GRDP. The traffic demand will grow accordingly. The total vehicular traffic demand in 2005 and in 2015 are predicted to be 2.6 times and 4.9 times that in 1990 respectively.

Under such a situation, the existing national/provincial roads are, without the presence of the Toll Road, not capable of efficiently meeting the 1990 transportation demand and clearly unable to accommodate 2005 and 2015 travel demands.

Future traffic volume on the Toll Road was forecast at 12, 100 vehicles/day in 1995, 39,900 vehicles/day in 2005 and 75,600 vehicles/day in 2015 in average cross-sectional traffic.

16.1.3 Technical Aspects

(1) Route

A total of 6 route alternatives were established initially, and these were narrowed down to three short-listed route alternatives (Route Alternative-B1, -D1 and -D2) which were examined further in detail based on the results of the preliminary traffic demand forecast and the preliminary economic analysis. As a result of the comparison, it was concluded that Alternative-B1 is superior to the other alternatives in all aspects of environmental impact, transportation and economics and should be selected as the optimum route.

From the Mojokerto terminus, the connection with the Mojokerto Bypass at the southeast of Mojokerto city, the route runs in the northeast direction and crosses a railway line and the Porong river. After running through farmland for 5 km, the route changes direction to the north to cross the Surabaya river, then turns easterly to pass through the edge of a gentle hill area along the Surabaya river. After passing 3.5 km north of Krian city, the route turns slightly to the northeast along the Surabaya river passing through a flat area, then turns again easterly to pass through the edge of gentle hills on the south of the planned new town of Driyorejo. It turns to the northeast to avoid a military area then turns again easterly, crosses the provincial road and the Mas river and reaches the junction with the Surabaya-Gempol Toll Road 2 km north from Waru IC.

The route will cross the planned Inner and Middle Ring Roads of Surabaya. The total route length is 38.32 km.

(2) Major Design Features

a) A 120 km/hr design speed will be applied as a regional toll road in flat terrain, except for the eastern section, east of the planned Inner Ring Road, where a 100 km/hr design speed will be applied as an urban toll road.

b) Based on the forecast traffic on the Toll Road, 4-6 lanes stage construction will be applied. Lane width is 3.6 m. Shoulder width is 3.0 m for the outer shoulder and 1.5 m for the inner shoulder. Median width is 5.5 m including 1.5 m inner shoulders with 2.5 m width raised in the ultimate 6-lane cross section.

c) The method of 4-6 lanes stage construction is to construct earthwork for 6-lane with 4-lane pavement at the outside in the initial stage construction and to widen the pavement at the inner lanes in the ultimate stage construction. Widening to 6-lane will be required around 2010. Bridges and viaducts will be constructed with full 6-lane width in the initial stage.

d) Basically, a distance proportional toll levy system will be adopted for the Toll Road. Three interchanges, Mojokerto IC, Krian IC and Surabaya JC, will be provided in the initial stage from the following five planned interchanges.

IC Name	Connecting Road	Type of IC
Mojokerto IC	Mojokerto Bypass	Double trumpet
Krian IC	Kabupaten road	Double trumpet
Driyorejo IC	Planned Middle Ring Road	Single trumped
Lakarsantri IC	Planned Inner Ring Road	Double trumpet
Surabaya JC	Surabaya-Gempol Toll Road	Trumpet

In addition to the toll facilities at Mojokerto IC and Krian IC, a mainline toll barrier gate will be provided west of Lakarsantri IC in the initial stage.

e) The total length of bridge and viaduct is 4.06 km taking up 10.6% of the total length of the Toll Road. Precast PC I-girders will generally be adopted because of economy and ease of construction, however for the Porong and Surabaya river bridges PC box girder will be adopted.

f) Most of the earthwork section is embankment. Soft ground treatment with 1.0 m thick sand mat and 0.4 m dia. sand drain pile is proposed for the area near Surabaya river crossing and the eastern part of the Toll Road. Total volume of embankment with borrow material is estimated at 4,800,000 m3, out of which 4,200,000 m3 have to be obtained from distant sources located southeast of Mojosari.

g) Flexible pavement was designed with a view to lower initial investment cost, better adoptability in soft ground areas and more comfortable riding condition than rigid pavement. The total thickness of pavement is 47-67 cm, consisting of surface/binder courses of asphaltic concrete, granular base and subbase courses.

16.1.4 Environmental Aspects

In the process of optimum route selection, due attention was paid to minimize adverse environmental impacts, in particular, such social impacts as displacement of residents and agricultural land.

Preliminary study for identification of environmental impact was carried out to provide information for the preparation of an ANDAL report. Possible adverse impacts and their mitigation measures were examined as a case study. A review of the environmental conditions along the Toll Road corridor, including social, manmade, physical and natural environment and examination of probable impacts in the three phases of pre-construction, construction and operation & maintenance in accordance with the EIA Guideline, suggested that most of the possible adverse impacts can be mitigated if the design is carefully prepared and proper construction methods are taken.

The most significant environmental problems will be displacement of residents and farms in the pre-construction phase, traffic related matters in the construction phase and noise/vibration/air quality impact in the operation & maintenance phase.

Displaced families will be sufficiently compensated or resettled to suitable areas. Farms acquired for the right-of-way will be sufficiently compensated.

Increased traffic congestion will occur on the road links for hauling embankment/pavement materials during construction. In order to mitigate such a condition, it is necessary to improve some provincial/kabupaten/desa road links by widening and overlay and to enforce traffic control for smooth traffic flow.

Noise/vibration/air quality problems are related to various factors, some of which could be mitigated by careful design for the road side. It is necessary to promote fundamental condition surveys and to establish a monitoring system for these problems.

As a continuation of this preliminary study, and at an early stage, a full scale environmental impact analysis based on detailed research and examination of the environmental conditions should be conducted and an ANDAL report prepared by the execution body of the Project.

16.1.5 Project Cost

The Project cost (initial investment cost) is Rp. 391,757 million in 1991 prices as shown below:

Summary of Initial Investment Cost

(Million Rp.)

Construction cost	263,194
Purchase of maintenance equipment	1,141
Land acquisition and compensation	75,433
Utility relocation	3,215
Engineering	13,160
Sub-Total	356,143
Contingency	35,614
Total	391,757

16.1.6 Results of Economic Project Analysis

The analysis followed the conventional discounted cash flow methodology in determining the EIRR, NPV and B/C ratio. The economic benefits quantified were the savings in vehicle operating and time costs. These results indicated that the Project is highly feasible.

EIRR	=	27.88%
NPV at 15%	=	457,541 Million Rp. at 1991 constant price
B/C ratio	=	2.68

The sensitivity test showed that even the most severe case of -30% benefit and +30% cost still maintains an EIRR of 19%.

16.1.7 Results of Financial Project Analysis

The analysis followed the conventional methodology to examine the FIRR and NPV and to determine the first year of continuous annual surplus and continuous accumulated surplus based on tabulations of the profit/loss statement and cash flow. The toll rates for estimation of revenue were based on the current rates of the Surabaya-Gempol Toll Road.

For the current price basis, which assumed an increase of toll rates by 40% in every 3 years and an increase of costs at 8% per annum, the FIRR was calculated at 22.0% for ROI and at 22.4% for ROE at a 20% interest rate of loan. The first years of annual surplus and accumulated surplus are 2001 and 2005 respectively in this case. The calculated FIRRs are similar to or lower than the prevailing level of interest rates on deposit in commercial banks in Indonesia which range from 23% to 28%, which increased greatly from last year as a result of a financial squeeze in Indonesia. This comparison shows that the results of the financial analysis are not very optimistic while the prevailing level of interest rates remains.

The results of sensitivity analysis to interest rate suggest that the interest rate of 22% is the maximum level, as the average interest rate of loans applied for the Project, in order to maintain a financial viability (the first year of accumulated surplus is 2014, which is 19 years after the opening, leaving 6 years in the Project life span).

An effort to introduce loans with lowest interest rate wherever possible is therefore advisable to improve the financial viability.

16.2 Recommendations

16.2.1 Implementation of the Project

The results of the Study indicate that the Project is technically sound (no serious technical difficulty is anticipated for the construction) and economically highly feasible. Taking into account the direct and enormous indirect benefits towards regional development other than the quantified savings in travel costs, the Project should be implemented at the earliest opportunity.

However, if the estimated FIRR is compared with the prevailing interest rates on deposit in commercial banks in Indonesia, the financial viability of the Project is not very optimistic. It is necessary to consider the following measures to improve the financial viability:

- To introduce loans with lower interest rate wherever possible. One of the suggested ways is to construct the costly section (e.g. the stretch in the east of the Inner Ring Road having long bridge/viaduct sections including Surabaya JC) by Jasa Marga alone introducing a soft loan.
- To seek the possibility of increasing the toll level.
- To further examine ways to reduce the construction cost in the final engineering design stage (e.g. to integrate or to abandon the culverts for crossing roads through discussion with the local government, if such a measure is effective in lowering the embankment height).
- To take favorable taxation measures toward the investor.

16.2.2 Environmental Impact Analysis

In accordance with the requirements of the EIA Guideline, an environmental impact analysis (ANDAL) should be carried out at the earliest stage. Putting particular emphasis on the impacts on socio-economic environment, additional data such as the number of affected houses and the number of residents to be replaced should be collected by thorough investigations at the site. Based on such data, an ANDAL report shall be prepared including recommendation regarding compensation and resettlement.

16.2.3 Matters for Further Consideration

(1) Planning of Ring Roads

For effective utilization of the Toll Road, the connections with the planned Inner Ring Road and the Middle Ring Road are quite important. It is recommended that the plan of these ring roads be finalized at an early date to realize an integrated road network in the region including the Toll Road.

(2) Westward Extension of the Toll Road

The route in Kab. and Kod. Mojokerto is already almost fixed for the westward extension of the Toll Road which will complete the Trans Java Tollway System. In order to avoid difficulty in ROW acquisition for the extension, it is recommended to freeze land development on the route.

Appendices

APPENDICES

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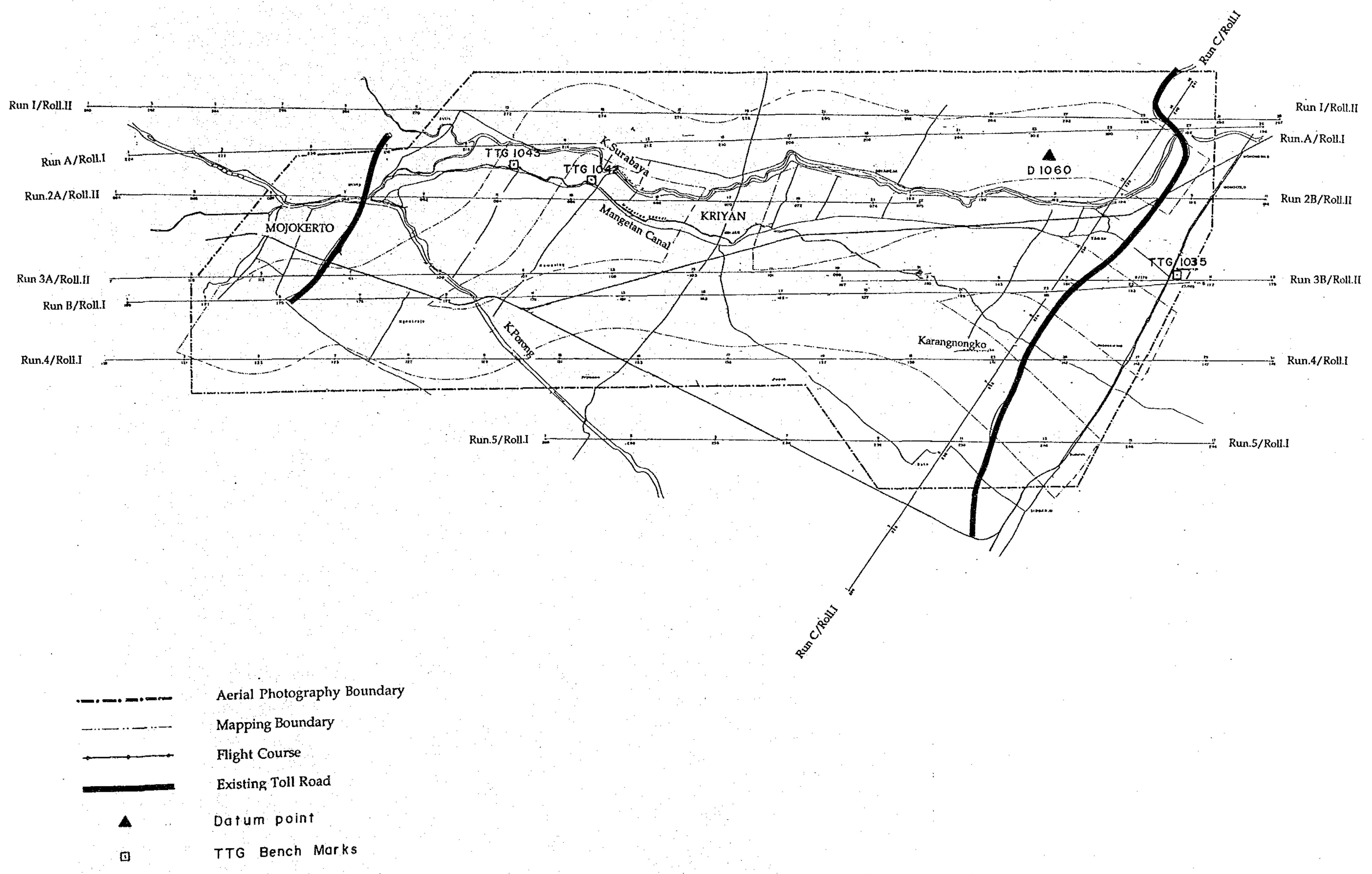
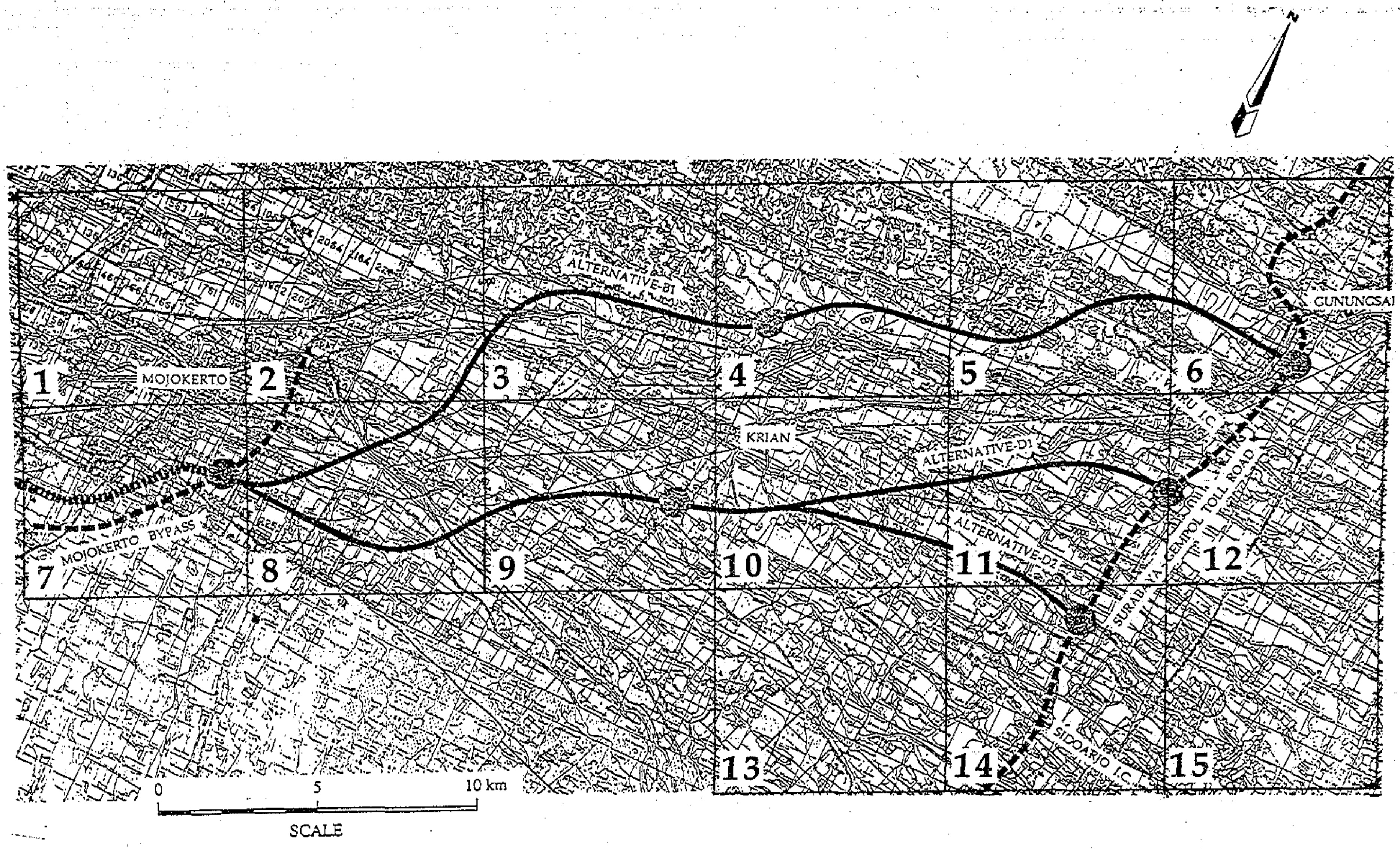
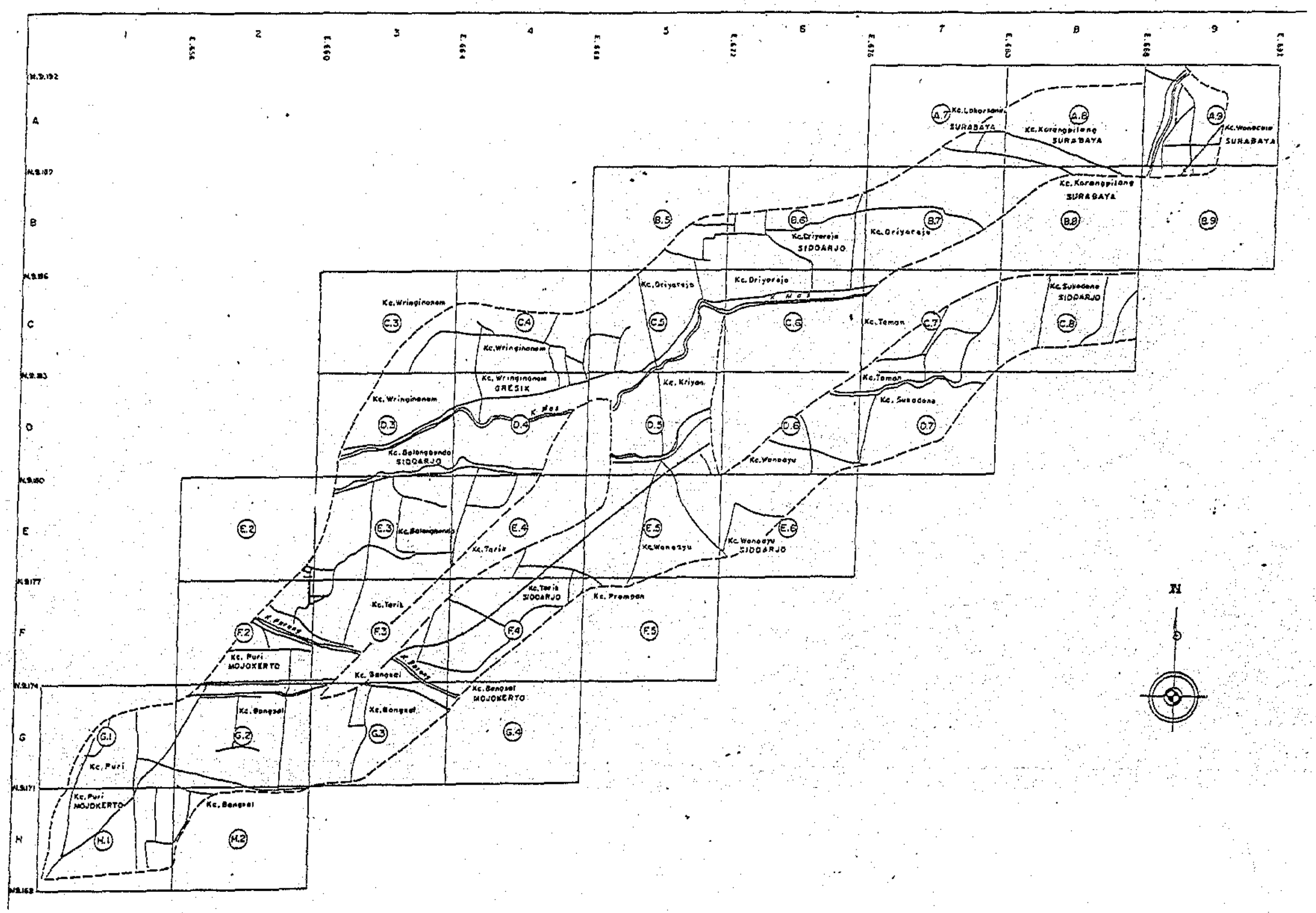


SURABAYA - MOJOKERTO TOLL ROAD PROJECT

Appendix A-6.1 Flight Courses Map



SURABAYA - MOJOKERTO TOLL ROAD PROJECT	Appendix A-6.2 Sheet Index Chart of Photo Mosaic



SURABAYA - MOJOKERTO TOLL ROAD PROJECT | Appendix A-6.3 Sheet Index Chart of Topographic Map

BORING LOG

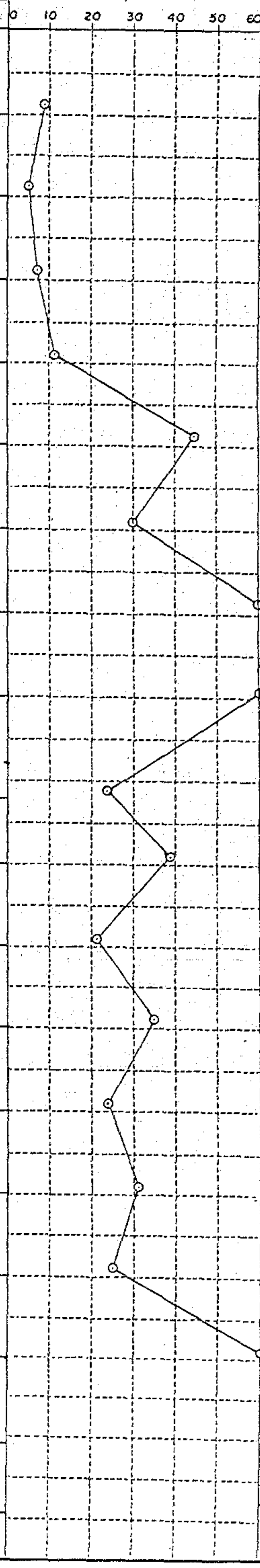
PROJECT: SURABAYA - MOJOKERTO TOLL ROAD
GROUND ELEVATION: +18.10 m.
DATE: 21st DEC 1990 - 22nd DEC 1990
HOLE NO.: MB.90.01
GROUND WATER LEVEL: GL -2.40 m.
SURVEYED BY: S. TAKADA / OHEN / HODI

SOIL

ELEVATION (m)	DEPTH (m)	THICKNESS OF STRATUM (m)	VISUAL CLASSIFICATION	COLOR	DESCRIPTION
17.70	0.40	0.40	CLAY	BROWN	SOFT SANDY CLAY
16.90	1.20	0.80	SAND	YELLOWISH BROWN	SOFT SILTY FINE SAND
10.50	7.60	6.40	CLAY	YELLOWISH BROWN / GREY / VIOLETISH GREY / GREY	SOFT TO MEDIUM SANDY CLAY COHESION : HIGH Wn : HIGH TO MEDIUM / MEDIUM CLAY / CLAY WITH SOME GRAVEL / SANDY CLAY
9.70	8.40	0.80	CLAY	WHITISH GREY	COHESION : HIGH INCLUDING GRAVEL
6.60	11.50	3.10	SAND	YELLOWISH BROWN / YELLOWISH BROWN / BLACKISH BROWN	CLAYEY FINE SAND / CLAYEY FINE TO MEDIUM SAND / SOLID STATUS
5.50	12.60	1.10	SAND	YELLOW TO BLACKISH BROWN	CLAYEY SAND WITH GRAVEL
1.60	16.50	3.90	SAND	GREY TO YELLOWISH BROWN / GREY TO BLACKISH BROWN	CLAYEY FINE SAND SOLID STATUS / FINE TO MEDIUM SAND SOLID STATUS
-0.80	18.90	2.40	SAND	BROWN / YELLOWISH BROWN	SILTY MEDIUM SAND / SILTY MEDIUM SAND
-2.60	20.70	1.80	SAND	GREY TO BROWN	SILTY FINE TO MEDIUM SAND SOLID STATUS
-2.90	21.00	0.30	SAND	BROWN	WITH GRAVEL
-6.50	24.60	3.60	SILT	GREYISH BROWN / BLACKISH GREY / YELLOWISH BROWN	SANDY SILT / HARD SANDY SILT
-8.30	26.40	1.80	SAND	BROWNISH BLACK	SILTY SAND
-9.80	27.90	1.50	CLAY	LIGHT BROWN	SANDY CLAY WITH BRECCA
-10.80	28.90	1.00	SAND	BROWN	SILTY SAND
-13.80	31.90	3.00	CLAY	BROWNISH GREY / GREYISH BROWN	CLAY WITH SOME SAND / SILTY CLAY WITH BRECCA
-14.60	32.70	0.80	SAND	YELLOWISH GREY	SILTY FINE SAND
-15.15	33.25	0.55	CLAY	BROWN	SANDY CLAY
-16.60	34.70	1.45	SAND	DARK BROWN	CLAYEY FINE SAND
-17.70	35.80	1.10	CLAY	LIGHT BROWN	SANDY CLAY

STANDARD PENETRATION TESTS

DEPTH	NO OF BLOWS / LENGTH OF PENETRATION (cm)	10 cm	20 cm	30 cm	NO OF SAMPLE	SOIL SAMPLE DEPTH (m)
1.55 - 2.00	9/30	3	4	5	SP.1	1.55 - 2.00
3.55 - 4.00	5/30	2	2	3	SP.2	3.55 - 4.00
5.55 - 6.00	7/30	2	3	4	SP.3	5.55 - 6.00
7.55 - 8.00	11/30	3	4	7	SP.4	7.55 - 8.00
9.55 - 10.00	45/30	15	24	21	SP.5	9.55 - 10.00
11.55 - 12.00	30/30	14	14	16	SP.6	11.55 - 12.00
13.55 - 14.00	62/30	20	30	32	SP.7	13.55 - 14.00
15.70 - 16.00	60/15	40	60		SP.8	15.70 - 16.00
18.00 - 18.45	24/30	5	9	15	SP.9	18.00 - 18.45
19.55 - 20.00	39/30	17	24	15	SP.10	19.55 - 20.00
21.55 - 22.00	21/30	8	9	12	SP.11	21.55 - 22.00
23.55 - 24.00	35/30	7	13	22	SP.12	23.55 - 24.00
25.55 - 26.00	24/30	2	11	13	SP.13	25.55 - 26.00
27.55 - 28.00	[illegible]	10	15	16	SP.14	27.55 - 28.00
29.55 - 30.00	25/30	5	9	16	SP.15	29.55 - 30.00
31.70 - 32.09	75/24	15	20	55 / 7	SP.16	31.70 - 32.09
34.00 - 34.20	55/5	25	55 / 5		SP.17	34.00 - 34.20
35.55 - 35.80	50/10	15	50 / 10		SP.18	35.55 - 35.80



SURABAYA - MOJOKERTO TOLL ROAD PROJECT

Appendix A-6.4 (1) Boring Log (B-1)