

REPUBLIC OF INDONESIA  
DIRECTORATE GENERAL OF HIGHWAYS  
MINISTRY OF PUBLIC WORKS

*Feasibility Study*  
on  
*Surabaya-Mojokerto Toll Road Project*

**FINAL REPORT**  
VOLUME 1 : TEXT

OCTOBER 1991

**JAPAN INTERNATIONAL COOPERATION AGENCY**

SSF
CR(3)
91-093(2/3)



JICA LIBRARY



1094421(3)

23054



REPUBLIC OF INDONESIA  
DIRECTORATE GENERAL OF HIGHWAYS  
MINISTRY OF PUBLIC WORKS

*Feasibility Study*  
*on*  
*Surabaya-Mojokerto Toll Road Project*

**FINAL REPORT**

VOLUME I : TEXT

OCTOBER 1991

**JAPAN INTERNATIONAL COOPERATION AGENCY**



国際協力事業団

23054

## PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a feasibility study on Surabaya-Mojokerto Toll Road Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a study team headed by Mr. Akira Shikichi (Mr. Keikichi Yoshida as Successor), Pacific Consultants International, three times between August 1990 and September 1991.

The team held discussions with the officials concerned of the Government of Indonesia, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the team.

October 1991

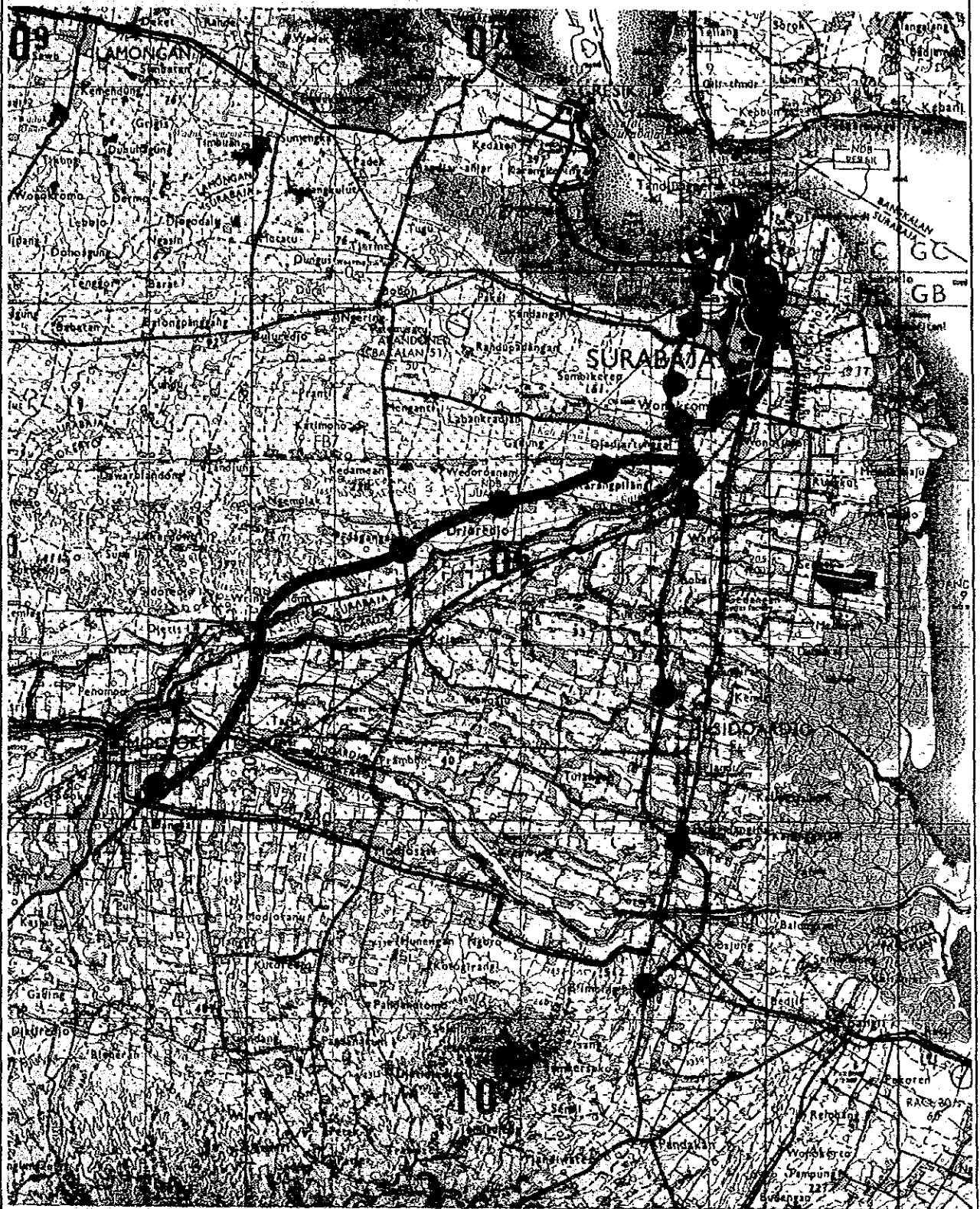


Kensuke Yanagiya  
President  
Japan International Cooperation Agency









# PROJECT LOCATION MAP



## LEGEND

-  SURABAYA-MOJOKERTO TOLL ROAD
-  SURABAYA-GEMPOL TOLL ROAD
-  MOJOKERTO BYPASS
-  JUNCTION OR INTERCHANGE, THIS PROJECT  
INTERCHANGE, EXISTING





## DEFINITIONS AND ABBREVIATIONS

### (1) Agencies and Administrative Structure

Bina Marga	Directorate General of Highways, Ministry of Public Works
Jasa Marga	Indonesia Highway Corporation
JICA	Japan International Cooperation Agency
Kab.	Kabupaten (Regency)
Kec.	Kecamatan (Sub-district)
Kel.	Kelurahan (Village)
Kod. or Kodya	Kotamadya (Municipality)
PU	Pekerjaan Umum (Public Works)
TK. I/TK. II	Tingkat I/Tingkat II (First/Second Level of Autonomy)

### (2) Technical, Traffic and Economic Terms

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average daily traffic
AADT	Annual average daily traffic
B/C	Benefit cost ratio
CBR	California Bearing Ratio
cm, cm <sup>2</sup> , cm <sup>3</sup>	Centimeter, square centimeter, cubic centimeter
Dia. or ø	Diameter
EIRR and FIRR	Economic and financial internal rate of return
EL	Elevation
FC	Foreign currency
FG	Finished grade
FY	Fiscal Year
G(R)DP	Gross (regional) domestic product
IC	Interchange
Jl	Jalan (Road or Street)
Km	Kilometer
Km/h or KPH	Kilometer per hour
LC	Local currency
m, m <sup>2</sup> , m <sup>3</sup>	Meter, square meter, cubic meter
OD	Origin and destination
PC	Prestressed concrete
PCC	Portland cement concrete
PCU	Passenger car unit
RC	Reinforced concrete
ROW	Right-of-way
Rp.	Rupiah
Sta.	Station
SWP	Satuan Wilayah Pembangunan (Regional development unit)
Toll Road	Surabaya-Mojokerto Toll Road
veh./h	Vehicle per hour
VOC	Vehicle operating cost



**FEASIBILITY STUDY  
ON  
SURABAYA-MOJOKERTO TOLL ROAD PROJECT**

**FINAL REPORT**

**VOLUME 1: TEXT**

**TABLE OF CONTENTS**

PREFACE

PROJECT LOCATION MAP

DEFINITIONS AND ABBREVIATIONS

		<u>Page</u>
<b>CHAPTER 1</b>	<b>INTRODUCTION</b>	
1.1	Background .....	1-1
1.2	Objective of the Study .....	1-2
1.3	Basic Approach to the Study .....	1-2
1.4	Phasing of the Study .....	1-2
1.5	Basic Activities and General Work Flow .....	1-3
1.6	Final Report .....	1-3
1.7	Study Organization .....	1-3
<b>CHAPTER 2</b>	<b>SOCIO-ECONOMIC CONDITIONS OF THE STUDY AREA</b>	
2.1	Definition of the Study Area .....	2-1
	2.1.1 Administrative Structure .....	2-1
	2.1.2 Study Area .....	2-1
2.2	Population .....	2-3
	2.2.1 Population in Indonesia and Java Island .....	2-3
	2.2.2 Population in East Java and Study Area .....	2-4
2.3	Landuse in East Java and Study Area .....	2-11
	2.3.1 Landuse in East Java .....	2-11
	2.3.2 Landuse in Study Area .....	2-17
2.4	Gross (Regional) Domestic Product (G(R)DP) .....	2-31
	2.4.1 GDP of Indonesia .....	2-31
	2.4.2 GRDP of Java and East Java .....	2-32
2.5	Vehicle Ownership .....	2-36
	2.5.1 General .....	2-36
	2.5.2 Registered Motor Vehicles .....	2-37
	2.5.3 Number of Tested Motor Vehicles .....	2-42

	<u>Page</u>
<b>CHAPTER 3</b>	<b>CURRENT TRANSPORTATION PROFILE</b>
3.1	Road Transportation ..... 3-1
	3.1.1 Road Network ..... 3-1
	3.1.2 Road Traffic ..... 3-5
3.2	Railway Transportation ..... 3-10
3.3	Sea Transportation ..... 3-11
3.4	Air Transportation ..... 3-13
<b>CHAPTER 4</b>	<b>SOCIO-ECONOMIC FRAMEWORK</b>
4.1	Fifth Five-Year Development Plan (Pelita V) ..... 4-1
	4.1.1 Pelita V - National Development Plan ..... 4-1
	4.1.2 Pelita V - East Java Provincial Development Plan ..... 4-4
4.2	Regional Structure Plan ..... 4-6
	4.2.1 Regional Development Structure ..... 4-6
	4.2.2 Strategic Development Area ..... 4-9
	4.2.3 Land Transportation System Development Plan ..... 4-11
4.3	Future Development Framework ..... 4-13
	4.3.1 Population of Indonesia and Java ..... 4-13
	4.3.2 Gross Regional Domestic Product ..... 4-16
	4.3.3 Future Vehicle Ownership ..... 4-17
4.4	Zonal Planning Parameters ..... 4-20
	4.4.1 Population ..... 4-20
	4.4.2 GRDP by Kabupaten ..... 4-21
<b>CHAPTER 5</b>	<b>TRAFFIC SURVEYS</b>
5.1	Execution of Traffic Surveys ..... 5-1
	5.1.1 Traffic Count Survey ..... 5-1
	5.1.2 Roadside OD Survey ..... 5-5
	5.1.3 Bus Terminal OD Survey ..... 5-9
	5.1.4 Travel Speed Survey ..... 5-10
5.2	Results of Traffic Surveys ..... 5-12
	5.2.1 Traffic Volume on Roads in the Study Area ..... 5-12
	5.2.2 Hourly Fluctuations of Traffic Volume ..... 5-14
	5.2.3 Composition of Vehicles ..... 5-14
	5.2.4 Trip Distribution ..... 5-22
	5.2.5 Travel Speed ..... 5-23
<b>CHAPTER 6</b>	<b>ENGINEERING SURVEY</b>
6.1	Physical Conditions of the Study Area ..... 6-1
	6.1.1 Topography ..... 6-1
	6.1.2 Geology ..... 6-1
	6.1.3 River System and Irrigation System ..... 6-2
	6.1.4 Climate ..... 6-2
6.2	Topographic Survey ..... 6-4
	6.2.1 Aerial Photography ..... 6-4
	6.2.2 Preparation of Uncontrolled Aerial Photo Mosaics ..... 6-4

	<u>Page</u>
6.2.3	Ground Survey ..... 6-4
6.2.4	Mapping ..... 6-5
6.2.5	Execution of Work and Accuracies ..... 6-5
6.2.6	River Cross Section Survey ..... 6-7
6.3	Soils and Materials Investigations ..... 6-8
6.3.1	Geological Descriptions of the Project Area ..... 6-8
6.3.2	Scope of Soils and Materials Investigations ..... 6-10
6.3.3	Properties of Typical Soils ..... 6-11
6.3.4	Soft Ground Treatment Study ..... 6-14
6.3.5	Embankment and Other Materials ..... 6-15
6.4	Hydrological Survey ..... 6-19
6.4.1	Site Survey and Data Collection ..... 6-19
6.4.2	Flood Conditions ..... 6-19
6.4.3	Irrigation System in the Brantas Delta ..... 6-22
6.4.4	Rainfall Analysis ..... 6-24
<b>CHAPTER 7</b>	<b>ROUTE SELECTION</b>
7.1	Establishment of Route Alternatives and Screening ..... 7-1
7.1.1	General ..... 7-1
7.1.2	Basic Policies for Route Location ..... 7-1
7.1.3	Review of Past Studies ..... 7-2
7.1.4	Bases of Route Study and Clarifications ..... 7-11
7.1.5	Basic Data for Route Study ..... 7-15
7.1.6	Consideration for Environmental Impact ..... 7-15
7.1.7	Major Control Factors for Route Location ..... 7-17
7.1.8	Interchange Study ..... 7-22
7.1.9	Description of Alternative Routes ..... 7-29
7.1.10	Screening of Alternative Routes ..... 7-35
7.2	Selection of the Optimum Route ..... 7-40
7.2.1	General ..... 7-40
7.2.2	Technical Aspects ..... 7-43
7.2.3	Environmental Impact ..... 7-45
7.2.4	Transportation Aspects ..... 7-48
7.2.5	Economic Aspects ..... 7-50
7.2.6	The Optimum Route ..... 7-51
<b>CHAPTER 8</b>	<b>TRAFFIC DEMAND FORECAST</b>
8.1	Present Vehicle OD Matrix ..... 8-1
8.1.1	Methodology ..... 8-1
8.1.2	Traffic Zone System ..... 8-3
8.1.3	Estimation of Partial OD Matrix ..... 8-10
8.1.4	Updating the 1982 National OD Matrix ..... 8-10
8.1.5	Estimated 1990 OD Matrix ..... 8-13
8.2	Toll Road Diversion Model ..... 8-18
8.2.1	Methodology ..... 8-18
8.2.2	Estimation of Diversion Formula ..... 8-18
8.3	Future Road Network ..... 8-20
8.3.1	Trunk Road Development Plan ..... 8-20
8.3.2	Link Conditions and Q-V Model ..... 8-25

	<u>Page</u>
8.4	Forecast Future Traffic Demand ..... 8-26
8.4.1	Future Vehicle OD Matrix ..... 8-26
8.4.2	Estimated Traffic Volume on the Toll Road ..... 8-31
<b>CHAPTER 9</b>	<b>PRELIMINARY ENGINEERING DESIGN</b>
9.1	General ..... 9-1
9.2	Design Standards ..... 9-1
9.2.1	Geometric Design Standard ..... 9-2
9.2.2	Bridge Design Standard ..... 9-12
9.2.3	Pavement Design Standard ..... 9-18
9.2.4	Drainage Design Standard ..... 9-19
9.2.5	Design Standard of Road Lighting ..... 9-21
9.3	Highway Capacity and Number of Lanes ..... 9-22
9.3.1	Results of Traffic Forecast ..... 9-22
9.3.2	Highway Capacity ..... 9-22
9.3.3	Stage Construction ..... 9-22
9.4	Preliminary Geometric Design ..... 9-24
9.4.1	Geometric Design Policies ..... 9-24
9.4.2	Horizontal Alignment Design ..... 9-25
9.4.3	Vertical Alignment Design ..... 9-26
9.5	Cross Section Design ..... 9-28
9.5.1	Cross Section Elements ..... 9-28
9.5.2	Side Slopes ..... 9-29
9.5.3	Drainage Channels and Erosion Control ..... 9-29
9.5.4	Typical Cross Sections and Right-Of-Way Width Requirement ..... 9-30
9.6	Preliminary Design of Interchanges ..... 9-33
9.6.1	General ..... 9-33
9.6.2	Toll Levy System ..... 9-33
9.6.3	Location of Interchanges ..... 9-34
9.6.4	Layout of Interchanges ..... 9-36
9.6.5	Location of Toll Barrier ..... 9-44
9.6.6	Rest Facilities ..... 9-48
9.7	Preliminary Design of Bridges and Culverts ..... 9-50
9.7.1	General Description of Bridge Types ..... 9-50
9.7.2	Design Features of Bridges and Viaducts ..... 9-53
9.7.3	Design Features of Culverts ..... 9-58
9.8	Preliminary Design of Pavement ..... 9-59
9.8.1	Pavement Type ..... 9-59
9.8.2	Thickness Design of Flexible Pavement ..... 9-62
9.9	Relocation of Roads, Waterways and Irrigation Channels ..... 9-68
9.10	Toll Road Supporting Facilities ..... 9-69
9.10.1	Categories of Supporting Facilities ..... 9-69
9.10.2	Road Furnitures ..... 9-69
9.10.3	Road Lighting ..... 9-70
9.11	Length by Structural Type and Major Work Quantities ..... 9-70
9.12	ROW Acquisition and Utility Relocation/Protection ..... 9-71



	<u>Page</u>
<b>CHAPTER 10 CONSTRUCTION PLANNING</b>	
10.1 General .....	10-1
10.2 Basic Conditions of Construction Planning .....	10-1
10.3 Construction Method .....	10-4
10.3.1 Equipment Intensive Construction .....	10-4
10.3.2 Earthwork .....	10-4
10.3.3 Paving Work .....	10-5
10.3.4 Bridge and Viaduct Construction .....	10-7
10.4 Construction Time Schedule .....	10-8
10.4.1 Conditions for Scheduling .....	10-8
10.4.2 Time Schedule .....	10-10
10.5 Implementation Schedule .....	10-10
<b>CHAPTER 11 OPERATION AND MAINTENANCE OF THE TOLL ROAD</b>	
11.1 Tollway Operator .....	11-1
11.2 Scope of Operation and Maintenance Works .....	11-2
11.3 Organization for Operation and Maintenance .....	11-4
11.4 Operation and Maintenance Cost .....	11-6
<b>CHAPTER 12 ENVIRONMENTAL STUDY</b>	
12.1 General .....	12-1
12.2 Study Purpose .....	12-3
12.3 Basic Premises of the Environmental Study .....	12-3
12.3.1 Environmental Quality Standards and Research Data .....	12-3
12.3.2 Preliminary Identification of Environmental Impacts and Environmental Impact Analysis (ANDAL) .....	12-3
12.4 Environmental Background in the Direct Influence Zone .....	12-4
12.4.1 Outline of Environmental Condition .....	12-4
12.4.2 Social Environment .....	12-5
12.4.3 Manmade Environment .....	12-6
12.4.4 Physical Environment .....	12-10
12.4.5 Natural Environment .....	12-11
12.5 Description of Favorable Environmental Impacts .....	12-12
12.5.1 General .....	12-12
12.5.2 Result of Economic Impact Analysis .....	12-12
12.5.3 Favorable Impact on Socio-Economic and Traffic .....	12-12
12.6 Description of Possible Adverse Impacts and their Mitigation .....	12-13
12.6.1 General .....	12-13
12.6.2 Pre-Construction Phase .....	12-13
12.6.3 Construction Phase (Preparation Stage) .....	12-16
12.6.4 Construction Phase (Implementation Stage) .....	12-18
12.6.5 Traffic Related Matters during the Implementation Stage of the Construction Phase .....	12-21
12.6.6 Operation and Maintenance Phase .....	12-24
12.7 Summary and Conclusion for Important Environmental Effects and their Mitigation .....	12-26

	<u>Page</u>
12.7.1 Pre-construction Phase .....	12-26
12.7.2 Construction Phase .....	12-26
12.7.3 Operation and Maintenance Phase .....	12-26
<b>CHAPTER 13 PROJECT COST ESTIMATE</b>	
13.1 General .....	13-1
13.2 Construction Cost .....	13-2
13.2.1 Unit Prices of Construction Works .....	13-2
13.2.2 Estimated Construction Cost .....	13-4
13.3 Purchase Cost of Maintenance Equipment .....	13-6
13.4 Land Acquisition and Compensation Cost .....	13-6
13.5 Utility Relocation Cost .....	13-6
13.6 Estimated Project Cost .....	13-6
13.6.1 Initial Investment Cost .....	13-6
13.6.2 Additional Investment Cost .....	13-7
13.6.3 Yearly Cash Flow of the Project Cost .....	13-7
<b>CHAPTER 14 ECONOMIC PROJECT ANALYSIS</b>	
14.1 General .....	14-1
14.2 Economic Project Cost .....	14-1
14.2.1 Economic Investment Cost .....	14-1
14.2.2 Economic Operation and Maintenance Costs .....	14-1
14.3 Economic Benefits .....	14-2
14.4 Unit Vehicle Operating Cost .....	14-2
14.4.1 General .....	14-2
14.4.2 Representative Vehicles .....	14-3
14.4.3 Unit Prices of Operating Cost Components .....	14-4
14.4.4 Unit Vehicle Operating Cost by Vehicle Type .....	14-8
14.5 Unit Vehicle Time Cost .....	14-10
14.5.1 General .....	14-10
14.5.2 Time Values by Vehicle Type .....	14-10
14.6 Estimation of Economic Benefits .....	14-12
14.6.1 General .....	14-12
14.6.2 Economic Benefits in Travel Costs .....	14-12
14.7 Economic Cost-Benefit Analysis and Project Returns .....	14-13
14.7.1 Basic Assumptions and Methodology .....	14-13
14.7.2 Economic Cost-Benefit Analysis .....	14-14
14.7.3 Sensitivity Analysis .....	14-14
14.8 <i>Impact of the Toll Road on the Development in the Direct Influence Zone</i> .....	14-16
14.8.1 Impact of Toll Road Development .....	14-16
14.8.2 Development Impact of Planned Interchanges .....	14-17
<b>CHAPTER 15 FINANCIAL PROJECT ANALYSIS</b>	
15.1 General .....	15-1

	<u>Page</u>
15.1.1	Methodology ..... 15-1
15.1.2	Assumptions ..... 15-1
15.2	Financial Project Cost ..... 15-2
15.3	Revenue Estimation ..... 15-3
15.3.1	Toll Rate ..... 15-3
15.3.2	Estimated Revenue ..... 15-4
15.4	Financial Internal Rate of Return ..... 15-4
15.5	Cash Flow Analysis ..... 15-5
15.5.1	Profit and Loss Statement ..... 15-5
15.5.2	Financial Cash Flow Analysis ..... 15-6
15.5.3	Analysis Results ..... 15-8
15.5.4	Sensitivity Analysis ..... 15-10
15.6	Conclusion ..... 15-12
<b>CHAPTER 16 CONCLUSIONS AND RECOMMENDATIONS</b>	
16.1	Conclusions ..... 16-1
16.1.1	Necessity of the Project ..... 16-1
16.1.2	Future Traffic ..... 16-1
16.1.3	Technical Aspects ..... 16-2
16.1.4	Environmental Aspects ..... 16-4
16.1.5	Project Cost ..... 16-5
16.1.6	Results of Economic Project Analysis ..... 16-5
16.1.7	Results of Financial Project Analysis ..... 16-6
16.2	Recommendations ..... 16-6
16.2.1	Implementation of the Project ..... 16-6
16.2.2	Environmental Impact Analysis ..... 16-7
16.2.3	Matters for Further Consideration ..... 16-7

## **APPENDICES**

## **VOLUME 2 : DRAWINGS**

## LIST OF TABLES AND FIGURES

		<u>Page</u>
<b>CHAPTER 1</b>	<b>INTRODUCTION</b>	
Fig. 1.1	Flow of the Study .....	1-5
Fig. 1.2	Study Organization .....	1-3
<b>CHAPTER 2</b>	<b>SOCIO-ECONOMIC CONDITIONS OF THE STUDY AREA</b>	
Table 2.1	Population Distribution and Annual Growth .....	2-3
Table 2.2	Population Growth in Kabupaten/Kotamadya in East Java (1980, 1985-1990) .....	2-5
Table 2.3	Population Density by Regency/Municipality .....	2-7
Table 2.4	Population and Density of Kecamatan in Study Area, 1989 .....	2-9
Table 2.5	Landuse by Kabupaten in East Java Province in 1987 .....	2-12
Table 2.6	Wet Land by Irrigation Section by Kabupaten in East Java Province in 1987 .....	2-15
Table 2.7	Landuse in Kabupaten Sidoarjo in 1987 .....	2-18
Table 2.8	Landuse in Kabupaten Gresik in 1987 .....	2-19
Table 2.9	Landuse in Kabupaten Mojokerto in 1987 .....	2-20
Table 2.10	Landuse in Kotamadya Surabaya in 1987 .....	2-21
Table 2.11	Landuse in Kotamadya Mojokerto in 1987 .....	2-22
Table 2.12	GDP and Industrial Structure of Indonesia at Current Prices .....	2-31
Table 2.13	GDP and Industrial Structure of Indonesia at 1983 Constant Prices .....	2-32
Table 2.14	GRDP of Java and GDP of Indonesia (at 1983 Constant Price) .....	2-32
Table 2.15	GRDP and Industrial Structure of East Java Province at Current Prices .....	2-34
Table 2.16	GRDP and Industrial Structure of East Java Province at 1983 Constant Prices .....	2-35
Table 2.17	GRDP of East Java in 1990 (at 1983 constant prices) .....	2-36
Table 2.18	Historic Pattern, Vehicles Registrations - Indonesia .....	2-38
Table 2.19	Number of Registered Vehicles in Indonesia .....	2-39
Table 2.20	Number of Registered Vehicles in Java .....	2-40
Table 2.21	Motorization Ratio of Registered Vehicles .....	2-41
Table 2.22	Number of Tested Motor Vehicles in Java .....	2-43
Fig. 2.1	Study Area and Administrative Districts in East Java .....	2-2
Fig. 2.2	Population Density .....	2-8
Fig. 2.3	Landuse in Kabupaten Sidoarjo .....	2-23
Fig. 2.4	Landuse in Kabupaten Gresik .....	2-25
Fig. 2.5	Landuse in Kabupaten Mojokerto .....	2-27
Fig. 2.6	Landuse in Kotamadya Mojokerto .....	2-29
<b>CHAPTER 3</b>	<b>CURRENT TRANSPORTATION PROFILE</b>	
Table 3.1	Road Length and Surface Conditions in East Java (June 1989) .....	3-1
Table 3.2	Traffic Volume on National and Provincial Roads in the Study Area .....	3-6

	<u>Page</u>
Table 3.3	Tariff System of Distance Proportional Section on Surabaya-Gempol Toll Road, Class I and Class II Vehicles ..... 3-7
Table 3.4	Number of Users on Surabaya-Gempol Toll Road ..... 3-8
Table 3.5	Traffic Volume on Surabaya-Gempol Toll Road ..... 3-8
Table 3.6	Growth of Traffic in the Study Area ..... 3-8
Table 3.7	Departing Railway Passengers and Cargo from Stations in East Java ..... 3-10
Table 3.8	Loaded and Unloaded Freight at Tg. Perak Port ..... 3-12
Table 3.9	Loaded and Unloaded Freight at Other Seaports in East Java, 1987 ..... 3-13
Fig. 3.1	National and Provincial Road Network in East Java ..... 3-2
Fig. 3.2	Road Network in GKS Region ..... 3-3
Fig. 3.3	Traffic Flows on Waru-Gempol Toll Road Section in July 1990 ..... 3-9
<b>CHAPTER 4</b>	<b>SOCIO-ECONOMIC FRAMEWORK</b>
Table 4.1	Population Growth in Pelita V ..... 4-2
Table 4.2	Age Structure of 1988 and 1993 Population ..... 4-3
Table 4.3	Target Economic Growth by Industrial Sector in Pelita V ..... 4-4
Table 4.4	Target Sectoral Composition of GDP in 1988 and 1993 ..... 4-4
Table 4.5	Projection of Population and Labor Force in East Java for Pelita V ..... 4-5
Table 4.6	Employment Opportunity by Industrial Sector in East Java for Pelita V ..... 4-5
Table 4.7	Economic Structure of East Java at the End of Pelita V ..... 4-6
Table 4.8	Projection of Future Population of Indonesia ..... 4-13
Table 4.9	Future Population of Major Islands in Indonesia ..... 4-14
Table 4.10	Estimated Population Growth of Major Islands in Indonesia ..... 4-15
Table 4.11	Future Population and Density of Provinces in Java ..... 4-16
Table 4.12	Future GRDP and GRDP per Capita in Java and East Java (at 1983 constant prices) ..... 4-17
Table 4.13	Socio-Economic Data and Vehicle Ownership in East Java and Java ..... 4-19
Table 4.14	Future Vehicle Ownership and Growth Factors in East Java and Java ..... 4-20
Table 4.15	Estimated Future Planning Parameters in East Java ..... 4-22
Fig. 4.1	Regional Development Unit (SWP) in East Java ..... 4-7
<b>CHAPTER 5</b>	<b>TRAFFIC SURVEYS</b>
Table 5.1	Traffic Count and O/D Survey Conducted ..... 5-2
Table 5.2	Results of Effective Sample Rate of Roadside OD Survey ..... 5-8
Table 5.3	Results of Traffic Count Survey ..... 5-13
Fig. 5.1	Location of Traffic Survey ..... 5-3
Fig. 5.2	Location of Traffic Survey on Surabaya-Gempol Toll Road ..... 5-4

	<u>Page</u>
Fig. 5.3	Survey Form for Roadside OD Survey ..... 5-7
Fig. 5.4	Location of Travel Speed Survey ..... 5-11
Fig. 5.5	Daily Traffic Volume in the Study Area in 1990 ..... 5-15
Fig. 5.6	Hourly Fluctuations of Traffic Volume ..... 5-17
Fig. 5.7	Compositions of Vehicles ..... 5-19
Fig. 5.8	Trip Distribution Pattern in 1990 ..... 5-24
Fig. 5.9	Results of Travel Speed Survey ..... 5-25
<b>CHAPTER 6</b>	<b>ENGINEERING SURVEY</b>
Table 6.1	Geological Formation ..... 6-8
Table 6.2	Definition of Soft Ground Layer ..... 6-14
Table 6.3	Results of Soft Ground Treatment Study ..... 6-15
Table 6.4	Probable Daily Rainfall ..... 6-28
Fig. 6.1	River System of Lower Brantas River Basin ..... 6-3
Fig. 6.2	Boring Location Map ..... 6-9
Fig. 6.3	Notional Geological Profile along the Project Route ..... 6-12
Fig. 6.4	Location Map of Material Sources ..... 6-17
Fig. 6.5	Brantas River Basin Flood Control Scheme ..... 6-20
Fig. 6.6	Design Flood Discharge of the Surabaya River ..... 6-21
Fig. 6.7	Location of Retained Water Area ..... 6-23
Fig. 6.8	Canal Network System in the Brantas Delta ..... 6-25
Fig. 6.9	Location of Rainfall Gauging Stations ..... 6-27
Fig. 6.10	Design Rainfall Intensity-Duration-Frequency Curve ..... 6-30
<b>CHAPTER 7</b>	<b>ROUTE SELECTION</b>
Table 7.1	Environmental Conditions in the Project Area ..... 7-16
Table 7.2	Irrigated Main Paddy Field in the Brantas Delta ..... 7-19
Table 7.3	Comparison of Route Alternatives ..... 7-38
Table 7.4	Comparison of Technical Aspects ..... 7-43
Table 7.5	Comparison of Social Impact ..... 7-45
Table 7.6	Existing Major Irrigation Canals to be Crossed by Each Route Alternative ..... 7-47
Table 7.7	Cross Sectional Traffic Volume and Toll Road Users on Alternative Routes ..... 7-48
Table 7.8	Summary of Economic Comparison ..... 7-51
Table 7.9	Preferable Priority in Four Major Aspects for Each Alternative ..... 7-51
Table 7.10	Comparison of Short-Listed Route Alternatives ..... 7-53
Fig. 7.1	Recommended Route by Trans Java Highway Feasibility Study (1) ..... 7-4
Fig. 7.2	Recommended Route by Trans Java Highway Feasibility Study (2) ..... 7-5
Fig. 7.3	Route Shown in Investment Opportunities : Tollroads in Indonesia ..... 7-6
Fig. 7.4	Recommended Route by Pre-Feasibility Study for the Surabaya-Mojokerto-Kediri Toll Road ..... 7-8
Fig. 7.5	Route Alternatives of East Java Provincial Government ..... 7-9
Fig. 7.6	Ring Roads System Proposed in GKS Study ..... 7-10
Fig. 7.7	Inner Ring Road Recommended in IUIDP ..... 7-12
Fig. 7.8	Basic Route in the West of Mojokerto ..... 7-13

		Page
Fig. 7.9	Proposed Krian Bypass .....	7-21
Fig. 7.10	Interchanges on the Surabaya-Gempol Toll Road .....	7-24
Fig. 7.11	Route Alternatives .....	7-31
Fig. 7.12	Short-Listed Route Alternatives .....	7-41
<b>CHAPTER 8</b>	<b>TRAFFIC DEMAND FORECAST</b>	
Table 8.1	Zone Code List .....	8-4
Table 8.2	1982 Zonal Traffic Data and Socio-Economic Data in East Java .....	8-12
Table 8.3	Estimated Socio-Economic Parameters in East Java, 1990 .....	8-14
Table 8.4	Estimated 1990 Zonal Trip Generation/Attraction in East Java .....	8-15
Table 8.5	Estimated 1990 Block OD Matrix .....	8-16
Table 8.6	Comparison of Screen Line Traffic in 1990 .....	8-17
Table 8.7	Q-V Conditions of Network Links .....	8-25
Table 8.8	Growth of Total Traffic Generation (T) .....	8-26
Table 8.9	Estimated Future Traffic Generation by Zone Block .....	8-27
Table 8.10	Estimated Future Zonal Trip Generation/Attraction for Passenger Vehicle and Bus .....	8-29
Table 8.11	Estimated Future Zonal Trip Generation/Attraction for Pick-up and Truck .....	8-30
Table 8.12	Average Sectional Traffic Volume and Toll Road Users on the Toll Road .....	8-33
Table 8.13	Vehicle-km and Average Travel Distance on the Toll Road .....	8-35
Fig. 8.1	Flow Diagram of Estimating 1990 OD Matrix .....	8-2
Fig. 8.2	Traffic Zones in the Study Area .....	8-6
Fig. 8.3	Traffic Zones in East Java .....	8-7
Fig. 8.4	Traffic Zones in Central Java and DI Yogyakarta .....	8-8
Fig. 8.5	Traffic Zones in DKI Jakarta and West Java .....	8-9
Fig. 8.6	Flow Diagram for Toll Road Diversion Model .....	8-19
Fig. 8.7	Road Network in the Study Area .....	8-21
Fig. 8.8	Road Network in East Java .....	8-22
Fig. 8.9	Road Network in Central Java and DI Yogyakarta .....	8-23
Fig. 8.10	Road Network in DKI Jakarta and West Java .....	8-24
Fig. 8.11	Flow Diagram for Estimating Future Assigned Traffic Volume .....	8-32
Fig. 8.12	Estimated Future Traffic Volume on the Toll Road .....	8-34
Fig. 8.13	Estimated Future Traffic Volumes (With Project Condition) .....	8-36
Fig. 8.14	Estimated Future Traffic Volumes (Without Project Condition) .....	8-37
<b>CHAPTER 9</b>	<b>PRELIMINARY ENGINEERING DESIGN</b>	
Table 9.1	Geometric Design Standard for Throughway of the Toll Road .....	9-3
Table 9.2(1)	Geometric Design Standard for Interchange Ramps .....	9-7
Table 9.2(2)	Geometric Design Standard for Throughway in the Vicinity of Interchange Ramp Terminal .....	9-7
Table 9.3	Analysis of Highway Capacity .....	9-23

		<u>Page</u>
Table 9.4	Summary of Design Features of Horizontal Alignment of the Toll Road .....	9-26
Table 9.5	Summary of Facilities to be Crossed by the Planned Toll Road .....	9-26
Table 9.6	Summary of Design Features of Vertical Alignment of the Toll Road .....	9-28
Table 9.7	List of Interchanges .....	9-34
Table 9.8	Summary of Design Features of Bridges and Viaducts .....	9-56
Table 9.9	Summary of Design Features of Overbridges .....	9-57
Table 9.10	Comparison of General Characteristics of Flexible Pavement and Rigid Pavement .....	9-60
Table 9.11	Number of Axles in Each Weight Group on Surabaya-Gempol Toll Road (24-hour traffic on 20-21, May 1990) .....	9-63
Table 9.12	ESAL by Vehicle Group (24-hour traffic on Surabaya-Gempol Toll Road on 20-21, May 1990) .....	9-64
Table 9.13	Length by Structure Type .....	9-71
Table 9.14	Work Quantities .....	9-72
Table 9.15	Summary of ROW Acquisition .....	9-73
Fig. 9.1	Clearance Limits .....	9-9
Fig. 9.2	Clearance at Railway Crossing .....	9-10
Fig. 9.3	Clearance Limits of Pylons of Electric Power Transmission Lines .....	9-11
Fig. 9.4	Reduction of "D" Loading .....	9-13
Fig. 9.5	Loading for Maximum Positive and Negative Bending Moment .....	9-14
Fig. 9.6	Area-Depth Curves for Use with Duration-Frequency Values (U.S. Weather Bureau) .....	9-20
Fig. 9.7(1)	Typical Cross Sections (Earthwork Section) .....	9-31
Fig. 9.7(2)	Typical Cross Sections (Bridge Section) .....	9-32
Fig. 9.8	Location of Interchanges .....	9-35
Fig. 9.9	Interchange Layout (1) - (5) .....	9-37
Fig. 9.10	Toll Levy System and Location of Toll Barrier .....	9-45
Fig. 9.11	Standard Spans for Various Types of Bridge .....	9-50
Fig. 9.12	Range of Heights for Various Types of Abutment .....	9-52
Fig. 9.13	Revetment Protection .....	9-55
Fig. 9.14	RC Portal Frame Culvert for Water Main Protection .....	9-58
Fig. 9.15	Axle Load Model .....	9-65

## CHAPTER 10 CONSTRUCTION PLANNING

Table 10.1	Earthwork Equipment .....	10-4
Table 10.2	Borrow Materials .....	10-4
Table 10.3	Summary of Earthwork Planning .....	10-6
Table 10.4	Paving Work Equipment .....	10-5
Table 10.5	Sources of Paving Materials .....	10-7
Table 10.6	Bridge Construction Equipment .....	10-7
Table 10.7	Number of Working Days .....	10-10
Fig. 10.1	Material Sources and Major Hauling Roads .....	10-3
Fig. 10.2	Construction Time Schedule .....	10-9
Fig. 10.3	Implementation Schedule .....	10-10



<b>CHAPTER 11</b>	<b>OPERATION AND MAINTENANCE OF THE TOLL ROAD</b>	
Fig. 11.1	Organization of Head Office and Regional Operation Office .....	11-5
<b>CHAPTER 12</b>	<b>ENVIRONMENTAL STUDY</b>	
Fig. 12.1	Population Density by Kecamatan .....	12-7
<b>CHAPTER 13</b>	<b>PROJECT COST ESTIMATE</b>	
Table 13.1	Unit Costs of Labor .....	13-3
Table 13.2	Unit Costs of Major Materials .....	13-3
Table 13.3	Construction Cost (Initial Stage Construction) .....	13-5
Table 13.4	Summary of Initial Investment Cost .....	13-7
Table 13.5	Summary of Additional Investment Cost .....	13-7
Table 13.6	Yearly Cash Flow of the Project Cost .....	13-8
<b>CHAPTER 14</b>	<b>ECONOMIC PROJECT ANALYSIS</b>	
Table 14.1	Summary of Financial and Economic Project Costs (Initial Investment) .....	14-2
Table 14.2	Unit Prices of Vehicle Operating Cost Components (Constant 1991 Price) .....	14-5
Table 14.3	Vehicle Composition Rate .....	14-8
Table 14.4	1991 Composite Unit Vehicle Operating Costs .....	14-9
Table 14.5	Unit Vehicle Time Cost .....	14-11
Table 14.6	Estimated Economic User Benefits of the Toll Road .....	14-13
Table 14.7	Economic Project Analysis .....	14-15
Table 14.8	EIRR by Altered Benefit and Cost .....	14-16
<b>CHAPTER 15</b>	<b>FINANCIAL PROJECT ANALYSIS</b>	
Table 15.1	Financial Project Costs (Initial Investment) .....	15-3
Table 15.2	Ratios of Toll and Financial Benefit .....	15-4
Table 15.3	Estimated Toll Revenue .....	15-4
Table 15.4	Summary of FIRR (ROI) and NPV .....	15-5
Table 15.5	Summary of Financial Analysis Results .....	15-9
Table 15.6	Summary of Sensitivity Analysis Results .....	15-11



# **Chapter 1**

## **INTRODUCTION**



# CHAPTER 1

## INTRODUCTION

### 1.1 Background

In realization of the balanced distribution of functions of growth poles to meet the strategic regional development of Java Island, the Trans Java Tollway System and other toll road networks will play an important role.

The necessity to improve the road network in the region of GERBANGKERTOSUSILA (Surabaya Metropolitan Region) by providing a toll road network is primarily due to the recent increase in vehicle traffic demand and rapid development in the region.

To cope with this situation, the Government of the Republic of Indonesia decided to develop a toll road system which consists of three radial toll roads in the major transportation and development corridors leading from Surabaya to the northwest (Surabaya-Gresik Toll Road), the southwest (Surabaya-Mojokerto Toll Road) and the south (Surabaya-Gempol Toll Road).

The Surabaya-Gempol Toll Road has been open to the public since July 1986. For the Surabaya-Gresik Toll Road, an agreement of private sector participation was concluded and the review of detailed design has been started. Its construction is scheduled to be completed at the end of 1995.

Under such circumstances, it is urgent to develop the entire section of the Surabaya-Mojokerto Toll Road since traffic congestion in the southwestern corridor (existing national highway and provincial highway between Surabaya and Mojokerto) could become a major problem in the very near future.

Realization of the Surabaya-Mojokerto Toll Road (hereinafter called the "Toll Road") will enhance the development of industrial and housing areas along the corridor and will also contribute to the development of the Trans Java Tollway System since the Toll Road constitutes the easternmost section of the said system.

Upon the background mentioned above, the Government of the Republic of Indonesia (hereinafter called the "Government") requested the Government of Japan to implement a feasibility study on the Surabaya-Mojokerto Toll Road Project.

In response to the request of the Government, the Government of Japan decided to proceed with the Feasibility Study on the Surabaya-Mojokerto Toll Road Project (hereinafter called the "Study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter called "JICA"), the official agency responsible for the implementation of technical cooperation programs of the Government of Japan, dispatched a Preliminary Study Team headed by Mr. Tsuneyoshi Funazaki to Indonesia in November 1989 for the purpose of discussing the Scope of Work for the Study (hereinafter called the "S/W"). The S/W together with the study schedule was agreed upon between the Directorate General of Highways, Ministry of Public Works of the Government and the JICA Preliminary Study Team.

## **1.2 Objective of the Study**

The objective of the Study is to carry out the feasibility study on the Surabaya-Mojokerto Toll Road Project.

## **1.3 Basic Approach to the Study**

The Study was carried out in principle based on the scope of work which was agreed between the Directorate General of Highways (hereinafter called "Bina Marga") and JICA Preliminary Study Team in November 1989.

## **1.4 Phasing of the Study**

The Study was carried out in two phases, Phase-1 and Phase-2.

The major works in Phase-1 were:

- (1) Socio-economic survey
- (2) Traffic survey
- (3) Engineering study including selection of optimum route

The major works in Phase-2 were:

- (1) Project cost estimate

- (2) Economic and financial analysis
- (3) Recommendations

**1.5 Basic Activities and General Work Flow**

A general work flow chart of the Study is shown in Fig. 1.1, which indicates the interrelationship among component activities.

**1.6 Final Report**

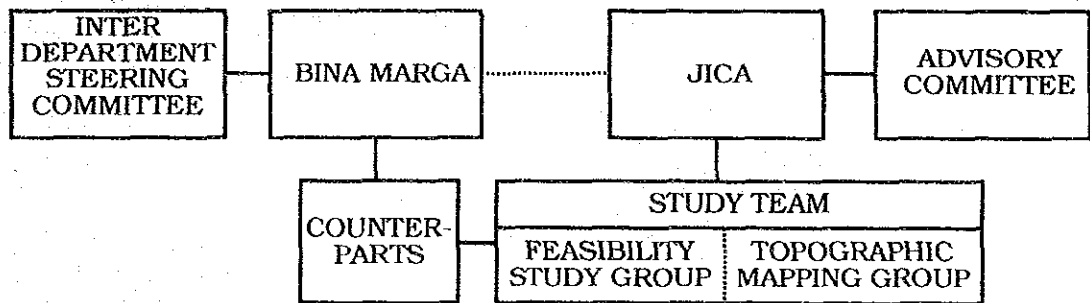
The Final Report contains summarized findings and recommendations, followed by the descriptions of all the work carried out in the Study, including cost estimates and all analyses which support our conclusion and recommendations.

The Final Report consists of the volumes as listed below:

- Volume 1 : Text
- Volume 2 : Drawings
- Executive Summary

**1.7 Study Organization**

The organization chart is shown in Fig. 1.2.



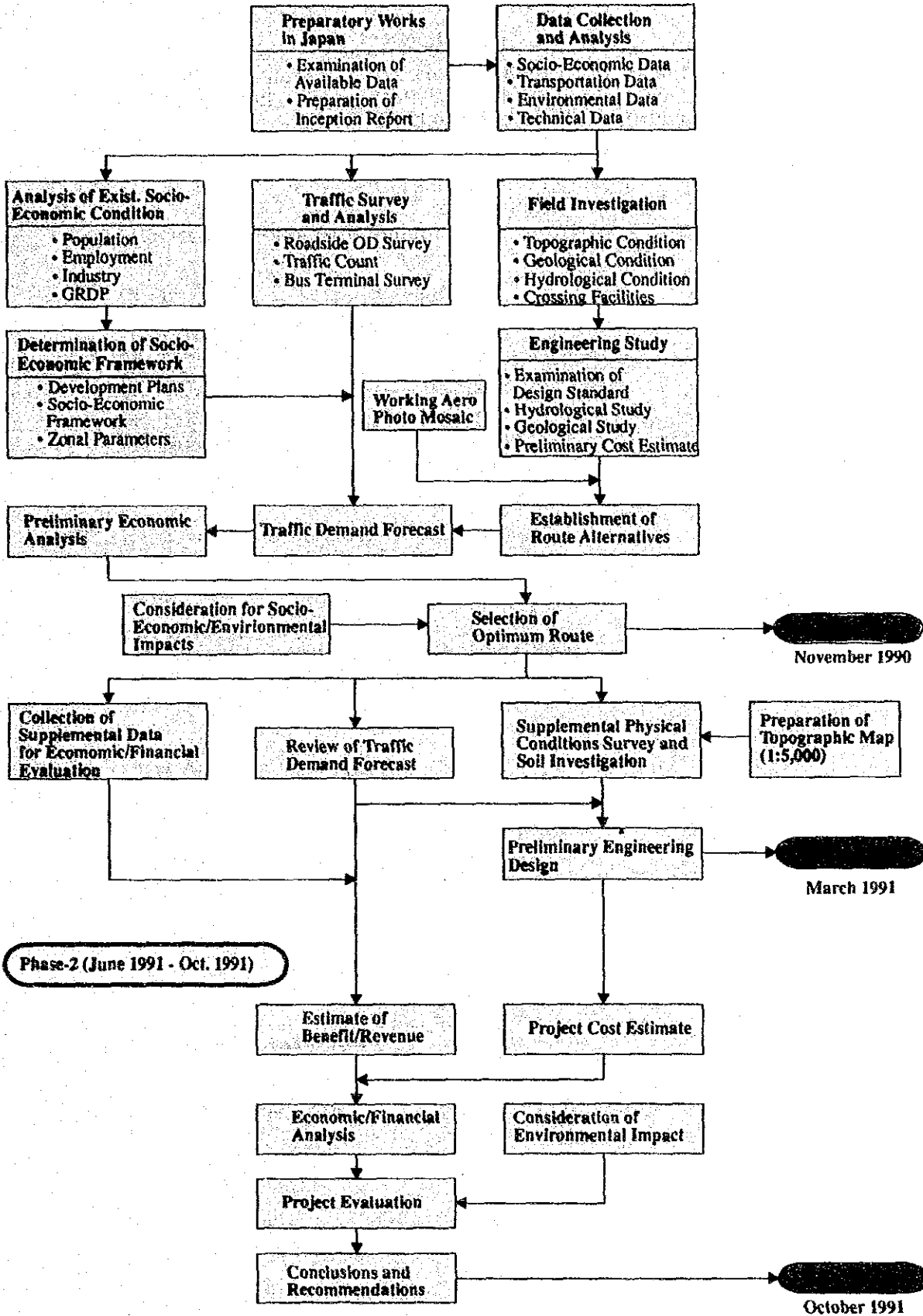
**Fig. 1.2 Study Organization**

The members of the Indonesian steering committee, technical committee, Indonesian counterparts, JICA advisory committee and the Study Team are as follows:





**Phase-1 (Aug. 1990 - Mar. 1991)**



**SURABAYA - MOJOKERTO  
TOLL ROAD PROJECT**

**Fig. 1.1 Flow of the Study**



(1) Indonesian Steering Committee

<u>Name</u>	<u>Organization</u>
Mr. Djoko Asmoro	Director of Urban Road Planning, Bina Marga
Mr. M.Djaelani	BAPPEDA, Provincial Government of East Java
Mr. Budiana	Head of Kanwil, PU of Provincial Government of East Java
Mr. Soehartono	President Director, Jasa Marga (Indonesian Highway Corporation)

(2) Indonesian Technical Committee

<u>Name</u>	<u>Organization</u>
Mr. Anas Aly	Bina Marga
Mr. Wiharso	Bina Marga
Mr. Bhudjono	Bina Marga
Mr. Parmin	Jasa Marga
Mr. Sahat Simorangkir	Jasa Marga
Mr. Budisantoso	Jasa Marga
Mr. Poernomohadi	BAPPEDA, Provincial Government of East Java

(3) Indonesian Counterparts

<u>Name</u>	<u>Assignment</u>	<u>Organization</u>
Mr. Bambang Djoko Pitojo	Project Officer	Bina Marga
Mr. Minton Panggabean	Project Officer	Bina Marga
Mr. Setiyono		Jasa Marga
Mr. Kristianto		Jasa Marga

(4) JICA Advisory Committee

<u>Name</u>	<u>Organization</u>
Mr. Tsuneyoshi Funazaki	Chairman Manager of Construction Department, Sapporo Construction Bureau, Japan Highway Public Corporation
Mr. Masashi Kimura	Member Assistant Director of National Expressway Division, Road Bureau, Ministry of Construction
Mr. Tsutomu Takazawa	Member Head of Planning Division, Third Construction Bureau, Honshu-Shikoku Bridge Authority
Mr. Mutsumi Narawa	Project Coordinator First Development Survey Division, Social Development Cooperation Department, JICA

(5) JICA Study Team

1) Feasibility Study Group

Name

Mr. Akira Shikichi  
Mr. Keikichi Yoshida  
Mr. Koichi Tanuma  
Mr. Isamu Gunji  
Mr. Kazuhiro Nagase  
Mr. Sumitada Takahashi  
Mr. Taichiro Kurayama  
Mr. Masatoshi Kaneko  
Mr. Sakae Takada  
Mr. Eiichi Yokota

Assignment

Team Leader (Aug. 1990 - July 1991)  
Team Leader (July 1991 - )  
Deputy Team Leader/Highway Engineer  
Transport Planner  
Highway Engineer  
Traffic Engineer  
Structure Engineer  
Transport Economist  
Soil and Material Engineer  
Hydrologist

2) Topographic Mapping Group

Name

Mr. Masaru Toshioka  
Mr. Katsuyuki Aoyagi  
Mr. Shoji Nagaoka  
Mr. Daikichi Nakajima  
Mr. Koichi Miki

Assignment

Head of Mapping Group  
Ground Survey Supervisor  
Aerial Photography Supervisor  
Mapping Supervisor  
Mapping Supervisor

## **Chapter 2**

### **SOCIO-ECONOMIC CONDITIONS OF THE STUDY AREA**



## **CHAPTER 2**

### **SOCIO-ECONOMIC CONDITIONS OF THE STUDY AREA**

#### **2.1 Definition of the Study Area**

##### **2.1.1 Administrative Structure**

The administrative system of the Republic of Indonesia is composed of 5 different levels of administrative hierarchy. They are Provincial, Kabupaten/Kotamadya (Regency/ Municipality), Kota Administratif, Kecamatan and Kelurahan/Desa.

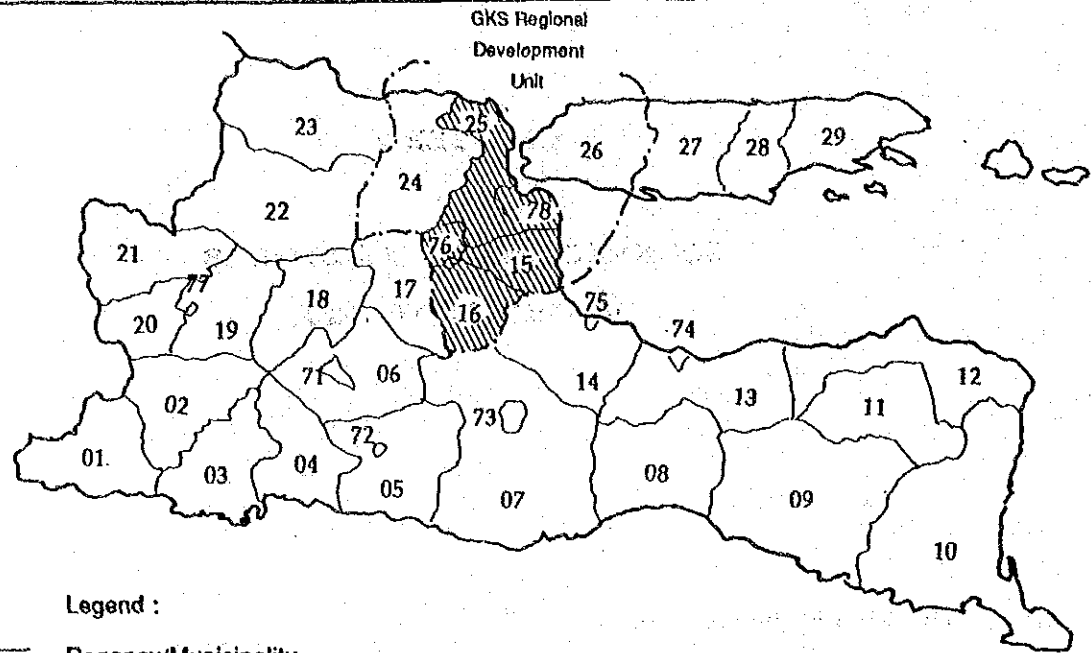
The total number of provinces in Indonesia is 27, among which the Special Districts of D.I. Aceh, DKI Jakarta and D.I. Yogyakarta are included. The Kota Administratif is defined as an urbanized area emerging from the Kecamatan level, but which is not matured yet as a Kotamadya level.

Java island includes 5 Provinces, namely DKI Jakarta, West Java, Central Java, D.I. Yogyakarta and East Java where the project toll road is located.

The Capital City of East Java Province is Surabaya and this is administrated by the Government of Kotamadya Surabaya. East Java Province consists of 29 Kabupatens and 8 Kotamadyas with a total area of about 47,922 square kilometers.

##### **2.1.2 Study Area**

The Study Area is defined as the direct influence area of the Project which includes such administrative districts as Kotamadya Surabaya, Kabupaten Sidoarjo, Kabupaten Gresik, Kotamadya Mojokerto and Kabupaten Mojokerto through which the Surabaya-Mojokerto Toll Road (hereinafter called the "Toll Road") is assumed to pass.



Legend :

————— Regency/Municipality

----- GKS Regional Development Unit

▨▨▨▨▨ Study Area

Code No.	Regency/ Municipality	Altitude of City (m)	Areas (SQ Km)	Code No.	Regency/ Municipality	Altitude of City (m)	Areas (SQ Km)	
<u>Kabupaten/Regency :</u>				<u>Kabupaten/Regency :</u>				
01.	Pacitan	7	1,310.50	20.	Magetan	394	672.70	
02.	Ponorogo	49	1,311.09	21.	Ngawi	47	1,245.70	
03.	Trenggalek	110	1,205.22	22.	Bojonegoro	19	2,384.02	
04.	Tulungagung	85	1,055.00	23.	Tuban	4	1,904.70	
05.	Blitar	167	1,651.86	24.	Lamongan	6	1,812.80	
06.	Kediri	60	963.21	25.	Gresik	3	1,137.05	
07.	Malang	445	4,728.83	26.	Bangkalan	47	1,144.70	
08.	Lumajang	54	1,790.90	27.	Sampang	15	1,152.04	
09.	Jember	83	2,948.87	28.	Pamekasan	8	732.85	
10.	Banyuwangi	25	5,782.50	29.	Sumenep	13	1,857.59	
11.	Bondowoso	255	1,560.10	<u>Kotamadya/Municipality :</u>				
12.	Situbondo	5	1,457.67	71.	Kediri	60	63.40	
13.	Probolinggo	10	1,397.50	72.	Blitar	167	32.37	
14.	Pasuruan	5	1,293.50	73.	Malang	445	118.57	
15.	Sidoarjo	3	591.59	74.	Probolinggo	10	56.67	
16.	Mojokerto	30	826.72	75.	Pasuruan	5	35.28	
17.	Jombang	44	1,159.50	76.	Mojokerto	20	16.48	
18.	Nganjuk	56	1,182.64	77.	Madiun	60	54.77	
19.	Madiun	60	1,009.05	78.	Surabaya	2	274.06	
							East Java	47,922.00

**SURABAYA - MOJOKERTO  
TOLL ROAD PROJECT**

**Fig. 2.1 Study Area and Administrative Districts  
in East Java**



These administrative districts are covered by a regional development unit, which is referred to as GERBANGKERTOSUSILA or GKS region in short. The GKS region involves, other than the above mentioned districts, Kabupaten Lamongan (which is located to the west of Kabupaten Gresik) and Kabupaten Bangkalan (which is located to the west of Madura Island) as shown in Fig. 2.1. Surabaya city is defined as the center of not only East Java Province but also the center of the regional development unit of the GKS region.

Thus, the Toll Road lies in East Java Province and the GKS region where Surabaya city functions as a primary center of Provincial and Regional activities in the administrative, social, economic, cultural and educational fields.

## 2.2 Population

### 2.2.1 Population in Indonesia and Java Island

According to the 1985 intercensus survey the population of Indonesia is estimated at 164 million in 1985 and 183 million in 1990. Growth of the population is 2.1% p.a. The population in major islands of Indonesia is summarized in Table 2.1.

**Table 2.1 Population Distribution and Annual Growth**

Major Islands	Population (x 1000)			% Distribution			Annual Growth(%)	
	1980	1985	1990	1980	1985	1990	1985/ 1980	1990/ 1985
1) Sumatra	28,016	32,720	37,939	19.00	19.87	20.77	3.15	3.00
2) Java	91,270	100,208	109,235	61.88	60.87	59.81	1.89	1.74
- DKI Jakarta	6,503	7,913	9,406	4.41	4.81	5.32	4.00	3.52
- West Java	27,454	30,940	34,434	18.61	18.79	19.21	2.42	2.16
- Central Java	25,373	27,041	29,017	17.20	16.44	16.08	1.28	1.42
- D.I.Yogyakarta	2,751	2,941	3,172	1.87	1.79	1.76	1.34	1.52
- East Java	29,189	31,373	33,206	19.79	19.06	18.36	1.45	1.14
3) Nusa Tenggara	8,487	9,369	10,380	5.76	5.69	5.68	2.00	2.07
4) Kalimantan	6,723	7,749	8,910	4.56	4.71	4.88	2.88	2.83
5) Sulawesi	10,410	11,594	12,724	7.05	7.04	6.97	2.18	1.88
6) Maluku/Irian Jaya	2,585	2,990	3,462	1.75	1.82	1.90	2.95	2.87
Indonesia Total	147,490	164,630	182,650	100.00	100.00	100.00	2.22	2.10

Source : "Statistical Year Book of Indonesia, 1989", Central Bureau of Statistics

Note : Figures in 1990 are the estimates of Central Bureau of Statistics.

Java island which has the dominant population in Indonesia of about 60% shows relatively lower growth rates than the other islands. Efforts of transmigration from the densely populated Java island to Sumatra and Kalimantan islands have been made in the past decades.

The population growth in Java island has been slowed down as a whole from 1.89% p.a. during 1980-1985 to 1.74% p.a. during 1985-1990, and its contribution to the total Indonesia population also lowered from 61.88% in 1980 to 59.81% in 1990.

Among the provinces in Java island, DKI Jakarta has 9.4 million population in 1990 and still holds the highest growth rate of 3.52% which is more than threefold of the population growth in East Java Province.

West Java Province has a 34.4 million population in 1990 and its growth rate has fallen down from 2.42% p.a. during 1980-1985 to 2.16% p.a. during 1985-1990. This rate comes to near the average growth rate of Indonesia.

The population of Central Java Province and D.I. Yogyakarta is 29.0 million and 3.2 million respectively and totals up to 32.2 million in 1990. The total population grew at a lower rate of 1.43% p.a. than that of the Indonesian average of 2.1% p.a. during 1985-1990.

The population in East Java Province is 33.2 million in 1990, which is roughly equal to West Java Province and the total of Central Java Province and D.I. Yogyakarta. The population growth has slowed down during the second half of the last decade (1.14% p.a.) and is the lowest growth among the provinces in Java island as well as in Indonesia.

### **2.2.2 Population in East Java and Study Area**

East Java Province comprises 29 Kabupatens and 8 Kotamadyas as shown in the previous diagram of Fig. 2.1. The population of these Kabupatens and Kotamadyas is presented in Table 2.2.

Kotamadya Surabaya holds the largest population of 2.65 million in 1990 followed by Kabupaten Malang, 2.28 million and Kabupaten Jember, 2.04 million. Kabupatens that have over 1 million population, other than the above three Kotamadya/Kabupaten, are 8 Kabupatens of Banyuwangi, Kediri, Lamongan,

**Table 2.2 Population Growth in Kabupaten/Kotamadya in East Java (1980, 1985-1990)**

Kab./Kodya	1980	1985	1986	1987	1988	1989	1990	Growth Rate (% p.a.)	
								1980-1985	1985-1990
<b>Kabupaten :</b>									
Pacitan	478,022	487,883	489,071	490,225	490,506	490,774	490,759	0.41%	0.12%
Ponorogo	783,356	804,047	806,885	809,675	811,024	812,356	813,219	0.52%	0.23%
Trenggalek	564,525	599,641	605,766	611,904	617,004	622,132	626,939	1.21%	0.89%
Tulungagung	833,172	871,676	887,974	884,245	888,976	893,710	897,947	0.91%	0.60%
Blitar	1,037,175	1,049,865	1,056,819	1,063,737	1,068,790	1,073,844	1,078,296	0.24%	0.54%
Kediri	1,235,026	1,322,805	1,338,425	1,354,124	1,367,566	1,381,110	1,393,978	1.38%	1.05%
Malang	2,045,704	2,207,715	2,237,083	2,266,670	2,229,703	2,254,109	2,278,391	1.54%	0.63%
Lumajang	874,263	921,805	929,840	937,872	944,290	950,727	956,655	1.06%	0.74%
Jember	1,880,654	1,973,712	1,989,145	2,004,545	2,016,465	2,028,406	2,039,237	0.97%	0.66%
Banyuwangi	1,420,532	1,525,405	1,544,178	1,563,060	1,579,355	1,595,780	1,611,444	1.43%	1.10%
Bondowoso	611,993	642,959	648,114	653,260	657,277	661,299	664,962	0.99%	0.68%
Situbondo	524,803	554,851	559,966	565,081	569,228	573,393	577,253	1.12%	0.79%
Probolinggo	866,293	876,134	886,741	897,407	906,585	915,832	924,639	0.23%	1.08%
Pasuruan	1,034,705	1,092,164	1,109,524	1,127,075	1,142,861	1,158,843	1,174,366	1.09%	1.46%
Sidoarjo	853,685	975,556	999,428	1,023,804	1,046,909	1,070,508	1,094,004	2.70%	2.32%
Mojokerto	705,547	752,646	764,460	776,400	787,120	797,968	808,501	1.30%	1.44%
Jombang	941,789	1,016,988	1,030,619	1,044,353	1,056,384	1,068,525	1,080,182	1.55%	1.21%
Nganjuk	882,607	943,954	954,817	965,732	975,029	984,395	993,273	1.35%	1.02%
Madiun	640,463	650,983	655,684	660,368	663,900	667,435	670,602	0.33%	0.60%
Magetan	608,810	635,538	639,873	644,190	647,378	650,569	653,395	0.86%	0.56%
Ngawi	769,159	809,643	816,458	823,268	828,654	834,057	839,007	1.03%	0.72%
Bojonegoro	999,067	1,078,992	1,093,453	1,108,023	1,120,788	1,133,670	1,146,037	1.55%	1.21%
Taban	871,739	943,714	956,834	970,059	981,717	993,490	1,004,823	1.60%	1.26%
Lamongan	1,049,808	1,131,249	1,145,961	1,160,772	1,173,684	1,186,708	1,199,182	1.51%	1.17%
Gresik	728,570	800,378	813,739	827,258	839,506	851,912	864,003	1.90%	1.54%
Bangkalan	688,291	717,469	722,149	726,805	730,186	733,565	736,534	0.83%	0.53%
Sampang	604,532	642,782	649,475	656,187	661,787	667,419	672,707	1.23%	0.91%
Pamekasan	539,055	581,383	589,059	596,790	603,547	610,365	616,902	1.52%	1.19%
Sumenep	854,925	905,766	914,564	923,376	930,613	937,884	944,664	1.16%	0.84%
<b>Kotamadya :</b>									
Kediri	221,636	248,890	254,112	259,423	264,374	269,411	274,389	2.35%	1.97%
Blitar	78,381	116,474	117,803	119,138	120,277	121,421	122,509	8.24%	1.02%
Malang	510,906	566,715	577,136	587,704	660,252	671,808	682,234	2.10%	3.78%
Probolinggo	100,152	164,621	167,428	170,270	172,853	175,474	178,034	10.45%	1.58%
Pasuruan	93,366	148,674	151,921	155,227	158,324	161,482	164,608	9.75%	2.06%
Mojokerto	68,507	91,956	93,140	94,334	95,373	96,422	97,427	6.06%	1.16%
Madiun	150,260	177,276	178,698	180,117	181,227	182,334	183,346	3.36%	0.68%
Surabaya	2,017,527	2,340,311	2,402,479	2,466,108	2,526,914	2,589,154	2,651,394	3.01%	2.53%
East Java	29,169,005	31,372,620	31,778,821	32,168,586	32,516,426	32,868,291	33,205,842	1.47%	1.14%

Source : Jawa Timur Dalam Angka (East Java Figures), 1988  
Statistical Office of East Java Province and the Government of East Java (BAPPEDA)

Note : Figures in the years between 1986 and 1990 are the estimates of Statistical Office of East Java Province.

Pasuruan, Bojonegoro, Sidoarjo, Jombang, and Blitar. Kabupatens Mojokerto and Gresik have 0.81 million and 0.86 million population respectively in 1990.

Population density in Kotamadyas, which are defined as urbanized area, in East Java Province ranges from about 31 to 97 persons per hectare in 1990 and Kabupatens Kediri and Sidoarjo follow thereafter ranging from 14 to 19 persons per hectare. The population density in East Java averages 7 persons per hectare. A classified population density by Kabupaten/Kotamadya is shown in Table 2.3 and diagrammatically in Fig. 2.2.

The population distribution in the Study Area is further analyzed to the Kecamatan level as shown in Table 2.4. Desa or Kelurahan is a lower level autonomy of the Kecamatan government and is divided into RWs and RTs which are organized to form and strengthen the neighborhood community.

According to the result of registered population by the end of 1989 (refer to Table 2.4), it is found that :

#### Kotamadya Surabaya:

- Kecamatan over the population density of 100 persons per hectare account for 11 out of the total 19.
- Average population per Desa exceeds 5,000 persons, except for Kecamatan Benowo.

#### Kabupaten Sidoarjo:

- Kecamatan that have a population density over either 20 persons per hectare or 3,000 persons per Desa are found in 5 Kecamatan, that is Kecamatan Waru, Taman, Sidoarjo, Gedangan and Krian.
- Kecamatan Waru in particular is densely populated relative to the other Kecamatan above.

**Table 2.3 Population Density by Regency/Municipality**

Regency/ Municipality	Areas (km <sup>2</sup> )	Population in 1990	Density per km <sup>2</sup>
1. Kab. Pacitan	1,310.50	490,759	374
2. Kab. Ponorogo	1,311.09	813,219	620
3. Kab. Trenggalek	1,205.22	626,939	520
4. Kab. Tulungagung	1,055.00	897,947	851
5. Kab. Blitar	1,651.86	1,078,296	653
6. Kab. Kediri	963.21	1,393,978	1,447
7. Kab. Malang	4,728.83	2,278,391	482
8. Kab. Lumajang	1,790.90	956,655	534
9. Kab. Jember	2,948.87	2,039,237	692
10. Kab. Banyuwangi	5,782.50	1,611,444	279
11. Kab. Bondowoso	1,560.10	664,962	426
12. Kab. Situbondo	1,457.67	577,253	396
13. Kab. Probolinggo	1,397.50	924,639	662
14. Kab. Pasuruan	1,293.50	1,174,366	908
15. Kab. Sidoarjo	591.59	1,094,004	1,849
16. Kab. Mojokerto	826.72	808,501	978
17. Kab. Jombang	1,159.50	1,080,182	932
18. Kab. Nganjuk	1,182.64	993,273	840
19. Kab. Madiun	1,009.05	670,602	665
20. Kab. Magetan	672.70	653,395	971
21. Kab. Ngawi	1,245.70	839,007	674
22. Kab. Bojonegoro	2,384.02	1,146,037	481
23. Kab. Tuban	1,904.70	1,004,823	528
24. Kab. Lamongan	1,812.80	1,199,182	662
25. Kab. Gresik	1,137.05	864,003	760
26. Kab. Bangkalan	1,144.70	736,534	643
27. Kab. Sampang	1,152.04	672,707	584
28. Kab. Pamekasan	732.85	616,902	842
29. Kab. Sumenep	1,857.59	944,664	509
30. Kod. Kediri	63.40	274,389	4,328
31. Kod. Blitar	32.37	122,509	3,785
32. Kod. Malang	118.57	682,234	5,754
33. Kod. Probolinggo	56.67	178,034	3,142
34. Kod. Pasuruan	35.28	164,608	4,666
35. Kod. Mojokerto	16.48	97,427	5,912
36. Kod. Madiun	54.77	183,346	3,348
37. Kod. Surabaya	274.06	2,651,394	9,675
East Java	47,922.00	33,205,842	693

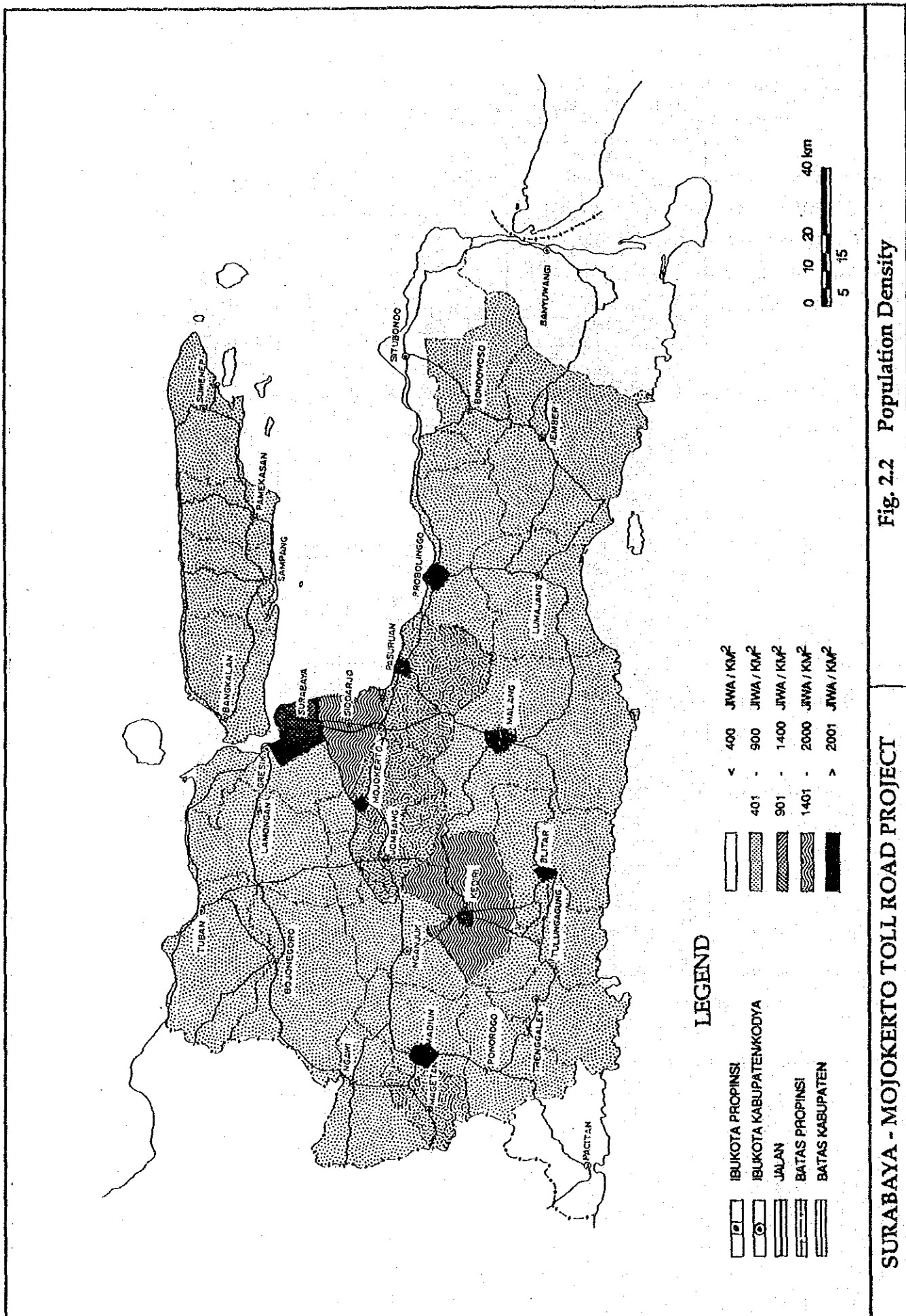


Fig. 2.2 Population Density

SURABAYA - MOJOKERTO TOLL ROAD PROJECT

**Table 2.4 Population and Density of Kecamatan in Study Area, 1989**

Kec. of Study Area	Area (km <sup>2</sup> )	No. of Desa	Population	Density per	
				Km <sup>2</sup>	Desa
<b>Kodya Surabaya</b>					
/3 1. Kec. Lakarsantri	34.19	10	50,690	1,483	5,069
/3 2. Kec. Karang Pilang	25.24	12	105,767	4,190	8,814
/3 3. Kec. Wonocolo	16.19	13	109,918	6,789	8,455
4. Kec. Wonokromo	6.70	6	171,188	25,550	28,531
5. Kec. Sawahan	7.64	6	213,766	27,980	35,628
6. Kec. Genteng	3.53	5	71,380	20,221	14,276
7. Kec. Tegalsari	4.90	5	120,788	24,651	24,158
8. Kec. Gubeng	7.49	6	142,225	18,989	23,704
9. Kec. Rungkut	35.71	15	92,129	2,580	6,142
10. Kec. Sukolilo	33.59	13	91,892	2,736	7,069
11. Kec. Kenjeran	12.50	9	65,429	5,234	7,270
12. Kec. Tambaksari	9.09	6	186,546	20,522	31,091
13. Kec. Simokerto	2.66	5	109,731	41,252	21,946
14. Kec. Semampir	5.34	5	157,973	29,583	31,595
15. Kec. Pabean Cantian	4.43	5	92,662	20,917	18,532
16. Kec. Krembangan	4.58	5	115,195	25,152	23,039
17. Kec. Bubutan	3.45	5	106,727	30,935	21,345
18. Kec. Tandes	32.18	22	155,752	4,840	7,080
19. Kec. Benowo	41.04	10	30,078	733	3,008
Total	290.45	163	2,189,836	7,539	13,435
<b>Kab. Sidoarjo</b>					
1. Kec. Sidoarjo	55.54	24	88,835	1,599	3,701
2. Kec. Buduran	36.60	15	37,928	1,036	2,529
3. Kec. Candi	37.77	24	51,783	1,371	2,158
4. Kec. Porong	27.75	19	54,460	1,963	2,866
5. Kec. Krembung	26.54	19	44,384	1,672	2,336
6. Kec. Tulangan	29.60	22	56,456	1,907	2,566
7. Kec. Tanggulangin	30.02	19	51,808	1,726	2,727
8. Kec. Jabon	62.25	15	39,399	633	2,627
9. Kec. Krian	30.02	22	64,387	2,145	2,927
/3 10. Kec. Balongbendo	28.64	20	45,104	1,575	2,255
11. Kec. Wonoayu	32.67	23	46,237	1,415	2,010
/3 12. Kec. Tarik	32.50	20	43,107	1,326	2,155
13. Kec. Prambon	31.39	20	51,665	1,646	2,583
14. Kec. Taman	28.83	24	95,523	3,313	3,980
15. Kec. Waru	27.72	17	86,601	3,124	5,094
16. Kec. Gedangan	23.10	15	54,523	2,360	3,635
17. Kec. Sedati	61.92	16	37,632	608	2,352
18. Kec. Sukodono	31.53	19	43,892	1,392	2,310
Total	634.39	353	993,724	1,566	2,815
<b>Kab. Gresik</b>					
/3 1. Kec. Wringinanom	62.62	16	43,947	702	2,747
/3 2. Kec. Driyorejo	51.30	16	45,851	894	2,866
3. Kec. Menganti	68.71	22	65,818	958	2,992
4. Kec. Kedamean	65.96	15	44,574	676	2,972
5. Kec. Balongpanggang	63.67	25	47,059	739	1,882
6. Kec. Benjeng	61.26	23	48,323	789	2,101

**Table 2.4 Population and Density of Kecamatan in Study Area, 1989  
(Continued)**

Kec. of Study Area	Area (km <sup>2</sup> )	No. of Desa	Population	Density per	
				Km <sup>2</sup>	Desa
<b>Kab. Gresik (Continued)</b>					
7. Kec. Cerme	71.67	25	48,830	681	1,953
8. Kec. Kebomas	29.70	21	53,203	1,791	2,533
9. Kec. Gresik	5.24	22	71,344	13,615	3,243
10. Kec. Manyar	82.98	23	53,798	648	2,339
11. Kec. Duduk Sampeyan	74.49	23	38,536	517	1,675
12. Kec. Bungah	79.36	22	47,718	601	2,169
13. Kec. Sedayu	45.21	21	27,801	615	1,324
14. Kec. Dukun	59.09	26	51,521	872	1,982
15. Kec. Panceng	62.59	14	35,002	559	2,500
16. Kec. Ujungpangkah	94.82	13	33,101	349	2,546
17. Kec. Sangkapura	118.72	17	40,101	338	2,359
18. Kec. Tambak	77.39	13	25,150	325	1,935
Total	1,174.78	357	821,677	699	2,302
<b>Kab. Mojokerto</b>					
1. Kec. Jatirejo	107.62	19	32,658	303	1,719
2. Kec. Gondang	98.62	18	32,715	332	1,818
3. Kec. Pacet	107.98	20	43,261	401	2,163
4. Kec. Trawas	58.00	13	22,624	390	1,740
5. Kec. Ngoro	70.50	19	54,095	767	2,847
6. Kec. Pungging	45.00	19	51,791	1,151	2,726
7. Kec. Kutorejo	43.50	17	44,255	1,017	2,603
8. Kec. Mojosari	28.85	19	55,471	1,923	2,920
9. Kec. Bangsal	35.12	23	50,939	1,450	2,215
10. Kec. Dlanggu	35.82	16	39,304	1,097	2,457
<sup>/3</sup> 11. Kec. Puri	48.74	22	66,974	1,374	3,044
12. Kec. Trowulan	45.93	16	49,207	1,071	3,075
13. Kec. Sooko	19.30	15	41,588	2,155	2,773
14. Kec. Gedek	26.18	14	45,263	1,729	3,233
15. Kec. Kemlagi	42.35	20	46,762	1,104	2,338
16. Kec. Jetis	53.05	16	55,768	1,051	3,486
17. Kec. Dawarblandong	102.80	18	41,697	406	2,317
Total	969.36	304	774,372	799	2,547
<b>Kodya. Mojokerto</b>					
1. Kec. Prajurit Kulon	7.76	8	43,599	5,618	5,450
2. Kec. Magersari	8.70	10	53,412	6,139	5,341
Total	16.46	18	97,011		

Source:

- <sup>/1</sup> "Penduduk Jawa Timur, Hasil Registrasi Akhil Tahun 1989"  
Statistical Office of East Java Province
- <sup>/2</sup> "Dalam Angka 1988" of Kodyas. Surabaya and Mojokerto; Kabs. Sidoarjo,  
Gresik and Mojokerto; Statistical Office of Respective Kodyas/Kabs.
- <sup>/3</sup> The district (Kecamatan) where the planned Toll Road is located.



#### Kabupaten Gresik:

- Kecamatan Gresik shows an outstanding population density of 136 persons per hectare or 3,243 persons per Desa, compared with other Kecamatans.
- Kecamatan Kebomas which is located immediately to the south of Kecamatan Gresik is relatively densely populated (18 persons per hectare).
- The other Kecamatans are dispersedly inhabited but it is presumed that Kecamatans having nearly 3,000 population per Desa, such as Wringinanom, Driyorejo, Meganti and Kedamean, are densely inhabited in their village areas.

#### Kabupaten Mojokerto:

- Kecamatans that have a population density over either 20 persons per hectare or 3,000 persons per Desa are found in 5 Kecamatans. They are Kecamatans Puri, Trowulan, Sooko, Gedek and Jetis and located around Kotamadya Mojokerto.
- Kecamatan Mojosari nearly satisfies the above criteria but it is located in the middle of Kabupaten Mojokerto and at the intersection between Krian-Pacet provincial highway and Mojokerto-Porong provincial highway.

#### Kotamadya Mojokerto:

- This is only comprised of two Kecamatans and both are densely inhabited over 50 persons per hectare and 5,000 persons per Desa.

## **2.3 Landuse in East Java and Study Area**

### **2.3.1 Landuse in East Java**

The landuse by Kabupaten in East Java in 1987 is presented in Tables 2.5 (1) and 2.5 (2).

Table 2.5 (1) Landuse by Kabupaten in East Java Province in 1987 (1)

(unit: ha)

Kabupaten/ Kotamadya	Dry Land							Wet Land	Total
	Developed for Building	Garden/ Shift Cul- tivation	Swamp/ Pond	Tempo- rary Un- utilized	Forest/ Pasture	Plantation	Other Dry Land		
1. Kab. Pacitan	23,186	80,651	3	2,261	1,195	11,010	2,771	14,015	135,092
2. Kab. Ponorogo	24,276	30,985			45,500	160	2,360	36,138	139,419
3. Kab. Trenggalek	16,084	30,112	4		57,843	2,267	2,633	11,579	120,522
4. Kab. Tulungagung	24,654	19,192	27	107	28,974	4,401	4,353	22,920	104,628
5. Kab. Blitar	26,795	48,833	73		25,666	16,515	7,235	33,756	158,873
6. Kab. Kediri	29,582	28,739	22	35	17,164	9,977	5,533	48,752	139,804
7. Kab. Malang	44,655	120,383	42	459	90,079	16,414	11,748	51,960	335,740
8. Kab. Lumajang	14,334	49,369					11,637	38,138	113,478
9. Kab. Jember	29,368	35,706	486	70	51,986	49,137	6,670	84,357	257,780
10. Kab. Banyuwangi	22,179	37,249	354	3	225,791	51,091	3,427	68,824	408,918
11. Kab. Bondowoso	17,048	32,940	6		47,660	11,146	3,231	29,477	141,508
12. Kab. Situbondo	10,624	42,333	586	95	72,051	1,993	8,499	27,642	163,823
13. Kab. Probolinggo	13,850	57,302	1,361		34,991	2,039	3,801	37,692	151,036
14. Kab. Pasuruan	18,069	44,287	3,202	1,025	22,498	2,408	4,073	44,281	139,843
15. Kab. Sidoarjo	13,957	1,186	14,726	112		8	3,128	29,998	63,115
16. Kab. Mojokerto	13,066	12,873	27		29,434	363	4,976	37,051	97,790
17. Kab. Jombang	16,864	11,924	16	40	13	464	2,103	48,891	80,315
18. Kab. Nganjuk	17,814	12,785	13		40,436	6,711	1,600	43,074	122,433
19. Kab. Madiun	12,779	9,444	147		40,925	2,308	1,792	33,691	101,086
20. Kab. Magetan	15,426	11,952			9,024	458	2,182	29,841	68,883
21. Kab. Ngawi	19,349	14,957	12	688	37,356	8,841	2,708	51,036	134,947
22. Kab. Bojonegoro	23,185	31,774	88	116	85,711	410	12,231	71,353	224,868
23. Kab. Tuban	14,828	61,144	651	249	46,357	157	4,965	55,634	183,985
24. Kab. Lamongan	12,730	33,326	793	70	29,676	4	7,102	83,182	166,883
25. Kab. Gresik	10,626	31,689	19,803	1,019	5,575	806	6,154	41,733	117,405
26. Kab. Bangkalan	20,625	50,043	1,693	778	2,251	7,887	3,220	41,112	127,609
27. Kab. Sampang	11,814	82,274	5,218	43	284	571	2,425	20,666	123,295
28. Kab. Pamekasan	9,913	51,485	491		360	450	4,063	12,453	79,215
29. Kab. Sumenep	19,078	114,225	181	424	16,944	4,193	22,504	22,223	199,772
30. Kod. Kediri	1,869	592			370		396	2,659	5,886
31. Kod. Blitar	1,432	71					391	1,336	3,230
32. Kod. Malang	4,553	1,196					334	1,304	7,387
33. Kod. Probolinggo	1,386	767	13				1,033	2,467	5,666
34. Kod. Pasuruan	1,091	93	430			18	296	1,671	3,599
35. Kod. Mojokerto	700	58					67	822	1,647
36. Kod. Madiun	1,783	131		62			123	1,326	3,425
37. Kod. Surabaya	12,703	1,935	2,268				7,025	4,775	28,706
East Java Total	572,275	1,194,005	52,736	7,656	1,066,114	212,207	168,789	1,187,829	4,461,611

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Table 2.5 (2) Landuse by Kabupaten in East Java Province in 1987 (2)

Kabupaten/ Kotamadya	Dry Land							Wet Land	Total
	Developed for Building	Garden/ Shift Cul- tivation	Swamp/ Pond	Tempo- rary Un- utilized	Forest/ Pasture	Plantation	Other Dry Land		
1. Kab. Pacitan	17.16%	59.70%	0.00%	1.67%	0.88%	8.15%	2.05%	10.37%	100.00%
2. Kab. Ponorogo	17.41%	22.22%			32.64%	0.11%	1.69%	25.92%	100.00%
3. Kab. Trenggalek	13.35%	24.98%	0.00%		47.99%	1.88%	2.18%	9.61%	100.00%
4. Kab. Tulungagung	23.56%	18.34%	0.03%	0.10%	27.69%	4.21%	4.16%	21.91%	100.00%
5. Kab. Blitar	16.87%	30.74%	0.05%		16.16%	10.40%	4.55%	21.25%	100.00%
6. Kab. Kediri	21.16%	20.56%	0.02%	0.03%	12.28%	7.14%	3.96%	34.87%	100.00%
7. Kab. Malang	13.30%	35.86%	0.01%	0.14%	26.83%	4.89%	3.50%	15.48%	100.00%
8. Kab. Lumajang	12.63%	43.51%					10.25%	33.61%	100.00%
9. Kab. Jember	11.39%	13.85%	0.19%	0.03%	20.17%	19.06%	2.59%	32.72%	100.00%
10. Kab. Banyuwangi	5.42%	9.11%	0.09%	0.00%	55.22%	12.49%	0.84%	16.83%	100.00%
11. Kab. Bondowoso	12.05%	23.28%	0.00%		33.68%	7.88%	2.28%	20.83%	100.00%
12. Kab. Situbondo	6.49%	25.84%	0.36%	0.06%	43.98%	1.22%	5.19%	16.87%	100.00%
13. Kab. Probolinggo	9.17%	37.94%	0.90%		23.17%	1.35%	2.52%	24.96%	100.00%
14. Kab. Pasuruan	12.92%	31.67%	2.29%	0.73%	16.09%	1.72%	2.91%	31.66%	100.00%
15. Kab. Sidoarjo	22.11%	1.88%	23.33%	0.18%		0.01%	4.96%	47.53%	100.00%
16. Kab. Mojokerto	13.36%	13.16%	0.03%		30.10%	0.37%	5.09%	37.89%	100.00%
17. Kab. Jombang	21.00%	14.85%	0.02%	0.05%	0.02%	0.58%	2.62%	60.87%	100.00%
18. Kab. Nganjuk	14.55%	10.44%	0.01%		33.03%	5.48%	1.31%	35.18%	100.00%
19. Kab. Madiun	12.64%	9.34%	0.15%		40.49%	2.28%	1.77%	33.33%	100.00%
20. Kab. Magetan	22.39%	17.35%			13.10%	0.66%	3.17%	43.32%	100.00%
21. Kab. Ngawi	14.34%	11.08%	0.01%	0.51%	27.68%	6.55%	2.01%	37.82%	100.00%
22. Kab. Bojonegoro	10.31%	14.13%	0.04%	0.05%	38.12%	0.18%	5.44%	31.73%	100.00%
23. Kab. Tuban	8.06%	33.23%	0.35%	0.14%	25.20%	0.09%	2.70%	30.24%	100.00%
24. Kab. Lamongan	7.63%	19.97%	0.48%	0.04%	17.78%	0.00%	4.26%	49.84%	100.00%
25. Kab. Gresik	9.05%	26.99%	16.87%	0.87%	4.75%	0.69%	5.24%	35.55%	100.00%
26. Kab. Bangkalan	16.16%	39.22%	1.33%	0.61%	1.76%	6.18%	2.52%	32.22%	100.00%
27. Kab. Sampang	9.58%	66.73%	4.23%	0.03%	0.23%	0.46%	1.97%	16.76%	100.00%
28. Kab. Pamekasan	12.51%	64.99%	0.62%		0.45%	0.57%	5.13%	15.72%	100.00%
29. Kab. Sumenep	9.55%	57.18%	0.09%	0.21%	8.48%	2.10%	11.26%	11.12%	100.00%
30. Kod. Kediri	31.75%	10.06%			6.29%		6.73%	45.17%	100.00%
31. Kod. Blitar	44.33%	2.20%					12.11%	41.36%	100.00%
32. Kod. Malang	61.64%	16.19%					4.52%	17.65%	100.00%
33. Kod. Probolinggo	24.46%	13.54%	0.23%				18.23%	43.54%	100.00%
34. Kod. Pasuruan	30.31%	2.58%	11.95%			0.50%	8.22%	46.43%	100.00%
35. Kod. Mojokerto	42.50%	3.52%					4.07%	49.91%	100.00%
36. Kod. Madiun	52.06%	3.82%		1.81%			3.59%	38.72%	100.00%
37. Kod. Surabaya	44.25%	6.74%	7.90%				24.47%	16.63%	100.00%
East Java Total	12.83%	26.76%	1.18%	0.17%	23.90%	4.76%	3.78%	26.62%	100.00%

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Kabupatens which have wet land more than 40% are Kab. Jombang (60.87%), Kodya Mojokerto (49.91%), Kab. Lamongan (49.84%), Kab. Sidoarjo (47.53%), Kodya Pasuruan (46.43%), Kodya Kediri (45.17%), Kodya Probolinggo (43.54%), Kab. Magetan (43.32%) and Kodya Blitar (41.36%).

More than 30% of the area of each Kotamadya in East Java (excluding only Kodya Probolinggo) is developed for buildings, Kodya Malang discloses the highest percentage of building area (61.64%) and Kodya Madiun (52.06%), Kodya Blitar (44.33%), Kodya Surabaya (44.25%) and Kodya Mojokerto (42.5%) follow.

Beside the Kotamadyas, Kabupatens which have more than 20% of building area are Kab. Tulungagung (23.56%), Kab. Magetan (22.39%), Kab. Sidoarjo (22.11%), Kab. Kediri (21.16%) and Kab. Jombang (21.00%). It is noted that Kab. Sidoarjo is covered with more than 40% of wet land and more than 20% of building area. Kabupatens Mojokerto and Gresik are occupied by building area of about 13% and 9% of the respective total areas.

The breakdown of wet land utilization is shown in Tables 2.6 (1) and 2.6 (2). Kabupatens, other than Kotamadyas, which have more than 80% of technically irrigated wet land are Kab. Sidoarjo (96.95%), Kab. Banyuwangi (91.25%), and Kab. Jember (82.91%).

Almost all of the wet land in Kab. Sidoarjo is technically irrigated and it produces a harvest twice or more per year. Accordingly, Kabupaten Sidoarjo can afford to settle more population than other Kabupatens.

Contrary to this, Kab. Gresik is only a little technically irrigated and the harvest frequency is low even in the technical irrigation area. About 40% of the wet land of Kab. Mojokerto is covered by technical irrigation but only half of it can afford a harvest twice or more per year.

Table 2.6 (1) Wet Land by Irrigation Section by Kabupaten  
in East Java Province in 1987 (1)

(unit: ha)

Kabupaten/Kotamadya	Technical Irrigation			Semi-Technical Irrigation			Others	Total
	Freq. of Harvest per Year			Freq. of Harvest per Year				
	Once	Twice or More	Total	Once	Twice or More	Total		
1. Kab. Pacitan	63	1,006	1,069	923	1,783	2,706	10,240	14,015
2. Kab. Ponorogo	4,461	16,507	20,968	649	2,300	2,949	12,221	36,138
3. Kab. Trenggalek	2,399	1,827	4,226	830	698	1,528	5,825	11,579
4. Kab. Tulungagung	5,062	5,412	10,474	3,607	4,218	7,825	4,621	22,920
5. Kab. Blitar	5,543	12,512	18,055	2,652	1,530	4,182	11,519	33,756
6. Kab. Kediri	10,594	23,007	33,601	3,945	1,866	5,811	9,340	48,752
7. Kab. Malang	7,393	23,159	30,552	3,315	5,027	8,342	13,066	51,960
8. Kab. Lumajang	850	22,035	22,885	1,070	6,660	7,730	7,523	38,138
9. Kab. Jember	26,620	43,324	69,944	1,236	4,438	5,674	8,739	84,357
10. Kab. Banyuwangi	12,457	50,346	62,803	330	532	862	5,159	68,824
11. Kab. Bondowoso	3,412	16,267	19,679	1,250	1,729	2,979	6,819	29,477
12. Kab. Situbondo	928	20,413	21,341	993	780	1,773	4,528	27,642
13. Kab. Probolinggo	11,907	17,292	29,199	4,118	271	4,389	4,104	37,692
14. Kab. Pasuruan	5,829	19,692	25,521	3,633	5,412	9,045	9,715	44,281
15. Kab. Sidoarjo	115	28,967	29,082	261	211	472	444	29,998
16. Kab. Mojokerto	7,352	7,630	14,982	5,137	5,747	10,884	11,185	37,051
17. Kab. Jombang	20,907	16,869	37,776	2,493	218	2,711	8,404	48,891
18. Kab. Nganjuk	11,124	15,898	27,022	5,935	690	6,625	9,427	43,074
19. Kab. Madiun	2,163	20,750	22,913	991	3,265	4,256	6,522	33,691
20. Kab. Magetan	3,782	19,100	22,882	3,124	1,283	4,407	2,552	29,841
21. Kab. Ngawi	585	28,729	29,314	2,227	6,085	8,312	13,410	51,036
22. Kab. Bojonegoro	6,578	9,237	15,815	4,375	1,198	5,573	49,965	71,353
23. Kab. Tuban	2,760	4,193	6,953	5,536	1,673	7,209	41,472	55,634
24. Kab. Lamongan	2,521	4,323	6,844	3,786	9,347	13,133	63,205	83,182
25. Kab. Gresik	603	111	714	2,518	1,268	3,786	37,233	41,733
26. Kab. Bangkalan	1,895	2,045	3,940	994	625	1,619	35,553	41,112
27. Kab. Sampang	1,404	2,233	3,637	250	560	810	16,219	20,666
28. Kab. Pamekasan	3,446	1,069	4,515	719	12	731	7,207	12,453
29. Kab. Sumenep	3,724	635	4,359	1,651	189	1,840	16,024	22,223
30. Kod. Kediri	102	1,333	1,435		369	369	855	2,659
31. Kod. Blitar		840	840	86	275	361	135	1,336
32. Kod. Malang	6	537	543	497	247	744	17	1,304
33. Kod. Probolinggo	1,614	824	2,438			0	29	2,467
34. Kod. Pasuruan		1,531	1,531	70		70	70	1,671
35. Kod. Mojokerto	160	428	588	15	49	64	170	822
36. Kod. Madiun	127	1,196	1,323			0	3	1,326
37. Kod. Surabaya	137	665	802	269	290	559	3,414	4,775
East Java Total	168,623	441,942	610,565	69,485	70,845	140,330	436,934	1,187,829

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Table 2.6 (2) Wet Land by Irrigation Section by Kabupaten in East Java Province in 1987 (2)

Kabupaten/Kotamadya	Technical Irrigation			Semi-Technical Irrigation			Others	Total
	Freq. of Harvest per Year			Freq. of Harvest per Year				
	Once	Twice or More	Total	Once	Twice or More	Total		
1. Kab. Pacitan	0.45%	7.18%	7.63%	6.59%	12.72%	19.31%	73.06%	100.00%
2. Kab. Ponorogo	12.34%	45.68%	58.02%	1.80%	6.36%	8.16%	33.82%	100.00%
3. Kab. Trenggalek	20.72%	15.78%	36.50%	7.17%	6.03%	13.20%	50.31%	100.00%
4. Kab. Tulungagung	22.09%	23.61%	45.70%	15.74%	18.40%	34.14%	20.16%	100.00%
5. Kab. Blitar	16.42%	37.07%	53.49%	7.86%	4.53%	12.39%	34.12%	100.00%
6. Kab. Kediri	21.73%	47.19%	68.92%	8.09%	3.83%	11.92%	19.16%	100.00%
7. Kab. Malang	14.23%	44.57%	58.80%	6.38%	9.67%	16.05%	25.15%	100.00%
8. Kab. Lumajang	2.23%	57.78%	60.01%	2.81%	17.46%	20.27%	19.73%	100.00%
9. Kab. Jember	31.56%	51.36%	82.91%	1.47%	5.26%	6.73%	10.36%	100.00%
10. Kab. Banyuwangi	18.10%	73.15%	91.25%	0.48%	0.77%	1.25%	7.50%	100.00%
11. Kab. Bondowoso	11.58%	55.19%	66.76%	4.24%	5.87%	10.11%	23.13%	100.00%
12. Kab. Situbondo	3.36%	73.85%	77.20%	3.59%	2.82%	6.41%	16.38%	100.00%
13. Kab. Probolinggo	31.59%	45.88%	77.47%	10.93%	0.72%	11.64%	10.89%	100.00%
14. Kab. Pasuruan	13.16%	44.47%	57.63%	8.20%	12.22%	20.43%	21.94%	100.00%
15. Kab. Sidoarjo	0.38%	96.56%	96.95%	0.87%	0.70%	1.57%	1.48%	100.00%
16. Kab. Mojokerto	19.84%	20.59%	40.44%	13.86%	15.51%	29.38%	30.19%	100.00%
17. Kab. Jombang	42.76%	34.50%	77.27%	5.10%	0.45%	5.54%	17.19%	100.00%
18. Kab. Nganjuk	25.83%	36.91%	62.73%	13.78%	1.60%	15.38%	21.89%	100.00%
19. Kab. Madiun	6.42%	61.59%	68.01%	2.94%	9.69%	12.63%	19.36%	100.00%
20. Kab. Magetan	12.67%	64.01%	76.68%	10.47%	4.30%	14.77%	8.55%	100.00%
21. Kab. Ngawi	1.15%	56.29%	57.44%	4.36%	11.92%	16.29%	26.28%	100.00%
22. Kab. Bojonegoro	9.22%	12.95%	22.16%	6.13%	1.68%	7.81%	70.03%	100.00%
23. Kab. Tuban	4.96%	7.54%	12.50%	9.95%	3.01%	12.96%	74.54%	100.00%
24. Kab. Lamongan	3.03%	5.20%	8.23%	4.55%	11.24%	15.79%	75.98%	100.00%
25. Kab. Gresik	1.44%	0.27%	1.71%	6.03%	3.04%	9.07%	89.22%	100.00%
26. Kab. Bangkalan	4.61%	4.97%	9.58%	2.42%	1.52%	3.94%	86.48%	100.00%
27. Kab. Sampang	6.79%	10.81%	17.60%	1.21%	2.71%	3.92%	78.48%	100.00%
28. Kab. Pamekasan	27.67%	8.58%	36.26%	5.77%	0.10%	5.87%	57.87%	100.00%
29. Kab. Sumenep	16.76%	2.86%	19.61%	7.43%	0.85%	8.28%	72.11%	100.00%
30. Kod. Kediri	3.84%	50.13%	53.97%	0.00%	13.88%	13.88%	32.15%	100.00%
31. Kod. Blitar	0.00%	62.87%	62.87%	6.44%	20.58%	27.02%	10.10%	100.00%
32. Kod. Malang	0.46%	41.18%	41.64%	38.11%	18.94%	57.06%	1.30%	100.00%
33. Kod. Probolinggo	65.42%	33.40%	98.82%	0.00%	0.00%	0.00%	1.18%	100.00%
34. Kod. Pasuruan	0.00%	91.62%	91.62%	4.19%	0.00%	4.19%	4.19%	100.00%
35. Kod. Mojokerto	19.46%	52.07%	71.53%	1.82%	5.96%	7.79%	20.68%	100.00%
36. Kod. Madiun	9.58%	90.20%	99.77%	0.00%	0.00%	0.00%	0.23%	100.00%
37. Kod. Surabaya	2.87%	13.93%	16.80%	5.63%	6.07%	11.71%	71.50%	100.00%
East Java Total	14.20%	37.21%	51.40%	5.85%	5.96%	11.81%	36.78%	100.00%

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

### 2.3.2 Landuse in Study Area

Landuses of Kabupatens in the Study Area in 1987 are summarized for respective Kecamatans as shown in Tables 2.7 through 2.11. Kecamatans that have more than 30% of developed building area are as follows:

Kab. Sidoarjo	:	Taman	(40.34%, 1,163 ha)
		Sukodono	(32.76%, 1,033 ha)
		Gedangan	(38.80%, 896 ha)
		Waru	(47.69%, 1,322 ha)
Kab. Gresik	:	Gresik	(36.76%, 193 ha)
Kab. Mojokerto	:	Sooko	(32.65%, 765 ha)
Kodya Surabaya	:	Almost all Kecamatans except for Rungkut, Lakarsantri and Benowo	
Kodya Mojokerto	:	All the Kecamatans	

The landuse in Kab. Sidoarjo, Gresik, Mojokerto and Kodya Mojokerto is presented in Fig. 2.3 through 2.6 (Source : BAPPEDA of respective Kabupatens and Kotamadya).

**Table 2.7 (1) Landuse in Kabupaten Sidoarjo in 1987 (1)**

(unit: ha)

Kecamatan	Dry Land							Wet Land			Total
	Devel-oped for Building	Garden/Shift Cultivation	Swamp/Pond	Tempo-rary Un-utilized	Forest/Pasture	Plan-tation	Other Dry Land	Technical Irrigation	Semi-Tech. Irrigation	Other Wet Land	
1. Tarik *	800		1				105	2,323	10	11	3,250
2. Prambon	803	8	12				167	2,147	2		3,139
3. Krembong	515	29					67	1,832			2,443
4. Porong	697	86	496				118	1,321	17	40	2,775
5. Jabon	419	180	3,732				247	1,631	16		6,225
6. Tanggulangin	702		500				131	1,669			3,002
7. Candi	894	14	1,034				151	1,533	56	82	3,764
8. Sidoarjo	936	25	2,930	73			213	1,122	85	170	5,554
9. Tulangan	821						156	1,983			2,960
10. Wonoayu	202	621				8	131	2,319			3,281
11. Krian	831	25					85	2,061			3,002
12. Bolong Bendo *	618	120					135	1,984	6	1	2,864
13. Taman	1,163	14	4	36			168	1,396	50	52	2,883
14. Sukodono	1,033	8					110	2,002			3,153
15. Buduran	734	2	1,636					1,076	11	88	3,547
16. Gedangan	896						121	1,292			2,309
17. Sedati	571	20	3,666	3			820	982	130		6,192
18. Waru	1,322	34	715				203	409	89		2,772
<b>Total</b>	<b>13,957</b>	<b>1,186</b>	<b>14,726</b>	<b>112</b>	<b>0</b>	<b>8</b>	<b>3,128</b>	<b>29,082</b>	<b>472</b>	<b>444</b>	<b>63,115</b>

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Note : \* denotes Kecamatan where the planned Toll Road is located.

**Table 2.7 (2) Landuse in Kabupaten Sidoarjo in 1987 (2)**

Kecamatan	Dry Land							Wet Land			Total
	Devel-oped for Building	Garden/Shift Cultivation	Swamp/Pond	Tempo-rary Un-utilized	Forest/Pasture	Plan-tation	Other Dry Land	Technical Irrigation	Semi-Tech. Irrigation	Other Wet Land	
1. Tarik *	24.62%		0.03%				3.23%	71.48%	0.31%	0.34%	100.00%
2. Prambon	25.58%	0.25%	0.38%				5.32%	68.40%	0.06%		100.00%
3. Krembong	21.08%	1.19%					2.74%	74.99%			100.00%
4. Porong	25.12%	3.10%	17.87%				4.25%	47.60%	0.61%	1.44%	100.00%
5. Jabon	6.73%	2.89%	59.95%				3.97%	26.20%	0.26%		100.00%
6. Tanggulangin	23.38%		16.66%				4.36%	55.60%			100.00%
7. Candi	23.75%	0.37%	27.47%				4.01%	40.73%	1.49%	2.18%	100.00%
8. Sidoarjo	16.85%	0.45%	52.75%	1.31%			3.84%	20.20%	1.53%	3.06%	100.00%
9. Tulangan	27.74%						5.27%	66.99%			100.00%
10. Wonoayu	6.16%	18.93%				0.24%	3.99%	70.68%			100.00%
11. Krian	27.68%	0.83%					2.83%	68.65%			100.00%
12. Bolong Bendo *	21.58%	4.19%					4.71%	69.27%	0.21%	0.03%	100.00%
13. Taman	40.34%	0.49%	0.14%	1.25%			5.83%	48.42%	1.73%	1.80%	100.00%
14. Sukodono	32.76%	0.25%					3.49%	63.50%			100.00%
15. Buduran	20.69%	0.06%	46.12%					30.34%	0.31%	2.48%	100.00%
16. Gedangan	38.80%						5.24%	55.95%			100.00%
17. Sedati	9.22%	0.32%	59.21%	0.05%			13.24%	15.86%	2.10%		100.00%
18. Waru	47.69%	1.23%	25.79%				7.32%	14.75%	3.21%		100.00%
<b>Total</b>	<b>22.11%</b>	<b>1.88%</b>	<b>23.33%</b>	<b>0.18%</b>	<b>0.00%</b>	<b>0.01%</b>	<b>4.96%</b>	<b>46.08%</b>	<b>0.75%</b>	<b>0.70%</b>	<b>100.00%</b>

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Note : \* denotes Kecamatan where the planned Toll Road is located.



Table 2.8 (1) Landuse in Kabupaten Gresik in 1987 (1)

(unit: ha)

Kecamatan	Dry Land							Wet Land			Total
	Devel-oped for Building	Garden/Shift Cul-tivation	Swamp/ Pond	Tempo-rary Un-utilized	Forest/ Pasture	Plan-tation	Other Dry Land	Technical Irrigation	Semi-Tech. Irrigation	Other Wet Land	
1. Wringin Anom *	974	2,643				2	39		227	2,375	6,260
2. Driyorejo *	1,043	1,215					517		186	2,168	5,129
3. Menganti	864	2,742	66				159			3,041	6,872
4. Kedamean	747	2,119	76			36	195			3,423	6,596
5. B. Panggang	1,034	793					157			4,216	6,200
6. Benjeng	558	1,144	131				225			4,070	6,128
7. Cerme	479	1,180	599				372	603	1,726	2,208	7,167
8. Kebomas	246	875	399			115	998		30	304	2,967
9. Gresik	193	12		32			288				525
10. Manyar	697	708	4,506	4	57		83		562	1,669	8,286
11. D. Sampeyan	204	65	4,811		7		433		450	1,477	7,447
12. Bungah	227	2,330	3,401				104		454	1,506	8,022
13. Sedayu	206	978	1,562		8		223	111		1,433	4,521
14. Dukun	401	1,478	6			250	44		145	3,592	5,916
15. Paanceng	159	3,127	150		1,018		391			1,413	6,258
16. Ujung Pangkah	108	3,275	4,094				1,013			993	9,483
17. Sangkapura	1,686	5,388			2,425		481		6	1,896	11,882
18. Tambak	800	1,617	2	983	2,060	403	432			1,449	7,746
Total	10,626	31,689	19,803	1,019	5,575	806	6,154	714	3,786	37,233	117,405

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Note : \* denotes Kecamatan where the planned Toll Road is located.

Table 2.8 (2) Landuse in Kabupaten Gresik in 1987 (2)

Kecamatan	Dry Land							Wet Land			Total
	Devel-oped for Building	Garden/Shift Cul-tivation	Swamp/ Pond	Tempo-rary Un-utilized	Forest/ Pasture	Plan-tation	Other Dry Land	Technical Irrigation	Semi-Tech. Irrigation	Other Wet Land	
1. Wringin Anom *	15.56%	42.22%				0.03%	0.62%		3.63%	37.94%	100.00%
2. Driyorejo *	20.34%	23.69%					10.08%		3.63%	42.27%	100.00%
3. Menganti	12.57%	39.90%	0.96%				2.31%			44.25%	100.00%
4. Kedamean	11.33%	32.13%	1.15%			0.55%	2.96%			51.90%	100.00%
5. B. Panggang	16.68%	12.79%					2.53%			68.00%	100.00%
6. Benjeng	9.11%	18.67%	2.14%				3.67%			66.42%	100.00%
7. Cerme	6.68%	16.46%	8.36%				5.19%	8.41%	24.08%	30.81%	100.00%
8. Kebomas	8.29%	29.49%	13.45%			3.88%	33.64%		1.01%	10.25%	100.00%
9. Gresik	36.76%	2.29%		6.10%			54.86%				100.00%
10. Manyar	8.41%	8.54%	54.38%	0.05%	0.69%		1.00%		6.78%	20.14%	100.00%
11. D. Sampeyan	2.74%	0.87%	64.60%		0.09%		5.81%		6.04%	19.83%	100.00%
12. Bungah	2.83%	29.05%	42.40%				1.30%		5.66%	18.77%	100.00%
13. Sedayu	4.56%	21.63%	34.55%		0.18%		4.93%	2.46%		31.70%	100.00%
14. Dukun	6.78%	24.98%	0.10%			4.23%	0.74%		2.45%	60.72%	100.00%
15. Paanceng	2.54%	49.97%	2.40%		16.27%		6.25%			22.58%	100.00%
16. Ujung Pangkah	1.14%	34.54%	43.17%				10.68%			10.47%	100.00%
17. Sangkapura	14.19%	45.35%			20.41%		4.05%		0.05%	15.96%	100.00%
18. Tambak	10.33%	20.88%	0.03%	12.69%	26.59%	5.20%	5.58%			18.71%	100.00%
Total	9.05%	26.99%	16.87%	0.87%	4.75%	0.69%	5.24%	0.61%	3.22%	31.71%	100.00%

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Note : \* denotes Kecamatan where the planned Toll Road is located.

**Table 2.9 (1) Landuse in Kabupaten Mojokerto in 1987 (1)**

(unit: ha)

Kecamatan	Dry Land							Wet Land			Total
	Devel-oped for Building	Garden/Shift Cultivation	Swamp/Pond	Tempo-rary Un-utilized	Forest/Pasture	Plan-tation	Other Dry Land	Technical Irrigation	Semi-Tech. Irrigation	Other Wet Land	
1. Jatirejo	590	116	1		4,523	12	388	1,812	224	156	7,822
2. Gondang	570	477	2		2,496	263	178	365	1,836	90	6,277
3. Pacet	556	549	1		7,236	85	241	1,051	1,396	725	11,840
4. Trawas	485	1,546			2,845			141	131	724	5,872
5. Ngoro	1,004	3,380			7,781		22		633	662	13,482
6. Pungging	1,136	499					774		1,977	156	4,542
7. Kutorejo	874	95					438	1,426	913	351	4,097
8. Mojosari	797	181					23	167	861	640	2,669
9. Dlangu	799	28	7			3	113	2,426		169	3,545
10. Bangsal	708	145					402	780	1,118	298	3,451
11. Puri *	1,170	1,018	3				229	1,276	730	528	4,954
12. Trowulan	929	344			63		596	1,798	75	596	4,401
13. Sooko	765	82					94	1,126	149	127	2,343
14. Gedek	528	29	6				203	1,682	4		2,452
15. Kemlagi	719	359			1,843		174	317	565	1,731	5,708
16. Jetis	918	1,336	4		947		778	615	272	1,815	6,685
17. D. Blandong	518	2,689	3		1,700		323			2,417	7,650
<b>Total</b>	<b>13,066</b>	<b>12,873</b>	<b>27</b>	<b>0</b>	<b>29,434</b>	<b>363</b>	<b>4,976</b>	<b>14,982</b>	<b>10,884</b>	<b>11,185</b>	<b>97,790</b>

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Note : \* denotes Kecamatan where the planned Toll Road is located.

**Table 2.9 (2) Landuse in Kabupaten Mojokerto in 1987 (2)**

Kecamatan	Dry Land							Wet Land			Total
	Devel-oped for Building	Garden/Shift Cultivation	Swamp/Pond	Tempo-rary Un-utilized	Forest/Pasture	Plan-tation	Other Dry Land	Technical Irrigation	Semi-Tech. Irrigation	Other Wet Land	
1. Jatirejo	7.54%	1.48%	0.01%		57.82%	0.15%	4.96%	23.17%	2.86%	1.99%	100.00%
2. Gondang	9.08%	7.60%	0.03%		39.76%	4.19%	2.84%	5.81%	29.25%	1.43%	100.00%
3. Pacet	4.70%	4.64%	0.01%		61.11%	0.72%	2.04%	8.88%	11.79%	6.12%	100.00%
4. Trawas	8.26%	26.33%			48.45%			2.40%	2.23%	12.33%	100.00%
5. Ngoro	7.45%	25.07%			57.71%		0.16%		4.70%	4.91%	100.00%
6. Pungging	25.01%	10.99%					17.04%		43.53%	3.43%	100.00%
7. Kutorejo	21.33%	2.32%					10.69%	34.81%	22.28%	8.57%	100.00%
8. Mojosari	29.86%	6.78%					0.86%	6.26%	32.26%	23.98%	100.00%
9. Dlangu	22.54%	0.79%	0.20%			0.08%	3.19%	68.43%		4.77%	100.00%
10. Bangsal	20.52%	4.20%					11.65%	22.60%	32.40%	8.64%	100.00%
11. Puri *	23.62%	20.55%	0.06%				4.62%	25.76%	14.74%	10.66%	100.00%
12. Trowulan	21.11%	7.82%			1.43%		13.54%	40.85%	1.70%	13.54%	100.00%
13. Sooko	32.65%	3.50%					4.01%	48.06%	6.36%	5.42%	100.00%
14. Gedek	21.53%	1.18%	0.24%				8.28%	68.60%	0.16%		100.00%
15. Kemlagi	12.60%	6.29%			32.29%		3.05%	5.55%	9.90%	30.33%	100.00%
16. Jetis	13.73%	19.99%	0.06%		14.17%		11.64%	9.20%	4.07%	27.15%	100.00%
17. D. Blandong	6.77%	35.15%	0.04%		22.22%		4.22%			31.59%	100.00%
<b>Total</b>	<b>13.36%</b>	<b>13.16%</b>	<b>0.03%</b>	<b>0.00%</b>	<b>30.10%</b>	<b>0.37%</b>	<b>5.09%</b>	<b>15.32%</b>	<b>11.13%</b>	<b>11.44%</b>	<b>100.00%</b>

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Note : \* denotes Kecamatan where the planned Toll Road is located.

Table 2.10 (1) Landuse in Kotamadya Surabaya in 1987 (1)

(unit: ha)

Kecamatan	Dry Land						Wet Land			Total	
	Devel- oped for Building	Garden/ Shift Cul- tivation	Swamp/ Pond	Tempo- rary Un- utilized	Forest/ Pasture	Plan- tation	Other Dry Land	Technical Irrigation	Semi- Tech. Irrigation		Other Wet Land
1. Karang Pilang *	1,119	380					327		224	485	2,535
2. Wonocolo	625						683	157	67	87	1,619
3. Rungkut	1,072	47					2,007	243	185	90	3,644
4. Wonokromo *	462						208				670
5. Tengalsari	458						32				490
6. Sawahan	617						147				764
7. Genteng	286						67				353
8. Gubeng	738						2	10			750
9. Sukolilo	1,621						1,220	60	33	64	2,998
10. Tambaksari	835	13					24	37			909
11. Simokerto	203						61				264
12. P. Cahlikan	370						52				422
13. Bubutan	329						28				357
14. Tandes	1,374						1,605	240			3,219
15. Krembangan	251						100				351
16. Semampir	650						13				663
17. Lankarsantri *	657	1,115					118		40	1,518	3,448
18. Kenjeran	591	23					267	55	10	210	1,146
19. Benowo	455	357	2,268				64			960	4,104
Total	12,703	1,935	2,268	0	0	0	7,025	802	559	3,414	28,706

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Note : \* denotes Kecamatan where the planned Toll Road is located.

Table 2.10 (2) Landuse in Kotamadya Surabaya in 1987 (2)

Kecamatan	Dry Land						Wet Land			Total	
	Devel- oped for Building	Garden/ Shift Cul- tivation	Swamp/ Pond	Tempo- rary Un- utilized	Forest/ Pasture	Plan- tation	Other Dry Land	Technical Irrigation	Semi- Tech. Irrigation		Other Wet Land
1. Karang Pilang *	44.14%	14.99%	0.00%				12.90%		8.84%	19.13%	100.00%
2. Wonocolo	38.60%						42.19%	9.70%	4.14%	5.37%	100.00%
3. Rungkut	29.42%	1.29%					55.08%	6.67%	5.08%	2.47%	100.00%
4. Wonokromo *	68.96%						31.04%				100.00%
5. Tengalsari	93.47%						6.53%				100.00%
6. Sawahan	80.76%						19.24%				100.00%
7. Genteng	81.02%						18.98%				100.00%
8. Gubeng	98.40%						0.27%	1.33%			100.00%
9. Sukolilo	54.07%						40.69%	2.00%	1.10%	2.13%	100.00%
10. Tambaksari	91.86%	1.43%					2.64%	4.07%			100.00%
11. Simokerto	76.89%						23.11%				100.00%
12. P. Cantikan	87.68%						12.32%				100.00%
13. Bubutan	92.16%						7.84%				100.00%
14. Tandes	42.68%						49.86%	7.46%			100.00%
15. Krembangan	71.51%						28.49%				100.00%
16. Semampir	98.04%						1.96%				100.00%
17. Lankarsantri *	19.05%	32.34%					3.42%		1.16%	44.03%	100.00%
18. Kenjeran	50.70%	2.01%					23.30%	4.80%	0.87%	18.32%	100.00%
19. Benowo	11.09%	8.70%	55.26%				1.56%			23.39%	100.00%
Total	44.25%	6.74%	7.90%	0.00%	0.00%	0.00%	24.47%	2.79%	1.95%	11.89%	100.00%

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

Note : \* denotes Kecamatan where the planned Toll Road is located.

**Table 2.11 (1) Landuse in Kotamadya Mojokerto in 1987 (1)**

(unit: ha)

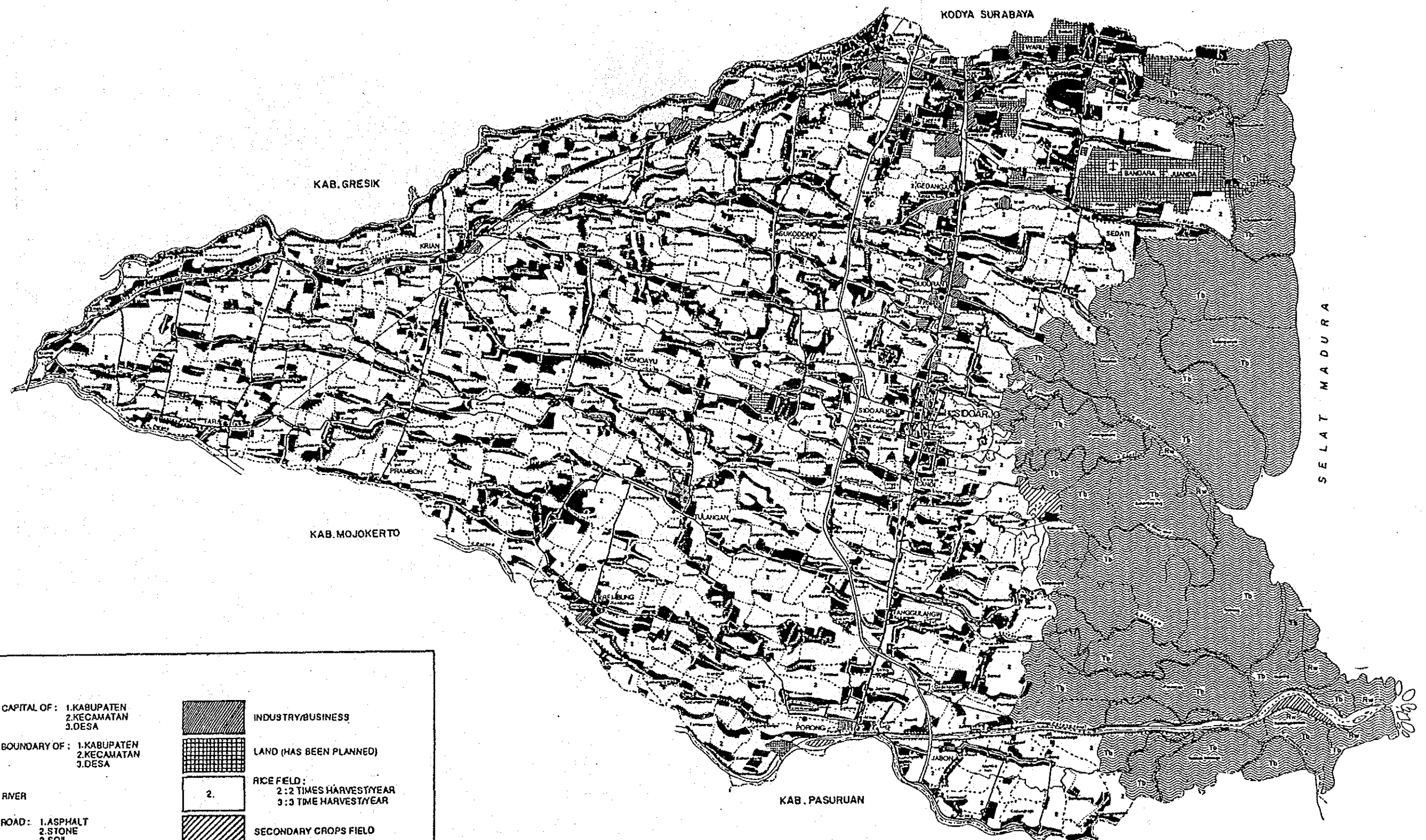
Kecamatan	Dry Land							Wet Land			Total
	Devel-oped for Building	Garden/Shift Cul-tivation	Swamp/Pond	Tempo-rary Un-utilized	Forest/Pasture	Plan-tation	Other Dry Land	Technical Irrigation	Semi-Tech. Irrigation	Other Wet Land	
1. Prajurit Kulon	308	58					37	318	5	50	776
2. Magersari	392						30	270	59	120	871
<b>Total</b>	<b>700</b>	<b>58</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>67</b>	<b>588</b>	<b>64</b>	<b>170</b>	<b>1,647</b>

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province

**Table 2.11 (2) Landuse in Kotamadya Mojokerto in 1987 (2)**

Kecamatan	Dry Land							Wet Land			Total
	Devel-oped for Building	Garden/Shift Cul-tivation	Swamp/Pond	Tempo-rary Un-utilized	Forest/Pasture	Plan-tation	Other Dry Land	Technical Irrigation	Semi-Tech. Irrigation	Other Wet Land	
1. Prajurit Kulon	39.69%	7.47%					4.77%	40.98%	0.64%	6.44%	100.00%
2. Magersari	45.01%						3.44%	31.00%	6.77%	13.78%	100.00%
<b>Total</b>	<b>42.50%</b>	<b>3.52%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>4.07%</b>	<b>35.70%</b>	<b>3.89%</b>	<b>10.32%</b>	<b>100.00%</b>

Source : LUAS TANAH, Menurut Penggunaannya di Jawa Timur 1987  
Statistical Office of East Java Province



**LEGEND**

	CAPITAL OF: 1.KABUPATEN 2.KECAMATAN 3.DESA		INDUSTRY/BUSINESS
	BOUNDARY OF: 1.KABUPATEN 2.KECAMATAN 3.DESA		LAND (HAS BEEN PLANNED)
	RIVER		RICE FIELD: 2:2 TIMES HARVEST/YEAR 3:3 TIME HARVEST/YEAR
	ROAD: 1.ASPHALT 2.STONE 3.SOIL		SECONDARY CROPS FIELD
	ROAD: 1.TOLL 2.RAILWAY		Tb : EMBANKMENT Rw : SWAMP
	VILLAGE: K: CEMETERY E: EMPLACEMENT L: FIELD		AIRPORT
	SERVICE		DIKE

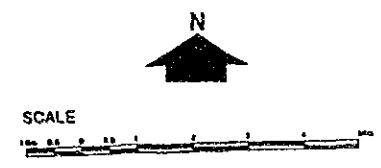
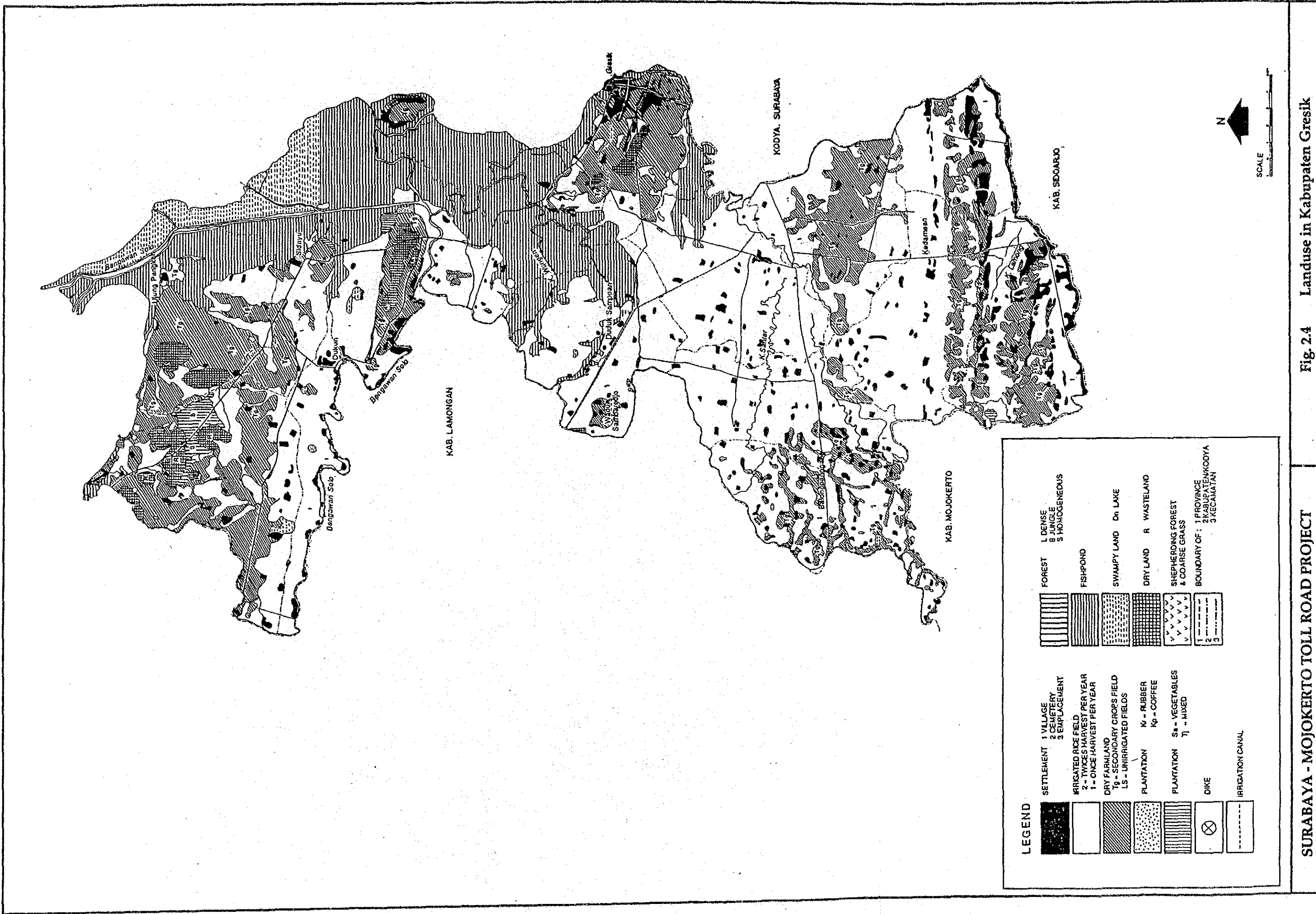


Fig. 2.3 Landuse in Kabupaten Sidoarjo



**LEGEND**

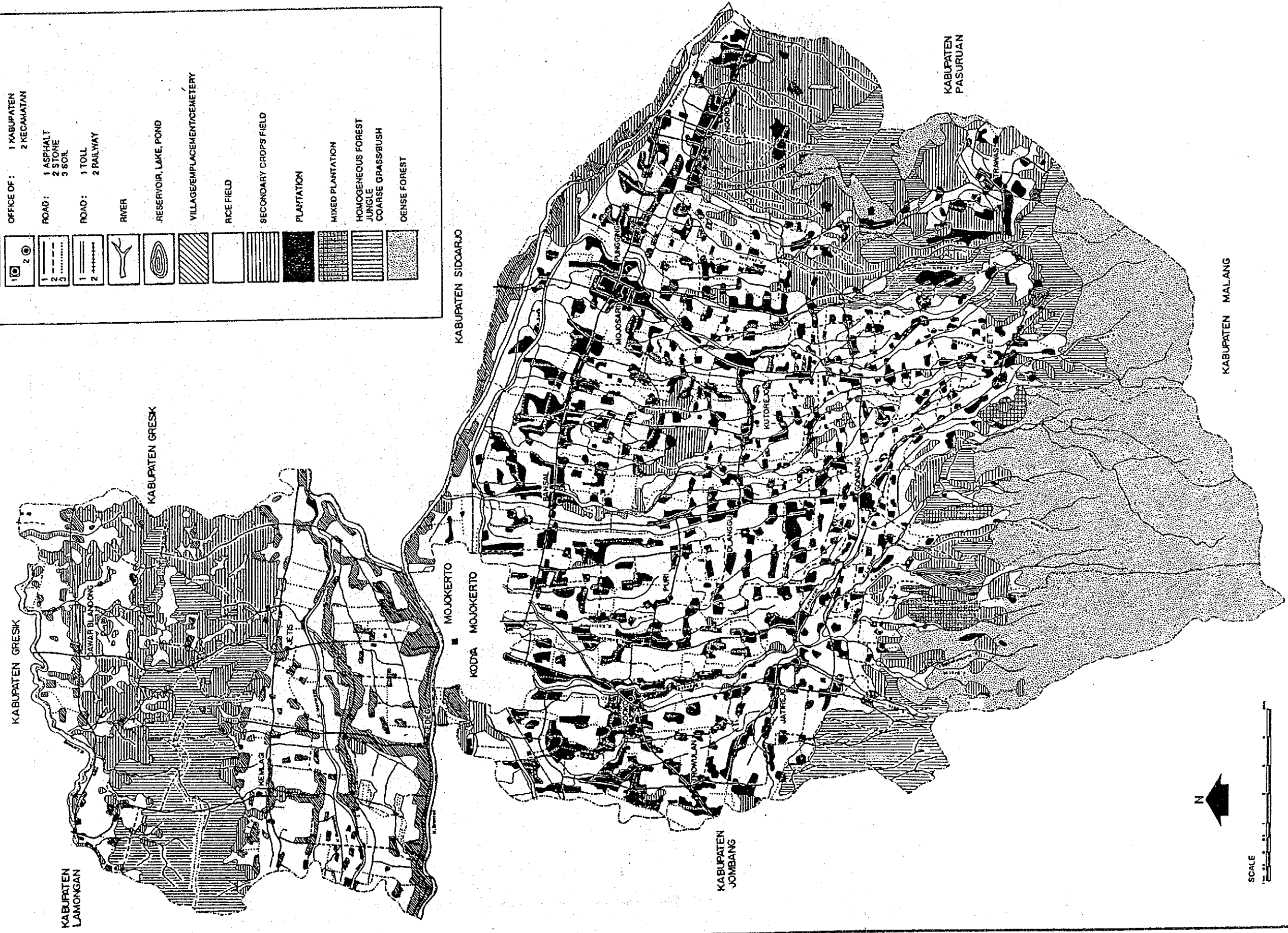
<ul style="list-style-type: none"> <li>SETTLEMENT           <ul style="list-style-type: none"> <li>1 VILLAGE</li> <li>2 CEMETERY</li> <li>3 EMPLOYMENT</li> </ul> </li> <li>IRRIGATED RICE FIELD           <ul style="list-style-type: none"> <li>2 - TWICES HARVEST PER YEAR</li> <li>1 - ONCE HARVEST PER YEAR</li> </ul> </li> <li>DRY FARMLAND           <ul style="list-style-type: none"> <li>T<sub>0</sub> - SECONDARY CROPS FIELDS</li> <li>LS - UNIRRIGATED FIELDS</li> </ul> </li> <li>PLANTATION           <ul style="list-style-type: none"> <li>K<sub>0</sub> - RUBBER</li> <li>K<sub>0</sub> - COFFEE</li> </ul> </li> <li>PLANTATION           <ul style="list-style-type: none"> <li>S<sub>a</sub> - VEGETABLES</li> <li>T<sub>1</sub> - MIXED</li> </ul> </li> <li>DIKE</li> <li>IRRIGATION CANAL</li> </ul>	<ul style="list-style-type: none"> <li>FOREST           <ul style="list-style-type: none"> <li>L DENSE</li> <li>B JUNGLE</li> <li>S HOMOGENEOUS</li> </ul> </li> <li>FISHPOND</li> <li>SWAMPY LAND OR LAKE</li> <li>DRY LAND OR WASTELAND</li> <li>SHEPHERDING FOREST &amp; COARSE GRASS</li> <li>BOUNDARY OF :           <ul style="list-style-type: none"> <li>1 PROVINCE</li> <li>2 KABUPATEN/KODYA</li> <li>3 KECAMATAN</li> </ul> </li> </ul>
---	--

SURABAYA - MOJOKERTO TOLL ROAD PROJECT

Fig. 2.4 Landuse in Kabupaten Gresik

**LEGEND**

1	BOUNDARY OF: 1 KABUPATEN/KODYA
2	2 KECAMATAH
1	OFFICE OF: 1 KABUPATEN
2	2 KECAMATAH
1	ROAD: 1 ASPHALT
2	2 STONE
3	3 SOIL
1	ROAD: 1 TOLL
2	2 RAILWAY
(Symbol)	RIVER
(Symbol)	RESERVOIR, LAKE, POND
(Symbol)	VILLAGE/PLACEMENT/CEMETERY
(Symbol)	RICE FIELD
(Symbol)	SECONDARY CROPS FIELD
(Symbol)	PLANTATION
(Symbol)	MIXED PLANTATION
(Symbol)	HOMOGENEOUS FOREST
(Symbol)	JUNGLE
(Symbol)	COARSE GRASS/BUSH
(Symbol)	DENSE FOREST



SURABAYA - MOJOKERTO TOLL ROAD PROJECT

Fig. 2.5 Landuse in Kabupaten Mojokerto

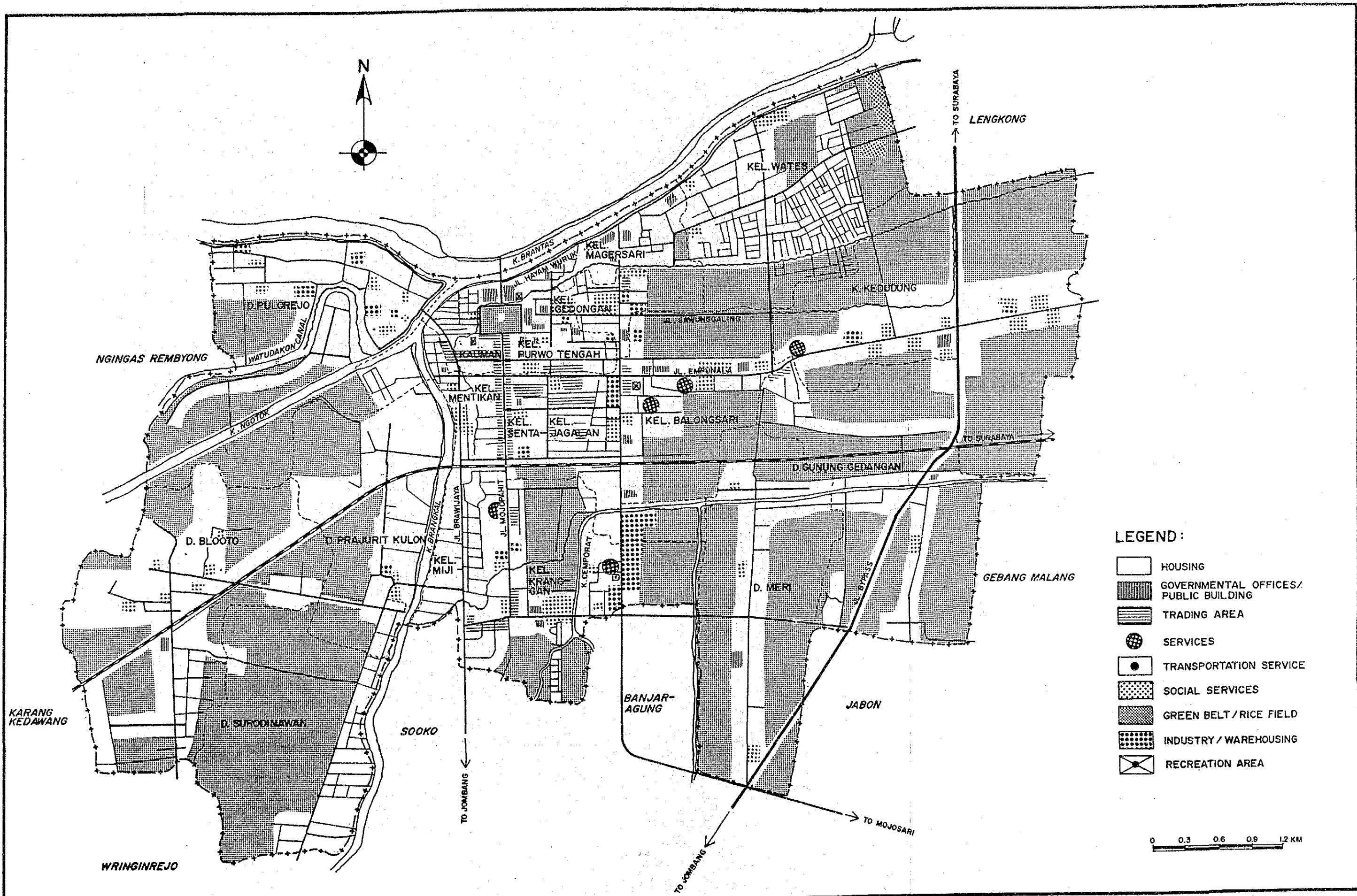


Fig. 2.6 Landuse in Kotamadya Mojokerto





## 2.4 Gross (Regional) Domestic Product (G(R)DP)

### 2.4.1 GDP of Indonesia

Indonesia's GDP in 1988 is 139,452 Billion Rupiah at current price and 99,697 Billion Rupiah at 1983 constant price as shown in Tables 2.12 and 2.13. The average real growth rate of GDP is 6.23% p.a. during 1983-1988.

The industrial structure of Indonesia still relies upon the agricultural sector (24.1%), but the manufacturing sector is steadily growing and has expanded its share from 11.1% in 1983 to 18.5% in 1988 in terms of current prices.

According to the news leaflet issued by the Bank of Tokyo in Jakarta, real growth of GDP is estimated at 6.0% during 1988-1989 and 7.4% during 1989-1990. Therefore, GDP in 1990 is estimated to be 113,499 Billion Rupiah at 1983 constant prices.

**Table 2.12 GDP and Industrial Structure of Indonesia at Current Prices**

Industrial Origin	1983		1988		Growth Rate (% p.a.)
	(Billion Rp.)	(% Share)	(Billion Rp.)	(% Share)	
1. Agriculture, Forestry and Fishery	17,696.2	(24.01%)	33,597.8	(24.09%)	13.68%
2. Mining and Quarrying	13,967.9	(18.95%)	16,184.9	(11.61%)	2.99%
3. Manufacturing Industries	8,211.3	(11.14%)	25,821.0	(18.52%)	25.75%
4. Electricity, Gas and Water Supply	524.3	(0.71%)	836.9	(0.60%)	9.80%
5. Construction	4,597.2	(6.24%)	6,988.4	(5.01%)	8.74%
6. Trade, Hotel and Restaurant	12,009.4	(16.30%)	24,167.2	(17.33%)	15.01%
7. Transportation and Communication	3,978.0	(5.40%)	8,059.3	(5.78%)	15.17%
8. Banking and Other Financial Institutions	2,039.2	(2.77%)	5,263.4	(3.77%)	20.88%
9. Ownership of Dwelling	1,961.8	(2.66%)	3,736.0	(2.68%)	13.75%
10. Public Administration and Defense	5,711.5	(7.75%)	9,446.2	(6.77%)	10.59%
11. Services	3,000.8	(4.07%)	5,351.0	(3.84%)	12.26%
Gross Domestic Product	73,697.6	(100.00%)	139,452.1	(100.00%)	13.60%

Source : Statistical Year Book of Indonesia, 1985 and 1989

**Table 2.13 GDP and Industrial Structure of Indonesia at 1983 Constant Prices**

Industrial Origin	1983		1988		Growth Rate (% p.a.)
	(Billion Rp.)	(% Share)	(Billion Rp.)	(% Share)	
1. Agriculture, Forestry and Fishery	17,696.2	(24.01%)	21,007.6	(21.07%)	3.49%
2. Mining and Quarrying	13,967.9	(18.95%)	15,934.0	(15.98%)	2.67%
3. Manufacturing Industries	8,211.3	(11.14%)	18,339.9	(18.40%)	17.43%
4. Electricity, Gas and Water Supply	524.3	(0.71%)	547.5	(0.55%)	0.87%
5. Construction	4,597.2	(6.24%)	5,119.1	(5.13%)	2.17%
6. Trade, Hotel and Restaurant	12,009.4	(16.30%)	15,662.3	(15.71%)	5.45%
7. Transportation and Communication	3,978.0	(5.40%)	5,225.2	(5.24%)	5.61%
8. Banking and Other Financial Institutions	2,039.2	(2.77%)	3,597.2	(3.61%)	12.02%
9. Ownership of Dwelling	1,961.8	(2.66%)	2,762.2	(2.77%)	7.08%
10. Public Administration and Defense	5,711.5	(7.75%)	7,932.1	(7.96%)	6.79%
11. Services	3,000.8	(4.07%)	3,569.8	(3.58%)	3.53%
<b>Gross Domestic Product</b>	<b>73,697.6</b>	<b>(100.00%)</b>	<b>99,696.9</b>	<b>(100.00%)</b>	<b>6.23%</b>

Source : Statistical Year Book of Indonesia, 1985 and 1989

#### 2.4.2 GRDP of Java and East Java

##### (1) GRDP of Java

The GRDP of Java occupies about 50% of the GDP of Indonesia. The growth rate of Java's GRDP is relatively higher, i.e. 6.71% p.a., than Indonesia's GDP, i.e. 6.23% p.a. as shown in Table 2.14.

**Table 2.14 GRDP of Java and GDP of Indonesia (at 1983 Constant Price)**

(Unit: Billion Rp.)

Year	1983	1984	1985	1986	1987	Av. Annual Growth Rate
Java	36,586	40,420	42,670	45,223	47,443	6.71%
(% share)	(49.6)	(51.7)	(53.3)	(50.2)	(50.3)	
Indonesia	73,698	78,214	80,120	90,014	94,302	6.23%
(% share)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	

Source: Statistical Year Book of Indonesia, 1989

Assuming that the contribution of Java's GRDP to Indonesia's GDP remains unchanged up to the present time of 1990, Java's GRDP in 1990 was estimated at 58,447 Billion Rupiah at 1983 constant prices.

(2) GRDP of East Java

GRDP in East Java Province in 1989 is 24,569 Billion Rupiah at current prices and 15,457 Billion Rupiah at 1983 constant prices as shown in Tables 2.15 and 2.16. The real growth rate of GRDP during 1983-1988 is 5.91% p.a. and this is a little lower than the Indonesian average of 6.23% p.a.

The industrial structure of East Java Province depends much more on the agricultural sector (30.57%) than the Indonesia average (24.09%) in 1988, in terms of current prices. The share of manufacturing industry in East Java is 18.32% which is almost the same as that in Indonesia, i.e. 18.52%.

The manufacturing industry in East Java has been growing beyond the average growth rate of GRDP in terms of 1983 constant price. However, the speed in the growth (9.17% p.a. during 1983-1988) is slow, compared to the Indonesia average (17.43% p.a. during 1983-1988). This is because the contribution of manufacturing industry to Indonesia's GDP in 1983 was low compared with that of East Java's GRDP in 1983.

During 1988-1989, the manufacturing industry in East Java seemed to accelerate, so that the total GRDP raised by about 1% point and reached nearly 7% p.a. in real economic growth from the previous year.

Assuming that the real growth rate of GRDP in East Java was 7% p.a. during 1989-1990, the GRDP in 1990 was estimated at 16,539,098 Million Rupiah at 1983 constant prices, and the GRDP of the primary and other sectors were estimated for 1990 as shown in Table 2.17.

Table 2.15 GRDP and Industrial Structure of East Java Province at Current Prices

Industrial Origin	1983		1988		1989		1988/1983	1989/1988
	(Million Rp.)	(% Share)	(Million Rp.)	(% Share)	(Million Rp.)	(% Share)		
1. Agriculture, Forestry and Fishery	3,528,584.5	(32.53%)	6,522,341.3	(30.57%)	7,431,935.4	(30.25%)	13.07%	13.95%
2. Mining and Quarrying	45,677.3	(0.42%)	81,934.1	(0.38%)	93,150.7	(0.38%)	12.40%	13.69%
3. Manufacturing Industries	1,768,479.6	(16.31%)	3,907,709.7	(18.32%)	4,585,608.6	(18.66%)	17.18%	17.35%
4. Electricity, Gas and Water Supply	93,974.0	(0.87%)	168,604.0	(0.79%)	191,205.4	(0.78%)	12.40%	13.41%
5. Construction	512,929.6	(4.73%)	904,094.6	(4.24%)	1,014,473.3	(4.13%)	12.00%	12.21%
6. Trade, Hotel and Restaurant	2,139,790.4	(19.73%)	4,665,274.9	(21.87%)	5,455,526.2	(22.21%)	16.87%	16.94%
7. Transportation and Communication	716,053.6	(6.60%)	1,377,659.7	(6.46%)	1,574,554.3	(6.41%)	13.98%	14.29%
8. Banking and Other Financial Institutions	180,407.5	(1.66%)	633,552.7	(2.97%)	820,886.6	(3.34%)	28.56%	29.57%
9. Ownership of Dwelling	232,016.2	(2.14%)	375,987.7	(1.76%)	414,502.0	(1.69%)	10.14%	10.24%
10. Public Administration and Defense	995,915.0	(9.18%)	1,637,643.8	(7.68%)	1,810,214.3	(7.37%)	10.46%	10.54%
11. Services	632,398.4	(5.83%)	1,058,034.8	(4.96%)	1,176,753.2	(4.79%)	10.84%	11.22%
Gross Regional Domestic Product (GRDP)	10,846,226.1	(100.00%)	21,332,837.3	(100.00%)	24,568,810.0	(100.00%)	14.49%	15.17%

Source : Government of East Java (BAPPEDA)

Table 2.16 GRDP and Industrial Structure of East Java Province at 1983 Constant Prices

Industrial Origin	1983		1988		1989		Growth Rate (% p.a.)	
	(Million Rp.)	(% Share)	(Million Rp.)	(% Share)	(Million Rp.)	(% Share)	1988/1983	1989/1988
1. Agriculture, Forestry and Fishery	3,528,584.5	(32.53%)	4,299,403.3	(29.75%)	4,501,337.9	(29.12%)	4.03%	4.70%
2. Mining and Quarrying	45,677.3	(0.42%)	61,304.8	(0.42%)	71,215.3	(0.46%)	6.06%	16.17%
3. Manufacturing Industries	1,768,479.6	(16.31%)	2,742,017.9	(18.97%)	3,031,291.2	(19.61%)	9.17%	10.55%
4. Electricity, Gas and Water Supply	93,974.0	(0.87%)	116,457.5	(0.81%)	126,941.6	(0.82%)	4.38%	9.00%
5. Construction	512,929.6	(4.73%)	623,510.8	(4.31%)	654,571.4	(4.23%)	3.98%	4.98%
6. Trade, Hotel and Restaurant	2,139,790.4	(19.73%)	3,025,097.1	(20.93%)	3,249,036.4	(21.02%)	7.17%	7.40%
7. Transportation and Communication	716,053.6	(6.60%)	907,001.9	(6.28%)	957,658.4	(6.20%)	4.84%	5.59%
8. Banking and Other Financial Institutions	180,407.5	(1.66%)	403,627.2	(2.79%)	479,267.8	(3.10%)	17.47%	18.74%
9. Ownership of Dwelling	232,016.2	(2.14%)	281,716.6	(1.95%)	298,271.4	(1.93%)	3.96%	5.88%
10. Public Administration and Defense	995,915.0	(9.18%)	1,230,063.2	(8.51%)	1,288,466.3	(8.34%)	4.31%	4.75%
11. Services	632,398.4	(5.83%)	762,442.3	(5.28%)	799,043.6	(5.17%)	3.81%	4.80%
Gross Regional Domestic Product (GRDP)	10,846,226.1	(100.00%)	14,452,642.6	(100.00%)	15,457,101.3	(100.00%)	5.91%	6.95%

Source : Government of East Java (BAPPEDA)

**Table 2.17 GRDP of East Java in 1990 (at 1983 constant prices)**

(Unit: Million Rp.)

Industrial Sector	1988 <sup>1/</sup>	1989 <sup>1/</sup>	1990 <sup>2/</sup>
Primary Sector	4,299,403	4,501,338	4,714,075
Secondary + Tertiary Sectors	10,153,240	10,955,763	11,825,023
Total	14,452,643	15,457,101	16,539,098

Note: <sup>1/</sup> Source: Government of East Java (BAPPEDA)

<sup>2/</sup> Estimated by JICA Study Team

## 2.5 Vehicle Ownership

### 2.5.1 General

There are two sources of vehicle ownership data. One is the Indonesian State Police which is quoted in the Statistical Year Book of Indonesia and the other is the Directorate of Arterial Road Traffic and Transport (DLLAJR: Direktorat Lalu Lintas dan Angkutan Jalan Raya). The former data source deals with vehicle registration and the latter does the issuance of commercial vehicle license and the vehicle test.

According to the classification of vehicle data by the Indonesian State Police, vehicle classes are defined as follows:

**Passenger Vehicle:** Every vehicle used or adapted to be used for carrying maximum eight passengers excluding a driver, whether or not it is complete with space for baggage.

**Bus:** Every vehicle used or adapted to be used for carrying more than eight passengers excluding a driver, whether or not it is complete with space for baggage.

**Truck:** Any motor vehicles constructed or adapted mainly for carrying goods.

Therefore, the data on registered passenger vehicles and buses cannot identify such mini-buses as Mitsubishi Colt, Suzuki, Daihatsu and Combi, which are used for both private and public transport. The data on registered trucks also cannot distinguish between such light trucks as pick-up trucks and medium/large trucks, which are counted separately for the traffic survey by the Study Team.

In order to improve the vehicle classification, the number of tested vehicles derived from the DLLAJR was compared with the number of registered vehicles. As a