

**The Study
on
Formulation of Spatial Planning
for
GERBANGKERTOSUSILA (GKS) Zone
in
East Java Province, the Republic of Indonesia**

Final Report

**Volume 4:
Development Action Plan for Transportation Sector**

February 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

**Value Planning International, Inc.
Oriental Consultants Co., Ltd.
Yachiyo Engineering Co., Ltd.**

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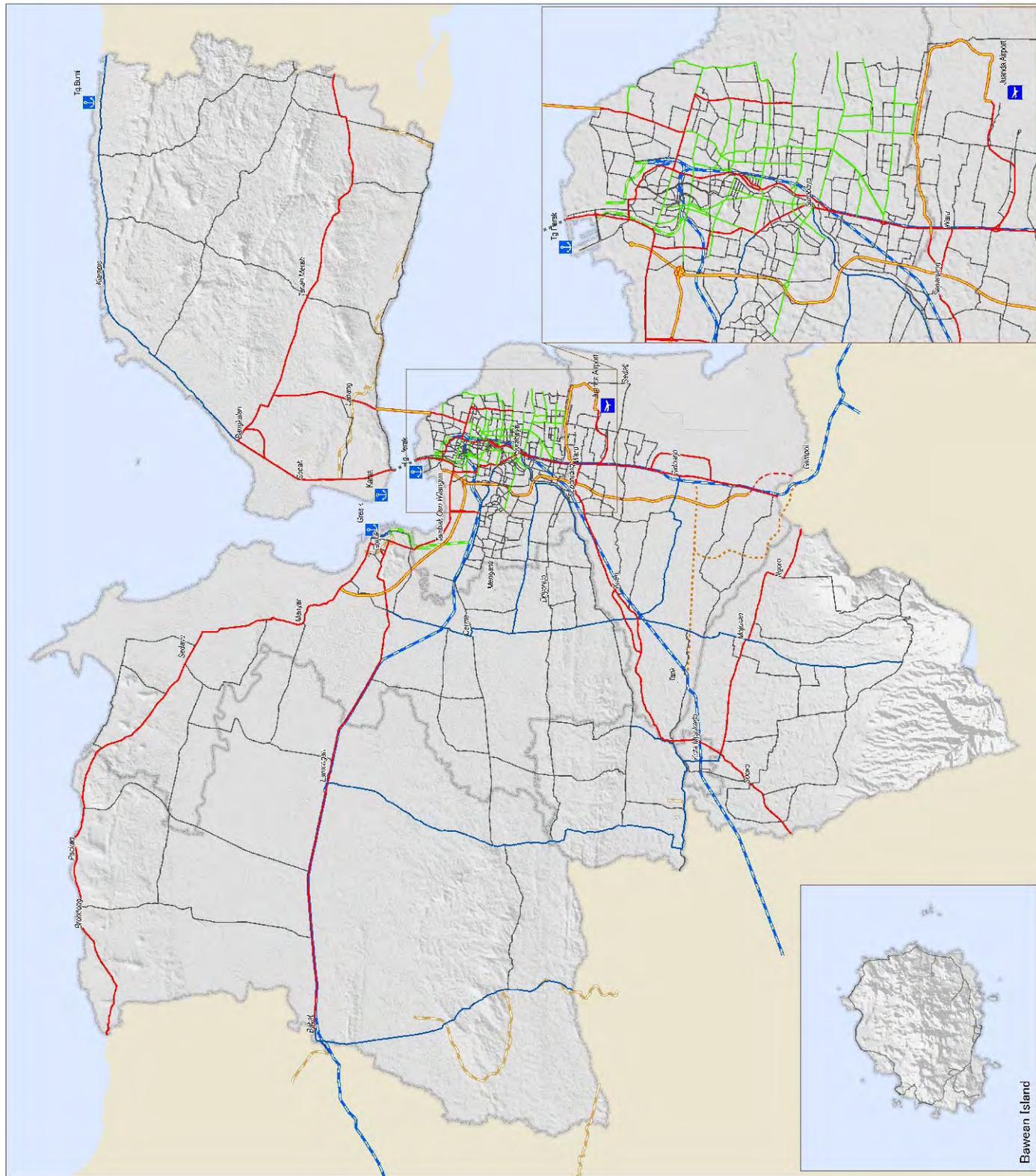
February 2011

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Existing Transport Network of GKS

- Legend**
-  Airport
 -  Port
 - Road Network (Existing)**
 -  Toll
 -  Toll (Not operated)
 -  Arterial
 -  Collector
 -  Secondary Arterial
 -  Local
 -  Ferry
 - Railway**
 -  Existing Railway (passenger service)
 -  Existing Railway (freight service)
 -  Existing Railway (discontinued Line)
 -  Existing Railway (under Construction)
 -  Kab/Kota Boundary

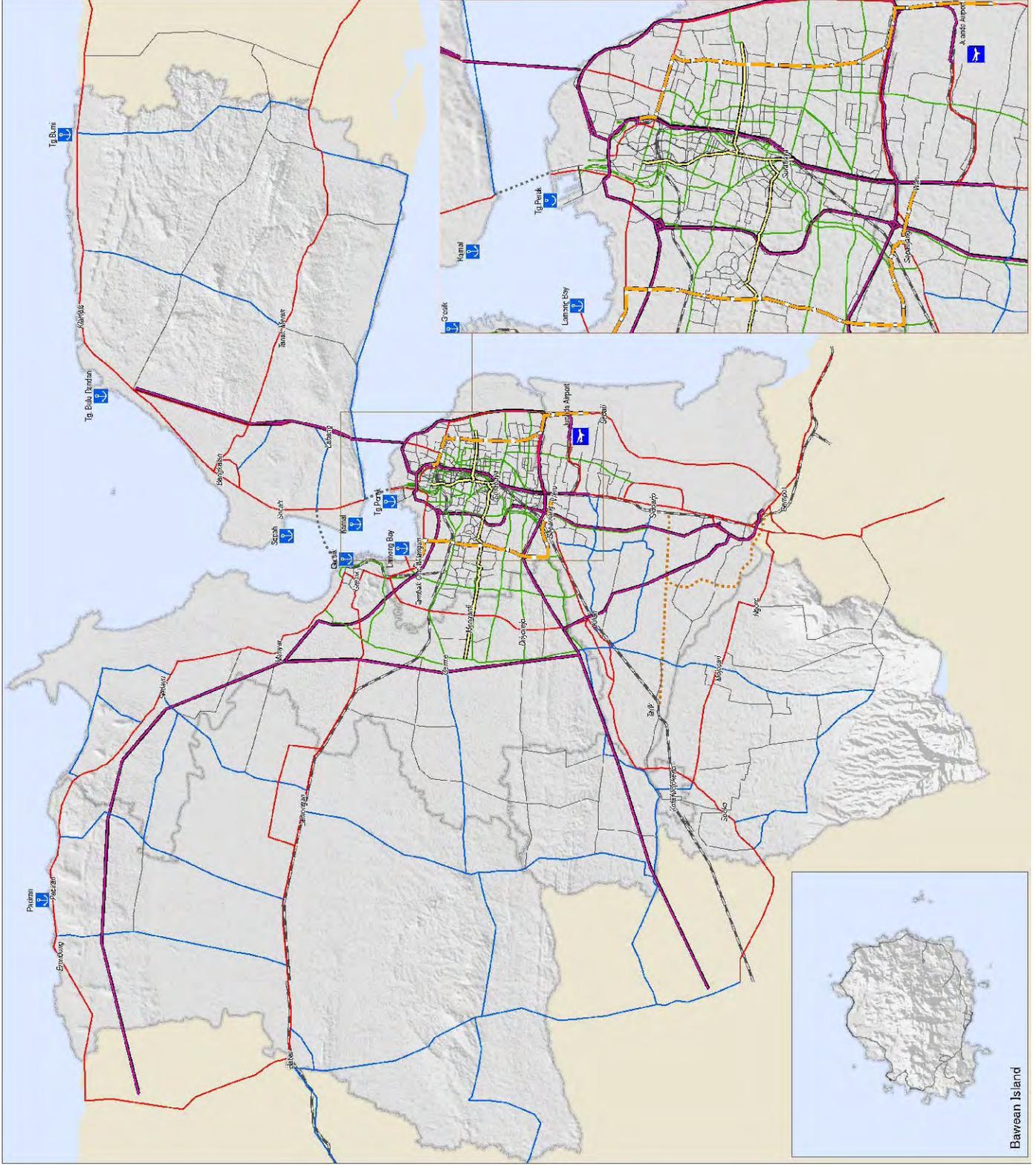


Bawean Island

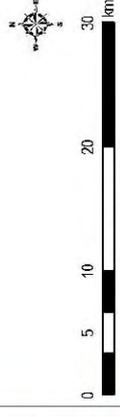
GKS-ISP
The Study on
Formulation of Spatial Planning
for GKS Zone

GKS Transport Network Plan 2030

- Legend**
- Airport
 - Port
 - Road Network
 - Toll
 - Arterial
 - Collector
 - Secondary Arterial
 - Local
 - Ferry
 - Railway
 - Proposed Railway Network (Passenger)
 - Proposed Railway Network (Freight)
 - Railway (under Construction as of 2010)
 - Mass Rapid Transit (MRT)
 - BRT
 - Kab./Kola Boundary



Bawean Island



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the Republic of Indonesia**

Final Report Volume 4:

Development Action Plan for Transportation Sector

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ABBREVIATIONS

AKDP	Antar Kota Dalam Propinsi, or Intra-Provincial Intercity
ARSDS-GKS	Study for Arterial Road System Development in Surabaya Metropolitan Area
ATCS	Area Traffic Control System
BRT	Bus Rapid Transit
CBD	Central Business District
CCTV	Closed Circuit Television
DAOP	Daerah Operasi, or Operation Area
DLLAJ	Dinas Lalu Lintas dan Angkutan Jalan, or Traffic and Road Transport Agency
EIA	Environmental Impact Assessment
EIRR	Economic Internak Rate of Return
EMU	Electric Multiple Unit
ERR	East Ring Road
FIRR	Financial Internal Rate of Return
FS	Feasibility Study
GERBANGKERTOSUSILA	Gresik-Bangkalan–Mojokerto(Kota/Kabupaten)–Surabaya–Sidoarjo-Lamongan
GIS	Geographic Information System
GKS	GERBANGKERTOSUSILA-Gresik-Bangkalan-Mojokerto (Kota/Kabupaten)-Surabaya-Sidoarjo-Lamongan
GOI	Government of Indonesia
GOJ	Government of Japan
GPRS	General Packet Radio Service
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
IBRD	International Bank for Reconstruction and Development
IE	Industrial Estate
ITS	Intelligent Transport System
JABODETABEK	Jakarta Metropolitan Area : Jakarta – Bogor – Depok – Tangerang – Bekasi
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JP¥	Japanese Yen
LARAP	Land Acquisition and Resettlement Action Plan
LRT	Light Rail Transit

MERR	Middle East Ring Road
MISI	Madura Seaport City
MWRR	Middle West Ring Road
OD	Origin Destination
OERR	Outer East Ring Road
OWRR	Outer West Ring Road
PCU	Passenger Car Unit
PPP	Public-Private Partnership
PTKA	PT Kereta Api, or Railway Company
PU	Public Works
ROW	Right-Of-Way
RTRW	Rencana Tata Ruang Wilayah, or Spatial Plan
RTG	Radioisotope Thermoelectric Generator.
SERR	Surabaya East Ring Road
SIER	Surabaya Industrial Estate Rungkut, Surabaya
SMA	Surabaya Metropolitan Area
SNCF	Société Nationale des Chemins de fer Français
SRRTS	Surabaya Regional Rail Transport System
SSWP	Sub Satuan Wilayah Pembangunan, or Area Development Sub Unit
SUDP	Surabaya Urban Development Project
SULAM	Surabaya – Lamongan Commuter
SUMO	Surabaya – Mojokerto Commuter
SUSI	Surabaya – Sidoarjo Commuter
SWM	Solid Waste Management
SWP	Satuan Wilayah Pembangunan, or Area Development Unit
TAZ	Traffic Analysis Zone
TEUs	Twenty-foot Equivalent Units
TC	Traffic Count
TCS	Traffic Count in Surabaya
TOD	Transit Oriented Development
TPS	Terminal Petikemas Surabaya or Surabaya Container Terminal
US\$	United States Dollar
V/C	Volume-Capacity
VOC	Vehicle Operation Cost.
VMS	Variable Message Signboard
WRR	West Ring Road
WWTP	Waru-Wonokromo-Tg. Perak

INTRODUCTION

1. INTRODUCTION

1.1 Background

GERBANGKERTOSUSILA (hereinafter referred to as “GKS”) in East Java Province is the second largest economic sphere in Indonesia. It consists of five kabupaten and two kotas, namely, Kabupaten Sidoarjo, Kabupaten Mojokerto, Kabupaten Lamongan, Kabupaten Gresik, Kabupaten Bangkalan, Kota Mojokerto, and Kota Surabaya. A regional development master plan of the GKS Zone was formulated with the assistance of JICA in 1983.

In Indonesia, the Spatial Planning Law which was amended in April 2007 stipulates that national, provincial, kabupaten and city governments must prepare a Spatial Plan. The National Spatial Plan was formulated in March 2008, based on which provincial governments are formulating their Spatial Plans. Subsequently local governments of kabupaten and kotas are supposed to prepare their Spatial Plans by April 2010 based on the Provincial Spatial Plans. A Spatial Plan for a metropolitan area like GKS, when needed, can be formulated because GKS is one of the national strategic areas, and the planning work is supposed to be conducted by the initiative of Directorate General of Spatial Planning, Ministry of Public Works.

1.2 Objectives of the Study

The objectives of the Study, which were mentioned in the Scope of Work agreed upon by both governments, are threefold as follows:

- To formulate the Spatial Plan for the GKS Zone with the target year of 2030;
- To prepare the action plan for urban transportation in the area; and
- To strengthen the capacity of the counterpart personnel and institutions in the course of the Study.

Major objective of the Study are to formulate long-term visions (on 2 decades time-horizon) with which the GKS national strategic area shall pursue the social and economic development in a sustainable manner, and identify short-term projects and programs to be prioritized within a five year framework in the line with strategies to achieve the visions. For the second objective of the Study, urban transportation action plans were formulated as part of the Spatial Plan for the GKS Zone.

The spatial plan, as stipulated in the 2007 Spatial Planning Law, should address the balanced land use, or spatial pattern, with sufficient considerations of environmental preservation and conservation. The spatial plan shall also depict the most economically efficient and functionally rational infrastructure network systems to support people’s social and economic

activities, including comprehensive transportation system, water supply systems, drainage and sewerage systems, power and telecommunication network, solid waste management, and so on.

1.3 GKS Zone Profile

The overall feature of GKS Zone is briefly explained as follows:

1) Population

Surabaya is almost saturated with the lowest population growth (0.65%), spilling over and sprawling to Sidoarjo, Gresik, and Mojokerto. Bangkalan shows the highest population growth (2.8%) perhaps with high expectation due to the opening of Suramadu Bridge.

2) GRDP & GRDP per Capita

GKS's GRDP in 2007 accounting for 45% of East Java Province is lead by SMA (Surabaya Metropolitan Area), with 89% of the GKS, Surabaya (58%), Sidoarjo (19%), and Gresik (11%), and the four Kabupaten and Kota, only 11 %. A large gap in GRDP per capita exists with the highest of Surabaya (27.2 million Rp.) and the lowest of Bangkalan (3.1 million Rp.). Also poverty levels in Kab. Bangkalan and Lamongan are high. The economic disparity and poverty should be improved.

3) Urbanization

Within GKS people are unevenly distributed. Some kelurahan has more than 1,000 persons per hectare in Surabaya. Due to the price hike of the property, housing development has moved toward suburban area. Housing supply is short, and there are still so-called slums in the GKS. Each kota and kabupaten has to formulate RP4D for housing supply. Urbanization causes lack of public facilities like schools, health and medical facilities.

4) Land use

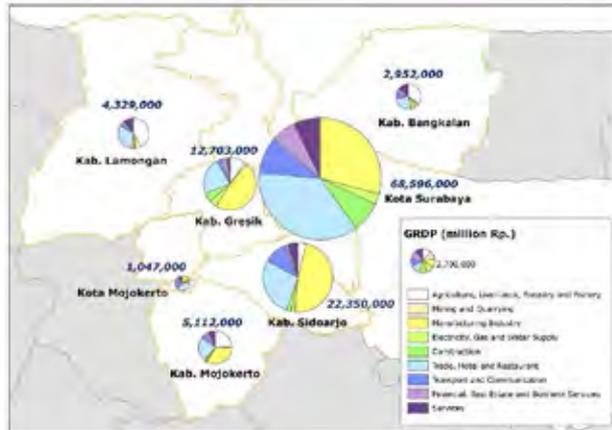
Inappropriate land use conversion, in particular, agricultural land to urban use is a big issue. Regarding land use plan, different land use categories are used among kota, kabupaten and Province. It seems there is less coordination and consistency among land use plans at kabupaten/kota level.

5) Transportation

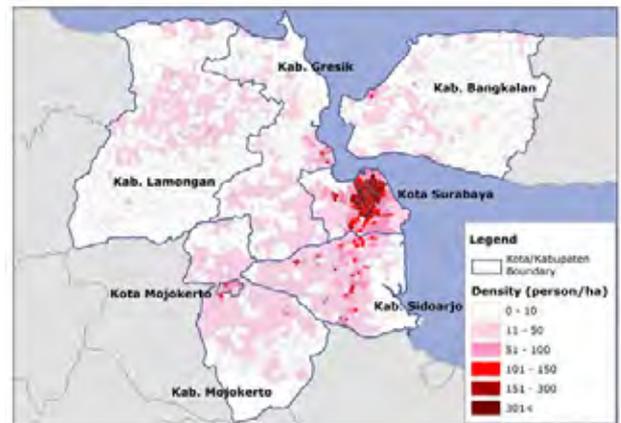
Because of the urbanization and rapid increase of motorcycle ownership, terrible traffic congestion occurs, especially in Surabaya, together with insufficient road network development. Regional road network has not kept pace with urbanization and there are missing links for sound regional development. Not only road, but the other modes of railway, port, and airport also improve their regional network from regional, national, and international context. Public transportation development, including commuter train, is one of the key factors to alleviate the traffic congestions and to lead the urban spatial structure in the planned direction of urbanization, like compact city.

Table 1.3.1 Social and Economic Profile of GKS

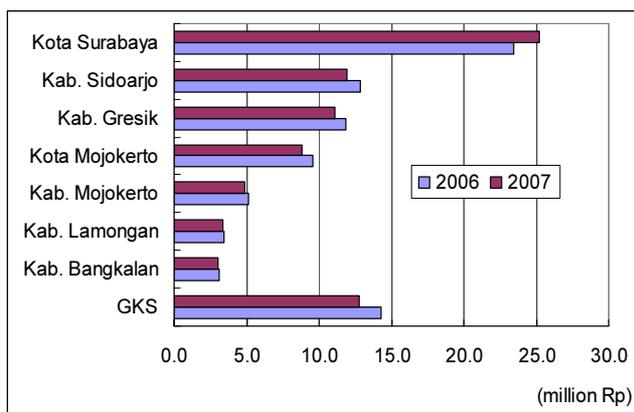
	Population 2007	Population growth rate (2000-07)	GRDP (Billion Rp., 2007)	GRDP per Capita (thousand Rp.)	Poverty Ratio (%) 2007	Unemployment rate (%) 2007
GKS	9,139,387	1.64%	128,235	13,859	15.7%	6.7%
Kab. Sidoarjo	1,869,350	2.59%	24,812	13,273	8.3%	9.7%
Kab. Mojokerto	1,041,269	1.98%	5,621	5,268	13.5%	4.4%
Kab. Lamongan	1,281,176	1.16%	4,526	3,489	28.2%	3.7%
Kab. Gresik	1,142,817	1.97%	14,265	12,286	16.9%	5.6%
Kab. Bangkalan	965,568	2.77%	3,074	3,127	33.4%	4.4%
Kota Mojokerto	119,051	1.25%	1,142	9,337	8.6%	9.0%
Kota Surabaya	2,599,796	0.65%	74,795	27,173	9.0%	9.2%



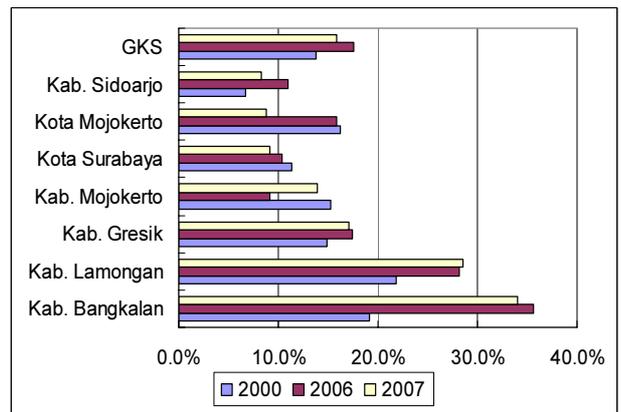
GRDP (2007)



Population Density



GRDP/capita



Poverty Ratio

Figure 1.3.1 Current Economic Indicators for GKS Zone

1.4 Study Work Flow

Flow of the task components as well as the work schedule especially for the transport sector is depicted in Figure 1.4.1. Each task number corresponds to the one in the “Tasks of the Study” in Inception Report. Since this chart is focused on the transport sector, only the major and relevant tasks have been included with respect to spatial planning. Furthermore, for better description, some tasks have been divided into two or more components while some have been combined into one task.

Five study reports have been produced before this Final Report - Transportation Action Plan Report. Inception Report (March 2009) included the scope of work for this Study and described each task component. Progress Report 1 (July 2009) showed the progress of the Study by describing the result of analysis of the current situation and review of the existing transportation plans and relevant studies. Subsequently, Interim Report (December 2009) compiled major findings of the various transportation surveys conducted in this Study, identified the current transport characteristics, analyzed the planning issues, and proposed the concept of alternative transportation development plans.

In Progress Report 2 (March 2010), more detailed transportation development plans and preliminary future traffic demand forecast were presented while the development plans were in the process of investigation in terms of the ongoing future traffic demand forecast as well as the consistency with detailed spatial and other infrastructure development plans. Those were discussed with various stakeholders including the central and local governments in the First Seminar (February 2010) and the workshops and the results were included.

Finally, the transportation action plans including identification of the short, medium, and long term plans, which should support the formulated land use plan of GKS, were presented in Draft Final Report (November 2010) along with the evaluation result of the future traffic demand forecast, an economic analysis. Organizational and institutional arrangements for implementation of the action plans and proposal of the priority projects and programs were also included in Draft Final Report.

Overall contents of the Study were presented and discussed in the Second Seminar (October/ November 2010) as well as the Steering Committee meeting. Then, comments on Draft Final Report were received from the Indonesian side and were accordingly reflected in Final Report (February 2011). All the above past reports have been compiled to make another final output of the Study, namely, Transportation Action Plan Report.

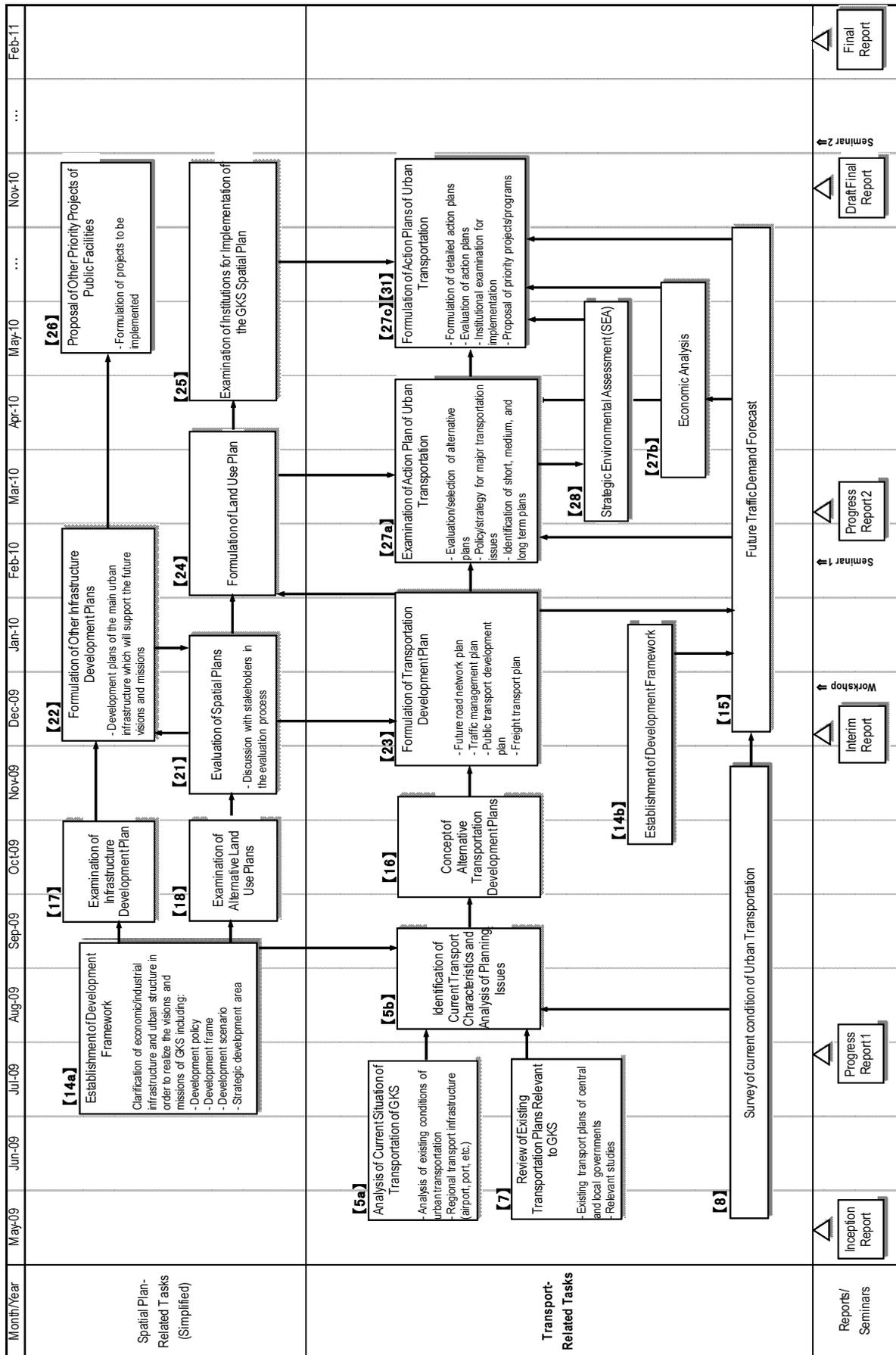


Figure 1.4.1 Study Work Flow in the Transport Sector

CURRENT SITUATION AND PROBLEMS

2. CURRENT SITUATION AND PROBLEMS

2.1 Road Network

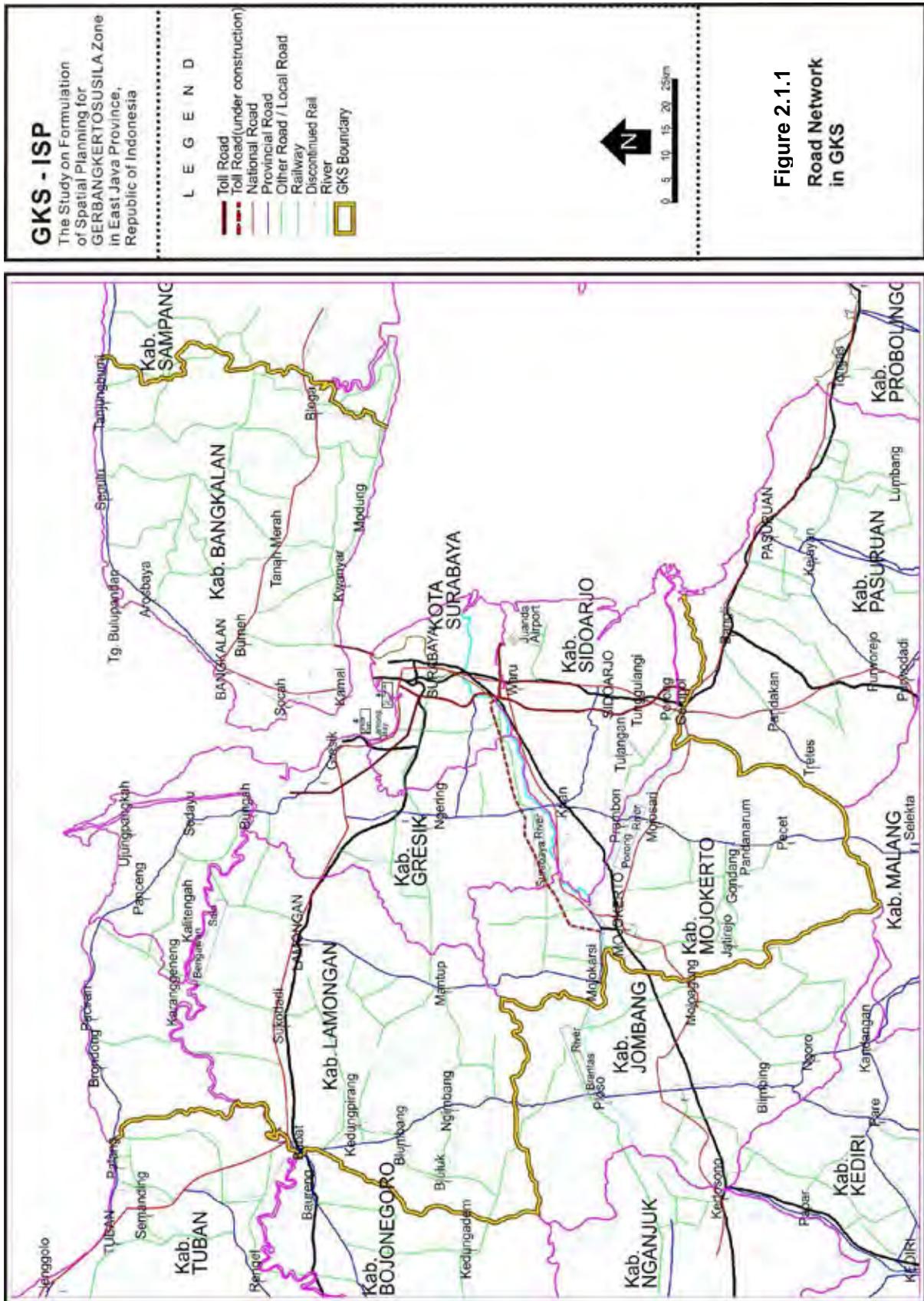
As shown in Figure 2.1.1, the main arterial roads in the GKS Zone are the national highways extending mainly from Surabaya west to Lamongan via Gresik and moving southwest to Mojokerto, then southward to Sidoarjo, before finally going northeast to Bangkalan over the Madura Strait. Other roads are provincial or kabupaten/kota roads, which consist of four-lane roads in urban areas and mostly two-lane roads in rural areas. The main toll road or expressway that is currently in service in the GKS runs north to south between Manyar (Kabupaten Gresik) and Gempol (Kabupaten Pasuruan) via Kota Surabaya and Kabupaten Sidoarjo.

The total length of the roads in the GKS is around 5,980 km. As shown in Table 2.1.1, as of 2007, about 89% are kabupaten/kota or municipal roads. Major cities in the GKS are interconnected by trunk roads. Problems that plague the road network, such as chronic traffic congestion in urban areas, significant road damages to municipal roads, inadequate road maintenance, and low management capacity of local governments, are concerns that need to be attended to in the decentralized governmental system.

Table 2.1.1 Total Road Length in GKS

Type	Length (km)	Share (%)
National Roads	365	6
Provincial Roads	299	5
Municipal (Kabupaten/Kota) Roads	5,317	89
Total	5,981	100

Source: Based on Road Division of Public Works (Dinas Pekerjaan Umum Bina Marga) of each kota/kabupaten



2.1.1 Toll Road Network

The main toll road in the GKS is a 62.1-km north–south toll road which connects Manyar (Kab. Gresik) and Gempol (Kab. Pasuruan), extending to Tanjung (Tg.) Perak Port. In addition, the Waru–Juanda Airport toll road (13.6 km) has been in service since 2008. The construction of additional toll roads financed by the private sector is in progress. One of these is the Surabaya–Mojokerto toll road (37 km) shown in Figure 2.1.2 below.



Figure 2.1.2 Construction of the Surabaya–Mojokerto Toll Road

All the existing toll road sections in the GKS have dual carriageways with four lanes in total, except for the sections of Waru–Kota Satelit and Dupak–Tg. Perak, which have six lanes. Since the current toll road network connects Tg. Perak Port to the industrial areas in kabupaten Gresik, Sidoarjo, and Pasuruan, it serves as the trunk freight transportation corridor. Therefore, as Table 2.1.2 shows, the composition of trucks on the toll roads is very high, especially at locations near Tg. Perak Port. This has a significant influence on traffic flow: slow, heavy vehicles are taking up considerable space on these toll roads.

Table 2.1.2 Vehicle Composition at Major Toll Road Sections

(Unit: no./day)

Location	Passenger Car	Truck				Bus		Total
		Pick Up	2-Axle Truck	3-Axle Truck	4 or more Axle Truck	Small Bus	Medium /Large Bus	
Dupak-Tg. Perak (near Tg. Perak, TCS01)	10,959 (33%)	3,257 (10%)	6,962 (21%)	4,404 (13%)	6,740 (21%)	39 (0.1%)	473 (1%)	32,834 (100%)
Dupak-Gresik (near Dupak Jct., TCS14)	25,161 (45%)	8,706 (16%)	8,498 (15%)	5,045 (9%)	5,914 (11%)	1,655 (2.9%)	1,166 (2%)	56,145 (100%)
Dupak-Gempol (near Gedangan, TC10)	34,540 (55%)	4,950 (8%)	12,048 (19%)	4,001 (6%)	4,500 (7%)	76 (0.1%)	2,690 (4%)	62,805 (100%)

Source: Traffic Survey done by the JICA Study Team on 30 June 2009.

Note: The number of passengers was estimated based on roadside occupancy survey.

2.1.2 Non-toll Road Network

The total road length in each kabupaten/kota is shown in Table 2.1.3. National highways comprise roughly 5% to 10% of the total network in each kabupaten/kota, while the rest are either provincial or municipal (kabupaten/kota) roads. The share of paved roads is around 95% on average, and the road conditions are generally good. In the study area, roads are more densely developed in Kota Mojokerto, where road density is 6.8 km/km², followed by Kota Surabaya at 6.2 km/km². Among the kabupaten, road densities in Sidoarjo and Mojokerto are relatively higher.

Table 2.1.3 Length of Roads by Type in Each Kabupaten/Kota

(Unit: km)

	Kota Surabaya		Kab. Sidoarjo		Kab. Mojokerto		Kota Mojokerto		Kab. Lamongan		Kab. Gresik		Kab. Bangkalan	
	Length (km)	% Share	Length (km)	% Share	Length (km)	% Share	Length (km)	% Share	Length (km)	% Share	Length (km)	% Share	Length (km)	% Share
Jurisdiction														
1. National Road	45.13	2.2%	66.23	6.7%	41.12	4.5%	0.00	0.0%	70.63	14.9%	67.62	10.8%	73.79	8.9%
2. Provincial Road	13.73	0.7%	28.63	2.9%	119.17	13.1%	0.00	0.0%	57.23	12.1%	32.80	5.2%	47.42	5.7%
3. Kab./Kota Road	1,977.09	97.1%	898.13	90.4%	748.69	82.4%	112.52	100.0%	346.73	73.1%	525.84	84.0%	708.44	85.4%
Total	2,035.95	100.0%	992.99	100.0%	908.98	100.0%	112.52	100.0%	474.59	100.0%	626.26	100.0%	829.65	100.0%
Surface Type														
1. Asphalt	2,024.48	99.4%	992.99	100.0%	769.38	84.6%	104.73	92.1%	474.29	99.9%	487.78	77.9%	552.45	80.7%
2. Gravel	0.00	0.0%	0.00	0.0%	55.05	6.1%	0.00	0.0%	0.30	0.1%	0.00	0.0%	82.05	12.0%
3. Earth	0.00	0.0%	0.00	0.0%	84.55	9.3%	8.95	7.9%	0.00	0.0%	27.80	4.4%	50.22	7.3%
4. Unspecified	11.47	0.6%	0.00	0.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	110.68	17.7%	0.00	0.0%
Total	2,035.95	100.0%	992.99	100.0%	908.98	100.0%	113.67	100.0%	474.59	100.0%	626.26	100.0%	684.72	100.0%
Road Condition														
1. Good	1,820.85	89.4%	768.45	77.3%	461.97	50.8%	91.18	81.0%	272.56	57.4%	115.54	18.4%	392.17	57.3%
2. Sufficient/Moderate	152.60	7.5%	89.81	9.0%	234.53	25.8%	21.35	19.0%	135.91	28.6%	344.33	55.0%	160.28	23.4%
3. Damaged	62.50	3.1%	135.98	13.7%	186.61	20.5%	0.00	0.0%	65.83	13.9%	149.89	23.9%	7.67	1.1%
4. Heavily Damaged	0.00	0.0%	0.00	0.0%	25.87	2.8%	0.00	0.0%	0.30	0.1%	16.50	2.6%	124.60	18.2%
Total	2,035.95	100.0%	994.24	100.0%	908.98	100.0%	112.52	100.0%	474.60	100.0%	626.26	100.0%	684.72	100.0%
Road Classification														
1. Class I	80.71	4.0%	103.46	10.4%	41.12	4.5%	11.43	10.1%	0.00	0.0%	67.62	10.8%	0.00	0.0%
2. Class II	76.95	3.8%	60.92	6.1%	119.17	13.1%	12.10	10.7%	34.26	7.2%	0.00	0.0%	52.73	7.7%
3. Class III	0.00	0.0%	828.61	83.3%	0.00	0.0%	6.38	5.6%	36.37	7.7%	32.80	5.2%	34.48	5.0%
4. Class IIIA	158.45	7.8%	0.00	0.0%	0.00	0.0%	7.58	6.7%	228.72	48.2%	0.00	0.0%	480.17	70.1%
5. Class IIIB	255.88	12.6%	0.00	0.0%	606.01	66.7%	43.90	38.8%	166.32	35.0%	0.00	0.0%	0.00	0.0%
6. Class IIIC	1,404.67	69.0%	0.00	0.0%	55.05	6.1%	20.27	17.9%	8.93	1.9%	300.00	47.9%	0.00	0.0%
7. Unclassified	59.29	2.9%	1.27	0.1%	87.64	9.6%	11.35	10.0%	0.00	0.0%	225.84	36.1%	117.34	17.1%
Total	2,035.95	100.0%	994.26	100.0%	908.99	100.0%	113.00	100.0%	474.60	100.0%	626.26	100.0%	684.72	100.0%
Road Density														
Area [km ²]	326.36		634.39		692.15		16.46		1,669.36		1,191.19		1,259.54	
Density [km/km ²]	6.24		1.57		1.31		6.87		0.28		0.53		0.83	

Note: Data as of 2007 (2005 for Bangkalan)

Source: Road Division of Public Works (Dinas Pekerjaan Umum Bina Marga) of each Kota/Kabupaten

In terms of function, primary and secondary roads are the principal components of the road network. To determine a road's function, traffic volumes and average trip lengths are first determined. Then, other factors are considered such as physical conditions, design speed, and continuity of the road's sections.

Primary roads serve interurban traffic or traffic between urban centers. Interurban traffic is characterized by relatively long distance trips. Primary arterial roads connect the main

cities in regional development units (SWP) such as the Surabaya–Malang road. These roads usually have partial access control. Meanwhile, primary collector roads connect the main cities of kabupaten/kota with the centers of regional development sub-units (SSWP) such as Sidoarjo–Krian road. Such roads have no access control.

On the other hand, secondary roads serve mainly intra-urban traffic. Secondary arterial roads are usually designed with partial access control, while secondary collector roads have no access control. Ideally, these two road systems should be integrated and smoothly connected with each other. Arterial and collector roads in the GKS and in Surabaya are presented in Figure 2.1.3 and Figure 2.1.4, respectively.

The road network in the study area has a complicated hierarchy due to the variety of road classifications which differ by kabupaten/kota. Primary arterial roads are classified as Class II, and primary collector roads are classified as Class IIIA. Daily traffic volumes on major road sections in the study area are presented in Table 2.1.4.

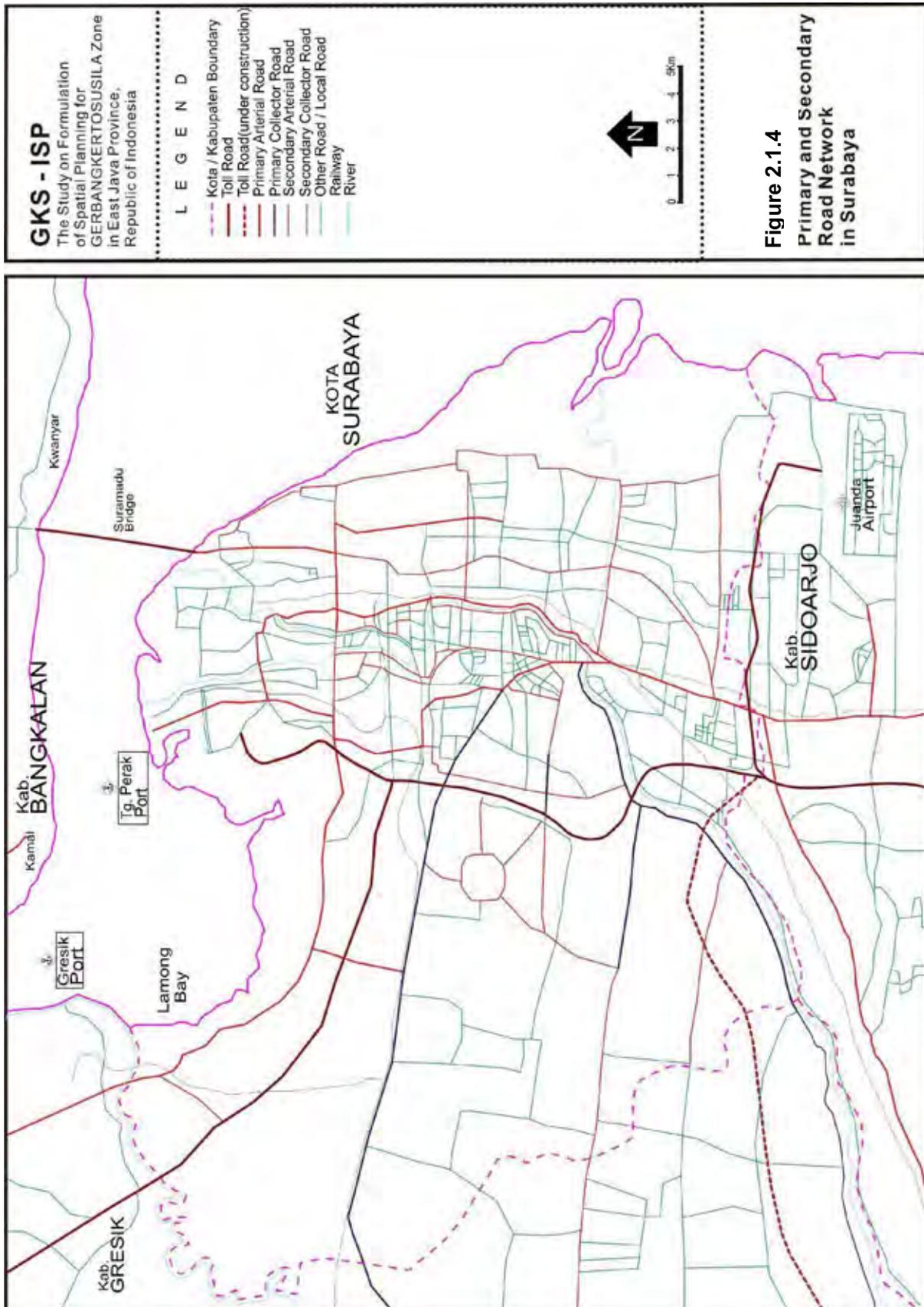


Table 2.1.4 Daily Traffic Volumes on Major Road Sections by Road Function
 (Unit: PCU/day)

Road Function	Location Code	PCU		Average	
		Without Motorcycle	With Motorcycle	Without Motorcycle	With Motorcycle
Toll Road (Expressway)	TCS01	48,276	48,286	63,000	63,000
	TCS14	72,757	72,757		
	TC10	69,160	69,160		
Primary Arterial	TCS02	68,369	99,173	35,000	55,000
	TCS03	18,744	32,401		
	TCS04	49,541	84,373		
	TCS05	83,854	138,297		
	TCS06	19,165	33,100		
	TCS07	69,784	137,941		
	TCS11	99,564	213,493		
	TCS12	28,906	39,141		
	TCS13	21,389	37,962		
	TC01	23,334	29,668		
	TC05	27,824	33,722		
	TC06	13,046	20,471		
	TC07	55,481	91,412		
	TC09	80,273	142,141		
	TC11	66,454	85,170		
	TC12	6,698	8,141		
	KB02	24,864	28,851		
	KB05	28,008	33,192		
	OC01	15,637	18,621		
	OC03	34,191	40,296		
	OC04	41,502	49,750		
	OC05	22,299	28,591		
	IC02	19,504	24,728		
IC05	5,887	11,103			
IC07	14,868	18,664			
IC09	826	2,494			
IC11	9,431	12,171			
Primary Collector	TCS10	13,516	31,277	10,000	18,000
	TCS16	26,042	51,399		
	TCS18	14,902	31,520		
	TC02	5,571	7,104		
	TC03	11,254	17,155		
	TC13	2,931	4,063		
	KB01	5,081	6,590		
	OC02	10,054	12,817		
	IC01	10,096	17,011		
	IC06	14,994	20,850		
IC12	5,825	8,053			

Source: 2009 Traffic Survey, JICA Study Team

2.1.3 Suramadu Bridge

Suramadu Bridge, which connects Kota Surabaya on Java Island and Kabupaten Bangkalan on Madura Island, opened to traffic as a toll bridge on 10 June 2009 after six years of construction. Before that, ferry transportation connecting Ujung (Kota Surabaya) and Kamal (Kabupaten Bangkalan) was the only transportation mode between the two points, and it took about 30 minutes. Now it takes only five minutes to travel between Surabaya and Bangkalan via the bridge.

Suramadu Bridge, shown in Figure 2.1.5, has four 3.5-meter-wide lanes for passenger and commercial vehicles, and two 3-meter-wide lanes for motorcycles. Toll fees are Rp. 30,000 for cars and Rp. 3,000 for motorcycles for one trip, whereas ferry crossings cost Rp. 70,000 per car and Rp. 5,800 per motorcycle and Rp. 3,700 for passengers. Pedestrians are not allowed on Suramadu Bridge.



Figure 2.1.5 Suramadu Bridge

A considerable number of the existing passengers and vehicles using the Ujung–Kamal ferry are expected to use the Suramadu Bridge. Among others, as shown in Table 2.1.5, growth in the number of motorcycles was remarkable as a recent trend of usage of the ferry. Furthermore, more commuters from Kabupaten Bangkalan are expected due to the completion of the bridge.

Table 2.1.5 Trend in Passenger and Vehicle Numbers on the Ujung–Kamal Ferry

Year	Passenger		Motorcycle		Four-wheel Vehicle	
	(million)	Growth (%)	(million)	Growth (%)	(million)	Growth (%)
2002	12.96	-	2.18	-	1.55	-
2003	12.95	-0.1	2.61	19.4	1.67	7.6
2004	12.07	-6.8	2.98	14.4	1.56	-6.1
2005	11.32	-6.2	3.00	0.5	1.66	6.3
2006	10.33	-8.7	3.22	7.3	1.39	-16.5
2007	9.99	-3.3	3.32	3.2	1.59	14.4

Source: Transportation Agency (Dinas Perhubungan) of East Java Province

The latest results of the traffic survey between Surabaya and Madura conducted on the Ujung–Kamal ferry and Suramadu Bridge after bridge opening are presented in Table 2.1.6. It was observed that considerable traffic shifted from the ferry to the bridge for all vehicle types except for large public buses, whose terminal is located relatively closer to the Kamal port. Buses using the bridge will have to travel 48 km more to reach this terminal. Daily bridge traffic is larger than the estimates made by PT. Jasa Marga, the toll bridge operator (around 4,000 automobiles and 9,000 motorcycles per day). Total daily passenger traffic between Surabaya and Madura is around 76,000, which is significantly greater than the average daily passengers (around 41,000 passengers per day) that were transported by the ferry in 2007. On the other hand, faster and cheaper crossings may be forcing ferry operators and related businesses to face a predicament brought about by the sharp decrease of ferry users.

Table 2.1.6 Number of Daily Vehicles and Passengers on the Ferry and Bridge

Route	Vehicle [no./day]							Passenger [no./day]
	Motorcycle	Passenger Car	Small Truck	Medium /Large Truck	Small Bus	Medium /Large Public Bus	Medium /Large Private Bus	
Ujung–Kamal Ferry	6,674	311	78	117	5	123	5	11,586
Suramadu Bridge	14,420	6,867	847	1,403	159	42	213	64,867
Total	21,094	7,178	925	1,520	164	165	218	76,454

Source: 2009 Traffic Survey, JICA Study Team.

Note: Number of passengers was estimated based on the results of roadside occupancy survey.

Suramadu Bridge is expected to bring benefits to the various regional development activities not only in Madura but also in Surabaya and surrounding areas as well. With the opening of the bridge, it is expected that the socio-economic disadvantages experienced by Madura Island will decrease significantly. Transportation flow to and from the remote areas of Madura is also expected to improve, which may make the area more competitive. Subsequently, spatial utilization and land-use pattern in Madura are expected to be formed in a balanced manner.

2.2 Road Traffic Characteristics

2.2.1 Results of Traffic Count

1) Traffic Survey Summary

For this survey, traffic volume was observed at 72 locations covering major roads inside the GKS from June to August 2009. Interview surveys of sampled passengers were carried out at roadsides in terms of trip origin and destination (OD). Occupancy per vehicle type was also recorded at the same location where the Roadside OD Interview Survey was conducted. Table 2.2.1 summarizes the traffic surveys conducted by the JICA Study Team. The results of the traffic count are analyzed in this section, while the results of the OD interview survey is discussed in Chapter 3.

Table 2.2.1 Summary of Traffic Surveys

Survey Location Code	No. of Survey Locations	Area	Coverage		
			Traffic Count	Origin–Destination	Vehicle Occupancy
TCS	18	Major road sections inside Kota Surabaya	16 hrs: 14 locations 24 hrs: 4 locations	X	X
TC	13	Major road sections inside GKS and outside Kota Surabaya	16 hrs: 11 locations 24 hrs: 2 locations	X	X
IC	11	Major inter-city road sections inside GKS and outside Kota Surabaya	16 hrs: 11 locations	16 hrs: 11 locations	16 hrs: 11 locations
KB	5	Major road sections at kabupaten boundary	16 hrs: 3 locations 24 hrs: 2 locations	16 hrs: 3 locations 24 hrs: 2 locations	16 hrs: 5 locations
OC	5	Major road sections at GKS boundary	16 hrs: 2 locations 24 hrs: 3 locations	16 hrs: 2 locations 24 hrs: 3 locations	16 hrs: 5 locations
P	3	Tanjung Perak Port	24 hrs: 3 locations	24 hrs: 3 locations	X
Total	72				

Source: JICA Study Team.

2) Traffic Volume

Traffic volume is discussed here using the following three basic units:

i) Vehicle

Results of the traffic count survey refer to the number of vehicles counted at the survey location. Vehicles were classified into 13 categories.

ii) Passenger Car Unit (PCU)

This is a measurement to interchange the number of vehicle traffic by vehicle type and the traffic volume of passenger cars to assess traffic flow rate and congestion rate. The Study Team adopted the following PCU in order to obtain traffic volumes in terms of passenger car equivalent.

Table 2.2.2 Passenger Car Unit

Mode	Type of Vehicle	PCU
Motorcycle		0.25
Passenger Car	Sedan, Jeep, S Wagon, Van, Comby (Minibus), Taxi, Angguna, Pick-Up	1.00
Truck	Truck 2 Axle	1.50
	Truck 3 Axle, Truck 4 Axle and More	2.00
Bus	Small bus	1.25
	Medium bus	1.50
	Large bus	2.00

Source: JICA Study Team

iii) Passenger

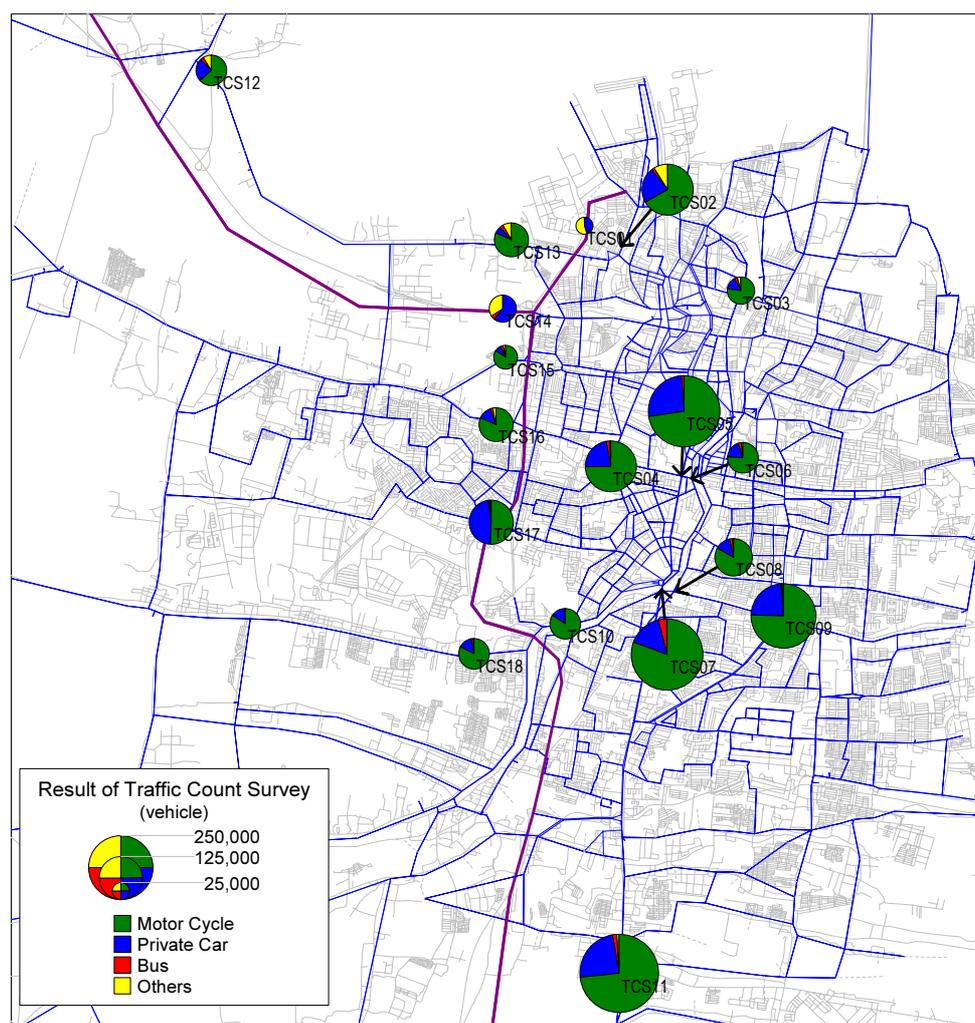
Travel is, basically, an individual activity that takes place from one location to another and travel demand is often discussed based on the passengers' movement. The Study Team conducted a Vehicle Occupancy Survey to determine the number passengers on each vehicle. Passenger demand on selected road sections can be estimated by multiplying the average vehicle occupancy for each vehicle type by the results of the vehicle count. The estimated average vehicle occupancy based on the survey is shown in Table 2.2.3.

Table 2.2.3 Average Vehicle Occupancy

Mode	Type of Vehicle	Average Occupancy (pax/veh.)
Motorcycle		1.4
Passenger Car	Sedan, Jeep, S. Wagon	2.8
	Van, Comby (Minibus)	4.0
	Taxi, Angguna	2.2
	Pick-up	2.0
Bus	Small bus	6.7
	Medium bus	17.4
	Large bus	44.9

Source: 2009 Traffic Survey, JICA Study Team

Figure 2.2.1 and Table 2.2.4 show the results of the traffic count at each location in Kota Surabaya. The highest volume of vehicles, i.e., 376,000, was observed at TCS11, which is located on Jl. Raja Jend. A. Yani, near Dinas PU, followed by 300,000 vehicles at TCS05, which is on Jl. Urip Sumoharjo. Meanwhile, all locations, except TCS01 and TCS14, have a large share of motorcycle traffic, ranging between 51% and 85%. TCS01 and TCS14 which are both located on toll roads. The traffic volume of "Others" category, which consists of freight vehicles, can be seen in northern Kota Surabaya, such as TCS01 and TCS14, which are on a toll road, TCS02, Jl. Tanjung Perak Barat and Timur, and TCS13, Jl. Kalianak.



Source: 2009 Traffic Survey, JICA Study Team

Figure 2.2.1 Traffic Volume in Kota Surabaya (unit: vehicle)

Table 2.2.4 Results of the Traffic Count Survey in Kota Surabaya

(Unit: vehicle)

Location Code	Location Name	Survey Hours	Motor Cycle	Rate (%)	Private Cars	Rate (%)	Bus	Rate (%)	Others	Rate (%)	Total
TCS01	Jl. Tol Surabaya - Gempol	16	36	0.1	12,151	42.9	652	2.3	15,475	54.7	28,314
TCS02	Jl. Tanjung Perak Barat & Timur	16	105,313	69.3	29,531	19.4	2,917	1.9	14,123	9.3	151,884
TCS03	Jl. Simokerto	16	46,690	77.1	9,070	15.0	2,262	3.7	2,546	4.2	60,568
TCS04	Jl. Raya Diponegoro	16	119,085	74.5	36,100	22.6	3,624	2.3	961	0.6	159,770
TCS05	Jl. Urip Sumoharjo	24	217,772	72.5	78,768	26.2	3,321	1.1	444	0.1	300,305
TCS06	Jl. Ngagel	16	47,644	75.8	11,971	19.1	2,144	3.4	1,073	1.7	62,832
TCS07	Jl. Raya Wonokromo	16	233,015	80.6	44,688	15.5	10,731	3.7	669	0.2	289,103
TCS08	Jl. Ngagel (Bridge)	16	85,315	83.2	13,560	13.2	2,955	2.9	672	0.7	102,502
TCS09	Jl. Raya Ngiden (Bridge)	16	180,142	75.4	55,750	23.3	1,546	0.6	1,498	0.6	238,936
TCS10	Jl. Karah ke Jl. Gunungsari	16	60,722	84.3	10,757	14.9	183	0.3	355	0.5	72,017
TCS11	Jl. Raya Jend. A. Yani	16	295,076	78.3	71,235	18.9	6,354	1.7	3,964	1.1	376,629
TCS12	Jl. Raya Veteran (Gresik)	24	40,939	63.1	15,876	24.5	2,378	3.7	5,673	8.7	64,866
TCS13	Jl. Kalianak	24	66,293	81.5	5,423	6.7	2,869	3.5	6,750	8.3	81,335
TCS14	Jl. Tol Surabaya - Gresik	24	0	0.0	33,867	60.3	2,821	5.0	19,457	34.7	56,145
TCS15	Jl. Tanjung Sari	16	36,144	84.1	3,625	8.4	1,686	3.9	1,522	3.5	42,977
TCS16	Jl. Raya Tandes	16	67,619	81.5	10,528	12.7	2,207	2.7	2,569	3.1	82,923
TCS17	Jl. Mayjend. HR. Muhammad	16	62,625	50.6	58,469	47.2	1,548	1.3	1,160	0.9	123,802
TCS18	Jl. Raya Menganti	16	56,814	82.5	9,888	14.4	1,643	2.4	508	0.7	68,853

Source: 2009 Traffic Survey, JICA Study Team

Traffic volume in terms of passenger car equivalent and passenger trips can be estimated by the factors mentioned above. Figure 2.2.2 and Table 2.2.5 show the traffic volume of passenger car equivalent, and Figure 2.2.3 and Table 2.2.6 show the passenger travel demand at each survey location.

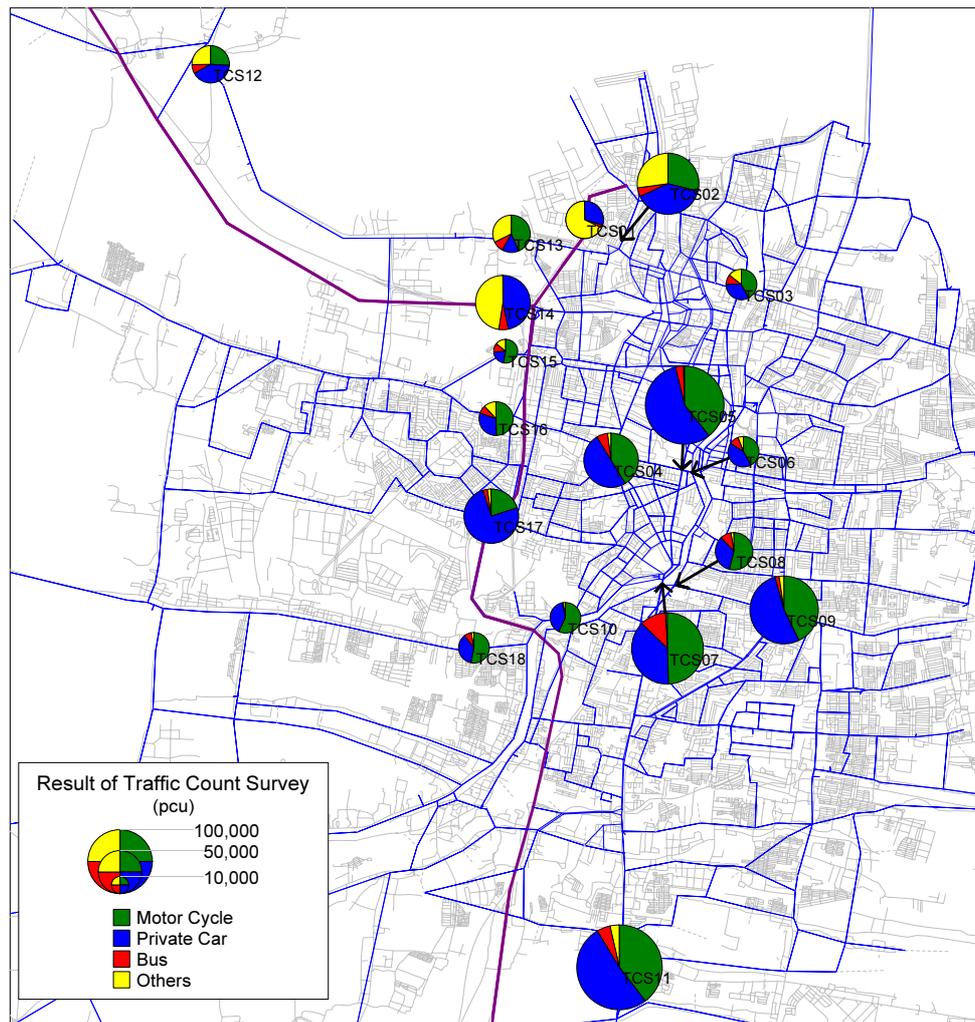
The modal share of each vehicle has been changed to passenger car unit wherein the traffic volume counted was converted to passenger car equivalent numbers, that is, the share of passenger car and freight cargoes becomes bigger and that of motorcycle becomes smaller. The highest traffic volume in terms of PCU is estimated at 160,000 at TCS11. Assuming the following factors, the capacity of traffic flow at this location can be calculated at 176,000 PCU, which is derived from 2,200 multiplied by eight and divided by 10%, and the volume–capacity ratio is 91%. This result implies that vehicles are running close to each other and free flow is noticeably limited almost all day. Consequently, the level of service becomes low.

- Possible traffic flow rate: 2,200 PCU/lane/hour;
- Peak ratio, which is the volume at the peak hour divided by daily traffic volume: 10%; and
- Number of lanes on both directions: eight lanes—six lanes and a shoulder on both directions for motorcycles.

In terms of passenger demand, the corridor of TCS05, TCS07, and TCS11 has a strong demand, ranging from 550,000 to 700,000, which means that at least 350,000 people are entering and exiting from Kota Surabaya every day, with 60% using motorcycle, 28% passenger car, and 12% public transportation. This shows that large transportation demand is concentrated on the north–south corridor, while 856,000, which is the sum of survey locations TCS13 to TCS18, is dispersed on six major east–west roads. The usage rate of public transportation is relatively high in northern Kota Surabaya, such as TCS02, TCS03, and TCS13, although this depends on the bus routes being operated.

The traffic volume counted outside Kota Surabaya by type of vehicle is shown in Figure 2.2.4 and 2.2.5 and in Table 2.2.7 and 2.2.8. Traffic demand between Kota Surabaya and Sidoarjo can be estimated by summarizing the traffic volumes at TC07, TC08, TC09, and TC10. The total volume is 517,000 vehicles, which consist of 65.9% motorcycle, 25.4% passenger car, 2.3% bus, and 6.4% truck.

The rest of the locations outside Kota Surabaya have at most 35,000 vehicles, except at the following locations: KB05, OC03, OC04, and OC05. The last three locations are on the GKS boundary.



Source: 2009 Traffic Survey, JICA Study Team

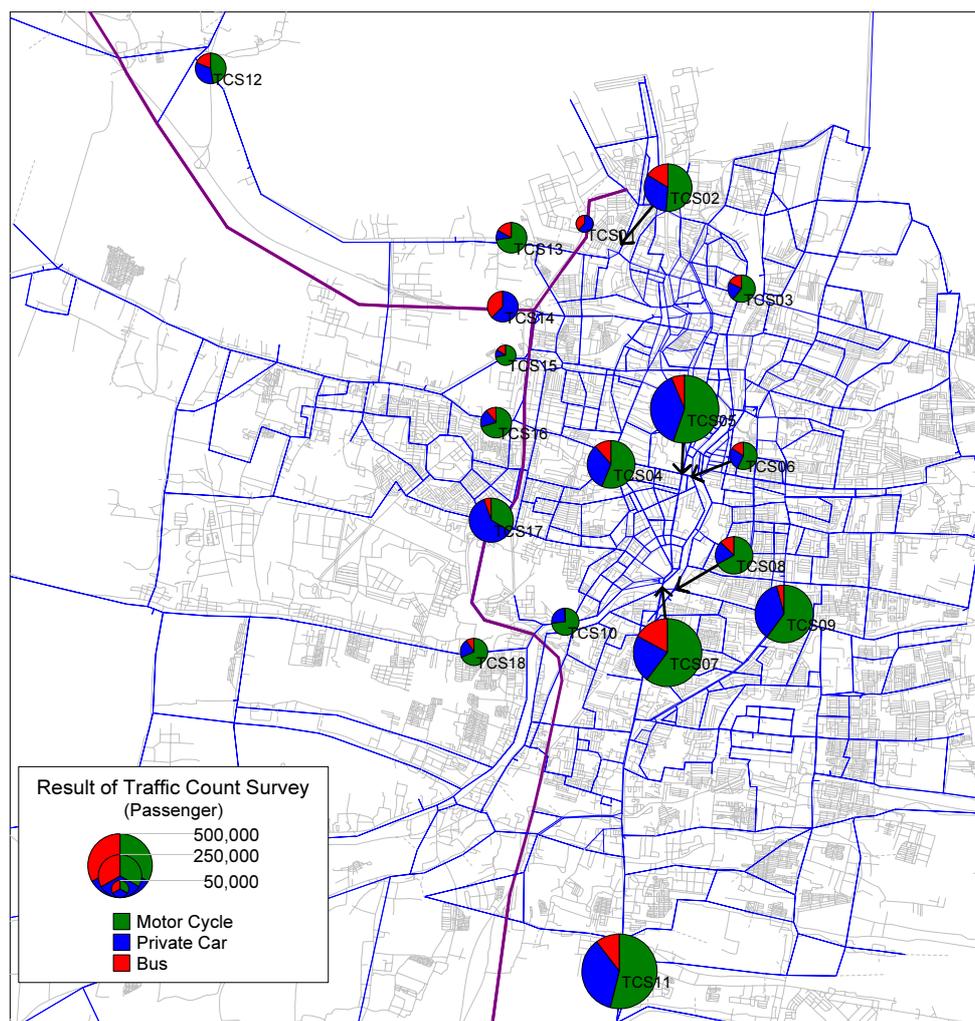
Figure 2.2.2 Traffic Volume in Kota Surabaya (unit: PCU)

Table 2.2.5 Traffic Volume in Kota Surabaya

(Unit: PCU)

Location Code	Location Name	Survey Hours	Motorcycle		Private Car		Bus		Others		Total
			Rate (%)		Rate (%)		Rate (%)		Rate (%)		
TCS01	Jl. Tol Surabaya - Gempol	16	9	0.0	12,151	29.4	1,135	2.8	27,975	67.8	41,270
TCS02	Jl. Tanjung Perak Barat & Timur	16	26,328	31.1	29,531	34.8	4,209	5.0	24,695	29.1	84,764
TCS03	Jl. Simokerto	16	11,673	42.1	9,070	32.8	2,922	10.6	4,029	14.5	27,693
TCS04	Jl. Raya Diponegoro	16	29,771	41.3	36,100	50.1	4,737	6.6	1,506	2.1	72,114
TCS05	Jl. Urip Sumoharjo	24	54,443	39.4	78,768	57.0	4,417	3.2	669	0.5	138,297
TCS06	Jl. Ngagel	16	11,911	42.1	11,971	42.3	2,761	9.8	1,649	5.8	28,291
TCS07	Jl. Raya Wonokromo	16	58,254	49.4	44,688	37.9	13,872	11.8	1,085	0.9	117,898
TCS08	Jl. Ngagel (Bridge)	16	21,329	53.7	13,560	34.2	3,764	9.5	1,034	2.6	39,686
TCS09	Jl. Raya Ngiden (Bridge)	16	45,036	42.8	55,750	53.0	2,083	2.0	2,408	2.3	105,277
TCS10	Jl. Karah ke Jl. Gunung Sari	16	15,181	56.8	10,757	40.2	234	0.9	561	2.1	26,732
TCS11	Jl. Raya Jend. A. Yani	16	73,769	46.1	71,235	44.5	8,772	5.5	6,290	3.9	160,065
TCS12	Jl. Raya Veteran (Gresik)	24	10,235	26.1	15,876	40.6	3,132	8.0	9,899	25.3	39,141
TCS13	Jl. Kalianak	24	16,573	43.7	5,423	14.3	3,652	9.6	12,314	32.4	37,962
TCS14	Jl. Tol Surabaya - Gresik	24	0	0.0	33,867	46.5	4,225	5.8	34,665	47.6	72,757
TCS15	Jl. Tanjung Sari	16	9,036	52.5	3,625	21.1	2,114	12.3	2,439	14.2	17,214
TCS16	Jl. Raya Tandes	16	16,905	49.3	10,528	30.7	2,763	8.1	4,071	11.9	34,266
TCS17	Jl. Mayjend. HR. Muhammad	16	15,656	20.1	58,469	75.0	2,026	2.6	1,855	2.4	78,006
TCS18	Jl. Raya Menganti	16	14,204	52.7	9,888	36.7	2,065	7.7	784	2.9	26,940

Source: 2009 Traffic Survey, JICA Study Team



Source: 2009 Traffic Survey, JICA Study Team

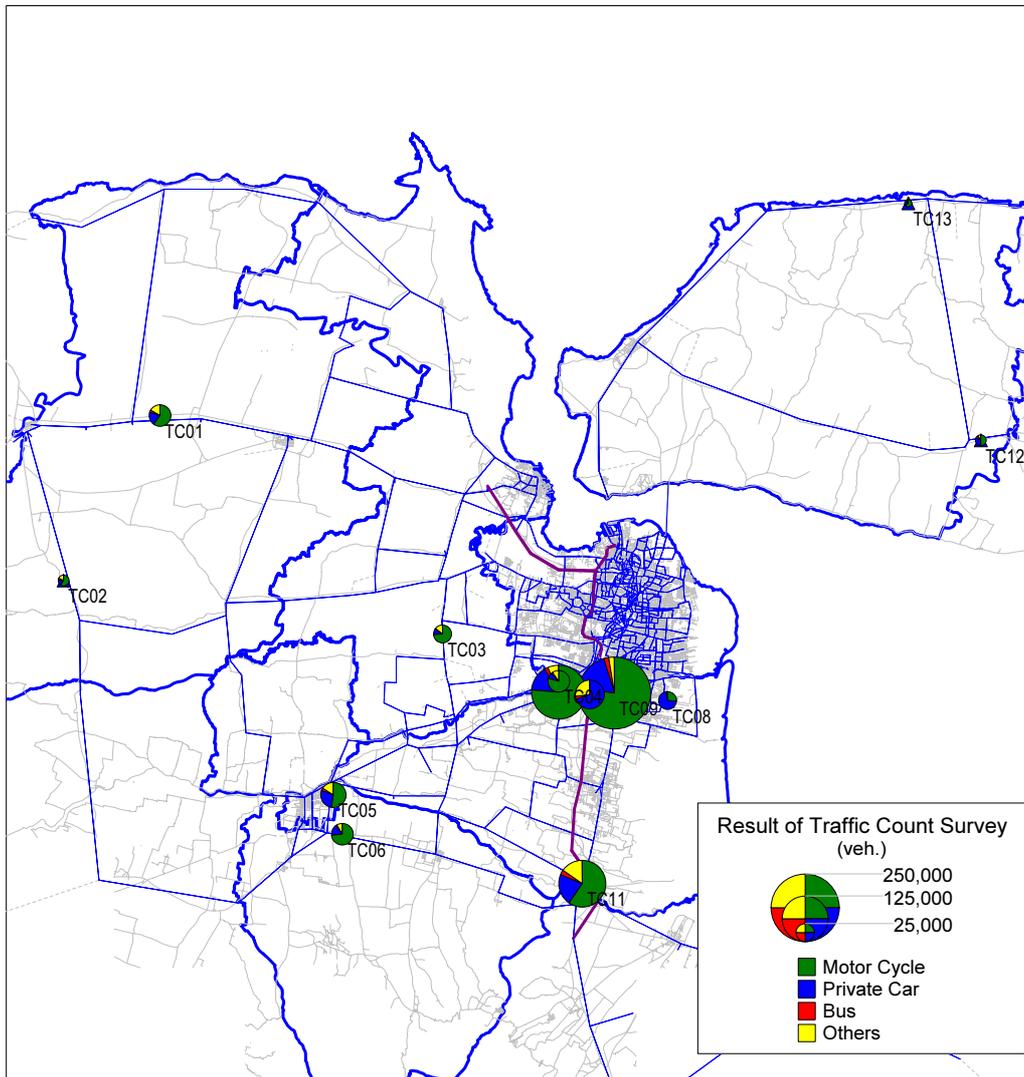
Figure 2.2.3 Estimated Passenger Trips in Kota Surabaya

Table 2.2.6 Estimated Passenger Trips in Kota Surabaya

(Unit: passenger)

Location Code	Location Name	Survey Hours	Motor Cycle	Rate (%)	Private Cars	Rate (%)	Bus	Rate (%)	Total
TCS01	Jl. Tol Surabaya - Gempol	16	51	0.1	32,519	61.7	20,097	38.2	52,668
TCS02	Jl. Tanjung Perak Barat & Timur	16	149,742	54.3	78,621	28.5	47,642	17.3	276,005
TCS03	Jl. Simokerto	16	66,387	60.4	23,883	21.7	19,687	17.9	109,957
TCS04	Jl. Raya Diponegolo	16	169,324	56.1	98,076	32.5	34,598	11.5	301,998
TCS05	Jl. Urip Sumoharjo	24	309,645	55.2	215,359	38.4	35,492	6.3	560,496
TCS06	Jl. Ngagel	16	67,744	57.2	32,456	27.4	18,318	15.5	118,518
TCS07	Jl. Raya Wonokromo	16	331,318	60.2	125,618	22.8	93,566	17.0	550,502
TCS08	Jl. Ngagel (Bridge)	16	121,307	66.9	36,726	20.3	23,188	12.8	181,221
TCS09	Jl. Raya Ngiden (Bridge)	16	256,139	60.0	153,377	35.9	17,689	4.1	427,205
TCS10	Jl. Karah ke Jl. Gunungsari	16	86,339	73.1	30,334	25.7	1,451	1.2	118,124
TCS11	Jl. Raya Jend. A. Yani	16	419,561	60.0	196,724	28.1	83,232	11.9	699,517
TCS12	Jl. Raya Veteran (Gresik)	24	58,210	47.0	42,077	34.0	23,547	19.0	123,835
TCS13	Jl. Kalianak	24	94,260	72.5	13,539	10.4	22,210	17.1	130,009
TCS14	Jl. Tol Surabaya - Gresik	24	0	0.0	88,762	62.3	53,718	37.7	142,480
TCS15	Jl. Tanjung Sari	16	51,392	71.6	8,851	12.3	11,567	16.1	71,810
TCS16	Jl. Raya Tandes	16	96,146	70.0	26,277	19.1	14,887	10.8	137,310
TCS17	Jl. Mayjend. HR. Muhammad	16	89,045	33.6	161,515	60.9	14,579	5.5	265,139
TCS18	Jl. Raya Menganti	16	80,782	68.1	26,393	22.3	11,432	9.6	118,608

Source: 2009 Traffic Survey, JICA Study Team



Source: 2009 Traffic Survey, JICA Study Team

Figure 2.2.4 Traffic Volume in GKS

Table 2.2.7 Traffic Volume in GKS

(Unit: vehicle)

Location Code	Survey Hours	Motorcycle	Rate (%)	Private Cars	Rate (%)	Bus	Rate (%)	Others	Rate (%)	Total
TC01	16	21,653	59.6	7,403	20.4	1,262	3.5	6,040	16.6	36,358
TC02	16	5,241	59.2	1,462	16.5	552	6.2	1,601	18.1	8,856
TC03	16	20,175	73.6	2,923	10.7	358	1.3	3,967	14.5	27,423
TC04	16	26,258	79.2	2,812	8.5	884	2.7	3,206	9.7	33,160
TC05	16	20,164	52.1	10,966	28.4	1,294	3.3	6,246	16.2	38,670
TC06	16	25,386	73.2	5,577	16.1	799	2.3	2,898	8.4	34,660
TC07	16	122,840	76.3	24,255	15.1	3,417	2.1	10,504	6.5	161,016
TC08	16	6,710	26.3	18,340	71.8	220	0.9	282	1.1	25,552
TC09	16	211,512	77.2	49,497	18.1	6,088	2.2	6,908	2.5	274,005
TC10	24	0	0.0	39,490	69.5	1,921	3.4	15,413	27.1	56,824
TC11	24	74,865	59.4	27,600	21.9	4,411	3.5	19,197	15.2	126,073
TC12	16	4,935	50.0	3,191	32.3	870	8.8	882	8.9	9,878
TC13	16	3,870	64.1	1,192	19.8	613	10.2	360	6.0	6,035

Source: 2009 Traffic Survey, JICA Study Team