PART III

STRUCTURE PLAN IN SURABAYA METROPOLITAN AREA

CHAPTER 7 AIMS & DEVELOPMENT CONCEPTS FOR SMA

7.1 AIMS OF THE STRUCTURE PLAN FOR SMA

The aims of the structure plan for SMA are basically derived from the national and regional development context.

It is a basic concept in this study that a dual system is established in order to realize the national and regional targets: one is the industrialization system and the other is the distribution system.

The aims can be achieved with the formation of these systems, and can be stated as follows:

From a socio-economic point of view, they are:

- to ensure the urban economic growth by making the best use of the economies of agglomeration, and
- to raise the income level and to ensure the social and living stability based on an appropriate distribution of benefits accruing from the development.

In terms of the physical structure,

- to develop urban facilities for industrial, living and communication activities, and
- to develop an orderly physical environment so as to activate the urban facilities developed.

7.2 PLANNING OBJECTIVES

OBJECTIVES FOR SOCIO-ECONOMIC SECTOR

(1) To establish an appropriate industrial structure, development of incentives for industrial investments should be given priority and to achieve this investment can be considered to be broken down as follows:

- Development of infrastructure supporting industrial activities,
- Aggressive inducement of foreign investment and modern industries, whose purpose is to modernize existing manufacture through a mutual relationship as well as to create employment opportunities.

(2) To improve the quality of the residents lives

The objective is broken down as follows:

There exist various factors influencing the resident's daily lives and these factors should be maintained and simultaneously advanced by the opportunities of occupying a dwelling, education, employment, participation in the community, and so on. Above all, dwellings should be provided for all citizens to ensure their social cultural and healthy lives.

OBJECTIVES FOR PHYSICAL STRUCTURE

(1) To Deliberately Control the Urban Growth

- to systematize the allocation of work places and housing in relation to the transport system
- to establish the rules for urbanization

(2) To establish an efficient transportation system

This is firmly related with socio-economic development, and is classified into the following items:

- To develop the public transportation network system including mass transportation modes,
- To regulate a development standard of roads and streets in accordance with the functional characteristics,
- To establish a functional system for utilization of roads such as primary and secondary systems.

(3) To develop the urban utilities system

Several developments should be executed with high priority for the utilities system.

Major developments are:

- Sanitary System,
- Drainage System,
- Water Supply System,
- Solid Waste Treatment System,
- Electricity System.

7.3 BASIC PLANNING CONCEPTS

The Study Team proposes an aggressive industrialization as a planning principle, and plans a functional urban structure in order to support the industrialization.

(1) INDUSTRIALIZATION OF SMA

Industrialization should be aggressively promoted in SMA as one of high level industrial development cores in East Java. There are four existing dominant factors for the industrialization of SMA:

- Existence of the major port, Tg. Perak,
- Function as a major transportation node connecting with major urban areas in East Java,
- Accumulation of financial, trading and wholesaling functions in the distribution sector, and
- Function of management and administration.

(2) FUNCTIONAL URBAN STRUCTURE

In terms of the functional structure, the following considerations are given:

- Ensuring an appropriate extent of urban area

  A maximum extent of one unified urban area is generally less than 30 km radius and within 30 minutes travel by vehicle.

- Internal System for Urban Functions

  Cargo flow and passenger flow should be separate systems.

- Connecting System with Outer Region

  In consideration of the high development potential of the three radial corridors, it will be necessary to develop a dual trunk system.

- Allocation System of Facilities

  Major industrial facilities are to be allocated along the major trunk routes supporting regional activities. They are to be located outside of the central business district but not too far from the residential areas.

- Mass Transportation Network as Urban Structure

  A future urban structure is largely influenced and characterized by a network of mass transportation.

(3) SOCIO-ECONOMIC FRAMEWORK

The socio-economic framework in the year 2000 as a target is summarized as shown in Table 11.3.1.

Table 11.3.1 SOCIO-ECONOMIC TARGET FOR DEVELOPMENT IN SMA AND GKS IN 2000

	ITEMS		SMA		GKS Region		Share of SMA (%)		Magnification 2000/1980		Annual Growth Rate (%)	
			1980	2000	1980	2000	1980	2000	SMA	GKS	SMA	GKS
SOCIAL FACTORS	Population		2,905,414	6,119,400	6,111,935	10,759,700	47.5	56.9	2.10	1.76	3.79	2.87
	(persons)	0 - 14	1,042,447	1,839,500	2,227,198	3,189,300	46.8	57.7	1.76	-	2.88	1.81
		15 - 24	653,567	1,101,300	1,285,451	1,824,800	50.8	60.4	1.69	1.42	2.64	1.77
		25 - 49	890,617	2,374,600	1,869,761	4,203,800	47.6	56.5	2.67	2.25	5.03	4.13
		50 - 64	228,907	532,300	530,286	1,020,000	43.2	52.2	2.33	1.92	4.31	3.32
		65 -years old	89,876	271,700	199,240	521,800	45.1	52.1	3.02	2.62	5.69	4.93
	Employments		1,141,768	2,459,300	2,565,022	4,700,800	43.0	52.3	2.15	1.76	3.91	3.08
	(persons)	Primary	186,593	186,800	1,123,649	1,165,400	16.6	16.0	1.00	1.04	0.01	0.18
		Secondary	162,959	584,800	233,613	847,000	69.8	69.0	3.59	3.63	6.60	6.65
		Tertiary	792,216	1,687,700	1,207,760	2,688,400	65.6	62.8	2.13	2.23	3.85	4.08
	Households (thousand)		597	1,243	1,268	2,236	47.0	55.6	2.08	1.76	3.73	2.88
	Monthly Expenditure Per Household (Rp.)		46,674	92,434	-	-	-	-	1.98	-	3.48	-
ECONOMIC FACTORS	GRDP (million Rp.)		441,843	1,821,500	642,889	2,543,700	68.7	71.6	4.12	3.96	7.34	7.12
		Primary	39,931	65,800	139,870	233,000	28.5	28.2	1.65	1.67	2.53	2.58
		Secondary	107,528	708,200	139,061	956,500	77.3	74.0	6.59	6.88	9.88	10.12
		Tertiary	294,384	1,047,500	363,958	1,354,100	80.9	77.4	3.56	3.72	6.55	6.79
	Per Capita GRDP (thousand Rp.)		152.1	297.6	105.2	236.4	-	-	1.96	2.25	3.41	4.13
	GRDP Per Employment (thousand Rp.)		387.0	740.6	250.6	541.1	-	-	1.91	2.16	3.30	3.92
		Primary	214.0	352.2	124.5	199.9	-	-	1.65	1.61	2.52	2.40
		Secondary	659.8	1,211.0	595.3	1,129.4	-	-	1.84	1.90	3.08	3.25
		Tertiary	371.6	620.6	301.3	503.7	-	-	1.67	1.67	2.60	2.60

NOTE : 1) For monetary terms, Rp. at 1975 Constant Price is applied.

7.4 FUNCTIONS TO BE DEVELOPED

The urban development in SMA should be considered as a core composing socio-economic harmony between the urban and the rural, and the central function to be ensured in SMA is to encourage the rural development of the hinterland.

The urban functions to be especially enhanced in SMA in accordance with Level I and Level II requirements consists of the following factors:

- Distribution Function
- Central Management and Administrative Function
- Information Function
- Employment Function

The urban function to be emphasized in SMA corresponding to the function levels is conceptionally summarized in Table 12.1.1.

7.5 SPATIAL FEATURE OF THE PLAN

(1) COMPOSITION OF URBAN LAYOUT

(i) Transportation Network as the Urban Structure

The principle of the allocation plan of population and industries in SMA are summarized as follows:

- To form an urban area which allows the continuous expansion of the existing urban area of Surabaya radially and circumferentially.
- To form some areas which are located outside the above area and create independent urban districts within Surabaya in order to reduce the burden of goods and population concentration towards urban Surabaya.

These areas are divided into three categories based on their characteristics, and are named, Central Urban Core Zone; Central Function Dispersion Zone; and Industry and Physical Distribution Facility Zone.

The principle of the transportation facility plan is to build a physical framework of the city in consideration of the expected function of these zones and the allocation of fundamental facilities to fulfil those functions.

(ii) Radial Circular Trunk Road System as Major Structure

The Radial Circular Road System is the acceptable pattern for the major highway structure of this area.

A ring road would contribute to the dispersal of this traffic and permit the rehabilitation of the existing road function.

(iii) Grid System Supporting Radial Circular System Activities

A street netowrk based on a grid pattern is recommended to be formed as a fundamental characteristic of the Secondary System in order to promote land development for urban exploitation and to give a diversity of access to the central core area.

The spacing of arterial streets within the grid pattern is recommended to be around 2.0 ∿ 3.0 km.

Table 12.1.1 COMPARISON OF FUNCTION EMPHASIS BETWEEN SMA CENTRAL CORE AND PERIPHERAL URBAN CORES

FACILITY LEVEL TO BE DEVELOPED		LEVEL (I)		LEVEL (II)		LEVEL (III)	
		A	B	A	B	A	B
INDUSTRIAL FUNCTIONS	ADMINISTRATION / CENTRAL MANAGEMENT	■		■			●
	DISTRIBUTION	■		■	○	□	●
	INFORMATION	■		■	○		●
	EMPLOYMENT	□		■	○	□	●
SOCIAL / CULTURAL FUNCTIONS	CONSUMPTION	▩		■	○	□	●
	SOCIAL WELFARE	▩		■	○	□	●
	CULTURE	▩		■	○		●
	MEDICAL TREATMENT	▩		■		□	●
	LEISURE		●	■	○	□	●

■ Strong
▩ Moderate

● Strong
○ Occasional

A = SMA Central Core
B = Peripheral Urban Cores

A = SMA Central Core B = Peripheral Urban Cores

(iv) Basic Urban Structure

The basic urban structure in Surabaya Metropolitan Area is composed of the two systems of radial circular pattern as the primary system, and the grid pattern as its supplement.

Based on the conceptional structure above, the physical structure planning is performed so as to solve the existing problems as follows:

– Development of the East-West Axis Inside of Surabaya City

· Some new trunk streets should be encouraged in order to connect the eastern and western areas.

· The following can be expected by the development of East-West trunk roads:

A) Enlargement of development potential in the western and eastern areas
B) An alternative for an efficient traffic flow and service access to the busy area

– Development of Four Ring Roads Centring on Central Business District

· Inner Ring Road
· Middle Ring Road
· Outer Ring Road 1
· Outer Ring Raod 2

– Encouragement of Radial Trunk Roads

The development of radial trunk roads has the function of distributing the benefits caused by the development of SMA to every area in East Java, as well as to the GKS Region.

In this context, four major corridors should be encouraged as follow:

· North-South Axis
· East-South Axis
· North-West Axis
· North Axis

– Development of By-Passes

It is sometimes found in many cities that a by-pass of arterial road forms a new structure to create development potential.

By-passes should be established at four places as follows:

· Sidoarjo (Sidoarjo – Krian – Mojokerto)
· Krian (Sidoarjo – Krian – Mojokerto)
· Krian (Surabaya – Krian – Mojokerto)
· Gresik (Surabaya – Gresik – Lamongan)

(2) PRIMARY ROAD NETWORK SYSTEM IN SMA

The primary system and the secondary system are the principal components of the total network system.

The Study Team proposes some alternative for the primary road network system based on the following conditions:

– to deal with wide variety of regional traffic,
– to serve industrial freight and goods traffic, and
– to serve as an access to major industrial facilities and freight generators.

After the consideration of three alternative network systems of the primary roads, the Study Team recommends that alternative A is the best system for SMA as shown in Fig. 12.3.3.

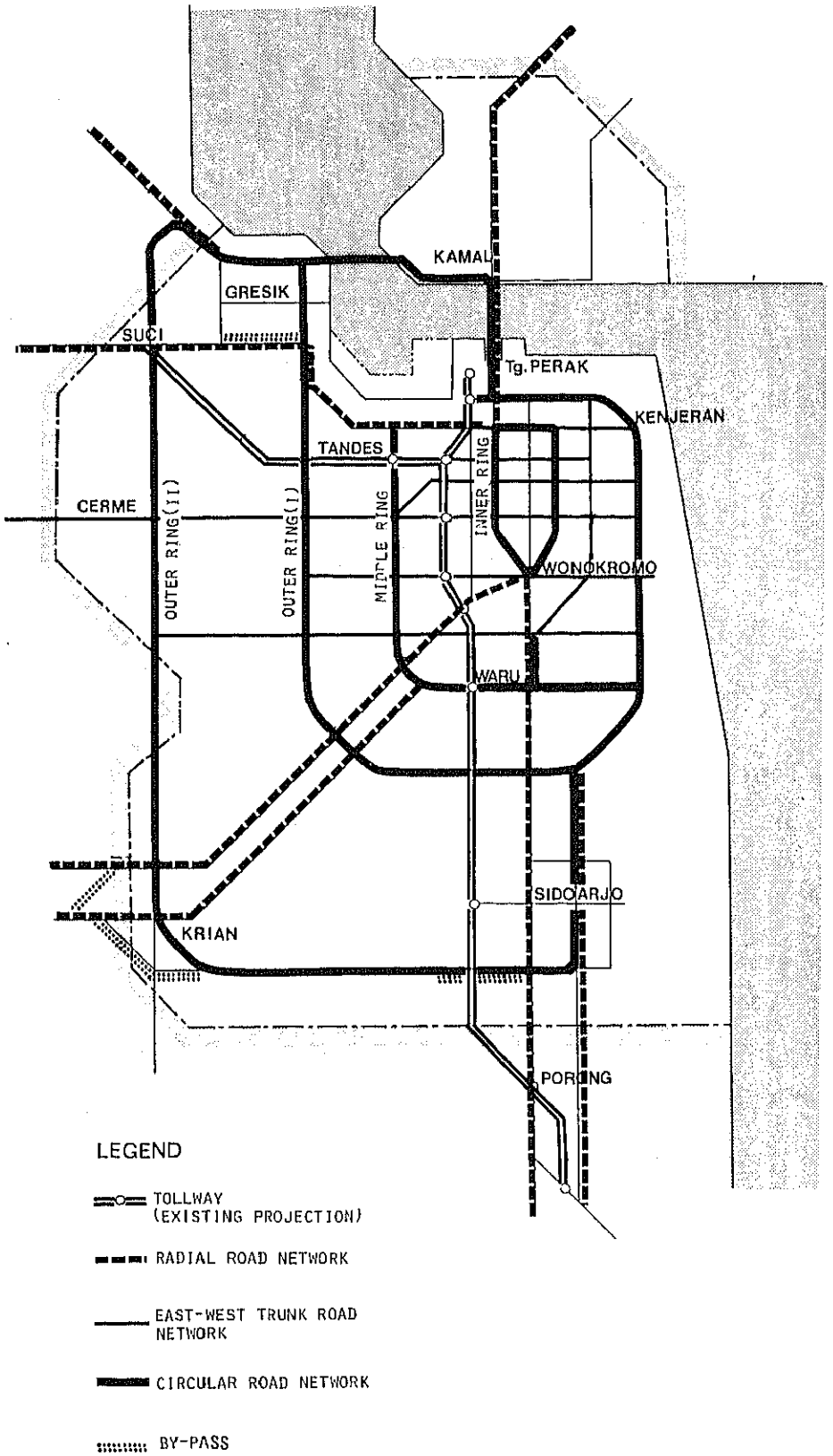


Fig. 12.3.1 PROPOSED BASIC URBAN STRUCTURE

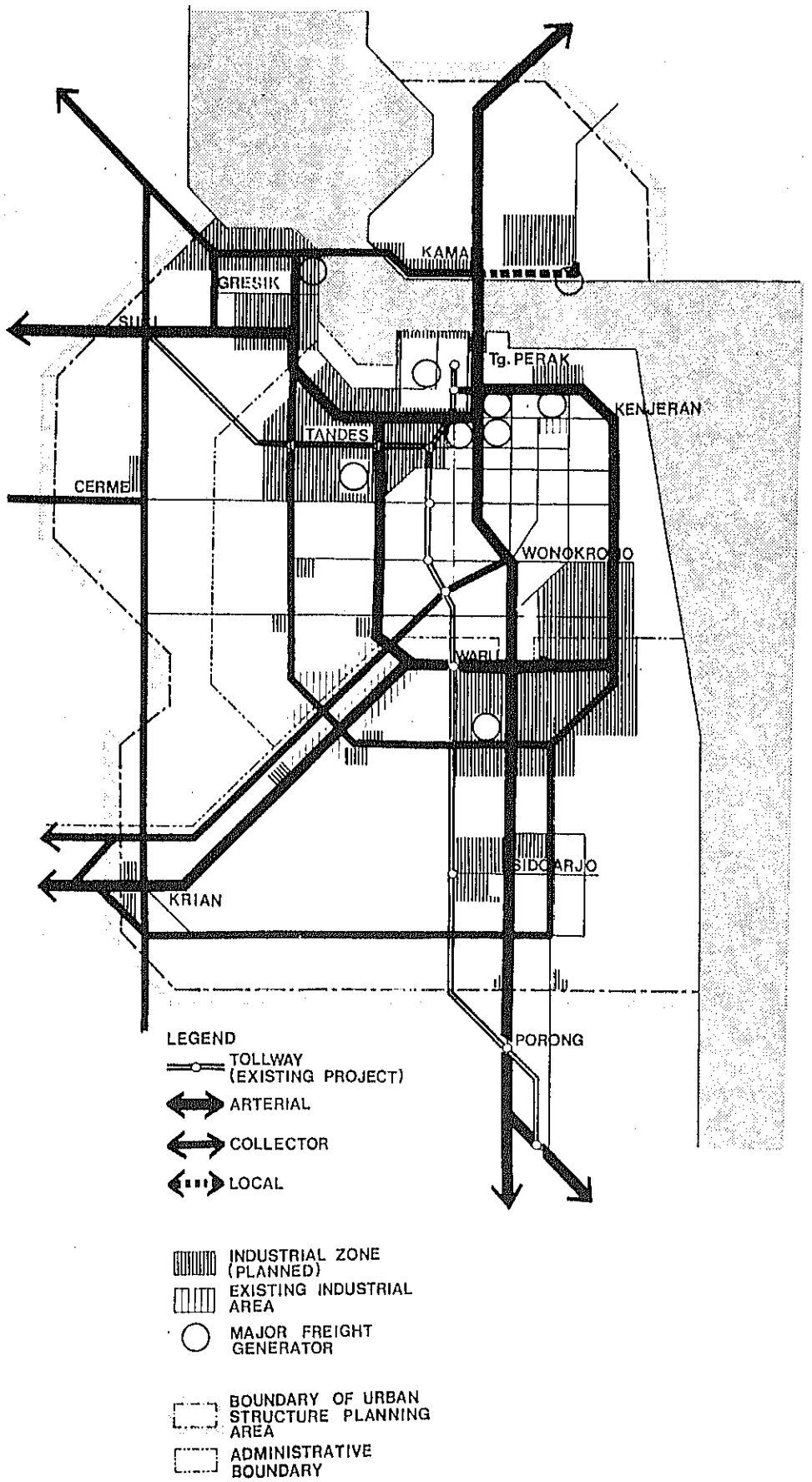


Fig. 12.3.2 ALTERNATIVES OF PRIMARY ROAD NETWORK SYSTEM (PATTERN: A)

7.6 LAND AVAILABILITY

(1) CHANGEABLE FACTORS FOR DEVELOPMENT POTENTIAL

The changeable factors in future are:

- Infrastructure and
- Urban accessibility (Time-distance).

Whilst, natural conditions are an unchangeable factor, these factors are utilized as the present conditions in the analysis.

Fig. 12.4.1 shows the change of "Urban Accessibility" similar to the time-distance to the central area of Surabaya between 1980 and 2000.

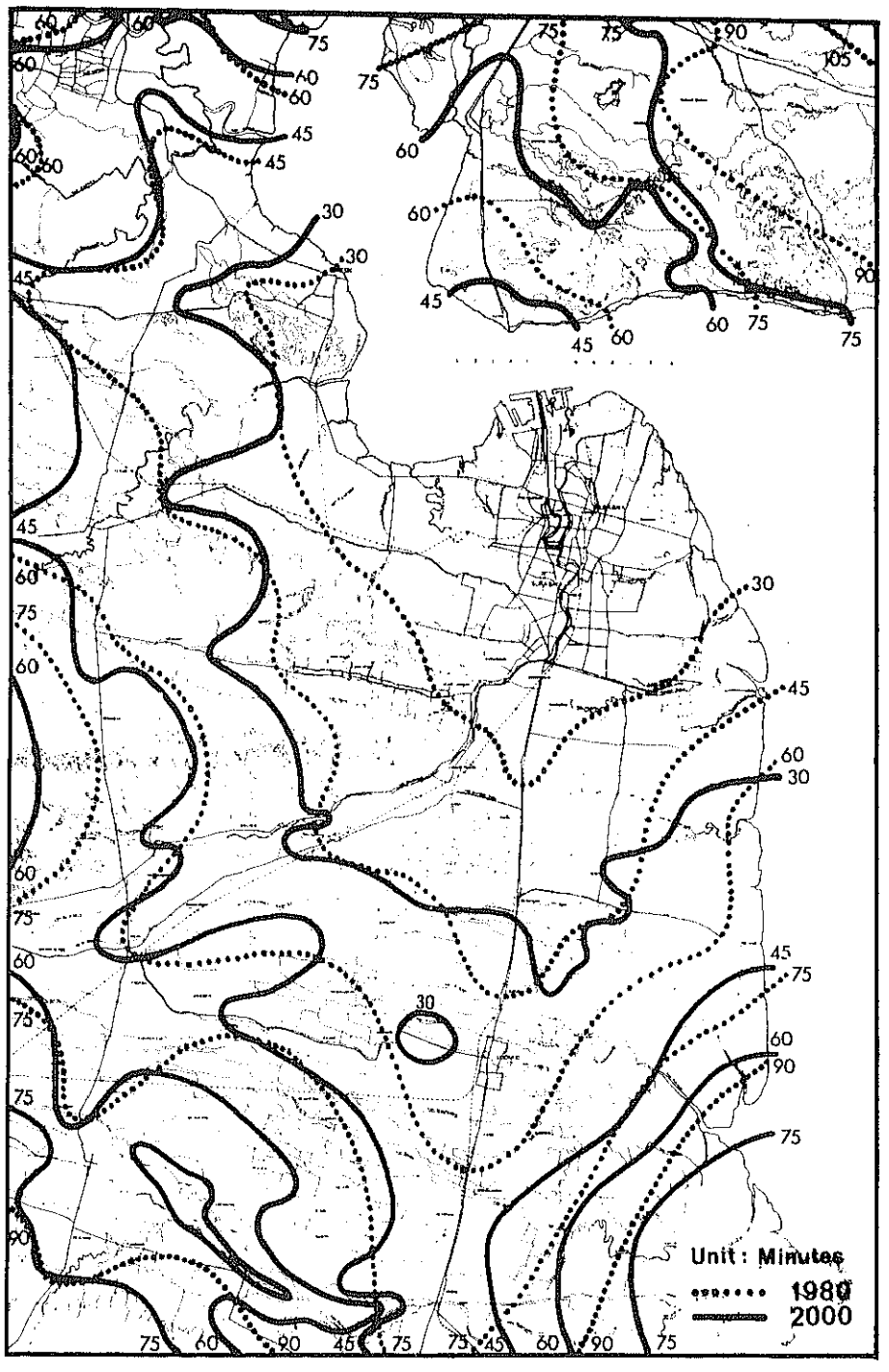


Fig. 12.4.1 CHANGE OF TIME-DISTANCE TO CENTRAL AREA OF SURABAYA BETWEEN 1980 AND 2000

(2) EVALUATION OF FUTURE DEVELOPMENT POTENTIAL

The analysis by a mesh method was carried out using 4 constraint factors (natural conditions) and 2 revised promotion factors.

The result of ranking evaluation is as shown in Fig. 12.4.2.

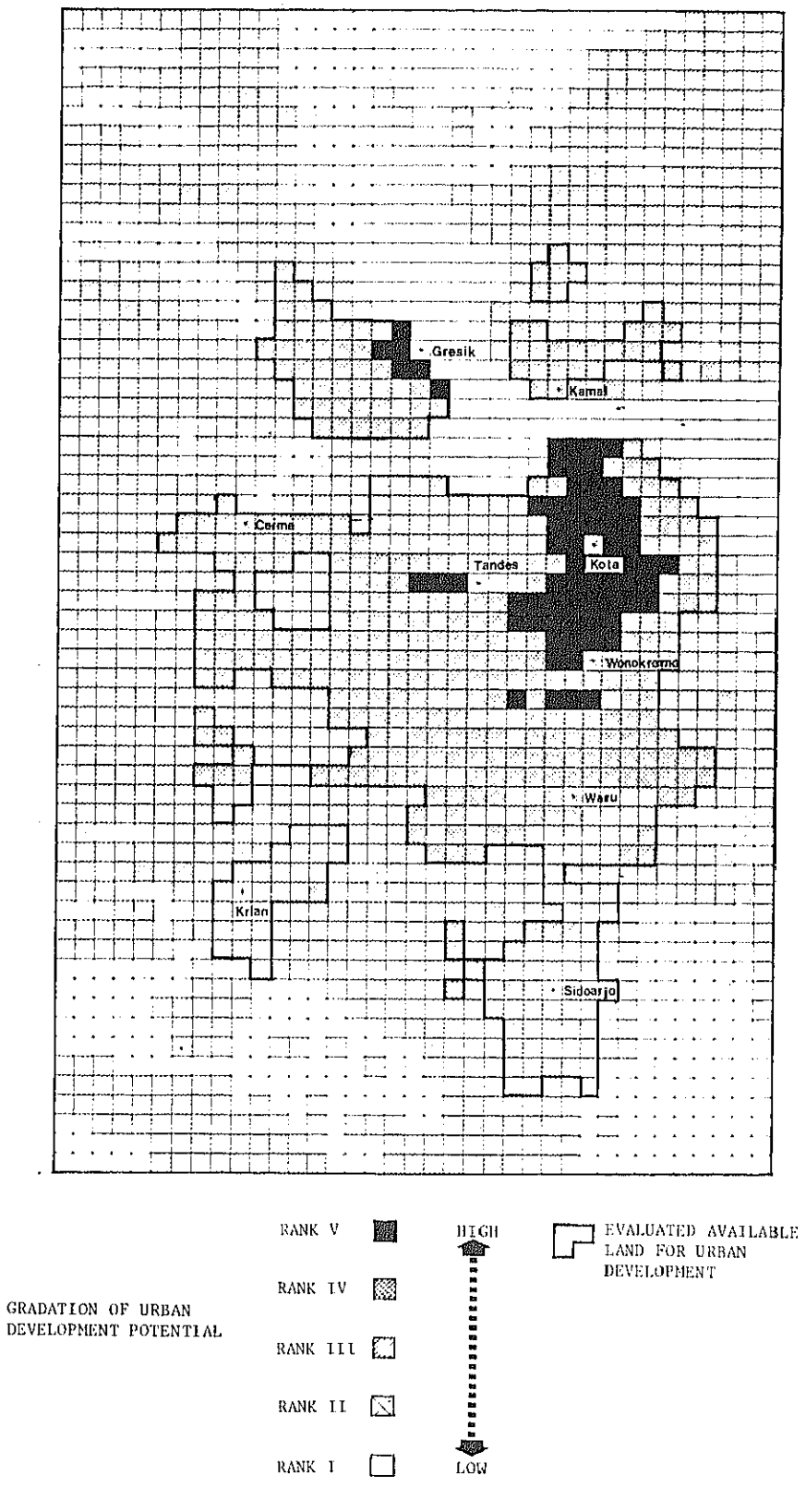


Fig. 12.4.2 LAND AVAILABILITY FOR URBAN DEVELOPMENT IN THE FUTURE

CHAPTER 8 TRAFFIC DEMAND FORECAST

8.1 FRAMEWORK OF FUTURE TRAFFIC GENERATION

(1) DEMAND FOR FUTURE PERSON TRIPS

Total person trips generated and attracted to Surabaya in 1982 was estimated at 3.7 million trips/day, of which 3.3 million trips were made by Surabaya residents with an average trip rate of 1.85 trips per person.

To estimate the future gross trip rate, a net trip rate and an outdoor trip rate (%) were respectively assumed to be 2.5 trips/person and 85%. These are compared in Table 13.2.1 with those derived from the home interview survey for Surabaya, 1982 and from the cases for Jakarta and a Japanese urban area.

Consequently, a future gross trip rate and a trip generation factor were estimated to be 2.1 trips/person and 2.35 trips/person respectively for Surabaya, 2000, as shown in Table 13.2.2.

(2) DEMAND FOR FUTURE TRUCK TRAFFIC

The existing truck generating factor per job in the secondary sector was calculated to be 0.28 trips/job without port related traffic. Considering the future increase in productivity, the factor was assumed to be 15% higher than present, that is 0.32 trips/job for both 1990 and 2000.

Future port traffic was projected based on the results of Tg. Perak Port feasibility study. The economic development framework adopted by the feasibility study is a little lower than that of this structure plan and therefore the future cargo traffic in the port was adjusted to be 10,714,000 ton/year and 25,054,000 ton/year for 1990 and 2000 respectively.

Distribution of this port traffic was assumed to increase in proportion to the growth of zonal jobs in the secondary and tertiary sectors. A summary of the above truck traffic generated is shown in Table 13.2.6.

8.2 PERSON TRIP DISTRIBUTION MODEL AND FUTURE O-D MATRIX

(1) PERSON TRIP DISTRIBUTION MODEL

In order to estimate a future trip distribution, two types of models, Gravity Model and Growth Factor Method, were applied.

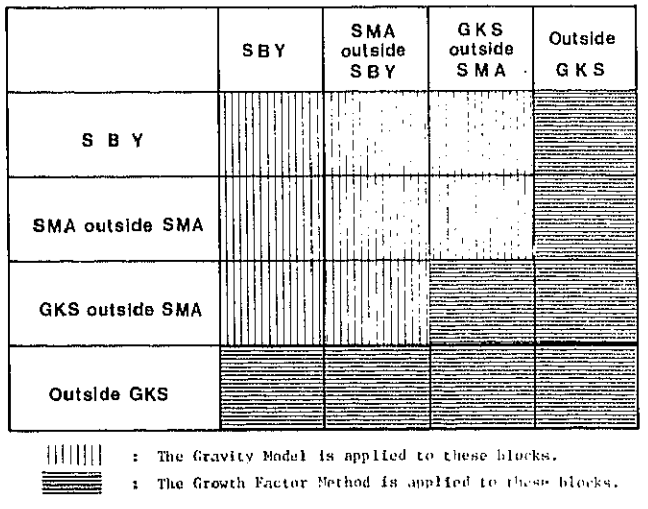


Fig. 13.5.1 TRIP DISTRIBUTION MODELS AND APPLIED AREAS

(2) FUTURE PERSON TRIP O-D MATRIX

Future O-D Metrix on person trip base was calculated by the above mentioned methods and the results in the year 1990 and 2000 are expressed in Table 13.5.1 as a Block O-D Table and in Figs. 13.5.2 and 13.5.3 as desire line diagram.

Table 13.2.1 COMPARISON OF TRIP RATES

Type of Trip Rate	Surabaya, 1982[4]	Surabaya, 2000 (Estimated)	Jakarta, 1980[5]	Average Urban Area in Japan
(1) Gross Trip Rate[1]	1.85	2.1	2.09	2.65
(2) Out-door Trip Rate[2]	75.8%	85%*	86.8%	87.3%
(3) Net Trip Rate[3]	2.44	2.5*	2.41	3.02

Notes: 1) Average trip times per person who lives in Surabaya and is over 6 years of age
2) Percentage population who made at least one trip and are over 6 years of age
3) Average trip times per person who made at least one trip and is over 6 years of age [(3) = (1) ÷ (2)]
* Assumed in comparison with other cases
Source: 4) Home Interview Survey by the Team in 1982
5) Feasibility Study on Jakarta Harbour Road Project, Nov., 1981 by JICA.

Table 13.2.2 TRIP RATE AND TRIP GENERATION FACTORS IN SURABAYA

Trip Rate/Factor	Surabaya, 1982	Surabaya, 2000 (Estimated)
(1) Gross Trip Rate	1.85	2.1
(2) Trips Generated/Attracted in SBY	3,708,600	7,757,300
(3) Population	2,103,800	3,825,000
(4) Percentage Population over 6 Years of Age	85.5%	86.3%
(5) Trip Generation Factor [(2)/(3) x (4)]	2.06	2.35

Table 13.2.6 ESTIMATED FUTURE TRUCK TRAFFIC GENERATION

(Unit:veh. trips/day)

Year	Origin \ Destination	Surabaya	Outside Surabaya	Total
1982	Surabaya outside Port	25,388	8,782	34,170
	Port related trucks	1,933 (x 2)	974	2,907(4,840)
	Surabaya Total	29,254	9,756	39,010
1990	Surabaya outside Port	35,722	14,549	50,271
	Port related trucks	3,202 (x 2)	2,605	5,807(9,009)
	Surabaya Total	42,126	17,154	59,280
2000	Surabaya outside Port	45,401	23,885	69,286
	Port related trucks	7,033 (x 2)	5,572	12,605(19,638)
	Surabaya Total	59,467	29,457	88,924

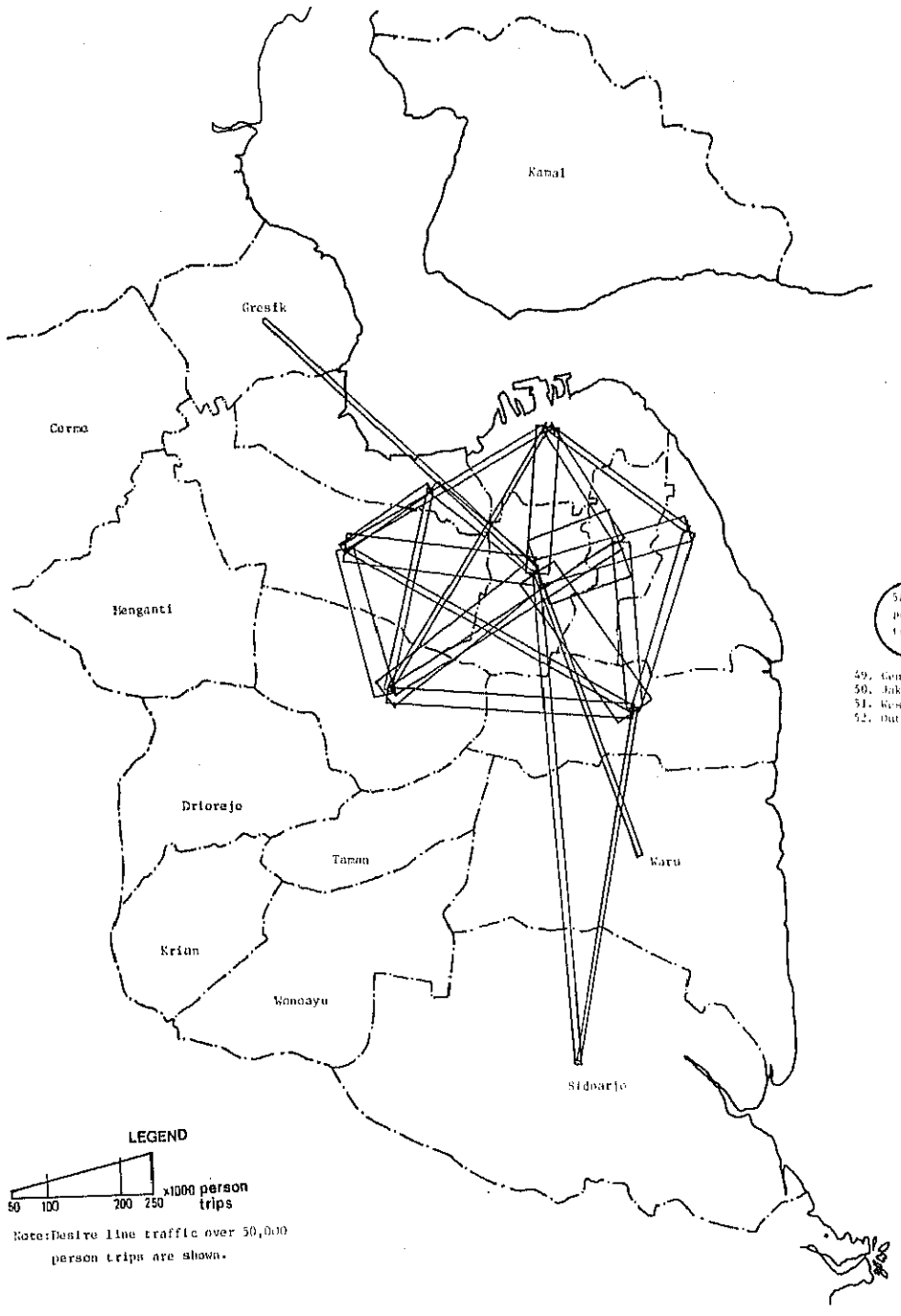


Fig. 13.5.2 DESIRE LINE TRAFFIC FOR SMA IN 2000 (PERSON TRIP)

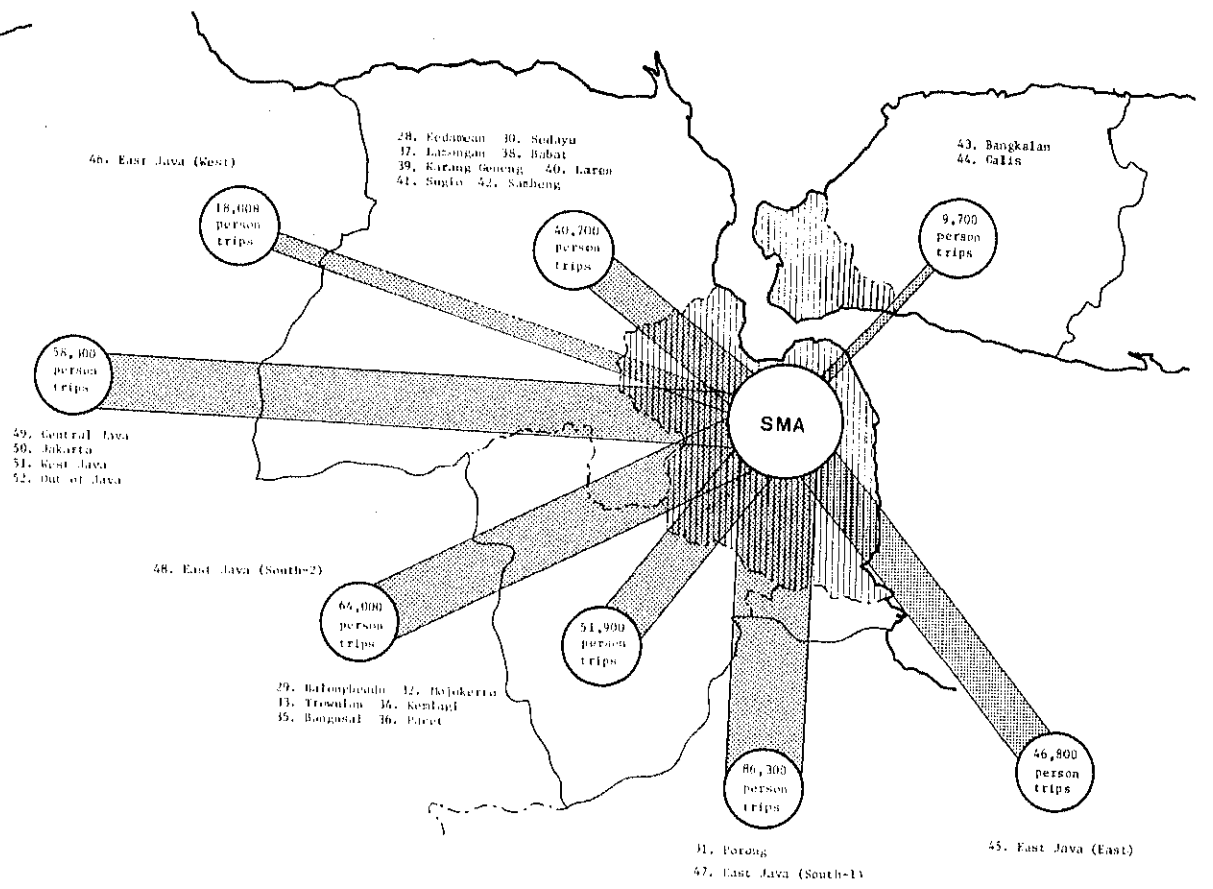


Fig. 13.5.3 DESIRE LINE TRAFFIC FOR OUTSIDE SMA IN 2000 (PERSON TRIP)

8.3 MODAL SPLIT AND TRIP DISTRIBUTION BY MODE

In estimating future O-D tables by mode future shares of commuter train (Urban Mass Transit and New Transit System) were assumed for the seven alternative cases described below:

Case 1 : In the year 2000, neither Urban Mass Transit nor New Transit System are available.

Case 2 : In the year 2000, Urban Mass Transit and New Transit System are available at Level I.*

Case 3 : In the year 2000, only Urban Mass Transit is available at Level I.*

Case 4 : In the year 2000, Urban Mass Transit and New Transit System are avaiable at Level II.**

Case 5 : In the year 2000, Urban Mass Transit is available at Level II.**

Case 6 : In the year 1990 neither Urban Mass Transit nor New Transit System are available.

Case 7 : In the year 1990 Urban Mass Transit and New Transit System are available at Level II.**

Notes: * Level I means the service level which enables Urban Mass Transit and New Transit System to attract 10% of inter-zonal trip makers within GKS Region. However, if only Urban Mass Transit is prepared on the Level I, it can not attract 10% but less than 10% of those trip makers within GKS Region.

** Level II, which is defined in the same way as Level I, is the service level that enables Urban Mass Transit and New Transit System to attract 20% of inter-zonal trip makers within GKS Region.

The total person trips by mode in GKS Region are compared with other alternative Cases as shown in Table 13.6.3.

8.4 VERIFICATION OF TRAFFIC DEMAND BY PRIVATE VEHICLE

(1) GENERAL

Premises assumed in the future modal split analysis are as follows:

a) Share of long distance trips by inter-city bus and railway is relatively proportional to the total person trips.

b) Share of the urban mass transit and the new transit system depends on the transport capacity.

c) Share of sedan trips is relatively independent from the development levels of such public transport as the urban mass transit, city bus transport, and also the ownership level of motorcycles. It is, however, dependent on the income level of the inhabitants.

d) Using the modal split curve, the percentage shares of motorcycle and city bus trips are determined based on travel distance, which were derived from the "Home Interview Survey in 1982". Accordingly, sedan ownership and average trip times per day were estimated as a prerequisite to assess a future framework of the sedan trips in Surabaya. However, the number of motorcycle trips designed in the modal split analysis will be influenced by the supply level of commuter trains and the travel distance of motorcycle. Therefore, it is also necessary to verify the probable range of motorcycle fleet which will vary corresponding to the alternative development levels of commuter trains. This means conversely to what extent the public transport including commuter trains and city buses should be developed in the future.

(2) FUTURE SEDAN OWNERSHIP AND MOTORCYCLE OWNERSHIP

(i) Forecast of future sedan ownership

The resulting future estimates of sedan fleet in Surabaya were compared as shown in Table 13.6.10, and it was eventually assumed to reach 107,145 vehicles for the 1990 and 209,400 for the year 2000.

(ii) Analysis of Future Motorcycle Ownership

The future motorcycle fleet in Surabaya, 1990 and 2000 were calibrated as shown in Table 13.6.11.

Table 13.6.3 COMPARISON PERSON TRIPS BY MODE IN GKS REGION FOR ALTERNATIVE CASE 1 THROUGH 7

Unit : Thousand person trips/day

	Year	Truck	Long Distance Train	Sedan	Motorcycle	City Bus	Inter-city Bus	Commuter Train	Total
Case 1	2000	238.2 (5.2)	30.1 (0.7)	1,635.0 (35.5)	793.5 (17.2)	1,578.0 (34.3)	327.2 (7.1)	- (-)	4,602.0 (100%)
Case 2	2000	238.2 (5.2)	30.1 (0.6)	1,632.1 (35.5)	675.2 (14.7)	1,299.2 (28.2)	321.6 (7.0)	405.6 (8.8)	4,602.0 (100%)
Case 3	2000	238.2 (5.2)	30.1 (0.7)	1,632.1 (35.5)	696.7 (15.1)	1,336.0 (29.0)	321.9 (7.0)	347.0 (7.5)	4,602.0 (100%)
Case 4	2000	238.2 (5.2)	30.1 (0.7)	1,629.3 (35.4)	555.8 (12.1)	1,021.8 (22.1)	315.5 (6.9)	811.2 (17.6)	4,602.0 (100%)
Case 5	2000	238.2 (5.2)	30.1 (0.7)	1,629.3 (35.4)	598.4 (12.9)	1,095.5 (23.8)	316.5 (6.9)	694.0 (15.1)	4,602.0 (100%)
Case 6	1990	76.4 (2.7)	23.1 (0.8)	813.8 (28.5)	601.4 (21.1)	1,088.0 (38.1)	252.4 (8.8)	- (-)	2,855.1 (100%)
Case 7	1990	76.4 (2.7)	23.1 (0.7)	812.6 (28.5)	438.6 (15.4)	750.1 (26.3)	247.0 (8.6)	507.3 (17.8)	2,855.1 (100%)

Table 13.6.10 COMPARISON OF ESTIMATED FUTURE SEDAN FLEET IN SURABAYA

Data Applied for Estimating Future Sedan Fleet in Surabaya					
Year (1)	Sedan Fleet in Surabaya	Per Capita GRDP at 1975 Const. Price in JKT: (1000 X_i)		Motorization Level (Sedan/1000 pop.): (Y_i)	
1971	21,133	--		--	
1972	23,308	--		--	
1973	26,474	--		--	
1974	26,445	--		--	
1975	29,234	195,892		28,227	
1976	31,665	207,508		31,507	
1977	34,102	216,754		32,935	
1978	34,465	223,886		35,264	
1979	36,972	244,719		37,525	
1980	40,927	264,616		41,145	
1981	45,525	--		--	
Estimating Models	Average Annual Growth Rate: 8.0% p.a.	Estimated Regression Equation: $Y_i = 0.1794\ X_i - 6.0206$		($r^2 = 0.9773$)	
Future Year (i)	Estimated Sedan Fleet in SBY:	Per Capita GRDP at 1975 Const. Price in SBY: (1000 X_i)	Estimated Motorization Level: (Y_i)	Population (x 1,000) : (Z_i)	Estimated Sedan Fleet in SBY: ($Y_i \times Z_i$)
1990	91,005	242,236	37,437	2,862	107,145
2000	196,472	338,716	54,745	3,825	209,400

Table 13.6.11 MOTORCYCLE OWNERSHIP FORECAST FOR SURABAYA BY DIFFERENT CASES

		Estimated Saturation Level	Assumed Saturation Level	
			CASE I	CASE II
OWNERSHIP (Motorcycle/1,000 population)		103	130	170
No. of Vehicle	1981	206,926	206,926	206,926
	1990	293,841	359,181	437,541
	2000	394,021	496,485	639,042

(iii) Verification of Modal Split Values

According to the alternative cases of development levels of commuter trains (Urban mass transit and New Transit System), total person trips made by motorcycle and city bus in Surabaya for the year 2000 were derived using the modal split curve and the results were presented in Table 13.6.12.

It is concluded finally that maximum efforts to develop commuter trains as well as city bus transport should be made in order to maximize the use of limited land space for transport infrastructure. Accordingly, the alternative Case 4 is assessed as a goal for the development of the public transport system by commuter trains and city bus as well.

To summarize repeatedly, the development of commuter trains with a transport share of 20% of the inter-zonal person trips in GKS Region should be realized and at the same time, city bus transport which fulfills the transport demand of about 1 million passengers per day in Surabaya is required together with a road network development to receive such bus operations. In case that the road network development can not match the bus transport demand, strengthening of commuter train network will be further required by the year 2000.

Table 13.6.12 RELATIONSHIP BETWEEN CITY BUS, MOTORCYCLE PERSON TRIPS AND DEVELOPMENT LEVEL OF COMMUTER TRAINS

Alternative Cases for Commuter Train Demand	Estimated P.T. by City Bus in SBY, 2000	Estimated P.T. by Motorcycle in SBY, 2000		
		Inter-Zonal Trip	Intra-Zonal Trip*	Total
Case 1: 0 (Year 2000)	1,525,096	772,860	607,000	1,379,860
Case 2: 395,546 (Year 2000)	1,250,868	655,698	607,000	1,262,698
Case 4: 791,088 (Year 2000)	978,020	637,462	607,000	1,150,462

Notes: Case 1 assumes that no commuter trains are developed in 2000

Case 2 assumes that 10% of the inter-zonal person trips in GKS Region will be made by commuter trains in 2000

Case 4 assumes that 20% of the inter-zonal person trips in GKS region will be made by commuter trains in 2000

* Total intra-zonal trips in Surabaya in the year 2000 were estimated at 3,278,000 trips/day and of these, person trips by walking and bicycles were estimated at 2,671,000 trips/day. Therefore, the remaining intra-zonal person trips, 607,000 trips/day, were considered to be made by motorcycle.

8.5 FUTURE TRUCK O-D MATRICES

In order to estimate future truck O-D matrices, the truck O-D matrix in the year 1982 was used as a pattern of trip distribution by the application of Mr. T.J. Frator's method. And the desire line diagrams for the truck O-D in the year 2000 are shown in Figs. 3.6.10 and 3.6.11.

8.6 ASSIGNED TRAFFIC ON ROAD AND RAIL NETWORKS

(1) ASSIGNED TRAFFIC VOLUME ON ROAD NETWORK

The same alternative cases as described in section 3.5(1) were considered. Case 4 and 6 are recommended as the preferable development level for the transport networks in the year 2000 and 1990 respectively by the Study Team. And Case 1, which is the case without Urban Mass Transit or New Transit System, is compared as the basic case for the analysis.

The assigned results are presented in Figs. 13.7.3 and 13.7.4.

(2) ASSIGNED TRAFFIC ON RAILWAY NETWORK

Future person trip O-D traffic by the commuter trains, which were estimated in the proceeding section 3.6 of Part III, were assigned to the railway network shown in Fig. 13.7.7. In order to estimate the demand for the commuter trains by link the traffic volume of each O-D pair was assigned to the minimum route regardless of link capacity at one time. The resulting link loads on the railway network are summarized in Table 13.7.2.

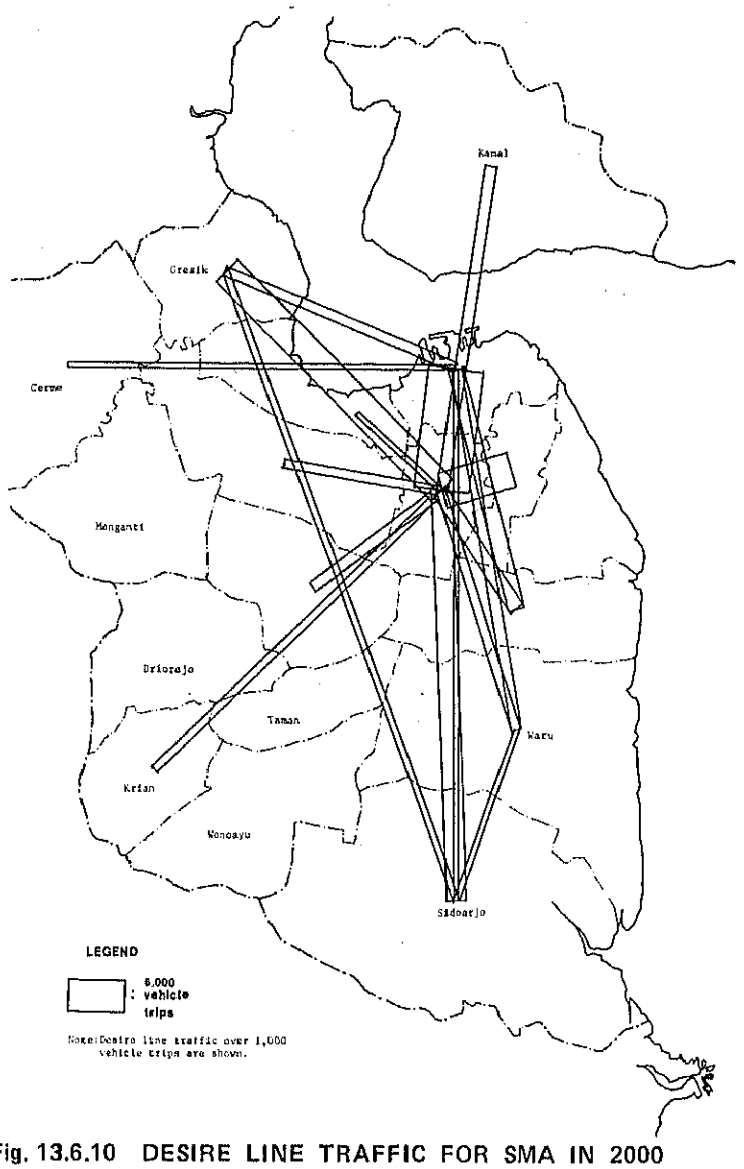


Fig. 13.6.10 DESIRE LINE TRAFFIC FOR SMA IN 2000

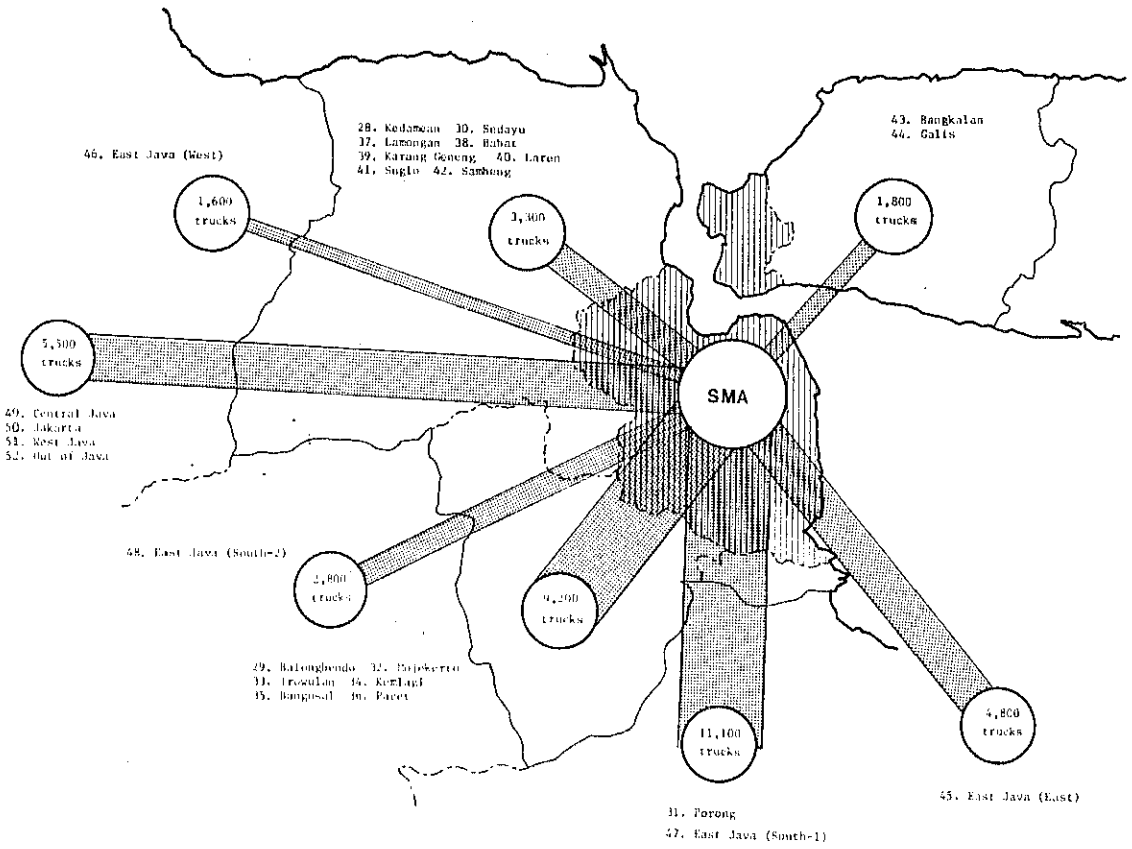


Fig. 13.6.11 DESIRE LINE TRAFFIC FOR SMA OUTSIDE SMA IN 2000 (TRUCK VEHICLE TRIP)

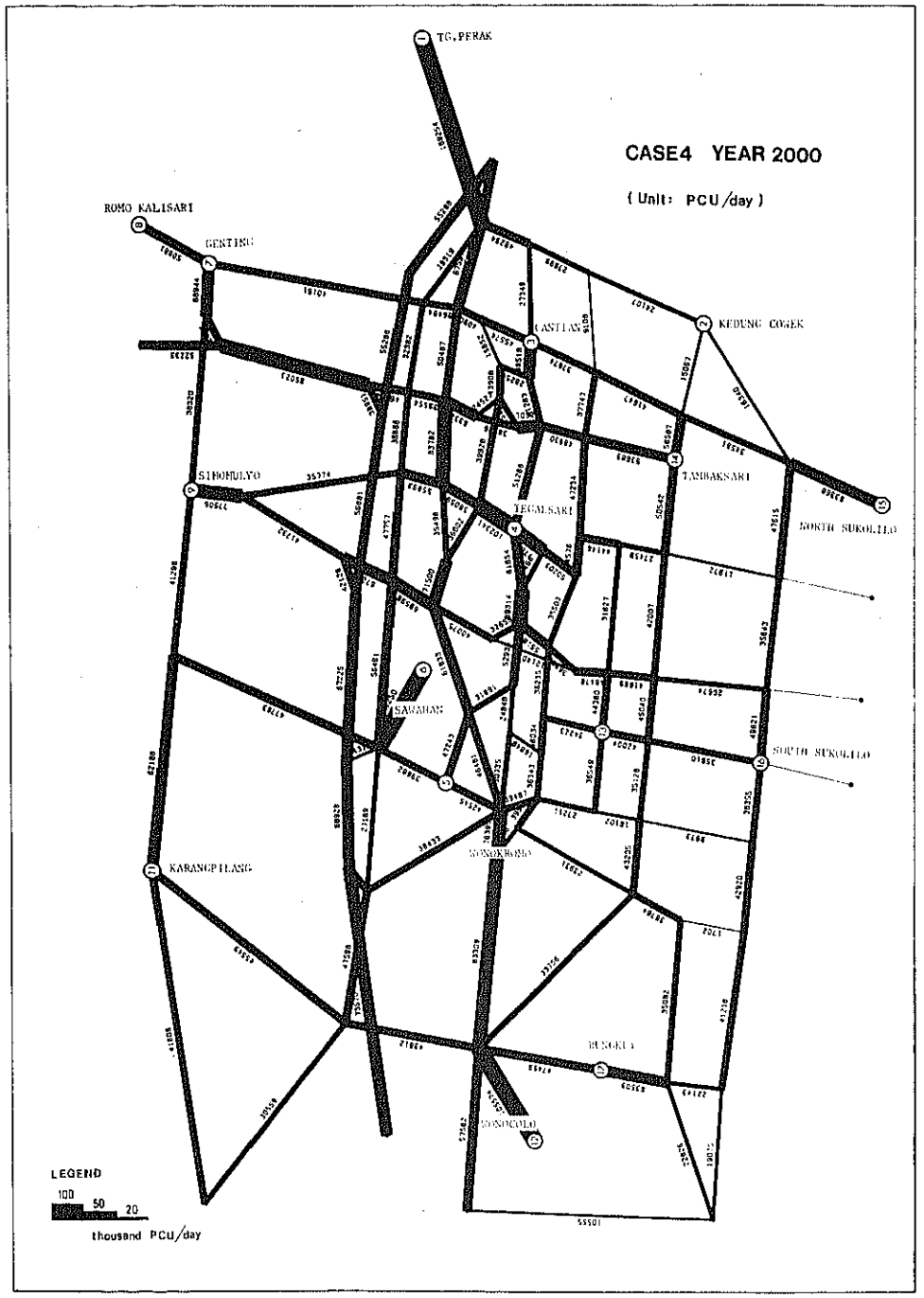


Fig. 13.7.3 ASSIGNED ROAD TRAFFIC FOR CASE 4 IN SURABAYA

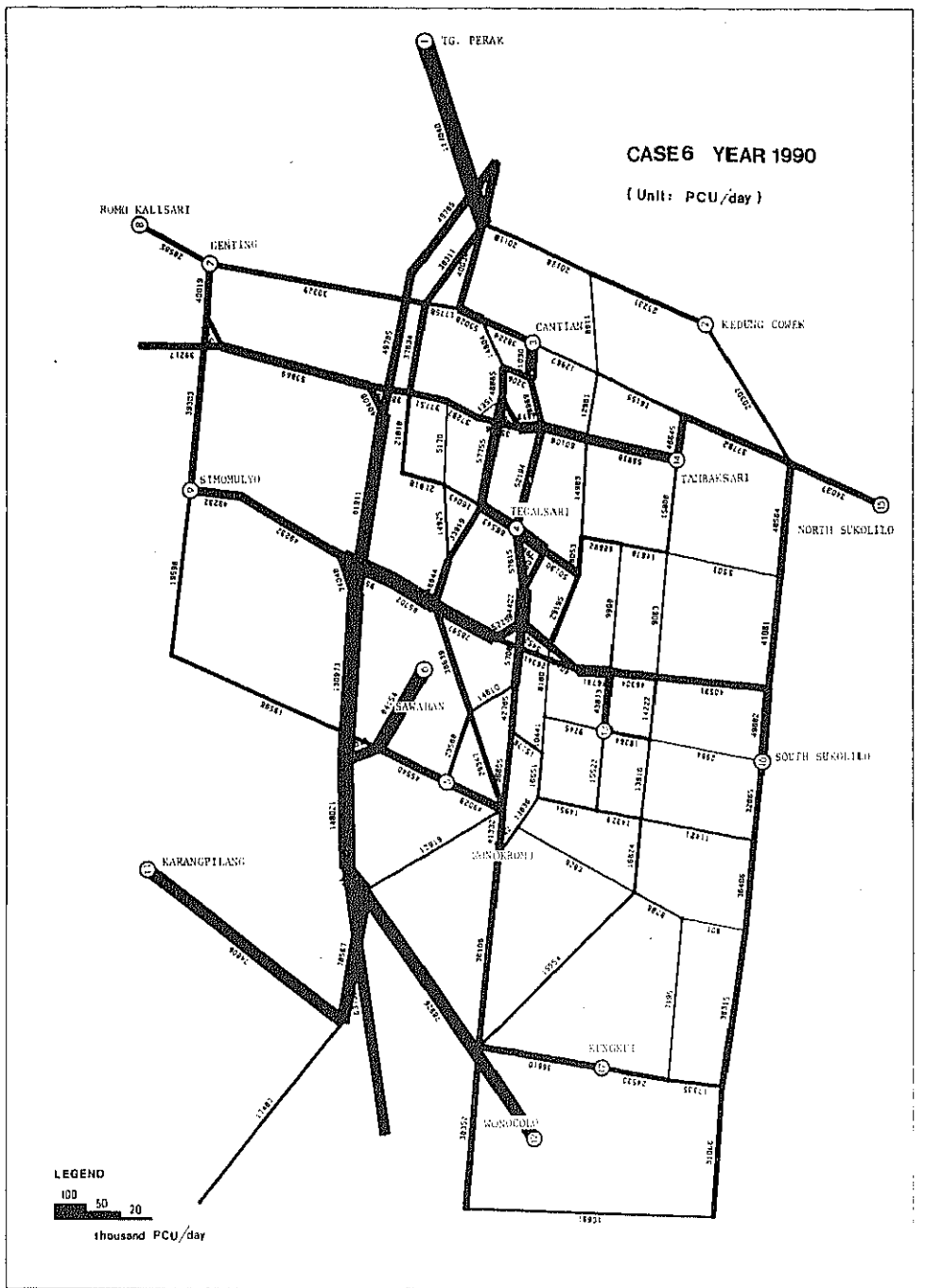


Fig. 13.7.4 ASSIGNED ROAD TRAFFIC FOR CASE 4 IN SMA

Table 13.7.2 ASSIGNED TRAFFIC VOLUME OF COMMUTER TRAIN

Link No.	Distance (km)	Sectional Passengers/day	
		Case 7 in the year 1990	Case 4 in the year 2000
3	1.8	110,970	168,434
4	4.0	84,328	136,106
5	2.4	106,681	163,748
6	3.0	106,112	161,658
7	3.0	32,722	82,944
8	10.0	36,707	67,846
9	7.0	19,428	54,698
10	0.1	35,935	78,020
11	7.0	46,317	108,506
12	7.0	57,732	130,552
13	6.8	141,344	243,200
14	4.0	68,878	186,732
15	5.2	36,499	60,518
16	5.8	18,662	31,324
17	4.2	35,008	142,446
18	5.8	4,270	25,722
19	23.0	2,577	2,560
20	28.0	1,902	1,902
21	11.0	17,925	44,560
22	12.0	17,450	61,110
23	8.0	4,612	5,350
24	10.0	3,546	4,282
1	7.4	74,042	73,452
2	0.8	119,581	161,340
27	2.4	137,868	186.146
26	5.0	124,120	156,454

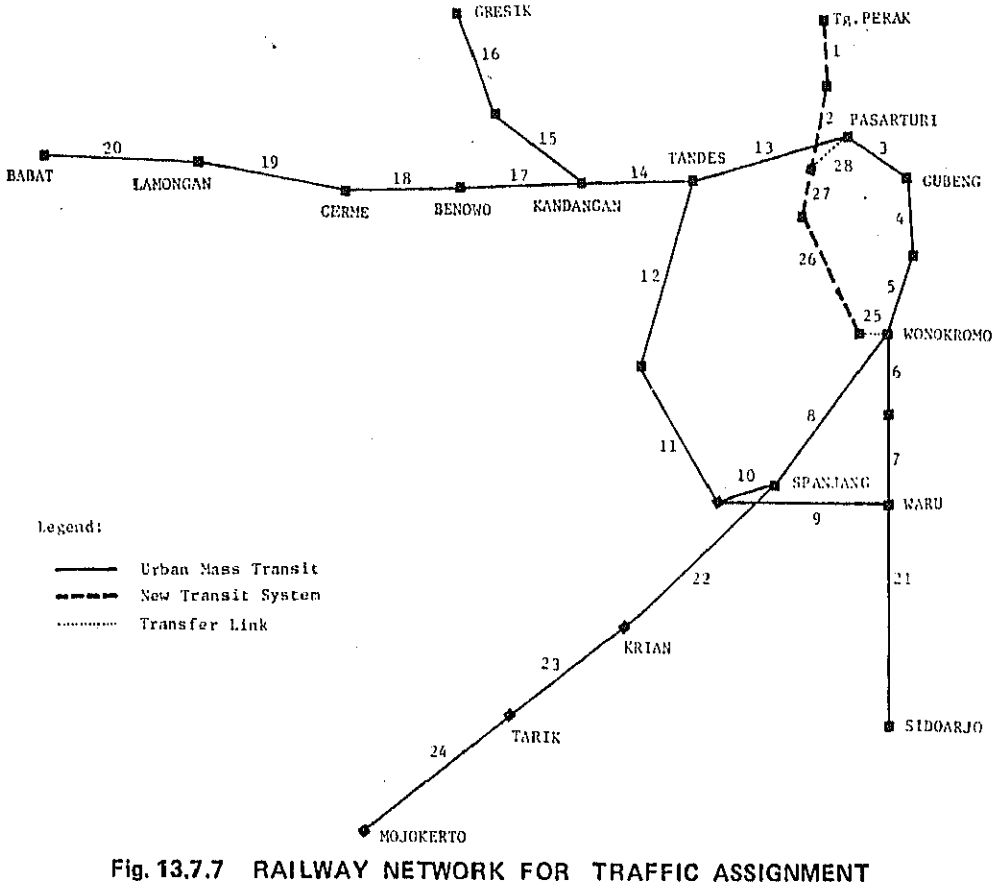


Fig. 13.7.7 RAILWAY NETWORK FOR TRAFFIC ASSIGNMENT

CHAPTER 9 SECTORAL DEVELOPMENT

9.1 INDUSTRY

(1) FORECAST OF INDUSTRIAL AREA DEMAND

The increase of landuse demand for the secondary sector, mainly manufacturing sector, is estimated in this section, corresponding with the assumed economic framework, and based on the analysis of present characteristics for manufacturing activities in SMA.

A study on various indicators for productivity is necessary, such as:

- Share of manufacturing sector to the secondary sector (GRDP basis),
- Productivity per employee and its growth rate,
- Comparison of productivity between normal manufacturing factories and small-scale home factories.

The volume of landuse demand is classified into three catogories:

- Land for newly established factories,
- Land for new estate for relocated factories,
- Land for new estate for small-scale factories.

The Manufacturing landuse demand to be developed in SMA is assumed to be approximately 3,300 ha as shown below:

For New Factories	;	2,920 ha
For Relocated Factories	;	350 ha
For Small-scale Factories	;	20 ha
Total	;	3,290 ha

Notes: 1) This estimated area includes the area for public use required in industrial estates, but does not allow for the arterial streets.

2) For Bangkalan, the central function of industrialization should be performed in Bangkalan town area, and in Kamal area allocation is about 440 ha including the new Cement Factory project.

(2) INDUSTRIAL DEVELOPMENT

(i) Need for Inducement of Kernel Manufacture

- Classifying the consumption goods manufacturing sector by the relationship between the process of industrialization and the required technology, three types of manufacturer are identified;

  1st Step : Miscellaneous Type
  2nd Step : Processing and Assembling Type
  3rd Step : Electrical and Electronic Manufacturing Type

- Generally, the manufacture of a consumption goods is likely to be more labour intensive, while the manufacture of productive goods is more capital intensive.
- The strategical manufacturing types are recommended to be "ship building and repairing" and "motor vehicles assembling and manufacturing".

(ii) Development of Industrial Estate

- Large-scale Industrial Estate (more than 300 ha)

  These estates should be provided for the kernel types of manufacture and the strategical types of manufacture with middle and large scale.

- Middle-scaled Industrial Estate (around 30–100 ha)

  The relevant types of manufacture be located in these estates is that relevant to the kernel and strategical types as above, as well as the factories removed from the built-up area.

- Small-scale Industrial Estate (around 10 ha)

  These estates should be developed as centres undertaking the projects of consolidation and cooperation of small-scale and handicraft factories as well as the traditional industries.

(3) DEVELOPMENT UNIT MODEL FOR INDUSTRIAL ESTATES

Two different development unit models are proposed as the model for industrial estate development. One provides for large/medium scale industries and the other for small scale industries and handicrafts.

Here, the outlines for two development unit models are described.

(i) Industrial estates model for large/medium scale industrial

- Total land area 250 hectares
- Landuse composition

Industrial Land	175.0 ha	(70.0)%
Management/Energy	5.0	(2.0)
Roads/Utilities	37.5	(15.0)
Open Space, etc.	32.5	(13.0)
Total	250.0	(100.0)

- Tentative distribution of plot size

Plot Size	No. of Companies		Land Area	
0.5 ha	62	(40.5)%	31.0 ha	(17.7)%
1.0	38	(24.8)	38.0	(21.7)
2.0	30	(19.6)	45.0	(25.7)
3.0	18	(11.8)	36.0	(20.6)
5.0	5	(3.3)	25.0	(14.3)
Total	153	(100.0)	175.0	(100.0)

- Road System

  37.5 hectares, 15.0% of total land area is needed for roads and utility installations running along the roads (water supply lines and sewage ditches).

- Other description for landuse and facilities.

  5 hectares of the model are envisaged as space for an administrative building, community building, and for certain utilities such as transformer station. Open space with an area of 13 hectares should be created to make the industrial estate attractive and to provide a multi-purpose recreation area for workers.

(ii) Industrial estate model for small scale industries and handicrafts

- Total land area 10 hectares
- Landuse composition

Industrial land	3.5 ha
Administrative/public facilities	1.5
Training centre/common machine building	2.5
Roads/utilities	1.5
Park/play ground	1.0
Total	10.0

- Other descriptions:
  - Considering investment potential of small scale industries and handicraft, mainly leasable production unit buildings based on some standard should be provided.
  - One of the important points is to provide some facilities and/or functions such as management and technical training centre, common machine building, and management counseling function.

9.2 HOUSING

The most serious problem for housing development in SMA is how to provide the housing for the enormous increase in population with control of suitable use of land. The increased population is estimated as approximately 3.2 million by the year 2000.

(1) HOUSING DEVELOPMENT POLICY

Observing the existing and future housing areas, policy on four areas are proposed.

- Highest density (VHD) and high density (HD) residential area
- General residential area
- Mixed residential area
- New residential development area

Existing general residential area will become more densely inhabited by abosorbing a part of the increased population. It is important to avoid a deterioration in the residential environment and avoid development of uncontrolled Kampungs. For this purpose, some landuse control by the public sector should be introduced and also programmes for the improvement and renewal for these general residential areas should be prepared.

It is essential that new residential development areas be established in accordance with rules and standards prepared by the public authorities. The rules and standards should control any residential developers and be established as eariest as possible to attain the goals of safety, health, convenience and amenity.

The development cost of infrastructure, which is the responsibility of the public sector, will become very large and the public sector may not be able to fulfill their responsibilities. Ways to reduce this responsibility include to place some obligations on development bodies, free of charge, to supply the land necessary for their associated public facilities and required.

It is expected that houses facilitated for the majority of the population increase will be supplied by PERUMNAS and Y.K.P. and they will have to play significant roles particularly in suburban areas with their designated functions. The housing development up to 2000 will be too large to be carried out only by the public sector. It is therefore necessary to make practical application of the private sector based on appropriate public controls, in order to promote residential development.

(2) DEVELOPMENT UNIT MODEL FOR NEW RESIDENTIAL AREAS

The development unit model for a general suburban residential area with mixed income groups was designed as follows:

- Population : 30,000 persons
- Land area : 150 hectares
- Spatial Diagram : See Figs. 14.2.2 and 14.2.3
- Drinking Water Demand : 7,200 m^3/day
- Development Cost : 18,500 million Rps/unit (This includes roads, utilities and public facilities, but does not include housing costs).

(3) ESTIMATION OF DEVELOPMENT REQUIREMENTS FOR HOUSING AND COMMUNITY

Development requirements for housing based on the proposed socio-economic framework are expreseed in terms of type and number of facilities to be provided. Here development requirements mean number of houses, schools, health centres, recreation facilithies, public facilities, type of roads, and so on. From those outputs the required development resources such as land area, water demand and development costs and estimated.

To calculate future demand in terms of development requirements, the development unit model was introduced. The future housing demand, therefore, can be calculated in terms of the number of units. Those results and required land area are shown in Table 14.2.2.

- Development Cost: 18,500 million Rps./Unit
  (This includes roads and public facilities, but does not include housing costs.)

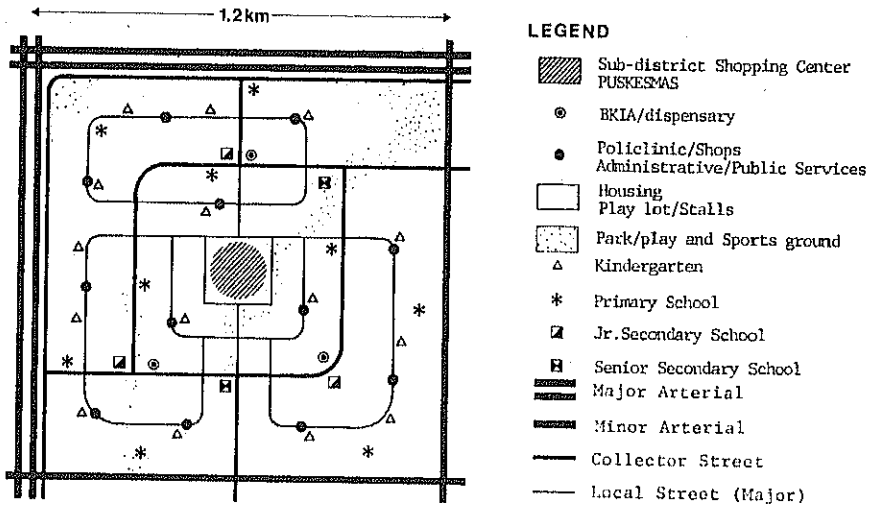
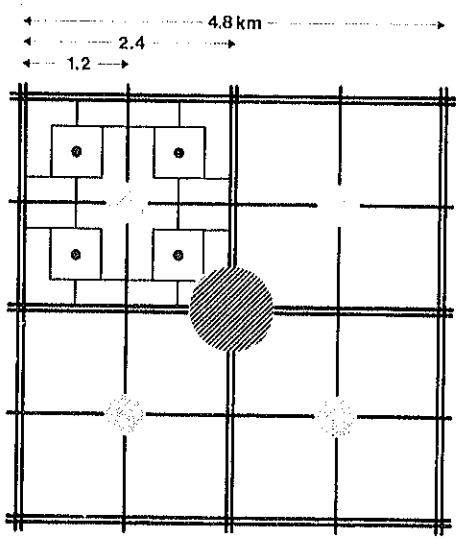


Fig. 14.2.2 SPATIAL DIAGRAM OF THE MODEL



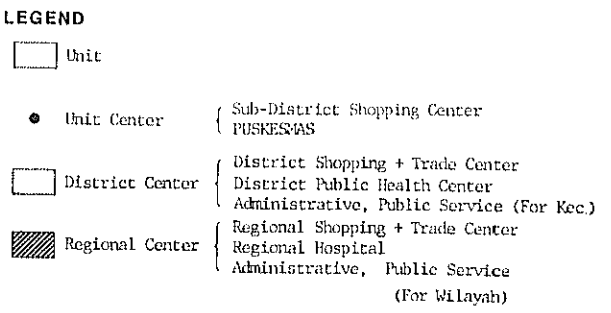


Fig. 14.2.3 ALLOCATION MODEL FOR DISTRICT/REGIONAL SERVICE FACILITIES

Table 14.2.1 LAND-USE COMPOSITION

Use of Land		Land Area	
Residential		90.0 ha	(60.0%)
Living Environmental Facilities		26.0	(17.3%)
- Education	(11.9)		
- Health	(1.1)		
- Commercial/business	(5.6)		
- Park/play ground/religion	(6.6)		
- Administrative/public Service	(0.8)		
Road/Parking Space		33.0	(22.0%)
Utilities/Others		1.0	(0.7%)
Total		150.0	(100.0%)

Table 14.2.2 LIVING ENVIRONMENTAL FACILITIES

Facility	Number of Facilities	Total Land Demand (m^2)
EDUCATION		
- Kindergarten	15	18,750
- Primary School (SD)	9	45,000
- Jr. Secondary School (SLP)	3	21,000
- Sr. Secondary School (SLA)	2	34,000
HEALTH		
- Policlinic	12	3,600
- Dispensary	3	1,050
- BKIA	3	4,800
- PUSKESMAS	1	1,200
- Doctor's Practicing Place	1/5000 persons	Doctor's home
COMMERCIAL/BUSINESS		
- Stalls	120	12,000
- Shops	12	30,000
- Sub-district Shopping Center	1	135,000
PARK/PLAY GROUND/RELIGION		
- Play Lot	120	30,000
- Park/play ground/religion	12	27,000
- Park/play and sports ground	1	9,000
ADMINISTRATIVE/PUBLIC SERVICE		
- Facility for RUKUN WARGA	12	8,400

Table 14.2.3 DISTRIBUTION OF INCREASED POPULATION IN SMA

	Future Population			Future Increased Population		
	1980	1990	2000	1980-1990	1990-2000	1980-2000
Existing Urbanized Area	2,905,414	3,629,000	4,222,000	724,000	593,000	1,317,000
New Residential Development Area in Suburb	-	558,000	1,897,000	558,000	1,339,000	1,897,000
Total (SMA)	2,905,414	4,187,000	6,119,000	1,282,000	1,932,000	3,214,000

9.3 SOCIAL SERVICE FACILITIES

(1) GENERAL

The urban facilities discussed in this section are limited to the facilities with high degree function servicing the regional level and above. The public service facilities to be developed within the communities are contained in the discussions on the housing development. The core of this discussion is how these facilities should be developed as functions to be provided for the first order city.

(2) BASIC CONCEPTS ON PUBLIC FACILITIES DEVELOPMENT

The facilities with function level 1 should be basically developed more. Besides that, the following facilities developments should be taken into account in the structure planning;

(i) Commercial Facilities Development

- As a first order city, the encouragement of the central commercial and business function should be indispensable. Especially the Pasar Turi area and the Kembang Jepun area should be redeveloped comprehensively.
- The Wonokromo district should be important as a subheart of the city of SMA. In accordance with the expansion of the urban area, the necessity for the formation of a sub-heart in the city will arise in order to supplement the existing CBD.
- Sidoarjo centre area and Gresik centre area should be also encouraged in the same way as Wonokromo.
- The centres evaluated as the third level in Section 2.3 of Part II, Cerme, Tandes, Kanal, Waru and Krian, should be encouraged intentionally in order to cope with the future urban growth.

(ii) Industrial and Transportation Facilities

The directions for the development of industrial facilities, and major distribution transportation facilities, are described in Sections 4.1 and 4.4 of Part III respectively.

(iii) Cultural and Educational Facilities

Some cultural and Educational facilities with high quality should be developed in SMA because it is necessary for SMA to cope with the residents needs for high level education and high level cultural activities, etc.

Moreover, as acknowledged in Pelita III, the development of vocational schools will be so much important for the sake of the achievement of planned industrialization.

(iv) Recreation Facilities

One of the significant planning problems is that few recreation facilities exist in SMA. Some attractions relevant to a metropolitan city should be given to this area. It is important that the recreation facilities serving the wide hinterland should be aggressively developed, making the best use of the abundant natural conditions.

9.4 TRANSPORTATION

(1) ROADS AND NETWORK PLAN

The road networks for traffic analysis in 1990 and 2000 were examined based on the traffic assignment results on the road networks and the link conditions assumed before the traffic assignment phase. As a result, the road conditions and priority of some routes were considered as follows:

(i) The primary route passing through Jl. Akhmad Yani-Diponegoro-Semarong-Tg. Perak should be improved to 6-lane road.

(ii) Surabaya-Malang Tollway, in the section between Waru and Tg. Perak, should be prepared as 6-lane road by the year 2000.

(iii) At the same time, a parallel arterial street to the Tg. Perak – Gunung Sari Hill section of the Surabaya–Malang Tollway should be constructed with higher priority to supplement the Tollway capacity.

(iv) Western and southern parts of the Middle Ring road should be given a higher priority for new road construction.

(v) Western part of the Outer Ring Road should be given a higher priority for new road construction.

(vi) Surabaya–Gresik Tollway, in the section between Dupak and Lamong River, should be developed as 6-lane road by the year 2000.

(vii) Semuni-Tg. Sari road section should be prepared as 4-lane road with relatively higher priority.

(viii) Menganti-Rungkut road section should be prepared as 4-lane road with relatively higher priority.

(ix) Krian–Langudi–Gunung Sari Dam road section should be improved as 4-lane road.

(x) In general, to the west of the Surabaya Malang Tollway requires the roads of 4-lane and over and to the east of the central urban area requires mostly 4-lane roads.

(xi) Major intersections on the primary road between Waru and Tg. Perak requires grade-separated.

Taking the above into considrations, future road network plan was prepared as shown in Figs. 14.4.1 and 14.4.2.

(2) CLASSIFICATION OF ROADS AND GENERAL ROAD STANDARD

Roads are classified by the function of linkage and required level of service to areas. The primary system is classified into 4 categories: local road, collector road, arterial road and major arterial road.

Major arterial road in its category includes roads of a higher standard than other major arterial roads. The road of higher standard can be named "Freeway", no matter whether it is access-controlled or not.

The secondary system is also classified into 4 categories from local street, collector street, arterial street, major arterial street including access controlled expressway. The expressway in an urban area does not always require a higher standard than other major arterial streets, but it requires to be access-controlled, unlike a freeway in the primary system. Freeways and expressways may often be operated as tollways.

Design features and general description for design standards for primary and secondary systems are summarized and proposed in Tables 4.4.3 and 4.4.4. At the same time, typical cross sections corresponding to each road classification is presented for both primary and secondary systems as shown in Figs. 14.4.3 and 14.4.4.

(3) PLANNING FOR URBAN MASS TRANSIT SYSTEM

The railway system currently operates with low efficiency compared the available facilities, which were constructed many years earlier. These facilities should be improved and rearranged. New facilities are also introduced to attain the expected requirements brought about by the expansion of densely developed urban area.

(i) Future Railway Network

The future railway service comprises short, medium and long distance systems. The short and medium systems are operated in SMA and GKS as a commuter service.

One ring railway line is introduced for the urban SMA and added to the existing railway network.

A new intermediate transportation system is introduced between Wonokromo and Tg. Perak using the existing track of the old steam tram.

(ii) Track Addition and Electrification

In general it is desirable that a railway section be double tracked and electrified where the traffic demand is more than 80 train per day. From this criteria double tracking and electrification are planned for 1990 and 2000 as shown in Fig. 14.4.6.

For the commuter train operation the electrification by an alternating current is proposed in this planning stage. Further discussions on this matter should be elaborated from the total development policy on the railway electrification throughout Indonesia.

(iii) Track Elevation

From the road traffic demand, promotion of area development and topographic condition, the track elevation is introduced. The railway sections of track elevation are recommended by stage as listed in the left hand side.

(iv) Required number of passenger and freight cars

Based on the traffic demand level in the future, the required number of rolling stock was estimated as shown in Tables 14.4.12 and 14.4.13.

(v) Depot for Passenger Coach

For commuter trains including medium distance commuter trains, the main depot is planned on the Waru-Gedangan line and a sub-depot at Benowo for efficient operations. The scale of both depots are 120,000 m^2 (52 train sets) for the main depot and 30,000 m^2 (10 train sets) for the sub-depot.

(vi) Work-shop

A new work-shop is planned at the main depot. Some 50,000 m^2 will be required for the daily inspection and some repair of passenger cars (Commuter/medium/long distance train)/freight cars and diesel cars. Main line locomotive overhaul is expected in to be carried out Gambil, Jakarta.

(vii) Consolidated Base Freight Station

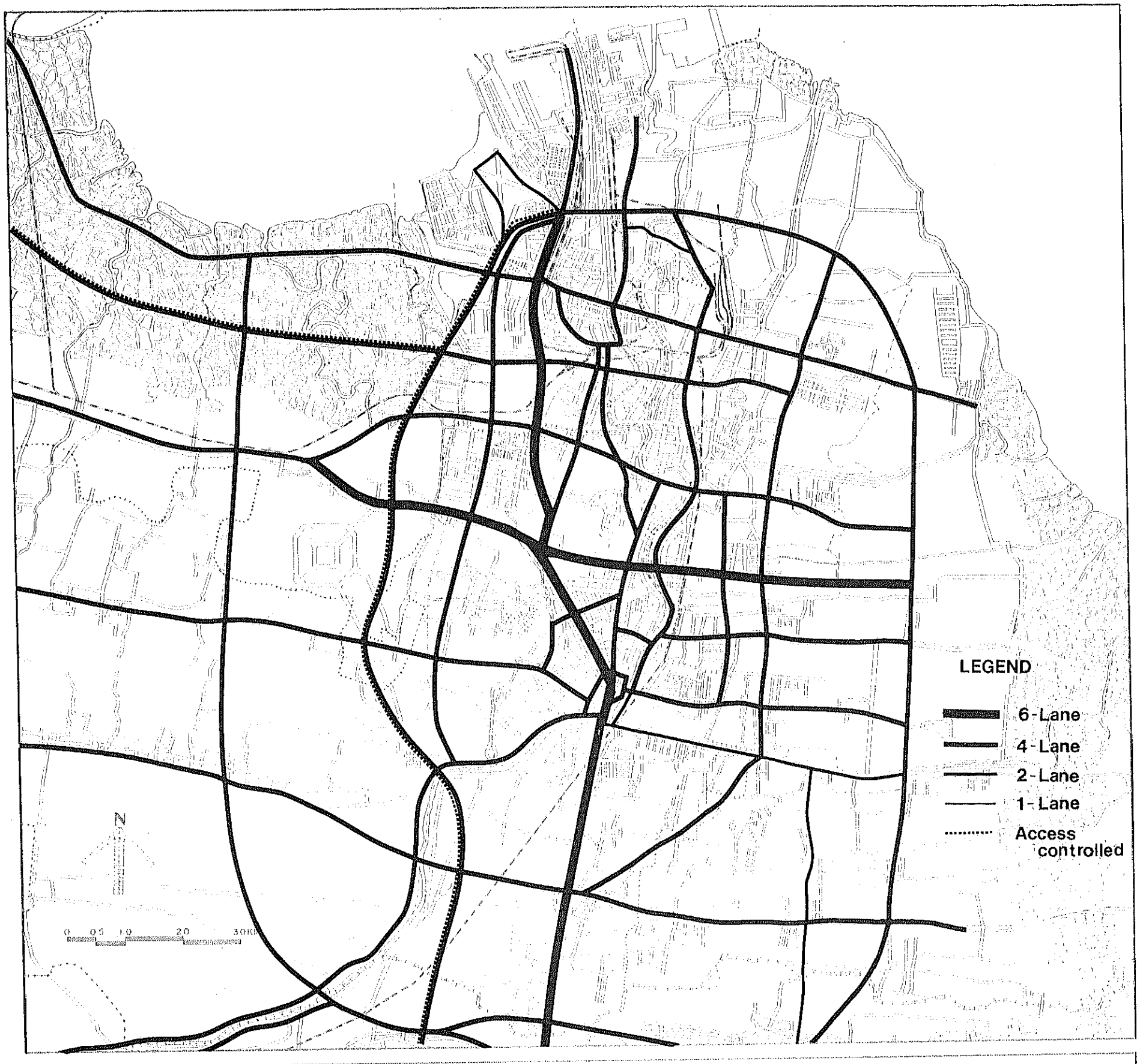
The existing freight stations are consolidated in Pasarturi station. The Pasarturi station handles 150 cars/day with an area of 30,000 m^2 excluding marshalling yard.

(viii) Benteng and Kali Mas Station

Benteng station handles mainly oil. The function will be maintained by the time of improving the Surabaya port. The Kali Mas freight station is relocated in Tandes, the hinterland of expanded Surabaya port up to 2000 and handles 230 cars/day with 90,000 m^2 including transfer marshalling yard. New freight line (Single track) is constructed between Tandes and existing Port area with the length of 9 km.

(ix) Main Marshalling Yard

A freight car marshalling yard is located on the North line between Kandangan and Benowo. The location is determined based on the location of the Surabaya port and future industrial area along the coast.



URBAN DEVELOPMENT PLANNING STUDY ON GERBANGKERTOSUSILA (SURABAYA METROPOLITAN AREA)

Fig. 14.4.1 RECOMMENDED ROAD NETWORK IN SURABAYA : 2000

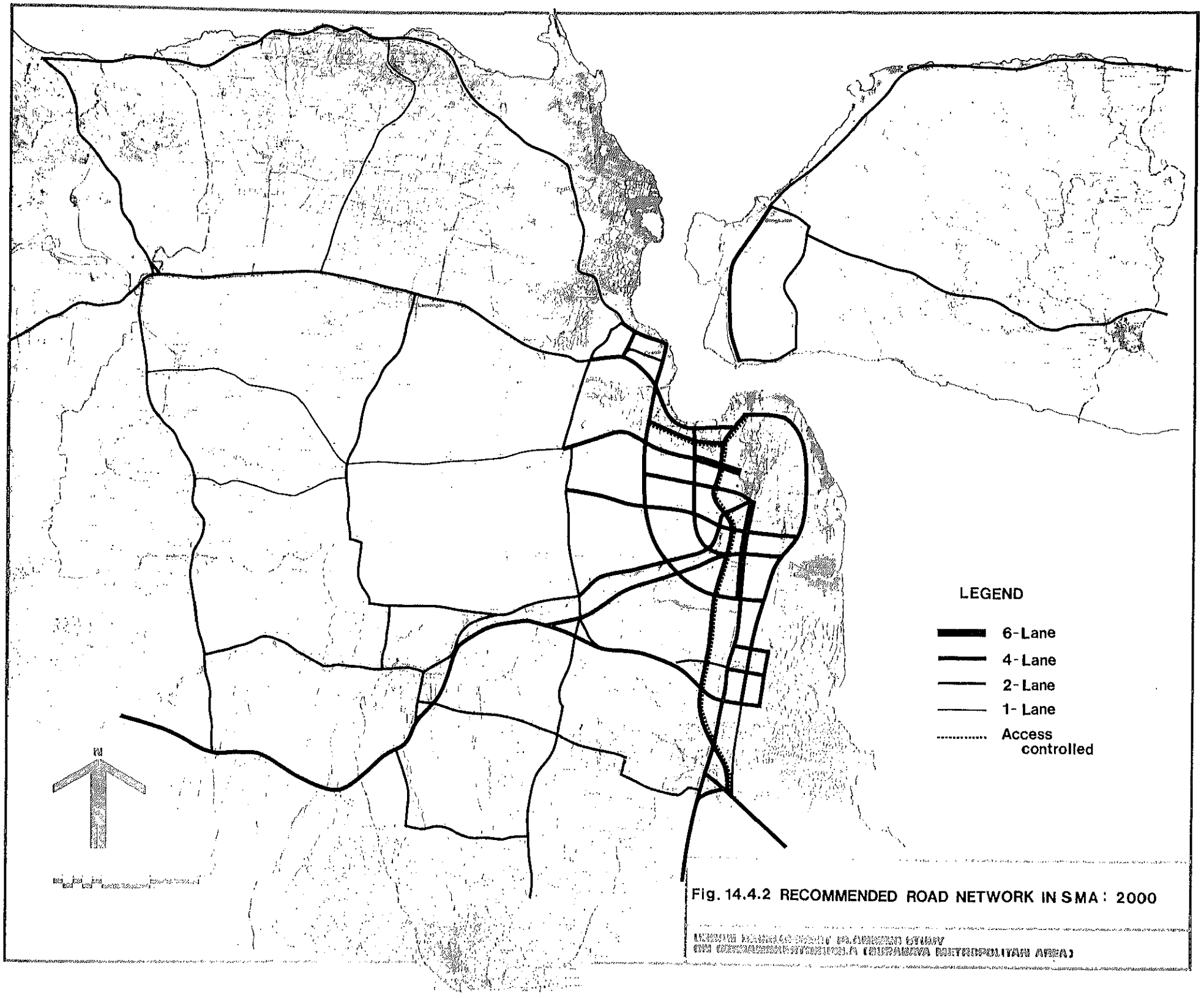


Fig. 14.4.2 RECOMMENDED ROAD NETWORK IN SMA : 2000

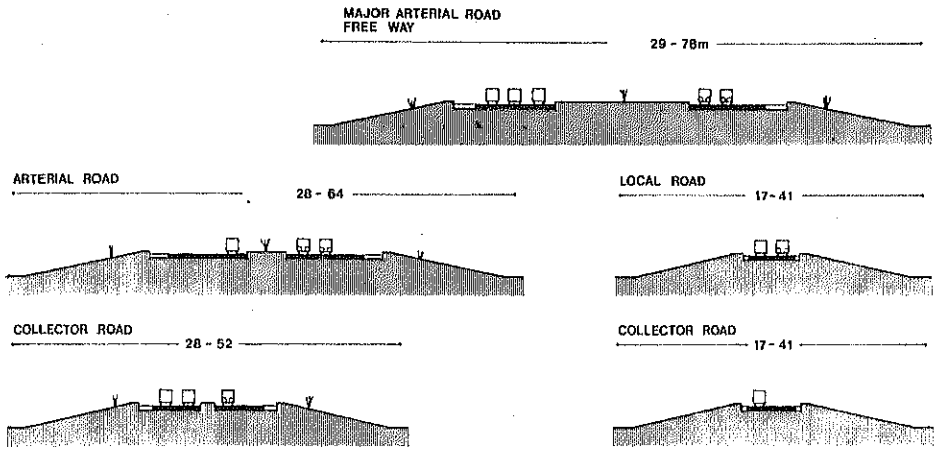


Fig. 14.4.3 TYPICAL CROSS SECTION OF PRIMARY SYSTEM

Table 14.4.3 GENERAL ROAD STANDARD FOR PRIMARY SYSTEM

Type of Facilities	Function and Design Features	Speed (Km/h)	Pavement Width	Desirable Maximum Grades	R.O.W. (m)	Other Features
Major Arterial Road (including Freeway)	Promote provincial/regional development, if necessary, full-/half-access controlled; no grade crossings.	120,100 (80,60)	Varies; 3.5m per lane; 1.75-3.0m shoulders on both sides of each road way; 2.5-18m median strip.	2,3 (4,5)	29-78	Require intensive landscaping, service roads as necessary. Road formation: preferally at grade
Arterial Road	Promote regional development. Minor access control. Occasionally channelized intersections with traffic signals at major intersection.	60 (50)	Varies; 3.5, per lane; 1.75-2.5m shoulders on both side of each road way; 1.75-5m median strip.	4 (5)	28-64	Usually no service road required.
Collector Road	Supplementary function to arterial road. Access free.	50 (40)	Varies; 3.25m per lane, 0.75-1.75m shoulders on both sides; In case of 4 lanes minimum 1.75m midian strip required.	5 (6)	17-52	
Local Road	Local feader service connecting MHP	≤40	3.0m per lane; minimum 0.75 shoulders both sides.	7	17-41	

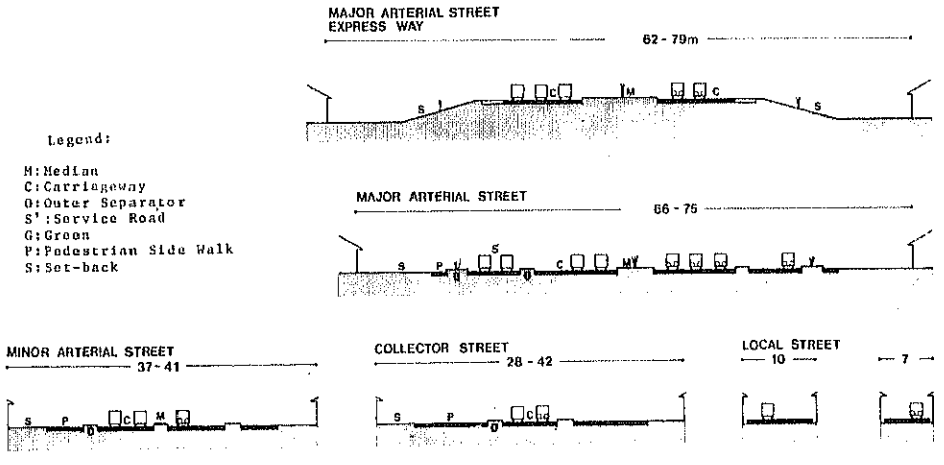
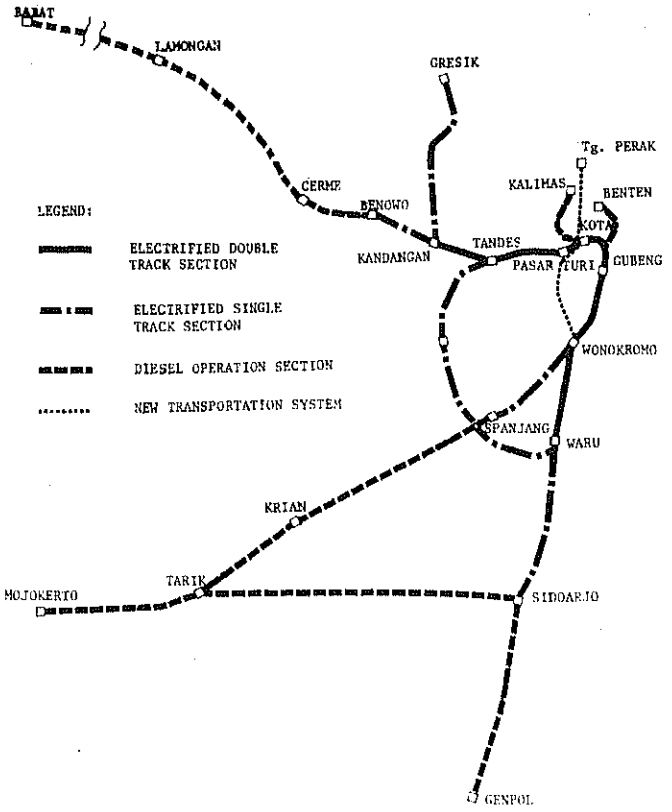


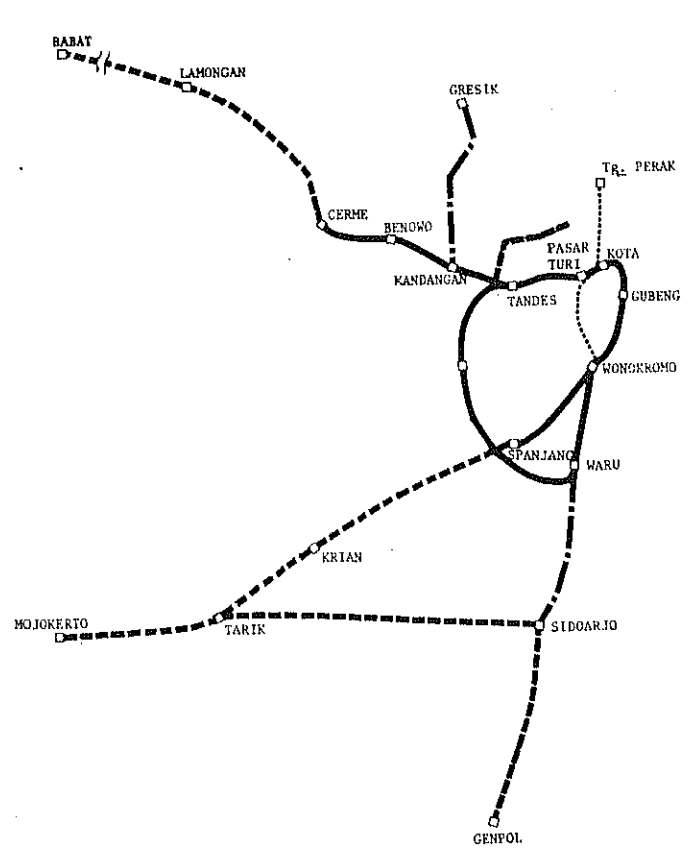
Fig. 14.4.4 TYPICAL CROSS SECTION OF SECONDARY SYSTEM

Table 14.4.4 GENERAL ROAD STANDARD FOR SECONDARY SYSTEM

Type of Facility	Function and Design Features	Road Interval (Km)	Speed (Km/h)	Widths of Pavement	Desirable Maximum Grade (%)	ROW (m)	Other Features
Expressway	Promote regional and metropolitan development access controlled no grade crossings, no traffic stops.	Variable; related to regional landuse pattern, population and major development districts	100 (80,60)	Varies; 3.5m per lane: 1.75-3.0m shoulders both sides of each roadway: 2.5-10m median strip	3 (4,5)	62-79	Road formation: Depressed, at grade or elevated. Require intensive landscaping, service roads, 20 meter setback to the building.
Major Arterial Street	Promote unity throughout continuous urban area. Usually form boundaries for neighbourhoods. Partial access control, some channelized grade crossings and signals at major intersections. Parking prohibited.	2-3	80 (60)	Varies; 3.5m per lane, minimum 4 lanes, 2.5-5m median, 2m outer separator, 7m service roads for bus and slow moving vehicles.	4 (5)	66-75	Require 1.5m wide detached side walk in urban areas, planting strips 3m and 10m building set-back.
Arterial Street	Main feeder streets. Signals where needed; stop signs on street. Occasionally it forms boundaries for neighborhoods.	1.0-1.5	60 (40)	Varies: 4 lanes and 2 lanes, 3.25m per lane, 1.5m median for 4 lanes road.	5 (7)	37-41	Require minimum 1m wide detached side walk, 2m planting strip and 5m building set-back.
Collector Street	Main interior streets. Stop signs on side streets.	0.4-0.8	40	2 lane road, 3.25m per lane.	7	28-42	Require 2m planting strip between carriage ways and side walks, minimum 1m wide side walk, 3m building set-back.
Local Street	Local service streets. Non-conducive to through traffic.	at blocks	30	Generally 6m width, 9m width for more heavily trafficked areas.	8	7-13	Generally no-need of side walk, but 1.5m on consideration of aesthetics or space, 0.5m side ditch necessary for both sides of the road.



Year 1990



Year 2000

Fig. 14.4.6 TRACK AND ELECTRIFICATION PLAN

Table 14.4.12 REQUIRED ROLLING STOCK

Year \ Type of Car	No. of Electric Car	No. of Diesel Car
1990	248	14
2000	464	56

NOTE : 1) Effective operation rate for electric cars is assumed at 85% of the total.
2) The composition of electric car train is 8 coaches in both 1990 and 2000, and that of diesel car train is 2 coaches in 1990 and 4 coaches in 2000.

Table 14.4.13 REQUIRED NUMBER OF FREIGHT CAR, 2000

Name of Station	Type of Cargo	Cargo to be handled (ton/day)	No. of Freight Car	Rate of Vacant car (x 1.4)	Total No. of Freight car (x 2)
Benteng	Oil	1,747	50	70	140
	Other	580	39	55	110
Kalimas	Other	1,192	79	111	222
Pasarturi	Other	501	33	46	92
Surabaya Gudang	Other	80	6	9	18
Gubeng	Other	14	10	14	28
Wonokromo	Other	50	3	4	4

The handling capacity is 750 cars/day with approximately 100,000 m^2 for stabling tracks, arrival-departure tracks and sorting tracks. The marshalling yard is planned as a plane yard with non-automatic operation.

(x) Station Improvement

The terminal stations of long distance trains are determined to be Tandes, Sepanjang and Waru. New stations or improved stations to accompany new line construction and track elevation are required, 9 new stations and 13-improved stations are identified:

- New station:

  Gresik Line – Karangpirang
  Ring Line – Ngaglik, Surawesih, Rungkut, Bulu, Sumwrwelt, Lidah Wetan, Tabanan
  South-Line – Kebonaguan

- Station improvement:

  North Line – Benowo, Kandangan, Tandes, Pasarturi
  Gresik Line – Gresik
  South Line – Sepanjang, Wonokromo, Gubeng, Sby. Kota
  Malang Line – Sidoarjo, Buduran, Gedangan, Waru

(4) SEAPORT DEVELOPMENT PLAN

(i) Forecast of Port Traffic

The total port traffic in future was estimated 10.7 and 25.1 million tons/yr for 1990 and 2000 respectively, which are slightly higher than that of the "Port of Surabaya, Phase 2 Feasibility Study, 1982", because of a higher economic framework estimated in this Study. Fig. 14.4.7 is prepared to make this comparison apparent.

(ii) Future Demand for Berth Space

Based on the future traffic demand, the berth space required for the Tg. Perak port is estimated as shown in Table 14.4.19.

(iii) Ferry Terminal

A ferry boad is now the only means of transport to connect Surabaya with Madura Island. In correspond to the future traffic demand, approximately 4,400 m^2 is required for the waiting room, ticket booth and administration offices of the passenger terminal. Parking area of about 15,000 m^2 is required for vehicles waiting before loading.

(iv) Seaport Development Plan

For the development of port, the following conditions are assumed to be required:

- The north coastal corridor from Tg. Perak to Gresik should be planned as an industrial zone in this study. For the future port development a 1 km wide strip from the existing Jl. Gresik is planned as the reservation area for port hinterland and industrial development.
- Kali Mas Port is recommended to remain within the port development area instead of relocation to Gresik.
- The Naval Academy, which is located within the future industrial corridor, should desirably be relocated when taking into consideration future land use requirements.
- The east end of Jamrud quay should be re-zoned and allocated to the area for the ferry (Surabaya–Kamal) extension.

As a result, the future development of the port area is planned as shown in Fig. 14.4.8.

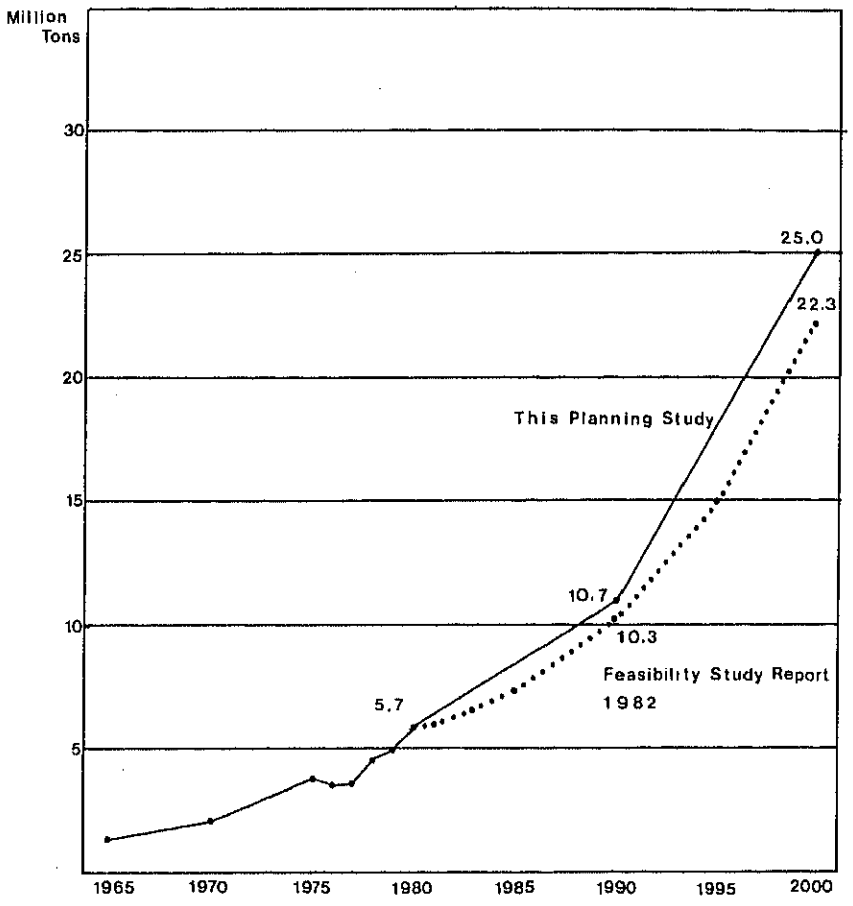


Fig. 14.4.7 COMPARISON OF PORT TRAFFIC FORECASTS

Table 14.4.19 SUMMARY OF BERTH SPACE

	Commodity \ Year	Ton (000t)		Handling Rate (t/h)		Berth Hour		Berth Occupancy (%)		No. of Required Berth	
		1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Foreign	Wheat	830	1,123	550	550	1,509	2,042	17	23	1	1
	Animal Feeds (Copra cake, Rice bran, Dried cassava and Tapioca)	618	1,013	300	300	2,060	3,377	24	39	1	1
	Molasses	155	168	-	-	-	-	-	-	-	-
	Pure Container	1,458	5,696	250	250	5,832	22,784	33	65	2	4
	Combo Container	273	633	125	125	2,184	5,604	76	86	6	19
	Combo Non Container	569	2,119	15	15	37,933	141,267				
	General Cargo	1,799	2,737	-	-	66,800	105,500	95	100	8	12
	Sub Total	5,702	13,489	1,240	1,240	116,318	280,034	-	-	18	37
Domestic	Fertilizer	483	522	142	142	3,401	3,676	39	42	1	1
	Coconut and Palm Oil	244	593	75	75	3,253	7,907	37	45	1	2
	Ro/Ro Berth	429	3,155	300	300	1,431	10,516	16	60	1	2
	General Cargo	2,112	4,561	-	-	254,700	615,000	104	100	28	70
	Combo Non Container	1,739	2,784	15	15	115,933	185,600	102	100	13	21
	Sub Total	5,007	11,615	-	-	378,718	822,699	-	-	44	96
	Total	10,799	25,104	-	-	495,036	1,102,733	-	-	62	133

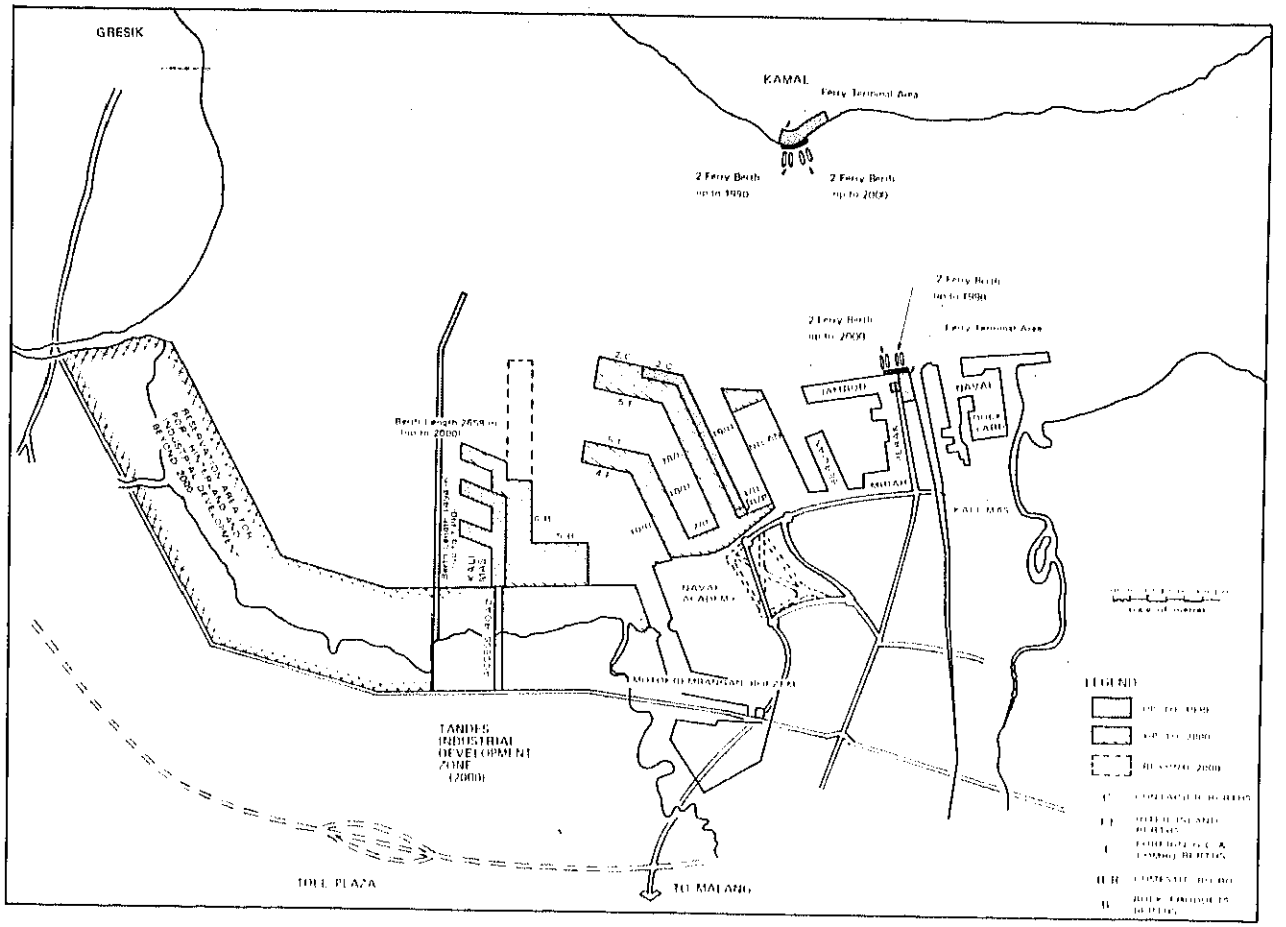


Fig. 14.4.8 SEA PORT DEVELOPMENT PLAN

(5) AIRPORT DEVELOPMENT PLAN

(i) Traffic Forecast

The Masterplan forecasts future passenger, freight and mail traffic, and also considered aircraft movements, at peak traffic and average daily traffic for design purposes.

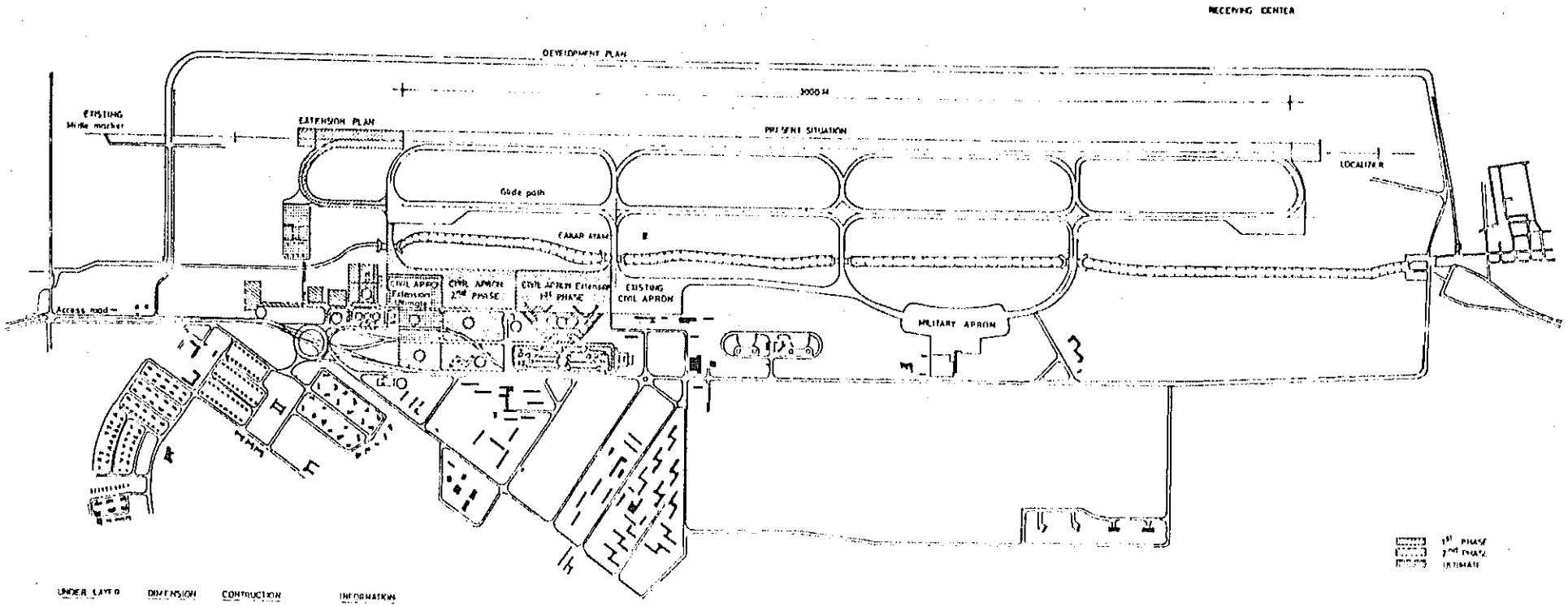
The forecast of future traffic is shown in Table 4.4.23 and on which basis major airport facilities were planned up to 2000 and these are listed in Table 14.4.24 and shown in Fig. 14.4.9.

Table 14.4.23 FUTURE AIRPORT TRAFFIC DEMAND

Traffic \ Year	Unit	1990	2000
Passenger	No.	2,410,000	5,130,000
Freight	Ton	14,500	27,900
Mail	Ton	1,000	2,100

Table 14.4.24 AIRPORT FACILITY DEVELOPMENT

Facility	Existing	Phase I (1990)	Phase II (2000)
Strip Runway	Non-precision App.	Precision App. 3,720 m x 300 m	-
Runway	3,000 m x 60 m	3,600 m 60 m	-
Taxiway	Parallel taxiway (w = 23m) with 5 perpendicular exit	Parallel taxiway (w = 23 m) with 6 perpendicular exit	-
Apron	320 m x 100 m	4 stands added for DC-10 or A-300	3 added stands for DC-10 or A-300
Passenger Terminal Building		17,300 m^2	26,700 m^2
Cargo Terminal Building		3,000 m^2	6,000 m^2
Administration Building		1,000 m^2	1,300 m^2
VIP Building		400 m^2	-
Carpark		610 lots	Increased by 320 lots
Nav-aids	NDB	ILS CAT-I (LLZ, GP, MM, OM) NDB, ASR	-
Power Supply		2,500 KVA	4,400 KVA
Water Supply	2,000 m^3/day	3,200 m^3/day	6,000 m^3/day
Fire Fighting		Category-8	-



UNDER LAYER	DIMENSION	CONTRUCTION	INFORMATION
RUNWAY	3000 X 60M	ASPHALTIC CONCRETE	SERVICEABLE 45M
TAXIWAY	225.0 X 22.5M	ASPHALTIC CONCRETE	SERVICEABLE 45M
FILLET	9007 20M	ASPHALTIC CONCRETE	SERVICEABLE 45M
APRON I	270 X 70M	PC CONCRETE	CONVENTIONAL
APRON II	160 X 90M	PC CONCRETE	CAKAR AYAM
WEST AREA ALARM	220 X 50 2M	ASPHALTIC CONCRETE	CAKAR AYAM
EAST AREA ALARM	220 X 50 2M	ASPHALTIC CONCRETE	CAKAR AYAM
WEST OVER RUN R W 10	100 X 60M	PENETRATION ASPHALT	CAKAR AYAM
WEST OVERRUN R W 28	100 X 60M	PENETRATION ASPHALT	CAKAR AYAM

REMARK
1 DESIGN THAT IN CLUDED IN MASTERPLAN MAKE DC 8 OPERATION AT FULL CAPACITY
2 ON THE 1ST DEVELOPMENT IS BORROW THE OPERATION OF 3RD PLANE (747)
3 RUNWAY IMPROVEMENT IS THE EXECUTION
4 ADDED RUNWAY LENGTH TO 3600M

1 CONTROL TOWER BUILDING
2 NEW PASSENGER TERMINAL 1ST PHASE
3 CAR PARK 1 PHASE
4 D G A C
5 POWER PLANT D G A C WORKSHOPS
6 WATER TANK
7 PASSENGER TERMINAL EXTENSION 2ND PHASE
8 CAR PARKS EXTENSION 2 PHASE
9 FREIGHT TERMINAL
10 FUEL FARM
11 + U P BUILDING
12 SAVAGE TREATMENT PLANT
13 AIRLINE ZONE
14 PASSENGER TERMINAL EXTENSION ULTIMATE
15 PILGRIM AREA
16 MAINTENANCE

Fig. 14.4.9 DEVELOPMENT PLAN OF JUANDA AIRPORT

9.5 RIVER

(1) PLANNING CONSIDERATION

The investment for the drainage system, the most fundamental and important infrastructure for urban development, has lagged far behind the development process of the cities and urban areas and a very severe drainage problem is anticipated. The end result required for future drainage work is to produce a good environmental condition and urban amenity. To realize this target the following key items for waterway planning are adopted for this study.

- Waterway alignments to promote the layout of urban unit/blocks, especially in the low lying coastal area.
- Runoff from the urban area to be carried as swiftly as possible to the sea.
- System to be operated by gravity wherever possible to avoid operational problems and to reduce costs.
- Waterway capacity to meet future development
- Irrigation canals to be converted to drainage canals with urbanization.

The basic elements design stome frequency, rainfall intensity, tidal influence and hydraulic design method for the initial design of the drainage facilities are referred to in the previous reports conducted in the study area.

(2) WATERWAY PLANNING

(i) Tidal Waterway in Surabaya and Sidoarjo

All canals are located in the low laying area and are under tidal influence. Among the alternatives available to avoid the tidal effects, the concept of global flood control is appled for the study and the concept are:

- In order to reduce the peak flood discharge, retarding ponds are provided along the canal.
- In order to protect from salt water intrusion at high tide, retarding ponds are also planned outside the sea dike.

The drainage system in SMA is shown in Fig. 4.5.1, and the scale of the canal facilities are calculated as follows:

- Canal width : 20 – 50 m at the sea dike
- Retarding basin
  along the canal : 1 ha. – 5 ha.
  outside the sea dike : 3.5 ha. – 14 ha.

The retarding basin along the canals can be a maximum of 5 ha. according to the progress of urbanization and provide the community park and recreational area for the nearby residents.

(ii) Kedurus River Basin

The Kedurus river is a branch river of the Surabaya river and the water level at the merging point is controlled at 3.8 m by the Jagir dam. Referring to the past study it is reported to attain gravity water flow, consequently there is a long period of inundation in every rainy season.

After review, an alternative method to resolve the inundation, by a new additional waterway (on the slope of the Gunungsari Hill) and a retarding basin on the Kedurus main river are proposed.

The scale of these river facilities are calculated as follows:

– New canal:	Width	18 – 55 m
	Depth	2 m
– Main river:	Width	14 – 70 m
	Depth	2 m
	Syphon	32 (4.0 m x 2.0 m)
	Retarding basin	113 ha

(iii) Lamong River

The Lamong river inundates at the lower reaches of Cerme and has less influence to the development of SMA. No improvement work is planned for the Lamong river before 2000 except the Lamong dam project planned upstream of the basin.

(iv) Drainage System in Gresik and Kamal

Inundation also occurs in every rainy season in the CBD of Gresik. Existing secondary/tertiary system should be well maintained and plans made to expand the size of the canals. A new drainage canal system is introduced so as to enclose the expanding city area and future anticipated development.

In Kamal less influence is expected on the existing secondary canal system considering future urban development. Consequently only tertiary canals are to be developed.

(3) DRAINAGE DEVELOPMENT PROGRAMME

(i) Development Plan

Many of the proposals are related to current drainage problems. The countermeasures to be taken are:

– Strengthen the Canal Maintenance Work

– Setting up the Control System for Water Flow

A "Coordination Board" for global water flow control should be established to take countermeasures for the whole waterway system in SMA.

Pengairan (including Brantas office) and Kotamadya/Kabpaten are to be members of the board, and the organization will be established similar to the Jakarta Flood Control Project Office.

The major functions of the board will be:

- Set up the organization for coordination
- Establishment of a development plan and implementation schedule
- Establish a communication network for flood control in the wet season, and water supply in the dry season
- Production of river canal facility standard
- Set-up regulations on the control and approval of a canal crossing structure, required by the third sector or private use.
- Conversion Irrigation Canal to Drainage Canal
  Existing irrigation canals are controlled by Pengairan at this time. With urbanization the canals should be converted to drainage canals by deepening the canal bed and increasing the canal width. At some time when the irrigation area is well reduced, the administration of those canals should be transferred to the local government.
- Implementation of Feasibility Study
- Construction of the Maintenance Road

(ii) Development Programme

The highest priority will be given to these items which solve the existing inundation and those which will accompany new developments expected in SMA. The programmes for 1990 and 2000 are prepared as shown below:

Upto 1990

- Establishment of "Coordination Board"
- Implementation of feasibility study
- Dredging and cleaning of canals
- Land acquisition and compensation for future canal development
- Development and improvement of canals and facilities for new urban development

Upto 2000

- Dredging and cleaning of canal
- Land acquisition and compensation
- Development and improvement of canal and facilities

9.6 UTILITIES

(1) WATER SUPPLY

(i) Future Water Needs

Future population in SMA is forecast to be approximately twice that of the present time. The special development of urban areas results in a bigger water demand in total. A negative influence is the serious inadequacies in water supply due to fewer available water sources and the inbalance in water use between urban water use and irrigation water use. Future water demand is estimated by sector (i.e. residential, industrial, commercial and social).

– Residential Water

Residential water demand is considered to be rather conservative under the present severe water supply situation. The estimate is made to aim at an equity in the spatial service to SMA rather than an up-grade of service level in the existing service areas. The future water supply for residential sector is shown in Table 14.6.1.

Table 14.6.1 RESIDENTIAL WATER SUPPLY

Service / Year	Service Level (%)		Service Volume (ℓ/capita/day)	
	Piped	Vendor	Piped	Vendor
1980	10.9	23.4	219	20
1990	40	20	220	20
2000	70	10	220	20

– Industrial Water

Industrial water estimate is based on the consumption per capita per day. The future unit consumption is assumed to be 200 ℓ/employee/day in 1990 and 500 ℓ/employee/day in 2000. The port water demand is based on the future cargo handling volume.

– Social Water

Social water is estimated in relation with the population growth in SMA.

– Commercial Water

Commercial water is forecast based on the tertiary sector of GRDP.

In 1990 a total of 9.6 m^3/sec. and 23.8 m^3/sec. in 2000 is needed for SMA as shown in Table 4.6.2.

(ii) Development of Water Sources

– Available water sources by 1990

The water development plan made by each PDAM is reviewed and investigated available water sources up to 1990 are shown in Table 14.6.4. Total 7.7 m^3/sec. will be available for SMA.

– New Water Sources Development

The additional water demand of 1.9 m^3/sec in 1990 and 16.1 m^3/sec in 2000 required is shown in Table 14.6.2. To meet this demand the available water sources are reviewed and recommended to develop water sources as shown in Table 14.6.5.

(iii) Water Distribution Plan

A new purification plant is located in Waru near Surabaya river as shown in Fig. 14.6.1.

(iv) Water Development Plan

– Recommendation for Future Water Development

The water supply to the future SMA is limited and further development of water sources is an urgent subject. For this subject recommendations are described as follows:

- Coordination on water usage between irrigation and urban water.
- Promotion of further development of water sources
- Examination of the existing water use
- Examination of salt water for industrial use

– Development Plan

Water development work is scheduled to be:

Up to 1990:

- Development of new Umbulan spring system
- Water transmission to Gresik (582 ℓ/sec from Surabaya)
- Mini plant development (PDAM Surabaya)
- Resource development (PDAM Surabaya)
- Water supply master plan and feasibility study for SMA 2000
- Waru water supply system development (Phase–I)
- "4 Spring" water development in Bangkalan

Up to 2000:

- Waru water supply system development (Phase–II)
- Sala river water development

Table 14.6.4 POSSIBLE WATER AVAILABILITY

(Unit: ℓ/sec.)

	Source/System	Existing Available Water (1982)	Possible Water Availability (by 1990)
Surabaya	Toman Spring	211	211
	Umbulan Spring	100	150
	Umbulan New Spring	–	3,000 1)
	Ngagel - I	1,000	1,000
	Ngagel - II	1,000	1,000
	Ngagel - III	1,000	1,000
	Mini Plant Development	–	100 2)
	Resource Development	–	100 2)
	Industrial Water from Surabaya/Mas River	700	700
	Sub-total	4,011	7,261
Gresik	Suci Spring	10	10
	Surabaya River Water for Cemen Gresik, and Petrokimia	300	300
	Sub-total	310	310
Sidoarjo	N-S System	95.5	95.5
	NE-SW System	18	18
	Sub-total	113.5	113.5
	Kamal	–	30 3)
	Total	4,434.5	7,714.5

Note: 1) New Umbulan Spring assumed to be available by 1990.
2) New development by PDAM SURABAYA by 1985.
3) Water supply for Kamal to be started in 1983.

Table 14.6.2 FUTURE WATER DEMAND IN SMA

Year	Ave. Day (1) Demand (m^3/day)	Max. Day Distribution Volume (2) Peak Factor	(1)×(2)=(3) Max. Day Demand	(4) Water Loss	(5)=(3)×(4) (m^3/day) Max. Day Distribution Volume	Max. Day Water Intake Volume (5) x 1.08 (m^3/day)	Total Demand Total (m^3/sec)	Total Demand Net (m^3/sec)
1990	521,280	0.8	651,600	0.85	766,600	828,000	9.6	9.6 – 7.7*= 1.9
2000	1,372,304	0.8	1,715,380	0.9	1,906,000	2,059,000	23.8	23.8 – 7.7*= 16.1

* Available water calculated in Table 4.6.3.

BREAKDOWN BY SECTOR

Unit: m^3/day

Year	SMA Total Population	Service Level Piped Water	Service Level Vendor	Service Volume (ℓ/capita/day) Piped	Service Volume (ℓ/capita/day) Vendor	Domestic Piped Water	Domestic Vendor	Industrial Industrial	Industrial Port	Social	Commercial	Total
1980	2,905,414	10.9%	23.4%	219	20	–	–	–	–	–	–	–
1990	4,186,574	40	20	220	20	368,419	16,746	61,606	2,241	33,919	38,349	521,280
2000	6,119,364	70	10	220	20	942,382	12,239	292,385	3,592	49,584	72,122	1,372,304

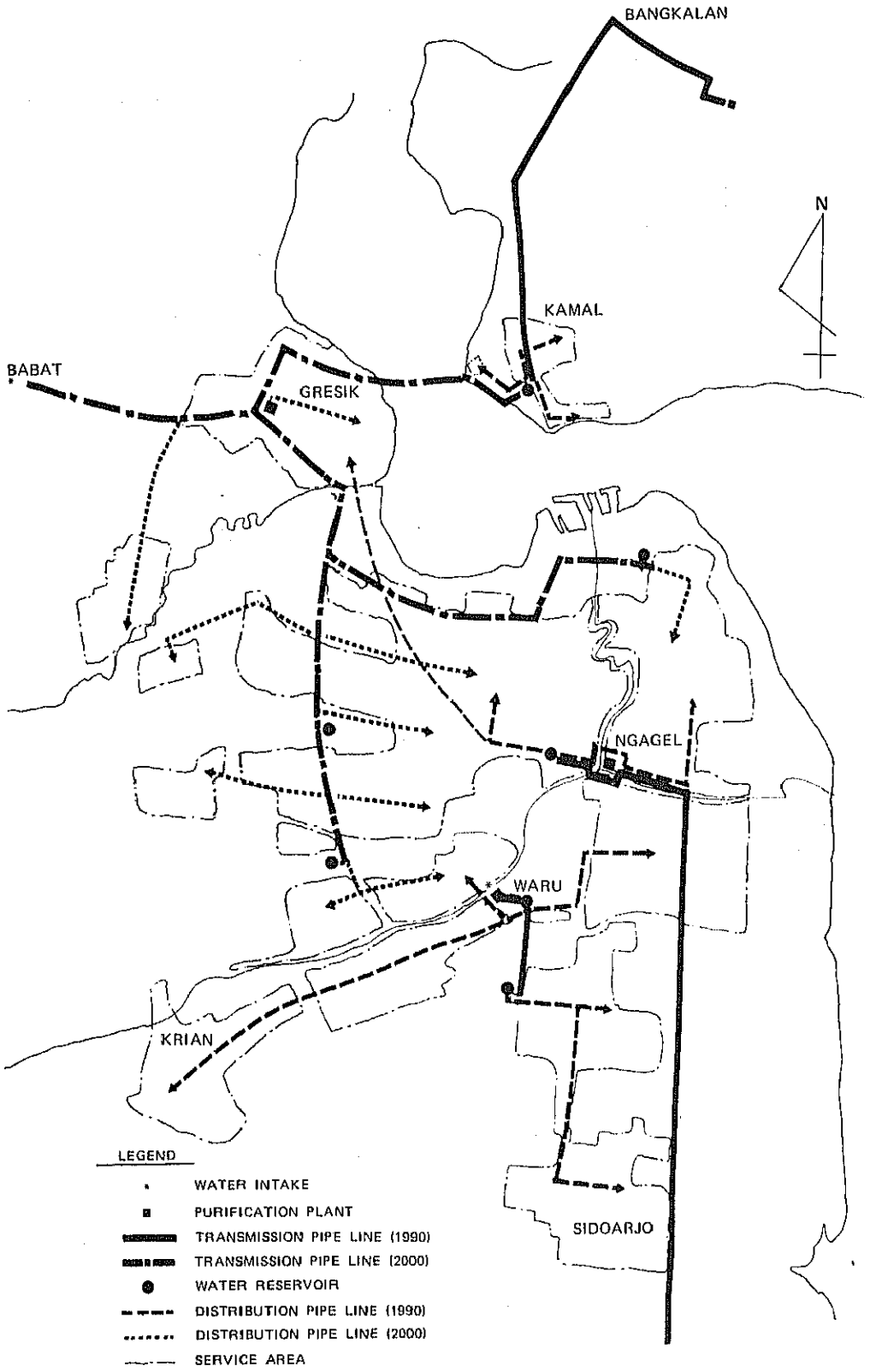


Fig. 14.6.1 WATER SUPPLY DEVELOPMENT PLAN

Table 14.6.5 WATER SOURCE DEVELOPMENT

Unit: $m^3/sec.$

Water Source	Expected Development
Sala river	10
Surplus irrigation water in Surabaya and Sidoarjo	6
4 Spring water in Bangkalan	0.15
Total	16.1

(2) WASTE WATER

(i) Forecast of Future Waste Water Disposal Volume

The free discharge of industrial and domestic waste water has a adverse effect upon the resident's health, especially from the residnet's raw sewage. Skin disease, cholera and its related diseases of digestive origans are still common. This is proved by the extremely high contamination of coliform in the major river/canal system.

The future waste water volume should be coordinated with that of water supply. The volume therefore is estimated by the area corresponding to the river and canal basin. In 1990 the total of approximately 520,000 m^3/day and 1.37 million m^3/day in 2000 are estimated to discharged to the river and canal system in SMA.

The maximum daily discharge volume is estimated in Table 14.6.6.

Table 14.6.6 MAXIMUM DAILY DISCHARGE VOLUME OF WASTE WATER

Unit: m^3/day

Area \ Year	1990	2000
Kamal	20,500	63,800
Gresik	61,600	253,800
Surabaya West	186,200	460,800
Surabaya East	204,800	416,800
Kedurus/Rungkut	12,000	57,200
Driorejo	107,100	282,900
Sidoarjo	155,300	436,700
Total	747,500	1,972,000

Night Soil Volume

The total night soil is estimated to be 54.4 ton/day in 1990 and 79.6 ton/day in 2000 based on the unit discharge of 13 g/capita/day. A service level of 50% is assumed considering the expansion of public toilet and private toilet. The volume to be treated is 27.4 t/day and 39.8 t/day.

(ii) Development Planning

– Planning Concept

Considering the level of water pollution of the existing river and canal system the treatment of waste water should start as early as possible. Large investment and long construction periods are however required for the realization of the system. People's understanding and consensus on the project is also an indispensable component. Therefore, the planning concept is applied for the waste water development programme as described below:

- A night soil treatment system is to be established by 1990. The treatment plant treats half of the night soil generated in 1990 and 2000.
- The pilot project of waste water treatment is executed in Surabaya by 2000. In case of the large scale residential area development, a treatment system should be constructed within the residential programme described in this study.
- The full-scale service of waste water treatment will occur after 2000.
- Industrial waste water is to be treated by the company and discharged to the canal system. The water qualities after the treatment should satisfy the water discharge regulations. The regulations will be set up on the basis of Industrial Estate Rungkut. In the case of large scale development as Industrial Estates Rungkut, the treatment system should be constructed within the development project regardless the schedule of global waste water treatment development.
- Public toilet should be expanded and assumed to construct additional 320 Nos. in 1990 and 550 Nos. in 2000.

- Technical Aspects (Selection of Waste Water Treatment System)

  Separate system is recommended based on the water pollution minimized and earliest realization of the waste water system.

(iii) Development Programme

The development of waste water treatment system is planned as follows:

Up to 1990

- Execution of master plan/feasibility study
- Expansion of public toilet service
- Introduction of night soil treatment plant
- Construction of waste water treatment system for the large-scale residential/industrial area development executed by the complex project.

Up to 2000

- Construction of additional public toilet
- Expansion of night soil treatment plant
- Pilot project of waste water treatment system

Beyond 2000

- Establishment of full-scale development of waste water treatment system.

(3) SOLID WASTE

Solid waste treatment does not have a beneficial effect like water treatment. It has however, a direct effect upon public health and urban amenities. Clearing work must be expanded in a direct relationship of solid waste generation.

(i) Forecast of Future Solid Waste Generation

In order to obtain basic data for formulation of solid waste management system of the year 2000 and 1990, the future volumes of solid waste generated for the entire SMA are forecasted.

- Forecast of Volume Generation

  Actual survey on the nature of solid waste was conducted in the CDM study in 1975. This data is used for the estimation of 1980 solid waste generation volume. Based on these two year volumes the future generated volume is forecasted in the relation of GRDP and generation volume.

Table 14.6.7 shows the forecast solid waste generated volume in SMA upto 2000. The generated volume in 1990 is 2,835 ton/day and 5,067 ton/day in 2000.

Table 14.6.7 FORCAST FUTURE SOLID WASTE GENERATION VOLUME IN SMA

Year	GRDP IN SMA (Million Rp)	Generation Volume (ton/day, M^3/day)	
1975 1)	333,061	1,529	8,935
1980 2)	441,843	1,784	10,504
1990	883,413	2,835	16,872
2000	1,821,422	5,067	30,398

Note: 1) Actual data by CDM study in 1975

Table 14.6.8 ASSUMED FUTUE PHYSICAL COMPOSITION IN 1990 AND 2000

(1) Year 2000

Waste Description by Category	Composition (%)		
	Bangkok 2000	Japan 1965	Surabaya 2000
1. Combustibles	72.6	80.3	80
Paper	22.1	42.2	20
Garbage	30.3	10.0	40
Plastic	12.5	5.2	10
Other (Textile, Rubber, Leather, etc)	7.7	22.9	10
2. Incombustibles	19.9	19.7	13
Metal & Glass	10.9	16.2	10
Construction (Stone, Brick, Sand, etc)	2.0	-	2
Others (Ceramic, Bones, Shells)	7.0	3.5	1
3. Miscellaneous	7.5	-	7.0
4. Total	100	100	100

(2) Year 1990

Waste Description by Category	Composition (%)		
	Surabaya Data 1975	Future 2000	Future 1990
1. Combustible	98	80	90
Paper	2	20	12
Gerbage	94	40	70
Plastic	2	10	6
Other (textile, Rubber, Leather, etc)	-	10	2
2. Incombustible	2	13	7
Metal & Glass	1	10	5
Construction (stone, brick, sand, etc)	-	2	1
Others (Ceramic, Bones, Shells)	-	1	1
3. Miscellaneous	1	7	3
Total	100	100	100

– Future Physical Composition

Solid waste component is proportionally related to the disposal volume of consumpted materials and to the consumption volume of the materials. This data however is not available. The future physical composition is therefore assumed using similar foreign city data as shown in Table 14.6.8.

Treatment/Disposal Volume

Table 14.6.11 is the assumed treatment/disposal volume by treatment method considering the various solid wastes generated in the sectors.

(ii) Solid Waste Management System

– Principle of Solid Waste Management

The solid waste management aims at accomplishment of the following objectives.

- Collection of solid waste in the urban areas to keep the city clean.
- Inactivation of solid waste
- Volume reduction
- Resource recovery

Solid waste management system is composed of four systems: collection, transportation, intermediate treatment, and final disposal.

– Major Aspects of the Proposed System

- To adopt a Separate collection (conbustible and incombustible, etc) system
- To vary the collection methods according to the generated volume/physical composition of solid waste and area/traffic conditions
- To introduce incineration plants as the intermediate treatment method and maintains a compost plant due to unknown factors in the future.
- Facilities to be developed:
  - The incineration plants with the total capacity of 2,100 ton/day are required up to 2000. A pilot plant (plant capacity of 300 ton/day) is started in Sukolilo for staff training.
  - Landfill site of total 2.7 million m^2 is required in SMA by 2000.
  - Transportation trucks to be purchased:
    In 1990: 180 Nos (Dump truck, 8 m^3), 124 Nos (Compactor truck, 7.5 m^3)
    In 2000: 497 Nos (Dump truck, 8 m^3), 300 Nos (Compactor truck, 7.5 m^3)

(iii) Development Programme of Solid Waste Treatment

– Execution of Mater Plan and Feasibility Study

There are no up-date data on the quantity and nature of current solid waste. These data are indispensable components when the plan is set up. A future study should be executed including these basic data survey.

– Recommendation for the Solid Waste Management

Up to 2000

- Execution of master plan and feasibility study
- Promotion of separate collection system (combustible and incombustible, etc.)
- Expansion of container depot system (including replacement of concreate depot), Phase-I
- Introduction of individual collection system for small-volume dischargers
- Expansion of hauled trailer system for large-volume dischargers.
- Introduction of incineration plan, Phase-I
- Expansion of transportation faculty, parking lots/workshops and purchasing equipment/tool, Phase-I
- Promotion of licensed treatment enterprises
- Promotion of treatment sector for residual material (metal, glass, plastic, paper, rubber, etc.)
- The pilot project for an incineration plant
- Development of land fill site, Phase-I

Upto 2000

- Provision of container depot, Phase-II
- Purchase of equipment/tool, Phase-II
- Development of incineration plant, Phase-II
- Development of land fill sites, Phase-II

(4) ELECTRICITY

(i) Future Demand Forecaste

Electricity is an indispensable component for urban development and should be developed according to future demand. The global planning for electricity, however, must be considered not only in East Java but also the other regions in Java.

– Peak Demand

For the forecast of future electricity demand, "SURABAYA LONG RANGE PLAN OF ELECTRIC POWER SYSTEM UPTO YEAR 2000, EAST JAVA ELECTRIC POWER TRANSMISSION AND DISTRIBUTION NETWORK PROJECT SECOND STAGE" conducted by Persahan Umum Listrik Negara (PLN), the Ministry of Public Works and Power in Dec. 1976. This is the source data for the forecasts in this study. The future electricity demand in SMA is estimated in Table 4.6.14.

– Average Annual Demand

The annual demand is estimated on the relation between GRDP and electricity consumption. The Table 14.6.15 is the future demand in SMA.

(ii) Development Plan

In 1981 PLN estimated the future electric demand (up to 1989) for East Java as 4,566.8 GWH in 1985/86 and 7,984.1 GWH in 1988/89.

In the development plan, the PLN stated that hydroelectric potential of the Brantas river would be limited. In 1982, 124 MW is produced by Karangates and Wlingi dams. Another 52 MW will be produced by Sungoro dam in the near future but after the Sangoro dam, further major generation will not be possible due to the lack of suitable sites.

To feed electricity to meet the increased demand of year 2000, an expansion of the 150 kV system, including an introduction of 150 kV lines to the business centre areas, is preferable than strengthening the existing 70 kV system.

Table 14.6.14 FUTURE ELECTRICITY DEMAND FORECAST
(Day Peak Demand)

Unit: MW

Year / Category	1990	2000
Surabaya	918	2,059
Gresik	269	578
Sidoarjo	272	642
Bangkalan	111	197
Total	1,570	3,476

CHAPTER 10 URBAN STRUCTURE PLAN

10.1 CRITICAL FACTORS

LAND CAPACITY

The population in the year 2000 adjusted from the land capacity is summarized in Table 15.1.2.

WATER CAPACITY

The domestic water demand is however considered to be rather conservative under the present water supply situation. The future water supply for residential sector is shown in Table 15.1.3.

Industrial water estimate is based on the consumption per capita per day. The future unit consumption is assumed to be 200 ℓ/employee/day in 1990 and 500 ℓ/employee/day in 2000.

Public facilities water is estimated in relation with the population growth in SMA. In 1990 a total of 9.6 m^3/sec. and 23.8 m^3/sec. in 2000 is needed for SMA.

- Development of Water Sources
  - Available water sources by 1990

    Total 7.7 m^3/sec. will be available for SMA.
  - New Water Sources Development

    The additional water demand of 1.9 m^3/sec. in 1990 and 16.1 m^3/sec. in 2000 must therefore be met. To meet this demand the available water potential is reviewed and results are summarized in Table 15.1.4. and Fig. 15.1.4.

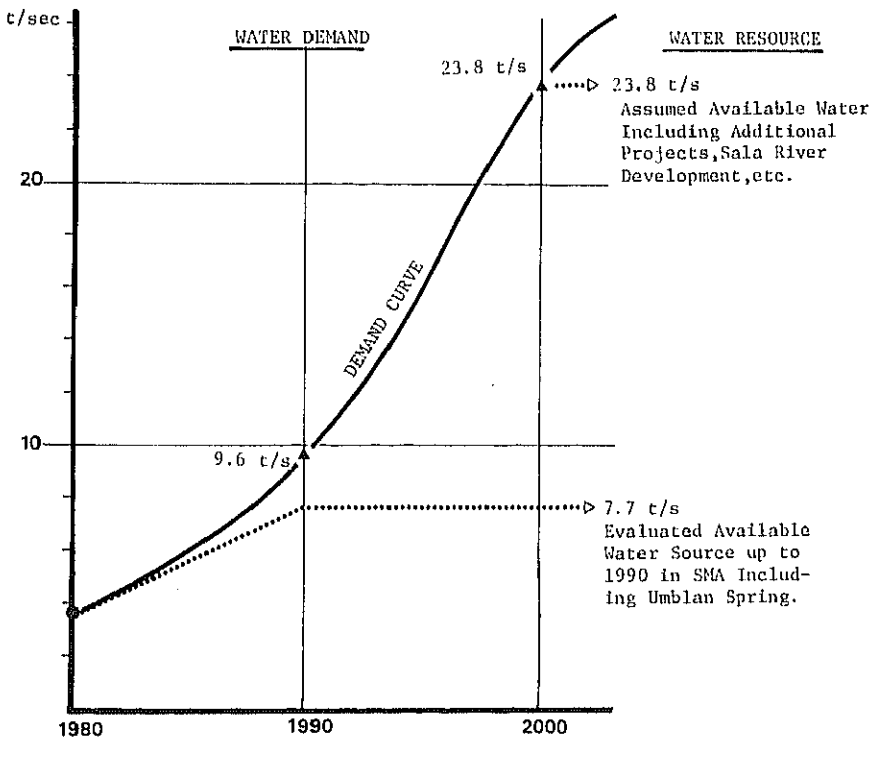


Fig. 15.1.4 WATER DEMAND AND CAPACITY OF SUPPLY IN SMA

Table 15.1.2 ADJUSTED POPULATION OF SMA IN 2000 FROM LAND CAPACITY

(Unit: Person)

Kot./Kab	Adjusted Population from Land Capacity	
	2000	Increase 2000/1980
Kab. Surabaya	3,825,000	1,807,000
Kab. Sidoarjo	1,312,000	788,000
Kab. Gresik	813,000	548,000
Kab. Bangkalan	170,000	70,000
Sub Total	6,120,000	3,213,000

Table 15.1.3 DOMESTIC WATER SUPPLY IN SMA

Year \ Service	Service Level (%)		Service Volume (ℓ/capita/day)	
	Piped	Vendor	Piped	Vendor
1980	10.9	23.4	219	20
1990	40	30	220	20
2000	70	10	220	20

Table 15.1.4 WATER SOURCE DEVELOPMENT

Unit: m^3/sec.

Water Source	Expected Development (m^3/sec.)
Sala River	10
Surplus irrigation water in Surabaya and Sidoarjo	6
4 Spring water in Bangkalan	0.15
Total	16.1

10.2 DEVELOPMENT FRAMEWORK

Based on the results of sectoral study, the landuse demand to be developed up to the year 2000 and the demand for public facilities are summarized as shown in Table 15.1.9 and 15.1.10.

10.3 AREA DISTRIBUTION BY PLANNING AREA

Distribution of Population

The distribution of population by unit of planning area was assumed as indicated in Table 15.1.11 and illustrated in Fig. 15.1.6.

Distribution of Work Places

The final framework was adjusted as shown in Table 15.1.12.

Table 15.1.9 LANDUSE FRAMEWORK IN SMA

Items	Existing	Future		New Development (2000-1980)
	1980	1990	2000	
Urban Landuse (ha)				
1. Total of Urban Landuse	27,796	35,540	49,131	21,335
1) Commercial	1,215	1,711	2,736	1,521
Central Business and Commercial	650	830	1,407	757
Neighbourhood Commercial	565	881	1,329	764
2) Industrial	1,741	2,573	4,801	3,060
For Existing Industry	1,741	1,626	1,511	Δ 230
For Newly Located	-	827	2,920	2,920
For Relocated and Small Scale Factories	-	120	370	370
3) Residential	20,761	25,683	32,938	12,177
Housing	16,609	20,546	26,350	9,741
Relevant Public Service	4,152	5,137	6,588	2,436
4) Major Public Services	508	630	806	298
5) Recreational/Park	125	663	1,835	1,710
6) Major Infrastructure	2,605	3,439	5,174	2,569
7) Military	841	841	841	0
2. OPEN SPACE (Agricultural, Natural Conservation, etc.)	73,810	66,066	52,475	Δ 21,335
* Urbanized Ratio (%)	27.4	35.0	48.4	-

Table 15.1.10 LIVING FACILITIES DEMAND IN SMA UP TO 2000

Categories	Items	Number of Facilities to be developed up to 2000
Public Service Facilities to be Developed	EDUCATION	1,856
	- Kindergarten	960
	- Primary School (SD)	576
	- Jr. Secondary School (SLP)	192
	- Sr. Secondary School (SLA)	128
	HEALTH	1,244
	- Policlinic	768
	- Dispensary	192
	- BKIA 1)	196
	- PUSKESMAS 2)	64
	(-) Distric Public Health Center	16
	(-) Regional	8
	COMMERCIAL/BUSINESS	8,532
	- Stall	7,680
	- Shop	768
	- Shopping Center (Sub-district)	64
	(-) District Shopping Center + Trade	16
	(-) Trade and Industry	4
	PARK/PLAY AND SPORTS GROUND	8,532
	- Play lot	7,680
	- Mosque/Park/Play ground or Langgar	768
	- Park/play and Sports Ground (sub-district)	64
	- " (district)	16
	- " (regional)	4
	ADMINISTRATIVE/PUBLIC SERVICE	788
	- For RUKUN WARGA	768
	(-) For KECAMATAN	16
	(-) For WILAYAH	4
Total Water Demand		- 23.8 t/sec.
Total Electricity Demand		around 1,782 GWH/year

Notes: 1) : Mother + Child care center and maternity hospital
2) : Health Center for Sub-district

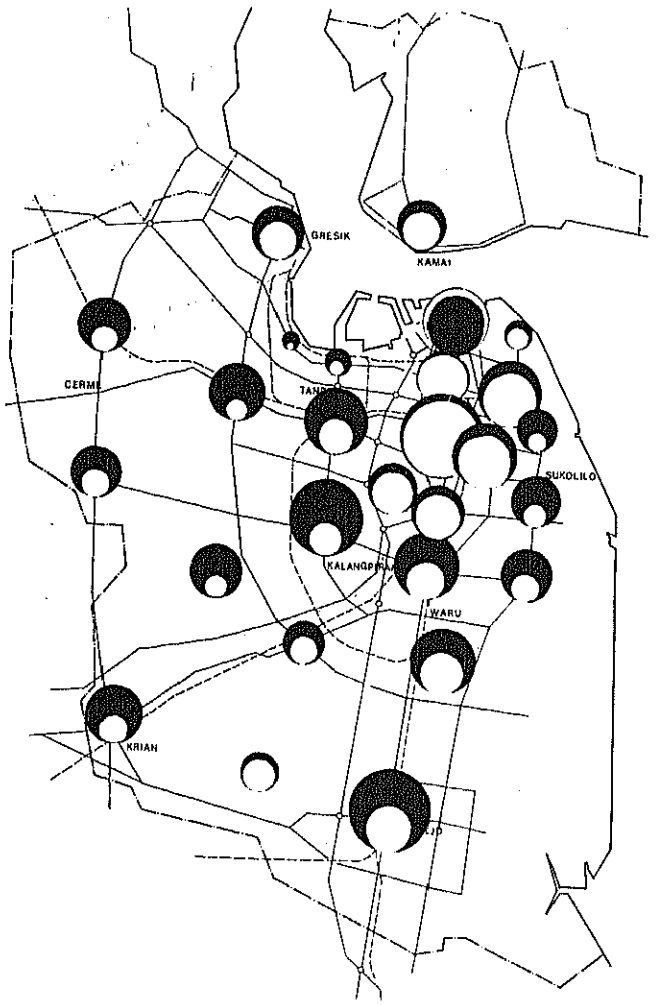


Fig. 15.1.6 DISTRIBUTION OF POPULATION IN SMA

Table 15.1.11 DISTRIBUTION OF POPULATION

No.	NAME OF ZONE	1980	1990	2000	1990/1980	2000/1980
1.	TG. PERAK	273,644	279,000	249,000	1.020	0.910
2.	KEDUNG COWEK	31,825	41,000	66,000	1.288	1.068
3.	CANTIAN	179,247	198,000	215,000	1.105	1.199
4.	TEGARSARI	412,605	456,000	495,000	1.105	1.120
5.	WONOKROMO	142,515	164,000	194,000	1.151	1.361
6.	SAWAHAN	131,867	161,000	180,000	1.221	1.365
7.	GENTING	16,489	28,000	57,000	1.698	3.456
8.	ROMO KALISARI	3,105	5,000	23,000	1.610	7.407
9.	SIMOMULYO	86,916	191,000	307,000	2.198	1.607
10.	SEMEMI	30,536	50,000	244,000	1.637	7.991
11.	KARANGPILANG	71,559	223,000	389,000	3.116	5.436
12.	WONOCOLO	103,486	240,000	308,000	2.319	2.976
13.	GUBUNG	199,131	242,000	271,000	1.215	1.361
14.	TAMBAKSARI	210,011	271,000	308,000	1.290	1.467
15.	NORTH SUKOLILO	25,516	73,000	124,000	2.861	4.860
16.	SOUTH SUKOLILO	42,805	111,000	186,000	2.593	4.345
17.	RUNGKUT	56,271	129,000	209,000	2.292	3.714
(1)	Sub. Total (SURABAYA)	2,017,527	2,862,000	3,825,000	1.419	1.896
18.	GRESIK	104,353	154,000	205,000	1.476	1.964
19.	CERME	44,096	53,000	208,000	1.202	4.717
20.	MENGANTI	59,414	63,000	180,000	1,060	3.030
21.	DRIOREJO	39,283	83,000	220,000	2.113	2.651
(2)	Sub. Total (Kab GRESIK)	247,146	353,000	813,000	1.428	3.290
22.	WARU	129,528	198,000	314,000	1.529	2.424
23.	TAMAN	76,376	95,000	137,000	1.244	1.794
24.	KRIAN	58,899	138,000	253,000	2.343	4.295
25.	SIDOARJO	158,783	349,000	494,000	2.198	3.111
26.	WONOAYU	79,531	85,000	113,000	1.069	1.421
(3)	Sub. Total (Kab. SIDOARJO)	503,117	865,000	1,311,000	1.720	2.606
27.	KAMAL	99,687	107,000	170,000	1.073	1.705
(4)	Sub. Total (Kab. BANGKALAN)	99,687	107,000	170,000	1.073	1.705
(5)	Total (2)+(3)+(4)	849,950	1,325,000	2,294,000	1.559	2.699
	GRAND TOTAL	2,867,477	4,187,000	6,119,000	1.460	2.134
OTHER AREA IN KAB. GRESIK		415,238	561,000	684,000	1.351	1.647
OTHER AREA IN KAB. SIDOARJO		350,568	368,000	456,000	1.050	1.301
KOD. MOJOKERTO		68,507	82,000	99,000	1.197	1.445
KAB. MOJOKERTO		705,358	889,000	1,135,000	1.260	1.609
KAB. LAMONGAN		1,049,808	1,277,000	1,569,000	1.216	1.495
OTHER AREA IN KAB. BANGKALAN		588,604	645,000	697,000	1.096	1.184
G.K.S. WITHOUT SMA		3,244,458	3,822,000	4,640,000	1.178	1.430
G. K. S. TOTAL		6,111,935	8,009,000	10,759,000	1.310	1.343

Fig. 15.1.1 PLANNING AREA DIVISION IN SMA