CHAPTER 14

SECTORAL DEVELOPMENT

14.1 INDUSTRY

14.1.1 MEANING OF INDUSTRIALIZATION

DEVELOPMENT OF MANUFACTURING

The basic aims of regional development, as mentioned in Chapter 11, are to ensure an appropriate economic activity and to elevate personal income levels through the economic growth. However, because of population increase, the economic growth should be higher than the population growth, in order to increase the real income level of the people. All citizens should be able to participate in the economic activities so as to disperse any social upheaval and distribute the benefits. The importance of industrialization lies in ensuring the increase of economic activity, income, and employment opportunities.

Industrial development should occur in each economic sector. In the primary sector, a significant policy impact is obtained by adding new productive values to the low existing production as well as maximizing land productivity. In the tertiary sector, services supporting regional activities should be developed and enlarged. From a political industrialization point of view the secondary sector is evaluated to be the key sector because of the greater benefits from development, derived from the following characteristics of the manufacturing sector;

- Direct contribution to the enlargement of employment opportunities,
- Major contribution to the raising of income levels because of the higher productivity per land area and labour,
- Influence upon the economic growth of the commercial and service sectors through production and distribution,
- Promotion of Social modernization and rationalization, which are required as principles of economic growth, and
- to activate the existing intermediate technological and traditional skills for manufacturing activities.

POLITICAL CONSIDERATIONS

From a political point of view, some consideration should be given to the industrialization process. First, the regional industrial development programme should be prepared in the context of the national programme which, supplies the background requirements of the degree of social growth. Second, the regional industrialization should ensure the maximum utilization of existing human and natural resources. Third, it is significant to prepare appropriate conditions for investment by the creation of necessary administrative and physical environments. The creation of new small and medium size industries, as well as large industries tend to require assistance and investment from foreign countries because of the need for intermediate technology to establish a firm industrial structure. Fourth, the skills of the workers in the manufacturing sector should be advanced by the development of vocational education with the intention of creating a pool of middle & high technical skills to achieve the industrialization levels that are planned.

URBAN PLANNING CONSIDERATIONS

Connected with the political measures, there are some urban planning considerations necessary for industrial development.

First, the area for the Industries should be appropriately prepared to relate the characteristics of locating the different manufacturing industries. A manufacturing industry has to possess a relationship not only with a major freight terminal and generator such as a port, a truck terminal, highway network etc. but also with main commercial centres for such services as banks and other financial functions. Moreover, the location of factories should be suitable for commuting by the employees. These conditions must be taken into account in the planning of an industrial location.

Second, the development of infrastructure to support industrial activities is indispensable. Water and electric power supplies, waste disposal, transportation service as well as site preparation must be undertaken.

Third, from an urban environmental point of view, some criteria for industrial location and for factory operations should be prepared. Building regulations, design criteria, and environmental standards for industrial waste are significant considerations in the plan.

14.1.2 INDUSTRIALIZATION PROGRAMME

GENERAL POLICY

Generally there are two view points for the industrial development policy:

- Encouragement of production of substitutes for imported goods,
- Encouragement of production of goods for export.

The former viewpoint usually holds that the direction of industrialization should be developed on the domestic demand market, and should be consumer oriented. The latter viewpoint expresses that the objective of industrialization is mainly the encouragement of exports.

In a discussion at the national level, it is true that both directions should be promoted with a harmonious relationship. In regional development, however, selection of direction is necessary due to consideration of the local resources and particulars.

In conclusion, the Study Team recommends that the former policy is selected in SMA based on the following considerations:

- SMA possesses a wide regional hinterland for a consumers' market with a large population base.
- SMA is located at the important traffic node for not only land communication, but also sea communication.
- Based on the conditions of the above (i) and (ii), there exists remarkable potential and capability to ensure a market for manufactured products.
- SMA also possesses a wide agricultural hinterland and is a focal point for agricultural products as stated in item (ii). Conditions exist for an "agro-industry" to be encouraged under a tied relationship between agriculture and manufacturing interests.

STRATEGIC PROGRAMME FOR INDUSTRIAL DEVELOPMENT

According to the context mentioned in the former section, the industrial development programme in SMA is discussed herein.

The planning topics for the strategic programme consist of 4 items:

(1) Types of Manufacturing Processes to be Encouraged

As a basis for industrialization, some strategic manufacturing processes should be considered for establishment in the SMA.

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

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

Generally it is recognized that in the process of industrial advancement, these types overlap and simultaneously the manufacture of intermediate goods and the manufacture of durable goods occur. Consequently, the industrial structure is composed of this mutual relationship between the manufacture of consumer goods and the intermediate and durable goods manufacture.

From this point of view, Indonesian industrialization is acknowledged to be about to enter the second step of processing and assembling type of manufacture. Accordingly, it is desirable that this type of manufacture should be aggressively introduced into SMA as the industrialization core. Centring on this core, various manufacturing processes should be established.

Generally, the manufacture of consumer goods is likely to be more labour intensive, while the manufacture of durable goods is more capital intensive. Therefore, the former is more suitable as it satisfies the requirement that a large increase in employment opportunities should be prepared in this area.

Basically, it is required that the strategic manufacturing type to be induced should correspond with the national policy on industrial development.

Table 14.1.1 shows the recommended types with high priority to be located in Surabaya and its peripheral areas, as planned by the central government.

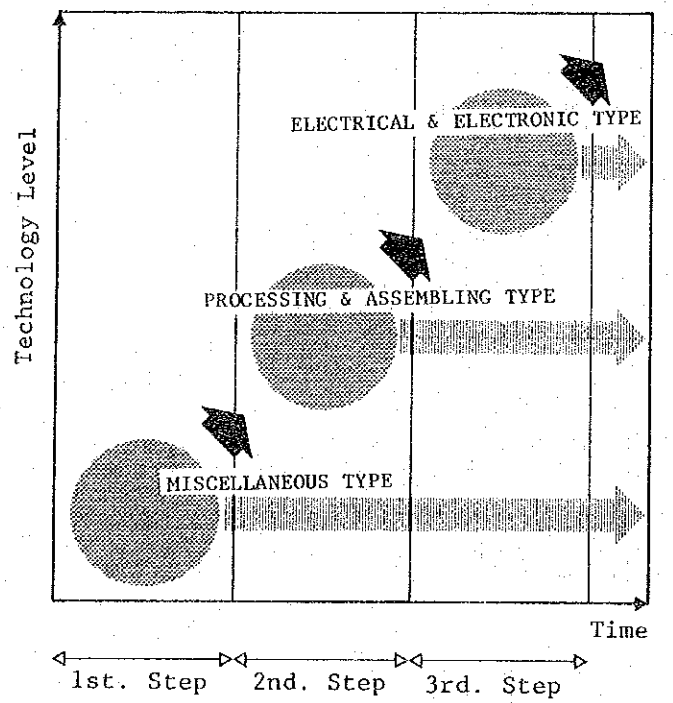


Fig. 14.1.1 CONCEPTIONAL SCHEME ON PROCESS OF INDUSTRIALIZATION

Table 14.1.1 PRIORITY LIST OF FOREIGN INVESTMENT (1982/83) IN MANUFACTURING SECTOR

ISIC	Field of Investment	Incentives T.H	Incentives I.A	REMARKS
3692	Pressure pipes of asbestos cement products		x	High technology and for export
3620	Glass & Glass Products		x	Comply with Health regulation
3851	Scientific measurement Equipments		x	"
	Medical instrumentations		x	
3822	Agricultural Tractors	xxx		Power: 60 - 90 hp. Utilizing local made components
3610	Laboratory ware		x	For export
3851	Industrial instrumentations		x	Including control panel for vehicle
3824	Electronic office machines		x	
3831	Active Components	xxx		Manufacturing
3832	Telecommunication Apparatus	xxx	or x	
3833		x		
3852	Photographic/Optical goods		x	Utilizing domestic made components (15 - 30%)
3833	Electrical Isolator		x	Domestic Raw Materials High voltage (20 KV and above)
3831	Electrical Industrial Machinery and apparatus	xxx		
3610	Table/Ware/high quality		x	For export
3824	Standarized machine parts	x	or x	
3513	Plastic & other resins	x		
3511	Sodium Carbonate	xxx		Gresik, East Java PMDN/PMA with government Participation
3511	Other	xxx-x		
3710	Basic material for iron/steel	xxx		Partially; Ciregon
3720	Basic Aluminium Industry	x-xxx	or x	Domestic Raw Material
3720	Basic Lead Industry	xxx		"
3720	Basic Zinc Industry			"
3821	Motor and Turbine	xxx		1. Power over 500 hp. 2. Diesel Engine manufacturing in 1985/86 3. Utilizing many local made components
3810	Metal Product	xxx-x	or x	
3841	Ship Building/Repair	xxx		1. min. 10,000 BRT 2. Except fishing ship and dredgers
3833	Railroad signaling equipments	x		
3843	Motor Vehicle assembling and manufacturing	xxx-x		
3844	Motor cycle/three wheel motor vehicles assembling & manufacturing	xxx-x		
3845	Bicycle assembling & Manufacturing	xxx		

Notes: 1) T.H : Tax Holiday Incentive
2) I.A. : Investment Allowance Incentive
3) Excluding the field the location of which is regulated to be outside of Java.

SOURCE: "Priority List for Foreign Investment" 1982/83 Investment Coordinating Board.

(2) Kernel Manufacturing Type

Considering the national context and the following conditions in addition to the points of view mentioned before, the strategic manufacturing types are recommended to be "ship building and repairing", "motor vehicles assembling and manufacturing", and "Construction Materials Manufacturing".

- The major port, Tg. Perak, functions as a important maritime node for foreign trade and inter-island transportation as well as the land transportation mode in East Java. This function means that two significant factors must be considered. The first is that, this area is endowed with suitable conditions for the location of general manufacturing factories, and is in an advantageous position to process raw and durable materials. The second is that it is suitable for the processing and assembling of transportation equipment such as ships and motor vehicles.
- It is evaluated, observing the characteristics of existing factories, that good potential exists to supplement these three types of manufacture, because metal casting, small ship building motor vehicle assembling/manufacturing factories and manufacture of basic materials for construction are already established.

– These three types of manufacture could greatly influence other manufacturing sectors. In other words, based on these types a manufacturing structure with diverse activities could be formed.

(3) Encouragement of the Existing Industries

The results of a factory survey carried out by the Study Team, give useful reference material for the identification of existing problems which need to be solved. (refer to Fig. 14.1.2)

The current problems for industrial activities reported by the managers in the Study Area are summarized in general form as follows:

– Most managers pointed out the problem of traffic and transportation as one of the most serious problems; the difficulty of on-time transportation caused by traffic congestion, the lack of infrastructure, and the increase in transportation costs. Moreover, the difficulty of stable transportation due to natural calamities especially in the rainy season was reported. It seems to be serious for the managers that the transportation procedure is complicated and that the capacity for forwarding goods cannot sufficiently cope with the demand. Besides the above, some managers pointed out the problem of the lack of a smooth connection with the port, Tg. Perak, and the inefficient truck traffic restrictions in the city area.

– Concerning the problems of the infrastructure, as mentioned above, the lack of a suitable road network for industrial activity is the most serious. Also, insufficient water supply and electric power supply seems to be a fairly common problem.

– The problems in operations, are mainly the increase in energy charges, staff salaries, and transportation costs. Problems due to shortage of labour seem to be small.

(4) Present Problems and Future Prospects of Existing Industries

From observations on future prospects for expansion taken from the same survey (refer to Fig. 14.1.3), two points of note arise. First, enlargement of the business, such as increasing the number of employees and expanding the land area was answered as one of the higher priorities.

Second, half the answers indicated a desire to relocate the factories to a more suitable area, and moreover, managers of more than 60% plan or desire to cooperate or merge with other factories in order to make the facilities and promotions more effective.

These two points give a useful indicator to how existing industry should be encouraged.

(5) Strategic Idea on Encouragement of Existing Manufacture

Two policies concerning the encouragement of existing manufacture should be taken into account. One is to improve the industrial environment such as:

– the preparation of suitable land for promoting a factory relocation policy, and

– to develop the infrastructure serving the main industrial locations which are evaluated for retention in the future.

The other is to encourage the introduction of small-scale industries and this problem is common to many countries.

Referring to the experiences of other countries, there are some measures for the encouragement of small-scale factories such as;

– development of a low interest loan system for the modernization and rationalization of small factories,

– development of industrial estates for mutual cooperation and consolidation with common facilities,

– development of a training system for labourers, and entreprenurial managers.

A guidance and subsidy system promoted by the Central Government is indispensable for the encouragement of small factories.

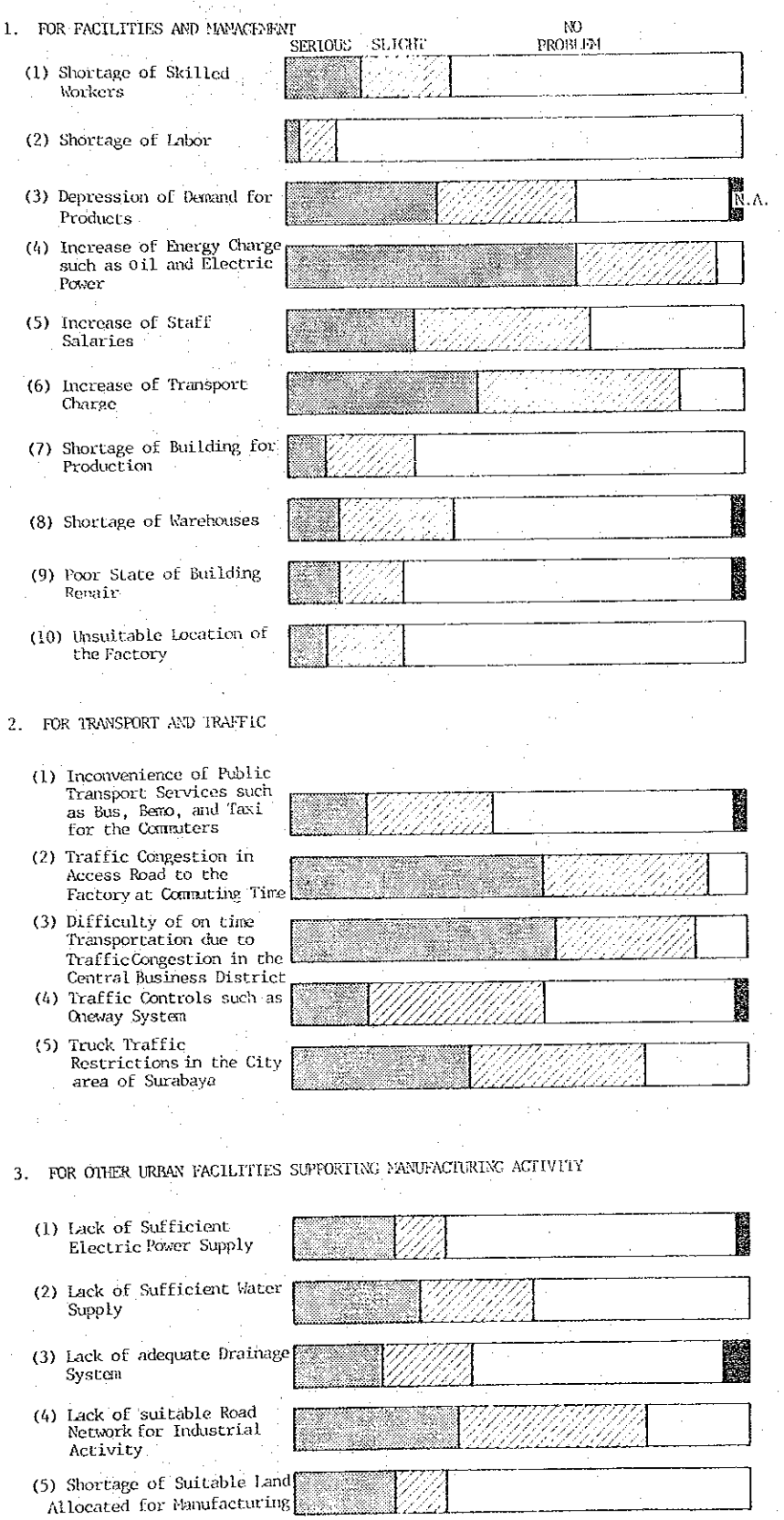
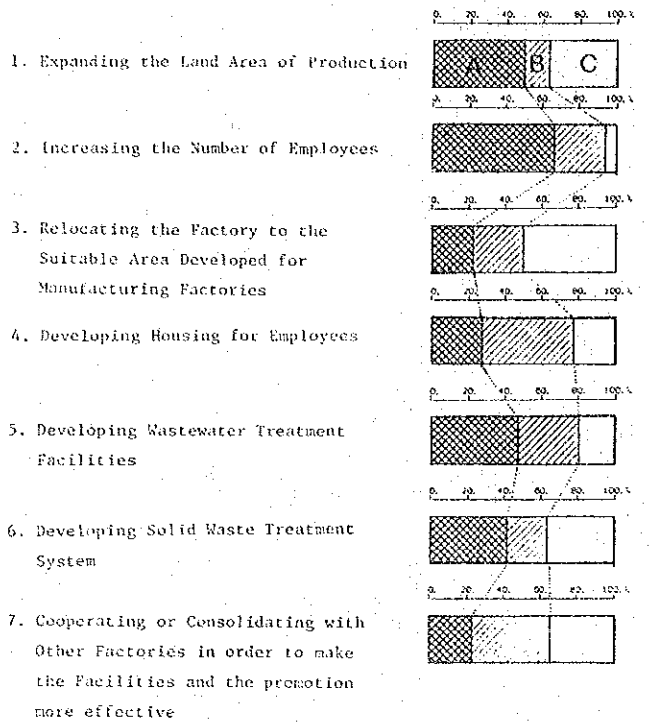


Fig. 14.1.2 CURRENT PROBLEMS ON INDUSTRIAL ACTIVITY



NOTE
A: It can be conceivably be realized or it is currently planned.
B: It is desirable, but not so likely to be realized in the future.
C: It is inconceivable and can not be realized.

Source: The results of Factory Survey carried out in March, 1982. (The questionaires were distributed to 60 firms and 36 replies were collected.)

Fig. 14.1.3 FUTURE PROSPECT FOR INDUSTRIAL ACTIVITIES (FROM THE RESULTS OF THE QUESTIONNAIRE)

(6) Composition of a Firm Industrial Base

It is a basic objective to make a firm industrial structure in a regional economy. In terms of this objective, there exist two viewpoints to be considered;

- First, it is necessary to obtain a mutual relationship and harmony between modern industry newly located and existing traditional manufacturing industries in order to make industrial activity an effective economic power. In other words, the modern manufacture should make an upper structure and the traditional manufacture a lower structure. Based on this structure, intermediate technology should be encouraged to interpose between those technical differences. In this meaning, the modernization of the productive system as well as development of productive skills are especially important in the field of traditional manufacture so as to provide a base for the modern industry.

- Second, a system to appropriately locate factories is necessary, not only for more effective investment in the infrastructure, but also to protect urban environment from industrial pollution. The Study Team strongly recommends that a zoning system with administratively enforced power for industrial location should be prepared as soon as possible.

(7) Sources for Skilled Man-power

As mentioned before, a pool of skilled man-power is a key factor for industrialization and the development of an educational system, especially vocational education, will perform an important role in this context. The desirable man-power, however, is not necessarily a certain number of people educated to a high level, but is as many people with a middle standard of education as possible. According to the statistics of the labour force, less than 8% of all workers in the secondary sector graduated from primary school and less than 5% graduated from middle high school.

The Study Team consider that it would be most important to produce a pool of man-power educated to middle high school or high school levels for industrialization.

To achieve this, a vocational school system oriented to achieve those levels should be developed by the government authorities.

It is recommended that these vocational schools have a manufacturing function so that they can have an income, to be able to give equal educational opportunities to students from low-income families.

4.1.3 INDUSTRIAL INFRASTRUCTURE DEVELOPMENT

ZONING SYSTEM FOR INDUSTRIAL LOCATION

Considering the environmental influence of industrial activities and the necessity of communication with major freight generators such as the harbour, truck terminal etc., an appropriate industrial location should be planned. Basically, zones are classified into three as described below:

(1) Zone in which Industrial Development is restricted

- Advanced Agricultural Area
  The area between the southern part of Kanal Mangetan and the western part of the arterial road, Surabaya-Malang, should be preserved as agricultural area.

- Undeveloped Hill Area
  The undeveloped hill area including the low level Kedurus basin should be developed as a housing area based on green and open space.

(2) Zone in which Industrial Development is controlled

- In the catchment area of Kali Surabaya and Kali Mas new factories using a lot of water should be prohibited and all of the existing factories located there should be required to undertake waste water treatment.

- In the central urban area, which is the inside area bounded by the intermediate ring road planned in this study, the commercial and business function should be encouraged. Therefore, careful attention should be given to industrial locations and it would be advantageous for the factories existing within this area to be relocated.

(3) Zone in which Industrial Development is encouraged

- The area outside of the intermediate ring road should be developed by the nodal development system, to form urban cores and other zoned functions such as commerce, recreation or industry. As one of the cores, industrial estates should be provided in this area, but environmental considerations must be given to the type of manufacturing industry to be located there.

- The coastal area between Surabaya and Gresik is suitable for the location of factories for which the raw material and the finished products are transported by ships. It is recommended that this area should be developed as a coastal industrial zone.

- The area by the airport has an advantageous location and will be suitable for the next step of the industrial progress when electrical and electronic manufacture can be developed. Those products with small bulk and high value can afford the burden of air transportation costs and consequently these factories would prefer the convenience of air transportation. In consideration of such a future demand the area by the airport should be reserved.

The above concept is shown in Fig. 14.1.4. Next, taking a note of the zone evaluated as "to be encouraged" item above, the Study Team recommends the use of development conditions in accordance with location requirements as shown in Fig. 14.1.5 and Table 14.1.2.

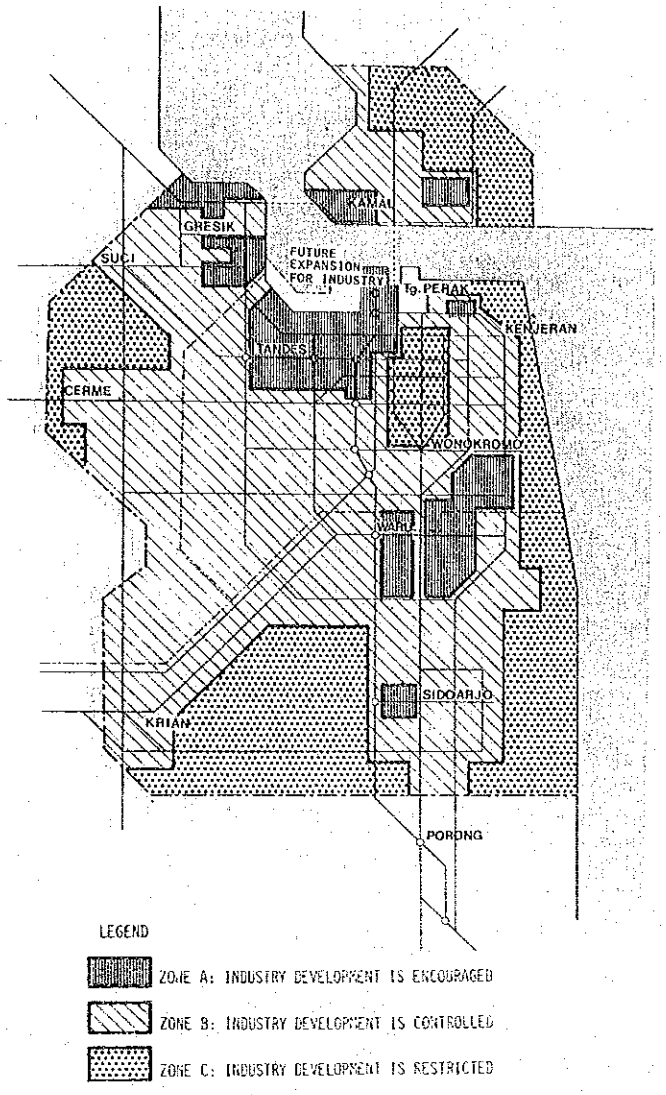


Fig. 14.1.4 ZONING SYSTEM FOR INDUSTRIAL DEVELOPMENT

The zones which are to be developed actively can be classified into four areas from their location:

- Coastal industrial zone (including port area);
- Airport industrial zone;
- Inland industrial zone; and
- Urban located industrial zone.

Generally, each zone has different and particular incentives for industrial location.

Table 14.1.4 shows the conceivable relationship between industrial location and type of industry, by some characteristics such as type of industrial activity, size of industrial estate recommended, and the consideration of water use.

Table 14.1.2 RELATIONSHIP BETWEEN ESTATE LOCATION AND TYPE OF INDUSTRY

	Type of Industry					Size of Industry					Location of Factories using much water
	A	B	C	D	E	(1)	(2)	I	II	III	
Coastal Industrial zone	o	o	o	NC	+	o	+	o	o	NC	*
Airport-side Industrial zone	NC	NC	+	o	+	NC	o	+	o	NC	x
Inland industrial zone	NC	o	o	o	o	+	o	+	o	o	x
Urban location Industrial zone	NC	NC	+	+	o	NC	o	NC	NC	o	x

Notes:

A; Basic Materials production
B; Intermediate and durable goods production
C; Processing and assembling manufacture
D; Electrical and electronic manufacture
E; General consumption goods production (Food, Textile, and Miscellaneous Production)

(1); Capital intensive manufacture
(2); Labour intensive manufacture

I; Large-scale estate (more than 300 ha)
II; Middle-scale estate (around 30 - 100 ha)
III; Small-scale estate (around 10 ha)

o; Suitable
+; Fairly suitable
*; Occasionaly suitable (but needs sufficient care)
x; Not suitable
NC; Not considered due to zoning requirements

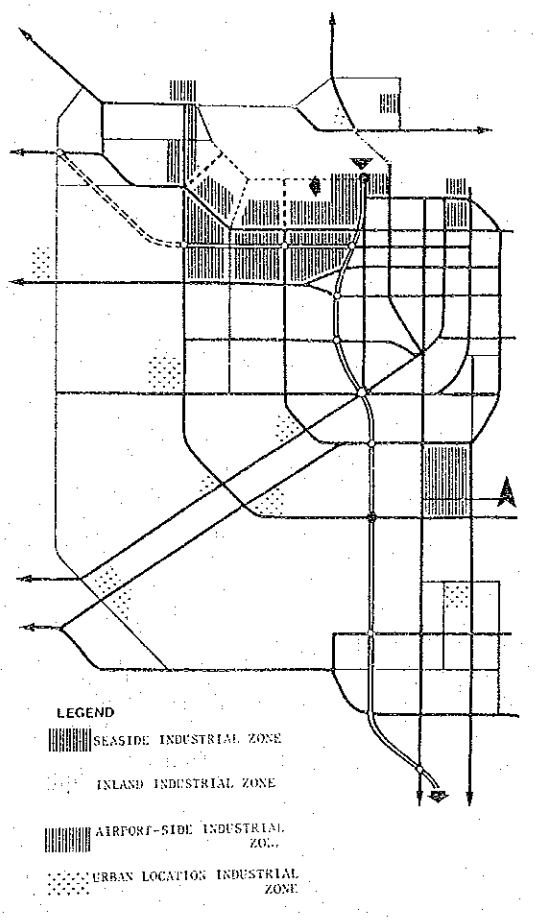


Fig. 14.1.5 RELATIVE LOCATIONS OF INDUSTRIAL ZOENS

DEVELOPMENT OF INDUSTRIAL ESTATES

Generally, the manufacturing sector is not endowed with the ability to carry the burden of high land costs compared with the other sectors located in an urban area. It is conceivable that the manufacturing sector could be defeated in the location competition unless some land price control is introduced. To achieve the required industrialization, planned land acquisition for the locations of industry is essential and industrial estates should therefore be provided, based on planning considerations. The merits of industrial estate development are:

- The difficulty of land acquisition by private industry can be eliminated. This will be a large incentive for investors.
- The development of an infrastructure can be simultaneously implemented.
- The treatment of industrial waste can be more easily arranged due to the development of central and cooperative facilities. This has two merits; administrative control of public pollution will be possible, and for the manufacturers, the cost of the waste treatment will be economical.
- The establishment of a central training school would be efficient to employers because of the cooperative development of the facilities.

Furthermore, from the urban planning point of view, there exists the merit that traffic control and effective utilization of the traffic facilities would be possible and simultaneously landuse planning could be effectively promoted.

PREPARATION OF INDUSTRIAL ESTATE DEVELOPMENT

Basically, industrial estates should be provided for the various types of Industry and three types of industrial estates to correspond with the characteristics of manufacture, are proposed.

(1) Large-Scale Industrial Estate (More than 300 ha)

These Estates should be provided for the kernel types and the strategic types of industry of middle and large scale.

For location planning, it is recommended that these estates should be located in districts where it is convenient for access to the major arterial roads, the major distribution facilities such as the port and the planned truck terminal, and the urben cores.

(2) Middle-Scale Industrial Estate (around 30-100 ha)

The types of industry to be located in these estates is relevant to the kernel and strategic types, as well as the factories removed from the built-up area. Basically, middle and small scale factories should be accepted by these estates.

The locations of these estate should ensure strong relationship with the large-scale estates as proposed above, because these should supplement and support the large-scale estates.

(3) Small-Scale Industrial Estate (Around 10 ha)

These estates should be developed as centres undertaking the consolidation and cooperation of small-scale and handicraft factories as well as the traditional industries. These estates are expected to perform various functions to encourage the rationalization and modernization of the management of the small scale factories and therefore the development of training centres for workers, sharing of equipment, treatment facilities for industrial waste, etc. should be carried out on a cooperative basis. These estates are recommended to be allocated to each Kabupaten/Kotamadya.

GUIDANCE FOR INDUSTRIAL ESTATES DEVELOPMENT

Two different development unit models are proposed for industrial estate development. One provides for large/medium scale industries and the other for small scale industries and handicrafts. To design these two units, existing industrial estates were surveyed, and in particular PT Surabaya Industrial Estate Rungkut (PT SIER for short) and Mini Industrial Estates Sidoarjo (Lingkungan Industri Kecil Sidoarjo, LIK for short). The former is for large/medium scale industries, the latter for small scale industries and handicrafts.

The reasons why existing industrial estates were used as the basis for the models, are as follows;

- These are existing industrial estates and are operating without any significant problems.
- It was easy to get a common and firm image of the development of a unit model for industry.

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

(1) Industrial estates model for large/medium scale industries

- 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 the total land area is needed for roads and utility installations running along the roads (water supply lines and sewage ditches). The road system adopted will result from the distribution of the factory plots and from the possibilities of connecting the estate area with the existing or planned primary/secondary road system. This will make possible a direct rapid access to Tg. Perak and to major cities.

- 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 electricity substation. The management complex with the community building should appear to future investors and visitors as the activity centre of the estate model, and it has to be established at a place on the industrial estate which offers favourable transport conditions and a good landscaped setting. Open spaces with a total area of 13 hectares should be created to make the industrial estate attractive and to provide a multi-purpose recreation area for workers.

(2) Industrial estate model for small scale industries handicrafts

- Total land area 8 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

- Considering the investment potential of small scale industries and handicrafts, mainly leasable production unit buildings based on some standard unit 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. These are necessary because it is the purpose of this model not only to offer space but also to foster development of small scale industries and handicraft companies.

14.1.4 FORECAST OF INDUSTRIAL AREA DEMAND

GENERAL

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 activites in SMA. Following that, spatial capacity and evaluation of the framework set up in this study will be checked.

Methodology

The method of computing the future landuse demand for the manufacturing sector is shown in Fig. 14.1.6. As preparatory works, 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.
- Others

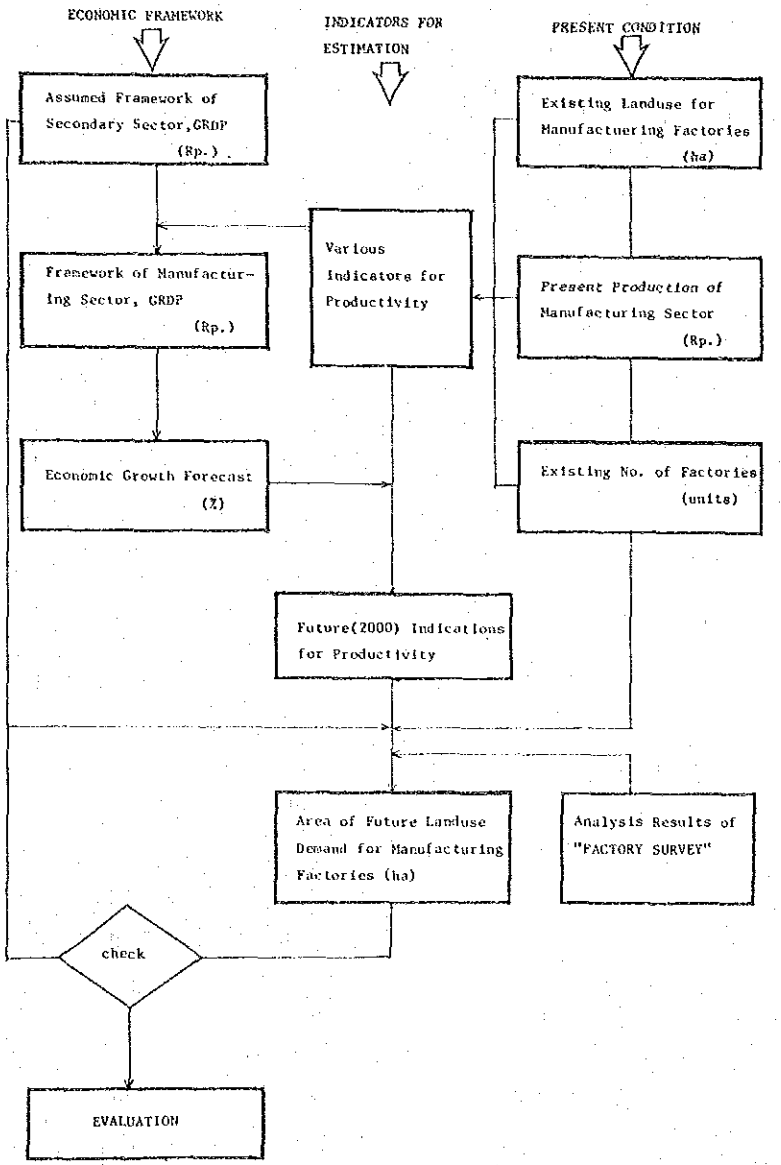


Fig. 14.1.6 WORK FLOW CHART FOR EVALUATION OF MANUFACTURING SECTOR

The volume of landuse demand is classified into three categories;

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

VARIOUS INDICATORS FOR PRODUCTIVITY

(1) Share of Manufacturing Sector to the Secondary Sector

According to the data for GRDP in 1978 by Sector, the share of manufacturing sector to the secondary sector in GKS Region is assumed to be 93.4%, and there exist only a slight difference between Kod. Surabaya and the other Kabupaten. The former is 92.3% and the latter are all more than 94%. However, in the characteristics for constitution of small-scale industry, a particular difference lies in each area and Kab. Gresik and Kab. Bangkalan show a high ratio of small-scale industry in productive value.

Table 14.1.3 SHARE OF MANUFACTURING SECTOR TO SECONDARY SECTOR (GRDP) IN 1978

(%)

	Secondary Sector	Manufacturing Sector	Industry	Small-Scale Industry
Surabaya	100	92.3	88.9	3.4
Gresik	100	94.2	71.7	22.5
Sidoarjo	100	95.0	80.7	14.3
Bangkalan	100	94.3	72.7	21.6
Mojokerto	100	95.7	77.0	18.7
Lamongan	100	98.2	87.8	10.4
G K S	100	93.4	85.2	8.2

(2) Productivity per Employee and its Growth

Based on the estimated GRDP and number of employees in 1975 and 1980, the productivity per meployee and its growth rate are assumed as shown in Table 14.1.4.

The productivity per employee in Surabaya is the highest in the GKS Region at 786 thousand Rupiah (at 1975 constant price) in 1980, while the other areas are nearly equal at between 420 - 520 thousand Rupiah. Average annual growth rate is approximately 3.8% in all areas.

Table 14.1.4 PRODUCTIVITY PER EMPLOYEE AND GROWTH RATE IN GKS REGION

(Unit: thousand Rp/person)

Area	Actual			Estimation in 2000	
	1975	1980	Annual Growth Rate (%)	Productivity per Employee	Growth Rate (%)
Surabaya	653	786	3.78	1,657	3.8
Sidoarjo	352	424	3.79	1,320	5.8
Gresik	358	431	3.78	1,320	5.8
Bangkalan	414	499	3.80	1,093	4.0
Mojokerto	348	421	3.88	922	4.0
Lamongan	432	521	3.82	1,142	4.0
G K S	508	595	3.21	-	-

Notes : at the 1975 constant price

In Table 14.1.4 the estimated future productivity per employee in 2000 is also shown. This estimation was computed according to the following planning considerations;

- Kod. Surabaya is to obtain an annual productivity growth rate of 3.8% based on the past trend.
- In Sidoarjo and Gresik, the existing difference in quality between Surabaya and these areas is to be reduced resulting from the aggressive promotion of factories with high value added. Consequently the growth rate in both areas is assumed to increase up to the target which means that the difference in quality between Surabaya and both areas will become 20% of that of Surabaya.
- In the other areas, an annual growth rate of 4.0%, which is higher than Surabaya, is assumed in order to bridge the difference in quality.

(3) Comparison of Productivity between Normal Factories and Small-Scale Factories

According to the criteria of classification regulated by the Central Government, "small scale factory" means an enterprise with less than 20 employees, and "Home Industry" means less than 5 employees. A "small-scale factory" as used in the chapter, includes Home Industry factories.

A factory with 20 or more employees is called a "normal" factory in this chapter. Generally speaking, it is conceivable that the productivity per employee in a small-scale factory is considerably lower than that in a normal factory. In GKS region the productivity ratio in a small scale factory to that in a normal factory is assumed to be 4 to 10, based on the following calculations;

- It is assumed that the difference in productivity per employee between Surabaya and the average of GKS region is caused by the difference of composition for number of employees engaged at the normal and small-scale factories. According to the data by Ministry of Industry in 1980/81, the breakdown of number of employee is shown in Table 14.1.5.

Table 14.1.5 NUMBER OF EMPLOYEES BY FACTORY SCALE (1980/81)

	Normal Factory	(per) (cent)	Small-scale Factory	(per) (cent)	Total
Surabaya	101,698	(93.9)	6,64	(6.1)	108,339
Gresik	20,208	(59.1)	14,010	(40.9)	34.218
Sidoarjo	22,237	(44.3)	27,915	(55.7)	50,152
Mojokerto	6,951	(19.9)	27,929	(80.1)	34,880
Lamongan	3,982	(13.7)	25,100	(86.3)	29.082
Bangkalan	3,257	(11.1)	26,118	(88.9)	29,375
Total	158,333	(55.4)	127,713	(44.6)	286,046

Source : " LAPORAN TAHUN, 1980/81 " DINAS PERINDUSTRIAN PROPINSI DAERAH TK.I, JAWA TIMUR

- If the productivity per employee of the normal factory is "a" thousand Rp/person and that of small-scaled factory is "b" thousand Rp/person, the following simultaneous equations can be composed;

  $(93.9 \times a + 6.1 \times b) / 100 = 786$

  $(55.4 \times a + 44.6 \times b) / 100 = 595$

  From this solution, a = 816 and b = 320 can be obtained, or a/b = 10/4.

ESTIMATION OF LANDUSE DEMAND IN 2000 FOR NEW FACTORIES

(1) Method

The method of estimation is shown in Fig. 14.1.7. Landuse demand for the new factories established up to the year 2000 is computed by two methods;

A. from the factors for employee productivity
B. from the factors for area productivity

After the results from both methods are evaluated mutually, the optimum forecast is determined.

(2) Estimation from the Factors for Employee

– Using the unit of productivity per employee in 2000 as estimated above, the number of employees in 2000 can be computed by dividing the GRDP of manufacturing sector in 2000, by that unit. Furthermore, the composition rate of normal factories and small-scale factories can be calculated from the difference of productivity per employee by area and by scale. The results are shown in Table 14.1.6.

Table 14.1.6 ESTIMATION OF NUMBER OF EMPLOYEES IN MANUFACTURING SECTOR

(Units; million Rp.; persons)

	GRDP, 2000 (Manufacturing Sector)	No. of Employee	Factories	
			Normal	Small-Scale
Surabaya	368,899	222,631	211,499	11,132
Gresik	162,546	123,141	77,579	45,562
Sidoarjo	218,759	165,348	104,169	61,179
Bangkalan	14,882	33,352	5,587	27,765
Mojokerto	67,574	73,291	18,323	54,968
Lamongan	67,021	58,687	26,996	31,691
Total	893,479	676,450	444,153	232,297

– Subtracting the future number of employees from the present number, the increase in number of employees be obtained. The increased numbers in Surabaya and Sidoarjo are more than 100 thousand persons as shown in Table 14.1.7.

Table 14.1.7 INCREASE IN EMPLOYEES ENGAGED IN MANUFACTURING SECTOR BETWEEN 1980 AND 2000

(Unit ; person)

	Total Increase	Normal Factory	Small - Scale Factory
Surabaya	114, 292	109,801	4,491
Gresik	88,923	57,371	31,552
Sidoarjo	115,196	81,932	33,264
Bangkalan	4,995	2,330	2,665
Mojokerto	138,411	11,372	27,039
Lamongan	29,605	23,014	6,591
G K S	391,422	285,820	105,602

– Next, the average number of employees per hectare for normal factories is assumed to be approximately 144 persons/ha based on the present condition of Surabaya. (The area for manufacturing use in Surabaya was measured from the existing landuse map of scale 1/10,000, made by the Study Team).

For small scale factories, the gross density for employee is assumed to be approximately 200 persons/ha as a result of the survey.

(3) Estimation from the Area Production

– The growth rate of production in the existing factories is assumed as approximately 3.8% per annum, and this is the same as the growth rate of productivity per employee. The value of production of new factories can therefore be computed as shown in Table 14.1.8.

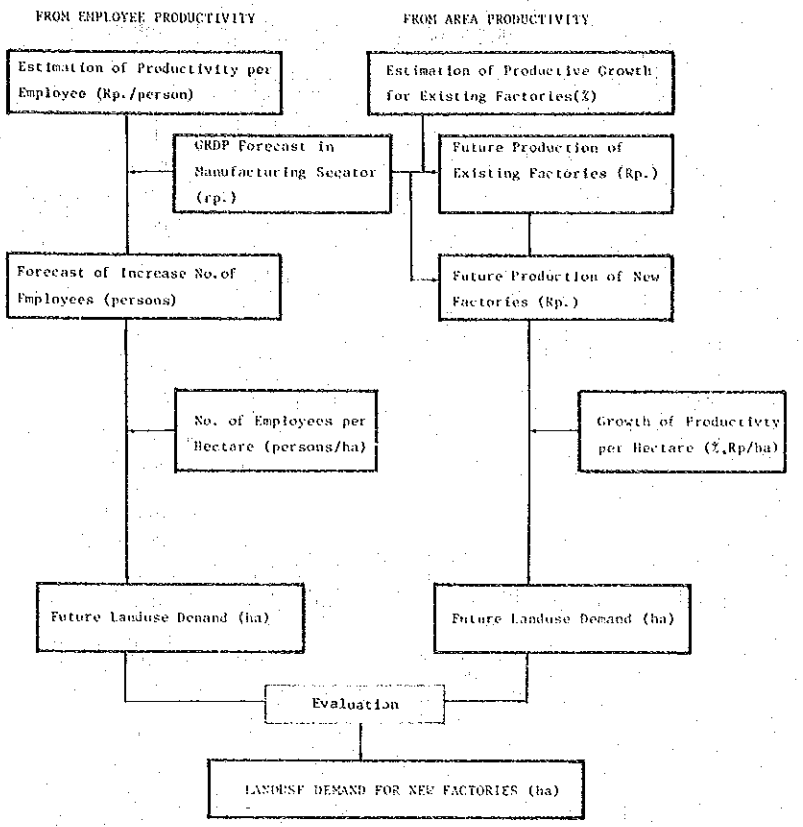


Fig. 14.1.7 ESTIMATION FLOW CHART FOR LANDUSE DEMAND FOR THE NEW FACTORIES

If it is tentatively presumed that these densities will be constant even in the future, the landuse demand, including the public use area of 20% of the total, can be computed as shown in column A of Table 14.1.9.

– According to this result, the total demand in GKS is approximately 3,400 ha, and of this total, 2,508 ha or 74%, of the area will be occupied by Surabaya, Sidoarjo and Gresik.

– The productivity per hectare also increases in the future. The existing data in the case of Surabaya is approximately 108 million Rp/ha at 1975 constant price, and the average in GKS region is estimated to be about 86 million Rp/ha. In the year 2000, if the growth rate of productivity per hectare is presumed to be 3.8% per annum, the productivity is estimated to be approximately 181 million Rp/ha.

– Using the above unit, 181 million Rp/ha, the landuse demand can be computed as summarized in Column B of Table 14.9.9. The public use ratio to the total area is also presumed at 20% in this calculation.

(4) Evaluation of the Results

There is a only slight difference in the results from both methods and consequently whichever is adopted, no significant error will result. From a landuse planning point of view however, the result from productivity for land in Column B which is the larger demand, is recommended in order to allow a safety factor.

MANUFACTURING LANDUSE DEMAND FORECAST

(1) Land Demand in the New Estate for Relocated Factories

According to the survey results from 36 questionnaires returned by existing factories located in GKS region, 8 factories were strongly willing to relocate to a suitable area developed for manufacturing activities, and 10 factories were fairly willing. As the

Table 14.1.8 CONSTITUTION OF PRODUCTION BY EXISTING AND NEW FACTORS

(unit; million Rupiah at 1975 constant price)

	GRDP in Manufacturing Sector in 1980	2000		
		Total	Existing	New
Surabaya	76,408	368,899	161,096	207,803
Gresik	13,839	162,546	29,118	133,428
Sidoarjo	23,152	218,259	48,813	169,446
Bangkalan	1,774	14,882	3,740	11,142
Mojokerto	9,490	67,574	20,008	47,566
Lamongan	6,947	67,021	14,647	52,374
(G K S)	129,883	893,479	273,842	619,637

Table 14.1.9 LANDUSE DEMAND FOR THE NEW FACTORIES

(Unit: ha)

	A Estimation From Productivity For Employee	B Estimation From Productivity For Land
Surabaya	975	1,148
Gresik	656	737
Sidoarjo	877	936
Bangkalan	463	462
Mojokerto	234	263
Lamongan	233	289
G K S	3,438	3,835

Note; For Bangkalan, the project for an additional factory for PT. Semen Gresik, is fixed at about 400 ha and so this area is considered in the result of the calculation.

number of samples is not so large, statistical mention should be avoided, but it could be speculated that above 50% of existing factories may be willing to relocate from their present location.

From an urban planning point of view, it is desirable to remove and relocate factories causing urban confusion and public pollution. Consequently, a new development area for these factories should be prepared. Judging from planning considerations, about 30% of the existing factories can be assumed to remove, and a corresponding area should be prepared to meet this demand.

(2) Land Demand for New Estate for Small-Scale Factories

It is most significant policy in the industrial development to encourage the small-scale industries and for the sake of that achievement the preparation of industiral estates for the small-scale factories is essential. However, there are some difficult problems to be overcome before implementation. BIPIK (Bimbingan dan Penyuluhan Industri Kecil = Guidance and Counseling of Small Industries) projects have been promoted by the government and some beneficial effects have been promoted by the government and some beneficial effects have been produced. However, the amount of projects is insufficient to meet the demand. The Study Team propose that an area equivalent to 5% of the total existing amount of such small-scale factories should be provided in the new estate. The average area per unit including the land for public use is assumed to be about 270 m^2, by reference to the existing enterprise in Sidoarjo. The result of the estimation is summarized in Table 14.1.10.

Table 14.1.10 ESTIMATION OF ADDITIONAL LANDUSE DEMAND FOR THE MANUFACTURING SECTOR

	For New Factories	For Relocated Factories	For Industrial Estate of Small Industries	Total
Surabaya	1,148	270	3	1,421 (33.0)
Gresik	737	50	9	796 (18.5)
Sidoarjo	936	45	12	993 (23.1)
Bangkalan	462	5	17	484 (11.2)
Mojokerto	263	10	14	287 (6.7)
Lamongan	289	13	22	324 (7.5)
G K S	3,835	393	77	4,305 (100.0)

Notes: 1) Including the area for public use

2) The area required for one factory relocated from Surabaya, Gresik and Sidoarjo is assumed to be 3,000 m2, referring to the present condition of Surabaya. In the case of the other areas, required land is assumed to be 1,000 m2.

(3) Landuse Demand for Manufacturing Sector

The results of all estimations are summarized as shown in Table 14.1.10. The total area required up to 2000 in GKS region is about 4,300 ha, and within that total, Surabaya, Sidoarjo and Gresik are about 1,420 ha (33%), 990 ha (23%) and 800 ha (19%) respectively.

MANUFACTURING LANDUSE DEMAND FOR NEW FACTORIES IN SMA

The Study Team basically stand on the idea that aggressive industrialization should be promoted within SMA and therefore about 80% of the total new demand of Gresik and Sidoarjo should be accommodated within SMA. 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 used 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 Kanal area allocation is about 440 ha including the new Cement Factory project.

14.2 HOUSING

14.2.1 GENERAL

The most serious problem for housing development in SMA is to provide housing for the enormous population increase with control of land use. The increased population is estimated as approximately 3.2 million by the year 2000 and it is important to provide the future inhabitants in SMA with not only sufficient dwelling units, but also a total residential environment including safety, health, convenience and amenity.

New housing developments in the peripheral area of SMA, and housing betterment and urban renewal development in the already urbanized area, will be required to cope with the enormous increase in population.

In this section, policies for housing developments both in the existing urbanized area and in the suburban SMA will be proposed. A residential development unit model will be prepared as a guideline for new housing development, and the development requirements for housing and community in the new residential development areas will then be estimated by using this model.

A comprehensive explanation of the housing plan is contained in "Working Paper No.6, A Study on Development Unit Model" published separately by the Study Team.

14.2.2 POLICY FOR EXISTING URBANIZED AREA

A part of the increased population will be expected to live in the existing urbanized area. In this case, a housing development policy should be proposed to cover the following categories:

- Policy for very high density (VHD) and high density (HD) residential areas
- Policy for general residential areas
- Policy for mixed residential area.

POLICY FOR VHD AND HD RESIDENTIAL AREAS

This policy is mainly proposed for the city of Surabaya where there are existing VHD and HD residential areas of 350 hectares and 1,700 hectares respectively. At present, the Kampung Improvement Projects (K.I.P.) are processing these areas and results are described in Section 4.3.

Unfortunately, the execution of this project has some problems and the Study Team obtained the following opinions from interviews with the relevant authority:

- the largest obstruction for achievement is the difficulty of land acquisition for expansion of road width and for public facility preparation.
- the current system of KIP places no obligation on the inhabitants to pay the money equivalent to the benefits resulting from the improvement project.

Nevertheless, from an urban planning point of view, KIP has a significant function for the policy of VHD and HD residential area development. At least in the near future, further execution programmes for KIP are expected to be prepared in accordance with the need.

In the future, a new system could be considred in order to ensure more extensive implemention of the scheme. Such a new system may be that the beneficiaries are obliged to pay at least part of the cost of implementation. And also it is important to consider that the areas in which KIP has already been executed, may require further programmes to ensure that the improved residential environment is maintained in the future.

POLICY FOR GENERAL RESIDENTIAL AREA

Existing general residential area will become more densely inhabited by absorbing a part of the increased population. It is important to avoid deterioration in the residential environment and thus 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 now.

This programme will be made according to the following process:

- Itemize present conditions and detail future prospects of existing general residential areas.
- Evaluate them by criteria such as safety, health, convenience and amenity.
- Classify them depending on priority of project execution.
- Decide the contents of each project such as betterment, and rehabilitation or renewal, depending on the existing and future situations.
- Adjust these projects from an overall residential planning point of view.

This programme, particularly in areas for renewal, will include construction of controlled high rise residential buildings. One of the ways to maintain a good residential environmental condition, even with a high population density due to absorption of increased population, is to arrange for cubic (three-dimensional) landuse.

POLICY FOR MIXED RESIDENTIAL AREA

It can be seen that there exists areas where residential and commercial landuses are mixed in Surabaya's CBD and its surroundings. According to measurements by the Study Team, the area is approximately 600 hectares.

This formation looks efficient and effective from the view point of desirable urban residential concept such as "residence with neighbouring work place". This means short distances from home to work place, and at present the inhabitants generally attach great importance not to their residential environment, but to their commercial environment.

Towards the year 2000 it is necessary to attach greater importance to residential environment and to improve it by arranging for the cubic use of land. For example upper stories for residential and lower stories for commercial/business activities. This can be undertaken as a renewal project in commercial/business districts. Open space created by arrangement of cubic use of land will be expected to be used for development of living environmental facilities.

14.2.3 POLICY FOR NEW RESIDENTIAL DEVELOPMENT IN SUBURBAN AREA

Although, as mentioned above, a part of the increased population will be expected to live in the existing urbanized area, the majority of them will be absorbed by new residential developments in SMA's suburban area. Therefore, it is anticipated that extensive new residential developments will be required by the year 2000.

New residential development areas can be divided into two types by development forms. One is an area where development will progress in accordance with some definite plan by either the public sector such as PERUM PERUMNAS and YAYASAN KAS PEMBANGUNAN KOTAMADYA SURABAYA (Y.K.P. for short) or else large scale private developers. The other is an area where unbanization will take place by small-scale private developers and individuals without any definite plan (hereinafter the formers is called "planned type", and the latter sprawled type").

It is essential that new residential development areas be established only in accordance with rules and standards prepared by the public authorities and all developers should be made to obey them. It is strongly recommended that these rules and standards should be established as soon as possible to ensure that all future residential development satisfies certain goals of safety, health, convenience and amenity.

In the cases of both the planned type and the sprawled type, the public sector has, in principle, to develop infrastructure such as arterial streets, trunk utility network etc. After this initial planning and construction, the development bodies will be free to develop the new residential areas in accordance with the development rules and standards. However, in this case the development cost of infrastructure, which is the responsibility of the public sector, will become very large and from the financial point of view, the public sector may not be able to fulfill their responsibilities.

Ways to reduce this responsibility should be agreed. One idea is to place some obligations on development bodies to supply, free of charge, the land necessary for their associated public facilities. The area of land required would depend on the size of their development. Another idea which can be considered, is that although land acquisition for arterial streets should be carried out, most arterial streets are not constructed in the early stage of the development process. Continuous collector streets would play the roles of the arterial street, in addition to their own function. After reaching some definite level of population, the remaining arterial streets would be constructed using taxes paid by the inhabitants.

Furthermore, a new programme called land re-adjustment can be proposed. The basis of this programme is that in an area where the living environment has become degraded, and roads, parks, etc. are needed, the environment can be restored by means of land area reduction and land substitution in order to improve public facilities such as roads and parks. Fig. 14.2.1 shows an example of this system. This programme can be adopted not only in suburban areas, but also in an existing urbanized area. This programme of land re-adjustment has good merits and should be taken into account in the near future.

For housing supply by the public sector, the target group for Perum PERUMNAS housing programme at present, is directed to the 20th up to the 80th percentile of the household income distribution. This is somewhat equivalent to the salary of a government employee. Y.K.P. also basically has the function of supplying houses for people with low income and this function will continue at least up to the year 2000.

It is therefore expected that the majority of the increased population will be supplied houses by these two bodies and they will have to play significant roles in the housing development programmes, particularly in suburban areas. The relative functions of PERUMNAS and Y.K.P. must be clarified to enable them both to carry out their designated functions in the most efficient way possible.

However, the housing development to be provided for the population increase 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 in the suburban area. The private sector can also help greatly by the provision of the land required for the public facilites.

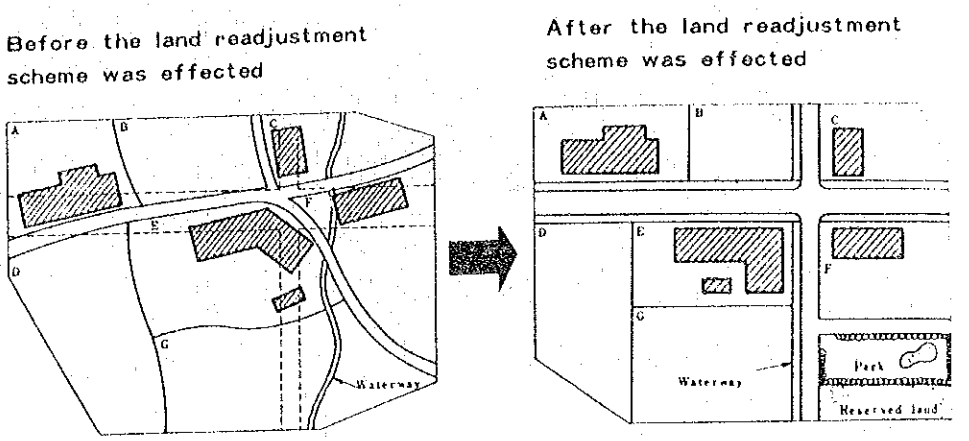


Fig. 14.2.1 EXAMPLE FOR SYSTEM OF EFFECTING THE SCHEME

14.2.4 DEVELOPMENT UNIT MODEL FOR NEW RESIDENTIAL AREAS

With regard to the proposals mentioned in 14.2.3 above, a development unit model for residential development in suburban areas, was discussed and designed. This model is expected to play the following roles:

- As a guideline to establish the rules and standards for new residential developments.
- As a mediation between structure plan and local plan.
- As a tool for estimation of development framework.

With respect to the above, the structure plan generally indicates only the approximate locations of major urban functions and action areas, because it has the characteristic for showing the future urban system as a whole. The physical plan of individual areas is to be determined in the Local Plan. Nevertheless, if some physical image of the type of future urban system as a whole can be proposed in the form of a "development unit model", it is expected to show the guide-lines for the Local Plan.

From this, the development unit model for a new residential development showing a general residential area with mixed income groups, is provided. In this Report, only the summary of the study is described and its details will be described in the WORKING PAPER, "Study on Development Unit Model".

The outline of the study is as follows; generally, depending on population size, various living environmental facilities must be provided mainly by the public sectors. At first the Study Team designed a residential development unit with reasonable population size as a daily living unit and clarified the type, number, and allocation system of the required living environmental facilities for this unit.

The typical spatial model was also prepared showing the conceptual landuse, street network, traffic system etc. in order to serve as a guideline to residential developments in the local plan. Major presuppositions were as follows:

- The population and land area for the unit would be estimated by considering the neighbourhood theory in Europe and America, the administrative/social organization system is GKS Region, the concepts of living unit in CIPTA KARYA and in Surabaya Master Plan 2000, the comparison of existing and planned residential densities, and also the average walking distance in the future.
- To estimate the living environmental facilities required for the unit, the Study Team decided that CIPTA KARYA's facilities standard was basically suitable for many reasons.
- The average land area per dwelling unit would be estimated by considering the standards of land area per dwelling unit proposed by PERUMNAS, JABOTABEK PLAN, CIPTA KARYA, Surabaya Master Plan 2000, and also the socio-economic framework estimated by the Study Team.
- Considering the allocation system of living environmental facilities, the existing social organization unit cannot be disregarded.
- The development unit would be positioned in a network of streets which are classified into 5 categories such as free ways, major arterials, minor arterials, collector streets and local streets.

Based on the above mentioned presuppositions, 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 ha.
- Spatial Diagram: See Figs. 4.2.2 and 4.2.3
- Drinking Water Demand: 7,200 m^3/day
- Development Cost: 18,500 million Rps./Unit
  (This includes roads and public facilities, but does not include housing costs.)

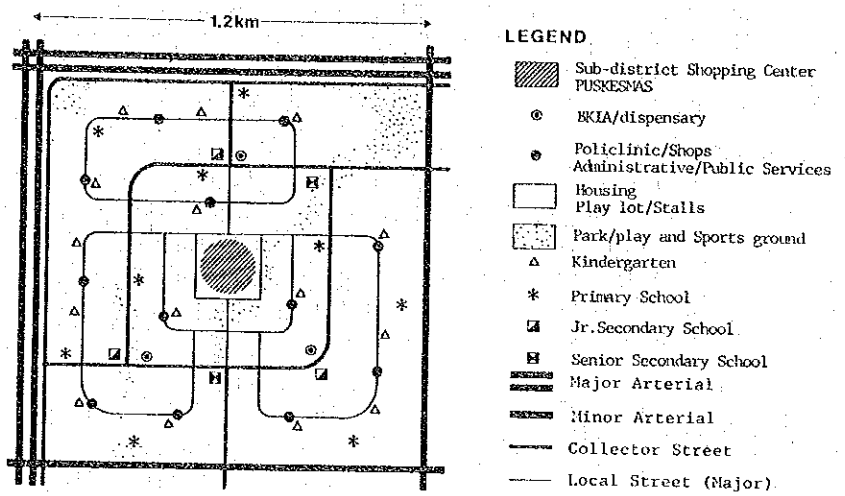


Fig. 14.2.2 SPATIAL DIAGRAM OF THE MODEL

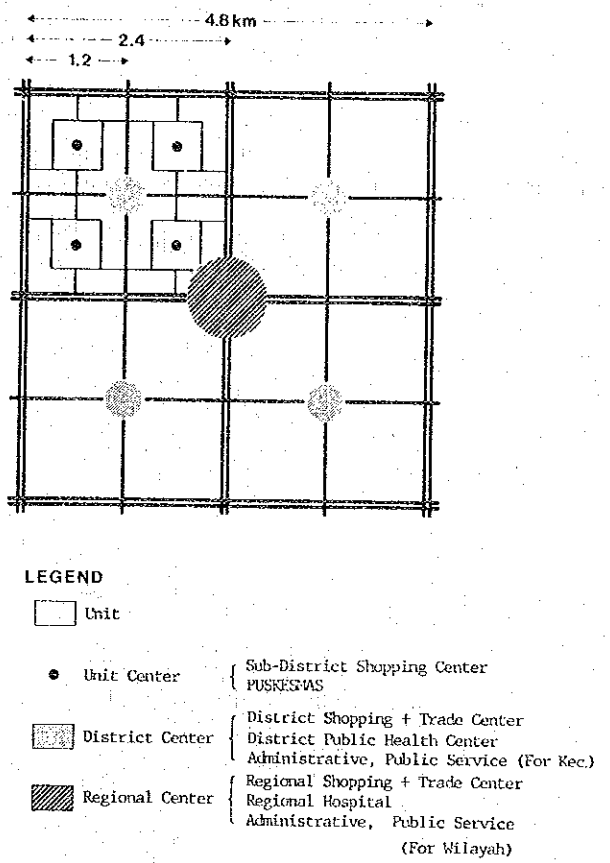


Fig. 14.2.3 ALLOCATION MODEL FOR DISTRICT/REGIONAL SERVICE FACILITIES

4.2.5 ESTIMATION OF DEVELOPMENT REQUIREMENTS FOR HOUSING AND COMMUNITY

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

The method of estimating development requirements has to be revised, because it is estimated not by using a physical plan, but rather is based directly on the socio-economic framework in this phase. The following method, therefore, was adopted. Some development unit models related to housing and industrial developments were designed in 14.2.4. These models are used as a tool to estimate development requirements particularly in the case of residential estate developments, because development requirements per unit were given in these models.

From the socio-economic framework it is therefore possible to quantify the development requirements and the overall development requirements were estimated by multiplying the development requirements per unit by the number of units.

DISTRIBUTION OF INCREASED POPULATION

According to the proposed socio-economic framework, it is likely that towards the year 2000, a large amount of new housing developments will be required for the enormous increase in population. This increase is estimated to be approximately 3.2 million between 1980 and 2000. The increase in population will be absorbed into both the existing urbanized area, and the suburban area where new residential areas will be developed. Considering this, the future housing demand was estimated by using the proposed socio-economic framework. Fig. 14.2.4 shows the process of assessment. To estimate the distribution of the increased population, the following were assumed by referring to the expenditure class structure estimated in the socio-economic framework.

- 3% of the population expected to live in the existing urbanized area up to 1990, will move to new suburban residential development areas during the period 1980 to 1990. Similarly 7% will relocate during 1990 to 2000.
- 70% of the social increase during 1980 to 1990 will be located in new residential development areas in the suburbs, and the equivalent figure for 1990 to 2000, is 80%. Based on these assumptions, the future distribution pattern is shown in Table 14.2.3.

Table 14.2.3 DISTRIBUTION OF INCREASED POPULATION IN SMA

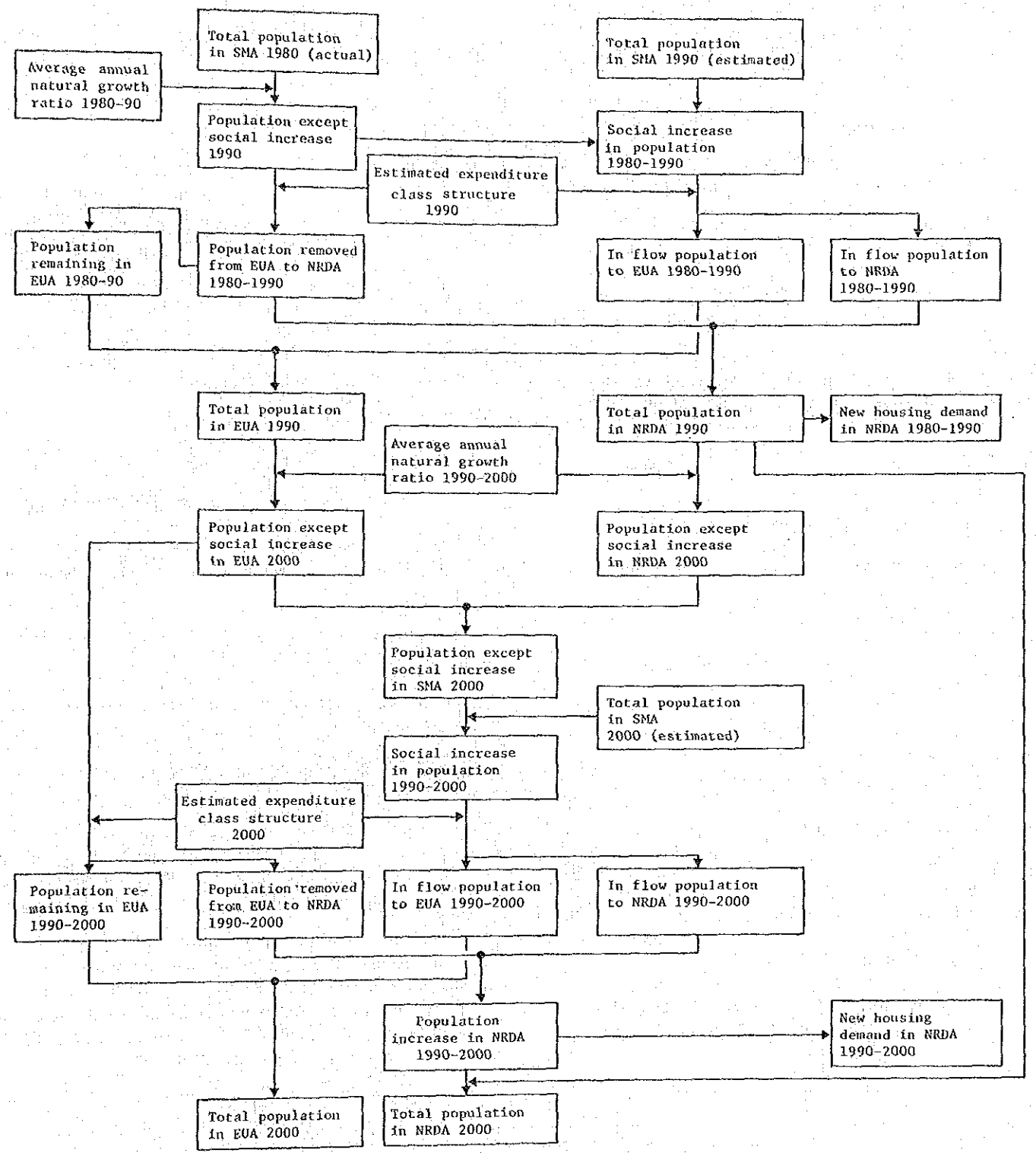
	Future Population			Future Increased Population		
	1980	1990	2000	1980-1990	1990-2000	1980-2000
Existing Urbanized Area	2,905,414	3,629,000	4,222,000	724,000	593,000	1,317,000
New Residential Development Area in Suburb	-	558,000	1,897,000	558,000	1,339,000	1,897,000
Total (SMA)	2,905,414	4,187,000	6,119,000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

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



E U A : Existing urbanized area in SMA
NRDA : New residential development area in SMA's suburban area

Fig. 14.2.4 ESTIMATION PROCESS OF FUTURE HOUSING DEMAND

From the results, it was assessed that new houses are required in the suburbs for approximately 1.9 million people during the period 1980 to 2000, that is, for 0.6 million people in 1980 to 1990, and for 1.3 million people between 1990 and 2000. There will also be an increase of 1.3 million people in the existing urbanized area between 1980 and 2000. 0.7 million people from 1980 to 1990, and 0.6 million people from 1990 to 2000, will have to be absorbed into the present urbanized area of approximately 24,000 hectares.

ESTIMATION OF DEVELOPMENT REQUIREMENTS

Based on the population increases from section 1, it is possible to calculate the necessary development requirements and thus the development resources required to implement the Plan.

Development requirements means the number of houses, schools, factories, clinics etc. and length and type of roads, sewers etc., which are required as part of the Plan. Development resources are the consumables used in fulfilling the development requirements and include finance, staff resources, and natural resources such as land, water, etc.

The future demand is divided into two categories, the present urbanized area, and the suburbs. In the first category, houses are required for approximately 1.3 million people during the period of 1980 to 2000 and they will be supplied from the following sources:

- programmes such as Kampung Improvement Project, betterment and/or rehabilitation of existing residential areas;
- housing developments on land remaining after the relocation of factories;
- housing developments on open space and unused land in the present urbanized area, and
- urban renewals

In case of the second category, houses for approximately 1.9 million people will be supplied by both the public and the private sectors.

To calculate future demand in terms of development requirements, the development unit model was introduced. The development unit model for residential developments in the suburbs, as given in 14.2.4, has a population of 30,000 and an area of 150 hectares. 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 14.2.4.

According to the results in Table 14.2.4, 64 residential development units, with an area of 9,600 hectares, have to be provided during the period of 1980 - 2000, 20 units during the period 1980 to 1990, and 44 units between 1990 and 2000. The landuse composition of the required land of 9,600 hectares can be estimated from the landuse composition of the development unit model, as shown in Table 14.2.5.

Table 14.2.4 NUMBER OF DEVELOPMENT UNITS AND LAND AREA TO BE PROVIDED FOR FUTURE RESIDENTIAL DEVELOPMENT

1980 - 1990			1980 - 2000			1980 - 2000		
Population Increase	No. of Units	Land Area (ha)	Population Increase	No. of Units	Land Area (ha)	Population Increase	No. of Units	Land Area (ha)
558,000	20	3,000	1,339,000	44	6,600	1,879,000	64	9,600

Note: A development unit model has a population of 30,000 and an area of 150 ha.

Table 14.2.5 THE LANDUSE COMPOSITION OF REQUIRED RESIDENTIAL LAND AREA

			Land area (ha)
Residential			5,760
Living environmental facilities			1,664
	Education	(762)	
	Health	(70)	
	Commercial	(358)	
	Park and playground/ Religious	(423)	
	Administrative / Public services	(51)	
Road and parking space			2,112
Others			64
Total			9,600

From Table 14.2.5, the land area for district/regional service facilities, such as regional hospital, district shopping centre and so on, should be added to the land area of 9,600 hectares.

Based on this development framework, the following statistics are prepared:

- the number of dwelling units;
- type, number, land area of living environmental facilities to be provided mainly by the public sector;
- drinking water demand; and
- development costs.

In order to calculate the number of dwelling units, reference was made to the socio-economic framework which gives the average number of persons per household in SMA, as 5.0 persons in the year 2000. The total number of dwelling units which would be provided to meet the year 2000 housing demand, is approximately 380,000.

In the meantime, the development unit model showed the type, number, land area of living environmental facilities to be provided for a unit with a population of 30,000, and also the district/regional service facilities for a population of 120,000 and 480,000. Using these materials, development requirements of living environmental facilities to be provided mainly by the public sector, between 1980 and 2000, are estimated a shown in Table 14.2.6.

Table 14.2.6 LIST OF LIVING ENVIRONMENTAL FACILITIES TO BE PROVIDED FOR FUTURE HOUSING DEMAND, 1980-2000

Facilities	Number of Facilities	Land area per Facility(m2)	Total Land Demand(ha)
EDUCATION			(760.0)
*Kindergarten	960	1,250	120.0
*Primary	576	5,000	288.0
*Jr.Secondary (SD)	192	7,000	134.4
*Sr.Secondary School (SLA)	128	17,000	217.6
HEALTH			(168.1)
*Policlinic	768	300	23.1
*Dispensary	192	350	6.7
*BKIA 1)	196	1,600	30.7
*PUSKESMAS 2)	64	1,200	7.7
(*)District Public Health Center	16	2,400	3.8
(*)Regional	8	84,400	96.1
COMMERCIAL/BUSINESS			(451.2)
*Stall	7680	100	76.8
*Shop	768	2,500	192.0
*Shopping Center (Sub-district)	64	13,500	86.4
(*)District Shipping Center + Trade	16	36,000	57.6
(*)Trade and Industry	4	96,000	38.4
PARK/PLAY AND SPORTS GROUND			(518.4)
*Play lot	7680	250	192.0
*Park/play ground/Langgar or Mosque	768	2,250	172.8
*Park/Play and Sports Ground (sub-district)	64	9,000	57.6
(*) " (district)	16	24,000	38.4
(*) " (Regional)	4	144,000	57.6
ADMINISTRATIVE/PUBLIC SERVICE			(82.3)
(*)For RUKUN WARGA	768	700	53.8
(*)For KECAMATAN	16	14,150	22.6
(*)For WILAYAH	4	16,000	6.4
TOTAL			1980.0

(*) district/regional service facilities
1): Mother + child care center and maternity hospital
2): Health Center for Sub-district

Drinking water demand for development unit was estimated at 7,200 m^3/day, and total demand for 64 units in the year 2000 is calculated to be approximately 500,000 m^3/day.

The total development costs from public funds per development unit are estimated to be 18.5 billion Rps. and a total investment of 1,184 billion Rps. is required as the development costs of 64 units. These development costs are for infrastructure and public facilities only. The cost of housing is assumed to be met by private investment or other sources, and has been excluded from the calculation in this section.

SOME CONSIDERATIONS ON THE RESULTS

Because of the estimated development costs, then the size of these investments will be inflationary in order to realize the socio-economic framework with a high growth ratio.

However, realistically speaking, the public sector will not be able to invest enough to meet the development requirements and it will therefore be necessary to make a practical application of private energy and funding.

The following can be suggested to the review of the socio-economic framework and identification of critical factors:

- The development potential of the required net land area for new residential areas of 9,600 hectares in suburban SMA, has to be confirmed. This should be undertaken comprehensively, from the view point of land capability and must also take into account other developments such as industry, recreation and conservation of the natural environment.
- The availability of large future public space, excluding that in the existing urbanized area, has to be checked particularly from the financial point of view.
- At present SMA has a problem of water availability and therefore the water supply potential for the estimated water demand should be checked. This check should include future water demand for industry, irrigation, etc.

14.3 SOCIAL SERVICE FACILITIES

14.3.1 GENERAL

The urban facilities discussed in this section are limited to the high level facilities serving 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.

14.3.2 DISTRIBUTION OF MAJOR PUBLIC FACILITIES WITH REGIONAL INFLUENCE

The government evaluates public facilities according to the following: Function Level 1 serving the regional level, Function Level 2 serving the local level, and Function Level 1 + 2 serving the region and local level jointly. According to the GKS Study, 1980, the distribution of those facilities in the city of Surabaya is as illustrated in Fig. 14.3.1, and the type of the facilities are shown in Table 14.3.1.

Among these, the facilities evaluated as function level 1 and 1 + 2, should especially be noted. The CBD area in Kembang Jepun, the Tunjungan area and the Pasar Turi area, possess function level 1 in the commercial/business sector. In the industrial sector, the Kalimas port area and the Rungkut industrial estate are listed. The Ujung Complex, the Sidotopo cargo Terminal and the Gubeng Railway Station are situated as major transportation facilities with the region wise service. The Ujung Complex consists of port, ferry port and the maritime facilities. For recreation facilities, the Zoo garden Wonokromo, THR (Taman Hiburan Rakyat), and the stadium named "Gelora 10 Nopember" are evaluated as function level 1. It is a basic concept that these facilities should be more encouraged to perform their own functions.

Table 14.3.1 MAJOR PUBLIC FACILITIES BY FUNCTION LEVEL IN SURABAYA

	FUNCTION 1 + 2 (Regional + Local Service)	Function 1 (Regional Service)	Function 2 (Local Service)
COMMERCIAL/ BUSINESS	A1. KEMBANG JEPUN (CBD) A2. TUNJUNGAN	B4. PASAR TURI COMPLEX	C5. PASAR KEMBANG COMPLEX C6. BANYUURIP & KEDUNG DORO COMPLEX
INDUSTRY	-	B7. RUNGKUT INDUSTRIAL ESTATE B2. KALIMAS TIMUR & BARAT (Warehouse/storage of interinsular Cargo)	C2. KABANG PILANG COMPLEX C3. NGAGEL COMPLEX
TRANSPORTATION/ DISTRIBUTION FACILITIES	-	B1. UJUNG COMPLEX (Ferry Port,Port,Maritime Facilities) B3. SIDOTOPO CARGO TERMINAL B5. GUBENG RAILWAY STATION	-
RECREATIONAL	A3. THR (TAMAN HIBURAN RAKYAT) A4. GELORA 10 NOVEMBER (Stadium)	B6. ZOO GARDEN WONOKROMO	-
HOUSING	-	-	C1. PERUMNAS & REAL ESTATES COMPLEX C4. RAYA DARMO COMPLEX

Fig. 14.3.1 DISTRIBUTION OF MAJOR PUBLIC FACILITIES IN SURABAYA

14.3.3 BASIC CONCEPTS ON PUBLIC FACILITIES DEVELOPMENT

As mentioned above, the facilities with function level 1 should be basically developed more and also the following facilities developments should be taken into account in the structure planning;

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 more important as a sub-heart 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. In this sense of meaning, the location of Wonokromo district is assumed to be suitable for the sub-heart of the city to be developed.

- Sidoarjo centre area and Gresik centre area should also be encouraged in the same way as Wonokromo as they have to function as not only the capital of a Kabupaten but also as the significant centres comprising the centre system of SMA.

- In the centre system of SMA, same activity centres should be developed. The centres evaluated as the third level in Section 2.3 of Part II, Cerme, Tandes, Kanal, Waru and Krian, should be encouraged in order to cope with the future urban growth.

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.

CULTURAL AND EDUCATIONAL FACILITIES

Some high quality Cultural and Educational facilities 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. Simultaneously it is desirable to prepare in SMA, large-scale museums and theatres.

Moreover, as acknowledged in Pelita III, the development of vocational schools will be very important for the sake of the achievement of planned industrialization. The high level educational facilities should include institutes and laboratories for various scientific and technology development, and the new energy system development.

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. Notwithstanding the abundant tropical nature, the amount of green within the city is not enough.

It is important that the recreation facilities serving the wide hinterland should be aggressively developed, making the best use of the abundant natural conditions. Generally, the recreation facilities consist of three types corresponding with the desired behavior of the people. One is the type for seeing such as a zoo garden or museum. Second is the type for resting such as a resort or park, and the third type is for actively participating, such as sports facilities. Basically the recreation facility planning should integrate these three types to cope with people's various needs.

Furthermore, the recreation facilities can be classified into two categories by location; one is the sea side recreation and another is the inland recreation. Each recreation has each own attraction and the comprehensive network of these facilities should be established from an urban planning point of view.

14.4 TRANSPORTATION

14.4.1 ROADS AND NETWORK PLAN

ROAD NETWORK PLAN

The road networks for traffic analysis in 1990 and 2000 were designed as given in Figs. 13.4.8 through 13.4.11 and these 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 following comments can be made about the road conditions:

- The primary route passing through Jl Akhmad Yani-Diponegoro-Semarong-Tg. Perak should be improved to a 6-lane road.
- The section of the Surabaya-Malang Tollway between Waru and Tg. Perak, should be prepared as 6-lane road by the year 2000.
- The western and southern parts of the Middle Ring road should be given a higher priority for new road construction.
- The western part of the Outer Ring Road should be given a higher priority for new road construction.
- The section of the Surabaya-Gresik Tollway between Dupak and Lamong River, should be developed as 6-lane road by the year 2000.
- The Semumi-Tg. Sari road section should be prepared as a 4-lane road with relatively higher priority.
- The Menganti-Rungkut road section should be prepared as 4-lane road with relatively higher priority.
- The Krian-Langudi-Gunung Sari Dam road section should be improved to a 4-lane road.
- In general, to the west of the Surabaya-Malang Tollway requires roads of 4-lane and over, and to the east of the central urban area requires mostly 4-lane roads.
- Major intersections on the primary road between Waru and Tg. Perak require to be grade-separated.

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

CLASSIFICATION OF ROADS AND GENERAL ROAD STANDARD

Roads are classified by their functions and require to be connected with each other in accordance with certain rules. In the case of a trip from a residential area to another region, a driver at first uses a local street in the residential area and then moves on to a collector street, and on to an arterial street or urban expressway, and then on to a regional arterial road. The traffic, therefore, passes through the secondary and primary systems and also the classified roads.

A street network with road classification by function is also required to coordinate with area characteristics such as landuse, accumulation of facilities, and the traffic generated from these areas. The streets are required to be allocated at certain intervals and density in order to cope with the traffic generated by such area characteristics.

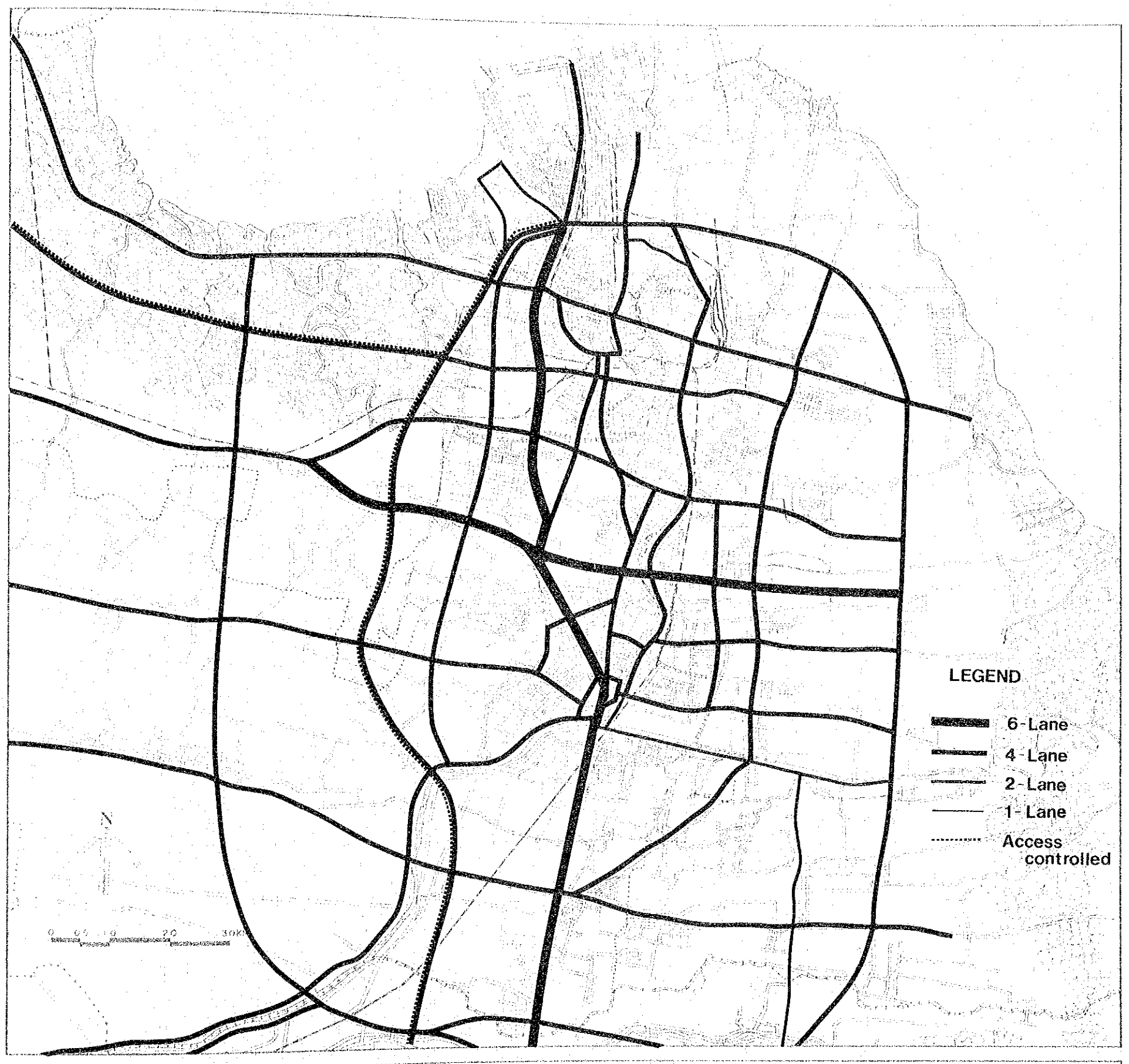
Accordingly, a higher efficiency of traffic flows and the satisfaction of road users as well as effective operation of landuse and urban activities, can be achieved by such a continuous hierarchy of road functions in one road network system.

Roads are classified by the function of linkage and required level of service to areas. The primary system is basically classified into 3 categories: local road, collector road, arterial road. Arterial roads, furthermore, are conceptionally classified into 2 categories in consideration of its function, significance and priority to be developed: major arterial roads and ordinary arterial roads. Major arterial road in its category includes roads of a higher standard than other arterial roads. Such a higher standard road can be named "Freeway", no matter whether it is access-controlled or not.

The secondary system is also basically classified into 3 categories from local street, collector street, and arterial street. As same as the primary system, secondary arterial streets are classified into 2 categories: major arterial and arterial streets. Major arterial streets include 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.

Criteria for road classification in primary and secondary systems are proposed in Tables 14.4.1 and 14.4.2.

Design features and general description for design standards for primary and secondary systems are also summarized and proposed in Table 14.4.3 and 14.4.4. 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.



URBAN DEVELOPMENT PLANNING STUDY ON GERBANGKERTOSUSILA (SURABAYA METROPOLITAN AREA)

Fig. 14.4.1 RECOMMENDED ROAD NETWORK IN SURABAYA : 2000

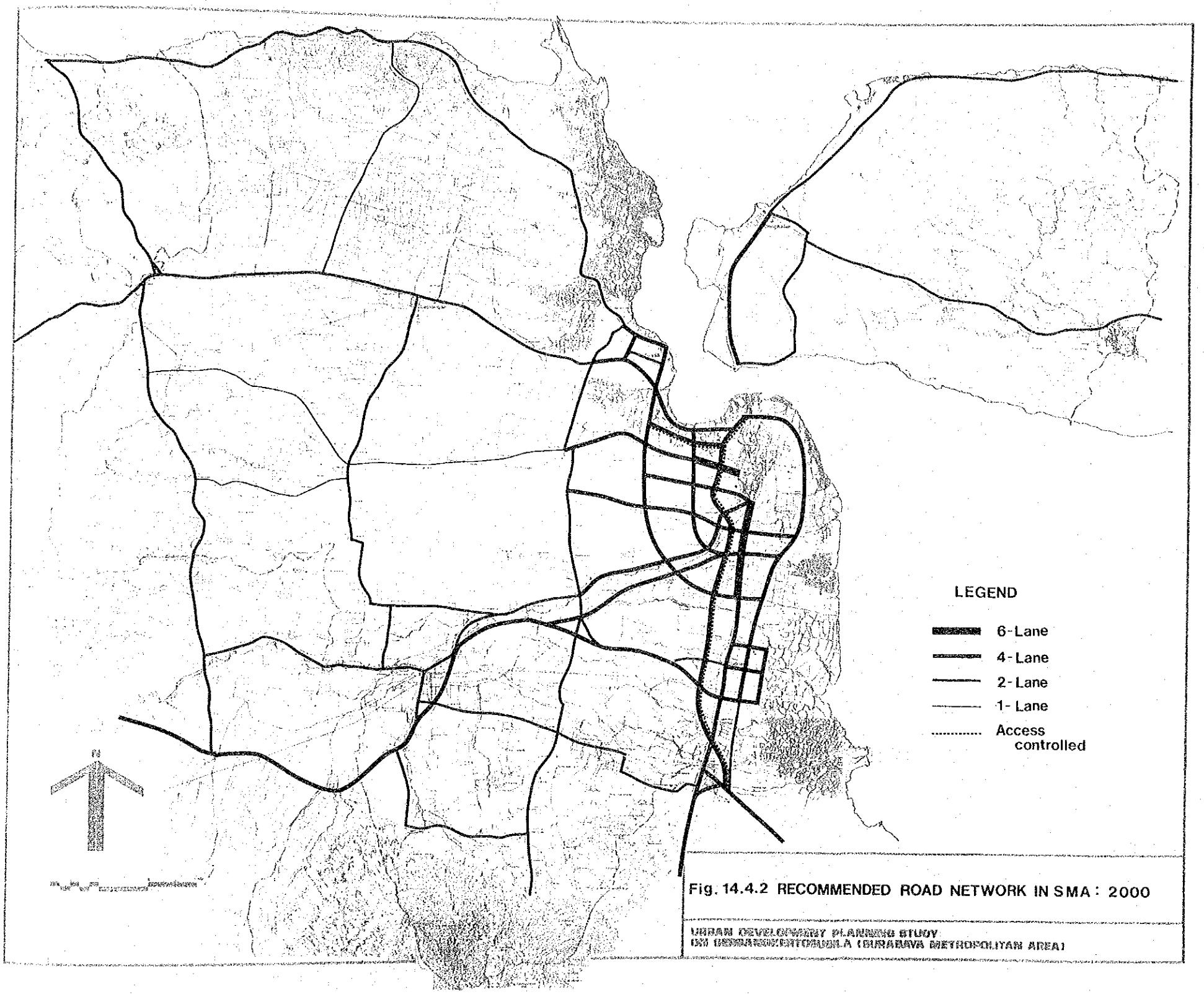


Fig. 14.4.2 RECOMMENDED ROAD NETWORK IN SMA : 2000

URBAN DEVELOPMENT PLANNING STUDY
IN DHAKA METROPOLITAN AREA (DMA)

Table 14.4.1 CRITERIA FOR CLASSIFICATION IN PRIMARY SYSTEM

Element	Arterial Road		Collector Road	Local Road
	Major Arterial Road (Freeway)	Arterial Road		
(1) Linkage with:				
City Levels	Mutural connections of First order cities(SWP) and also between those and major second order cities	Mutural connections of major second order cities and also between those and Central Cities of WWP	Mutural connections of Central cities of Kab/ Kod. and also between those and other centers of WPP	Mutural connections of other centers of WPP
Secondary System	Expressway & major Arterial streets	Expressway, major arterial streets & arterial streets	Major arterial & arterial streets	Minor arterial streets
(2) Service function:				
Through traffic	Major	Major	Equal	Minor
Access	Full-/Half-controlled/ Free from control	Half-controlled/ Free from control	Free from control	Free from control

Note : SWP - Unit of development region (Satuan Wilayah Pengembangan)
WPP - Local development unit (Wilayah Pengembangan Partial)

Table 14.4.2 CRITERIA FOR ROAD CLASSIFICATION IN SECONDARY SYSTEM

Element	Arterial Street		Collector Street	Local Street
	Major Arterial Street (Expressway)	Arterial Street		
(1) Linkage with:				
Land uses	Major Traffic Generators & C.B.D.	Secondary Generators & C.B.D.	Local Areas	Local Area
Primary System	Freeway/major arterial roads, arterial roads & collector roads	Arterial roads, collector roads & local roads	None	None
(2) Service Function:				
Through traffic	Major	Equal	Minor	Minor
Access	Full-/Partial-controlled	Equal class	Primary	Primary
Principal trip length	Over 3 - 5 Km	Over 1.5 Km	Under 1.5 Km	Under 0.8 Km
Traffic volume	Big	Equal	Equal	Small
(3) Road Interval	Variable (Expressway) 1.5 - 3 Km (2.4 Km)	0.8 - 1.5 Km (1.2 Km)	0.4 - 0.8 Km (0.6 Km)	-

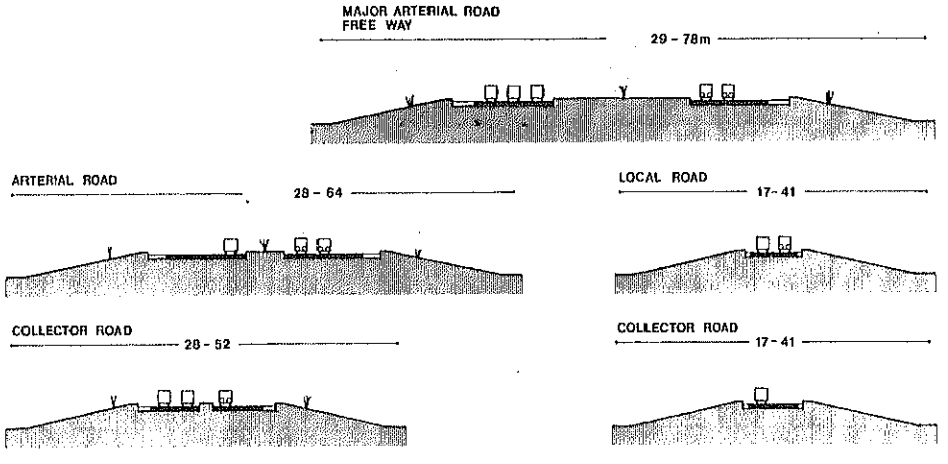


Fig. 14.4.3 TYPICAL CROSS SECTION OF PRIMARY SYSTEM

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; 1.25-2.5m 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 WHP	≤ 40	3.0m per lane; minimum 0.75 shoulders both sides.	7	17-41	

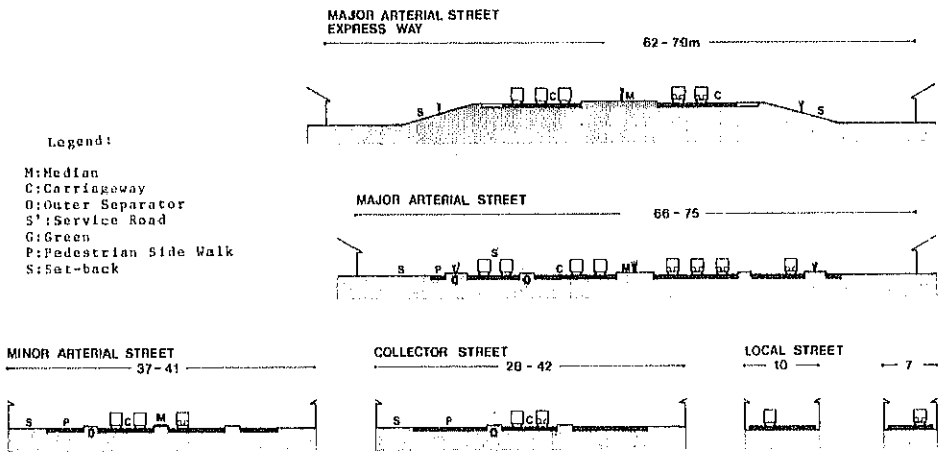


Fig. 14.4.4 TYPICAL CROSS SECTION OF SECONDARY SYSTEM

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: 1.75-4.0m 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 3m 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 3m wide side walk, 5m 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.

ROAD ENGINEERING

(1) Effective use of Right-of-Way

The right-of-way of roads and streets should be not only be utilized for transportation purposes, but also as the space for utilities.

Generally road cross-section, especially in a major street, comprises median, carriageway, shoulder, outer-separator, service road and sidewalk. These elements have their own functions.

(2) Function of Cross-Section Elements

Median has an important role on traffic safety and enhancement of roadway appearance with shrub plantings. It provides the space for roadway facilities (traffic sign/signal, head light glare fence and street lighting poles), drainage canal and trunk pipe line of water supply.

Shoulder, especially on an inter-city highway, promotes highway capacity, ease of driving, and provides spaces for disable vehicles, drainage and pedestrian walkways. It also provides space for water pipe (city water, sewage). The shoulder of streets is usually a narrow width of some 50 cm accompanied by a sidewalk and it is used only for street drainage.

Service road is located to one side of a high standard throughway with semi/full control access to it. It serves local traffic to and from the adjacent area of this road. Bus, motor bicycle and vehicles generated locally are expected to use the service road. In the urban area sometimes a service road may be required with a higher standard, such as the case of a service road to an urban tollway. The service road provides the space for trunk water.pipe line (city water and sewage).

Outer separator is used to avoid traffic conflict between throughway and local traffic on the service road. The outer separator can be used for traffic signs and street lighting poles.

Pedestrian walkways (sidewalks) are an indispensable component of streets, especially in the urban area. They contribute to urban amenity if accompanied by well-arranged plants and an adjacent row of stores and houses. Pedestrians, bicycles and becak are expected to use the sidewalk. The sidewalk usually has a green verge at the service road side. The sidewalk, including the verge, is the most suitable space for utilities; water pipe line (city water and sewage) and electric power-line.

The set-back required to be provided by the individual land occupier is established by Bina Marga. The set-back area is used mainly for the parking purpose for the individual occupier and this space is not expected to be used for the public utilities.

Consequently, the median, service road and pedestrian sidewalk provide the advantage of space for urban utilities. Each cross-section element and width is varied by land use, characteristics of road/street, traffic demand/needs and available right-of-way. It is very common for street designs to have different cross-section elements in each street block. Therefore it is necessary for the roadway designs to meet various kind of requirements from macro and micro scopic points of view.

TRAFFIC MANAGEMENT

(1) Traffic Control Policy

The control of the movement of traffic on any road network is dependent on the quality of the routes within the network and the adequacy of the various driver and pedestrian aids such as road signs, road markings, traffic signals, and street lighting. In addition, the traffic regulations which define the use of the highway by all forms of transport, and are therefore the basis for all network control, must be strictly enforced by the responsible authorities.

(2) Control

A large number of different bodies have responsibility for traffic management and many of them appear to be concerned with all aspects including policy, design, implementation and control. A Coordination Committee should be created and the members of the Committee should share their responsibilities.

(3) Regulations

The current regulations are based on a collection of rules for road traffic prepared by the Directorate General of Land Transportation and the basis of these rules is understood to be many years old. The content of the document is extremely varied and all aspects of traffic control are not included. There is a need for a comprehensive redraft of this document to include all regulations pertaining to the safe, orderly, and efficient use of rural and urban roads. Once this basic enabling legislation has been enacted by the central government, it would be advisable to maintain a continuing process of additions and amendments to suit rapidly changing transportation needs in the future.

(4) Standards

There are no comprehensive Indonesian standards for the design of roads, junctions, and traffic control devices (signs, signals, carriageway markings, etc.) especially for urban streets. Clearly, there is a need for such standards to ensure uniformity throughout the nation.

(5) Enforcement

The degree to which traffic regulations are enforced by the highway authorties determines the success or failure of traffic management policies. Any new proposal requires strict enforcement in the early stages of operation to ensure that the general public become aware of the purpose and effect of complying with the pertinent regulation. Non-compliance should be firmly treated, initially by warnings of the penalties to be incurred and subsequently, by application of a progressive system of fines and driving licence endorsements, culminating in licence suspensions.

(6) Public Education

Linked to the subject of enforcement is the need to establish programmes of public education. One aspect of this is regular use of the mass media, i.e., newspapers, television, radio, and the distribution of pamphlets and posters; all publicising particular traffic management proposals or describing the function of new and established traffic regulations. Included in these programmes should be general campaigns to improve road safety and the ability of drivers to control their vehicles. Each driver is required to know and understand the role he plays and what consequences result from his actions. Training of proper traffic behavior of citizens should be started as early as at their pre-school age and should be continued through schools and university as well as at drivers schools.

(7) Alternative Traffic Signal Control System

There are three traffic control systems especially for urban traffic control and they are listed as follows:

- Individually operating traffic signal system;
- Route-Coordinated traffic signal system; and
- Area-Coordinated traffic signal system

The first system currently operates in SMA. To meet the future increasing traffic demand the second and third system should be examined in a future study. The system to be applied for the future road/street system is also cross related to the development progress of roads and streets.

The second and third systems are outlined as follows:

- Route-Coordinated Traffic Signal System
  The system is adopted to a major road with big traffic demand and comparatively long distance trips. Traffic efficiency is attained by coordinating the signals located on a selected major road.

- Area-Coordinated Traffic Control System
  The system is applied for the congested area such as the CBD, in order to maximize area traffic efficiency. The control programmes are selected based on information regarding traffic volume, average travel speed etc., collected by traffic detectors.

DEVELOPMENT PROGRAMME

Road and Street development programmes are presented below, as well as the traffic management programme:

Up to 1990

- Execution of Master Plan and feasibility study
- Development and improvement of roads and streets
- Establishment of Coordination Committee
- Re-draft of traffic regulation
- Establishment of design standard for roads, (especially for streets), junctions and traffic control devices
- Promotion on traffic enforcement and public education
- Installation and expansion of traffic control devices.

Up to 2000

- Development and improvement of roads and streets

14.4.2 TRUCK TERMINAL PLAN

PHYSICAL DISTRIBUTION

In principle, the improvement of physical distribution is necessary because there is no other way but to rationalize transport business in order to reconcile two objectives: handling of the growing demand for cargo transport in big cities on one hand and the necessity to reduce transport frequency to conserve resources on the other. Physical distribution, is the flow of goods: that is, transporting, storing, handling and packaging. This chain of activities consists of two parts, "line part" which corresponds to means of transport and "nodal part" which connects these means of transport. These nodal points are called physical distribution facilities, functions of which can summarized as follows: (1) reloading, (2) mixed loading, (3) storing, (4) processing, (5) communication. Improvement of distribution facilities must be carried out along with the improvement of "line part" facilities.

Improvement of Physical distribution facilities has the following effects:

- It rationalizes inter-district transport: Centralization of goods and inventory control standardizes transport schedules thereby increasing volume of cargoes per unit and promoting usage of large-sized trucks and other means of transport.

- It rationalizes collection and delivery service of inter-district transport: Establishment of physical distribution facilities at appropriate places in the district makes it easy to set up distribution network and schedule for each destination.

- It provides stable supply of daily commodities: It becomes a stock point where demand and supply of daily commodities which are consumed regularly and in large quantity can be adjusted.

- It promotes containerization and palletization: As the cargoes in small lots are packed or sorted into a container, containerization becomes easy. Establishment of pallet depots promotes palletization thereby rationalizing loading and unloading operation.

- It provides merits of scale: Physical distribution facilities are an amalgamation of terminals owned by each enterprise. By efficiently allocating various facilities, operation costs can be saved and the volume of cargoes handled will be increased. Mechanization and joint operation become possible.

- It improves labour management: The establishment of wayside amenities such as rest room and room for taking a short sleep improves the working conditions of drivers.

CONCEPT OF TRUCK TERMINAL DEVELOPMENT

(1) Functions of Truck Terminals

The functions of truck terminals are as follows:

- Function of transshipment and sorting

  Loading, unloading and sorting by shipping destinations of collected and delivered cargoes.

- Function of storge

  Storage activities allow for timely adjustment of demand and supply through the transport industry.

- Function of mode selection

  In the intercity transport of LTL* cargo, coordination with other modes (or intermodal transport service) such as rail, ship and air is required. Intermodal transport service is based on the unit load system for shipping destinations (by box-pallet and container, etc.).
  Note* Less than Truckload

- Function of Distribution-Processing

  Shipping of LTL Cargo requires packaging, labelling and collection of various goods.

(2) Related and Auxiliary Facilities

Truck terminals are the node facilities of LTL cargo where platforms are located. In order to promote more efficient physical distribution, it is necessary to centralize physical distribution related facilities in a group such as chartered truck hiring, warehouses, container yards and transshipment platforms. Systematic tie-up among the facilities is desirable.

Other auxiliary facilities are also required such as maintenance and checking of vehicles, parts storage, garage, parking area and administration building, etc., all of which function to make the transport business more efficient. (See Table 14.4.5.)

(3) Kinds of Truck Terminal

Since the functions of truck terminals facilities mentioned above differ by size of city

and traffic conditions, different kinds of terminals are employed. Generally, the main types of truck terminals are main-terminals, sub-terminals (touch-at-terminals), depots and transit-terminals:

– Main terminals

Main terminals are large-sized facilities located on the periphery of large cities where the demand for transport services has a high volume. Related and auxiliary facilities are located jointly with it.

– Touch-at-Terminals (Sub-terminals)

Touch-at-terminals are needed for line-haul trucks in small cities and towns for transshipment of commodities on a route. The facilities focus on pickup and delivery services of LTL cargo and loading and unloading of line-haul trucks. Usually, related and auxiliary facilities are not required.

– Depots

If pickup and delivery services from the main terminal around a large city are not operated efficiently or benefits of shippers are obstructed, depots are required. The area required for them is rather small and the main activities are to transship the transit cargoes from the main terminal for delivery to the area and to transship cargoes collected from the area to the main terminal. Alternatively, shippers and consignees can bring or receive their cargoes at the depots by themselves.

– Transit Terminals

Transit terminals are established around traffic key cities to link shipping destinations. Transshipment service between line-haul trucks by destination is made at transit facilities. Main terminals also have a function as transit terminals.

(4) Operation Pattern of Truck Terminals

Truck Terminals are nodes between line-haul trucks and pickup and delivery trucks for efficient transport of mixed LTL cargo. Their major patterns of operations are listed below:

– Pickup and delivery service

Pickup and delivery services within an area by small trucks (4-wheel) are made to the terminal according to schedules. Unloaded cargoes from line-haul trucks are therefore delivered within the territory of the service efficiently.

– Materials handling on platform

Unloading from pickup trucks and sorting by shipping destination are performed and cargo is transferred onto a specific shipping block on the platform for loading to line-haul trucks.

Unloading cargoes from line-haul truck are sorted for transshipment to other line-haul trucks or for delivery by delivery zone in delivery trucks.

– Operation of Line-haul trucks

Line-haul trucks on designated routes are operated on time-schedules. The operation is done exactly and promptly according to user requirements. Efficient loading, unloading and improvement of load factor are promoted by truck terminals.

For line-haul truck operators who transport mixed cargoes in small lots, it is necessary to have a facility where they can link and rationalize trunk road transport with collection and delivery operation (loading, unloading, sorting of goods according to destination and temporary storing). The facility called for is a truck terminal which offers separate service from that of chartered truck transport.

(5) Merits of establishing truck terminals

– Improvement of inter-district transport efficiency: By concentrating cargoes and adjusting inventories, truck operation can be planned in advance and more cargoes can be transported as a large-scale operation.

– Improvement of collection and delivery efficiency in intra-district transport: By establishing terminals at appropriate places, truck operators can organize the most suitable collection and delivery network and schedule for each destination.

– Promotion of unit load system: Unit load system can be adopted by mobilizing containers which accommodate small-lot cargoes.

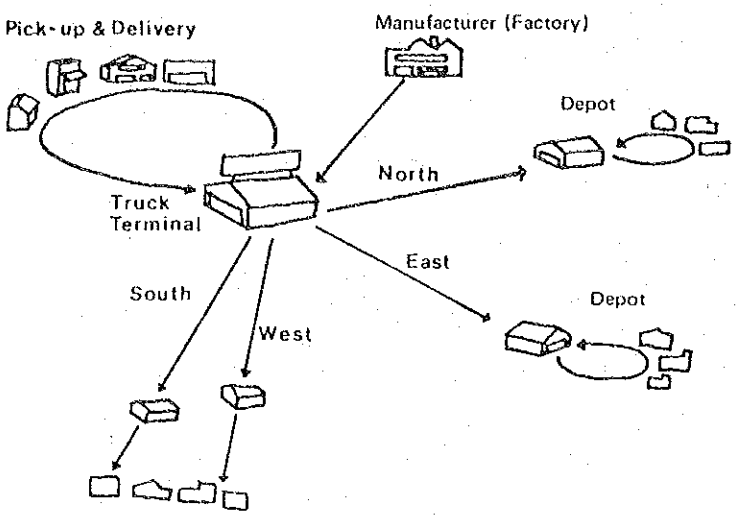
– At the truck terminals, merits of scale for terminal users (truck operators) will be increased by the common use of various terminal facilities and land space.

– The establishment of truck terminals will support SMA comprehensive land use planning to establish satellite towns and help reduce the urban population over-centralization.

Table 14.4.5 FUNCTIONS OF TRUCK TERMINAL FACILITIES

Function / Description	Transshipment	Storage	Distribution Processing	Mode Selection Coordinating	Auxiliary Function
Activity	Transshipment of cargo in the process of transport	Storage for the coordination of demand and supply	Processing and assembling to coordinate the change in quality to meet the change of customer demand	Coordination with other modes as appropriate	Supporting maintenance and operation activities
Contents	Loading, Unloading, Pick-up, Delivery, Sorting, Checking, Measuring	Storage Inbound and Outbound of Cargo, Sorting, Selecting, Checking	Processing, Assembling, Packing, sorting, Selecting, Checking	Vanning and De-vanning container (Rail, Ship) Transfers	Measures for vehicle maintenance and for Health and Welfare of Employees
Main Facilities	Truck Terminal Cargo Platforms Distribution Center Post Facilities Containers Yards	Warehouse Field Storage Facilities Silo	Processing, Assembling and Packing Facilities	Docking Yard Truck Terminal Distribution Warehouse Container Yard	Parking Area Petrol Station Maintenance Shop Cargo Checking Facilities Sleeping Room Dining Room Shower-bath Room Clinic, Bank, Post-Office

Line-Haul Distribution Network



TERMINAL LOCATION CONSIDERATIONS

In selecting suitable site locations for the truck terminals, the following criteria should be examined.

- Contribution to the decongestion of traffic from the central urban area.
- Avoidance of land use conflicts
- Accessibility to the road network and terminal users
- Accessibility to other modes of transport without causing conflict with them
- Availability of land

(1) Decongestion Criteria

Major impediment to traffic flows are as follows:

- Insufficient road network
- Insufficient by-passes of the urban road system
- Inconsistent road width and inadequate surfacing and maintenance
- Insufficient number of bridges crossing the major rivers
- Lower standard of structure design
- Insufficient city parking areas such that public roadways are blocked for private parking and loading/unloading of cargoes
- Distribution of land use not related to the road network

(2) Land Use Criteria

In order to avoid conflict with the land use areas, truck terminal site location should avoid areas designed for specific land uses such as industrial, institutional and high density mixed use. Consequently, attention for site location was focused on areas designated as low density mixed use.

(3) Accessibility Criteria

The major users of a truck terminal are outbound inter-city truckers who O-D ranges are large. Without a truck terminal, their less-than-truckload (LTL) mixed cargoes are not only unprofitable from a trucking industry point of view, but also represent a loss to the national economy since an empty truck takes up public road space and causes wear on the road surface just as a loaded truck.

From the viewpoint of the road network, accessibility is defined in terms of the major 6-lane roadways.

From the viewpoint of other transport, accessibility to airports and sea ports is desirable since both are major originating nodes for the trucking industry. On the other hand, too close a proximity represents a conflict.

Consideration of access to railway terminals is problematic since the major railway cargo terminals will be located within the high density mixed-use area of the central urban area. Therefore by locating the terminal not in the central urban area traffic conflict can be avoided.

Intermodal transfer is a possibility, and since the major functions of truck terminals are for road transport, location near and with access to major roads is considered to be the overriding determinant of terminal location.

(4) Availability of Land

Although the terminal locations should be in low density land use areas, land availability can only be confirmed by actual negotiation. The prices of land are examined in Chapter 5, however, it is recommended that the government initiate zoning restrictions and land acquisition at the earliest possible date in order to keep land values from becoming inflated and to prevent the large land parcels required for truck terminals from disappearing from the market.

Taking the above criteria into consideration, it can be proposed to locate main truck terminals in Tg. Perak, Tandes and Waru areas and depot/sub-terminals in Sidotopo, Gresik, Krian and Sidoarjo.

14.4.3 PUBLIC ROAD TRANSPORT AND TERMINAL PLANS

CITY BUS DEVELOPMENT PLAN

(1) Future demand for buses

City bus services are operated only in Surabaya and mainly service the north-south direction. In order to supplement the city bus transport, bemo (4-wheeled motor vehicle with bench seat in the back for 6-10 passengers) operates in the north-south and east-west directions.

The average passenger-kms was estimated at 11,700 pass.-kms/veh./day for city bus and 750 pass.-kms/veh./day for bemo in 1982. The total traffic demand for these transport means in Surabaya in 1982, amounted to 3,500,000 pass.-kms/day operated by 168 city buses and 2,074 bemos. The all-day occupancy rate of city bus is more than 90% and this is considered very high.

As residental and industrial areas develop twoards the outside of Surabaya in future, the coverage of city bus, bemos and colt transport should also be expanded to cover the whole of SMA. SMA is divided into three areas served by city bus (inside Surabaya, between Surabaya and SMA outside Surabaya, and inside SMA outside Surabaya). According to this division, the demand for the city bus, which is considered as a potential demand, is shown in Table 14.4.6. Assuming that the travel characteristics of bus passengers and the bus operating conditions are like those shown in Table 14.4.7, then the required numbers of city buses to meet the potential demand were estimated and shown in Table 14.4.8.

The service level and capacity of the city buses cannot be improved by only providing buses to meet the required demand, because it is much influenced by the development level of the road network where the city buses operate. Even the recommended road network in the year 2000 may not be able to operate city buses in the conditions (headway and number of routes) shown in Table 14.4.9. That is to say, it is considered that the potential demands for city buses are too large to be met by the acceptable road network development.

Especially inside Surabaya, the necessary density of bus service with respect to space and time is too high and the streets in Surabaya in the year 2000 where large buses can operate are limited. It is therefore necessary that micro buses such as "Metro Mini",

as currently operated in Jakarta, are introduced for the areas which can not accept city bus service by large buses.

Naturally, the provision of the urban mass transit system contributes not only to the reduction of the burden on bus transport but also to improvement of city bus services by the reduction in the total urban traffic on the roads.

Table 14.4.6 CITY BUS TRIP GENERATION BY BLOCK: CASE 6 IN THE YEAR 1990 & CASE 4 AND CASE 1 IN THE YEAR 2000

(Unit: Thousand Person trips/day)

Name of Block	CASE No.	YEAR	SBY	SMA outside SBY	Total
SBY	CASE 6	1990	925.2	78.4	1,003.6
	CASE 4	2000	748.2	114.9	863.1
	CASE 1	2000	1,143.3	190.9	1,334.2
SMA outside SBY	CASE 6	1990	78.4	60.2	138.6
	CASE 4	2000	114.9	43.8	158.8
	CASE 1	2000	190.9	52.9	1,578.0

Table 14.4.7 ASSUMPTION FOR ESTIMATING NO. OF BUSES REQUIRED

	Inside SBY	SBY-SHA outside SBY	SMA outside SBY
Average Route Length	14 km	20 km	20 km
Type of buses operated and Passenger load in in the peak period	Large Bus: 50 pass. Micro Bus: 25 pass.	Large Bus: 50 pass.	Micro Bus: 25 pass.
Average returning load ratio	60%	60%	60%
Scheduled speed	20 km/h	30 km/h	30 km/h
Operation factors of buses in the peak period	80%	90%	90%
Average trip length of city bus passenger	7.1 km	17.5 km	10.0 km
Peak period ratio (% per 2 hours)	20%	20%	20%

Table 14.4.8 ESTIMATED RESULT FOR CITY BUS OPERATION FOR CASE 4 IN THE YEAR 2000 (1)

Operated Block	Inside SBY	SBY - SMA outside SBY	Inside SMA
Average passenger per frequency	Large Bus : 98.6 pass./fre. Micro Bus : 49.3 pass./fre.	Large Bus : 56.8 pass./fre.	Micro Bus : 50.0 pass./fre.
CASE 4 IN 2000 Number of buses required (Possible combinations of large bus and micro bus)	Large Bus 738 Micro Bus 0 Large Bus 500 Micro Bus 412 Large Bus 375 Micro Bus 629	300	162

Table 14.4.9 EXAMINATION OF CITY BUS OPERATION FOR CASE 4 IN THE YEAR 2000 (2)

Service Area	Examined Case	Type of Buses operated	No. of Buses required	Headway (min.)	No. of Routes required
Inside SBY	1	Large Bus	738	2	14
				3	21
				5	35
		Micro Bus	0	-	-
Inside SBY	2	Large Bus	500	2	10
				3	14
				5	24
		Micro Bus	412	2	8
				3	12
				5	20
				10	39
Inside SBY	3	Large Bus	375	2	7
				3	11
				5	18
		Micro Bus	629	2	12
				3	18
				5	30
				10	60
Inside SBY	4	Large Bus	0	-	-
		Micro Bus	1,280	2	24
				3	36
				5	61
				10	120
SBY ↔ SMA outside SBY	-	Large Bus	300	2	7
				3	10
				5	17
Inside SMA outside SBY	-	Micro Bus	162	3	3
				5	5
				10	10

(2) Operation Routes and Areas

Large buses are planned to be operated on major arterial and arterial streets and micro buses on arterial and collector streets of the secondary system in SMA. Bemo/colt operation in the central urban area will bring about a big increase in traffic volume, because of the small transport capacity inspite of large traffic demand. Therefore, bemo/colt should be banned in the central urban area during peak hours.

However at present bemo/colt services have an important role to support the public large bus transport. In the future the private sector of transport will also have an important role. In this sense, increase in transport capacity from bemo/colt to Micro Bus should be promoted in the private sector of transport.

Except for the busy central urban area, bemo/colt are still an advantageous means of public transport for areas requiring constant transport service but with a smaller traffic demand. Consequently, bemo/colt transport is expected to operate to connect residential areas with the activity centres, and also to transport commuters from residential area to arterial streets and to stations of the urban mass transit system, as a supplementary transport means.

Those who live near the railway stations in SMA outside Surabaya will prefer to use the urban mass transit for commuting to Surabaya, but those who live in the fan shaped areas enclosed by radial rail lines may prefer to use road transport up to stations on the railway loop or directly enter the central urban area. In this sense, bus routes of relatively longer distance of about 20-25 kms should be operated in radial directions at a higher scheduled speed for those living in the fan shaped area in order to realize easier access to the central urban area.

INTER-CITY BUS DEVELOPMENT PLAN

(1) Future Passenger Flows

Based on the estimated person trip O-D table for inter-city transport, the O-D traffic was consolidated to the zones with planned terminals and the totals of arriving and departing passengers at these terminals were estimated for the year 2000. Results are shown in Table 14.4.10. The total passengers using the terminals in Surabaya urban area was estimated at 255,960 persons/day and this is about 4.5 times the 1982 total for Joyoboyo and Jembatan Merah bus terminals.

The resulting passenger flows between the terminals were assigned to the most probable routes of inter-city transport which are extending from Surabaya in the major directions to the south (Surabaya-Malang), southwest (Surabaya-Madium-Yogyakarta-Bandung-Jakart), northwest (Surabaya-Lamongan-Babat-Semarang-Jakarta) and southeast (Surabaya-Pasuruan-Banyuwangi). The estimated passenger flows on these routes are presented in Fig. 14.4.5.

Table 14.4.10 ESTIMATED PASSENGER TRAFFIC AT TERMINALS IN 2000

Zone No.	Terminal Names	Total of Arr. and Dep. Pass./day
7	Tandes	72,806
18	Gresik	2,780
22	Waru	183,154
24	Krian	12,772
25	Sidoarjo	8,748
32	Mojokerto	27,602
37	Lamongan	23,884
38	Babat	10,804
43	Bangkalan*	0

*Passengers bound for Madura were assumed to exchange buses at Tandes or Waru terminal for a city-Bus going to Bangkalan terminal.

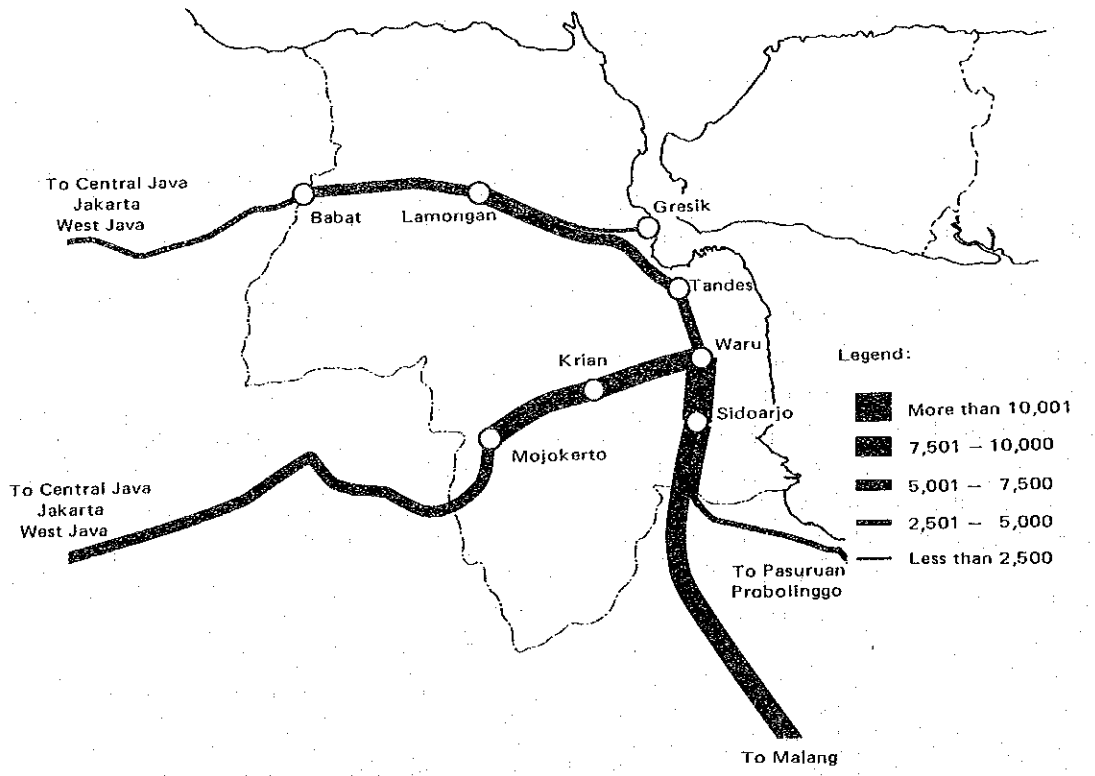


Fig. 14.4.5 INTER-CITY BUS DEMAND BY ROUTE

(2) Inter-City Bus Terminal Plan

Terminal locations in the Surabaya urban area were assumed in the zones of Waru and Tandes for the purpose of traffic analysis. This will, however, cause intra-urban traffic to and from these two terminals to be concentrated to the south and west of the urban area. In order to disperse such intra-urban traffic it is desirable to plan another terminal in the east of the urban area. Furthermore, these three terminals should be located near the middle ring road in order to realize various combinations of starting and ending terminals for the route operation.

14.4.4 NETWORK AND FACILITIES PLANS FOR URBAN RAILWAYS

NUMBER OF TRAIN AND ROLLING STOCK

(1) Passenger Train

The operating plans for Urban Railways is based on the sectional traffic demand, which is shown in Table 13.7.2 and plans were made on the assumption of 1,800 passengers/train in peak period and 800 passengers/train in off peak period. The total number of trains operated in the peak hour are estimated and shown in Table 14.4.11 and the total number of rolling stock required were calculated corresponding to this operating plan and are shown in Table 14.4.12.

Table 14.4.11 REQUIRED NUMBER OF TRAIN

Operation Route	Total No. of train operated / peak hour			
	One-way		Two-way	
	1990	2000	1990	2000
1. Ring	3	7	8	18
2. Benowo - Gubeng - Sidoarjo	1	3	2	8
3. Benowo - Gubeng - Kalongpilang	2	4	4	9
4. Gresik -Gubeng - Rugkut	2	-	4	-
5. Gresik -Tandes	-	4	-	4
6. Wonokromo -Tg. Perak	8	10	8	10
Total			26	49

(2) Diesel car operation (GKS)

Operation Route	No. of train/hour	
	1990	2000
Babat - Benowo	1	-
Babat - Cerme	-	1/2
Cerme - Tandes	-	4
Mojokerto - Krian	1	1.5
Krian - Sranjang	2	6

Table 14.4.12 REQUIRED ROLLING STOCK

Type of Car / Year	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.

(2) Freight Train

– Number of freight cars to be handled.

In order to determine the yard requirements of the freight station the number of freight cars handled is estimated for 2000 based on the standard loading weight by the type of freight car. Two types of freight car, for oil (35 ton/veh.) and general cargo (15 ton/veh.), are tentatively selected. These are shown in Table 14.4.13.

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

– Number of freight train arrival/departures

The number of freight train arrival/departure is estimated based on the gross tonnage of freight car (two types) and assumed train pay load of 1,000 ton.

A total of 10 trains arrive and depart from Benteng and Kalimas stations but only 2 trains arrive and depart from the other stations. These trains would be operated in the off-peak hours of passenger train and therefore operated within the track capacity for passenger traffic.

DEVELOPMENT PLAN

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. And new facilities should also be introduced to meet the expected future demand.

(1) 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 core of SMA and added to the existing railway network.

(2) Modernization of Railway Transportation

It is most important for a railway service to accord with the future needs anticipated by the urban development and this requires big changes in conventional operation and in railway facilities.

Track addition and elevation, electrification, tele-communication, signaling and rearrangement/relocation of the freight system are necessary components to attain an effective railway system.

– Consolidation of freight stations

For effective transportation of general carges some minor handling stations, such as Pasarturi, Sby. Gokdang, Gubeng and Wonokromo are consolidated at Pasarturi station.

– Kalimas and Benteng station

Kalimas station is located in the port area and will have a reduced function as a freight station. The port siding is maintained and strengthened for marine transportation in some instance. Benteng station is used mainly for oil freight and the function remains for the time when the Surabaya port is improved for the handling of oil products.

– Freight car marshalling yard (namely "Main Marshalling yard")

A big demand for freight transportation from the port and industrial development is expected in the coastal area between Surabaya and Gresik. To facilitate the demand a freight car marshalling yard is planned in Kandangan area (Between Kandangan-Benowo station). The marshalling yard will have a function of transit of freight cars arriving at and departing from the main yard and a marine transportation centre, which is planned in the future port area as the substitute for the Kalimas facility.

(3) New Transportation System

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

The steam tram was operated between Karangpilang and Benteng until 1976, and ran in a central reservation between dual road carriageways of JL. Diponegoro, JL. Pasar Kembang and JL. Semarang.

Based on the passenger traffic forecast, some 18,000 person/one way in the peak hours is expected. This demand is almost the maximum capacity of an inter-mediate transportation system but the system is adaptable if the one-way demand in the peak hours is less than about 10,000 persons. The items for discussion are summarized as follows:

– The new mode to be suitably adopted within the existing CBD.
– Limited right-of-way within the median width.
– Almost same construction cost as existing railway system
– Difficulties caused by a new mode of operation compared with a railway system.

A new inter-mediate transportation system is tentatively recommended in this study and is therefore subject to future study.

(4) Railway Elevation

More than 40 railway crossings are operated in the SMA and many traffic accidents and inefficiencies occur on major crossings, especially in the CBD area. In future major streets are planned at 2 km intervals and there is expected to be a big traffic demand resulting in increased traffic jams and reduced efficiency.

The elevation of the railway will contribute to reduction of operating costs of vehicles and saving of accident costs at crossings and the operating and maintenance costs of crossings should be compared with the benefit of improvement in traffic safety.

Since the benefit through the elevation is to relieve the road traffic jam and promotion of desirable landuse, it is desirable that the project costs of elevation be shared by the municipal government and the State Railway (PJKA).

The sharing ratio could be decided based upon the amount of benefits to be received upon each side and upon the existing financial circumstances, etc.

A "Coordination Board" comprising Kotamadya/Kabpatens, the State Railway, Bina Marga, Cipta Karya, etc. should be established and this organization will aim at maintaining coordination among the authorities concerned. Furthermore, through this organization, it would be possible to establish an appropriate and concrete cost-sharing ratio.

FACILITY PLANNING

(1) Track and Electrification

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

Benowo-Babat and Mojokerto-Sepanjang sections are forecast to have lower demands compared with their route length. These sections are operated by small number of diesel coaches (2-4 coaches) upto 2000 and will be re-examined according to the demand. Among these sections, Cerme-Benowo and Krian-Sepanjang with comparatively big traffic demand should be re-examined shortly. The electrification of these two sections should be studied in relation to the electrification for the whole sections mentioned above.

Sidoarjo-Gempol section will also be operated by diesel car as a medium distance commuter service. Sidoarjo-Tarik section should be rehabilitated as the division line between Mojokerto and Pasuruan.

Automatic block system should be applied for the electrified double tracking section. For electrified single track section tokenless block system is adopted if the station intervals can be similar. Some limited aspects of operation are however anticipated and electrified sections such as Kandangan-Gresik and Waru-Sidoarjo should be examined with a view to double tracking in the future study.

(2) Track Elevation

From the road traffic demand, promotion of area development and topographic condition, track elevation is introduced. The railway sections for track elevation are recommended by stage as listed below:

Section	Length (km)
Upto 1990	
Kandangan-Gubeng-Waru	25
Tandes-Bulu-Waru	11
Upto 2000	
Sepanjang-Wonokromo	9

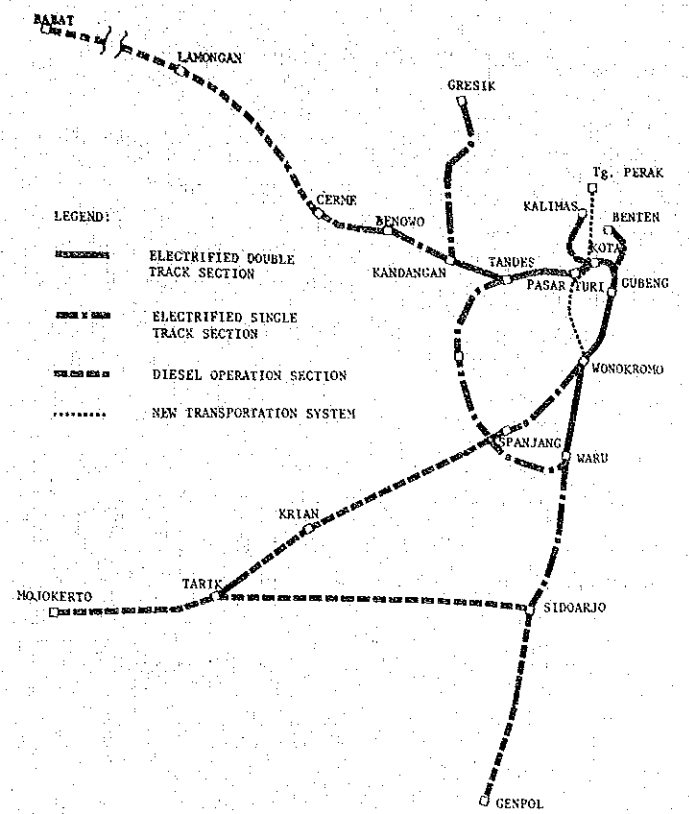
(3) New Intermediate Transportation System

A new intermediate transportation is tentatively recommended with a total length of 12 km and 12 new stations.

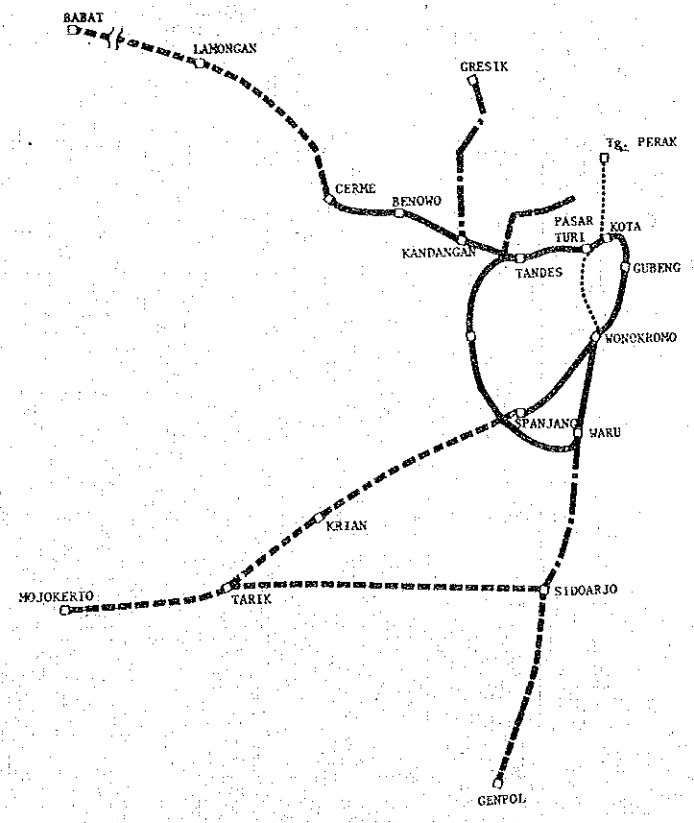
(4) Facilities Relevant to the Commuter Traffic

Direct current and alternating current have merits and demerits. For the commuter train operation the electrification by alternating current is adopted for the reasons as follows:

– Alternating current is adopted for the long distance railway line (North and South lines, etc.)
– To avoid current change at the connection point between the long distance line and the commuter line.
– Ground facilities are cheaper than the direct current system.



Year 1990



Year 2000

Fig. 14.4.6 TRACK AND ELECTRIFICATION PLAN

The size of unit coach used will be 20 m length and 3 m width. The composition of electric car will be 8 cars comprising 2 four-coach units per train. The four-coach units will comprise one motor car with driving cab, 2 trailers, and one trailer with driving cab.

For diesel car composition, fewer diesel motor units is advantageous for maintenance reasons. The basic composition of a diesel car train is 2 cars, one motor car and one trailer.

(5) Depot for Passenger Coach

For commuter trains including long distance commuter trains, the main depot is planned on the Waru-Gedangan line and a sub-depot is also planned 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.

(6) Work-shop

A new work-shop is planned at the main depot and some 50,000 m^2 will be required for the daily inspection and routine repair of passenger coaches (Commuter/medium/long distance train)/freight cars and diesel cars.

Main line locomotive overhaul is expected to be carried out at Gambir, Jakarta.

(7) Consolidated Base Freight Station

The freight function of four stations, Pasar Turi, Surabaya Gudang, Gubeng and Wonokromo is consolidated in Pasarturi station. The Pasarturi station handles 150 cars/day with an area of 30,000 m^2 excluding marshalling yard.

(8) Benteng and Kali Mas Station

Benteng station handles mainly oil and this function will be maintained by the time of improving the Surabaya port. The Kalimas 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 from around Tandes Station, with a length of 9 km.

(9) 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.

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 plan yard with non-automatic operation.

(10) 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 — Karangpilang
  - Ring Line — Ngaglik, Surawesih, Rungkut, Bulu, Sumwrwelt, Lidah Wetan, Tabanan
  - South-Line — Kebonagung
- Improved station
  - North Line — Benowo, Kandangan, Tandes, Pasarturi
  - Gresik Line — Gresik
  - South Line — Sepanjang, Wonokromo, Gubeng, Sby. Kota
  - Malang Line — Sidoarjo, Buduran, Gedangan, Waru

DEVELOPMENT PROGRAMME

The development programme is prepared for railway sector by 1990 and 2000.

Up-to 1990

- Execution of railway master plan for SMA
- Establishment of Coordination Board
- Rehabilitation of Tg. Perak freight line
- Rehabilitation of Sidoarjo-Tarik section
- Coach depot rehabilitation at Sidotopo
- Construction of new ring (Western Ring section), phase-I
- Track elevation (Eastern Ring section), phase-I (including connection of North Line and South Line)
- Electrification and communication system
- Construction and improvement of a stations on Eastern Ring, phase-I
- Development of station plazas of Eastern Ring, phase-I
- Land acquisition for future development of yard, depot, workshop and new freight line from North Line, phase-I
- Purchase of coaches and diesel cars.
- New transportation system development

Up-to 2000

- Abandonment of Kali Mas and Benteng freight lines
- Double Track for Ring Line (Western section)
- Track Elevation (phase-II)
- Improvement of station (phase-II)
- Development of station plaza (phase-II)
- Construction of yard, depot and workshop (phase-II)
- Continuation of purchase of coaches and diesel cars.

14.4.5 SEAPORT DEVELOPMENT PLAN

FORECAST OF PORT TRAFFIC

The total port traffic in future was forecast based on the estimation made by the Feasibility Study Report* in 1982. However, the future economic growth factors employed in the Feasibility Study Report* are a little lower than those in this planning study and accordingly, the future port traffic was revised in accordance with the factors mentioned below. The results are given in Table 14.4.14 and compared in Fig. 14.4.7.

*"Port of Surabaya, Phase 2 Feasibility Study, 1982"

Table 14.4.14 COMPARISON OF FUTURE PORT TRAFFIC

	Economic Growth Factors	Source	Estimated Traffic demand (10^3 tons/yr)
Feasibility Study Report	6.5 % p.a. (1980 - 2000)	Pelita III	1990 : 10,329 2000 : 22,308
This Planning Study	6.89% p.a. (1980 - 2000) 7.12% p.a. (1980 - 1990)	Study Team	1990 : 10,714 2000 : 25,054

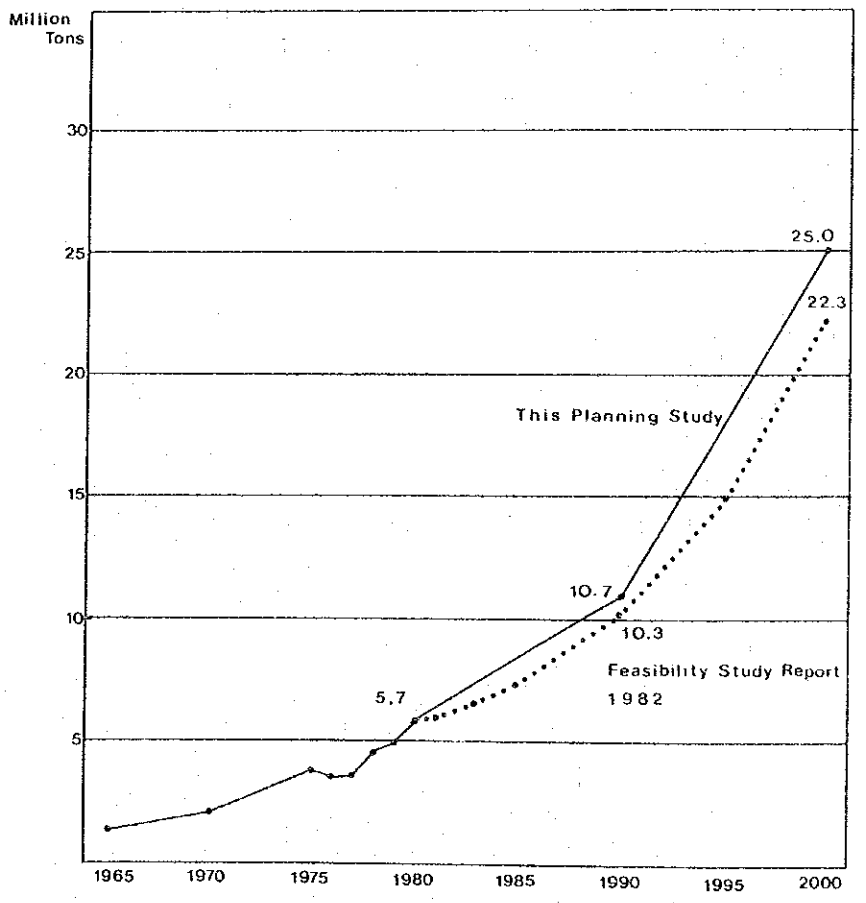


Fig. 14.4.7 COMPARISON OF PORT TRAFFIC FORECASTS

The break-downs of the forecast future traffic which follow are therefore proportional to those analysed in the Feasibility Study Report, but in general other ratios and factors used in the following figures are accepted by this Planning Study and are given in the following figures and tables where relevant.

Imports and outwards domestic traffic are expected to grow more strongly than exports and inwards domestic traffic as shown in Table 14.4.15. The stronger growth is thus expected to be found in the trades where a mature distribution centre is supplying a less developed economy. The break down by products is shown in Table 14.4.16. and 14.4.17.

Table 14.4.15 SEA PORT TRAFFIC FORECAST

(Unit: '000 ton)

Year	1980	1990	2000
Foreign			
Imports	2,131	4,297	10,428
Exports	849	1,411	3,011
Total	2,980	5,708	13,439
Domestic			
Inwards	1,423	2,403	5,366
Outwards	1,359	2,604	6,249
Total	2,782	5,007	11,615
Foreign & Domestic			
Imports/Inwards	3,544	6,700	15,794
Exports/Outwards	2,208	4,015	9,260
Total	5,762	10,714	25,054

Table 14.4.16 FORECASTS OF FOREIGN IMPORTS AND EXPORTS 1980-2000

(Unit: '000 tons)

Year / Imports	1980	1990	2000
Wheat	530.9	830	1,123
Sugar	24.5	52	56
Rice	134.5	83	56
Fertiliser	44.4	21	22
Cement	29.4	16	17
Project equipment	236.5	639	1,425
Iron and Steel	370.1	582	846
Chemical Goods	126.4	399	1,024
Paper	79.6	83	90
Plastics	52.6	184	392
Maize	10.2	21	22
Salt		5	6
CKD + spares	55.1	83	194
Soya ash	33.4	61	143
Lubricating Oil	33.2	16	11
Asphalt	36.5	10	11
Textiles	28.7	40	113
Soda beans	62.4	87	170
Tapioca flour	4.3	-	-
Coke	26.0	10	11
Coconut oil		5	6
Other goods	212.4	1,070	4,689
Total Imports	2,131.1	4,297	10,428
Year / Exports	1980	1990	2000
Molasses	178.9	156	168
Copra Cake	278.7	166	112
Rice bran	171.6	307	492
Coffee	25.3	56	99
Rubber	11.2	52	121
Maize	0.1	31	34
Wood	37.3	44	47
Dried Cassava & tapioca	-	145	409
Other Goods	146.8	454	1,529
Total Exports	849.4	1,411	3,011
Total Foreign	2,980.5	5,708	13,439

Table 14.4.17 FORECASTS OF INWARD AND OUTWARD DOMESTIC TRAFFIC, 1980 - 2000

(Unit: '000 tons)

Year / Inward	1980	1990	2000
Fertiliser	542.5	467	505
Wood	233.7	611	1,303
Copra	219.6	187	90
Coconut Oil	30.9	73	112
Palm Oil	58.4	171	481
Maize	3.3	10	11
Agricultural Produce	13.9	56	131
Salted fish	14.4	32	57
Other goods	306.1	796	2,675
Total Inwards	1,422.8	2,402	5,366
Year / Outward	1980	1990	2000
Sugar	323.3	563	993
Rice	170.5	83	56
Fertilizer	17.9	16	17
Cement	53.0	21	22
Wheat flour	77.7	124	168
Salt	32.8	31	34
Building Materials	24.2	61	172
Other Goods	650.2	1,704	4,787
Total Outwards	1,358.6	2,603	6,249
Total Domestic	2,781.4	5,006	11,615

FUTURE CONTAINER TRAFFIC

Cargo value density and fixed container box rate are determinable elements in calculating the future potential for containerisation traffic. There are in addition some unknown factors in forcasting the growth of container tonnage and therefore the proportion of containerable cargo is determined from the experience of many international ports as described in the Masterplan. The forecast is shown in Table 14.4.18.

FUTURE DEMAND FOR BERTH SPACE BY CARGO CATEGORY

The approach to the preliminary estimation of demand for berth space is based on:

- the present situation of Surabaya port;
- present cargo handling rates and expected future development;
- traffic forecasts; and
- expected future ship demand in terms of arrival pattern, consignment size and vessel characteristics.

From this information the expected future demand for berthing space can be calculated directly. The main measure of berth demand used is vessel hours per year.

Total Berth demand has only limited usefulness in port planning purposes since different traffics have different characteristics and consequently vary in their berth and other requirements. The main categories used in the following analysis are as follows:

- overseas bulk traffic (liquid and solid);
- overseas container and "Comb" ships;
- overseas general cargo;
- domestic bulk traffic (liquid and solid);
- domestic Roro and LoLo;
- other domestic general cargo; and
- Kali Mas port traffic

The berth space by cargo category is estimated and summarized in Table 14.4.19.

Table 14.4.18 FORECAST OF CONTAINER TRAFFIC

Unit: ('000 tons)

Item	1979	1980	1990	2000
Foreign Traffic				
Potentially containerisable volume ('000 tons)	743	805	2,278	7,032
percentage of above which is containerised	12	17	80	90
Containerised volume ('000 tons)	88	137	1,822	6,329
Domestic Traffic				
Potentially containerisable volume ('000 tons)	433	402	1,051	3,062
percentage of above which is containerised	-	-	8	45
Containerised volume ('000 tons)	-	-	84	1,224
of which:				
75 per cent RoRo ('000 tons)	-	-	63	918
25 per cent LoLo ('000 tons)	-	-	21	307

KALI MAS PORT

(1) Future Demand

Table 14.4.20 shows the traffic forecasts split between Lokal vessels and perahus.

Table 14.4.20 TRAFFIC FORECAST BY VESSEL TYPE OF KALI MAS PORT

(Unit: Percent)

Vessel Type	Actual 1978	1979	1980	1990	2000
Lokal	46	50	51	58	58
Motorised Perahus	29	32	35	42	42
Sailing Perahus	25	18	14	0	0

The data shown for the years 1978, 1979 and 1980, show that Lokal vessels are increasing their share of the traffic at about 2.5 percent per annum, while motorised perahus increase theirs at 3% per annum. Sailing perahus on the other hand suffered a decrease in traffic of 5.5 percent per annum. For forecasting purposes, the study team have assumed that sailing perahus activity would become negligible by 1985 and that their share of the trade would be equally divided between Lokal vessels and motorised perahus. No other cargo transfers have been assumed.

(2) Capacity Requirement

Based on the current and forecasted vessel lengths and the forecast vessel visits, the total berthing length is estimated at 1494 M. in 1990 and 2658 M. in 2000. These are shown in Table 14.4.21.

Table 14.4.21 CAPACITY REQUIREMENT IN KALI MAS PORT

Year	Additional Vessel Visits		Additional Berthing Length Required (m)		
	Lokal	Perahus	Lokal	Perahus	Total
1990	2,770	2,430	990	504	1,494
2000	4,869	5,180	1,650	1,008	2,658

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

PORT DEVELOPMENT PLAN

(1) Planning Concept

Facility allocation is the most important planning item for port activities, management and operation. Among the facilities, quay allocation controls cargo handling efficiency. Some alternatives on the port development are applied for this study.

- The north coastal corridor from Tg. Perak to Gresik is 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. This is shown in Fig. 14.4.8.

- Kali Mas Port is recommended to remain within the port development area instead of relocation to Gresik.
  It was recommended in the Masterplan that the Kali Mas Port be relocated to Gresik. This is eventually an inefficient and uneconomical alternative considering cargo movements, and the fact that the major consumer area is in Surabaya.

- The Naval Academy, which is located within the future industrial corrodor, should desirably be relocated when taking into consideration future land use requirements. The existing land space of the academy is advantageous for port development due to the land requirements in the future port area. Continuation of this area as the site of the Naval Academy will reduce the efficiency of port operations and an alternative location of the academy is proposed on the west coast of Kamal, facing on to the Madura Strait.

- The east end of Jamrud quay should be re-zoned and allocated to the area for the ferry (Surabaya-Kamal) extension. The area to be rearranged is shown in Fig. 14.4.8.

(2) Port Development Plan

Based on the facilities requirement estimated in the previous sections 3) and 4), the port developments are scheduled in Table 14.4.22. The Masterplan conducted in 1981 should be reviewed for the major alternative concept proposed in this study.

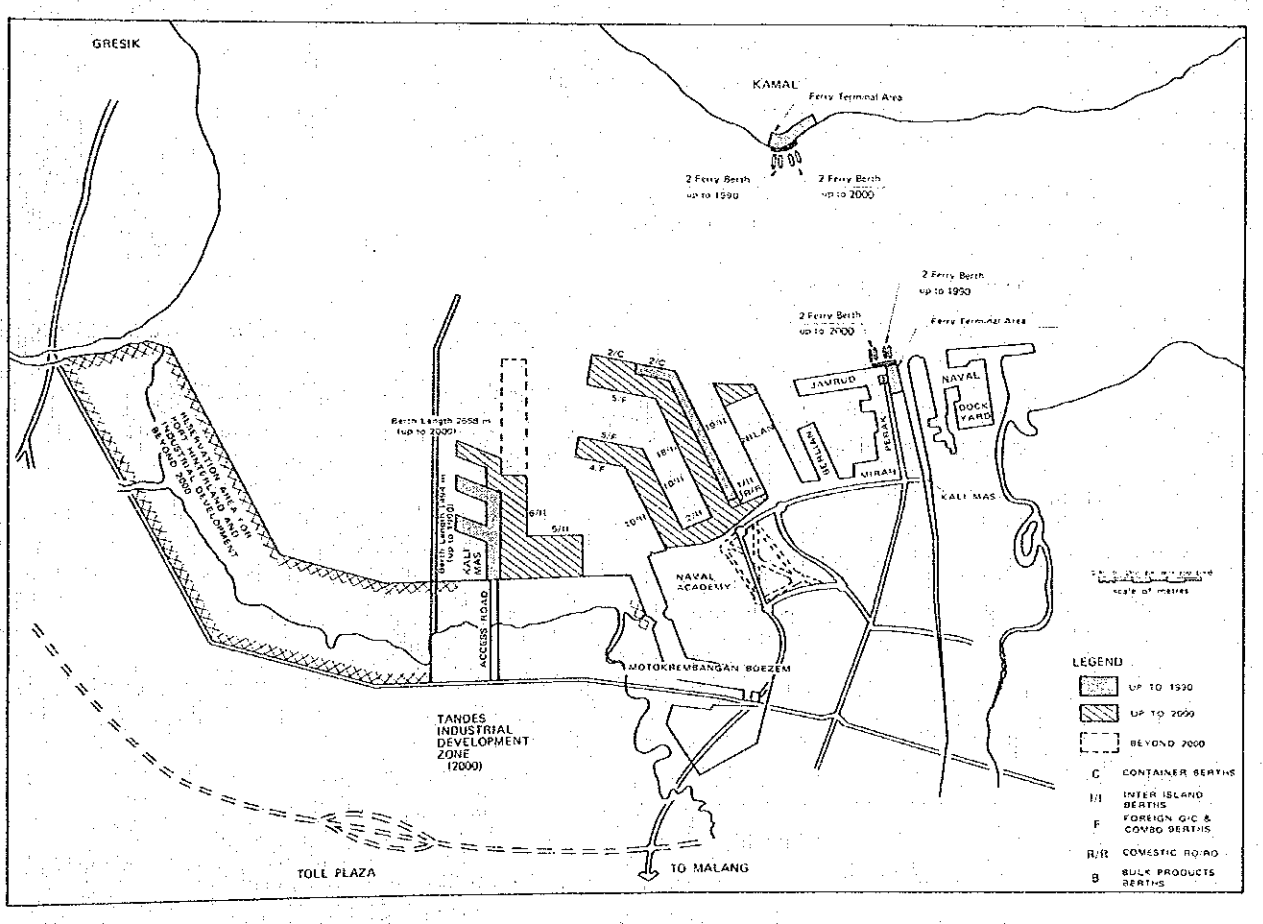


Fig. 14.4.8 SEA PORT DEVELOPMENT PLAN

Table 14.4.22 SEA PORT DEVELOPMENT PLAN

Term	Facilities to be constructed
Up-to 1990	- Rehabilitation of Berlian quay with loading/unloading equipment. - 2 container berths with handling equipment. - 19 inter-island berths.
Up-to 2000	- 2 container berths with handling equipment. - 52 inter-island berths - 14 foreign berths - 1 Ro/Ro berth - 2 Bulk berths with loading/unloading equipment - Reclamation (100 Million m^3)

14.4.6 AIRPORT DEVELOPMENT PLAN

GENERAL

Surabaya Juanda Airport serves not only SMA but also East Java and is formulated within the airline system in Indonesia.

In November, 1979 "MASTERPLAN AND FIRST PHASE PRELIMINARY DESIGN" for Surabaya-Juanda Airport ("The Masterplan") was executed by the Directorate General of Air Communication, Ministry of Transport, Communication and Tourism. The Masterplan was the source of reference in this study and the relevant extracts are used in the following paragraphs.

TRAFFIC FORECAST

The Masterplan forecast 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 14.4.23.

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

FACILITIES PLANNING

Based on the future traffic demand, 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 14.4.24 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	-

14.4.7 FERRY TERMINAL DEVELOPMENT PLAN

FORECAST OF FERRY TRAFFIC

Passenger and cargo were forecast separately, based on the estimated linear regression equations derived from the past data.

Passenger Traffic (Annual)

From Surabaya to Kamal

$Y_1 = 8.379\ X - 16{,}391$

From Kamal to Surabaya

$Y_2 = Y_1$

where: Y = Number of passengers (1,000 persons)
X = Number of employed persons in GKS (1,000 persons)

Cargo Traffic (Annual)

From Surabaya to Kamal

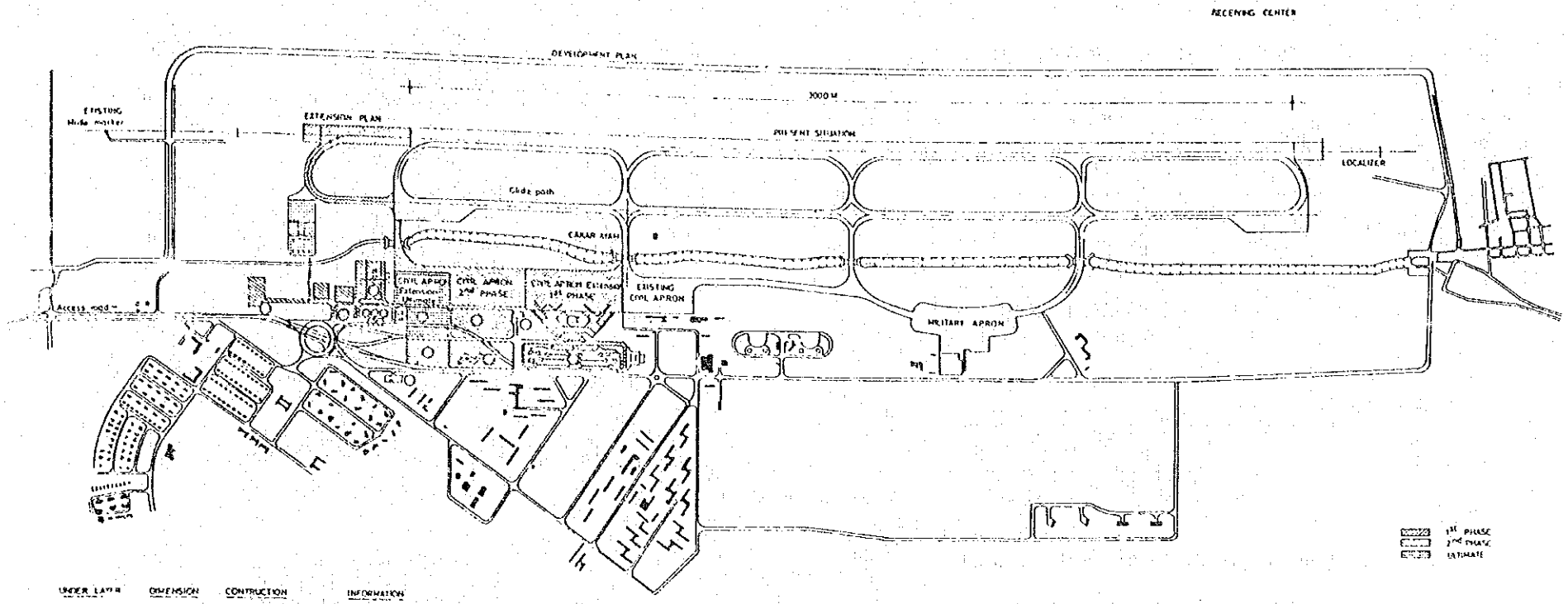
$Y_1 = 0.4285\ X - 812.7$

From Kamal to Surabaya

$Y_2 = 0.429\ Y_1$

where: Y = Cargo volumes (1,000 ton)
X = Number of employed persons in GKS (1,000 persons)

The resulting future estimated are shown in Table 14.4.25.



UNDER LAYER	DIMENSION	CONTRUCTION	INFORMATION
R/W	3000 X 60 M	ASPHALTIC CONCRETE	SERVICEABLE 45 M
T/W	3750 X 22.5 M	ASPHALTIC CONCRETE	SERVICEABLE 45 M
FILLET	900 X 20 M	ASPHALTIC CONCRETE	SERVICEABLE 45 M
APRON I	250 X 20 M	PC CONCRETE	CONVENTIONAL
APRON II	110 X 100 M	PC CONCRETE	CARGO AREA
WEST AIR CARGO AREA	220 X 50 M	ASPHALTIC CONCRETE	CARGO AREA
EAST AIR CARGO AREA	220 X 50 M	ASPHALTIC CONCRETE	CARGO AREA
WEST OVER RUN R/W 10	100 X 60 M	PENETRATION ASPHALT	CARGO AREA
WEST OVERRUN R/W 28	100 X 60 M	PENETRATION ASPHALT	CARGO AREA

REMARK
1 DESIGN THAT IS CLUDED IN MASTERPLAN MAKE DC 8 OPERATION BY FULL CAPACITY
2 ON THE 1982 DEVELOPMENT IS BORROW THE OPERATION OF 747 PLANE B747
3 RUNWAY IMPROVEMENT IS THE EXECUTION
4 ADDED RUNWAY LENGTH TO 3600 M

1 CONTROL TOWER BUILDING
2 NEW PASSENGER TERMINAL 1ST PHASE
3 CAR PARK I 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 II PHASE
9 FREIGHT TERMINAL
10 FUEL FARM
11 V.V.I.P. BUILDING
12 SAVAGE TREATMENT PLANT
13 AIRLINE ZONE
14 PASSENGER TERMINAL EXTENSION ULTIM TE
15 PILGRIM AREA
16 MAINTENANCE

Fig. 14.4.9 DEVELOPMENT PLAN OF JUANDA AIRPORT

FACILITIES PLANNING

– Vehicle Demand by Vehicle Size

Based on the existing data of vehicles, the number of vehicles by size is estimated for facilities planning and Table 14.4.26 shows the number of vehicles estimated. Table 14.4.27 shows the numbers converted to equivalent trucks.

– Ferry Boat and Berth Requirement

To meet the future traffic demand, it is necessary to use a 2000 GT ferry boat. This estimate is made based on the following conditons:

– One round trip: (including loading/un-loading)	60 minutes
– Operation hours of ferry:	24 hours

As a result, 2 berths for 2000 GT ferries are required for each side in 1990 and an additional 2 berths in 2000 as shown in Fig. 14.4.10.

Passenger Terminal

Approximately 4,400 m^2 is required for the waiting room, ticket booth and administration offices of the passenger terminal.

Parking Area

Parking area of approximately 15,000 m^2 is required for vehicles waiting before loading.

These areas are required in both Surabaya and Kamal. The existing port area must be re-arranged in order to produce the space for the ferry facilities and the alternative location is shown in Fig. 14.4.8.

FERRY DEVELOPMENT PROGRAM

Based on the estimated facilities capacity, a development plan is determined and shown below.

Up to 1990

– Development of four ferry berths in total and terminal facilities

– Purchase of two 2000 GT ferry boats

Up to 2000

– Development of additional four ferry berths

– Purchase of additional two 2000 GT ferry boats

The feasibility study for the ferry facilities plan should be executed as soon as possible.

Table 14.4.25 FORECAST OF FERRY TRAFFIC

(Unit: '000 persons, '000 ton)

Year		1980	1990	2000
Passenger	Arrived	4,802	12,224	22,997
	Departed	4,802	12,224	22,997
	Total	9,604	24,448	45,994
Cargo	Unloaded	112	279	515
	Loaded	262	651	1;202
	Total	374	930	1,717

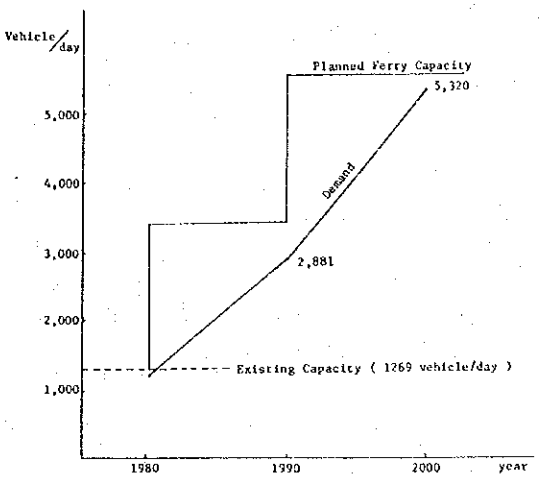


Fig. 14.4.10 FERRY VEHICLE DEMAND (Large Truck Base)

Table 14.4.26 VEHICLE DEMAND BY VEHICLE SIZE

Year		1980	1990	2000
Vehicle	Trucks	325,680	809,228	1,494,150
	Small Size	146,320	363,566	671,285
	Total	472,000	1,172,794	2,165,435

Table 14.4.27 CONVERTED TRUCK DEMAND

Year	1980	1990	2000
Number of Truck/Year	423,227	1,051,605	1,941,673
Number of Truck/day	1,160	2,881	5,320

Note: Conversion factor from small vehicle to big vehicle is 1.5. (Converted truck)

14.5 RIVER

14.5.1 PLANNING CONSIDERATION

GENERAL

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 evident.

The end result required for future drainage work is to produce a good environmental condition and urban amenity and 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.

BASIC CONDITIONS FOR PLANNING

The basic elements for the initial design of the drainage facilities are refered to in the previous reports conducted in the study area, and are:

(1) Design Storm Frequency

Surabaya/Wonokromo River	20 year
Mas river, Kedurus river	10 year
Secondary canal/river	5 year

(2) Rainfall Intensity

The rainfall intensity used in the feasibility study on Surabaya River Improvement Project is applied for this Study.

The rational method is used for run-off estimation in this Study and the co-efficients used are as follows:

Land-use	Run-off Co-efficient
Commercial/Public Building Area	0.8
Central Urban Housing Area	0.6
Industrial/Warehouse Area	0.5
Village Housing Area	0.4
Military Area	0.4
Forestry/Open Space	0.1

(3) Tidal Influence

Based on the preliminary study report on the Extension of Kali Surabaya River Improvement Project, June 1978, only the following data is available and is used for this Study.

Speciafic Tide levels (Surabaya Harbour: 1913–1930)

Level	LWS (m)	GW (m)	SHVP (m)
Highest tide on record (HHW)	+3.22	+1.74	+0.52
SHVP-datum	+2.70	+1.22	0
Most frequent high tide (GHW)	+2.13	+0.65	-0.57
Mean tide (GW)	+1.48	0	-1.22
Most frequent low tide (GLW)	+0.88	-0.60	-1.82
LWS datum	0	-1.48	-2.70
Lowest tide on record (LLW)	-0.02	-1.50	-2.72

(4) Hydraulic Design

Manning's formula is adopted to examine structure size with roughness co-efficient of 0.015 for concrete pipe and 0.025 for lined open channel.

14.5.2 WATERWAY PLANNING

TIDAL WATERWAY

In Surabaya and Sidoarjo the canals are located in the low lying area and the height of the boundary between fishpond (salt pond) and rice field is around SHVP ±0.00. Therefore, all canals are under tidal influence. For future urbanization these low areas should be maintained from habitual sea water inundation.

In Sidoarjo, irrigation and drainage canals are clearly separated and the irrigation canals should be maintained for thier present function in the meantime. The drainage canals will be improved in accordance with the urban expansion.

Among the alternatives available to avoid the tidal effects, the alternative of global flood control is applied for the Study. The concepts of the global flood control 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.

Applying this alternative, the canal size can be reduced and provided with a low canal bank to allow drainage of the surrounding surface water. The retarding pond along the canal will also provide the community park and recreational area for the nearby residents.

The retarding basin along the canals can be a maximum of 5 ha. according to the progress of urbanization.

The drainage system in SMA is shown in Fig. 14.5.1, and the scale of the canal facilities are caluculated 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.

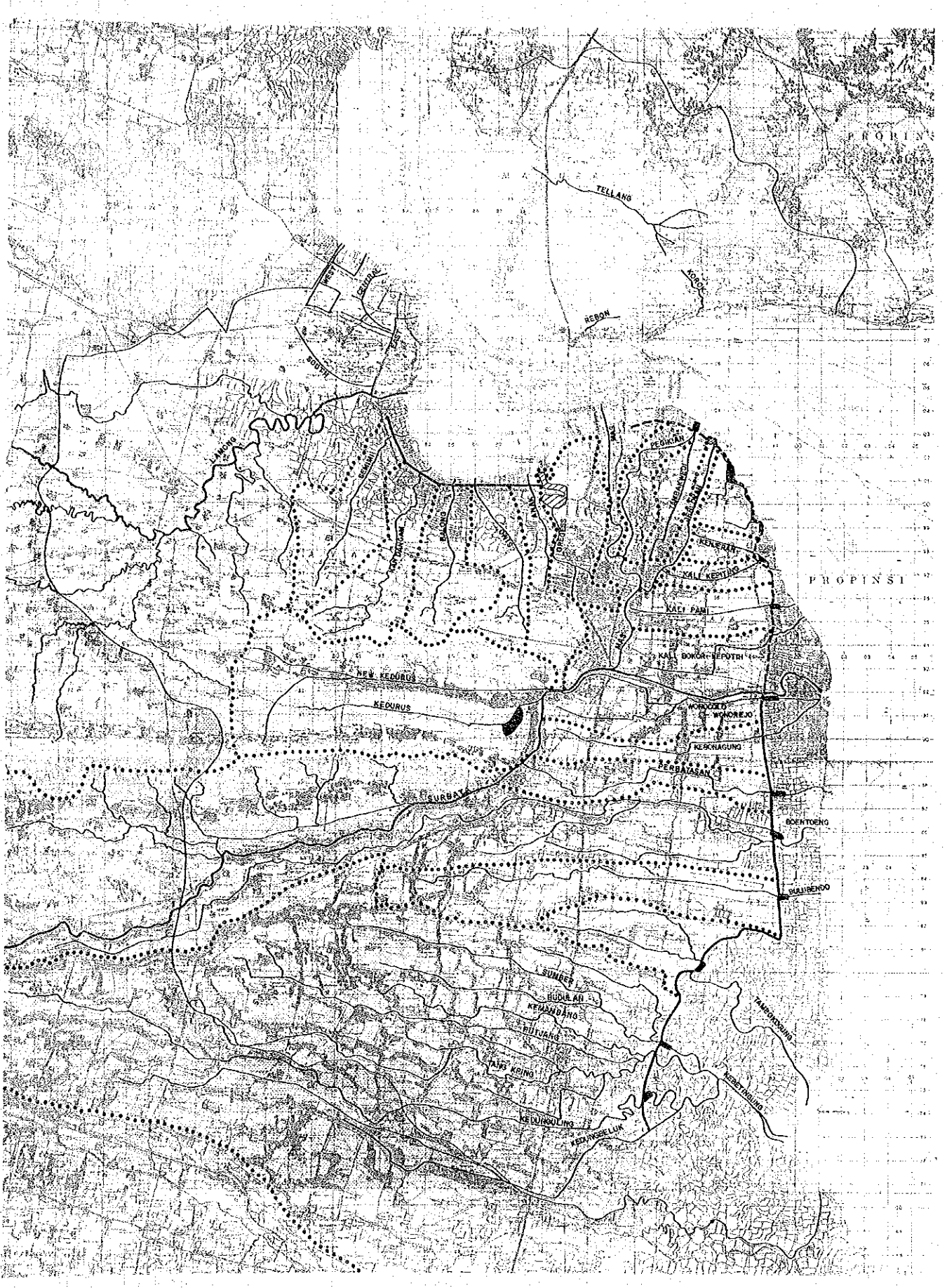


Fig. 14.5.1 DRAINAGE DEVELOPMENT PLAN IN SMA

- SMA BOUNDARY
- DRAINAGE BOUNDARY
- RIVER / DRAINAGE CANAL
- EXISTING RETERDING POND
- PLANNED RETERDING POND
- PLANNED SEA DIKE
- EXISTING SEA DIKE

The out-side retarding basin is located out side of the sea dike, but where there is no available space for the basin these must be inside the dike. It is not necessary to widen the Mas river, but revetment and dredging works are required.

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. Refering to the past study it is desired to attain gravity water flow and consequently there is a long period of inundation in every rainy season.

After review, an alternative method to resolve the inundation, by a new additonal waterway and a retarding basin on the Kedurus main river are proposed:

- New drainage canal provided on the slope of the Gunungsari hill with direct outlet to the Surabaya river.
- Retarding basin provided on the existing Kedurus river to cut the peak of the run-off, then discharge water to the Surabaya river through the existing river course. A syphon is used at the crossing point of the new additonal canal adjacent Jl. Gunungsari.

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	3@ (4.0 m x 2.0 m)
	Retarding basin	113 ha

The size of the waterway outlet from the retarding basin can be maintained as the existing canal, since the upstream of the basin should be expanded to around 70 m in width. The inundation area can be reduced to about 1/10th of therecorded inundation area. The water in the retarding basin is planned to flow by gravity.

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. The Lamong dam project planned upstream of the basin however is recommended to be executed exclusive of the SMA development projects.

DRAINAGE SYSTEM IN GRESIK AND KAMAL

Inundation also occurs in every rainy season in the CBD of Gresik. Existing secondary/teriary system should be well maintained and plans made to expand the size of the canals.

It is necessary to introduce a new drainage canal system so as to enclose the expanding city area and future anticipated development as shown in Fig. 14.5.1.

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

14.5.3 DRAINAGE DEVELOPMENT PROGRAMME

DEVELOPMENT PLAN

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

- Strengthen the Canal Maintenance Work

  Dredging and cleaning work for existing canals should be undertaken as soon as possible to rehabilitate their function.

- 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 system, and waterways from the upstream to the river mouth should be planned as one unit. Factors to be considered include flood water control, systematic water gate operation in the rainy season, and water usage (irrigation, domestic and industrial water including flushing water) in the dry season.

Pengairan (including Brantas office) and Kotamadya/Kabpaten are to be members of the Board, and the organization should be established similar to the Jakarta Flood control project office as shown in Fig. 14.5.2.

Kotamadya/Kabupaten will play a role of maintenance/operation for all secondary drainage/irrigation systems in each jurisdiction.

The major function 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.

In relation with the permission for river/canal crossing structure, a permit system and required standards should be made considering that present inundation is partially caused by the existing crossing structures constructed freely by public and private bodies.

- 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 bed and increasing the width. At some time when the irrigation area is well reduced, the administration of those canals should be transferred to the local government. For the short term programme, the land required for future drainage canals should be obtained as frequently as budgetry conditions permit.

- Constructions of the Maintenance Road

  For canal cleaning and maintenance, access space for this work is indispensable and a maintenance road for each canal should be constructed. The concept of a right-of-way for the public will be promoted, and fences should be provided on the both sides of canal banks to denote right-of-way and prevent illegal occupants. The standard of the maintenance road will be authorized by the Coordination Board. In this Study a 4 m road width on one side of the canal and 2 m green belt on both sides is adopted for the secondary waterways.

- Implementation of Feasibility Study

  At first a feasibility study on improvements to the drainage system in SMA shall be made and study subjects to be included in the feasibility study are:

  · Geographical map in SMA
  This might be made separately for the feasibility study.

  · Implementation programme based on the feasibility study and priorities determined

  · Operation and communication system

  · River and canal facilities standard proposal

  · Staff Training
  Engineer and operator will be included in the training programme to promote planning and operation capability.

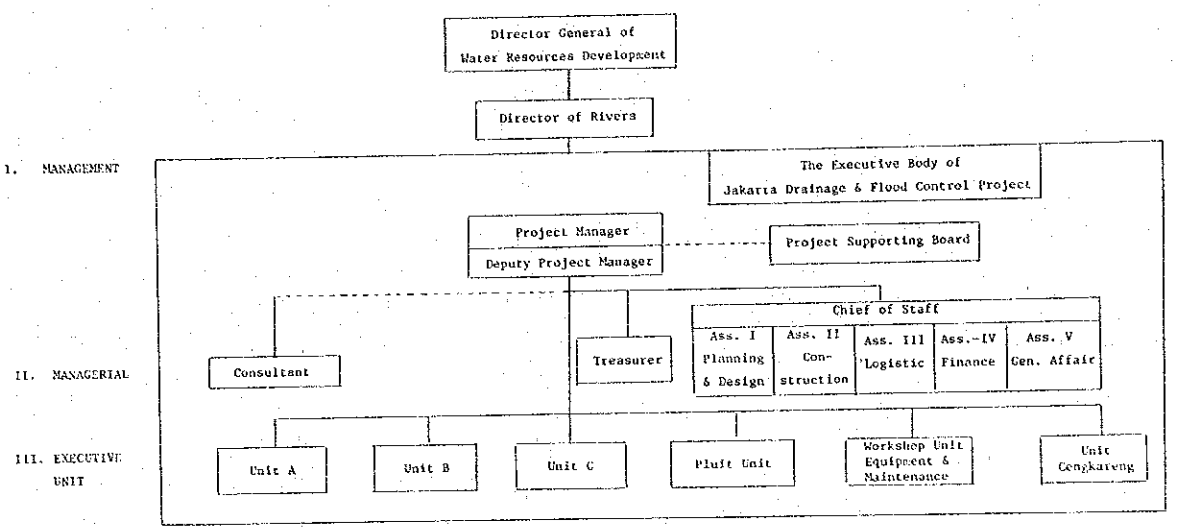


Fig. 14.5.2 STRUCTURAL ORGANIZATION
JAKARTA DRAINAGE AND FLOOD CONTROL PROJECT

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 canals
- Land acquisition and compensation
- Development and improvement of canals and facilities

14.6 UTILITIES

14.6.1 WATER SUPPLY

FUTURE WATER NEEDS

Future population in SMA is forecasted to be approximately twice that of the present time and also the spatial 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 sociall.

(1) Residential Water

Residentail 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-grading of service level in the existing service areas. The future water supply for the 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

(2) Industrial Water

Industrial water is estimated based on the consumption per capita per day. In 1975 the consumption was high at around 300 ℓ/employee/day. This has decreased to 72 ℓ/employee/day in 1980. 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.

(3) Social Water

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

(4) Commercial Water

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

(5) Design Factor

To estimate the water intake volume the peak factor, water losses in the distribution system, and losses at the purification plant and transmission system are assumed to be:

- Peak factor = $\frac{\text{Ave. Day Demand}}{\text{Max. Day Demand}} = 0.8$
- Water loss in distribution system:
  in 1990: 15%
  in 2000: 10%
- Losses in purification plant and transmission system: 8%

The future water demand is shown in Table 14.6.2.

In 1990 a total of 9.6 m^3/sec and 23.8 m^3/sec in 2000 is needed for SMA. Therefore and additional 1.9 m^3/sec and 16.1 m^3/sec are required in 1990 and 2000 hence new water sources must be developed by 1990.

Table 14.6.2 FUTURE WATER DEMAND IN SMA

Year	Ave. Day Demand (1) (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)	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

Table 14.6.3 shows the water demand by service area in SMA. In 1990 an additional 1.7 m^3/sec in Surabaya and Sidoarjo, and 0.2 m^3/sec in Kamal will be required. For Gresik 50 ℓ/sec by 1985 and 198 ℓ/sec by 1990 are scheduled to be transmitted from Surabaya. The transmission project for 50 ℓ/sec is under construction and that for 198 ℓ/sec in order to meet the total domestic demand of 632 ℓ/sec in 1990.

In 2000 an additional 12.6 m^3/sec in Surabaya and Sidoarjo, 2.8 m^3/sec in Gresik and 0.7 m^3/sec in Kamal will be required over the existing supply. Industrial water demand is estimated to total 81,700 m^3/day in 1990 and 406,000 m^3/day in 2000 respectively. If some of the industries to be located near the coast could use salt water, the service level for domestic use could increased.

DEVELOPMENT OF WATER SOURCES

(1) Available water sources by 1990

The water development plan made by each PDAM is reviewed and investigated. Kamal will be supplied in 1983 at 30 ℓ/sec from Tangkal plant. Available water sources up to 1990 are shown in Table 14.6.4. A total of 7.7 m^3/sec will be available for SMA.

PDAM Surabaya plans the water development of 8.06 m^3/sec total including Umblan spring and some 6.5 m^3/sec is defined as future available water sources. The Surabaya river water source is not expanded due to the limited water flow in the river.

(2) 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 as described in the previous section, and to meet this demand the available water sources are reviewed.

Brantas river (Surabaya river) has low development potential due to the previous development of the river. Sala river has been developed only in its upper reaches, and therefore the Sala has big development potential. Lamong river is not expected to be a water supply source for SMA due to the small water potential and the several shortage of irrigation water in the basin.

The drainage water from the irrigation system in the Brantas Delta Sidoarjo is also considered as a possibile urban water source, but it is possible that adverse effects may occur as water which flows to the sea, whether as groundwater or in the surface channels, maintains a balance with the saline water in the coastal area. Any reduction of the fresh water flow through the system would alter this balance causing a further intrusion of saline water and possibly converting productive sawah to salt marsh.

The result of urbanization in the agriculture area of Surabaya and Sidoarjo is also considered to be a potential source of water supply. The surplus water from this source is estimated to be 6 m^3/sec in 2000. These sources are summarized in Table 14.6.5.

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 14.6.3 WATER DEMAND BY SERVICE AREA

Year / Service Area	Distribution Cap (m^3/day)		Max. Day Distribution Volume (m^3/day)		Required Water Volume			
					1990		2000	
	1982	1990	1990	2000	Max. Day Distribution Volume (m^3/day)	Water Source (m^3/sec)	Max. Day Distribution Volume (m^3/day)	Water Source (m^3/sec)
Surabaya	329,800	538,200	511,300	1,122,000	132,000	1.7	1,005,700	12.6
Sidoarjo			158,900	421,900				
Gresik	24,800	75,400	75,400	300,500	0	0	225,100	2.8
Kamal	-	2,400	21,000	61,600	18,600	0.2	59,200	0.7
Total	354,600	616,000	766,600	1,906,000	150,600	1.9	1,290,000	16.1

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

Water development except for irrigation purposes in the Brantas basin is expected to be used for the dilution and flushing of the urban canals, especially in Surabaya. In surabaya existing flushing water of 1.9 – 4.1 m^3/sec is provided through Surabaya river in the dry season and this water volume intake is maintained in this Study. The canals to be flushed will however increase with urban expansion and more water will be required for this purpose.

WATER DISTRIBUTION PLAN

By 1990, water to be developed from the Sala River will not yet be available for SMA, due to the construction period of new water reservoirs and the surplus irrigation water is therefore the only available water source. The surplus irrigation water of 1.75 m^3/sec is diverted into the Surabaya river and is supplied for new development area and sub-service level area in Surabaya, Sidoarjo and Gresik. A new purification plant is located in Waru near Surabaya river as shown in Fig. 14.6.1.

In Bangkalan, a water source of only 0.15 m^3/sec from 4 springs is available compared with the demand of 0.2 m^3/sec in 1990. The service level by 1990 is below target. Full service is however attained from the Sala river by means of a submerged pipeline planned between Kamal and Gresik before 2000.

WATER DEVELOPMENT PLAN

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

(1) Coordination on Water Usage

Urban water needs have only been considered in a minor role in the past water development projects. For future water development programmes, water usage between agriculture use and urban use should be considered in more equal terms and urban water needs must be incorporated into water development plans.

Water flow control is also an indispensable aspect to ensure correct water supply to water user sectors. This is an important role of the "Coordination Board" which is which is recommended in the river study of this report.

(2) Promotion of Further Development of Water Sources

Water sources (surface, spring, ground water) are to be further developed and the planned water reservoirs must be re-examined to raise additional water for urban water usage.

– Examination of the Existing Water Use

  An examination of the existing water use should include the effective use of any surplus water.

– Examination of Salt Water and second-hand water for Industrial Use

  A study should be made of the uses of sea water and second-hand water applications in industry to replace fresh water.

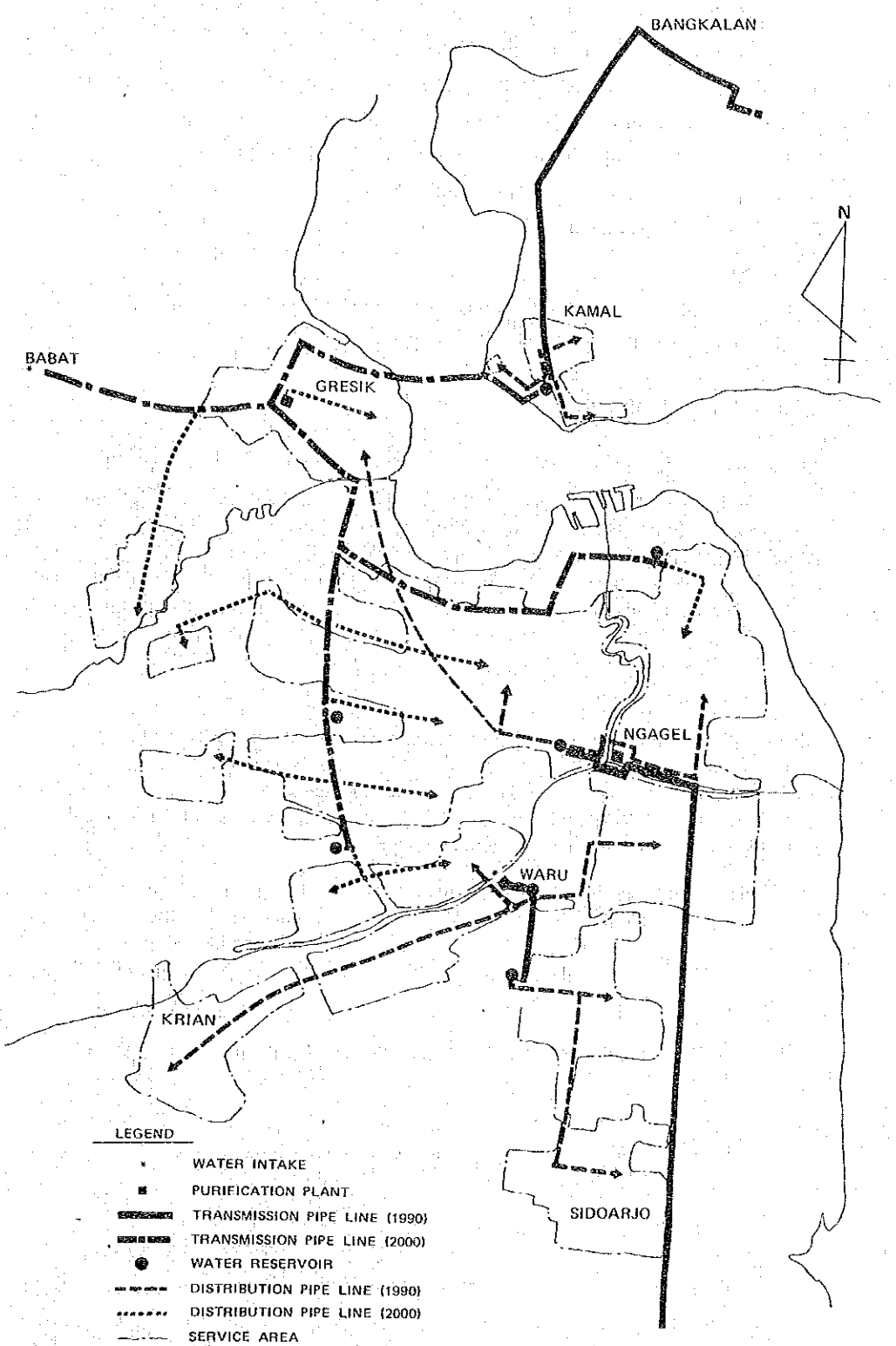


Fig. 14.6.1 WATER SUPPLY DEVELOPMENT PLAN

(3) Development Programme

Water supply 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)
- 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

14.6.2 WASTE WATER

GENERAL

The free discharge of industrial and domestic waste water has a adverse effect upon the resident's health, especially from the resident's raw sewage. Skin disease, cholera and related diseases of digestive organs are still common. This is proved by the extremely high contamination of coliform in the major river/canal system. An appropriate treatment should be commenced as early as possible.

FORECAST OF FUTURE WASTE WATER DISPOSAL VOLUME

(1) Waste Water

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 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 service areas of waste water treatment are tentatively divided into 7 areas considering the existing geography. They are Kamal, Gresik, Surabaya west (Tandes), Surabaya East (Sukolilo), Kedurus/Rungkut, Driorejo and Sidoarjo. The max. discharge volume by area is estimated with the inclusion of 15% ground water and is shown 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

(2) Night Soil

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 so the volume to be treated is 27.4 t/day and 39.8 t/day.

DEVELOPMENT PLANNING

(1) 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.

In this study the planning concept therefore is applied for the waste water programme as described below:

- Night Soil Treatment

  A night soil treatment system is to be established by 1990 and the treatment plant treats half of the night soil generated in 1990 and 2000. The other domestic waste water is discharged into the nearby canal as at present.

- Pilot Project for Waste Water Treatment

  A 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.

- Full-scale Treatment

  The full-scale service of waste water treatment will occur after 2000.

- Industrial Waste Water

  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.

(2) Facilities Planning

- Night Soil Treatment

  The night soil treatment plant will treat 27.4 t/day in 1990 and 39.8 t/day in 2000.

- Public Toilet

  In order to determine the project magnitude for public toilets, the ratio of home toilet is assumed using the existing numbers of private toilets as follows:

Year	Percentage of home toilet (%)	Population served by home toilet	Population to be served by public toilet
1980	30.6	890,000	640,000
1990	40	1,670,000	1,300,000
2000	60	3,670,000	2,450,000

From this assumption additional public toilet required will be 320 by 1990 and 550 by 2000 based on the current service rate of 2,100 person/public toilet.

(3) Technical Aspects

– Selection of Waste Water Treatment System

To systems, the combined system and the separate system, are currently operated in the world. For the selection of the system, water pollution, cost, and technical points are considered and alternatives must be studied in a future study. In this Study the separate system is recommended for the following reasons:

- To minimize water pollution
- To realize the system early due to the smaller construction cost of separate method

– Night Soil Treatment Plant

The night soil transported by vacuum trucks is converted to inorganic substance and gas in the digestion tank through the anerobic treatment process. The inorganic substance, "so-called sludge" is transported to the incineration plant. The remaining liquid is discharged into waterway after the activated sludge treatment.

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 as a complex.

Up to 2000

- Construction of additonal 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

14.6.3 SOLID WASTE

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

FORECAST OF FUTURE SOLID WASTE GENERATION

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

(1) 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 forecast in relation to the GRDP.

The adopted equation is as follows:

$$Y = a x_i + b$$

where : Y = Generation volume (ton or M^3/day)
x_i = GRDP in year i
a,b = Constants

Table 14.6.7 shows the forecast solid waste generated volume in SMA upto 2000. The generated volume in 1990 is 600 g/capital/day and 828 g/capital/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

(2) Future Physical Composition

Solid waste component is proportionally related to the disposal volume of consumed materials and to the consumption volume of the materials. This data however is not available and the future physical composition is therefore assumed from similar Data from foreign cities as shown in Table 14.6.8. In 1990 the physical composition is assumed to be an intermediate value between that of 1975 and 2000.

COLLECTION, TREATMENT AND DISPOSAL

(1) 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.

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
Cerbage	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

Denpending upon the classification methods, the collection system is further divided into storage and discharge of solid waste at its generation point or, on the contrary, collection and transportation are united into one system. Table 14.6.9 shows the solid waste management system and its function.

Talbe 14.6.9 SOLID WASTE MANAGEMENT SYSTEM AND FUNCTION

	Subsystem	Function	Method (Example)
Solid Waste Management System	Collection	Collection of discharged solid waste, including actions to store and discharge solid waste at the generation point.	Door-to-door collection, station collection, hauled-type container collection. Mixed-waste collection method. Classified-waste collection method.
	Transportation	Transportation of collected solid waste to its destination. Transportation involves transfer stations which form transport junctions.	Transportation by trucks, barges, pipe line or train. Direct transportation. Transfer transportation.
	Intermediate treatment	Intermediate treatment of solid waste by physical, chemical or biochemical means to make the treated waste non-biodegradable, non-toxic and harmless, reduced in volume, and reutilizable.	Pulverization, selection, incineration, pyrolysis, methanation, composting, feed-making. Material recovery method. Energy recovery method. Material conversion method.
	Final disposal	Restoring of solid waste or residue from intermediate treatment to the natural environment as the final stage of solid waste management, by means of landfilling or disposal into water.	Anaerobic landfill, aerobic landfill. Unsanitary landfill method. Sanitary landfill method.

(2) Collection, Transportation and Disposal Volume

– Colection/Disposal

In 2000 the total collection/disposal volume is determined as 90% considering the retrieval material (metal, glass, paper etc) and the treatment (burning and land filling) at the generation points.

The total collection/disposal volume are assumed as shown in Table 14.6.10.

– 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 as described below:

* Household waste to be generally suitable for composting
* Market waste (garbage and plants in the major) to be suitable for composting
* Large store, hotel and office waste (generally paper in major parts) to be suitable for incineration and sanitary landfill.

* Factory waste (various kind of waste) to be suitable for incineration and sanitary landfill.

The percentage of solid waste for composting, however will be kept at the same volume as the current operations due to its higher price than fertilizer in the market, and the unknown factor of future demand.

Table 14.6.10 COLLECTION/DISPOSAL VOLUME IN 1990 AND 2000

Year	Generation Volume (ton/day)	Percentage of Collection/ Disposal (%)	Collection/ Disposal Volume (ton/day)
1980 *	1,784	35	630
1990	2,835	60	1,700
2000	5,067	90	4,560

Note: * figures in 1980 are the estimated values.

– Technical aspects

Collection and Transportation

Solid waste containers or storage are required to have the following functions:

From viewpoint of public health:

- Protection from insects, vermin and animals
- Prevention of diffusion of rank odour
- Prevention of leakage of leachate
- Easy to keep container clean (easily washable, for instance)

From viewpoint of use:

- Easy to put solid waste in and out
- Strong and durable
- In the case of portable type, (moderate in size, light in weight and easy to carry)

(3) Intermeidate treatment

In this plan two intermediate treatments (composting and incineration) are considered. Intermediate treatment is a process to make solid waste non-toxic and harmless, non-degradable, reduced in volume and re-usable through physical, chemical and/or biological treatment before discharging it into the natural environment.

(4) Final Landfill Disposal

Purposes of landfill disposal are, first of all, to store solid waste in a proper manner that should assure security of living environment and then, to stabilize the stored solid waste (converted to soil) and to decontaminate it (to be non-toxic and non-biodegradable) in a natural metabolic cycle.

Landfill sites should possess the following features:

– economical and able to offer sufficient landfill capacity,

– easy for collection trucks to approach and permit disposal of incoming solid waste,

– able to make landfilled solid waste non-toxic, harmless and non-biodegradable in a relatively short period of time,

– prevent the occurrence of pollution from landfill site or the reclaimed land; inexpensive pollution control costs; and shorter time period for maintenance of pollution control costs; and shorter time period for maintenance of pollution controls of the completed landfill,

– safe from accident and able to be coordinated into the surrounding environment,

Table 14.6.11 TREATMENT/DISPOSAL VOLUME

Category of Treatment/Disposal \ Year / Treatment Volume	2000 % of Solid waste	2000 % of Treatment	2000 Treatment Volume (t/day)	1990 % of Solid Waste	1990 % of Treatment	1990 Treatment Volume (t/day)
Total Collection/Disposal Volume			4,560			1,700
Land Fill			2,780			1,360
Incombustible & Miscellaneous	20	100	912	10	100	170
Combustible Garbage	40	28.6	522	70	40	476
Combustible Other ex. Garbage	40	50	912	20	82.4	280
Compost residual	40	23.8	434	70	36.5	434
Incineration			1,680			240
Combustible Garbage	40	42.1	768	70	15	180
Combustible Other ex. Garbage	40	50	912	20	17.6	60
Composting						
Garbage	40	5.5	100	70	8.5	100

SOLID WASTE MANAGEMENT SYSTEM

The solid waste management system described below is recommended for the years up to 2000, and is based on the existing solid waste prictice in SMA. However the study in detail of an alternative is still required in future study.

(1) Collection Methods

Separate collection (compustible and incombustible, etc) system is recommended in this study. This system will increase collection frequency and collection cost, but it is effective system for recycling the recovered materials.

Collection method and equipment used should be changed according to the volume of dischargers.

– Collection from small-volume dischargers such as households and small shops

Storage

A container with lid (20 to 100 liters, made of plastic or metal), a polyethlene bag or a paper bag is used. The polyethlene bag or paper bag is a disposable bag used to pack commodities. However, a paper bag should not be used for wet waste or on a rainy day.

Collection method: Station and individual collection

Two collection systems are applied for the area; station collection system (Same system as current practice) and individual collection system. For the station collection system, stations are established along routes of collection trucks. If houses are located along a narrow street, such as in a kampung, a station is established along the narrow street, and collection workers carry out the solid waste with push carts from the station to the collection truck waiting on a wider street. Existing temporary depots made of concrete are replaced by contained depot station.

In the individual collection system, compactor trucks collect individual household waste and transport the waste to incineration or compost plants. This system is introduced in the suitable area, such as a residential complex, with suitable street and traffic conditions.

Equipment: Middle-size compactor (5-10 m^3/Truck)

A collection truck with compaction equipment (compactor) is recommended for improvement of the loading efficiency, increase of the loading weight, and release of collection workers from heavy labor or dangerous work.

– Large-volume dischargers (Large markets, large stores and large buildings)

Storage and collection

The hauled container system is adopted as much as possible for large-volume dischargers, considering situations of buildings and sites, and the discharge volumes.

The hauled container is remains at the site of large-volume dischargers and hauled to the landfill site and incineration plant.

Equipment

Container loader and large-size container should be used for hauled container system. Compactor should be used for container storage.

– Hospital

The solid waste discharged from hospitals is classified into the following two types:

– Unsanitary waste and hazardous waste

Unsanitary waste includes organs and organic materials from operations, used gauze patches, materials potentially contaminated with germs, used syringe-needles, ampoules, pieces of broken glass, drugs, etc.

– Sanitary waste and non-hazardous waste

Office papers and kitchen food waste which are not contaminated with germs.

Wastes of above items should be separately stored. Unsanitary waste should be stored in heavy gauge plastic bags for collection. Hospitals (including small medical facilities) usually organize a cooperative, which collects or entrusts to an outside service to collect the two types of wastes separately. Water-tight type dump trucks with lids should be used to prevent breakage or spillage.

The collected solid waste should be incinerated at a treatment plant managed by the cooperative or reliably managed by a licensed waste treatment company. The incineration residue should be transported to the landfill site. A large hospital may incinerate the waste at its own plant constructed in the hospital site, and ashes are transported to the landfill site.

(2) Transport

There are two tansport alternatives; direct transport to the destination either collection trucks or by transfer transport. On the examination of transport distance (12 km in general) between a disposal site and the centre of collected area, a transfer transport system is not required and is not applied to this study.

(3) Others

– Cleaning of Roads

The use of mechanical or manual cleaning depends upon the type of road. Mechanical cleaning consists of a dump truck to collect relatively large solid waste (wood-chips, stones, etc.); a road-sweeper with brush and swallow-in inlet and a sprinkler truck. The frequency of cleaning is about 2–4 times a month. The manual cleaning is performed by workers with brooms and dust pans. The collected solid waste is thrown into small-size containers (about 500 liters), which are always placed at a proper place on the road. A compactor with a container lifting system collects the waste from the container.

– Transport of incineration residue (ash)

Incineration residues discharged from incineration plants should be transported by a water-tight dump truck to a landfill site.

FACILITIES PLANNING

(1) Incineration and Sanitary Landfill Site

Incineration plant is tentatively planned at four sites in Sukolilo, Sidoarjo, Semimi, and Kamal. The capacity of each of the plants and area of landfill site are estimated in Table 14.6.12. Approximately 2,100 ton/day total plant capacity is required for incineration plants upto 2000. By 1990 a pilot plant will be started in Sukolilo for staff training, the plant capacity is 300 t/day. Incineration plant is not required in Kamal before 2000. Landfill site of total approximately 2.7 million m^2 is required in SMA by 2000.

Table 14.6.12 REQUIRED INCINERATION CAPACITY AND LANDFILL AREA

(1) INCINERATION CAPACITY Unit: ton/day

Location \ Year	1990	2000	Total
Sukolilo	300	600	900
Sidoarjo	–	600	600
Semimi	–	600	600
Kamal	–	–	–
Total	300	1800	2100

(2) LANDFILL AREA

Unit: m^2

Location \ Year	1990	2000	Total
Sukolilo	590,000	672,000	1,262,000
Sidoarjo	286,000	222,000	508,000
Semimi	281,000	559,000	840,000
Kamal	36,000	72,000	108,000
Total	1,193,000	1,525,000	2,718,000

Note: Height of landfill is assumed as 5m.

(2) Transportation Trucks to be Purchased

In case of equal use of dump truck (8 m^3) and compactor truck (7.5 m^3) for solid waste transportation, the total number of truck are estimated in Table 14.6.13.

Table 14.6.13 NUMBER OF TRUCK REQUIRED

Unit: Number of truck

Landfill and Incineration Site \ Year	1990		2000	
	Dump Truck	Compactor Truck	Dump Truck	Compactor Truck
Smimi	37	25	149	105
Sukolilo	101	70	228	161
Sidoarjo	37	26	106	25
Kamal	5	3	14	9
Total	180	124	497	300

DEVELOPMENT PROGRAMME OF SOLID WASTE TREATMENT

(1) Execution of Master Plan and Feasibility Study

There is no up-data on the quantity and nature of current solid waste. This data is an indispensable component when the plan is prepared and a future study should be executed including this basic data survey.

(2) Recommendation for the Solid Waste Management

Upto 1990

- Promotion of separate collection system (combustibel and incombustible, etc.)
- Expansion of container depot system (including replacement of concrete depot), Phase-I
- Introduction of individual collection system for small-volume dischargers
- Expansion of hauled trailer system for large-volume dischargers.
- Expansion of transportation faculty, parking lots/workshops and purchasing equipment/tool, Phase-I
- Promotion of licensed tratment enterprises
- Promotion of treatment sector for residual material (metal, glass, plastic, paper, rubber, etc.)
- The pilot project for an incineration plant (for staff training)
- Development of landfill site, Phase-1

Upto 2000

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

14.6.4 ELECTRICITY

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.

FORECAST OF FUTURE ELECTRICITY DEMAND

For the forecast of future electricity demand, reference is made to "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 electricity unit rates cited for the report and estimation in this study are listed as follows:

- Residential Sector
  - Electrification 1980 estimated to be 13.6%.
    Electrification to be 60% in 1990
    90% in 2000
  - Daytime Peak: 300 W/household in 1990
    500 W/household in 2000
- Commercial Sector
  - Number of employed person in offices to be assumed at 60% in commercial/industrial sector in both 1990 and 2000.
- Floor space/Peak demand per worker:

	1990	2000
– Floor space per worker	10 m^2	15 m^2
– Peak demand/floor space	40 W/m^2	60 W/m^2

- Industrial Sector
  - Peak demand per unit factory land space assumed to be 300 kwh/ha.
  - Factory land space:
    4,819 ha in 2000
    3,316 ha in 1990
- Public Sector
  - White collar workers in government offices are assumed to be 262,000 persons in 1990 and 383,000 persons in 2000.
  - Floor space and peak demand to be same as the rate of commercial sector.
- Street lighting

	1990	2000
– Length of street/road	585.5 km	598.6 km
– Service Level:	60%	90%
– Demand per Unit length:	18 kw/km	

The future electricity demand in SMA is estimated in Table 14.6.14

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

New generators totalling 1,818 MW by 1990 are necessary for SMA, and a further 2,382 MW by 2000.

DEVELOPMENT PLAN

In the development plan, 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 Sungoro dam, further major generation will not be possible due to the lack of suitable sites. Electricity development plans for SMA are listed below:

- New generators are constructed in the global planning of Java.
- Total 28 new substations are necessary in SMA.
- Three banks of transformers are recommended for each substation to obtain high reliability.
- New transmission lines of 150 KV are recommended from an economic point of view.
- Distribution lines of 20 KV (3-phase, 3-wires) and of 380 V (3-phase, 4-wires) are recommended.

DEVELOPMENT PROGRAMME

Upto 1990

- New Generators Construction, Phase-I
- 150 KV Substations Construction, Phase-I
- 150 KV Transmission construction, Phase-I
- Distribution Lines Construction, Phase-I

Upto 2000

- Additional Generators Construction, Phase-II
- 150 KV Substations Construction, Phase-II

Beyond 2000

- 150 KV Substation Construction, Phase-III

14.7 ENVIRONMENT

14.7.1 ENVIRONMENTAL PRESERVATION CONCEPT

As long as people live in the city, the urban environment must be preserved regardless of regional economic growth. Various kinds of waste are discharged through daily human life and industrial activities, and these are stored in nature till it becomes a part of the environment. This forms the so-called environmental circulation cycle of material.

This natural circulation cycle of material has a certain quantitative limit and a qualitative acceptability called "environmental capacity" and "environmental acceptability", respectively. If either quantitatively or qualitatively excess waste is abandoned, nature becomes unable to cope with it, resulting not only in accumulation of excessive waste in nature, but also destruction of the natural environment. This is what is called "destruction of nature by waste" or, more commonly, "pollution". The ultimate solution for waste problems is to prevent the occurence of destruction of nature by waste in order to realize co-existence and co-prosperity of nature and human society.

14.7.2 RECOMMENDATION ON ENVIRONMENTAL PRESERVATION

Generally the term pollution includes air, water, soil, noise, vibration, ground subsidence and odours. Some recommendations on environmental preservation are:

- Establishment of Environmental Law

  The total quantity discharged and quality of individual discharges should be limited according to the location and treatment methods available.

- Promotion and expansion of solid waste treatment programme

  The programme for this purpose is proposed in the solid waste section of this report.

- Introduction of waste water treatment system

  This is referred to in the waste water section.

- Promotion of traffic safety and efficiency of the traffic movements

  In order to promote traffic safety and efficiency three basic strategies should be applied, education, engineering and enforcement. The details are described in the road section of this report.