4.3.4 Modal Split

Modal split is to determine the composition of various transport modes. Taking into account the regional characteristics and data availability, the modal split model employed here is characterized as :

a) Trip interchange type
This type is to determine the mode share after forecasting OD distribution. Therefore, it is able to correspond to the future changes of trip length.

b) Binary choice type
This type is to determine the modal share stepwise as shown in Fig. 4.3.3.

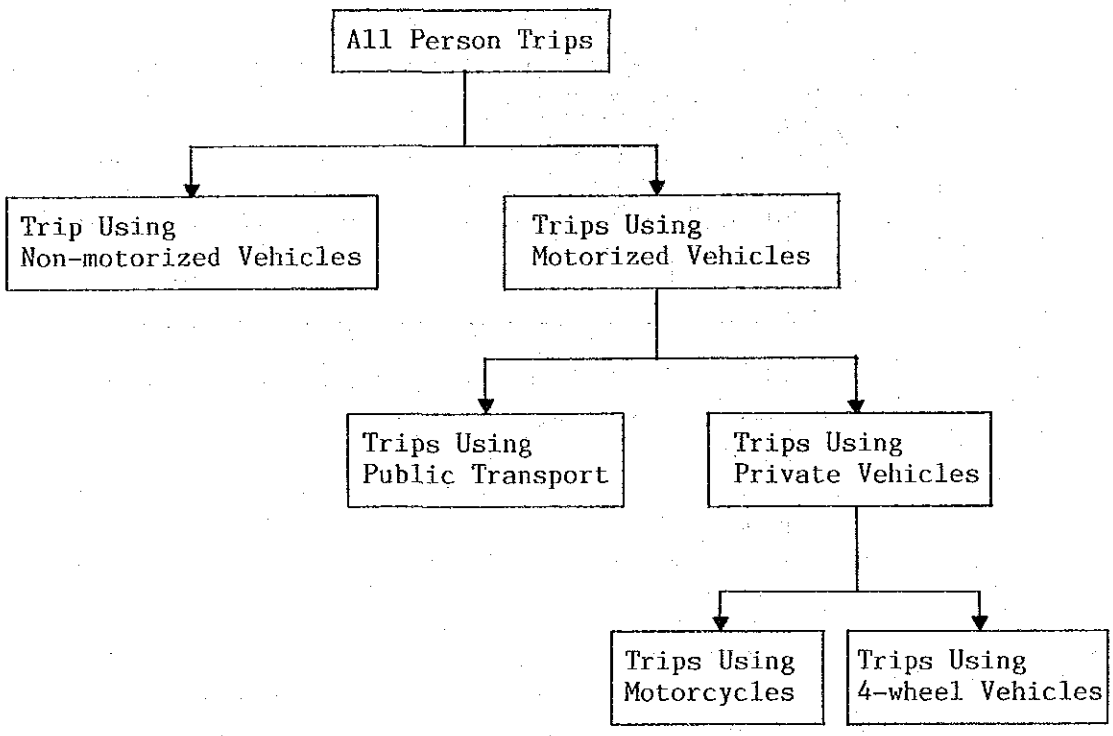
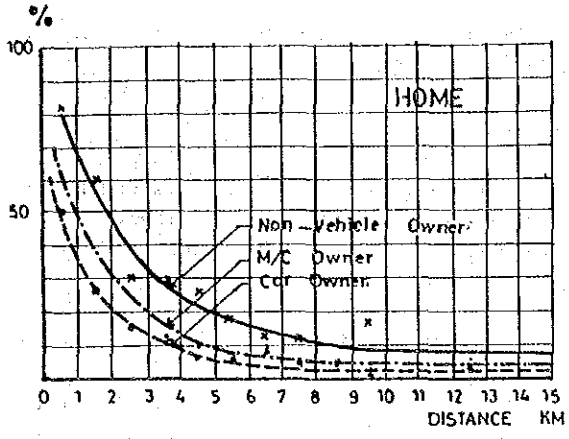


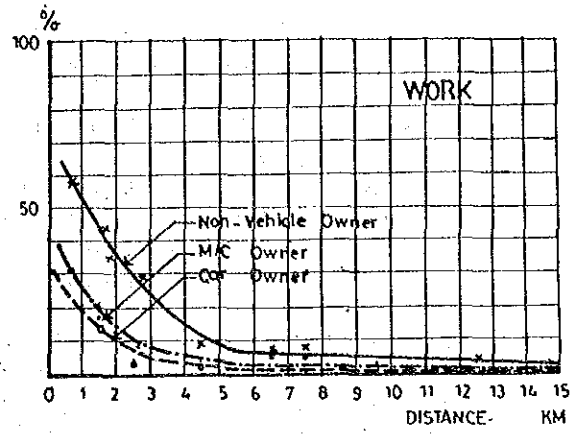
Fig. 4.3.3 Modal Split Procedure

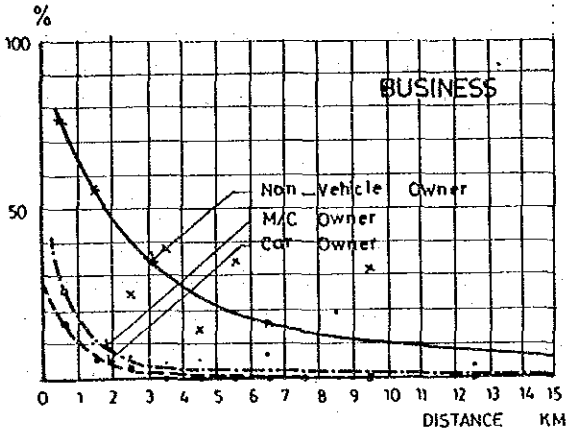
1) Modal split of Non-motorized Vehicles

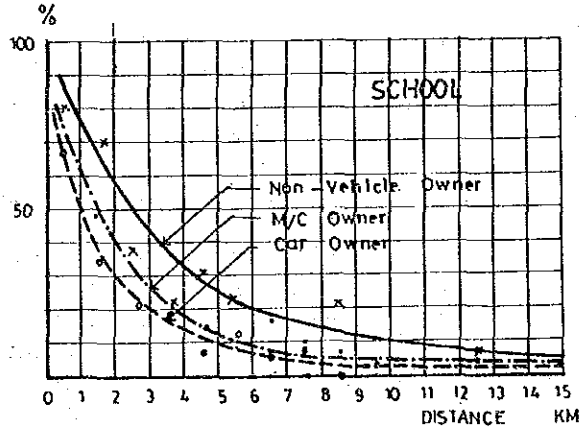
The first step is to determine the modal share of non-motorized vehicles i.e. on foot, bicycle and becak. The choice of these modes is largely depending on the trip length. Hence, the modal share of these modes is plotted with the distance of each trip by purpose.

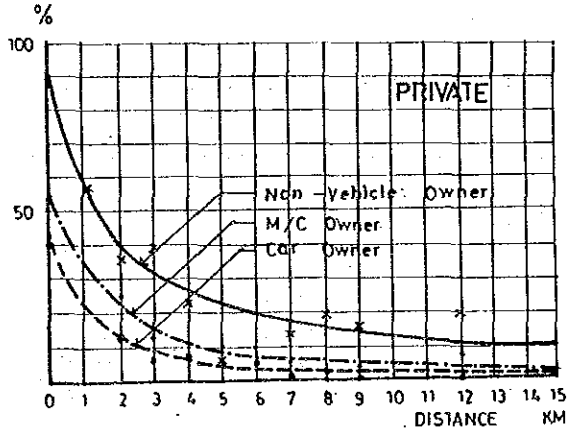
The results show a decreasing curve which sharply drops till about 4 km in distance and gradually approaches to zero according to the increase of trip length as illustrated in Fig. 4.3.4.
In any trip purposes, non-vehicle owner has a higher modal share curve compared with motorcycle or car











UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 4.3.4	Modal Split for Non-Motorized Vehicles
	JAPAN INTERNATIONAL COOPERATION AGENCY	

owners. This is because there is no choice of transport mode except bus for non-vehicle owners.

2) Modal Split for Public Transport

The second step is the modal split of public transport use among the motorized vehicle use. It is assumed that the modal share of public transport is dependent on the travel time ratio (public/private).

The travel time for public transport mode is calculated by using the distance and average travel speed of buses, taking into account the access time to the nearest bus route and waiting time for buses. The travel time for private transport mode is simply calculated by using the distance and average travel speed of automobiles.

Fig. 4.3.5 shows the modal share of public transport plotted with the travel time ratio. In any trip purposes, the curve shows a flat logistic type with upper and lower limits.

3) Modal Split for Motorcycles

As the third step, the trips of private vehicle use are further split to motorcycle use and 4-wheel vehicle (car) use. It is found from the Home Interview Survey results that the modal share of motorcycle use is almost determined by vehicle ownership and shows a constant line with regard to trip length.

Accordingly the constant modal share by vehicle ownership, which is shown in Table 4.3.8, is used for the modal split estimation.

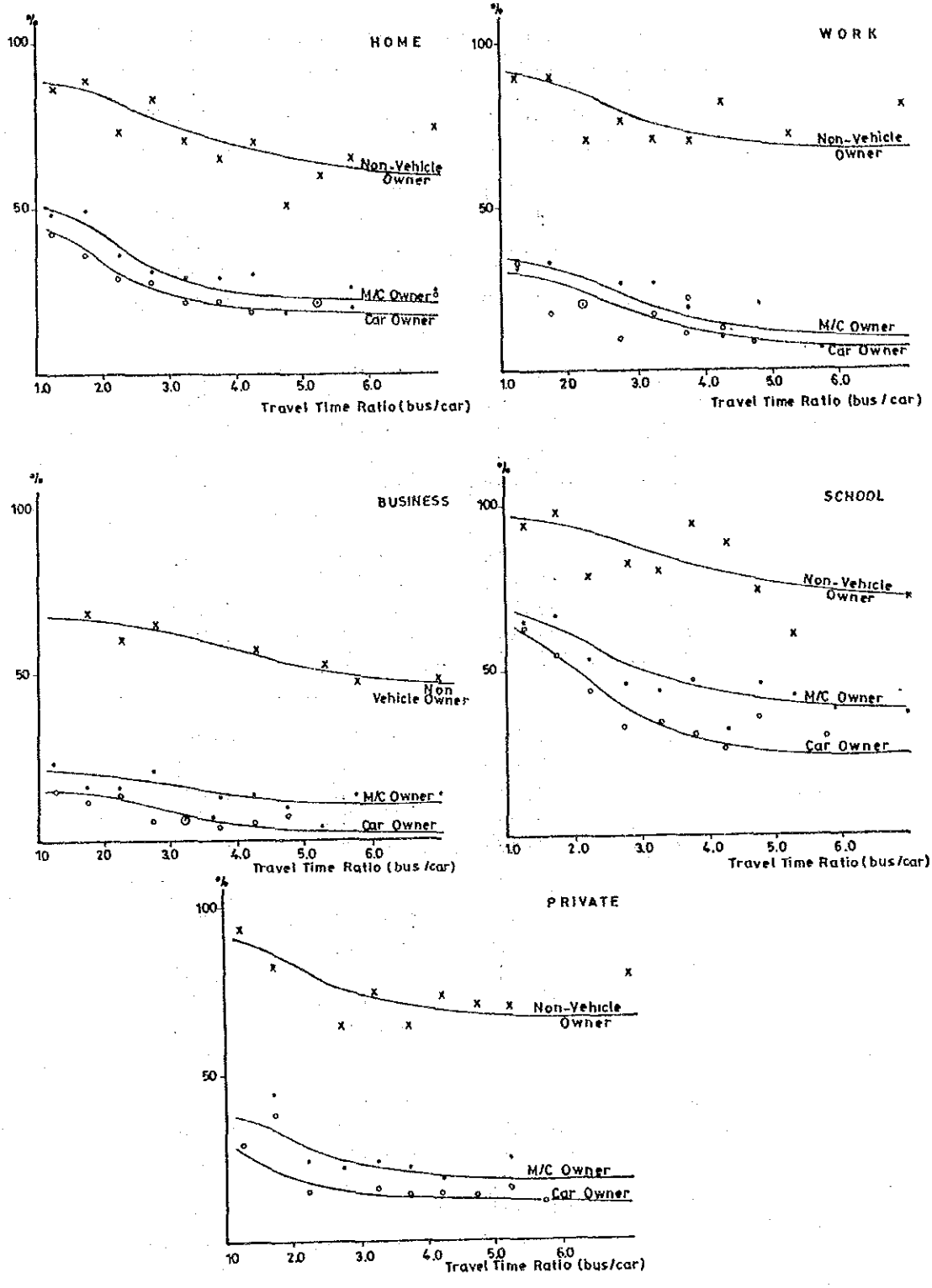
Table 4.3.8 Modal Split of Motorcycle to All Private Vehicles

Trip Purpose	Non-Owner	M/C Owner	Car Owner
Work	0.42	0.95	0.08
School	0.51	0.97	0.16
Home	0.44	0.95	0.11
Business	0.19	0.86	0.05
Private	0.41	0.94	0.10

Table 4.3.9 shows the comparison of the person trips between observed and estimated by using model. As a total, the compatibility is found to be more than 90 %.

4) Forecast of Modal Split

Table 4.3.10 shows the results of future modal split forecast.



UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 4.3.5	Modal Split Curve for Public Transport
	JAPAN INTERNATIONAL COOPERATION AGENCY	

Table 4.3.9 Test of Compatibilty of Modal Split Model

		Observed	Model	Model/Observed
Work	Walk	29,421	28,033	0.953
	Bus	51,360	51,099	0.995
	M/C	91,669	94,062	1.026
	Car	51,798	51,054	0.986
	Total	224,248	224,248	1.000
School	Walk	161,451	153,071	0.948
	Bus	108,406	109,748	1.012
	M/C	80,808	85,887	1.063
	Car	25,498	27,457	1.077
	Total	376,163	376,163	1.000
Home	Walk	328,548	309,503	0.942
	Bus	249,296	237,138	0.951
	M/C	291,533	309,710	1.062
	Car	134,201	147,227	1.097
	Total	1,003,578	1,003,578	1.000
Business	Walk	7,755	6,975	0.899
	Bus	8,605	8,792	1.022
	M/C	19,781	20,406	1.032
	Car	20,852	20,820	0.999
	Total	56,993	56,993	1.000
P. Matter	Walk	128,067	104,252	0.814
	Bus	89,916	84,362	0.938
	M/C	142,063	163,485	1.151
	Car	80,147	88,094	1.099
	Total	440,193	440,193	1.000
Total	Walk	655,242	601,834	0.919
	Bus	507,583	491,139	0.968
	M/C	625,854	673,550	1.076
	Car	312,496	334,652	1.071
	Total	2,101,175	2,101,175	1.000

If the population and income growth projected in Chapter 3 is realized, private vehicle mode share will increase from 45 % in 1988 to 59 % in 2009. On the contrary, the percentage share of other modes will decrease in the future, particularly the non-motorized vehicle share will remarkably decrease from 31 % in 1988 to 20 % in 2009.

Table 4.3.10 Forecast of Modal Split

Transport Mode	Person Trips (1000 trips/day)			Ave. Annual Growth rate (%)	
	1988	1994	2009	1988-1994	1994-2009
Walk/Bicycle/ Becak	655.2 (31.2%)	779.7 (29.2%)	874.2 (20.3%)	2.9	1.2
Motorcycle	625.9 (29.8%)	756.2 (28.4%)	973.1 (22.6%)	3.2	1.7
Car	312.5 (14.9%)	499.9 (18.8%)	1,562.1 (36.3%)	8.0	8.0
Public Transport	507.6 (24.2%)	628.6 (23.6%)	888.7 (20.7%)	3.6	2.3
T O T A L	2,101.2 (100.0%)	2,664.5 (100.0%)	4,298.1 (100.0%)	4.0	3.2

4.3.5 Company Vehicle Trips

In this study, person movement has been surveyed by Home Interview Survey, while freight vehicle movement has been obtained by Company and Government Office Survey.

Here, the movement of company vehicles which are mainly pickups and trucks is forecasted according to the procedure shown in Fig. 4.3.6.

The existing traffic demand of company vehicles can be obtained from the Company and Government Office Survey carried out in February 1988. By analyzing the relationship between traffic demand and zonal characteristics, the future growth rate by zone is projected.

On the other hand, the traffic generated from new large-scale development projects is forecasted individually. Namely, the traffic to be generated from industrial estates is estimated by referring the JICA report, "The Feasibility Study of Ujung Pandang Industrial Estate Project" 1977.

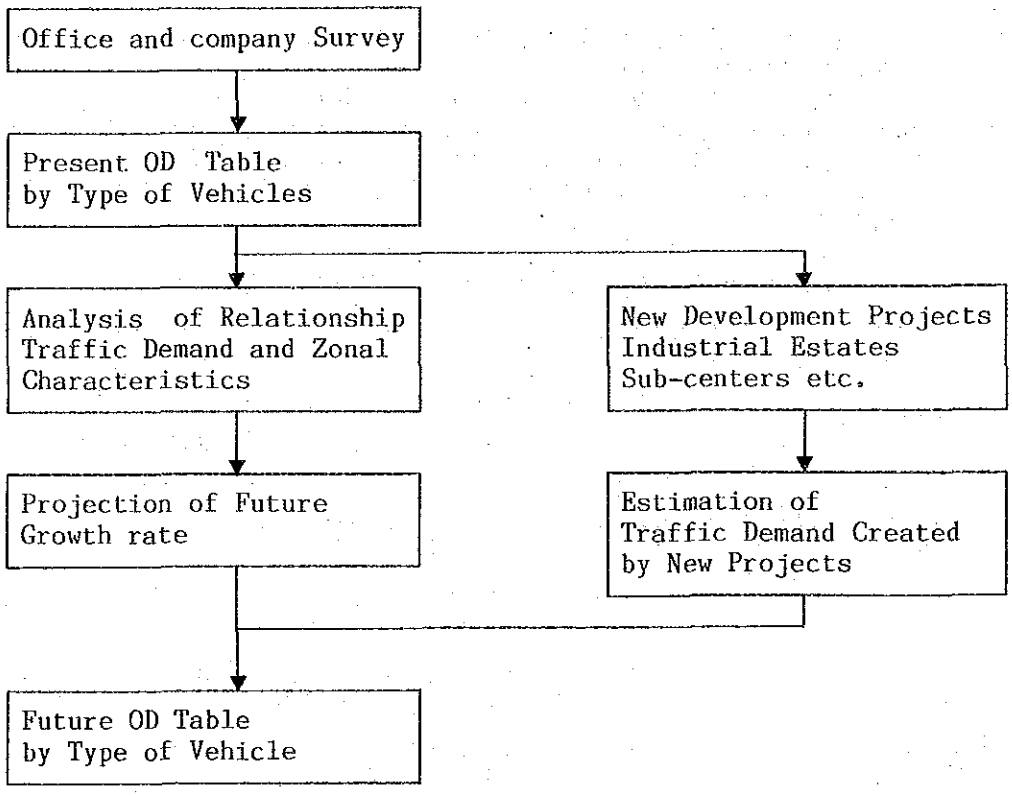


Fig. 4.3.6 Forecasting Procedure for Company Vehicle Trips

As for the sub-centers and other industrial zones, traffic generation is estimated by considering the unit generation rate per employment by industry. Finally, future OD table is obtained by summimg-up the two types of demand i.e. those related to the existing facilities and those generated from the new projects. The estimated company vehicle trips are shown in Table 4.3.11.

Table 4.3.11 Company Vehicle Trips

(veh trips/day)

	1988	1994	2004	Ave. Annual Growth ('88-'09)
Pick-up/Car	6,653	8,150	14,950	3.9 %
Truck	7,421	9,420	17,440	4.2 %
Micro-bus	1,621	1,700	2,770	2.6 %
Total	15,694	19,270	35,160	3.9 %

Source : 1) Company and Government Office Survey 1988
2) Study Team Estimates

4.3.6 External Trips

The existing external trips coming into and going out of or through the Study area is obtained from the Road Side Interview Survey at the cordon line. Those external trips contribute a minor proportion to the total traffic in the Study area i.e. only about 3 % of the total traffic in terms of person trips.

The future external traffic is estimated by assuming that the external traffic will increase in proportion to the growth of vehicle ownership and population in the corresponding direction for private and public transport modes respectively. As a result, the external traffic is forecasted as shown in Table 4.3.12.

Table 4.3.12 Future External Vehicle Traffic

(veh trips/day)

Vehicle Type	1988	1994	2009
Motorcycle	4,032	5,540	12,450
car	2,856	4,560	14,660
Pick-up/Truck	3,802	5,600	15,740
Mini bus/Bus	5,970	6,930	9,930
Total	16,660	22,630	52,780

Source : 1) Roadside Interview Survey
2) Estimated by Study Team

4.3.7 Total Vehicular Traffic

The vehicular traffic in the Study area is obtained by converting the forecasted person trips to vehicular trips combined with the company vehicle trips.

The resultant vehicular traffic flow is illustrated in Fig. 4.3.7.

The total vehicular traffic in the Study area grows 1.33 times the existing traffic in the year 1994 and 2.59 times in the year 2009 in terms of passenger car unit (p.c.u.).

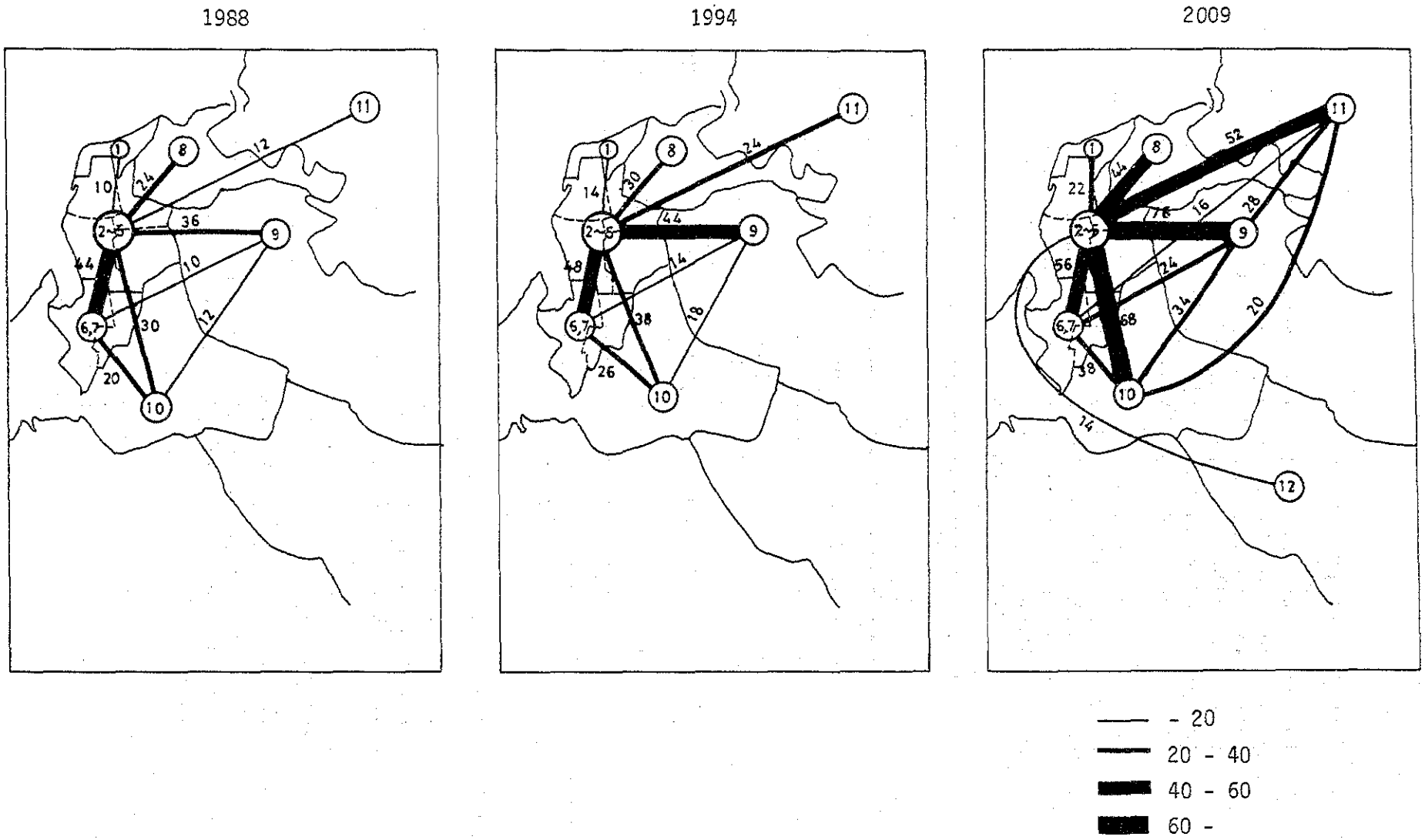


Fig. 4.3.7 Growth of Vehicular Traffic Flow

4.3.8 Traffic Assignment to the Existing Network

1) Assignment Model

In order to find the traffic conditions of roads and public transport in the future, transport demands for both private and public are assigned to the road and public transport networks respectively. Future public transport network is basically assumed to be same as the existing network, since re-organization of network could be made only after a careful study on institutional, financial and social viability.

Since the bus and pete-pete network is a part of road network, the result of bus and pete-pete traffic assigned to the corresponding network should be reflected in the total traffic capacity of road network. The traffic capacity of roads is calculated by section based on the Highway Capacity Manual.

The traffic demand of O-D pairs is divided into several lots and travel time is calculated repeatedly according to the traffic volume on a link at the every assignment of each lot. The minimum time path is searched in this way. This procedure is repeated until all the traffic demand is assigned exhaustively to the road network.

The travel time is calculated from Q - V formula, which expresses the relationship between the traffic volume and running speed on the road as shown in Fig. 4.3.8.

Q - V formula is determined by taking into account the characteristics of each section such as number of lanes, design speed, number of signalized intersections, road side conditions, etc.

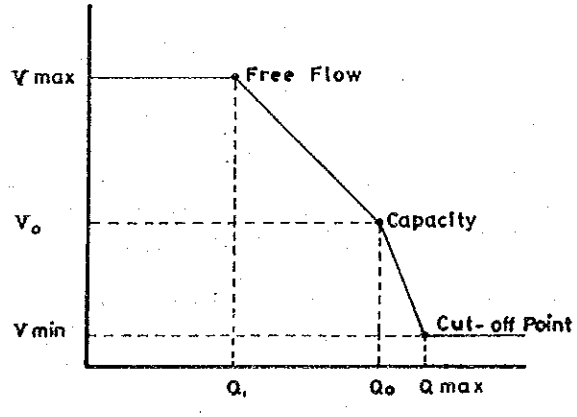


Fig. 4.3.8 Q - V Formula

2) Result of Traffic Assignment

Fig. 4.3.9 and Fig. 4.3.10 show the result of the traffic simulation of the existing condition, namely the assignment result of the present demand to the existing network. It is found that the present traffic condition is fairly well simulated except for the roads around bus terminals where more traffic mainly composed of pete-petes is actually observed.

Fig. 4.3.11 - Fig. 4.3.16 show the traffic volume/capacity ratio for the years 1988,1994 and 2009, which is estimated by assigning the traffic demand of the corresponding years to the existing road network.

In 1994, there are already many road sections where V/C ratio is exceeding 1.0, particularly the high V/C ratio is found on the arterial roads such as Jl. Gowa Jaya (Urip Sumoharjo), Jl. Sudirman, Jl. Tallo Lama, Jl. Gowa Raya (St. Alauddin), Jl. Andi Pangerang Pettarani, etc.

In the year 2009, the congested road sections are found in much wider area covering almost all the urban area. It is also noted that V/C ratio exceeding 2.0 is normally found on the arterials radially extending to the sub-urban area, where large scale development projects are expected in accordance with the future expansion of urban area. The results of traffic assignment and V/C ratio implicitly indicate the following :

a) In the axis connecting Daya including the industrial estate with the central area, the existing roads such as Jl. Gowa Jaya (Urip Sumoharjo), Jl. Toll (Prof. Dr. Ir. Sutami) and the newly built Alternative Road will not be enough in their capacity. Therefore, some measures to expand the capacity will be required.
b) Also in the axis connecting Sungguminasa with Ujung Pandang i.e. Jl. Gowa Raya (St. Alauddin) will have an excess load if the capacity is not expanded.
c) In the new urbanized area of Antang, where a main road does not exist at present, however, an adequate road network should be prepared in configuration with the new development of housing and sub-center.
d) At present, where a circumferential road does not exist outside of Jl. Andi Pangerang Pettarani, however, a necessity of it seems to exist. The high V/C ratio on the collector roads connecting Panaikang and Sungguminasa shows the need for this circumferential road.

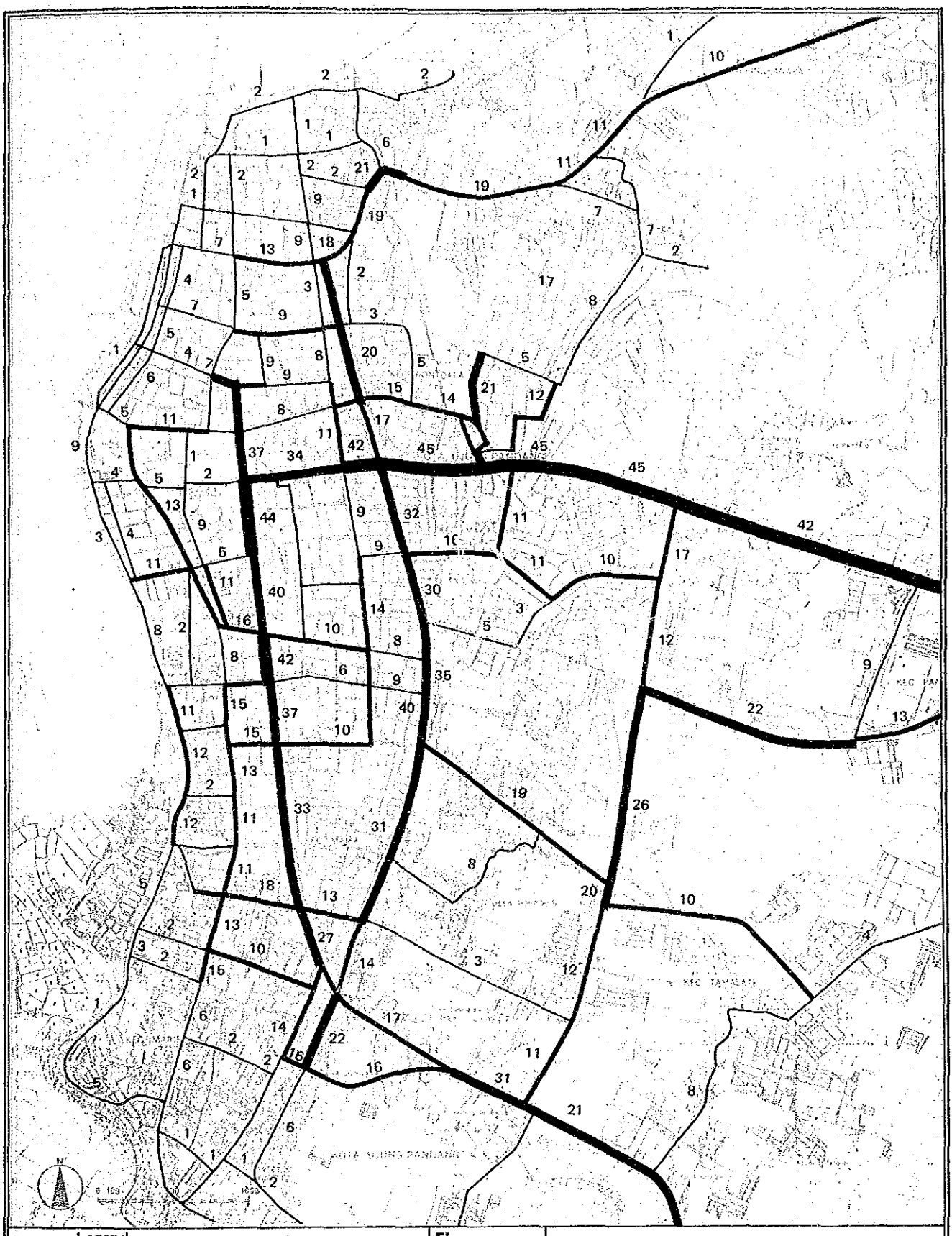


Fig. 4.3.9 Traffic Assignment to Existing Network (1988)

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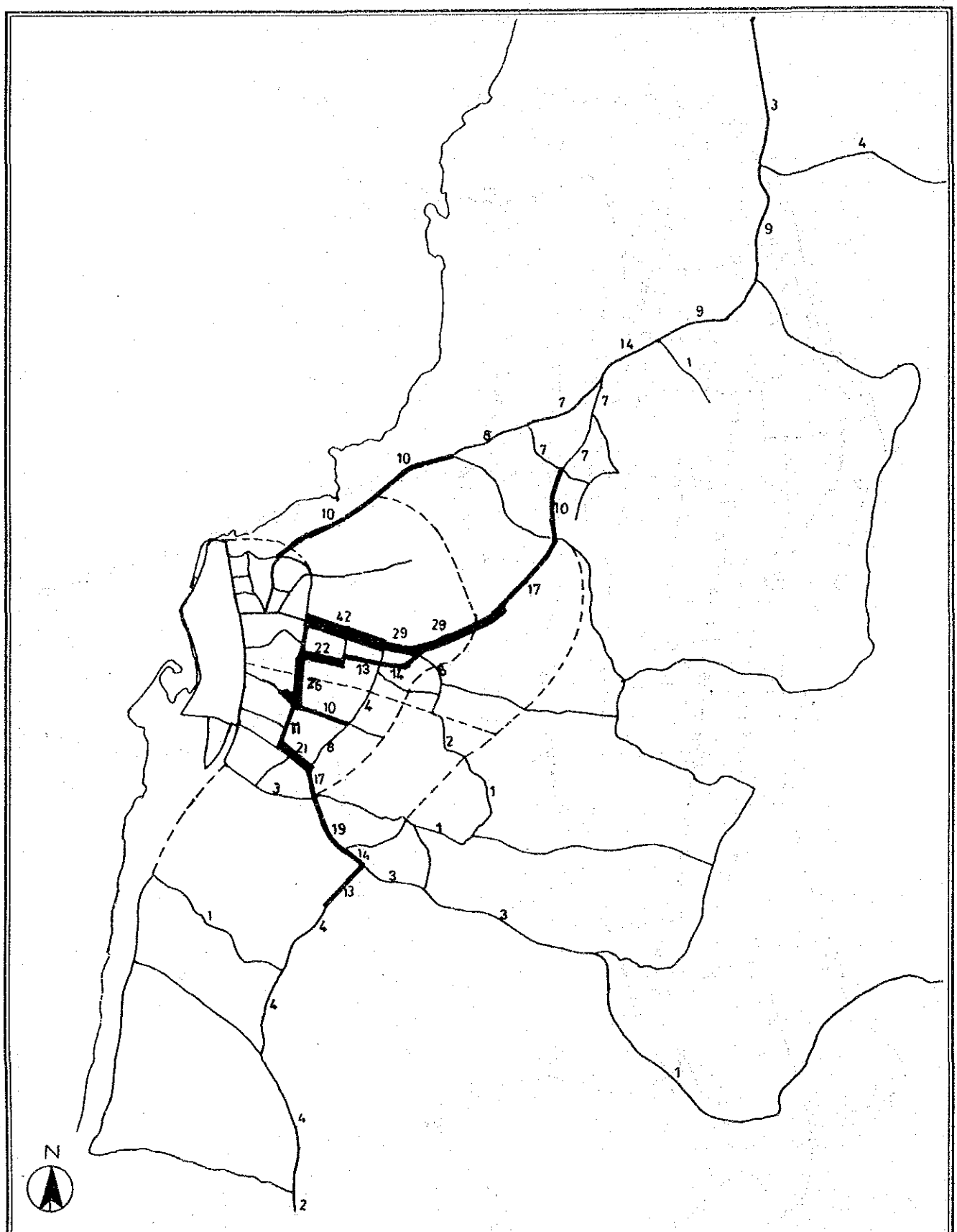

Fig. 4.3.10 Traffic Assignment to Existing Network (1988)

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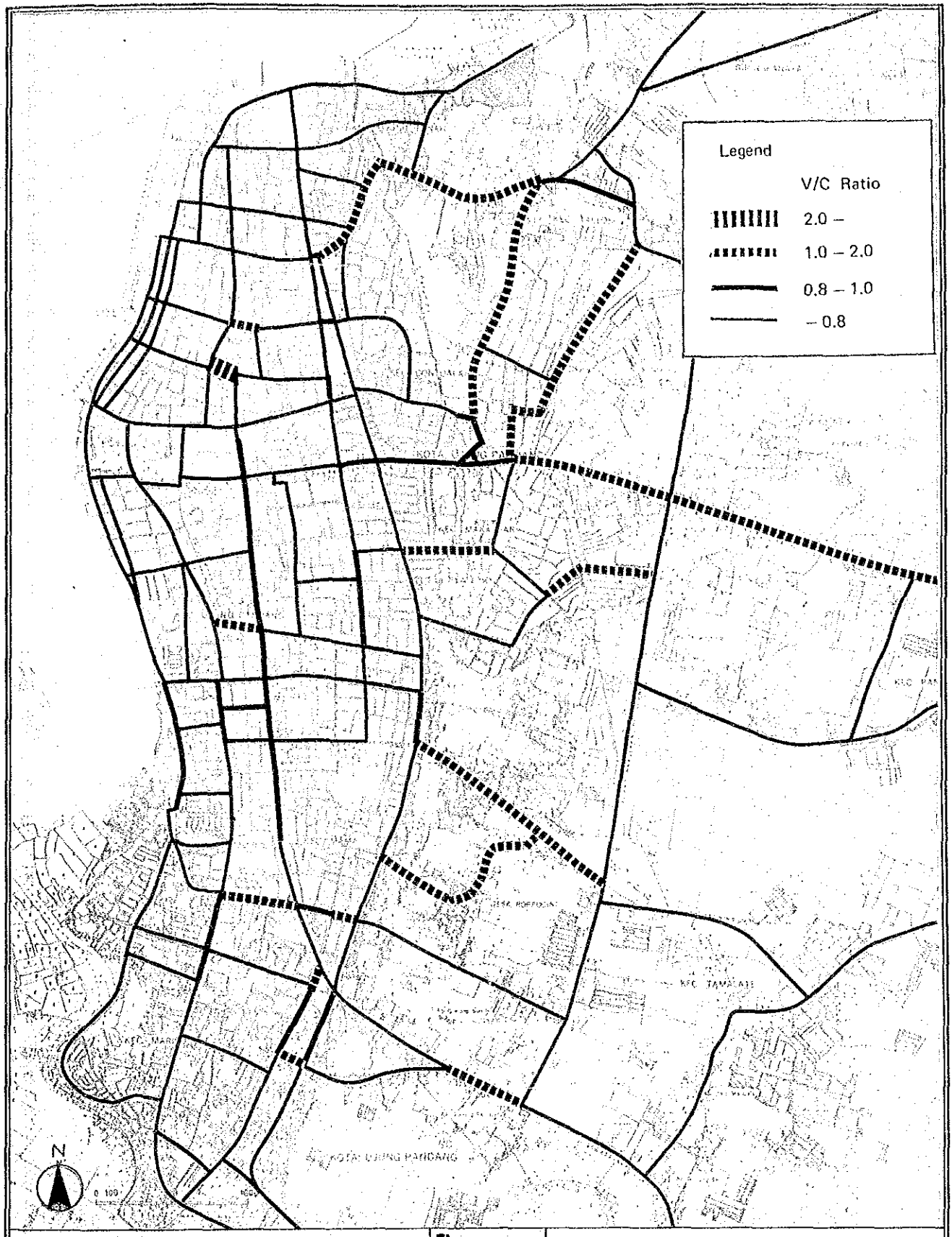
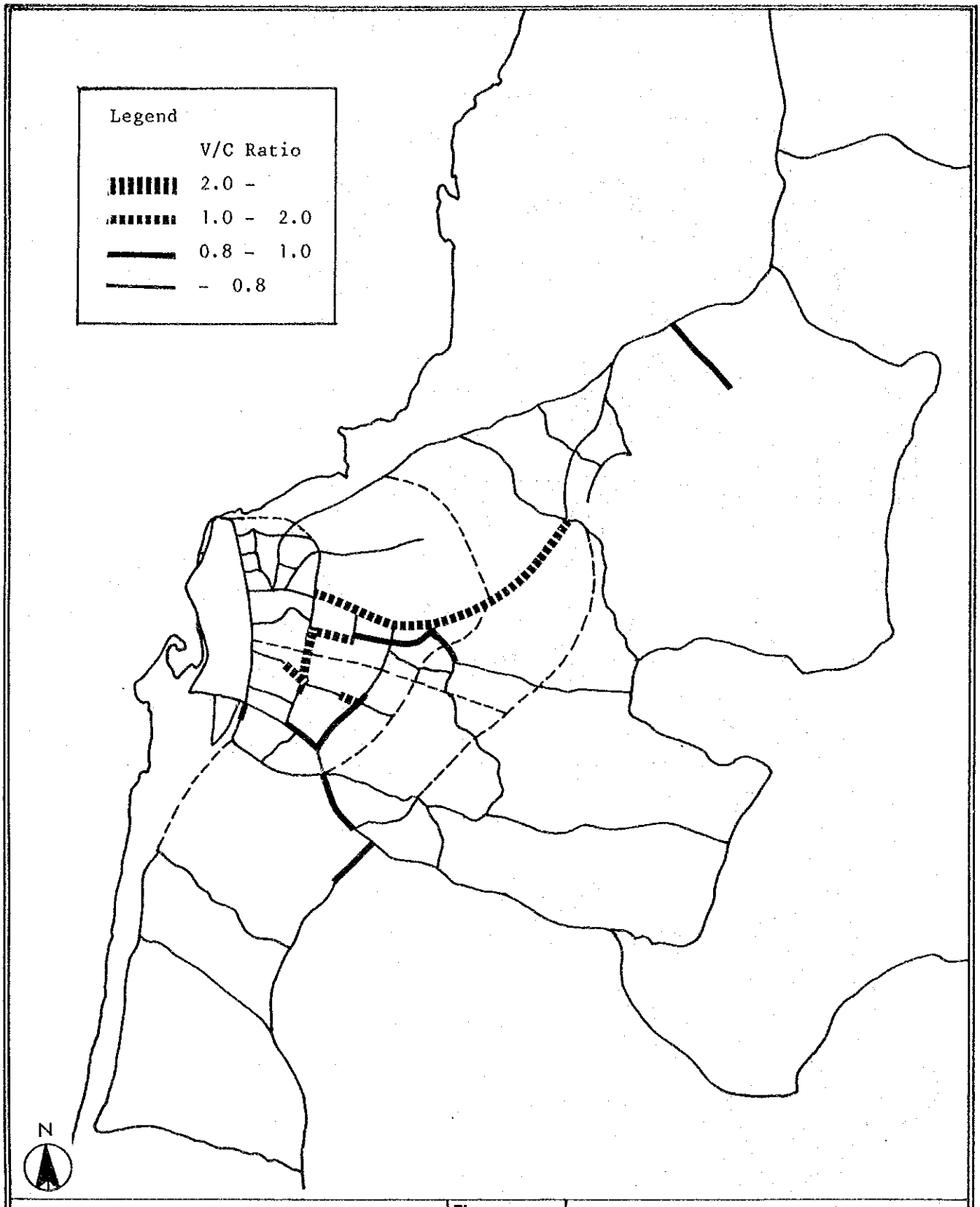


UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 4.3.11	Traffic Volume/Capacity Ratio in 1988 (Existing Network)
	JAPAN INTERNATIONAL COOPERATION AGENCY	



UJUNG PANDANG AREA
HIGHWAY DEVELOPMENT STUDY

Fig. 4.3.12

Traffic Volume / Capacity Ratio in 1988
(Existing Network)

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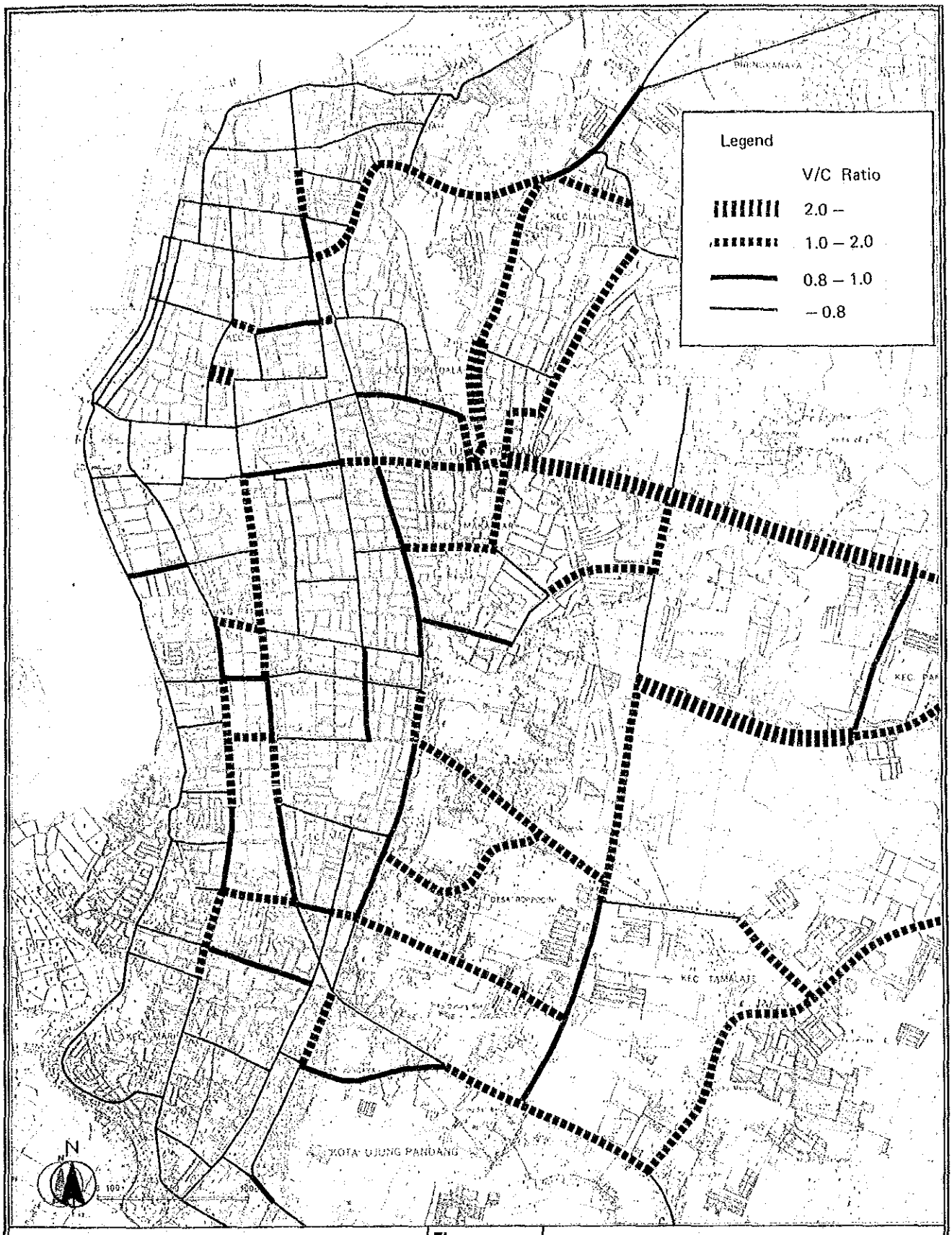
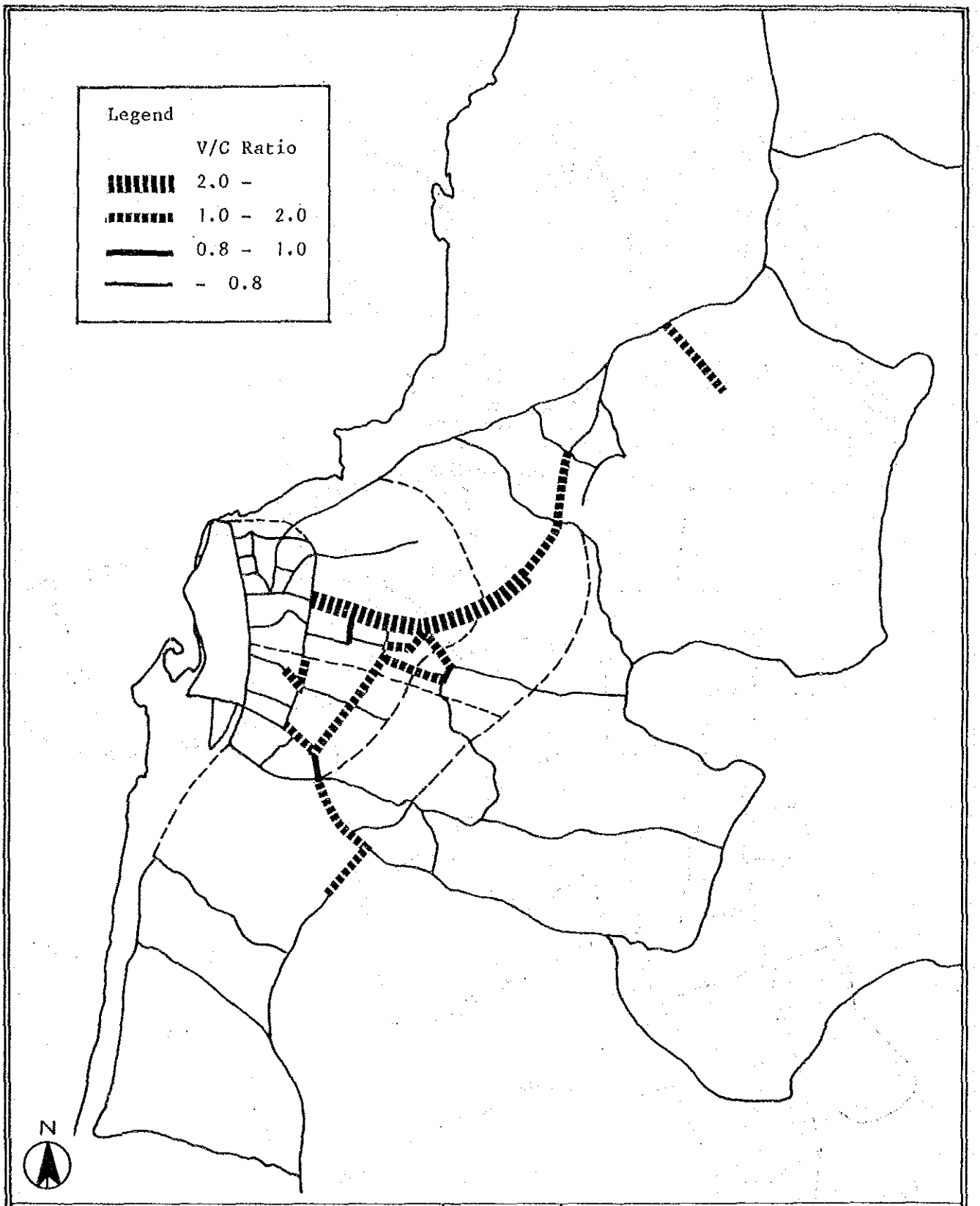


UJUNG PANDANG AREA
HIGHWAY DEVELOPMENT STUDY

Fig. 4.3.13

Traffic Volume/Capacity Ratio in 1994 (Existing Network)

JAPAN INTERNATIONAL COOPERATION AGENCY

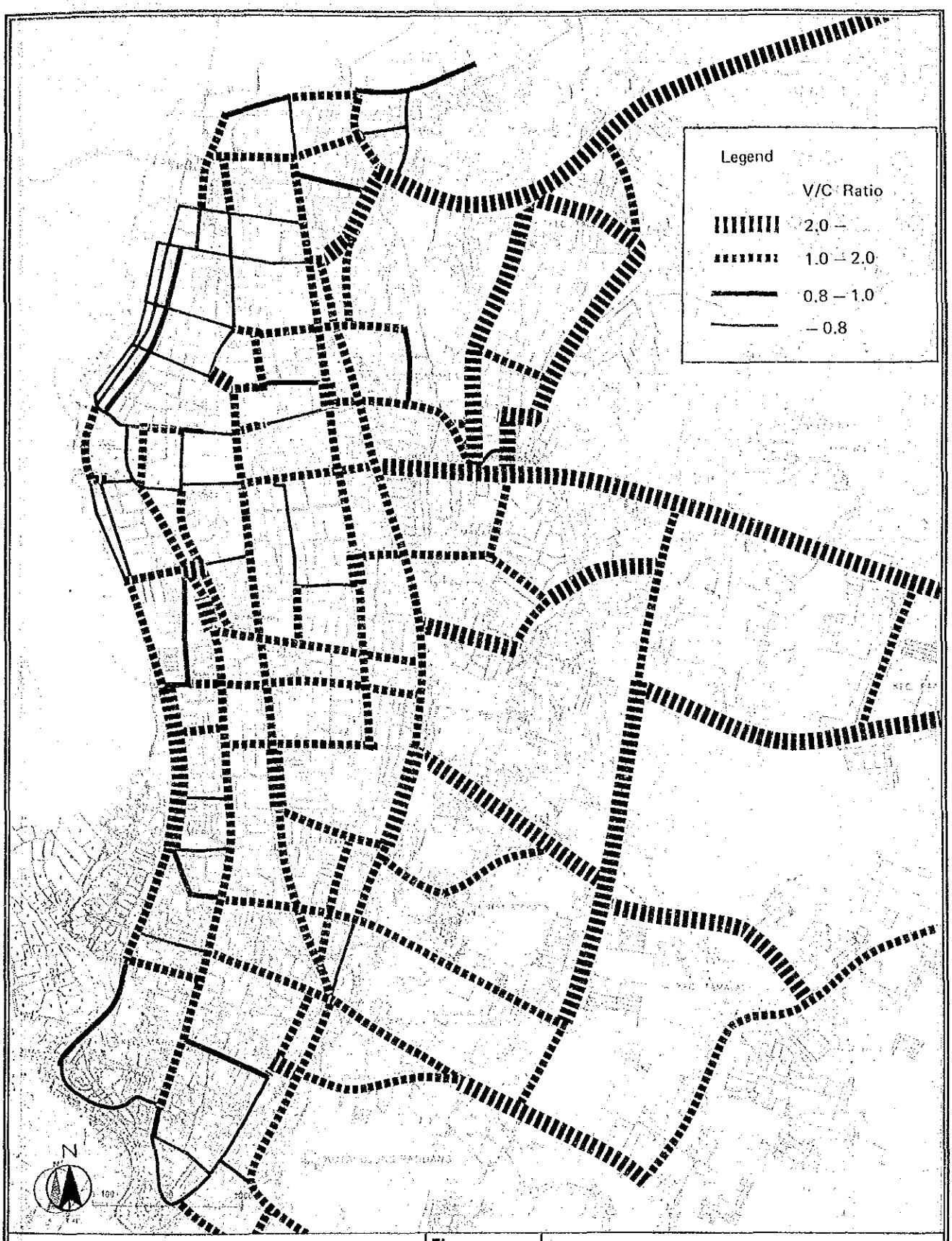


UJUNG PANDANG AREA
HIGHWAY DEVELOPMENT STUDY

Fig. 4.3.14

Traffic Volume / Capacity Ratio in 1994 (Existing Network)

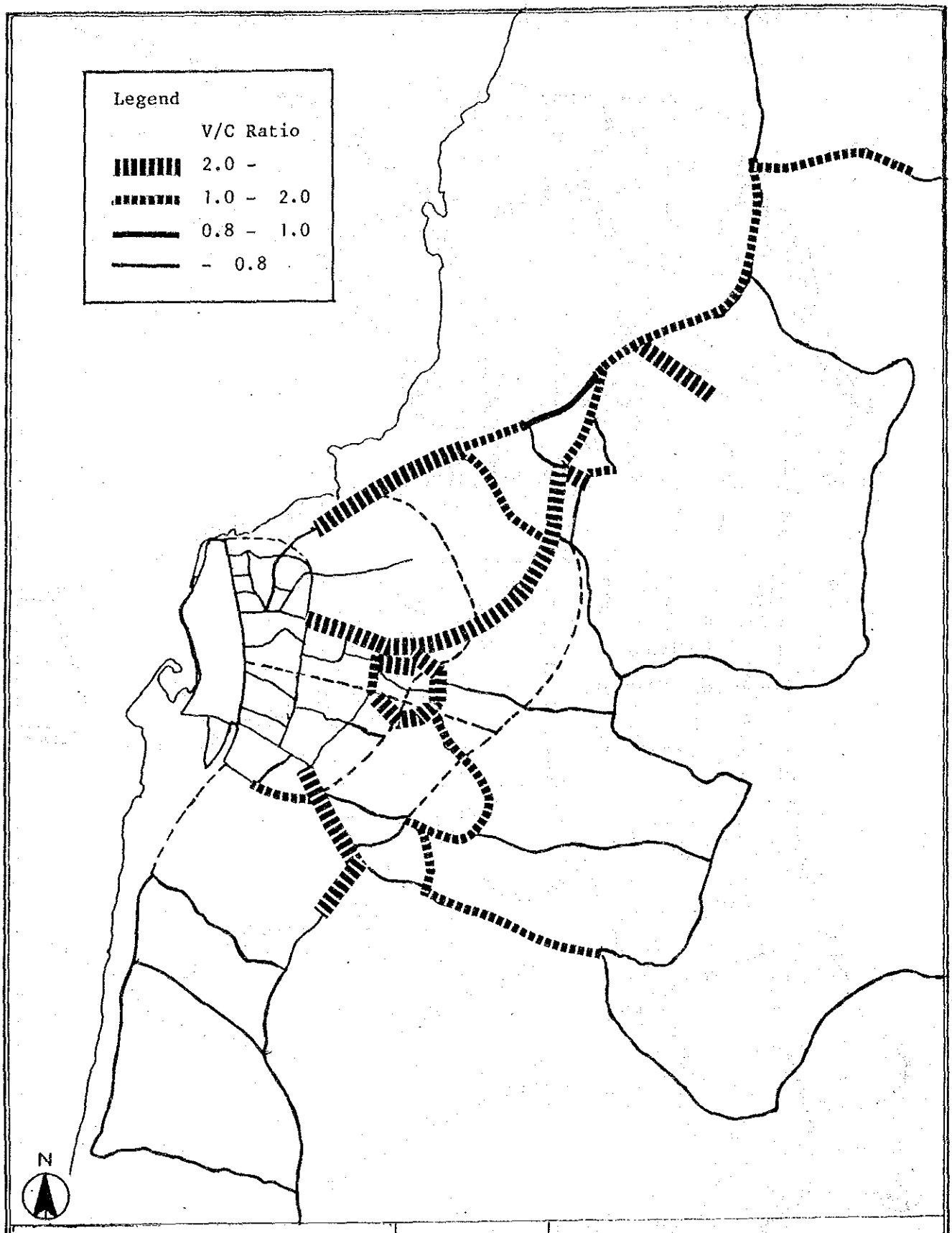
JAPAN INTERNATIONAL COOPERATION AGENCY



UJUNG PANDANG AREA
HIGHWAY DEVELOPMENT STUDY

Fig. 4.3.15 Traffic Volume/Capacity Ratio in 2009 (Existing Network)

JAPAN INTERNATIONAL COOPERATION AGENCY



UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 4.3.16	Traffic Volume / Capacity Ratio in 2009 (Existing Network)
	JAPAN INTERNATIONAL COOPERATION AGENCY	

4.3.9 Traffic Assignment to the Proposed Road Network for the Year 2009

Based on the above consideration, a future road network is formulated as will be described in Chapter 5.

The future traffic demand are assigned to the arterial road and collector road network in urbanized area, however, in suburban area, the future traffic demand are assigned to the arterial road network when the future traffic generation points of each traffic zone are set up on the arterial roads within each traffic zone. Because, there is no collector roads in suburban area.

Fig. 4.3.17 and 4.3.18 show the result of traffic assignment to the proposed road network for the year 2009. In addition, traffic assignment to the proposal road network for the year 1994 are shown in Fig. 4.3.19 and Fig. 4.3.20.

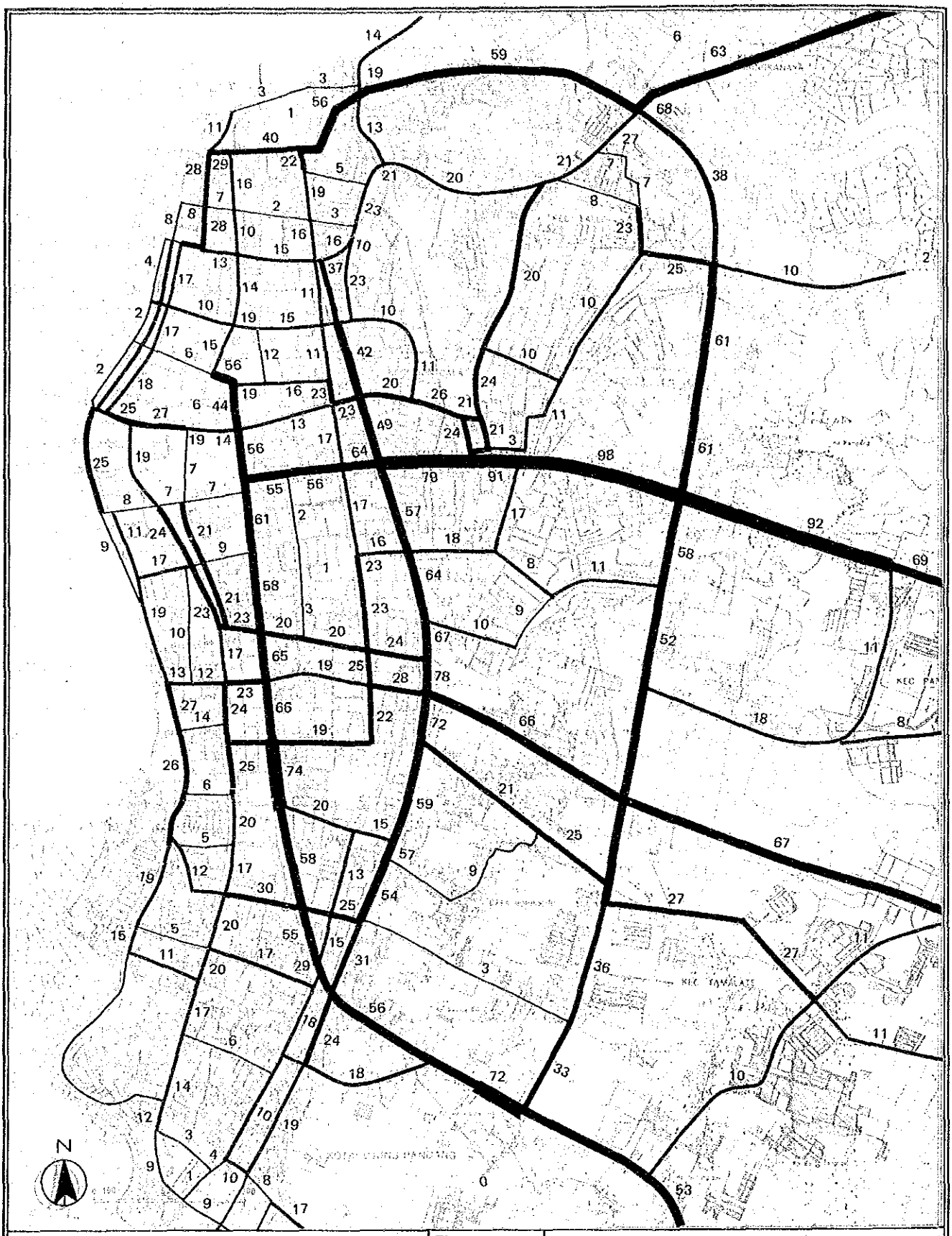
In this assignment, the bus network is expanded so as to cover the proposed new roads. The following remarks are pointed out from the result :

a) Jl. Gowa Jaya has an extremely large traffic demand, ranging from 40,000 pcu/day to 98,000 pcu/day in the section from Jl. Veteran to Industrial Estate area.

b) Jl. Prof. Dr. Sutami and Jl. Gowa Raya can also expect large traffic demand which requires 4-lanes in the section inside the Outer Ring Road.

c) All the new roads proposed in this Study will function well. In the case of the Outer Ring, the assigned volume is relatively low, however, this road might be used more effectively in accordance with the development progress of sub-centers.

d) On the main roads in the built-up area, like Jl. Veteran, Jl. Sudirman and Jl. Ratulangi, etc.,an excessive demand is expected in some sections. Since the widening of these roads is difficult, some other measures including traffic management would be necessary.



Legend

Thousand pcu/day

- — 10
- 10 — 20
- 20 — 40
- 40 — 70
- 70 —

Fig. 4.3.17

Traffic Assignment to Case F (2009)

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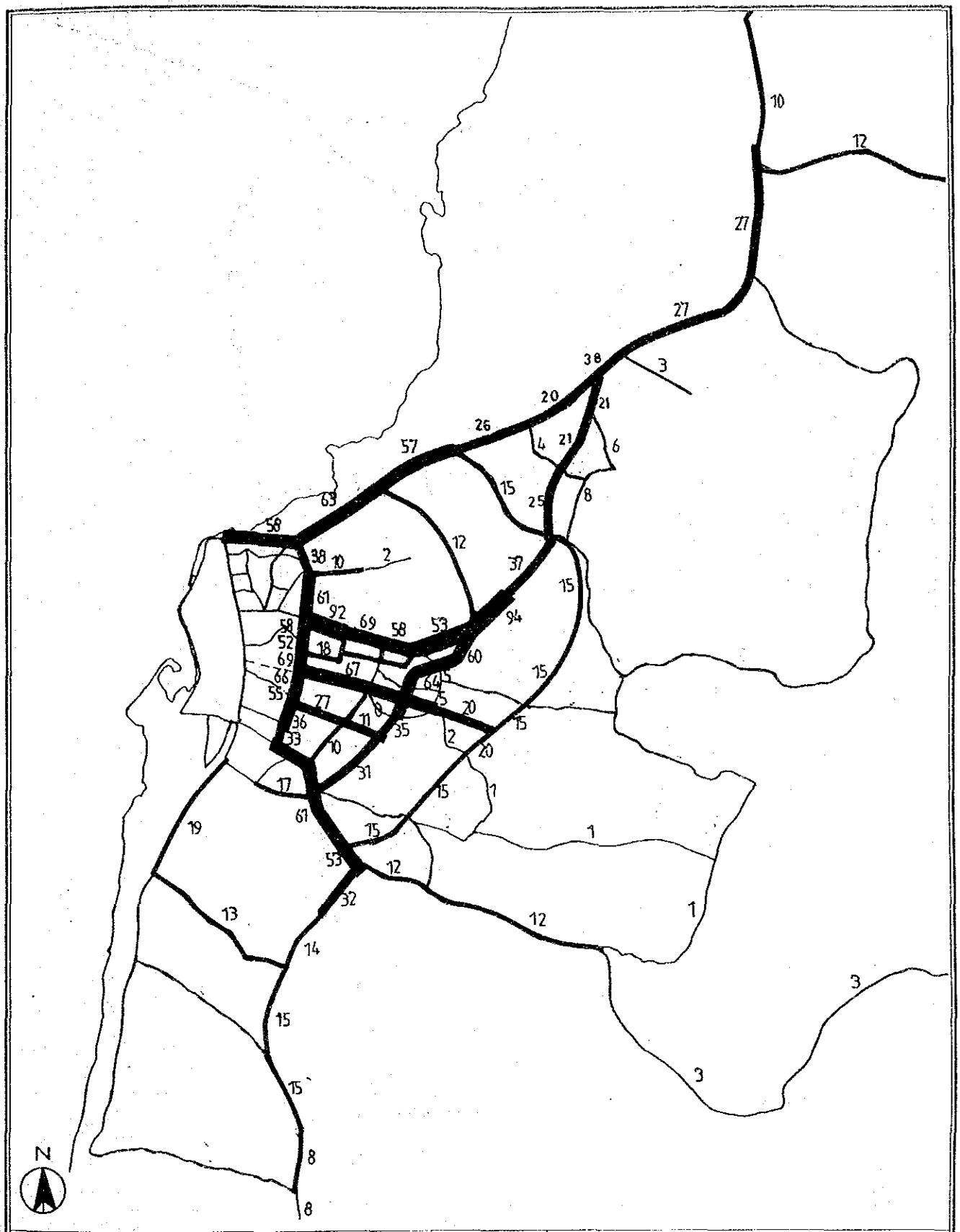


Legend

Thousand pcu/day

- 10
10 - 20
20 - 40
40 - 70
70 -

Fig. 4.3.18

Traffic Assignment to Case F (2009)

JAPAN INTERNATIONAL COOPERATION AGENCY

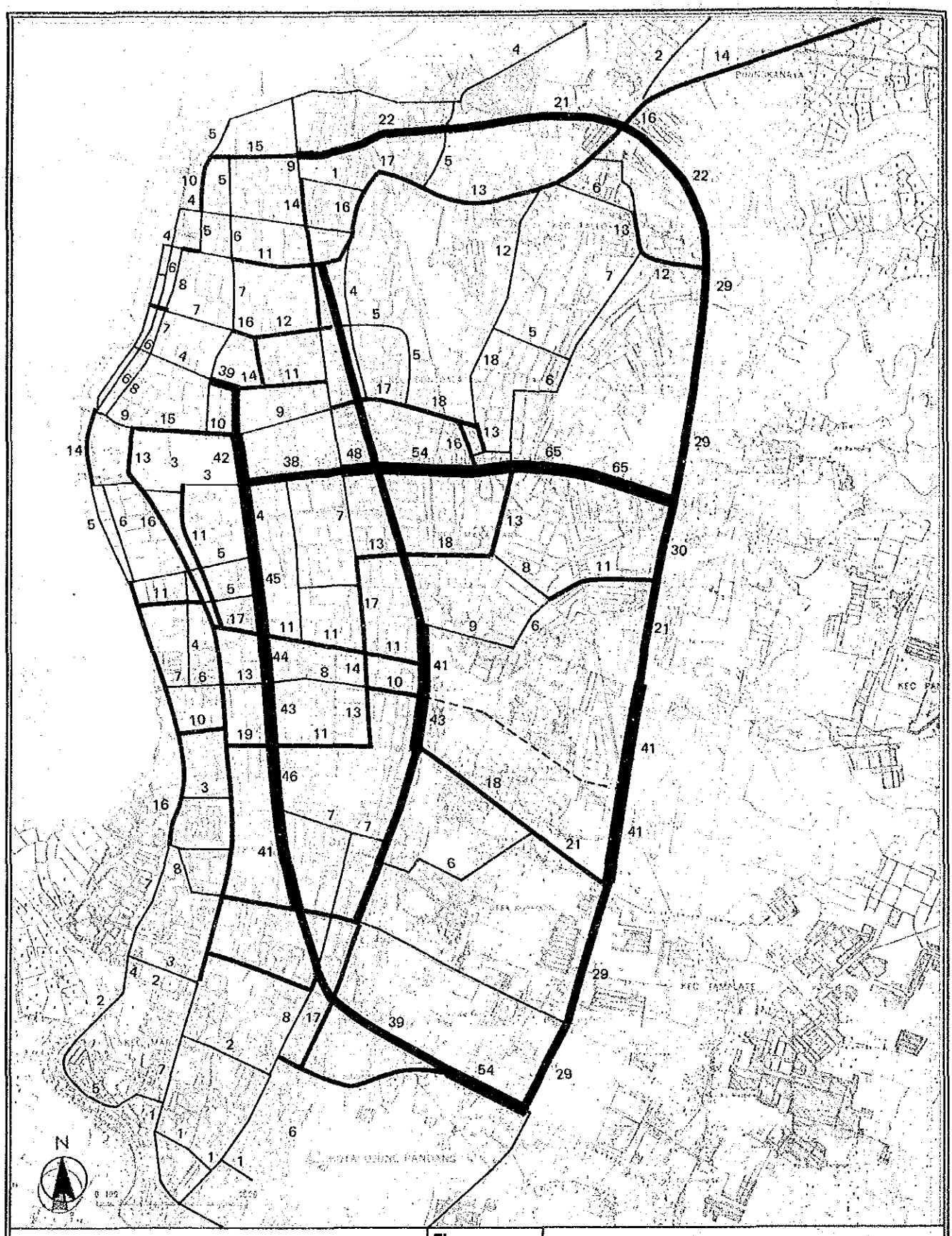
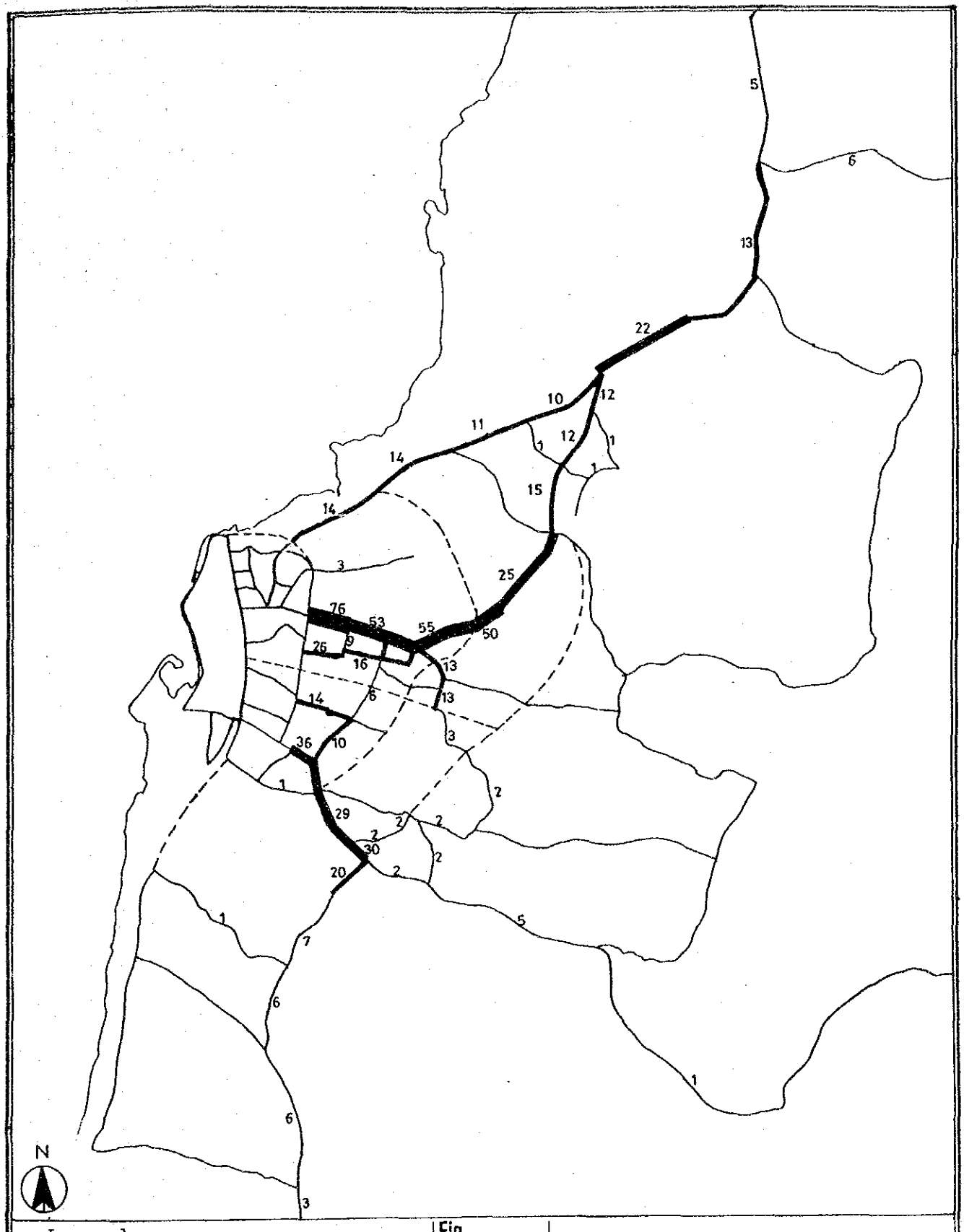


Fig. 4.3.19

Traffic Assignment to Case C (1994)

JAPAN INTERNATIONAL COOPERATION AGENCY



Legend

Thousand pcu/day

- 10
10 - 20
20 - 40
40 - 70
70 -

Fig. 4.3.20 Traffic Assignment to Case C (1994)

JAPAN INTERNATIONAL COOPERATION AGENCY

CHAPTER 5 LONG TERM PLAN

CHAPTER 5 LONG TERM PLAN

5.1 Planning Goals

5.1.1 Background

By the year 2009 the population of Ujung Pandang City will have increased to about 1.5 million and about 17,500 hectares of land will have been developed in harmonious balance with urban and sub-urban activities.

GRDP of Ujung Pandang has grown steadily during the recent 5 years from 1980 to 1985 with the growth rate of 6.2 percent per annum, and annual growth rate of future GRDP of Ujung Pandang City is expected to be ranging from 5.7 percent to 6.2 percent. This economic and population growth will result in a large increase in future transport demand to threefold of the present trip production.

Many housings have been located in urbanized area but new housing developments are already spreading to the suburban area. The traffic volume is also increasing in proportion to the housing development. As a result, Ujung Pandang is already facing some traffic problems to hinder the city urban activities which will be getting worse owing to the increasing traffic volume. For mitigation measurement of the above mentioned problems, preparation of a future plan is required.

5.1.2 Outline of the Fifth Five Year Plan Preparation Strategy

The preparation of strategy for urban road construction project outlined and specified by the Fifth Five Year Plan prepared by the Indonesian Government is as follows:

1) When the Fifth Five Year Plan Programs or Projects are identified, the following should be studied :

   a) Master Plan
   b) Project implementation program
   c) Budget arrangement
   d) Organization for implementation of the project
   e) Investment ability and re-payment schedule.

2) When the projects to be implemented during the Fifth Five Year PLan (April 1989 - March 1994) are decided, the economic feasibility and economic efficiency should be considered. In addition, the following should also be considered when the high priority projects are selected :

a) The high priority projects should be selected based on the result of comparative study between road projects and other different sector projects such as industrial and housing development projects.
b) The selected high priority projects should bring positive effect on the local economic activities and should improve the function of city within urbanized area.
c) The high priority projects should be selected taking into consideration on the utilization of existing traffic and transport facilities. In other words, the existing facilities should be used as much as possible.
d) The high priority projects should contribute to the increase of local and regional income.
e) The high priority projects should keep a good environmental conditions.

5.1.3 Planning Goals and Strategy

Taking into account the existing traffic conditions, careful examination of the Fifth Five Year Plan Preparation Strategy, future development directions and future socio-economic potentials, the Study Team identified the following planning goals for the future highway development master plan for long term and short term in the Study area :

a) To maximize the benefits of urban transport economy.
b) To maximize the utilization of existing transport facilities.
c) To maintain a high quality urban environment.
d) To provide a smooth and safe means of transport.
e) To contribute to the development of urban socio-economic activities.

In order to prepare Master Plan for solution of the urban transportation problems, following plans are examined.

a) Long Term Plan
b) Short Term Plan

The long term plan with target year 2009 is studied for road network development planning and the short term plan with target year 1994 is studied mainly for traffic management planning including improvement of existing intersections and short length urban roads, traffic regulation system and bus terminals.

The long and short term plans are examined according to the planning goals. In order to achieve the planning goals, following planning strategies are identified :

Long term planning strategy
a) To arrange systematic road network
b) To arrange functional road network
c) To arrange structural road network
d) To maintain open space

Short term planning strategy
a) To increase traffic capacity
b) To control traffic demand
c) To decrease traffic accident.

The above mentioned planning goals and strategies for long and short term plans preparation are summarized in Fig. 5.1.1.

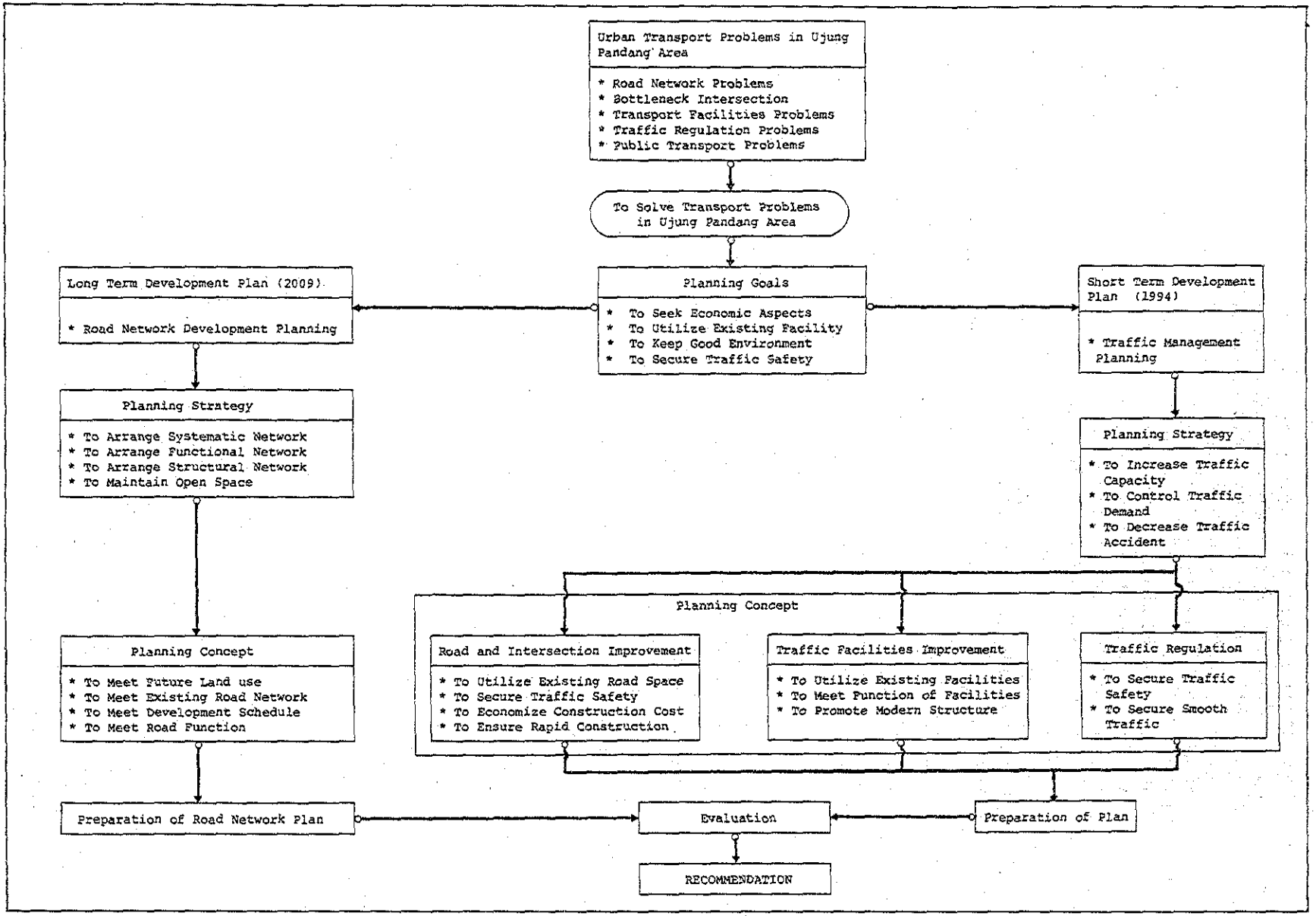


Fig. 5.1.1 Planning Guideline Conceptual Plan

5.2 Road Functional Classification

5.2.1 Comparison of the Road Functional Classification

In this Section, road functional classification of three countries that is Indonesia, Japan and United States of America are compared.

1) Indonesian Standard

Road functional classification is stipulated by the government regulation (No. 26, 1985, Yellow Book). According to the regulation, a road is divided into six (6) types of functional classification as described below.

a) Primary Arterial Road
b) Primary Collector Road
c) Primary Local Road
d) Secondary Arterial Road
e) Secondary Arterial Road
f) Secondary Arterial Road

In addition, the regulation reads as follows :

Article 3

a) The road developer shall ensure that roads can be utilized for the maximum welfare of the people, especially in stepping up national economic growth,and further ensure that vehicle operating costs are kept at minimum levels.
b) The road developer shall ensure that roads serve as an encouragement towards the objective of realizing inter-regional stability which corresponds with regional growth levels by giving due consideration to regional development units and geographical market orientation in line with the structure of regional development aimed towards development at national level.
c) In endeavoring realization of well-balanced distribution service, the road developer shall ensure that roads form a unit of the entire road network system consisting of primary road system and secondary road system sustained within the hierarchy of co-relation.

Article 4

a) The primary road system is drawn up in compliance with the stipulations on regional road planning and structure for regional road development at a national level, which link the ties of distribution services as follows :
   * To continuously link one regional development unit from fist level cities to second, third and lower

level cities down to premises.
* To link one city level to another between regional development units.

b) Primary arterial roads link first level cities located side by side, or link first cities with second level cities.
c) Primary collector roads link second level cities with similar cities, or link second level cities with third level cities.
d) Primary local roads link first level cities with premises, or link second level cities with premises, or link third level cities with similar cities, third level cities with premises or cities below the third level with premises.

Article 5

a) A secondary road system is drawn up in compliance with stipulations on city planning of a city linking zones that assume primary functions, first secondary function, second secondary function, third secondary function, and onwards up till private homes.
b) Secondary arterial roads link primary to first secondary zones , or link first secondary zones to second secondary zones.
c) Secondary collector roads link second secondary zones to similar zones, or link second secondary zones to third secondary zones.
d) Secondary local roads link the first secondary zones to residences, and link second secondary zones to residences, and third secondary zones, and so on to residences.

2) Japanese Standard

The road functional classification, cross-sectional elements, and design elements for horizontal or vertical alignment design are stipulated by the manual of road design.

According to the manual, urban road is divided into four (4) types of road functional classification, namely i) Primary arterial road ii) Secondary arterial road iii) Collector road and iv) The other roads.

The function and characteristics of the above mentioned roads are almost the same as those of Indonesian standards.

3) U.S.A. Standard

The road functional classification, cross-sectional elements and design standards are stipulated by a policy on design of urban highway and arterial street (AASHOTO).

According to AASHOTO, urban road is divided into four (4) types of road functional classification, namely i) Principal arterial street, ii) Minor arterial street iii) Collector street and iv) Local street.

The function and characteristics of these roads are almost the same as those of Indonesian Standard. Table 5.2.1 shows the above mentioned standards.

Table 5.2.1 Comparison of Road Classification

Indonesian Standard	Japanese Standard	U.S.A. (AASHOTO) Standard
1. Primary Arterial Road	1. Primary Arterial Road	1. Principal Arterial Street
2. Primary Collector Road	2. Secondary Arterial Road	2. Minor Arterial Street
3. Primary Local Road	3. Collector Road	3. Collector Street
4. Secondary Arterial Road	4. Other Road	4. Local Street
5. Secondary Collector Road		
6. Secondary Local Road		

5.2.2 Road Functional Classification to Be Adopted in the Study

As a result of the comparative study on the three countries' road functional classification , it is identified that road function and characteristics of the three countries do not differ from each other. Therefore, the road functional classification to be adopted in the study follows the Indonesian Standard.

In this study, the road network is examined on the basis of Indonesian standard classification, however, the scope of study is confined to primary and secondary arterial roads taking into account the planning stage and characteristics of the Study.

The collector and local road network system will be studied by the local government or related agencies after formulating the arterial road network system.

5.3 Road Function and Characteristics

The function and characteristics of a road have already been described in previous section. In this Section, the function and characteristics of a road are summarized.

Fig. 5.3.1 shows the road function and characteristics. According to this Figure, arterial roads are required mainly for maintaining mobility function and high road-design standards; and local roads are required mainly for maintaining land access and low road-design standards.

The main and subordinate functions assigned to the characteristics of each road is summarized in Fig. 5.3.2. According to this Figure, primary arterial road is to serve mainly for long distance trips, high capacity and high travel speed ; and local road is mainly for short distance trips , small capacity and low design speed.

Road network system arrangement is not only to contribute for development of urban activities but also to from the basic urban structures. In addition, the road network system arrangement is also to contribute a socio-economic development of the city.

	Network Characteristics				Traffic Characteristics								
	Link City to City	Form Community	within Community	Access to Housing	Trip Length			Capacity			Travel Speed		
					Long	Middle	Short	Large	Middle	Small	High	Middle	Low
Primary Arterial Road	◎	○			◎			◎			◎		
Primary Collector Road	◎	○			○	◎		○	◎		○	◎	
Primary Local Road.	◎	○				◎	○		○	◎			○
Secondary Arterial Road		◎	○			◎	○		◎	○		◎	○
Secondary Collector Road			◎	○			◎		◎	○			◎
Secondary Local Road				◎			◎			◎			◎

Note :
◎ Main Function
○ Subordinate Function

Fig. 5.3.1 Function and Characteristics of Road

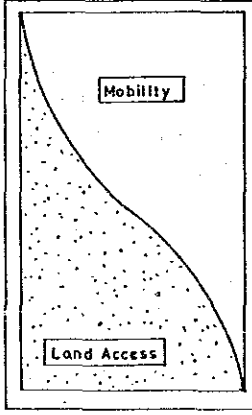
Function of Road	Characteristics of Road Traffic.					Class of Road	Remarks
	Traffic Volume	Trip Lenght	Travel Speed	Mode of Transportation	Trip Purpose		
	Heavy ↓ Low	Long ↓ Short	High ↓ Low	↑ Moter Vahicle ↓ Motor Cycle Bicycle Foot	Business to work ↓ To School Shopping a Walk	Arterial Road Collector Road Local Road Access Road	

Fig. 5.3.2 Relation of Road Function to Characteristics of Road Traffic

5.4 Road Network Planning Criteria

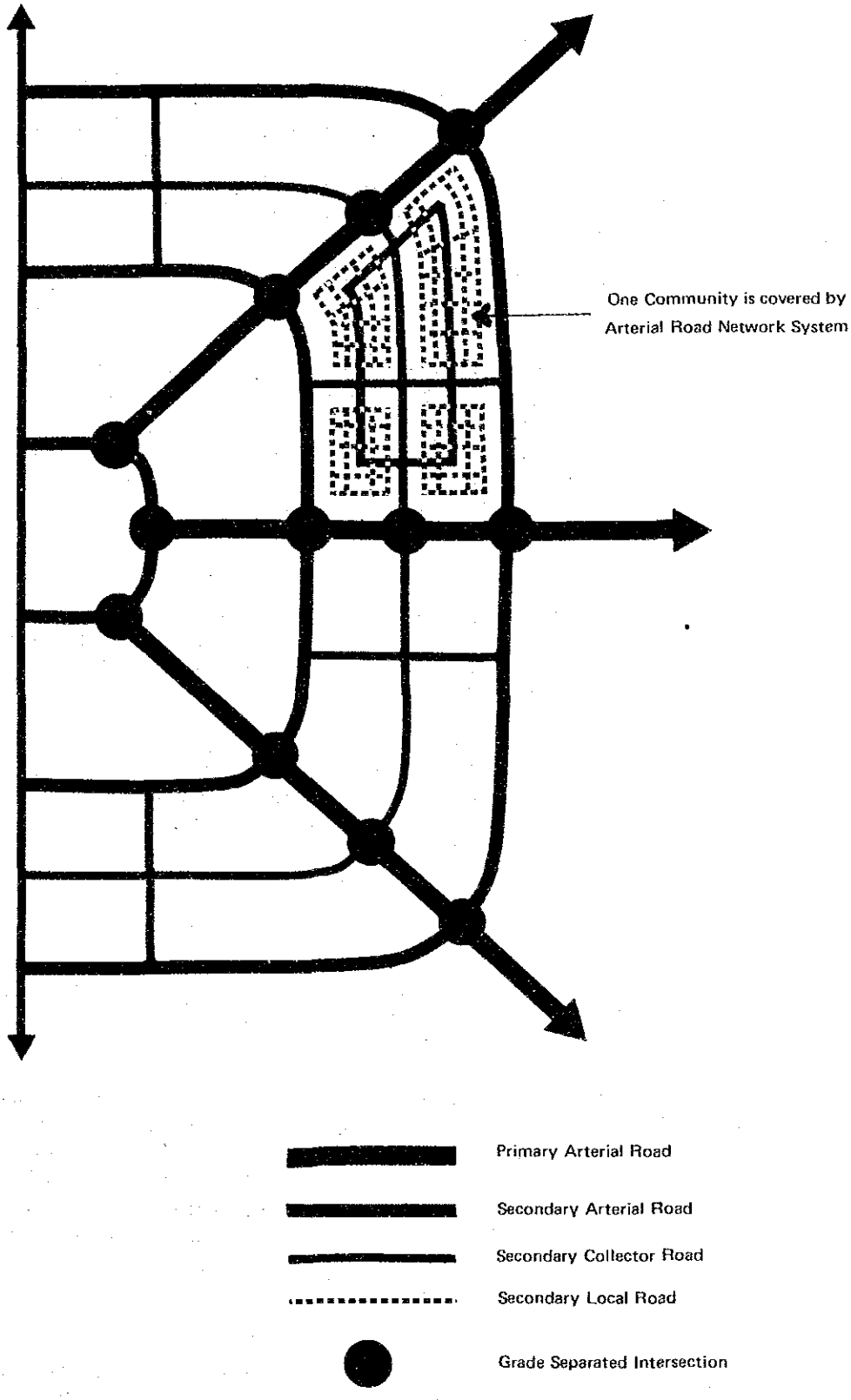
5.4.1 Road Network Connection System

It is very important to consider the road network connection system for road network development planning in order to keep a smooth and safe traffic flow and to ensure the function and characteristics of each road.

Considering the function and characteristics of each road and planning goals, road network connection system is arranged as shown in Fig. 5.4.1. The road network connection systems stipulated in Indonesian Standard are summarized below :

- Primary Arterial Road → Primary Arterial Road, Primary Collector Road, Secondary Arterial Road
- Primary Collector Road → Secondary Arterial Road, Primary Collector Road, Secondary Collector Road
- Secondary Arterial Road → Primary Arterial Road, Secondary Arterial Road, Primary Collector Road
- Secondary Collector Road → Primary Collector Road, Secondary Collector Road, Primary Local Road

From the above mentioned system, primary arterial roads must not be connected to the local roads directly. A road should be connected to the same class road or the road classified as one class higher or lower.



UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.4.1	Road Network and Criteria Configuration
	JAPAN INTERNATIONAL COOPERATION AGENCY	

5.4.2 Road Design Criteria

Taking into account the following items, road design criteria are examined for road network planning study.

a) Traffic and vehicle operating conditions
b) Road function and its characteristics
c) Planning goals
d) Natural conditions

1) Number of Lanes

Usually, the number of lanes is decided based on a comparative analysis between road capacity and planned traffic volume. However, the number of lanes adopted for primary and secondary arterial roads are at least 4-lane dual carriageway because these roads are required to have a high mobility function.

2) Width of Lane

Primary and secondary arterial roads should be maintained mainly for long distance trip vehicles i.e. trucks and buses, referring to functions and characteristics of the roads.

These roads require enough space for truck and bus traffic flows. Considering the vehicle size i.e. 2.50 m for trucks and buses and lateral clearance during vehicle running operation, the width of lane for arterial roads is decided as 3.5 meters.

3) Design Speed

Design speed of primary and secondary arterial roads are adopted to be 100 -- 80 km/hr and 80 -- 60 km/hr respectively considering functions and characteristics of these roads.

In fact, it seems to be a slightly high design speed adopted for these roads. However, it is adequate considering such factors as that the roads will be located in flat terrain and that horizontal and vertical alignment will be set up in a gentle curvature. So, the driver can easily maintain a high running speed.

4) Access Control

To ensure the traffic safety and to maintain the smooth traffic flows, full access control will be required for primary and secondary arterial roads. However, sometimes enough space can not be found for introducing the full access control system within the urbanized area. In this case, partial access control system will be introduced.

5) Parking Control

Parking restriction system is introduced on primary and secondary arterial roads in order to maintain traffic safety and smooth traffic flows on the roads.

6) Becak Control

According to the data collected from the traffic survey carried out in February 1988, the running speed of becaks driven by man power is recorded about 10 km/hr. This is quite a different running speed as compared with motor vehicles. Becak restriction system is introduced on primary and secondary arterial roads in order to maintain traffic safety and smooth traffic flows on the roads. The above mentioned road design criteria are summarized in Fig. 5.4.2.

5.4.3 Road Design Standard

Basically, the road design standard to be adopted in this study follows Indonesian Design Standard which is prepared by BINA MARGA. According to this standard, road type and class are stipulated below, and cross-sectional elements and alignment design factor are presented in Table 5.4.1 and Table 5.4.2 respectively.

1) Type I

a) Class I : The highest standard road to serve inter-region or inter-city high speed traffic with full access control

b) Class II : The high standard road to serve inter-region or intra-metropolitan city high speed traffic with full access control.

2) Type II

a) Class I : The highest standard streets of 4 or more lanes to serve inter-city or intra-city high speed, through traffic with partial access control.

b) Class II : The high standard streets of 2 or more lanes to serve inter/intra-city (intra-district) high speed,mainly through traffic with/without partial access control.

c) Class III : The intermediate standard streets of 2 lanes or more to serve intra-district moderate speed, through or access traffic without access control.

d) Class IV : The low standard streets of 1 traveled way to serve as the access to the road side land lots.

Road Class	Number of Lanes (M)	Widt of Lane (M)	Design Speed (Km/H)	Access Control	Parking Restrain	Construction of Median	Construction of Side Walk	Becak Restrain	Connected Road
Primary Arterial Road	> 4 =	> 3.5 =	100-80	Full & Partial	Full	Full	Full & Partial	Full	Arterial
Primary Collector Road	> 2 =	> 3.0 =	80-60	Non	Non	Partial	Partial	Partial	Arterial Collector
Primary Local Road	> 1 =	> 3.0 =	40-30	Non	Non	Non	Non	Non	Collector Local
Secondary Arterial Road	> 4 =	> 3.5 =	60-40	Partial	Partial	Partial	Full	Full	Arterial Collector
Secondary Collector Road	> 2 =	> 3.0 =	40-30	Non	Non	Non	Partial	Non	Collector Local
Secondary Local Road	> 1 =	> 3.0 =	30-20	Non	Non	Non	Non	Non	Local

Fig. 5.4.2 Criteria of Road Function

Table 5.4.1 Cross-section Elements

Sign Classification	Freeway (Type I)											
	Class I	Class II	Class I			Class II			Class III		Class IV	
Functional Classification	P.A	S.A	P.A	P.C	S.A	P.C	S.A	S.C	S.C	S.L	S.L	
DIV (p.c.u)	—	—	—	>10,000	>20,000	<10,000	<20,000	<6,000	<8,000	<500	<500	
Design Speed (Km/h)	100/80	80/60	60			60/50			40/30		30/20	
Traveled way width (m)	2n x 3.5	2n x 3.5	2n x 3.5 2 x 3.25			2n x 3.25			2n x 3.25, 3.0 2 x 3.25, 3.0		4.0	
Median Width (m)	2.5	2.0	2.0			2.0			1.5			
Min. Leaf Shoulder width (m)	2.0	2.0	2.0(0.5)			2.0(0.5)			2.0(0.5)		0.5	
Min. Right shoulder width (m)	1.0	0.75	0.5			0.5			0.5		0.5	
Parking Lane			2.5(2.0)			2.5(2.0)			2.5(2.0)			
Min. plated strip width (m)			2.0(1.5)			2.0(1.5)			2.0(1.5)		2.0(1.5)	
Min. outer separation width (m)			1.5			1.5			1.5			
Marginal strip width of outer separation			0.25			0.25			0.25			
Min. Sidewalk width (m)			3.0(1.5)			3.0(1.5)			1.5(1.0)			
Min. Bicycle way width (m)			2.0(1.5)			2.0(1.5)						
Min. Bicycle pedestrian way width (m)			3.5(3.0)			3.5(3.0)			2.5(2.0)			
Max. super elevation	10%	10%	6%			6%			6%		6%	
Cross - slope	2.0(1.5)%	2.0(1.5)%	2%			2%			2%		2%(3-5)	

Note P.A: Primary Arterial Road
S.A: Secondary Arterial Road
P.C: Primary Collector Road
S.C: Secondary Collector Road
P.L: Primary Local Road
S.L: Secondary Local Road

Table 5.4.2 Minimum (Maximum) Value of Alignment Design Factors

Design Speed (Km/h)	Stopping Sight Distance (m)	Passing sight distance (m)	Min. Radius for curve (m)			Min. Radius not requiring superelevation (m)	Min. Radius not requieing transition section (m)	Min. Length of transition section (m)	Max. grade (%)	Min. Vertical curve radius	
			e=10%	e=6%	e=-2%					Crest	Sag
100	160	-	380	460	-	5,500	1,500	85	3	6,500	3,000
80	110	550	230	280	-	3,500	1,000	70	4	3,000	2,000
60	75	350	120	150	220	2,000	600	50	5	1,400	1,000
50	55	250	80	100	150	1,300	400	40	6	800	700
40	40	200	-	60	100	800	250	35	7	450	450
30	30	150	-	30	55	500	150	25	8	250	250
20	20	100	-	15	25	200	60	20	9	100	100

5.4.4 Typical Cross Section

Based on road functions and characteristics, road network planning criteria and design standards, the typical cross section elements are examined.

1) Primary Arterial Road

Basic considerations of cross-section design are as follows :

a) Within Residential Area

* Becak traffic is restricted to pass this road.
* Parking is restricted on this road.
* 3.5 meters one lane width is adopted.
* 2.0 meters shoulder width on both sides are adopted for keeping traffic safety and lateral clearance. This space is also used for motorcycles.
* 10.0 meters median strip width is adopted. This space includes U turn lane and median strip opening width and is also used for road widening in the future.
* 11.0 meters side-walk width on both sides are adopted. This is used for pedestrian path, and buffer zone which keeps a good environmental conditions for residential area.

b) Within Commercial Area

* Becak traffic is restricted to pass this road.
* Short time parkings for loading and un-loading of goods are allowed on this road.
* 3.5 meters one lane width is adopted.
* 2.5 meters parking space width on both sides is adopted.
* 10.0 meters median strip width is adopted. This space includes U turn lane width and median strip opening width and is used for road widening in the future.
* 5.5 meters side walk width on both sides is adopted. These spaces are used as pedestrian path as well as for keeping a good environmental conditions especially by greenery.

2) Secondary Arterial Road

a) Within Residential Area

* Becak traffic is restricted to pass this road.
* Parking is also restricted on this road.
* 3.5 meters one lane width is adopted.
* 2.0 meters median strip width is adopted. U turning traffic is restricted on this road.

* 2.0 meters shoulder width on both sides is adopted. These spaces are used as motorcycle lane as well as for keeping the lateral clearance.
* 10.0 meters side walk on both sides is adopted to be used as pedestrian path and for keeping a good environmental conditions especially by greenery.

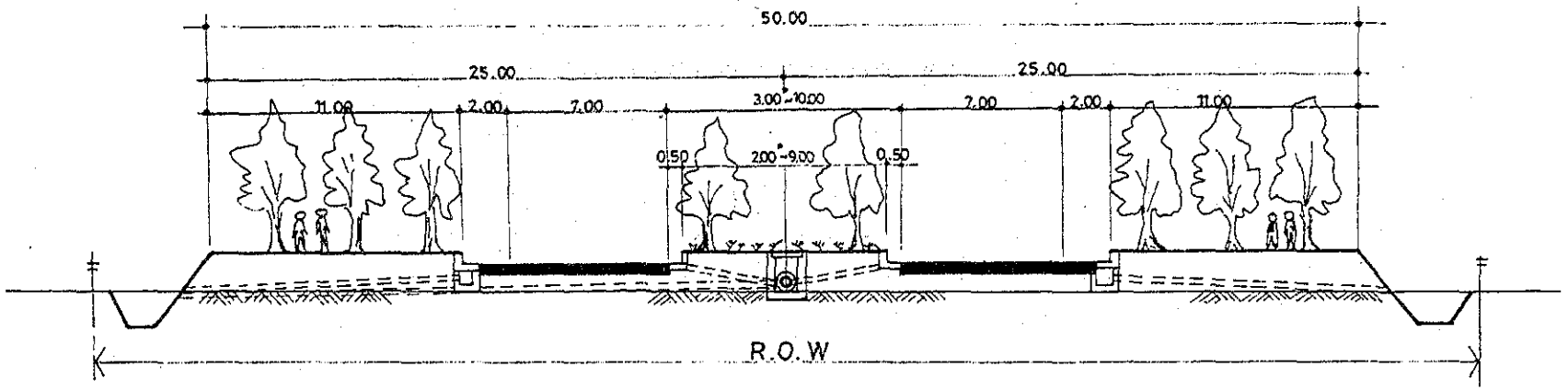
b) Within Commercial Area

* Becak traffic is restricted to pass this road.
* Short time parkings for loading and un-loading of goods are allowed on this road.
* 3.5 meters one lane width is adopted.
* 2.5 meters short time parking space width on both sides is adopted.
* 2.0 meters median strip width is adopted.
  U turning traffic is restricted on this road.
* 4.5 meters side walk width on both sides is adopted.
  These area are used for pedestrian path and for keeping a good environmental conditions (plantation).

The above mentioned typical cross-sections are summarized in Fig. 5.4.3 and Fig. 5.4.4, and for reference, typical cross-sections of the collector roads are also illustrated in Fig. 5.4.5 and Fig. 5.4.6. These typical cross-sections are adopted for new-road construction and the cross-sections for the existing road improvement are identified depend on the existing road conditions.

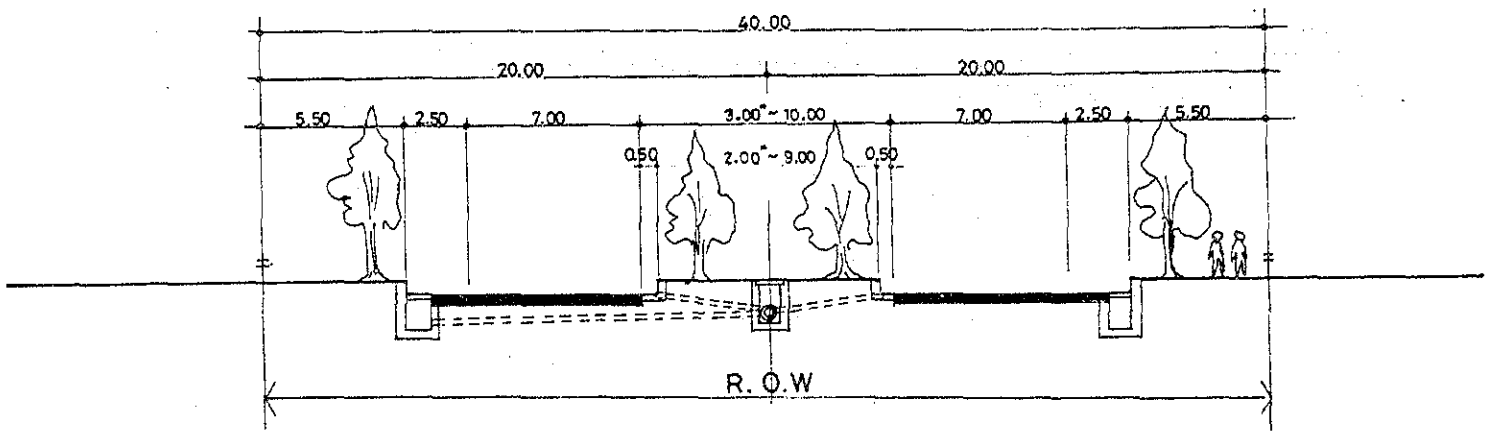
PRIMARY ARTERIAL ROAD

1. Residential Area.



* For Expansion

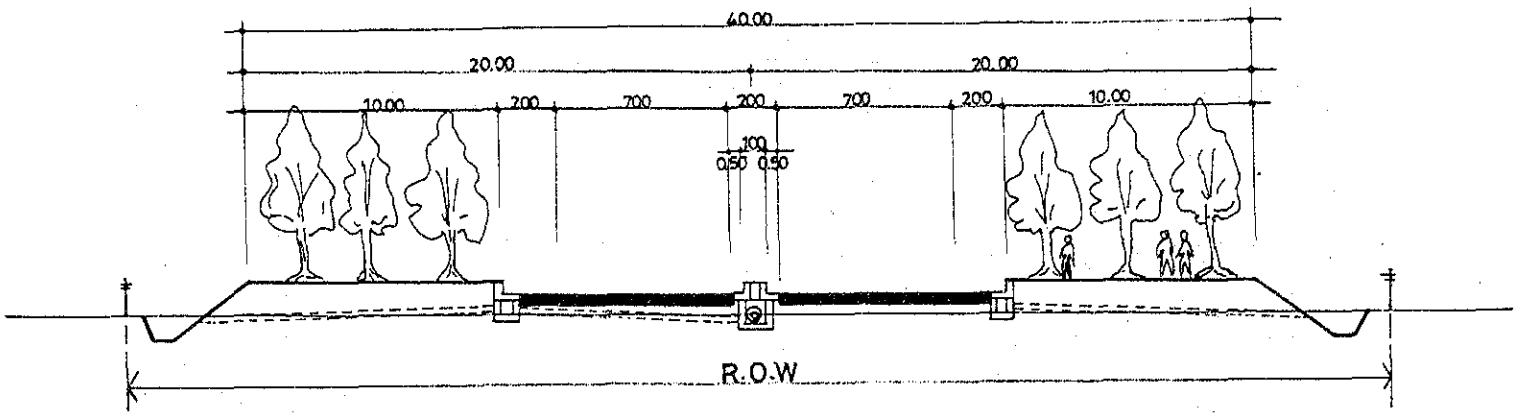
2. Comercial Area



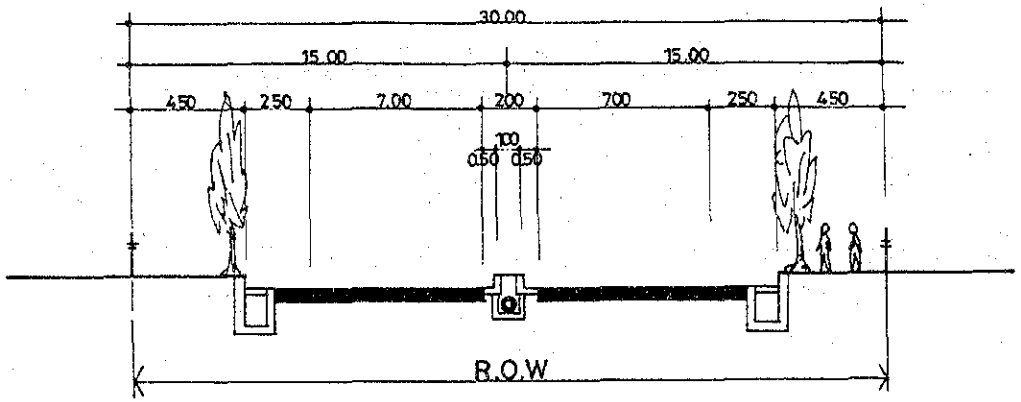
UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.4.3	Typical Cross-Section for Primary Arterial Road
		JAPAN INTERNATIONAL COOPERATION AGENCY

SECONDARY ARTERIAL ROAD

1. Residetial Area



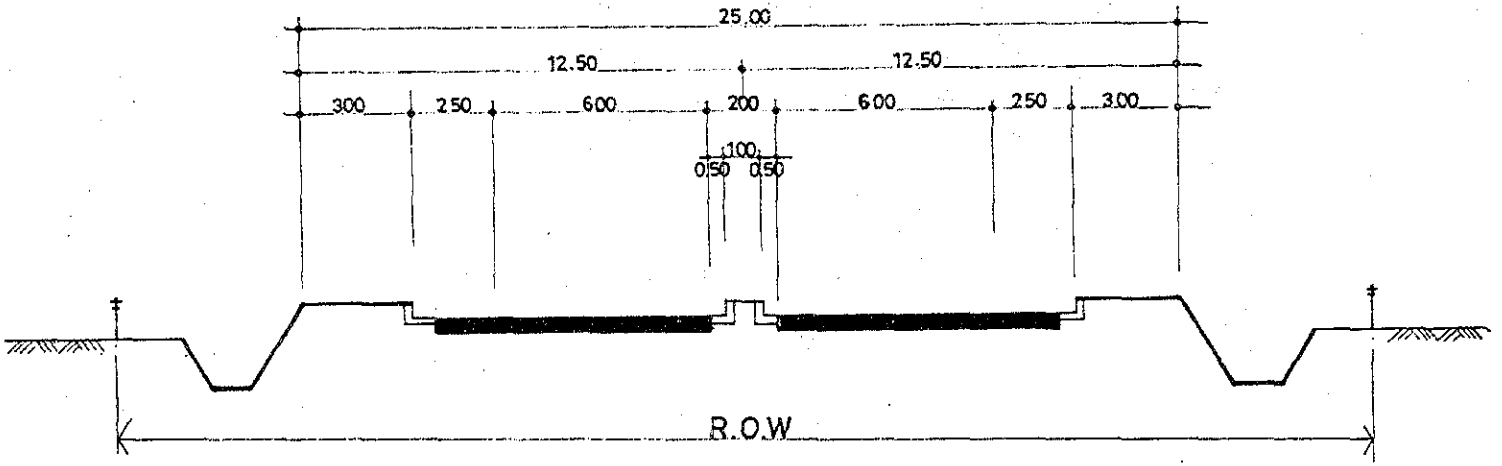
2. Comercial Area



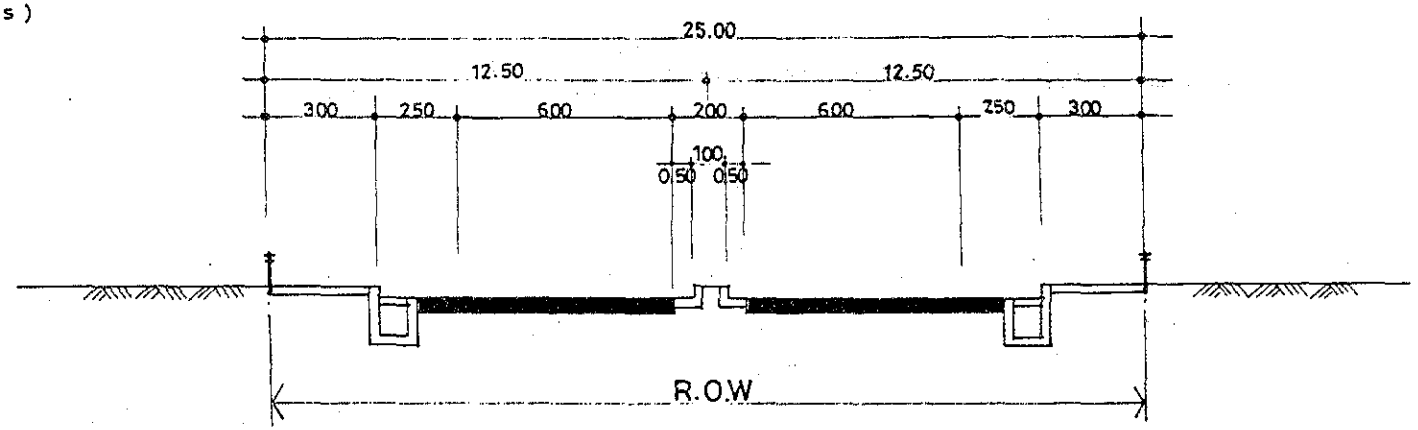
UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.4.4	Typical Cross-Section for Secondary Arterial Road JAPAN INTERNATIONAL COOPERATION AGENCY

COLLECTOR ROAD (For Reference)

1. Residential Area
(4 - Lanes)



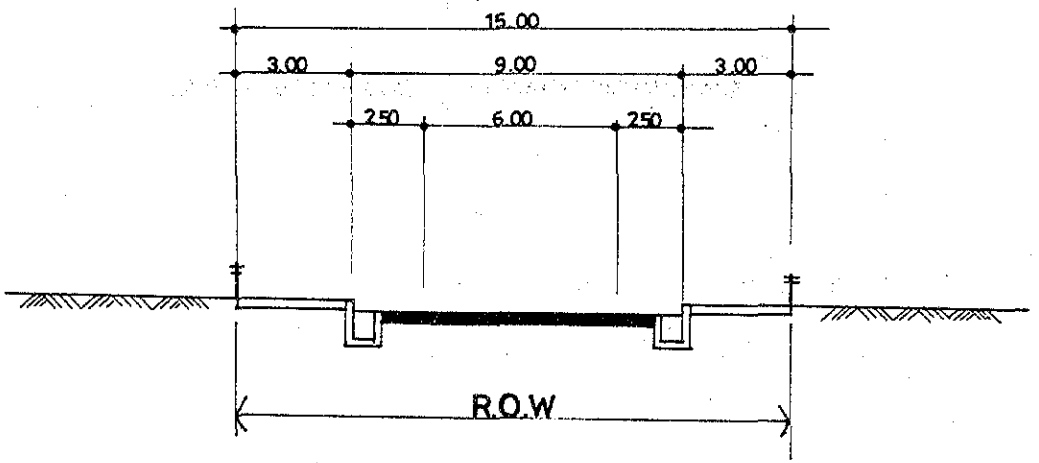
2. Comercial Area
(4 - Lanes)



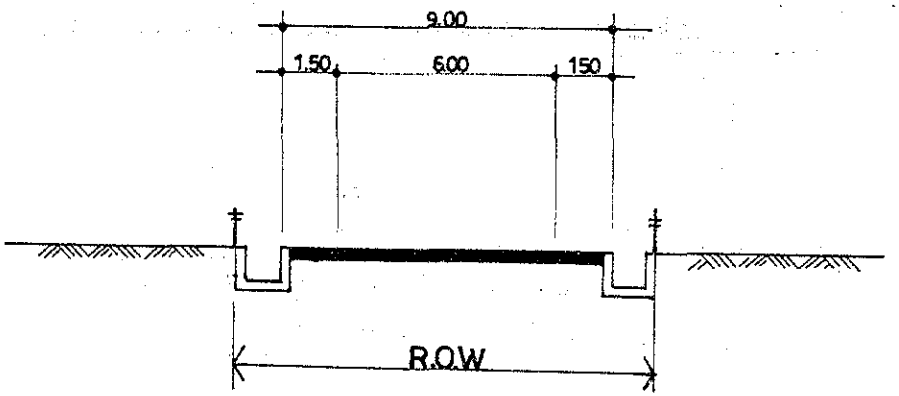
UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.4.5	Typical Cross-Section (4 lanes) for Collector Road
		JAPAN INTERNATIONAL COOPERATION AGENCY

COLLECTOR ROAD (For Reference)

1. 2 - Lanes with Side walk



2. 2 - Lanes without Side walk



UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.4.6	Typical Cross-Section (2 lanes) for Collector Road
		JAPAN INTERNATIONAL COOPERATION AGENCY

5.5 Natural Conditions

5.5.1 Geography

Kotamadya Ujung Pandang, the capital city of South Sulawesi Province, is the trade center of East Indonesia usually known as "The Gate" of East Indonesia. Ujung Pandang is located on the west coast of South Sulawesi, on 119°24'17.38" East Longitude and in 5°8'6.19" South latitude.

Topographically, Ujung Pandang and its surrounding area (MINASAMAUPA) is divided into 3 regions i.e. low-land region, hills region and mountains region.

1) Low-land Region

Low-land region lies along the west coast and extends eastward to the point of 25 m above sea level, stretching from North to South. This low-land region includes Kecamatan Mandai & Maros Baru in Kabupaten Maros, Ujung Pandang City and the surroundings of the area drained by rivers (Tallo, Jeneberang, Jenelata). Land slope ranges from 0 - 20 %. Almost all the Study area are covered by this low-land region.

2) Hills Region

It lies at the middle of Minasamaupa, 25 - 400 m above the sea level, and stretches from north to south to cover Kecamatan Bantimurung, part of Kecamatan Mandai, Kecamatan Bontomarannu, Kecamatan Bajeng, Kecamatan Polombangkeng and Kecamatan Mangarobombang. Land slope ranges from 20 - 40 %.

3) Mountains Region

It lies east of Minasamaupa, with Kallopolompo as the highest mountain (885 m above the sea level).

5.5.2 Geology

1) General

Land in Ujung Pandang consists of coast alluvium rock with high bearing capacity for physical development. This kind of rock is found along the main area drained by Tallo, Jeneberang and Jenelata rivers; also at coastal plain and the down-land plain of Ujung Pandang (covers the city of Ujung Pandang, Maros, Sungguminasa and Pattallasang). Tertiary sedimentary rock is found at the middle of Minasamaupa while volcanic rock (eruption products of Lompobattang mountain) is found in the east from 600 m above the sea level.

2) Soil Investigation at Cargo Terminal

Soil Investigation at cargo terminal planned along the Jl. Toll (Prof. Dr. Ir. Sutami) in the Study area was done by Bapak Pemimpin Proyek Pembangunan Terminal Cargo dan Pergudangan di Ujung Pandang in March 1988, to find out the physical/ technical characteristics and conditions of soil. According to this report, the results of soil investigation are summarized as follows:

a) Soil surface until 1.00 m : mud mixed with a little clay and contains shell-fish. Several points contain white sand and gravel; other points contain soft mud (mixed with a little clay).
b) From 1.00 m to 2.00 m : mud mixed with a little clay, and contains more shell-fish than the first layer above.
c) Hard-soil layer was found at 2.80m under the surface.
d) The hard-soil layer was found at the point less than 1.00 m under the surface.
e) Hand-boring could not be done at points B12, B13, B14, B15, B16 and B17 because hard-soil layer was found 0.40 meters under the surface.
f) The water level during the survey was higher than the soil-layer surface.

According to these soil investigation data and reconnaissance survey of surface soil conditions, the soil condition seems to be good for housing and road development. However, boring survey will be required to find out more detailed soil condition of below 3.0 meters during a feasibility or a detailed study stage for a road construction projects.

5.5.3 Climate

Kotamadya Ujung Pandang has a tropical climate because of its location near the Equator. According to Schmid and Ferguson, Ujung Pandang region has the climate of type D and C. Humidity ranges from 73 to 86 %, temperature between 22 C and 32 C. Minimum and maximum temperature in centrigade in Ujung Pandang by Months 1982 - 1986 is shown in Interim Report (2).

5.5.4 Rain Fall

The annual rain fall ranges from 2,000 m/m (Down-land plain) to 3,000 m/m (Mountains region). In general, rainy season is from October to April, while dry season from April to October.

Number of rain fall and rain days in Ujung Pandang are shown in Interim Report (2).

5.5.5 Wind Condition

Meteorology and Geophysics Board is a part of Communication Ministry which is responsible for recording and analyzing the climate condition in all parts of Indonesia.

Since Indonesia Archipelago covers a very large area, the Meteorology and Geophysics Board is divided into several areas/zones. Area/zone IV consists of all parts of Sulawesi and Maluku island which is centralized in Ujung Pandang. For Kotamadya Ujung Pandang and its surroundings, 2 Meteorology Stations were installed :

a) Marine Meteorology Station, Paotere , Ujung Tanah-Ujung Pandang is located on 05°08' South Latitude 119°24' East Longitude and 2.3 m above the sea level.

b) Meteorology Station Class I, Hasanuddin Airport, Maros is located in 05 04' South Latitude, 119 33' East Longitude and 14 m above the sea level.

From Meteorology and Geophysics Board, the Study Team obtained some data about wind condition in Ujung Pandang as follows:

a) Paotere Station (Ujung Tanah)
The maximum average speed occurred in January, 1987 i.e. 6.7 knots (east direction). Maximum speed occurred in December 1987 i.e. 37 knots (west direction). Most direction is southeast, but the direction at maximum speed is north-west.

b) Hasanuddin Station (airport)
The maximum average speed occurred in August, 1987 i.e. 3.6 knots (direction 290). Maximum Speed occurred in January and February 1986 i.e. 38 knots. Most direction is 270 and the direction at maximum speed is inconstant.

Further data about wind condition can be seen in Interim Report (2).

5.5.6 Water Conditions

1) Sewerage Condition

The sewerage system of rain water and waste water in Kotamadya Ujung Pandang is two ways, naturally through Tallo river and Jeneberang river , and artificially through Panampu channel and Sinrijala channel (part of which are rivers) and also through 2 sluices at Jeneberang river.

Tallo river is a tide-river with an average flow inclination of 0.01 % . Effect of the Makassar Straits' tide is still felt up to 10 km of the river down stream.

The flowing capacity in the urban area is about 50 - 150 m^3/second. The total area drained by Tallo river is 417.3 km^2, total length is 66 km starting from Kallulompo Mountain up to Makassar Straits.

Tallo river has tributary i.e. Pampang river (20 Km) which flows to the east of the city, and functioning as urban drainage with the capacity of 4 m^3/second.

Jeneberang river flows from Bawakaraeng Mountain to south of the city and empties into Makassar Straits. The total length is 75 km , covers an area of 727 km^2, capacity 1,000 m^3/second with an average inclination of 0.05 %.

The Panampu channel is 4 km in length, flows from Jalan Kerung-kerung to Paotere Quay in the north of the city, with capacity of 4 m^3/second and 36 km^2 area of service. Sinrijala channel connects Panampu channel in the west to Pampang river in the east with capacity of 4 m^3/second and 1 km^2 area of service. Panampu channel together with Sinrijala channel serves 30 % of the entire catchment area in the city.

The capacity of Panampu channel has remarkably declined because of the solid and liquid waste dumped into the channel by people in that area with high activities.

In certain area such as Kecamatan Bontoala,the ground surface is lower than Panampu channel. As a result, the area is always inundated with stagnant water.

The sluices placed at the main river and tributary of Jeneberang river (at the points of 2.8 km and 6.5 km) cannot effectively control all the stagnant water along the tributary.

2) Drainage Condition

Drainage service covers a total area of 15.1 km^2 in the west of the city and an area of 45.4 km^2 in the extension region of the city. This two parts are separated by Jalan A. Pettarani.

The average altitude of the urban area is about 1.5 m above the sea level, and is about 0.3 m at the extension region of the city in the east. As a result, there was a big flood at the eastern part of the city for example at Perumnas, etc.

The capacity of the channel also declines because it becomes shallow and narrower by the solid waste dumped into it from the urban area. Channel in Ujung Pandang is open channel, consequently it is polluted when it overflows during flood time. The existing drainage system is shown in Interim Report (2).

3) Stagnant-Water Condition

In the rainy season between December to March, flood sometimes occurs along the Tallo river and Jeneberang river. In addition, low level land of some districts (Kecamatan) such as Tallo, Mariso, Bontoala,Makassar and Panakkukang is also filled by the stagnant water. Even in dry season, some parts of the land within those area are still filled with stagnant water.

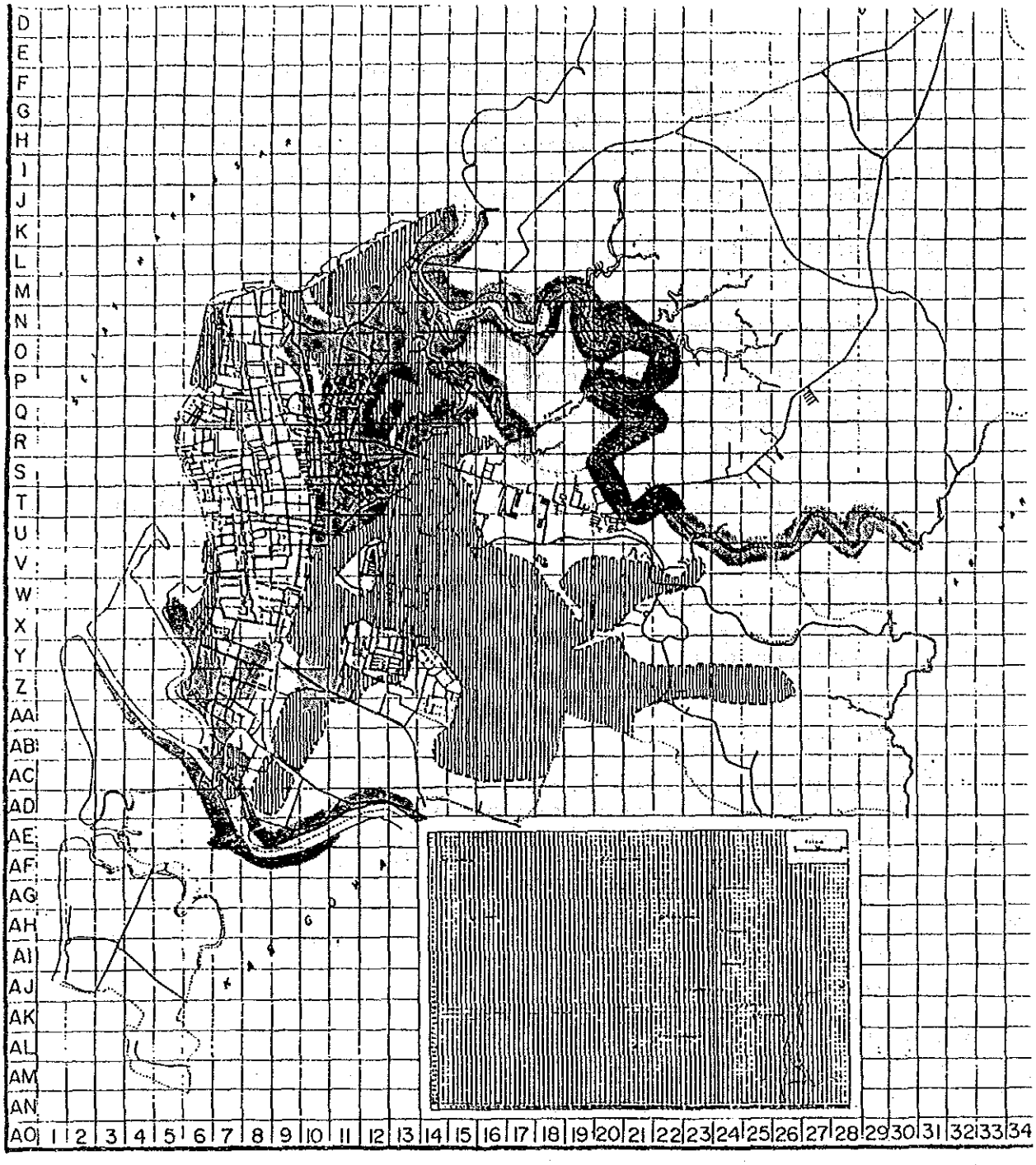
The flood area and stagnant water area are presented in Fig. 5.5.1.

A survey on the condition of flood and stagnant water is carried out by study team to find out the depth of stagnant water by applying hearing survey method to the inhabitants.

The result of depth of stagnant water is shown in Section 5.8.

The stagnant areas are mostly classified as paddy field; but recently, some housing estates are constructed in these areas. These housing estates are constructed on the embankment of land with 50 cm - 60 cm above the existing ground level (paddy field).

Consolidation settlement may be feared for embankment, however, it may not occur due to the good condition of underground soil as described previously in The description Soil Condition.



UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.5.1	Location of Flood and Stagnant Area
	JAPAN INTERNATIONAL COOPERATION AGENCY	

5.6 Road Network Planning

5.6.1 The Premises of Planning

Prior to the road network study, the premises of study are defined as below :

a) The final target year of the road network plan is adopted as the year 2009.

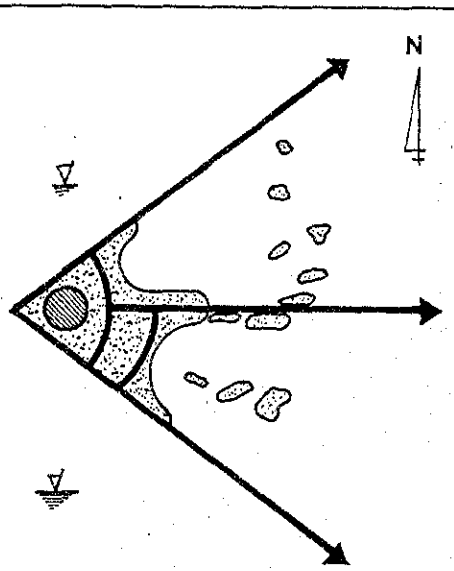
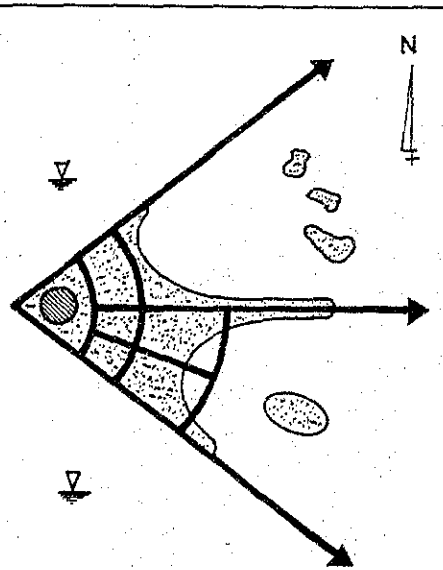
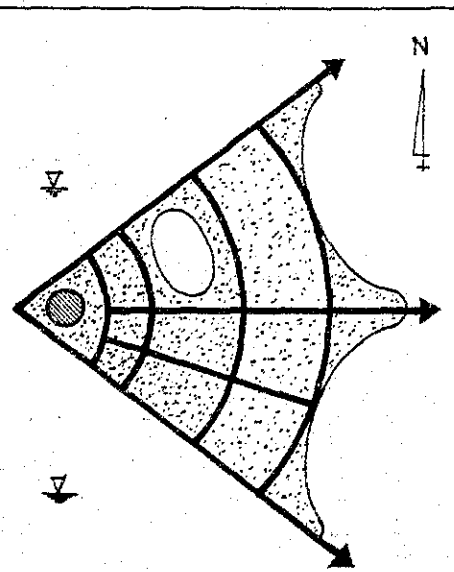
b) The primary and secondary arterial road network is examined in this study and the other road network that is collector and local road network is excluded.

5.6.2 Conceptual Development Pattern

The population of Ujung Pandang in 1986 was about 778,000 persons and the future population in 1994 and 2009 is forecasted to be about 976,000 and 1,520,000 persons respectively.

The existing housing development has gradually spread towards east and south-east directions from Ujung Pandang urbanized area. The future development needs may not be changed considering the ground condition of Ujung Pandang which is suitable for housing development.

Considering the natural condition, future population projection and future land-use strategy, the conceptual development pattern can be illustrated as shown in Fig. 5.6.1.

YEAR	1986	1994	2009.
Population (U.PG)	778.000	976.000	1.520.000
Development Pattern.			

NOTE : Development Area.
Road Development.

UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.6.1	Conceptual Development Pattern
		JAPAN INTERNATIONAL COOPERATION AGENCY

5.6.3 Road Network Pattern

As mentioned in Interim Report (1), the existing road network pattern within urbanized area of Ujung Pandang is formed as a ladder or grid pattern and its surrounding area is formed as radial pattern.

In view of the economic activities in Ujung Pandang and its surrounding area, Ujung Pandang City is connected to three (3) directions that is to Maros, to Malino,and to Takalar.

Even in the future, the above mentioned economic activities pattern will not dramatically change. Therefore, radial road network also will remain unchanged.

In the existing urbanized area, many housings and buildings are built along the existing roads. This will cause difficulty in constructing new roads within urbanized area, so, traffic management study is carried out in search of solution to traffic problems within urbanized area.

In the existing suburban area, some housing estates are developed. However, the sufficient road network for inhabitants has not been formed.

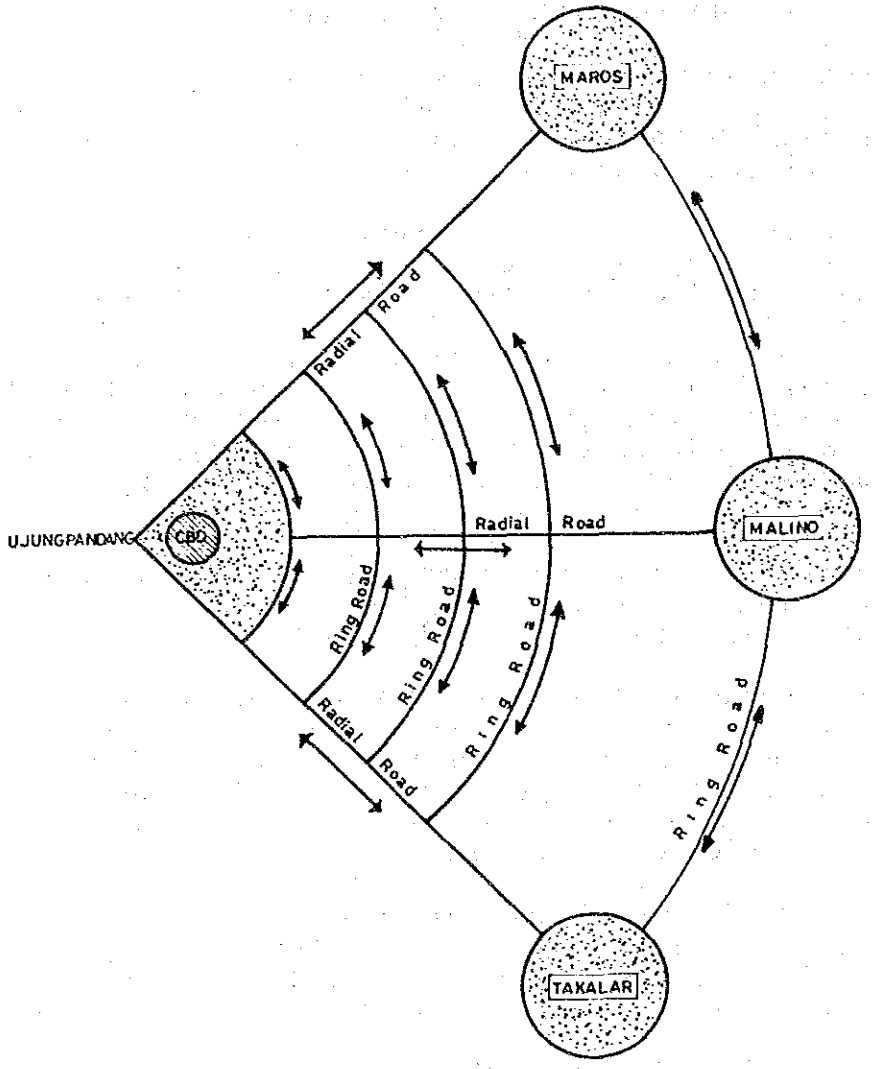
Either the ring and radial road network pattern or grid road network pattern can be considered for application within this area. However,from the following view points, to set up the ring and radial road network pattern in this area seems to be more appropriate than the grid network pattern :

a) Roads to be planned are classified as arterial roads. The arterial roads are required to keep a high mobility function. Considering high mobility function, ring and radial network is considered more functional than grid road network due to the longer intersection interval that can be available on ring and radial network.

b) The radial road network has already been formed in this area, so ring road system is more justified.

c) The urbanized area of the city covered by the arterial road is generally formed as grid or ladder road network pattern by the roads classified as collector. The zone within the urbanized area covered by the collector roads is generally formed as grid or ladder or cul-de-sac road network pattern by the roads classified as local road.

Based on the above mentioned examination, the conceptual road network pattern is illustrated in Fig. 5.6.2.



UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.6.2	Road Network Conceptual Plan
	JAPAN INTERNATIONAL COOPERATION AGENCY	

5.6.4 Road Network Planning Concept and Guideline

1) Road Network Planning Concept

Road network planning is carried out based on the planning goals and planning strategies for road network study as mentioned in Section 5.1.3.

Considering the above mentioned goals and strategies, existing road network condition, results of reconnaissance survey, the planning concept for road network location study are formulated as follows :

* To meet future land-use
* To meet existing road network
* To meet development schedule
* To meet road functions

2) Planning Guideline

There are many items to be considered for road network planning study, taking into account the above mentioned planning concept. The planning guideline items for road network study are explained below.

The relation of planning goals, strategy concept and planning guideline are presented in Fig. 5.6.3.

a) Existing Road Network Configurations

As the results of careful reconnaissance survey and analysis regarding the existing roads and road network configuration, traffic flow characteristics, existing land use, and development plan revised by the Study Team, some problems attributable to the existing road network configuration are pointed out as mentioned below.

* Considering traffic control and traffic safety, the road network configurations require arrangement in accordance with road criteria which are primary road, secondary road and local road. The existing road configuration, however, is not clearly formed by road criteria.
* The classification of the existing roads according to the road function and characteristic is not clearly defined because the existing road width and traffic flow characteristics are presented in similar size and conditions.
  The roads require classification according to the road function and characteristics for traffic control and safety.

b) Development Needs

The number of population in 1986 was about 800,000

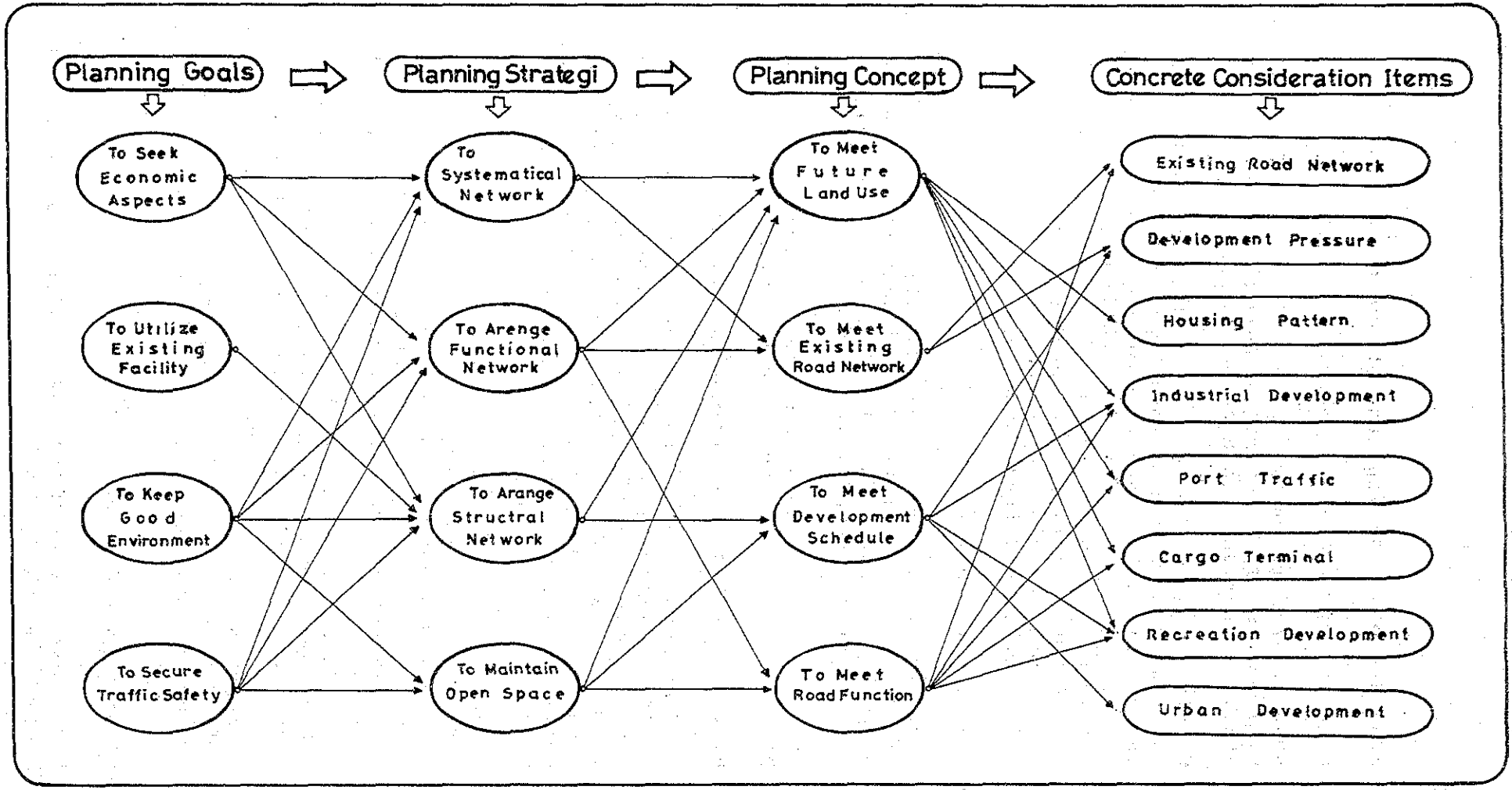


Fig. 5.6.3 Road Network Planning Concept Plan

persons and future population in the year 2009 is forecasted to be 1,500,000 persons.

About 700,000 persons will be spread towards east or south-east direction by the year 2009. Considering annual population growth rate,new road construction and widening of the existing roads are required in accordance with the increase in future traffic volume.

The guideline for road network within these areas is to encourage the housing development and to ensure to absorb the increased traffic volume. In addition, good environmental conditions should also be maintained.

c) Population Density

According to the results of land-use plan and population distribution strategy,the population density patterns are divided into three categories namely high density zone with about 410,000 accommodated population, medium density zone with about 790,000 accommodated population and low density zone with about 320,000 accommodated population.

In the future, city or community will be built in accordance with the planned population densities in respective zone.

Considering the function of arterial road as the unifying instrument of a city or community, two (2) or three (3) arterial roads are required to be set up on boundary of each population density zone, so as to separate each community clearly.

d) Industrial Development Traffic

There are two industrial estates in Ujung Pandang area namely Daya Industrial Estate with an area of 221 ha and Tallo Industrial Estate with an area of about 35 ha.

When Daya Industrial Estate will be fully occupied, the cargo traffic volume and commuter traffic volume are forecasted to be 2,500 v/day and 4,000 v/day respectively by Daya Industrial Report.

These cargo traffic flow should be avoided to pass through and within housing area and it should be guided to the arterial roads in order to keep safe and smooth traffic flow, and to ensure good environment for residential area.

e) Port Traffic

There are two sea ports; international and domestic harbor (Makassar Port) and a domestic harbor at the

northern part of Ujung Pandang urbanized area.

Truck and commuter traffic volume from and to Makassar port is recorded as 356 v/day and 418 v/day in 1988 and this port has a future expansion plan. At present, many cargo (transport) traffic are passing through existing urbanized area. This is one of the causes of the traffic congestion and destruction of good environmental conditions. In future, traffic conditions may be getting worse due to the increase in cargo traffic volume.

For improvement of the traffic congestion, environmental aspects, traffic safety and traffic routes, the cargo traffic should be guided to pass through arterial roads. So, the setting of arterial roads is required to avoid the flow of cargo traffic through urbanized area.

f) Cargo Terminal Traffic

A cargo terminal is planned along Jl. Toll (Prof. Dr. Ir. Sutami) in Tallo district by Bapak Pemimpin Proyek Pembangunan Terminal Cargo dan Pergudangan di Ujung Pandang. It is estimated that after the completion of this cargo terminal, the traffic volume for cargo transport will amount to 370 v/day.

For the same reason as mentioned in point e), the truck traffic should be guided to pass through arterial roads. Hence, the arterial roads should connect the cargo terminal to any direction.

g) Recreation Development

According to the future land-use plan, a recreational area is planned at the southern part of existing urbanized area in Ujung Pandang.

There is few recreational area in Ujung Pandang, so it is a very important matter to introduce the recreational facilities for the citizen. However, at present there is no road directly connects the urbanized area to the planned recreational area.

To introduce the arterial roads in the planned recreation area is required by the following three (3) reasons :

* This road can promote recreational development.
* This road can promote the agricultural development.
* This road can be used as a diversion road connecting Ujung Pandang to the Takalar direction.

The promotion of diversion road is a very important matter to be considered for road network planning. At present, there is no diversion road in this area. As a

consequence, when an accident occurs on existing road, transportation between Ujung Pandang and Takalar should be suspended during the cleaning works of the accident site.

h) Urban Development

According to the Master Plan prepared by the Municipality and future land-use plan, two (2) sub-centers are planned in Daya and Antang districts respectively.

Considering urban activities of these sub-centers, introduction of the connection roads between sub-centers and other cities is required.

The above mentioned guideline for road network planning is summarized in Fig. 5.6.4 and Fig 5.6.5

5.6.5 Existing Condition for Route Location

1) Existing Facility Conditions

Prior to the road network route location study, facilities condition survey was carried out. The survey was done to find out the location of big buildings, schools, cemeteries, hospitals and other important facilities which are difficult to be removed or demolished for the road construction.

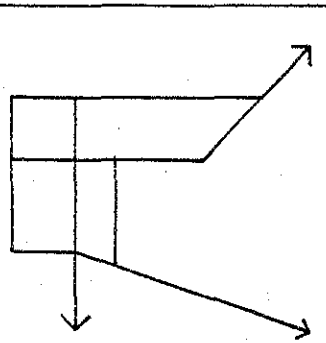
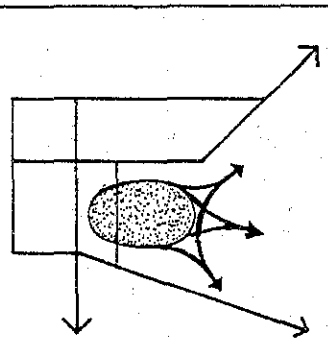
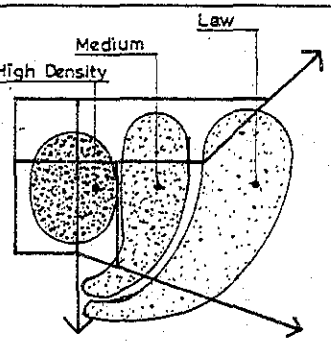
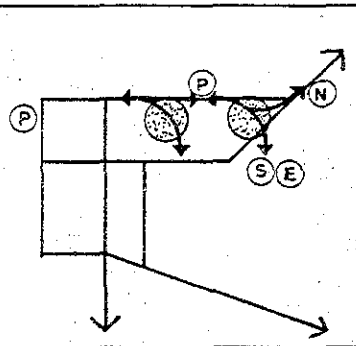
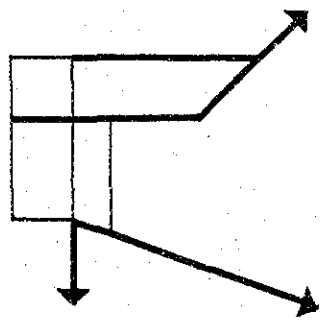
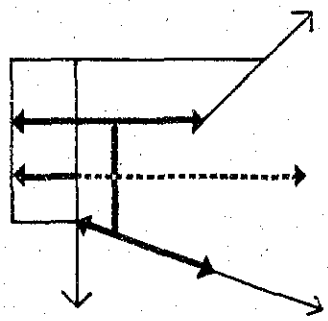
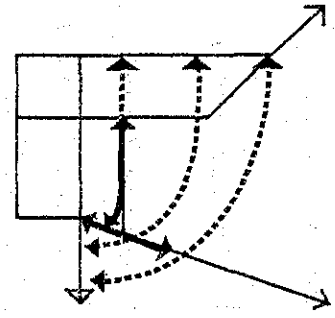
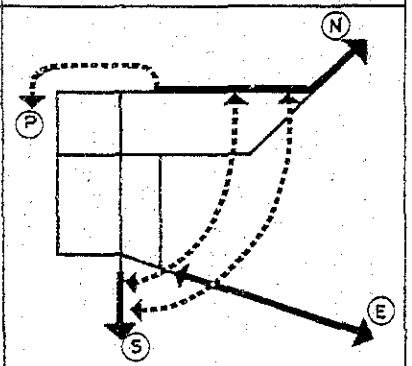
The result of this survey, the location and name of facilities, are shown in Interim Report (2). According to the results of this survey, there are many important facilities along Jl. Gowa Jaya (Urip Sumoharjo) and Jl. A Pettarani. When the improvement plan is examined, more careful reconnaissance survey is required.

2) Difficult Area for Route Location

There are many control points for route location in the Ujung Pandang area. Prior to setting of the road network route location, it is necessary to define the area where route location is difficult.

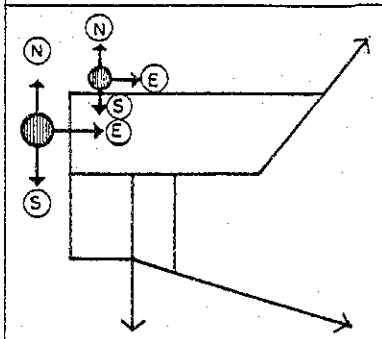
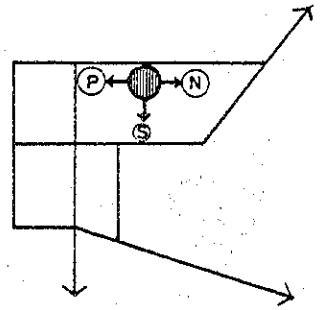
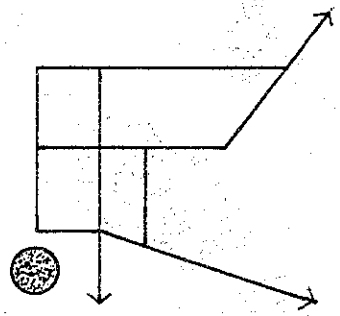
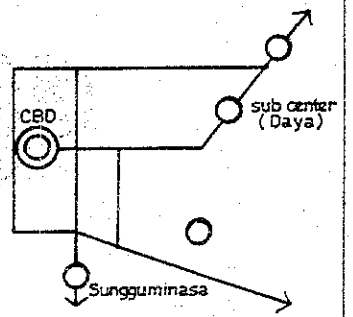
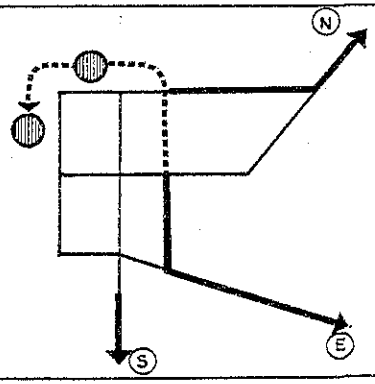
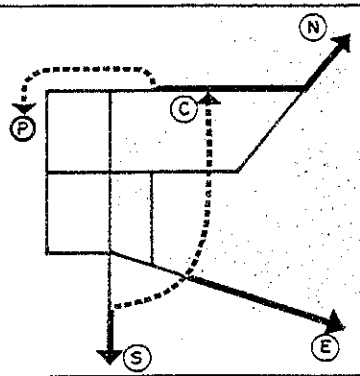
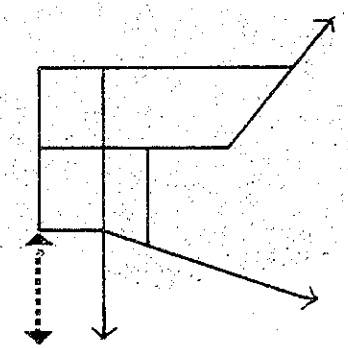
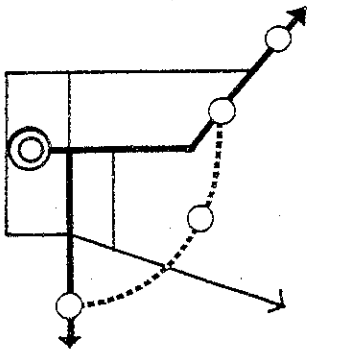
Based on the careful reconnaissance survey during rainy and dry seasons, data collection and its analysis and information from the inhabitants, difficult areas for the route location are identified as shown in Fig. 5.6.6.

The reasons the difficulty are also summarized in Interim Report (2).

Items to be considered for Transport Network	Existing Road Network	Development Pressure	Housing Pattern	Industrial Development Traffic
				
Basic Policy for Network Plan	1) To maximize utilization of existing road and transport facilities 2) To classify road function 3) To keep a safety	1) To induce housing development 2) To ensure Traffic demand as housing development	1) To form a community by road 2) To classify a community 3) To keep a good environment	1) To avoid mixed traffic 2) To avoid passing through housing area 3)To connect port
	For existing Road Network	For Development Pressure	For Housing Pattern	For Industrial Development
Road Network Basic Pattern				

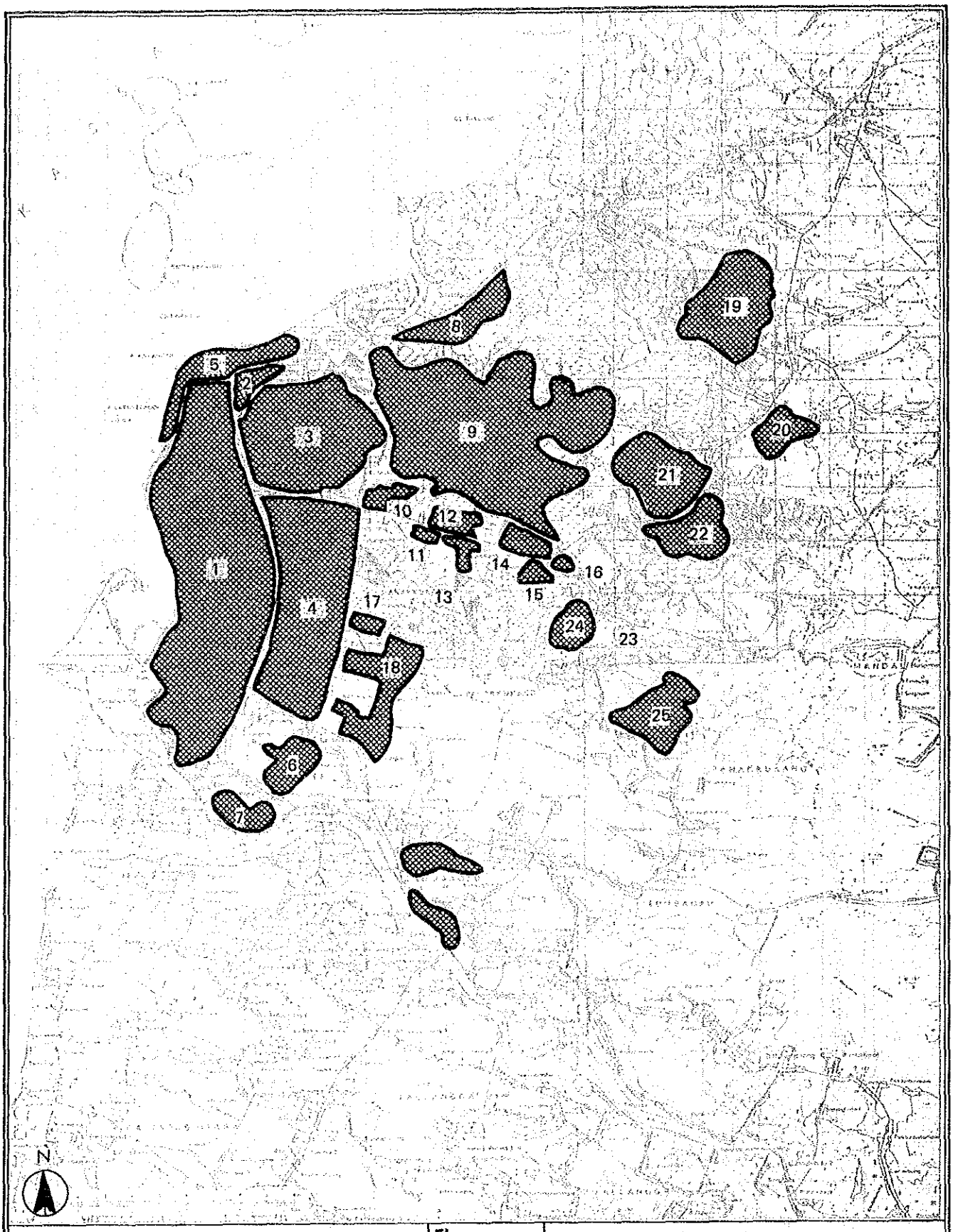
NOTE :
- Existing Road.
- Improvement Existing Road.
- New Construction

Fig. 5.6.4 Guideline for Road Network Planning

Items to be considered for Transport Network	Port Traffic (Come/Go)	Cargo Terminal Traffic	Recreation Development Traffic	Urban Development Traffic
				
Basic Policy for Network Plan	1) To avoid passing through urbanized area 2) To avoid using mixed traffic 3) To keep a good environment	1) To avoid passing through urbanized area 2) To avoid using mixed traffic 3) To Keep a good Environment	1) To keep a good environment 2) To ensure a traffic comfortable	1) To link C B D and sub-center directly
Road Network Basic Pattern	For Port Traffic	For Cargo Terminal Traffic	For Recreation Traffic	For Urban Development Traffic
				

NOTE :
- Existing Road
- Improvement Existing Road.
- New Construction Road

Fig. 5.6.5 Guideline for Road Network Planning



UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.6.6	Route Location Difficulty Area
	JAPAN INTERNATIONAL COOPERATION AGENCY	

5.7 Future Road Network Configuration

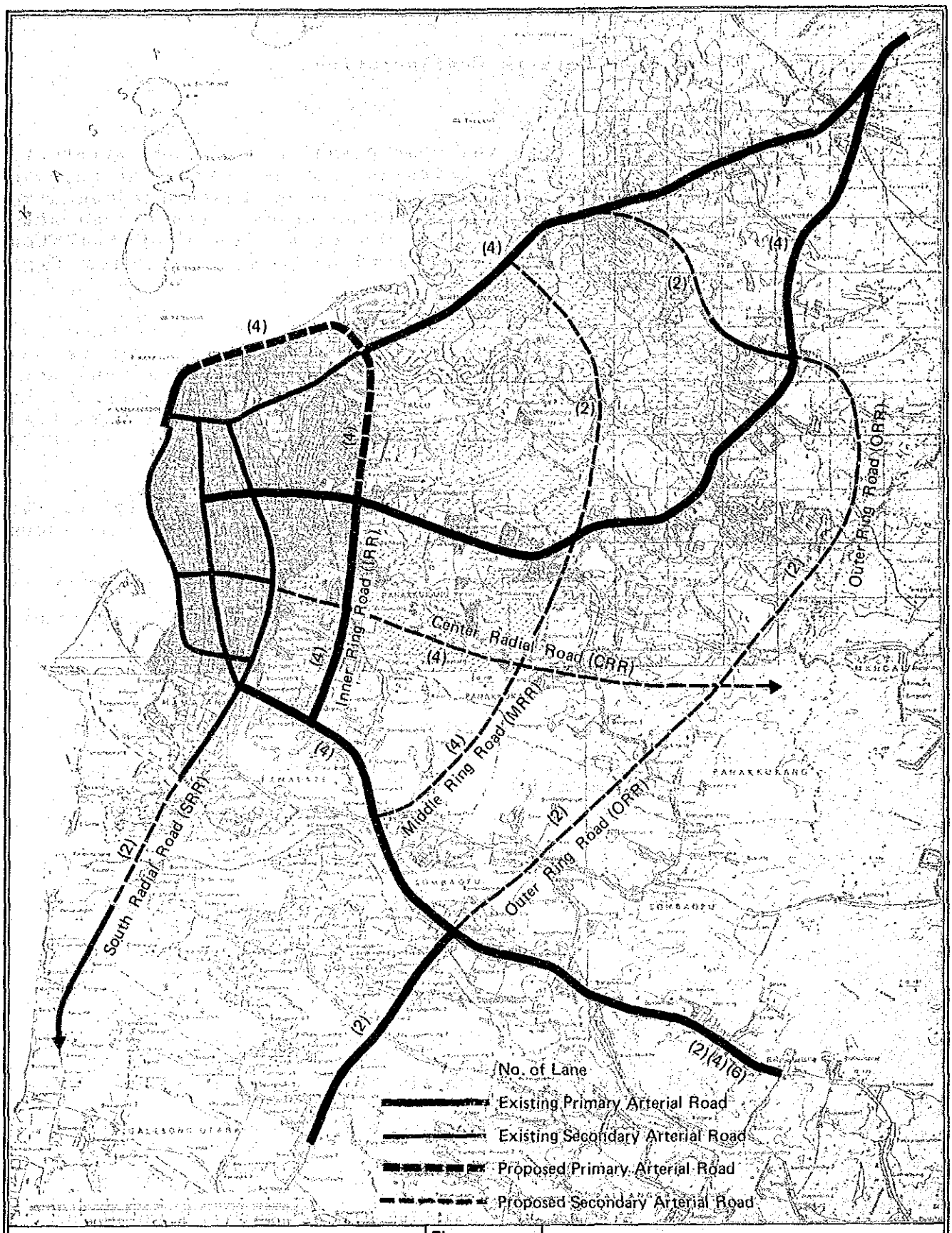
5.7.1 General

In accordance with the road planning goals and strategy, planning concept and guideline for network planning, the future road network configuration of Ujung Pandang area is studied. As a result of the study, future road network configuration for the year 2009 is formulated (worked out) as illustrated in Fig. 5.7.1 and Fig. 5.7.2.

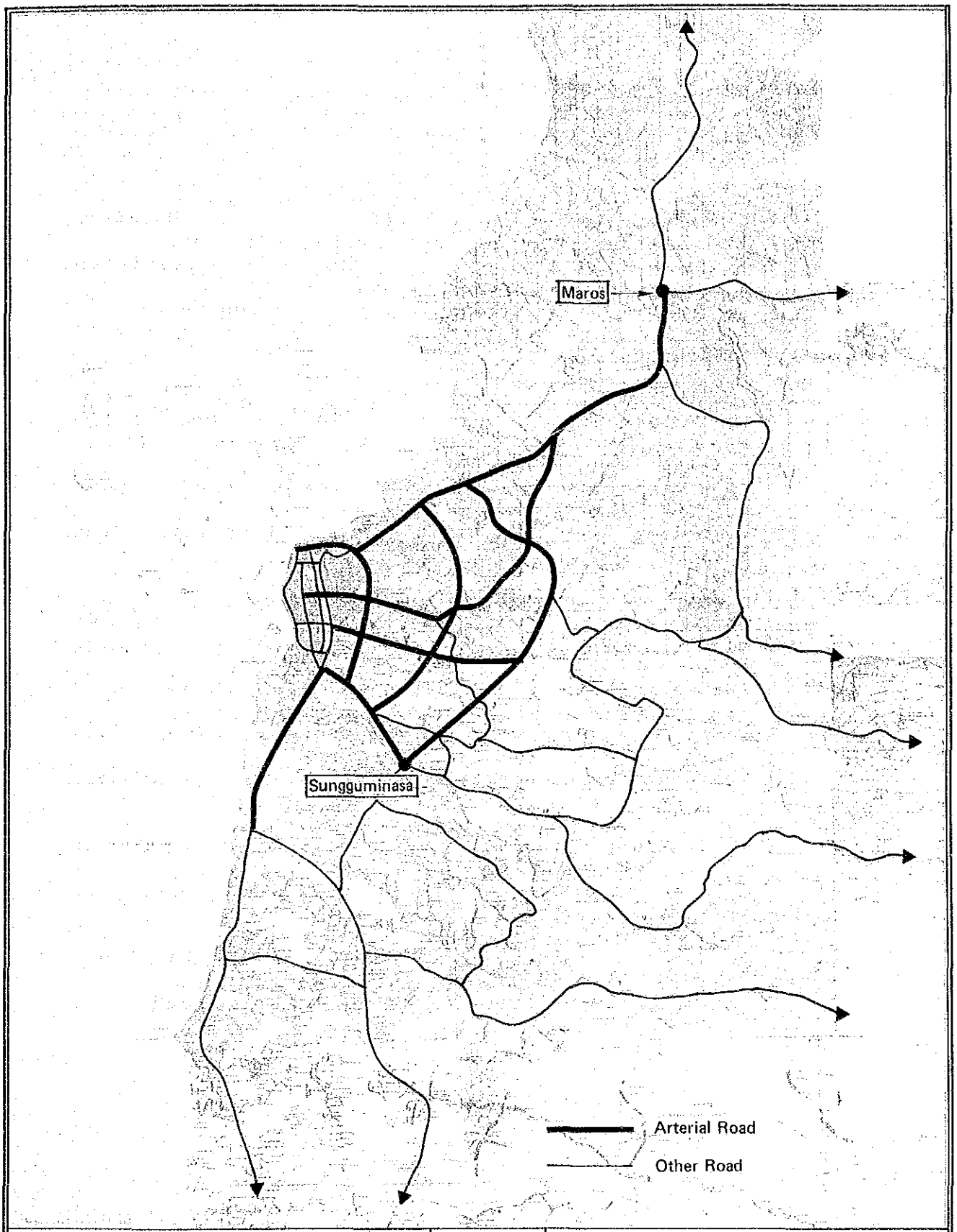
Basically, the future road network comprises five (5) radial roads and three (3) ring roads for primary and secondary arterial road network. The future road network configuration consists of roads proposed to be constructed i.e. Inner Ring Road (IRR), Middle Ring Road (MRR), Outer Ring Road (ORR), Center Radial Road (CRR) and South Radial Road (SRR).

The characteristics and functional classification of the roads for future road network configuration are shown below.

Name of Road	Road Type	Functional Classification
a) IRR	Proposed Road	Primary Arterial Road
b) Jl. Toll (Prof. Dr. Ir. Sutami)	Existing Road	Primary Arterial Road
c) Jl. Gowa Jaya (Urip Sumoharjo)	Existing Road	Primary Arterial Road
d) CRR	Proposed Road	Secondary Arterial Road
e) Jl. Gowa Raya (St. Alauddin)	Existing Road	Primary Arterial Road
f) SRR	Proposed Road	Secondary Arterial Road
g) MRR	Proposed Road	Secondary Arterial Road
h) ORR	Proposed Road	Secondary Arterial Road
i) Jl. Veteran	Existing Road	Secondary Arterial Road
j) Jl. Ratulangi	Existing Road	Secondary Arterial Road
k) Jl. Rajawali	Existing Road	Secondary Arterial Road
1) Jl. Monginsidi	Existing Road	Secondary Arterial Road
m) Jl. Seram	Existing Road	Secondary Arterial Road



UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.7.1	Road Network Configuration (2009)
	JAPAN INTERNATIONAL COOPERATION AGENCY	



UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.7.2	Road Network Configuration in the Study Area (2009)
	JAPAN INTERNATIONAL COOPERATION AGENCY	

5.7.2 Function of Proposed New Road

The major functions of the proposed new roads are explained below.

a) The main functions of IRR are :
   * To distribute the cargo traffic from/to Makassar Port without passing through urbanized area.
   * To distribute the traffic from/to the radial road without passing through urbanized area.
   * To stimulate activities of the urban community
   * To maintain urban open space for keeping a good environmental conditions.

b) The main functions of MRR are :
   * To distribute the cargo traffic from/to Tallo Industrial Estate and Cargo Terminal without passing through housing area.
   * To distribute the traffic from/to radial road without passing through housing area.
   * To maintain urban activities as well as urban open spaces.

c) The main functions of ORR are :
   * To distribute the cargo traffic from/to Daya industrial Estate without passing through housing area.
   * To distribute the traffic from/to radial road without passing through housing area.
   * To directly connect Daya Sub-center, Antang Sub-center and Sungguminasa.
   * To maintain urban activities and urban open spaces.

d) The major functions of CRR are :
   * To directly connect Antang Sub-center to the CBD of Ujung Pandang.
   * To maintain urban activities and urban open spaces.

e) The major function of SRR are :
   * To act as a diversion of the existing Jl. Gowa Raya (St. Alauddin).
   * To encourage the recreation and agricultural development.

5.7.3 Comments for Implementation of Collector Road Network System

In the Study, the future road network configuration of Primary and Secondary Arterial road is proposed for the trunk road network system in Jjung Pandang Area.

The Collector Road Network System as under classification of above mentioned arterial road network systems will be implemented by Government of Indonesia based on the primary and secondary arterial road network system.

When the collector road network system will be implemented, following items should be considered:

a) To meet arterial road network system. (See Fig 5.4.1)

b) To meet existing road network system.

c) To maintain function and characteristics of the collector roads. (See Table 5.3.1)

d) To maintain future traffic demand.

e) To maintain function and characteristic of related development projects.

f) To meet future land use plan and related development plan.

The road network development contributes not only to activate the urban socio-economic functions, but also to guide and induce orderly urban developments as the indispensable infrastructure of the urban spatial structure. Therefore, in addition to the arterial roads recommended above, the construction of collector roads and local roads should be carried out at the same time, with close coordination with the land use/urban development plan, in order to form an effective integrated urban road network.

5.8 Road Preliminary Design

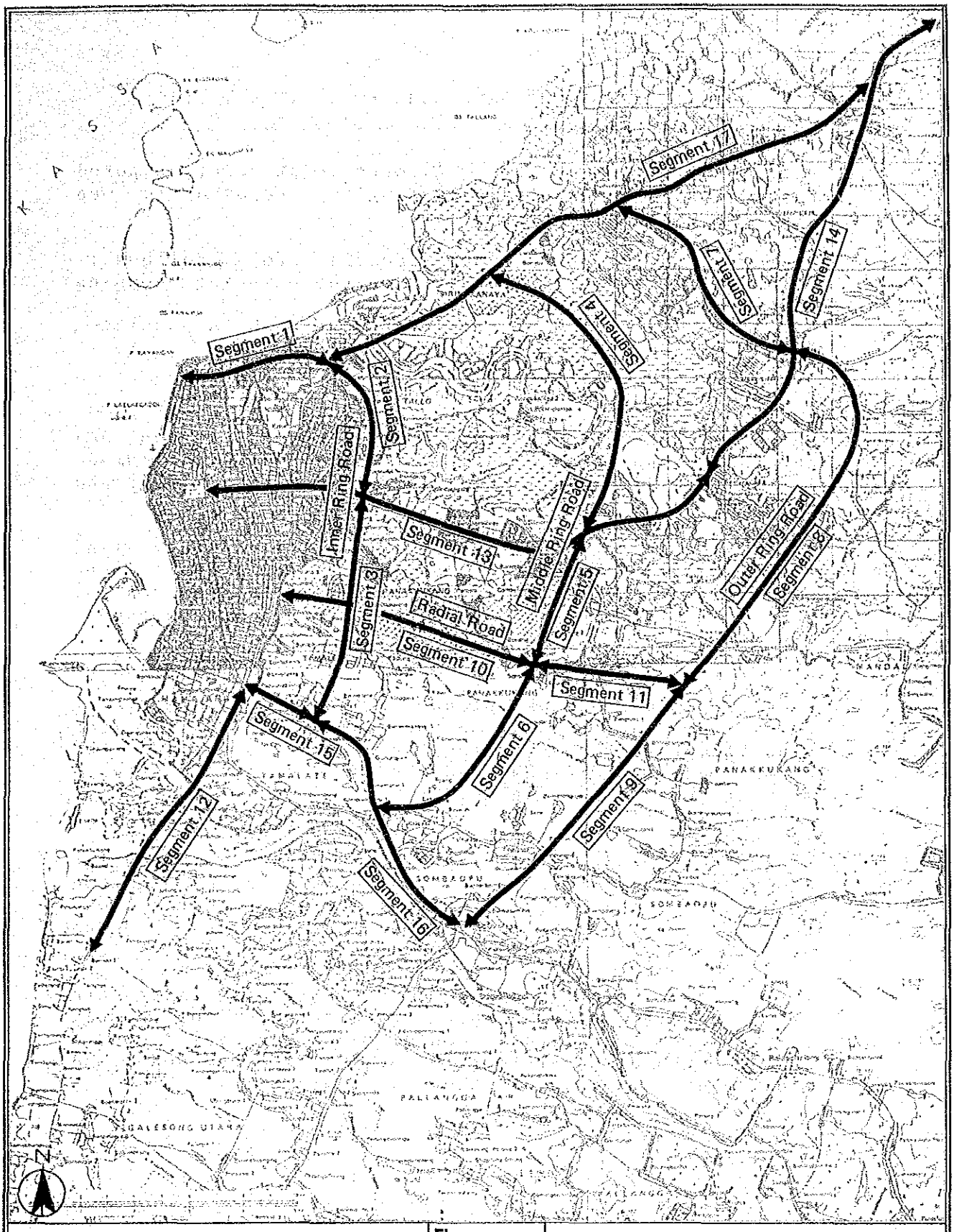
5.8.1 General

In previous section, future road network configuration has been proposed. Based on this configuration, a road preliminary design is formulated for rough examination of technical and economical feasibility on the proposed road network.

Prior to the commencement of the road preliminary design, the road network is divided into 17 segments by ground condition and road characteristics. The relation between proposed road name and its segments is shown in Table 5.8.1 and Fig. 5.8.1.

Table 5.8.1 Road Name and Segment

Road Name	Composed Segment
Inner Ring Road (IRR)	Segment 1, Segment 2, Segment 3
Middle Ring Road (MRR)	Segment 4, Segment 5, Segment 6
Outer Ring Road (ORR)	Segment 7, Segment 8, Segment 9
Center Radial Road (CRR)	Segment 10, Segment 11
South Radial Road (SRR)	Segment 12
Existing Jl. Gowa Jaya (Urip Sumoharjo)	Segment 13, Segment 14
Existing Jl. Gowa Raya (St. Alauddin)	Segment 15, Segment 16
Existing Jl. Toll (Prof. Dr. Ir. Sutami)	Segment 17



UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY	Fig. 5.8.1	Location of Road Segment
	JAPAN INTERNATIONAL COOPERATION AGENCY	

5.8.2 Alignment

1) Horizontal Alignment

Horizontal alignment study on route location of proposed road network is carried out using the topographic map with the scale of 1 : 10,000.

Basic considerations of route location are as follows :
* To avoid it from passing through the existing housing or community area
* To make use of the existing roads as much as possible
* To consider the intersection condition
* To pass the river as short as possible
* To ensure the design standards

Based on the above mentioned basic considerations and careful reconnaissance survey, the horizontal alignment is decided as shown in the figures from Fig. 5.8.8 to Fig 5.8.28.

Since any topographic maps for more detailed study along the proposed road are not available, topographic maps with the scale of 1:2000 to 1:5000 shall be prepared for road designing when the feasibility study is commenced.

2) Vertical Alignment

The proposed roads are planned within the area most of which are flat terrain ,so the maximum gradient is not significant for controlling the vehicle speed. On the other hand, the minimum gradient is important for treatment of the stagnant water.

In addition, the natural conditions, particularly the stagnant water in rainy season, should be considered for decision making of proposed road height. For examination of proposed road height, the stagnant water depth along the area flooded in rainy season was surveyed by the Study Team.

The survey points and depth of stagnant water are illustrated in Interim Report (2). Based on the result of this survey, careful reconnaissance survey and considering natural condition, the height of proposed road embankment is decided as shown in Table 5.8.2.

Table 5.8.2 Proposed Road Embankment Height

Segment	Stagnant Water Depth	Proposed Embankment Height (m)
Segment 1	0.6 - 0.7	1.2
" 2	0.7 - 0.8	1.3
" 3	0.6 - 0.7	1.2 (Existing Road Level)
" 4	0.3 - 0.6	1.0
" 5	0.3 - 0.5	1.0
" 6	0.3 - 0.4	0.9
" 7	0.3	0.8
" 8	0.3	0.8
" 9	0.3	0.8
" 10	0.6 - 0.7	1.2
" 11	0.3 - 0.5	0.9
" 12	0.6 - 0.9	1.4
Segment 13 - 17		0.5 - 1.0 (Existing Road Level)

5.8.3 Cross Section Design

1) General

Basically, a cross-section for new road construction is designed based on Indonesian Standard and typical cross-section of each road is determined according to its function and characteristic. (Refer to Section 5.4.4). However, in designing the cross-section for improvement of the existing road, road side conditions shall primarily be taken into account.

Basic consideration items for cross-section design on each segment are described below.

(1) Segment 1-(1)

a) This segment is primary arterial road as a part of Inner Ring Road System.
b) This segment is designed for road improvement project of the existing Jl. Satando and its extension road.
c) There are many two-or three-story concrete housing along the south side of Jl. Satando.
Therefore, it is very difficult to acquire the land for widening the road toward this side.
d) Besides, there are some government and private offices along the north side of this road. Therefore, the land along this side is also difficult to be acquired for road widening. However, 5.0 - 6.0 m widening may be possible according to the existing land-use situation.
e) Considering above situation, minimum cross-section elements shall be adopted for this segment and the existing Jl. Satando shall be widened toward its north side.

(2) Segment 1-(2)

a) This segment is primary arterial road as a part of Inner Ring Road System.
b) This segment with route located within urbanized area is designed for a new road construction project.
c) It may be very difficult to acquire the land for road construction in this area.
d) Considering the feasibility of road construction, cross section elements are required.
e) According to the typical cross-section, width of the primary arterial road is 50 meter. However, 30 meter width is adopted so as to reduce width of median strip and side walk.

(3) Segment 2

a) This segment is primary arterial road as a part of Inner Ring Road System.
b) This segment is designed for new road construction project. Its route is located within sub-urban area, so it may not be so difficult to acquire the land for this project.
c) Cross-section width of this segment is adopted as same as that of the segment 3 of the typical cross-section.

(4) Segment 3

a) This segment is primary arterial road as a part of Inner Ring Road System.
b) This segment is located beside the existing Jl. Pettarani.

c) This segment is designed for road improvement project of the existing Jl. Pettarani.
d) The road side trees are planted on both sides of Jl. Pettarani. And there are many houses and government buildings along its west side.
e) On the other hand, there are few housing along its east side.
f) There is 40m right of way for construction of new road on east side of Jl. Pettarani,so, the road width is adopted as that of the typical cross-section of secondary arterial road.

(5) Segment 4, 5 and 6

a) These segments are secondary arterial road as a part of Middle Ring Road (MRR) system.
b) These segments are designed for new road construction project and are located in existing paddy field.
c) There is no obstruction for cross-section design, so, secondary arterial road typical cross-section elements are adopted for these segments.

(6) Segment 7-(1)

a) This segment is classified as secondary arterial road as a part of Outer Ring Road System.
b) This segment is designed for improvement project of the existing road with 5.0 meter width and gravel pavement.
c) There is no obstruction matter for cross-section design, so, typical cross-section of secondary arterial road width is adopted for this segment.

(7) Segment 7-(2)

a) This segment is classified as secondary arterial road as a part of Outer Ring Road System.
b) This segment is designed for improvement project of the existing road with 26.5 meter road width.
c) There are many houses along the existing road therefore it is comparatively difficult to acquire the land for widening this road.
d) Cross-section width of this section is adopted to be 26.5 meter.

(8) Segment 8 and 9

a) These segments are classified as secondary arterial road as a part of Outer Ring Road System.
b) These segments are designed for new road construction project with route located in existing paddy field.
c) There are no obstruction matter for cross-section design. So, typical cross-section element of secondary arterial road is adopted for these segments.

(9) Segment 10 and 11

a) These segments are classified as secondary arterial road as a part of Central Radial Road system.
b) These segments are designed for new road construction project and their route is located in existing paddy field and some parts of housing area.
c) There is a few obstruction matter for cross-section design, therefore,land acquisition for new road construction seems not so difficult.
d) Typical cross-section elements of secondary arterial road is adopted for this segment.

(10) Segment 12

a) This segment is classified as secondary arterial road as a part of South Radial Road System.
b) This segment is designed for new road construction project with route located in existing paddy field.
c) There is no obstruction matter for cross-section design, so cross-section elements of this segment follow that of the typical cross-section of secondary arterial road.

(11) Segment 13

a) This segment is classified as primary arterial road as a part of Radial Road System which connects CBD to the northern part of Sulawesi.
b) This segment is designed for widening of existing Jl. Gowa Jaya.
c) There are many buildings along the both road sides, the right of way is almost 21 meters. So, widening two (2) lanes to four (4) lanes is designed within 21 meters right of way without additional land acquisitions. However, widening two (2) lanes to six (6) lanes is designed with additional land acquisition. The right of way on primary arterial road is adopted as 50.0 meters. However, 40 meters right of way is adopted in this segment considering housing or building conditions of along the existing Jl. Gowa Jaya.

(12) Segment 14

a) This segment is classified as primary arterial road as part of Radial Road System which connects CBD to the northern part of Sulawesi.
b) This segment is designed for widening of existing Jl. Gowa Jaya (Urip Sumoharjo) with two (2) lanes to four (4) lanes.
To the right of way of primary arterial road is adopted as 50 meters based on the typical cross-section. However, the right of way on this segment is adopted as 40 meters considering road side housing conditions.

(13) Segment 15

a) This segment is classified as primary arterial road as a part of Radial Road System which connects CBD to the southern part of Sulawesi.
b) This segment is designed for widening of existing Jl. Gowa Raya with two (2) lanes to four (4) lanes.
c) There are many buildings along the both sides of road, and the right of way is almost 23 meters. So, widening two (2) lanes to four (4) lanes is designed within 23 meters right of way without additional land acquisition.

(14) Segment 16

a) This segment is classified as primary arterial road as a part of Radial Road System which connects CBD to the southern part of Sulawesi.
b) This segment is designed as widening of existing road Jl. Gowa Raya (St. Alauddin) from two (2) lanes to four (4) lanes.
c) The right of way of primary arterial road is adopted as 50 meters based on typical cross-section. However, the right of way of this segment is adopted as 40 meters considering road side housing conditions.

(15) Segment 17

a) This segment is classified as primary arterial road as a part of Radial Road System in Ujung Pandang City.
b) This segment is designed for widening of existing Jl. Toll (Prof. Dr. Ir. Sutami) from two (2) lanes to four (4) lanes.
c) The right way of primary arterial road is adopted as 50 meters based on typical cross-section. However, the right of way on this segment is adopted as 40 meters considering housing conditions.

2) Number of Lanes

Number of lanes on each segment is decided by dividing forecasted traffic volume of that segment based on by its traffic capacity.

$$N_i = \frac{V_i}{V_{ic}}$$

N_i : Number of lanes on segment (i)
V_i : Forecasted traffic volume of segment (i)
V_{ic} : Traffic capacity of segment (i)

The traffic capacity is calculated depend on the following items :

a) Lane width condition
b) Lateral clearance
c) Traffic component
d) Road side condition
e) Horizontal and vertical alignment conditions
f) Service level

According to Indonesian standards, the traffic capacity is stipulated as shown in Table 5.8.3.

Table 5.8.3 Road Class and Traffic Capacity

Design Classification		Standard Design Daily Traffic per Lane (unit : p.c.u.)
Type I	Class I	15,000
	Class II	14,000
Type II	Class I	13,000
	Class II	13,000
	Class III	12,000

In general, the daily traffic capacity of dual carriageway in urban area is about 16,000 - 17,000 p.c.u./lane. So, the capacity of Table 5.8.3 seems to be small. It may be accepted in urbanized area. Considering traffic characteristics of Ujung Pandang, however, 15,000 pcu/day traffic capacity is adopted in suburban area in this study in the light of traffic characteristics and road side conditions.

Table 5.8.4 illustrates the traffic capacity and volume of each road in 1994 and 2009 as well as the number of lanes on each segment.

The above mentioned cross-section elements of each segment are summarized as shown in Fig. 5.8.2 to Fig. 5.8.5 and Table 5.8.5.

Table 5.8.4 Capacity and Lane Numbers

	capacity/lane v/d	Forecasted Traffic Volume		Require Lanes		Remarks
		1994	2009	1994	2009	
Segment 1	13.000	13,000	58.000	2	4	
Segment 2	13.000	25.000	61.000	4	4	
Segment 3	13.000	36.000	69.000	4	4	
Segment 4	13.000	-	11.000	-	2	
Segment 5	13.000	40.000	59.000	4	4	
Segment 6	13.000	10.000	35.000	2	4	
Segment 7	13.000	7.000	15.000	2	2	
Segment 8	13.000	-	15.000	-	2	
Segment 9	13.000	-	15.000-20.000	-	4	
Segment 10	13.000	32.000	67.000	4	4	
Segment 11	13.000	-	20.000	-	4	
Segment 12	13.000	-	19.000	-	4	
Segment 13	13.000	54.000	92.000	4	6	
Segment 14	13.000	15.000	37.000	2	4	
Segment 15	13.000	44.000	57.000	4	4	
Segment 16	13.000	29.000	61.000	4	4	
Segment 17	13.000	13.000	63.000	2	4	

Note: In case of two (2)-lane road, 1500 v/d capacity is adopted for both direction.

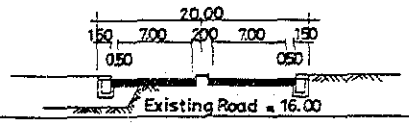
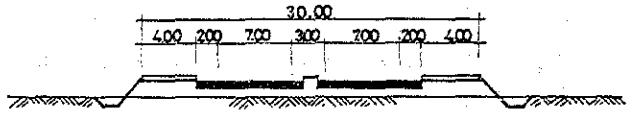
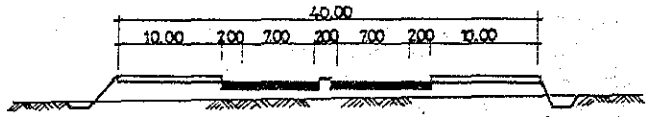
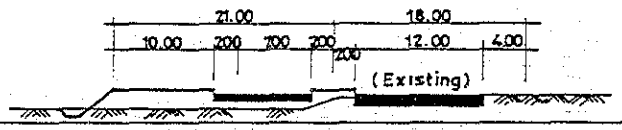
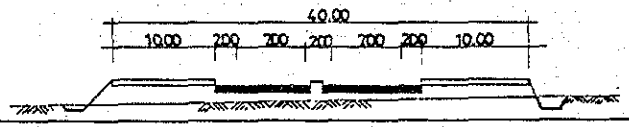
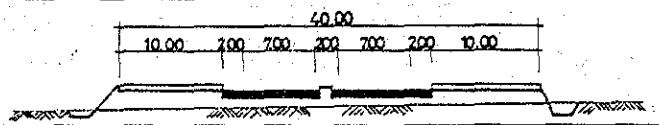
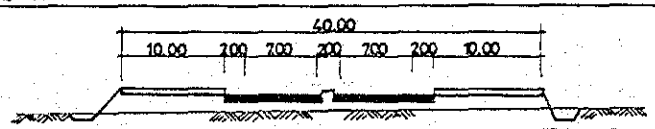
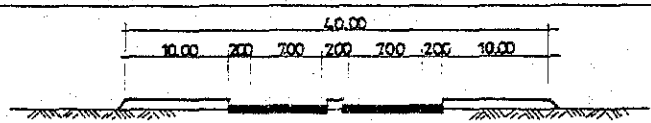
NAME OF SEGMENT	ROAD CLASSIFICATION	CONSTRUCTION TYPE	LAND USE	EMBANKMENT HIGTH (m)	CROSS - SECTION
Segment 1 (1)	Primary Arterial Road	Improvement Existing Road	Commercial	0.6	
Segment (2)	Primary Arterial Road	New Construction	Residential	1.2	
Segment 2	Primary Arterial Road	New Construction	Residential	1.3	
Segment 3	Primary Arterial Road	Improvement Existing Road	Residential	1.2	
Segment 4	Secondary Arterial Road	New Constrution	Residential	1.0	
Segment 5	Secondary Arterial Road	New Construction	Residential	1.0	
Segment 6	Secondary Arterial Road	New Construction	Residential	0.9	
Segment 7 (1)	Secondary Arterial Road	Improvement Existing Road	Residential	0	

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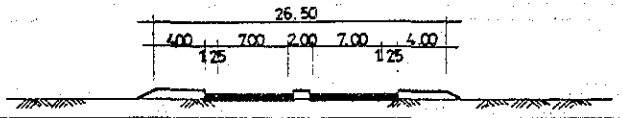
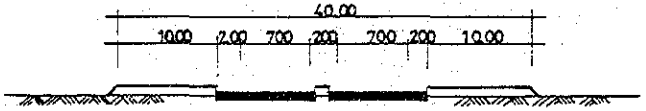
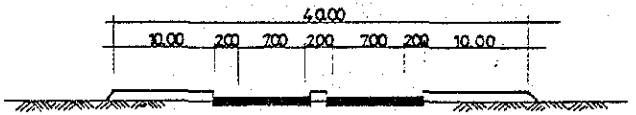
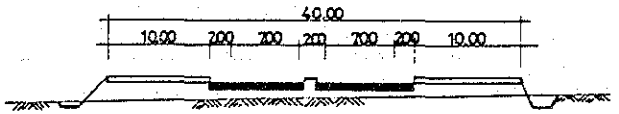
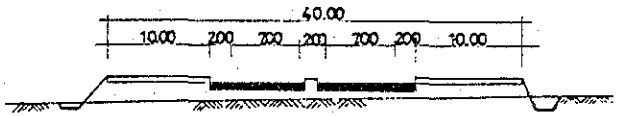
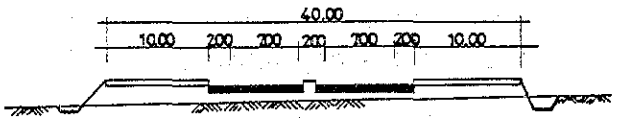
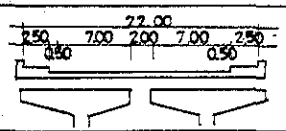
Fig. 5.8.2

Typical Cross-Section on Segment

JAPAN INTERNATIONAL COOPERATION AGENCY

NAME OF SEGMENT	ROAD CLASSIFICATION	CONSTRUCTION TYPE	LAND USE	EMBANKMENT HIGTH (m)	CROSS - SECTION
Segment 7 (2)	Secondary Arterial Road	Improvement Existing Road	Industrial	0	
Segment 8	Secondary Arterial Road	New Construction	Residential	0.5	
Segment 9	Secondary Arterial Road	New Construtuion	Residential	0.5	
Segment 10	Secondary Arterial Road	New Construction	Residential	1.2	
Segment 11	Secondary Arterial Road	New Construction	Residential	0.9	
Segment 12	Secondary Arterial Road	New Construction	Residential	1.4	
Segment 4 (Bridge)	Secondary Arterial Road	New Construction	River	—	
Segment 12 (Bridge)	Secondary Arterial Road	New Construction	River	—	

UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY

Fig. 5.8.3

Typical Cross-Section on Segment

JAPAN INTERNATIONAL COOPERATION AGENCY