

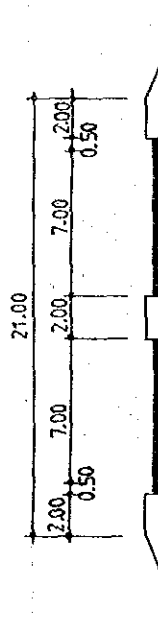
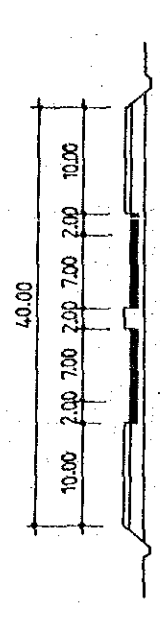
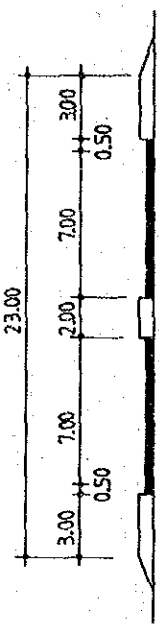
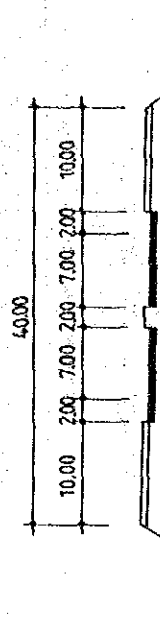
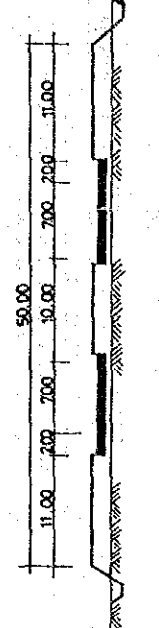
NAME OF SEGMENT	ROAD CLASSIFICATION	CONSTRUCTION TYPE	LAND USE	EMBANKMENT HEIGHT (m)	CROSS - SECTION
Segment 13	Primary Arterial Road	Improvement Existing Road	Residential Commercial	0.5	
Segment 14	Primary Arterial Road	Improvement Existing Road	Residential Commercial	0.5	
Segment 15	Primary Arterial Road	Improvement Existing Road	Residential	1.0	
Segment 16	Primary Arterial Road	Improvement Existing Road	Residential	1.0	
Segment 17	Primary Arterial Road	Improvement Existing Road	Residential	1.0	

Fig. 5.8.4

Typical Cross-Section on Segment

UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY

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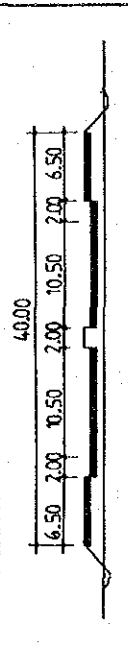
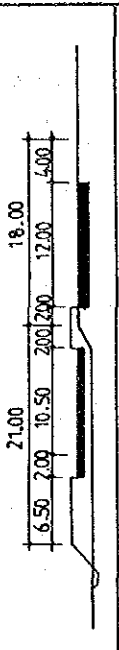
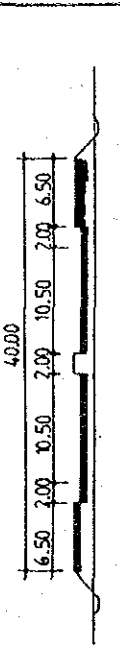
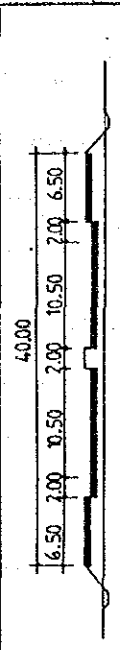
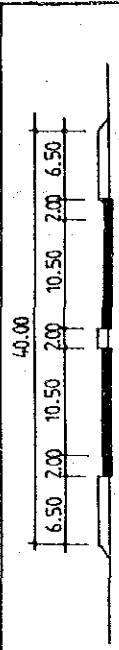
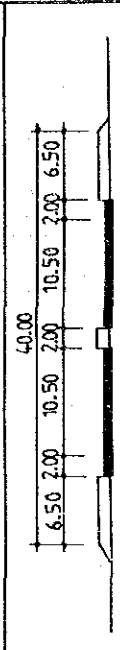
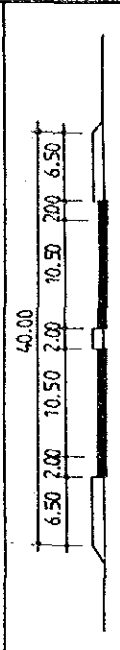
NAME OF	ROAD CLASSIFICATION	CONSTRUCTION TYPE	LAND USE	EMBANKMENT HEIGHT (m)	CROSS - SECTION
Segment 2	Primary Arterial Road	New Construction	Commercial	1.3	
Segment 3	Primary Arterial Road	Improvement	Residential	1.2	
Segment 5	Secondary Arterial Road	New Construction	Residential	1.0	
Segment 6	Secondary Arterial Road	New Construction	Residential	0.9	
Segment 13	Primary Arterial Road	New Construction	Residential	0.5	
Segment 15	Primary Arterial Road	Improvement Existing Road	Residential	1.0	
Segment 16	Primary Arterial Road	Improvement Existing Road	Residential	1.0	

Fig. 5.8.5

Typical Cross-Section on Segment ( for 6 lanes )

UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY

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Table 5.8.5 Description of Each Segment

Name of Segment	Length (m)	Number of Lanes		Construction Type	Remarks
		1994	2009		
Segment 1	2,900	2	4	New Road	Port -Jl. Tol
Segment 2	2,850	4	4	New Road	Jl. Gowa Jaya
Segment 3	4,200	4	4	Widening	Jl. Gowa Jaya - Jl. Toll
Segment 4	5,850	-	2	New Road	Jl. Gowa Jaya
Segment 5	2,670	4	4	New Road	Antang Area
Segment 6	4,400	2	4	New Road	Jl. Gowa Jaya - Jl. Toll
Segment 7	3,250	2	2	New Road	Jl. Gowa Jaya
Segment 8	6,900	-	2	New Road	Antang Area
Segment 9	6,950	-	4	New Road	Sungguminasa - Jl. Veteran
Segment 10	5,100	-	4	New Road	M.R.R
Segment 11	3,650	-	4	New Road	O.R.R
Segment 12	5,710	-	4	New Road	Jongaya - Barombong
Segment 13	10,200	4	6	Widening	CBD - Unhas
Segment 14	16,800	2	4	Widening	Maros - Jongaya
Segment 15	1,450	4	4	Widening	Pettarani
Segment 16	5,100	4	4	Widening	Sungguminasa
Segment 17	11,500	2	4	Widening	Toll bridge
Total	99,480				

#### 5.8.4 Drainage Design

##### 1) General

At present, the drainage system in Ujung Pandang area is operated by 4 rivers i.e. Jeneberang river with capacity of 1000 m<sup>3</sup>/sec, Tallo river 150 m<sup>3</sup>/sec, Sinrijala river 4 m<sup>3</sup>/sec, Panampu channel 4 m<sup>3</sup>/sec; and by many small drainages located along the existing roads.

As mentioned in previous section, channel in Ujung Pandang is open channel, consequently it is polluted when it overflows during flood time.

Many existing open channels have been polluted by dust and grasses thrown into it by inhabitants, as a result the drainage system does not function properly. To improve this situation, existing open channels should be cleaned up frequently.

There is Master Plan for improvement of the drainage system in Ujung Pandang area. Considering existing drainage condition, the Master Plan should be implemented as soon as possible.

In addition, preparation for improvement of the Sinrijala river will be required to ensure a good function of drainage.

##### 2) Drainage System of Proposed Road

Considering the existing drainage system in Ujung Pandang, stagnant water condition of study area and the existing rivers and channel conditions along the proposed roads, the drainage system of the proposed roads is examined.

The road drainage treatments are divided into two (2) types that is road surface treatment and road side surface treatment.

The drainage system of the proposed road is planned as follows :

- a) L-Type concrete gutters are planned on both sides of shoulders for road surface treatment.
- b) U-Type concrete drainages are planned under the L-Type gutters.
- c) Earth drainages are planned on both road sides for road side surface treatment.
- d) The U-Type concrete drainages are connected by concrete drainage pipe to earth drainage.
- e) Earth drainage is connected to the existing river.

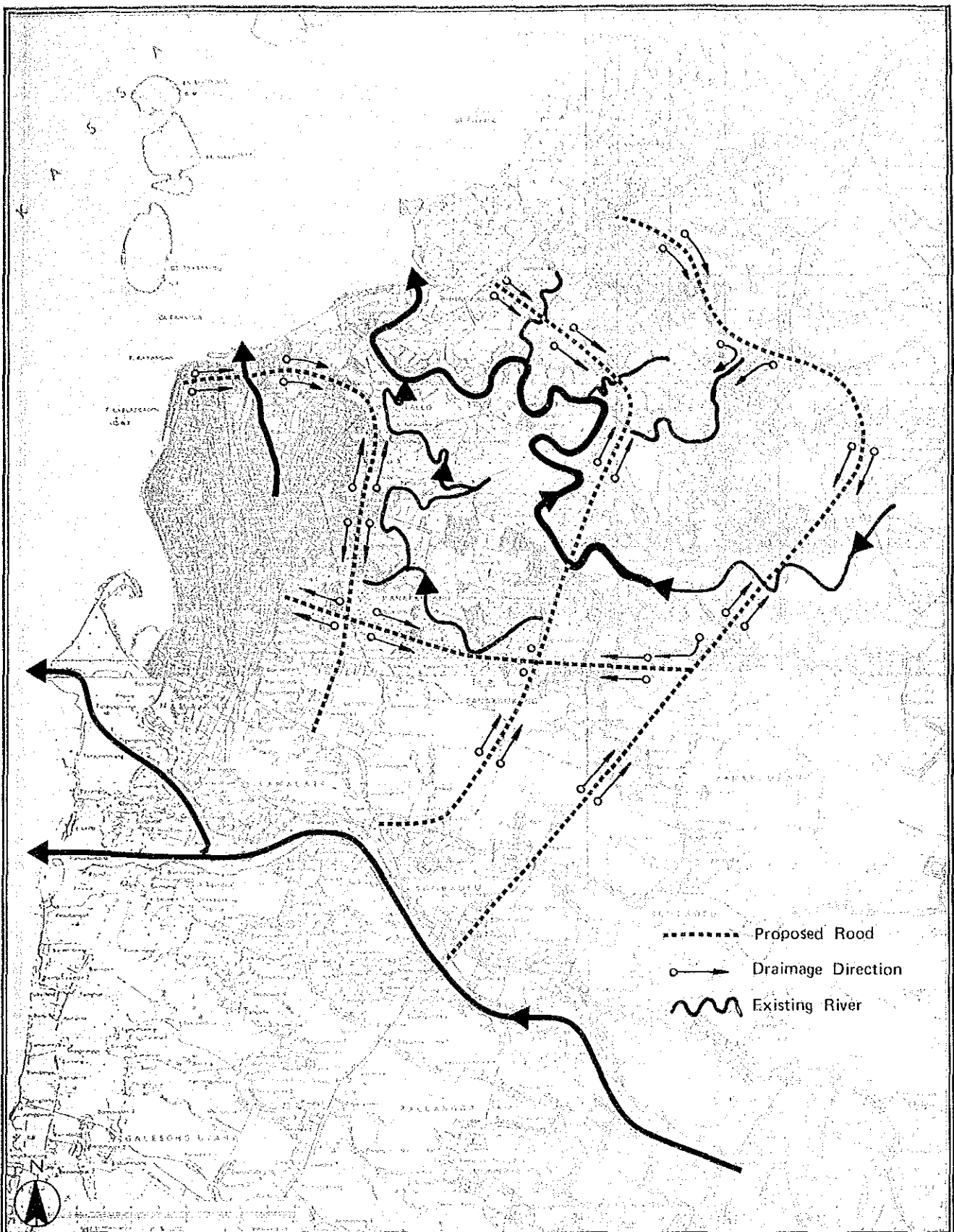
The above mentioned system is illustrated in Fig. 5.8.6. and Fig. 5.8.7; and the river or channel to which each drainage be connected is shown in Table 5.8.6.

Most of the proposed roads located within stagnant area shall be constructed with about 1.0 meter height of embankment.

So, the culvert pipe is planned, as shown in Fig. 5.8.7, at 300 meters interval along the roads for management of stagnant water.

**Table 5.8.6 Segment and Flow Out-let**

Segment	Name of River for Out-Let
Segment 1	Panampu channel
2	Tallo River
3	Sinrijala River
4	Tallo River
5	Sinrijala River
6	Sinrijala River
7	Tallo River
8	Tallo River
9	Sinrijala River
10	Sinrijala River
11	Sinrijala River
12	Jeneberang River

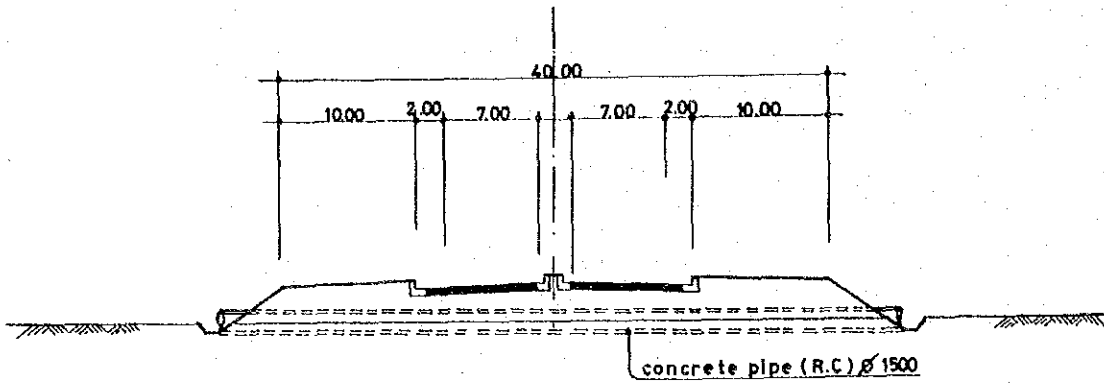


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

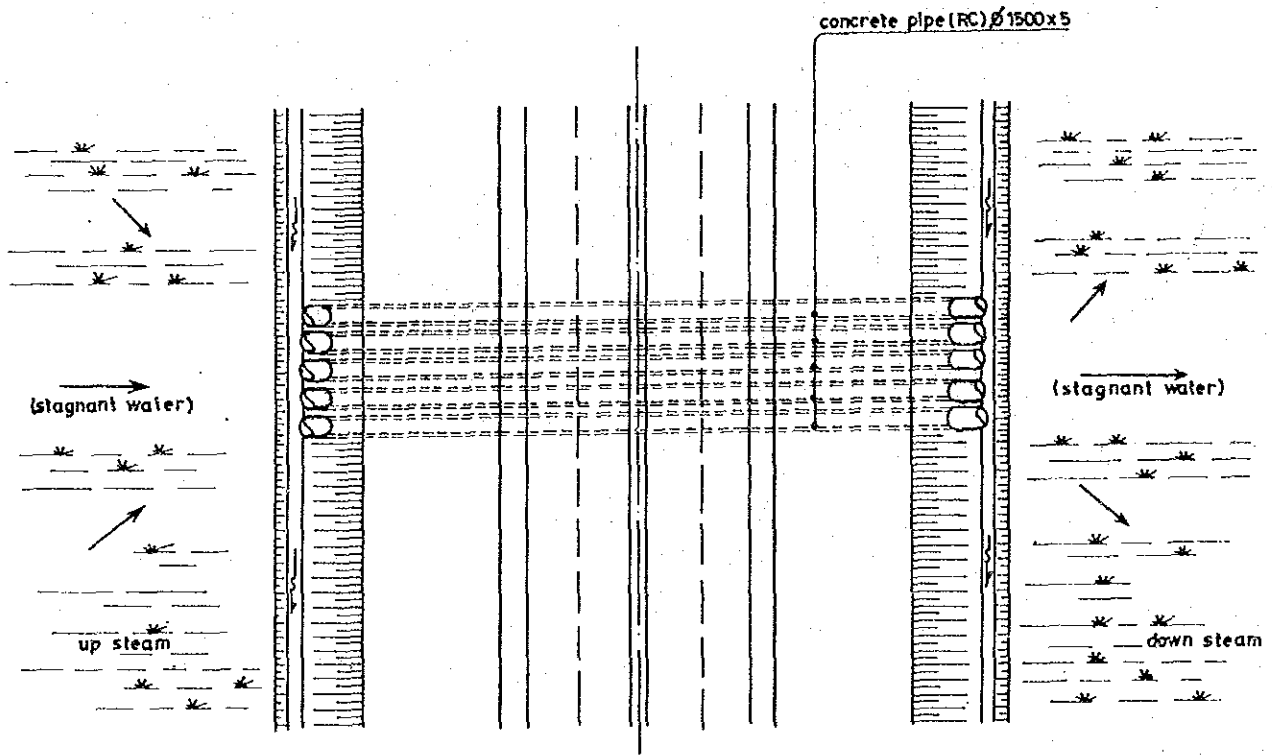
**Fig.  
5.8.6**

**Drainage System**

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CROSS - SECTION



P L A N

UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY

Fig.

5.8.7

Treatment of Stagnant Water

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### 5.8.5 Construction Material Survey

#### 1) General

A construction material survey was conducted to find out the availability of the construction materials needed for construction of the proposed roads. The survey is carried out by applying hearing survey method to some construction companies and analyzing the data collected.

#### 2) Construction Materials

The main construction materials needed for road construction project are soil for embankment, stone or rock for concrete work, steel for structure and asphalt for pavement. The results of the survey are described below.

##### a) Soil Materials

When the road will be constructed in Ujung Pandang suburban area, 0.5-1.0 m height of embankment will be required to prevent it from being inundated during rainy season.

There is no soil material for embankment along the recommended project roads due to their location within flat terrain. However, it is plentifully available at the area outside Ujung Pandang according to the result of surface soil condition survey.

##### b) Gravel and Sand Materials

Sufficient volume of gravel and sand for road construction are found at Pangkep and Gowa which are respectively measured to be 50km and 30 km distance from Ujung Pandang.

##### c) Stone and Rock Materials

Stone and rock material for concrete structure and other rock construction are found at Pangkep and Maros ; both of which are located about 40 km from Ujung Pandang. The capacity of these materials are regarded enough to supply the amount needed for recommended road projects. There is one quarry factory along Jl. Toll in Ujung Pandang , however, its output is regarded not enough for recommended road projects.

##### d) Cement and Ready Mixed Concrete

In Ujung Pandang, cement can be produced in sufficient volume while ready mixed concrete is not available.



e) Steel and Reinforced Concrete Bar

There is no factory of steel and reinforced concrete bar in Ujung Pandang at present. Therefore, these materials should be transported from Jakarta.

Standard specifications are as follows :

Yield Strength :  $Y = 2500 \text{ kg/cm}^2$

Allowable axial tensile stress :  $t_a = 1400 \text{ kg/cm}^2$

Allowable axial compressive stress

$1/r \leq 20$  :  $c_a = 1400 \text{ kg/cm}^2$

$20 < 1/r < 93$  :  $c_a = 1400 - 8.4 (1/r - 20)$   
 $12,000,000$

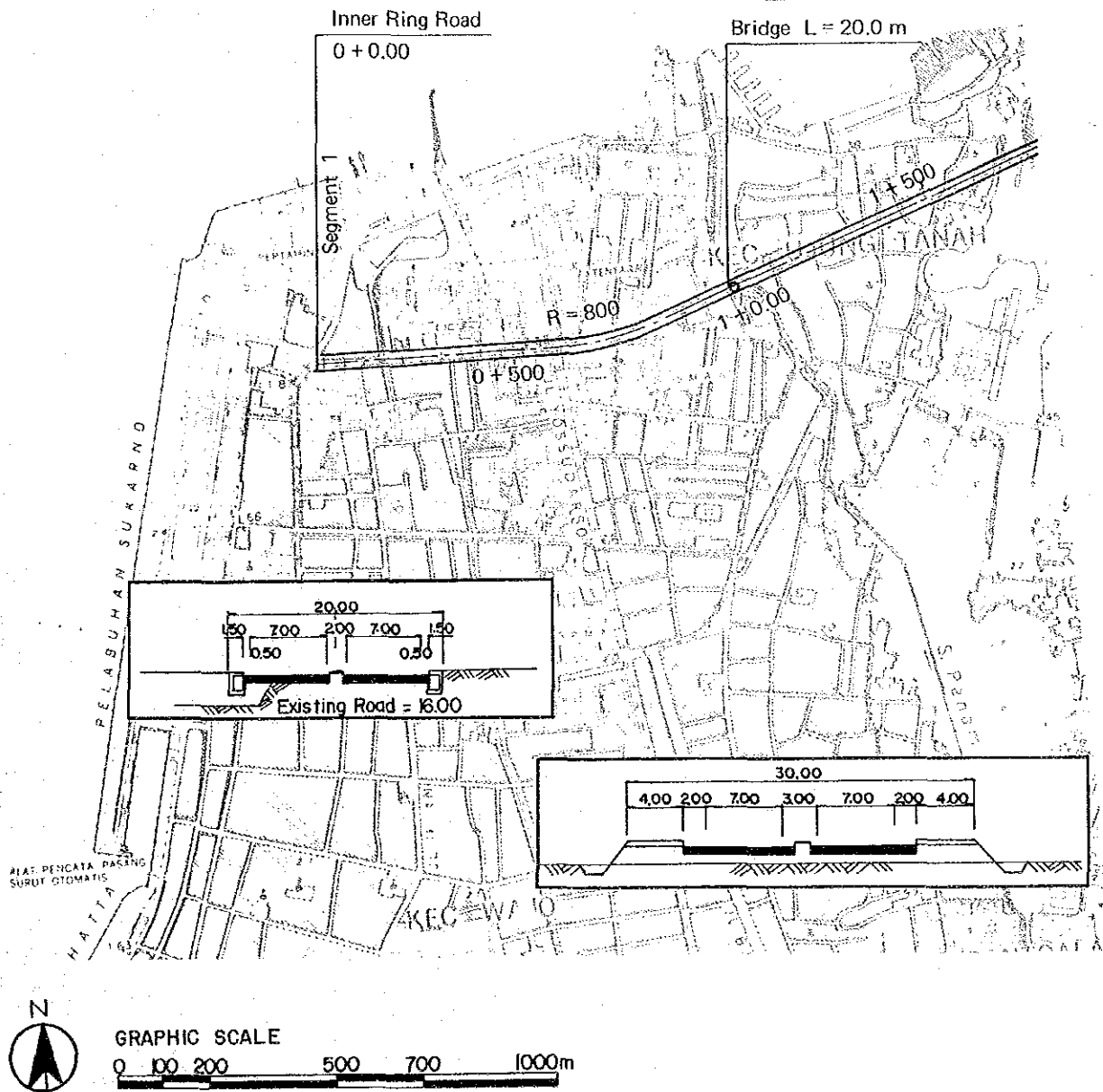
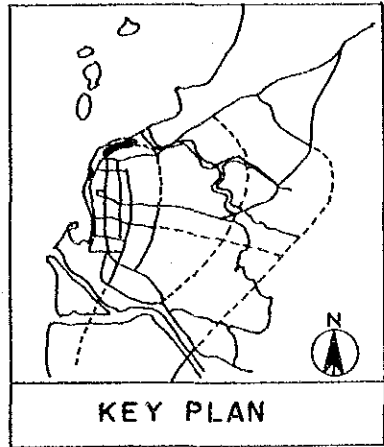
$95 \leq 1/r$  :  $c_a = \frac{6700 + (1/r)^2}{12,000,000}$

Allowable bending stress :  $b_a : 1400 \text{ kg/cm}^2$

Allowable shearing stress :  $s_a : 800 \text{ kg/cm}^2$

On the whole, it can be said that the above mentioned construction materials are obtainable locally in sufficient volume. Therefore, it seems that there is no constraint for actual new road construction in terms of quantity.

As for the quality, it cannot be identified now since it is not examined in this study. Therefore, the next study stage of feasibility study will focus on detailed quality survey on construction materials.

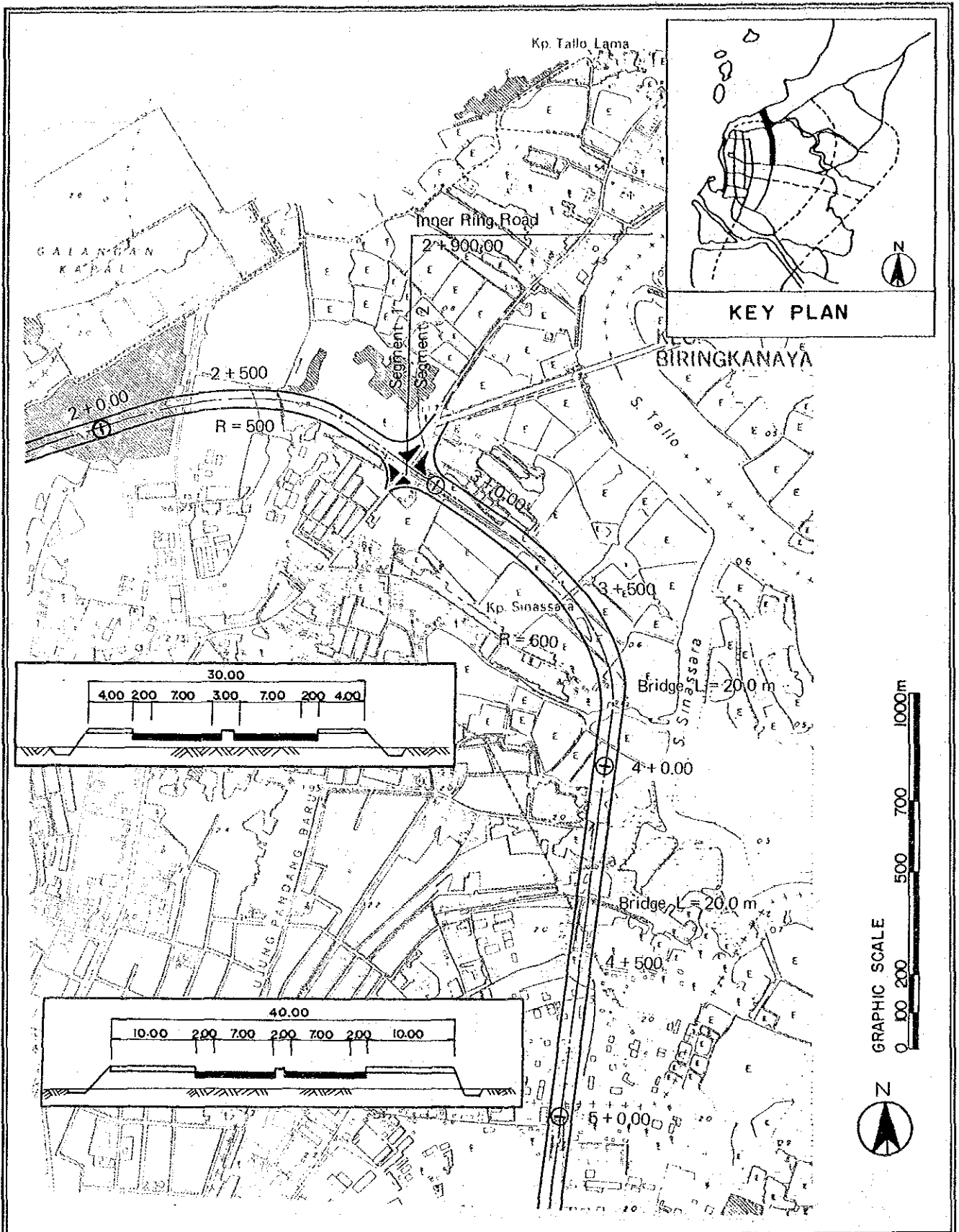


UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY

Fig.  
5.8.8

Inner Ring Road (Segment 1)

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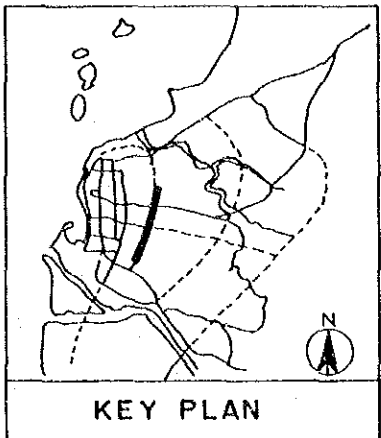
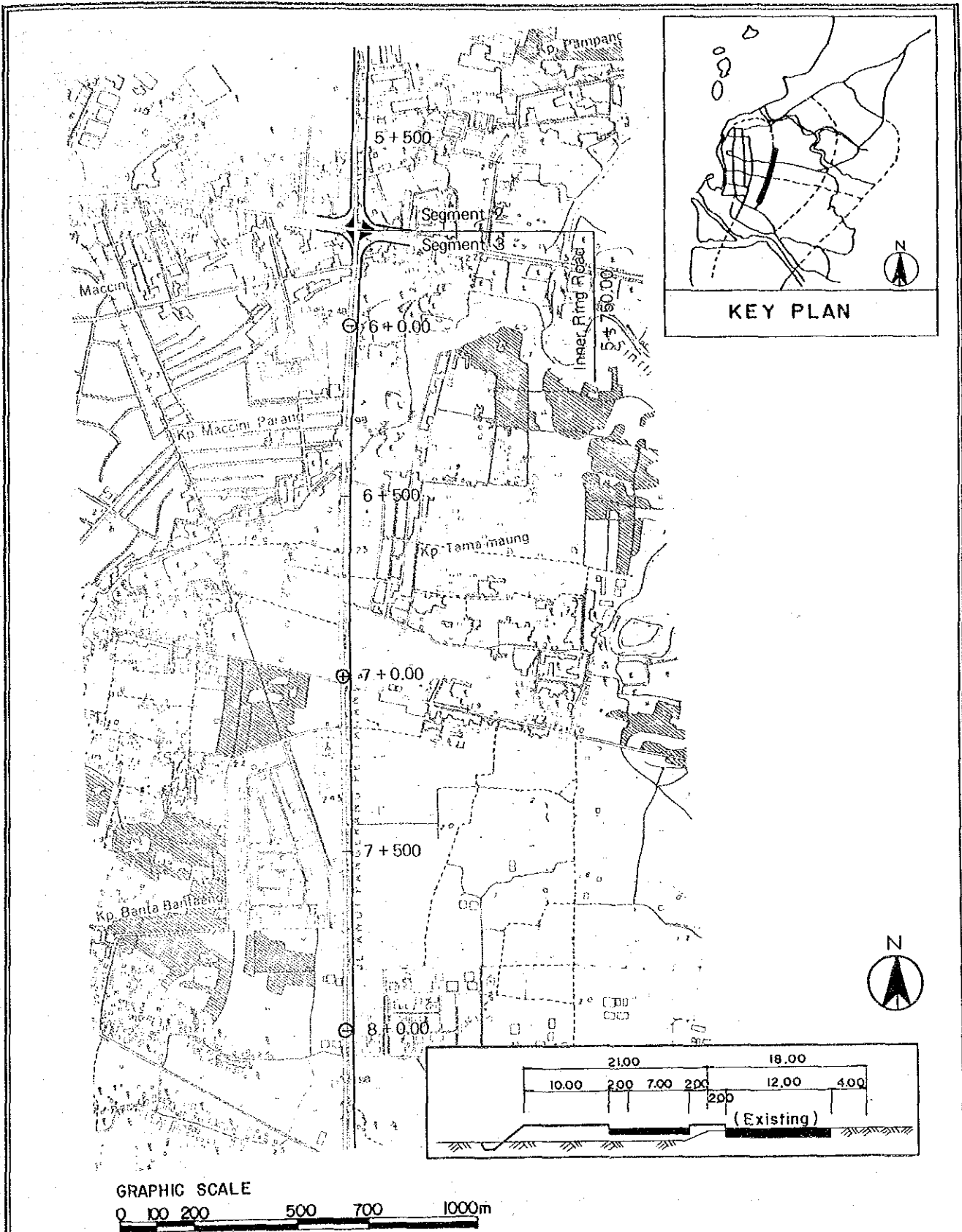


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.  
5.8.9**

**Inner Ring Road (Segment 2)**

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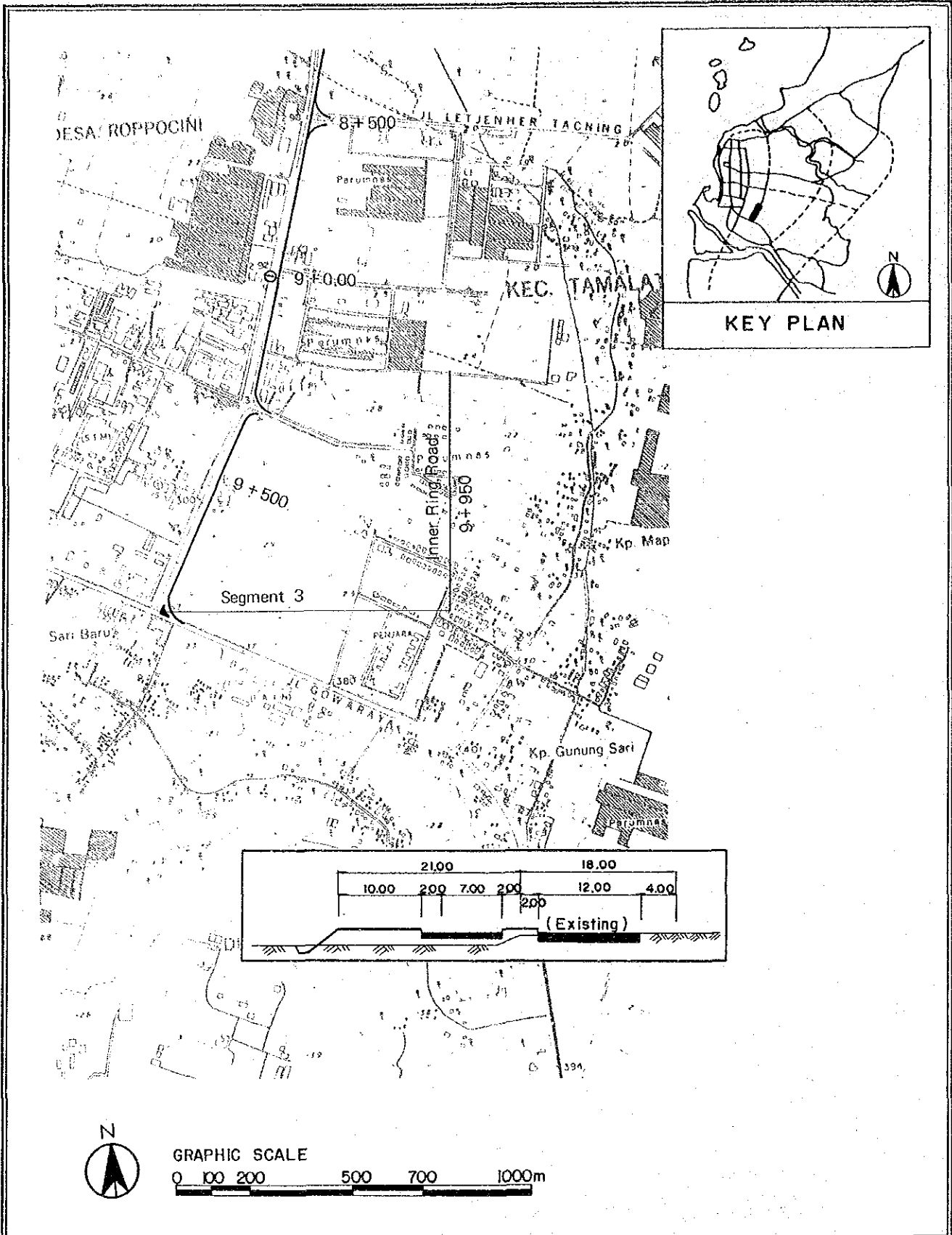


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig. 5.8.10**

**Inner Ring Road (Segment 3)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

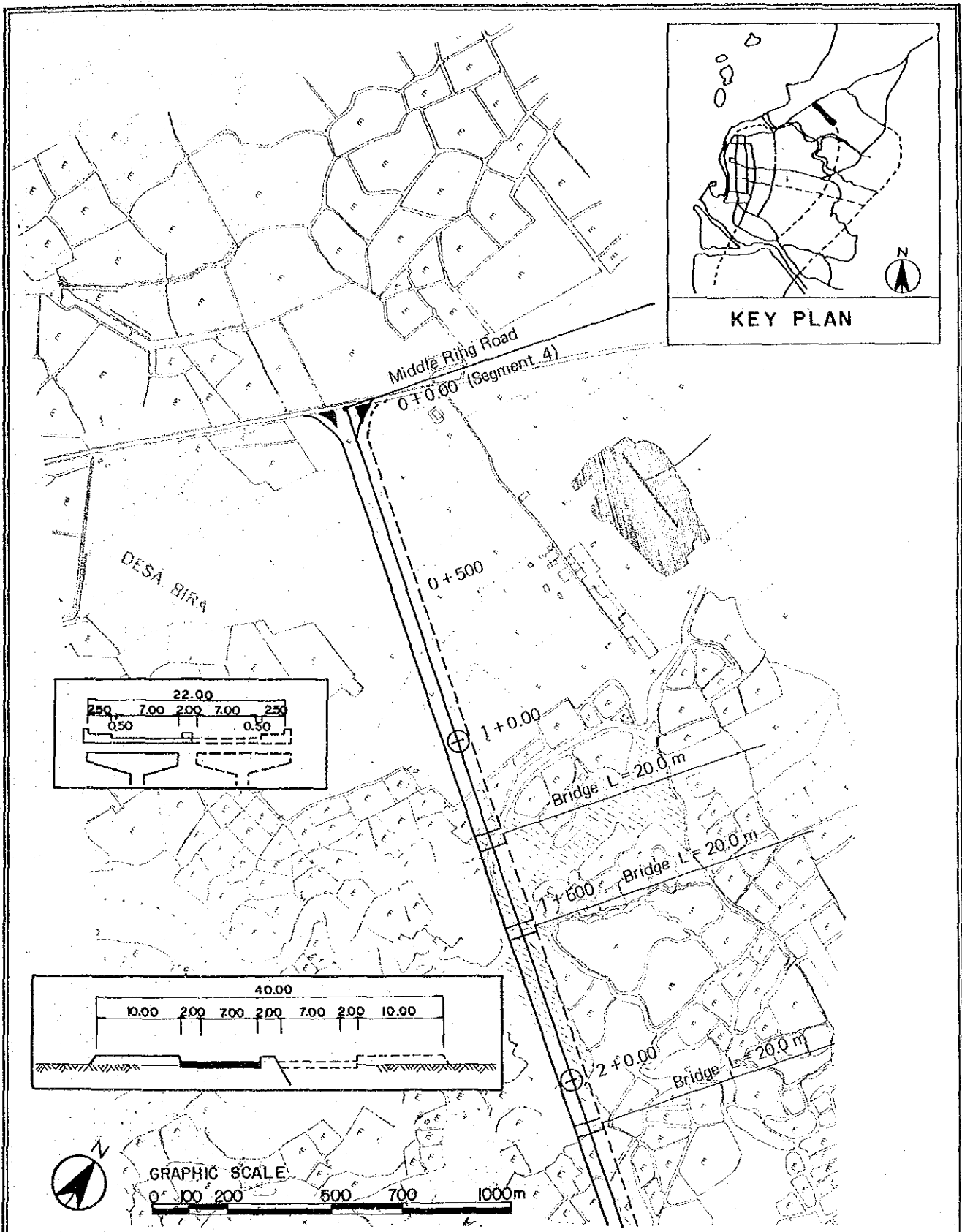


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.  
5.8.11**

**Inner Ring Road (Segment 3)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

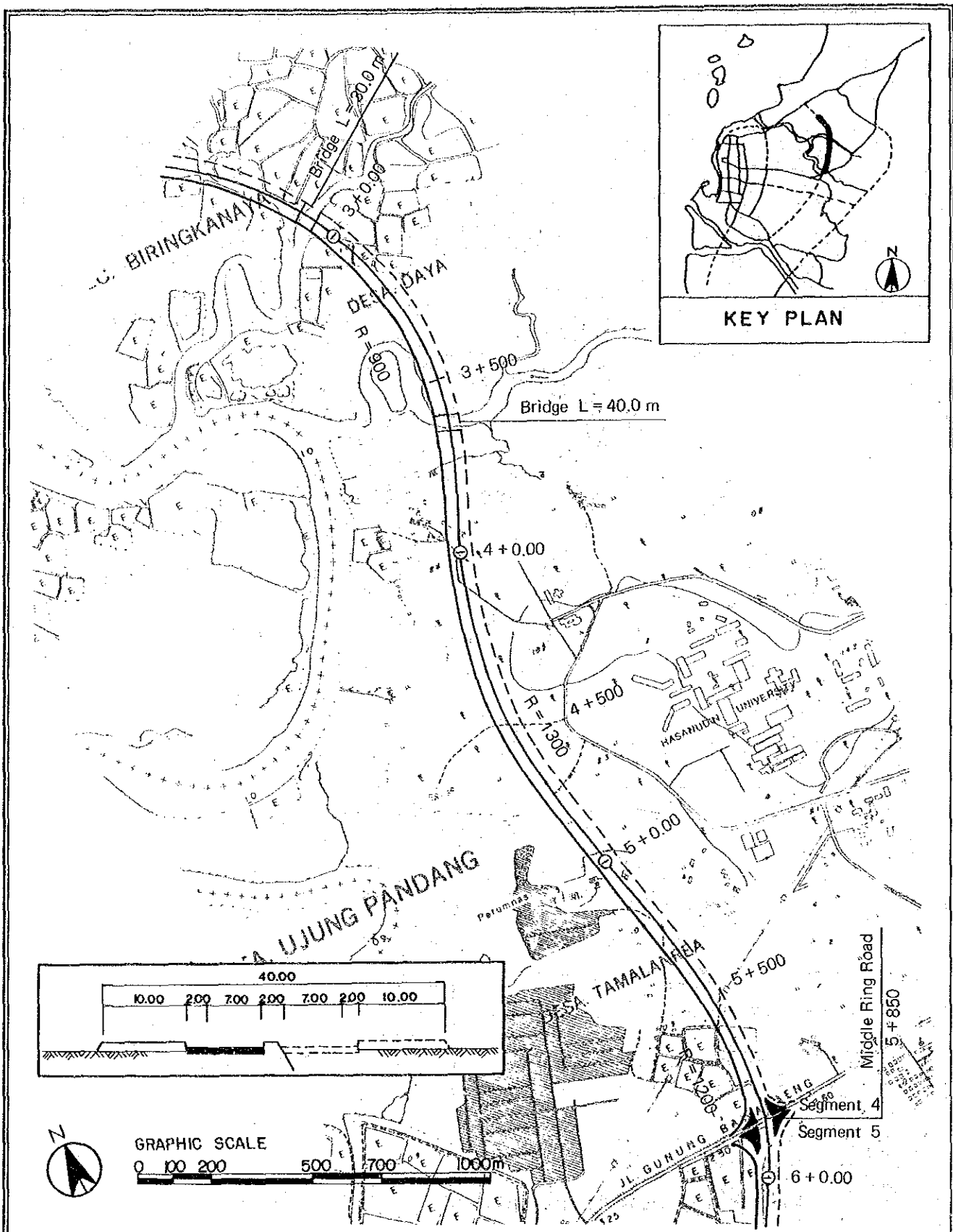


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig. 5.8.12**

**Middle Ring Road (Segment 4)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

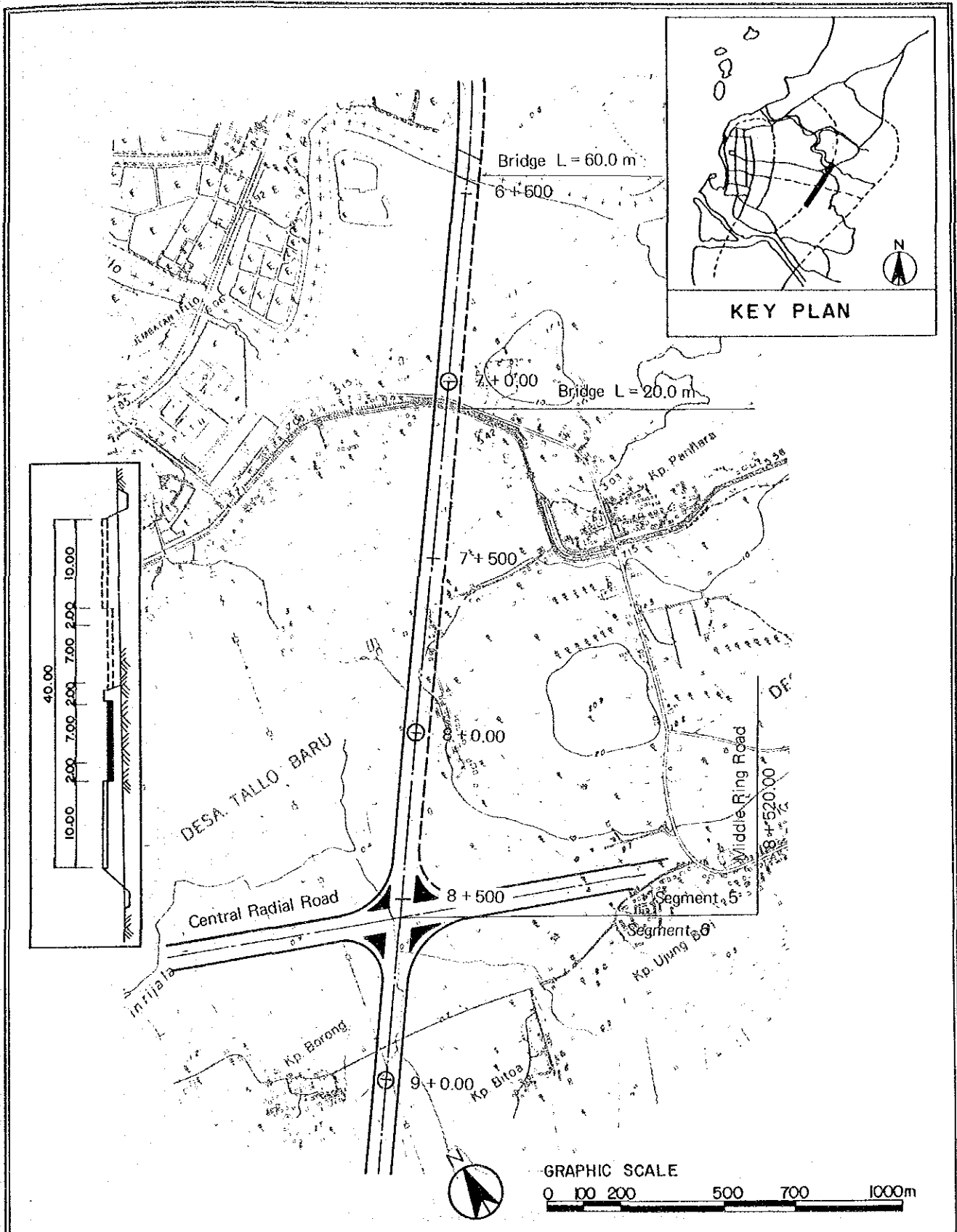


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.  
5.8.13**

**Middle Ring Road (Segment 4)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**



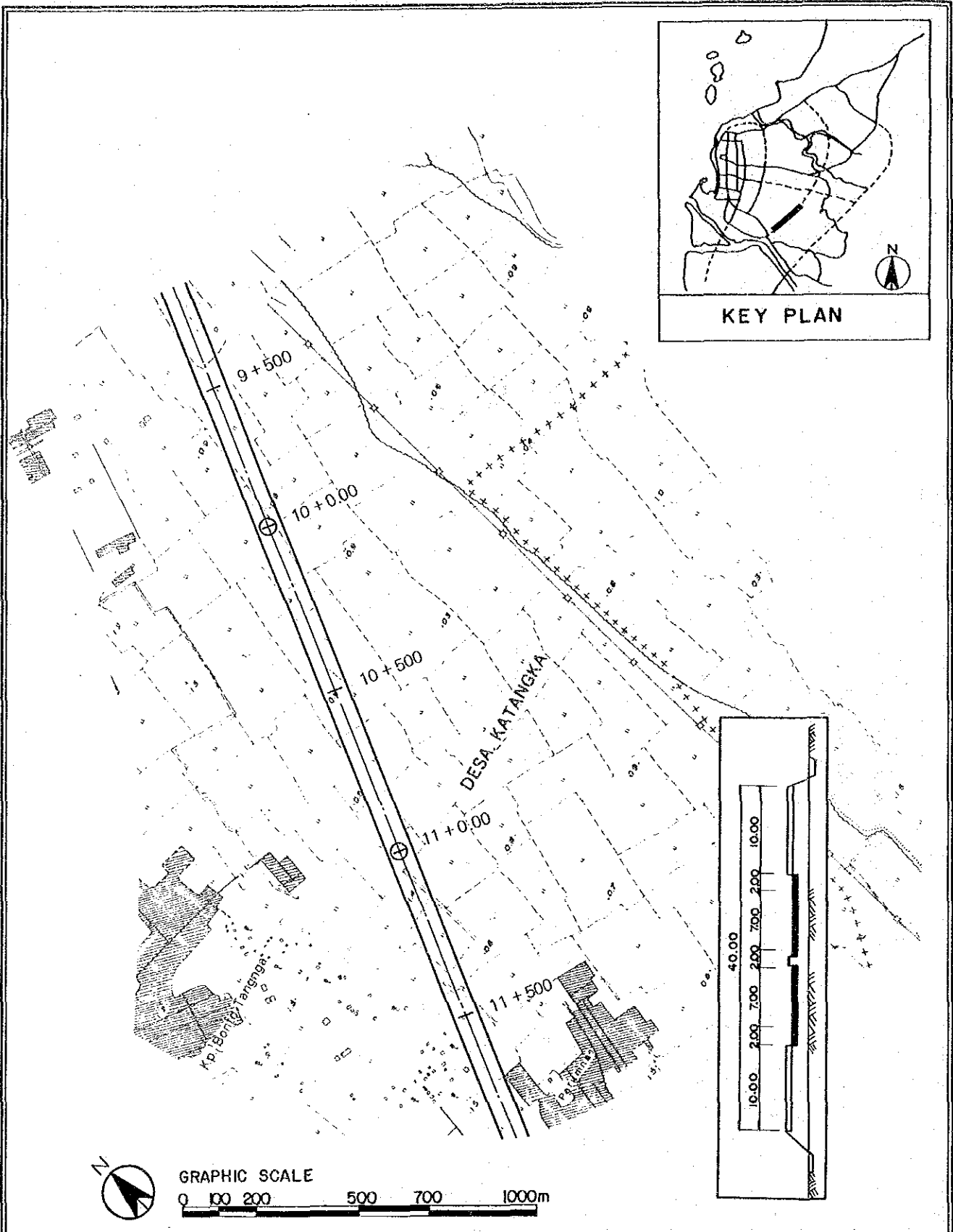
**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.**  
5.8.14

**Middle Ring Road (Segment 5)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**



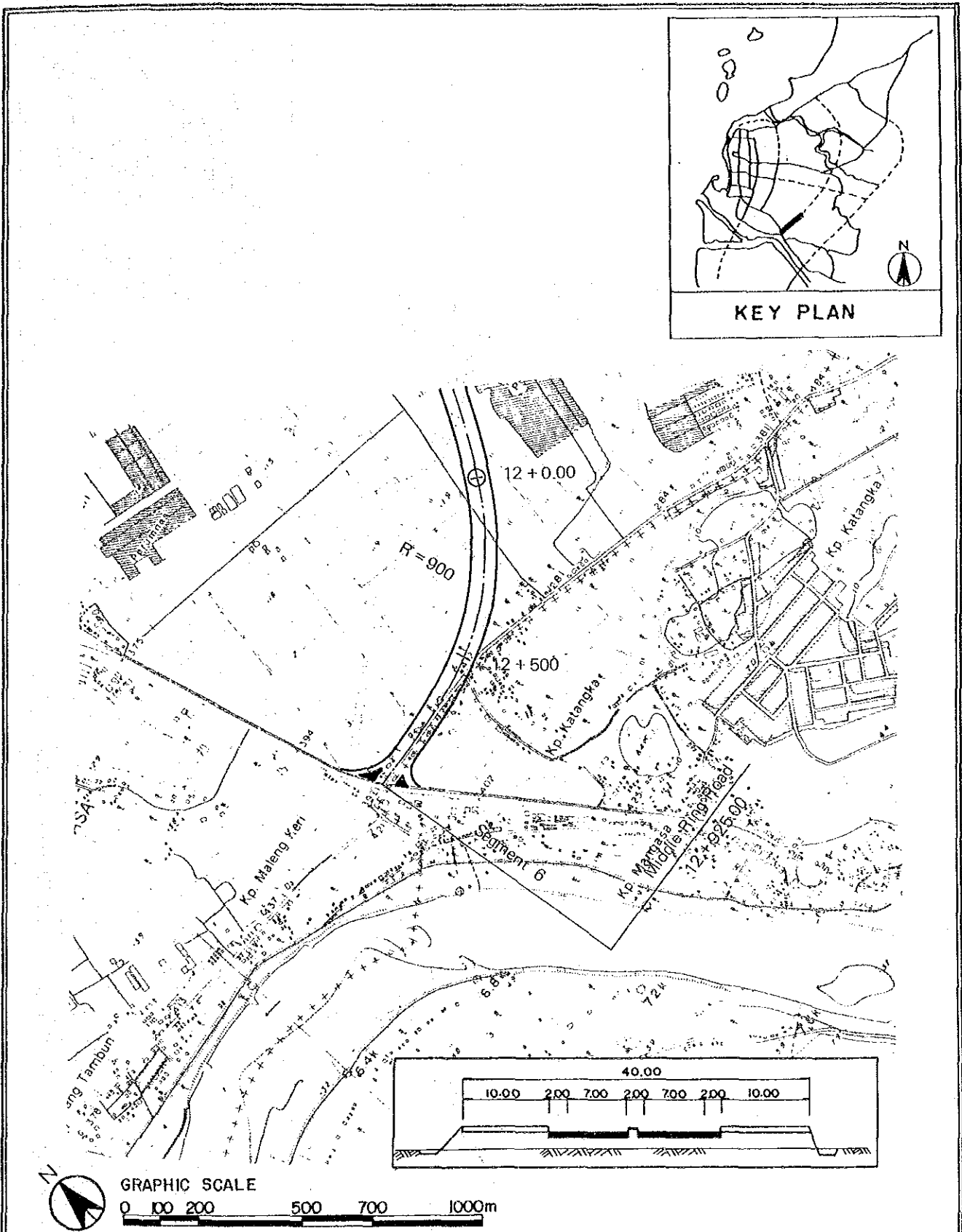


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig. 5.8.15**

**Middle Ring Road (Segment 6)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

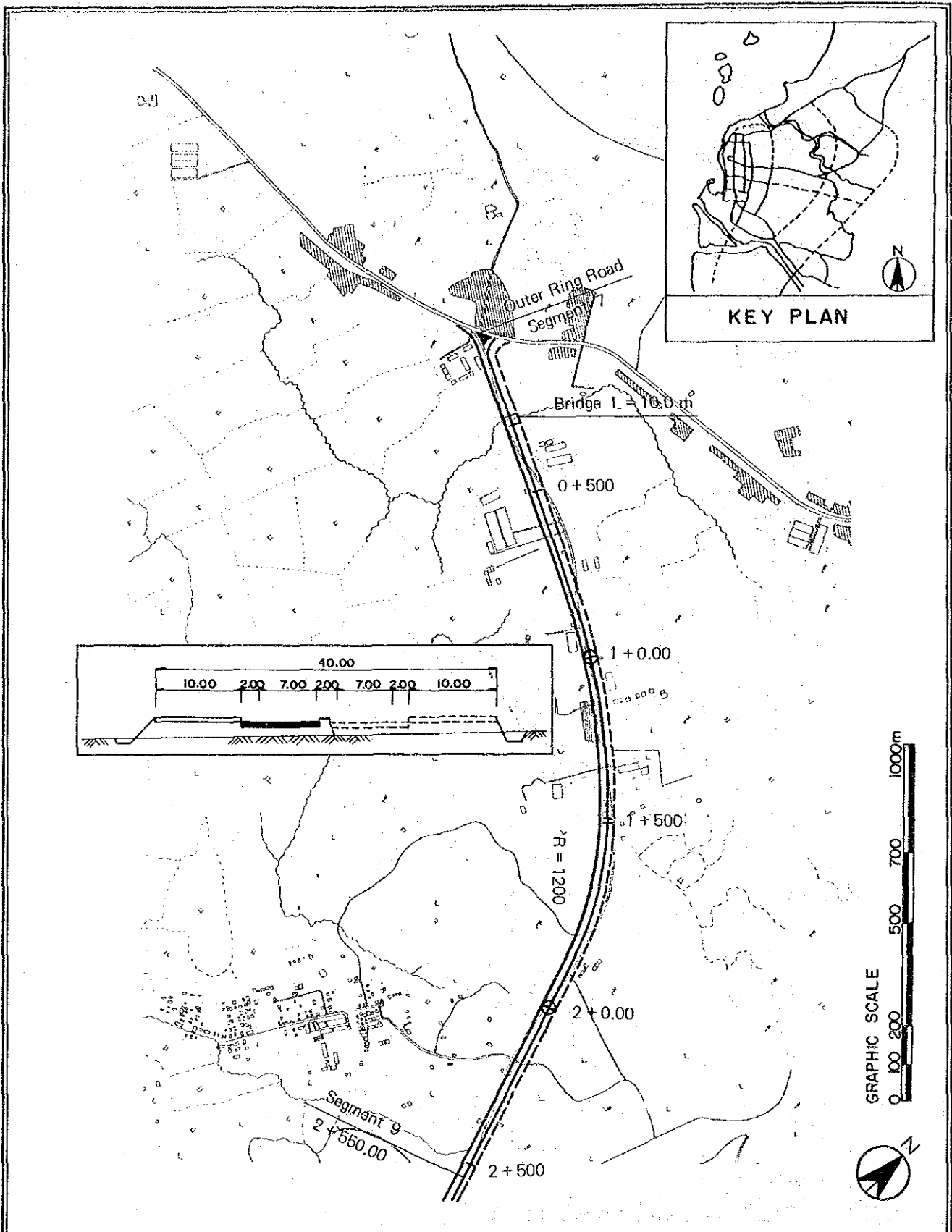


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.**  
5.8.16

Middle Ring Road (Segment 6)

**JAPAN INTERNATIONAL COOPERATION AGENCY**

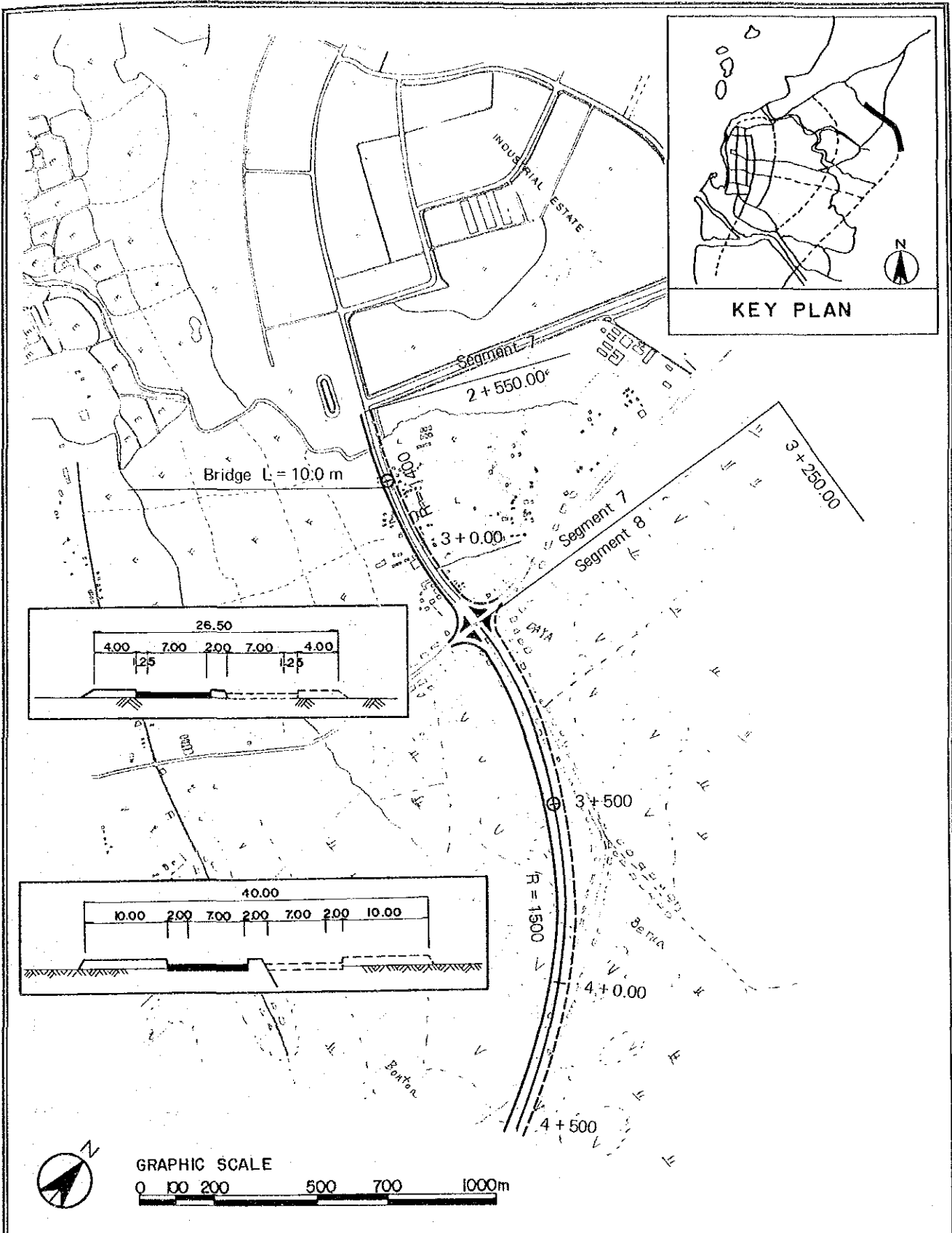


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.  
5.8.17**

**Outer Ring Road (Segment 7)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

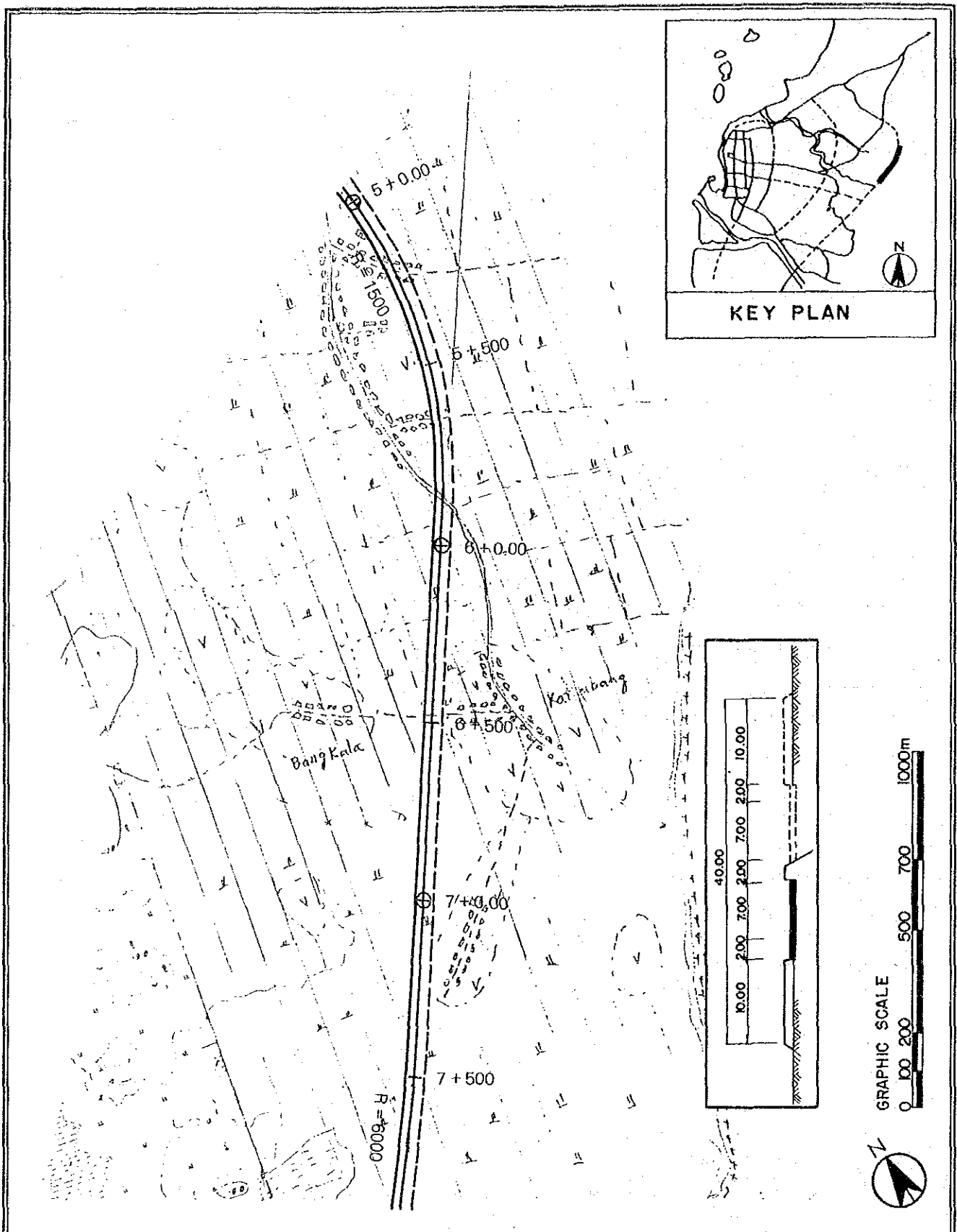


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.  
5.8.18**

**Outer Ring Road (Segment 7, 8)**

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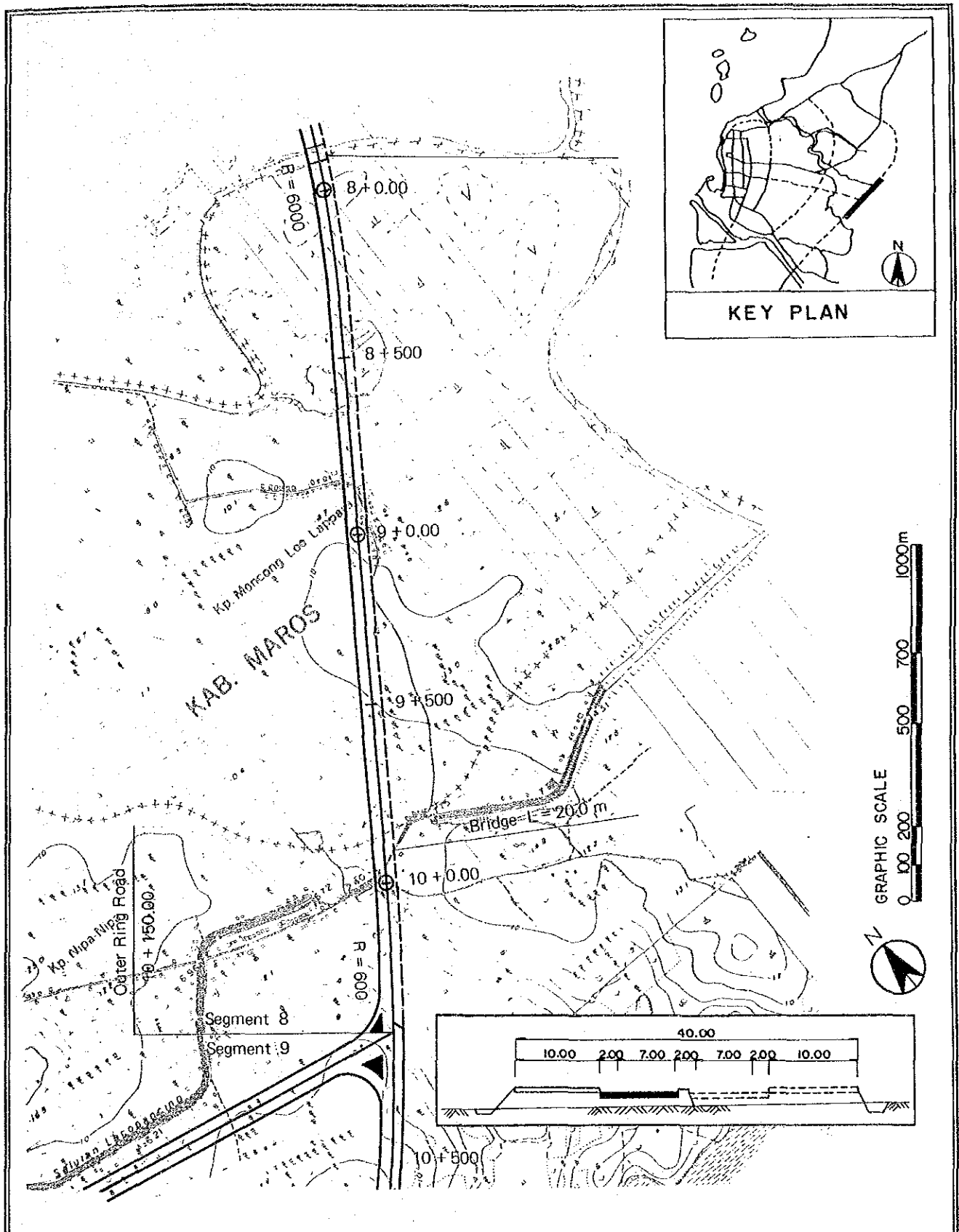


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig. 5.8.19**

**Outer Ring Road (Segment 8)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

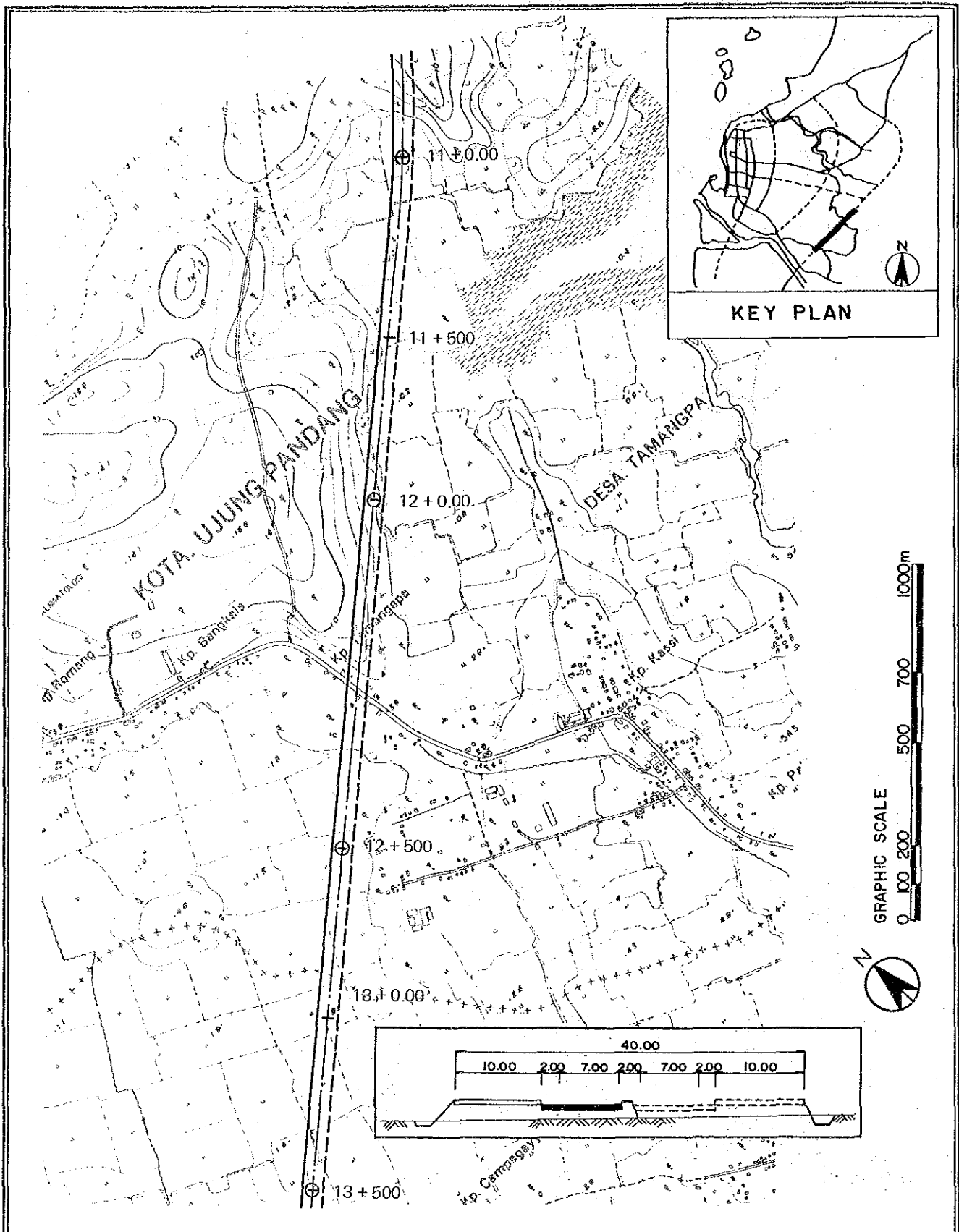


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.**  
5.8.20

Outer Ring Road (Segment 8, 9)

**JAPAN INTERNATIONAL COOPERATION AGENCY**

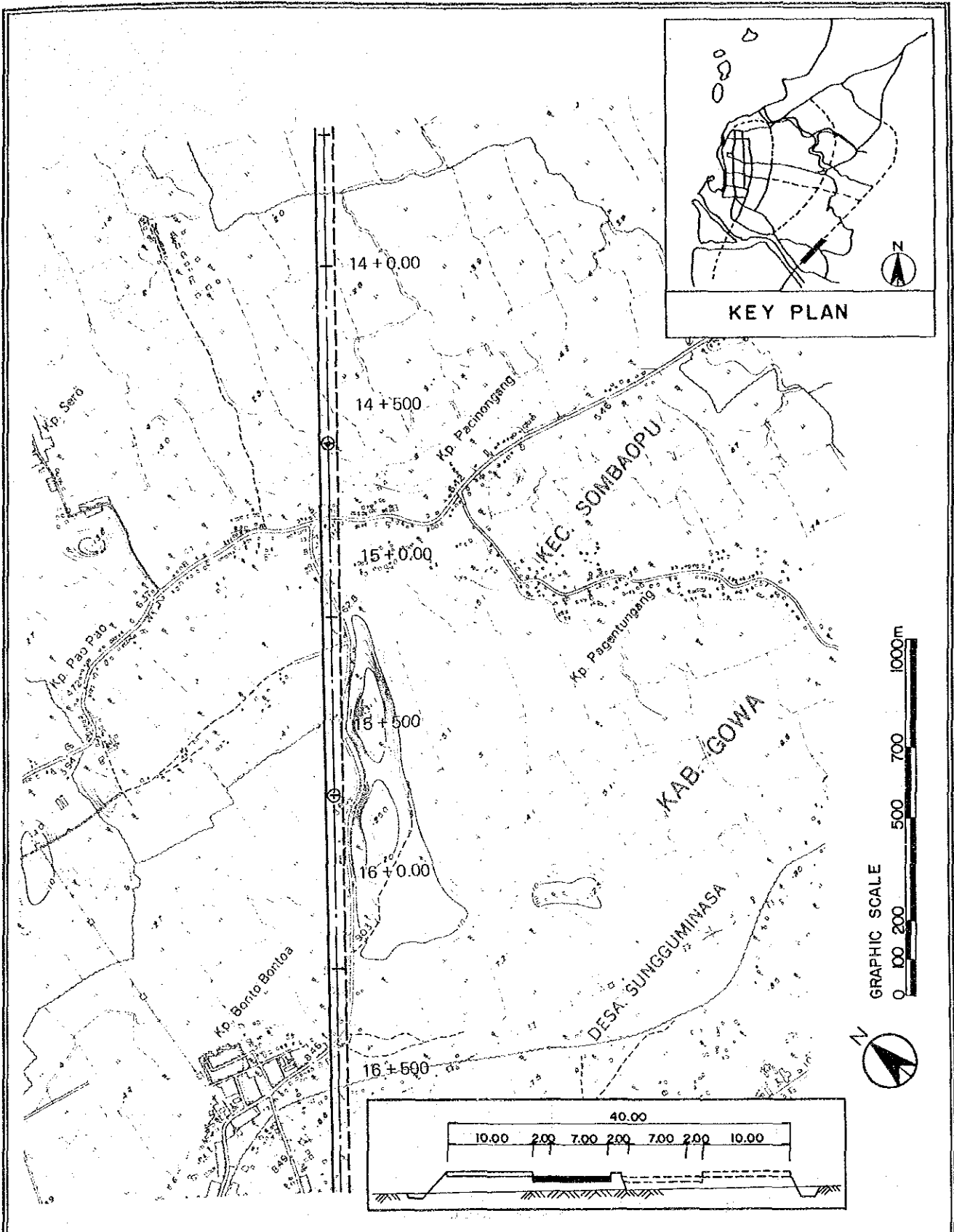


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.  
5.8.21**

**Outer Ring Road (Segment 9)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**



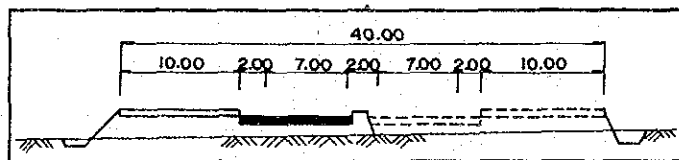
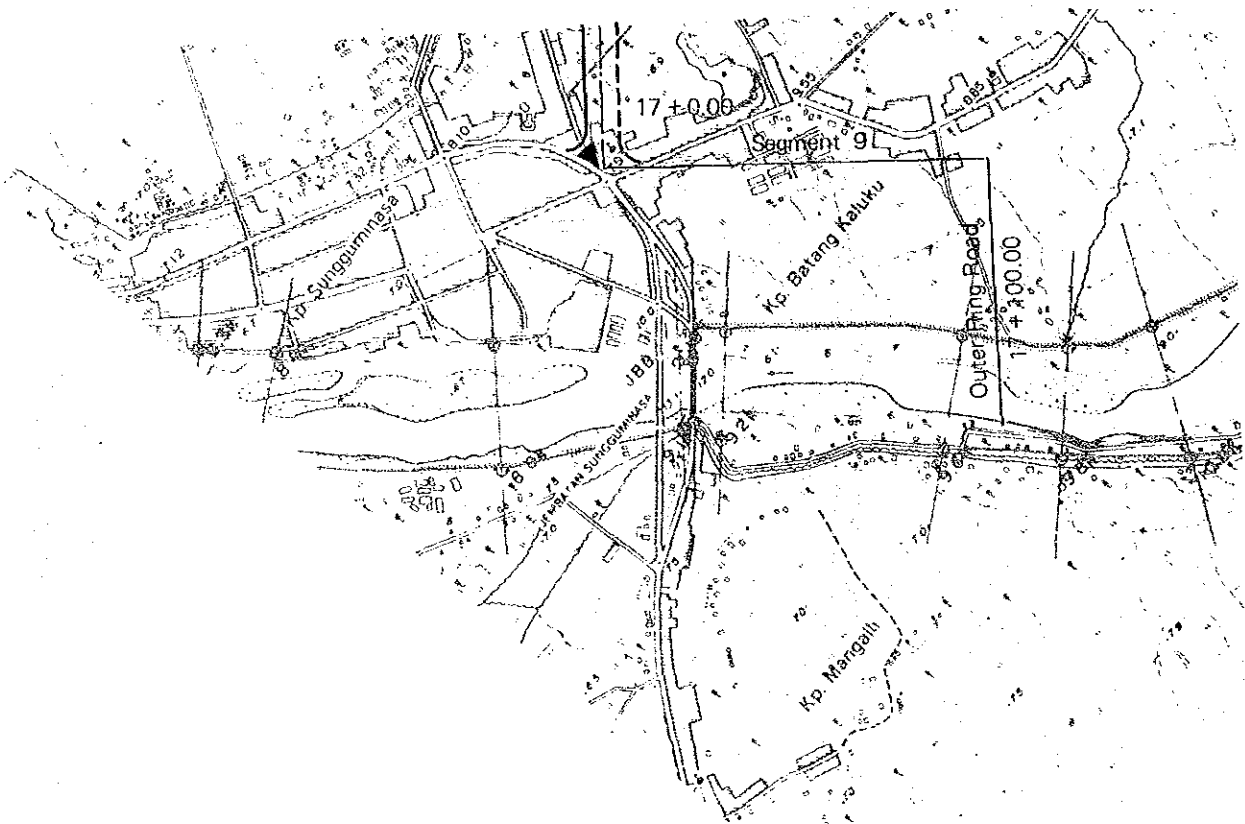
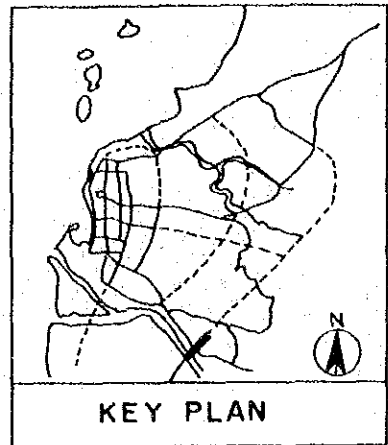
**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.**  
**5.8.22**

**Outer Ring Road (Segment 9)**

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GRAPHIC SCALE

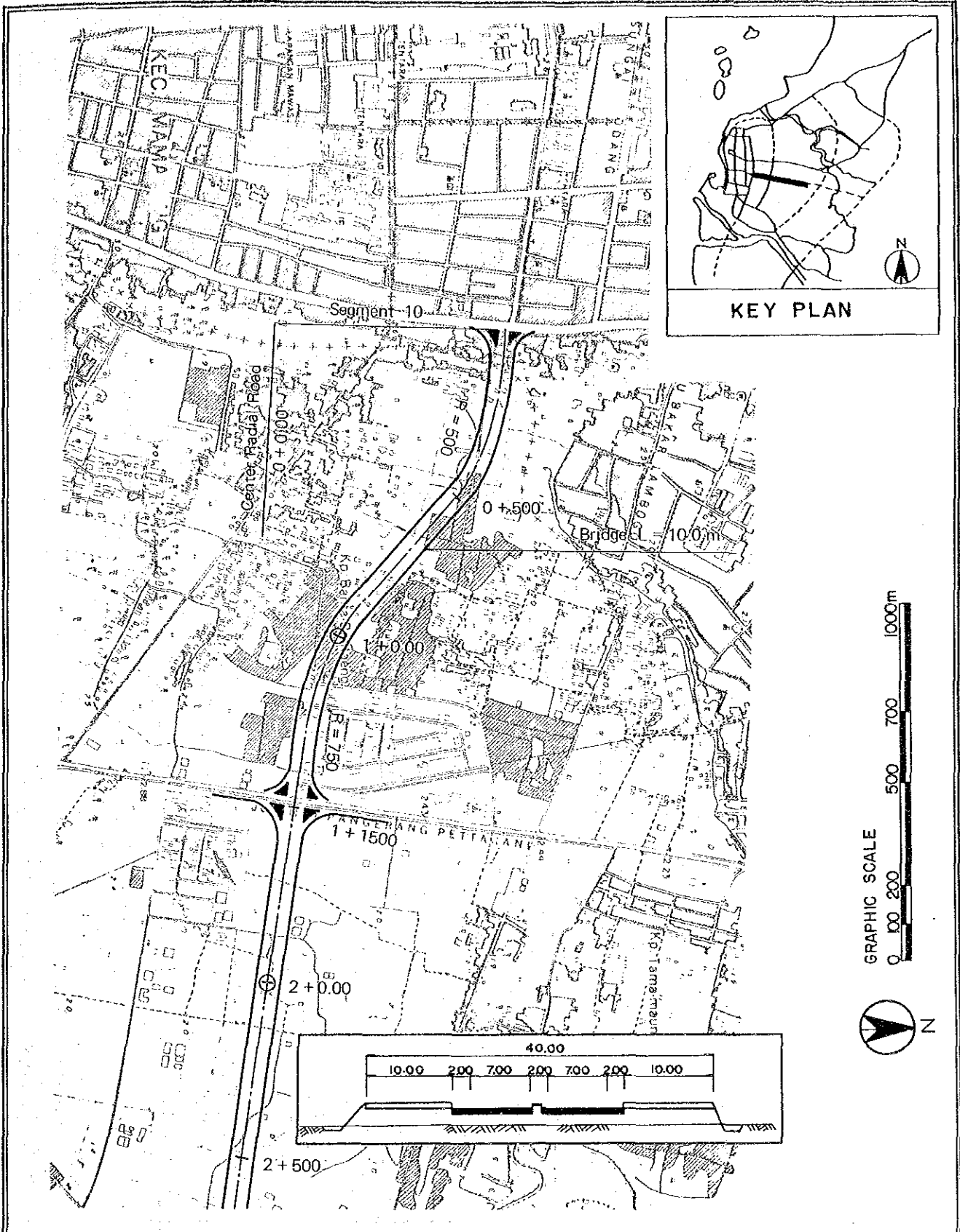


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.  
5.8.23**

**Outer Ring Road (Segment 9)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

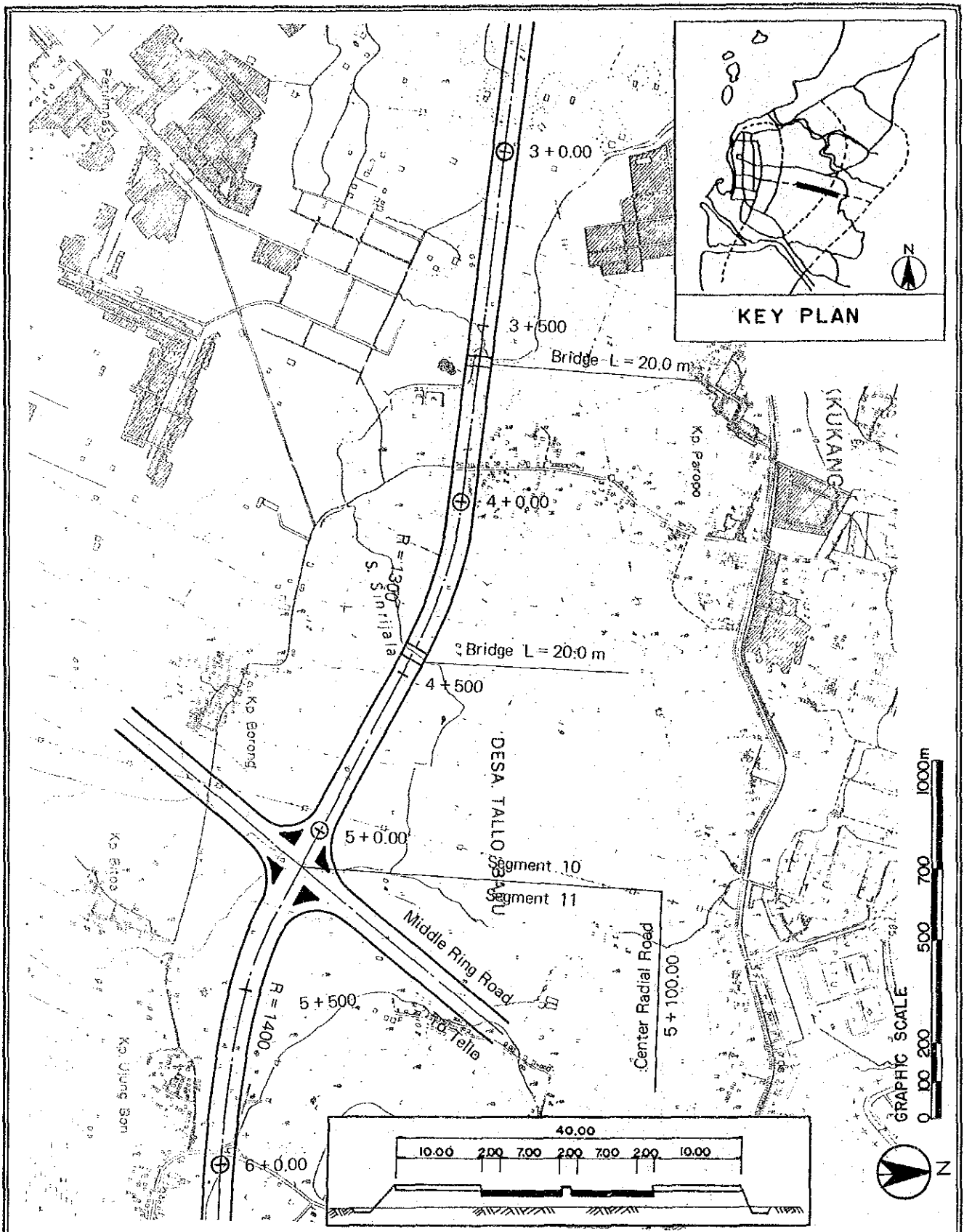


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig. 5.8.24**

**Center Radial Road (Segment 10)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

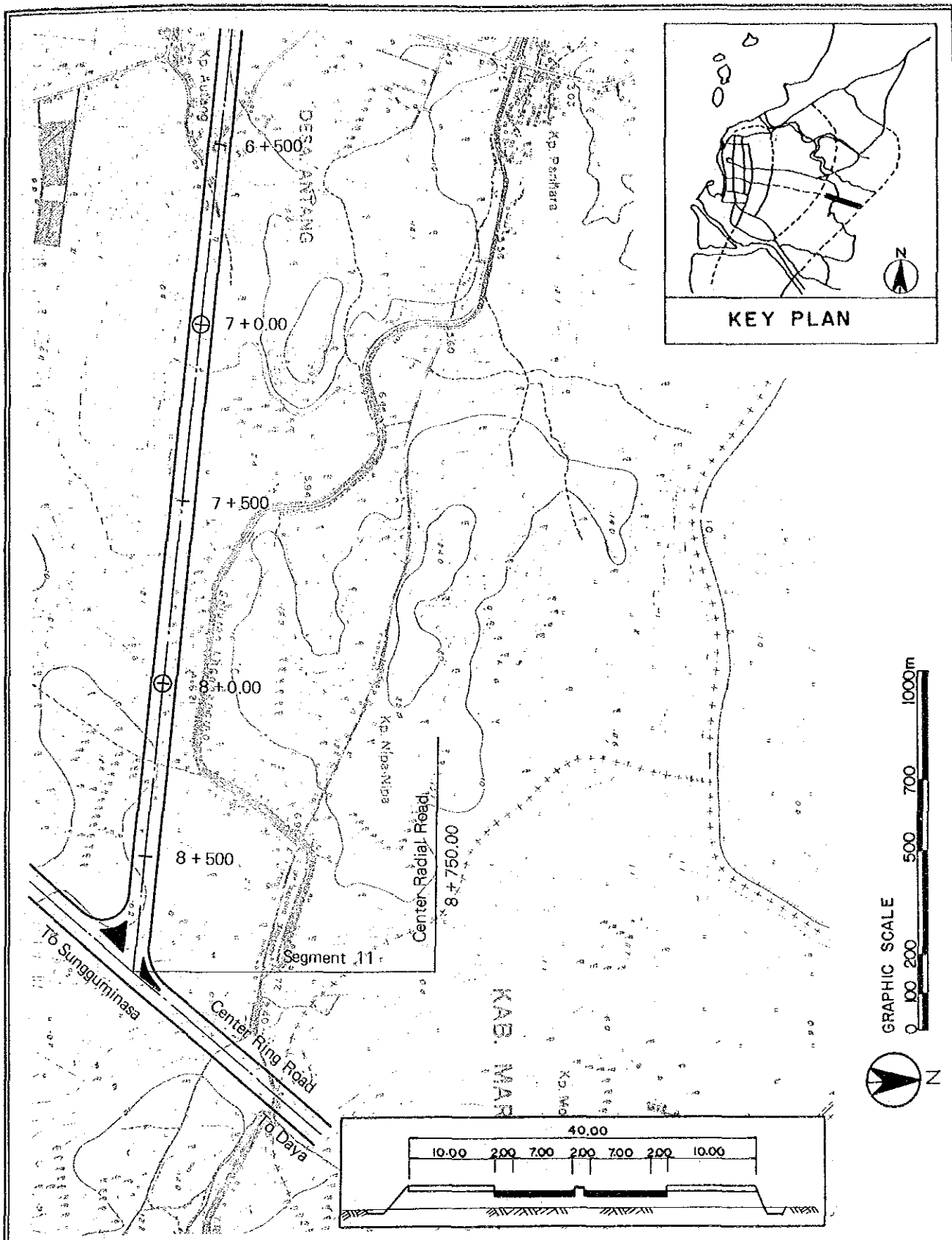


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig. 5.8.25**

**Center Radial Road (Segment 10)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

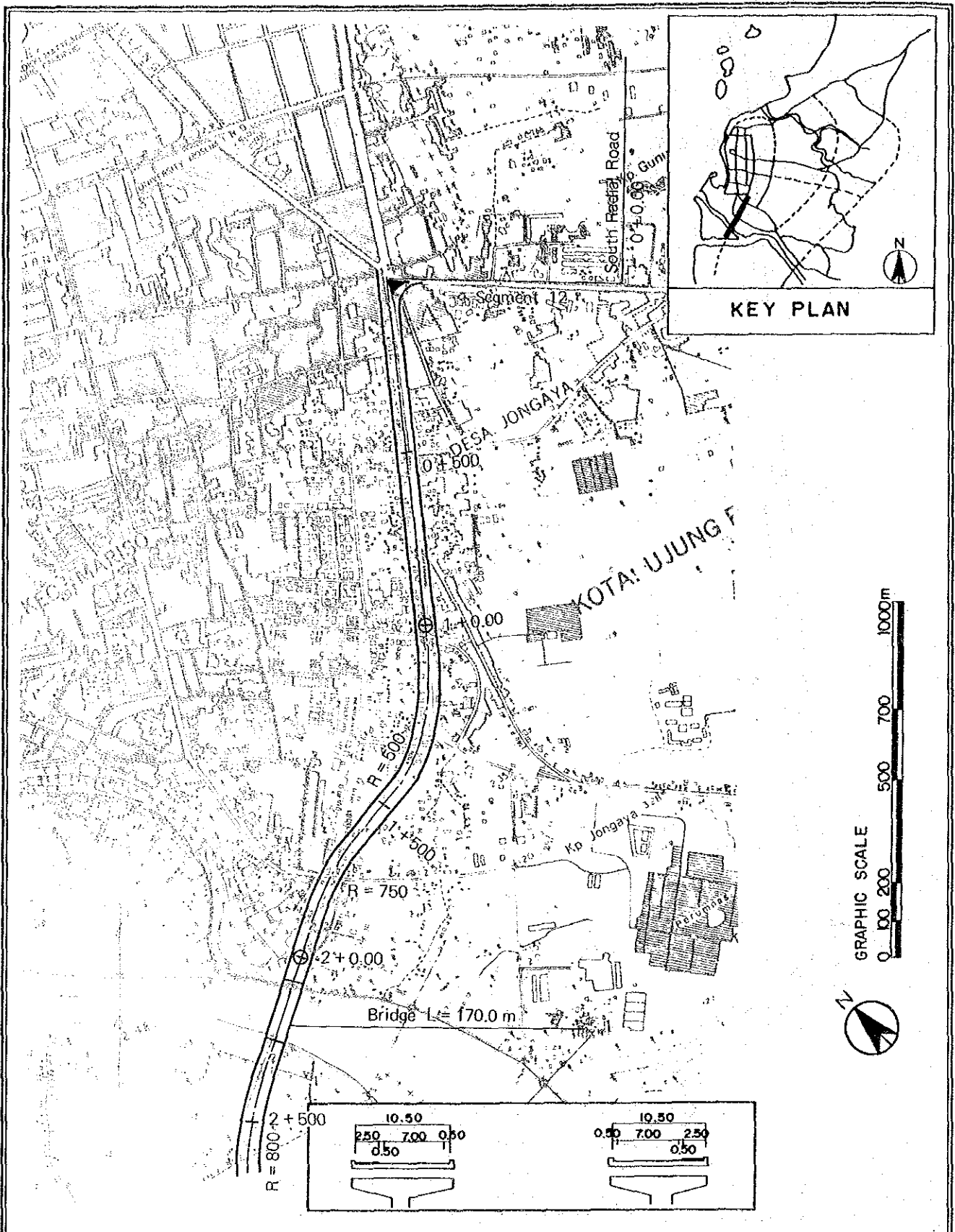


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.**  
**5.8.26**

**Center Radial Road (Segment 11)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

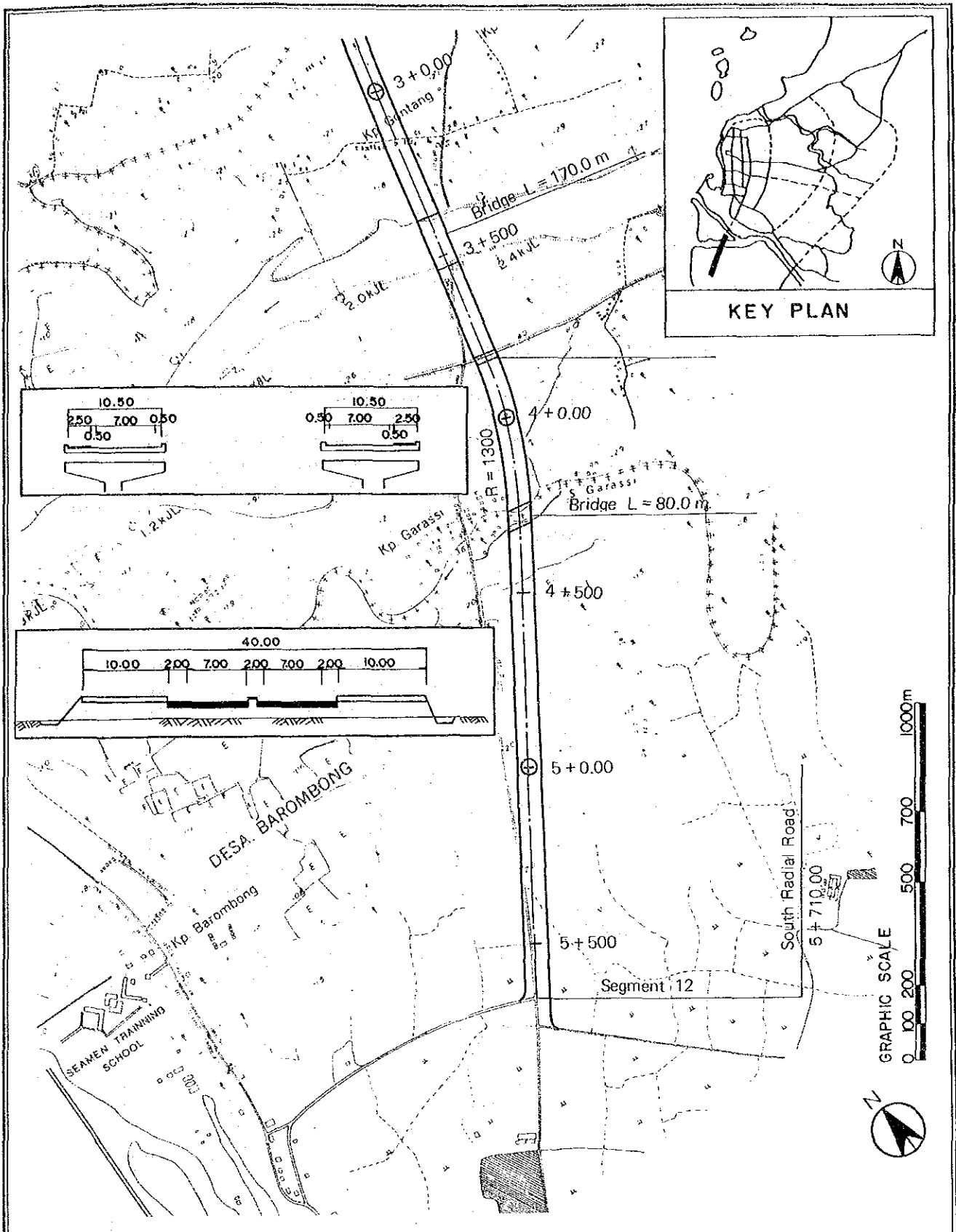


**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.**  
5.8.27

South Radial Road (Segment 12)

**JAPAN INTERNATIONAL COOPERATION AGENCY**



**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.  
5.8.28**

**South Radial Road (Segment 12)**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

## 5.9 Project Cost Estimate

### 5.9.1 General

Project cost of each segment is estimated based on 1988 prices to provide data for economic analysis and examination of project size. The project cost is indicated in Rupiah of Indonesian currency.

The project cost includes following items :

- a) Construction cost  
Construction cost includes direct construction cost, overheads, tax and profit of contractor.
- b) Land Acquisition and Compensation
- c) Engineering Fee  
Engineering fee includes field survey fee, both sub-surface investigation and topographic survey and detailed design and supervision fee of the project. Engineering fee is estimated as 12 percent of the construction cost.
- d) Administration Fee  
Administration fee is estimated as 5 percent of the total of construction cost, land acquisition and compensation cost as well as engineering fee.
- e) Contingency  
Contingency comprises the physical contingency and price escalation contingency. However, in this section, only the physical contingency is estimated namely 15 percent of the total of a) to e).

### 5.9.2 Material Cost and Labour Cost

The main construction material cost data are collected from BINA MARGA Jakarta and Ujung Pandang, and other related agencies of Ujung Pandang. On the basis of these data, material cost and labour cost are decided.

The main construction material cost and labor cost in Ujung Pandang area are shown in Table 5.9.1 and Table 5.9.2.

Table 5.9.1 List of Construction Material Market Price

1988 Price (Rupiah)

Item	Sub-Item	Class	Unit	Unit Cost
Soil, stone	Soil	Common	m <sup>3</sup>	3,000
			m <sup>3</sup>	3,500
	Sand	River Sand	m <sup>3</sup>	4,000
		Gravel	> 10 mm	m <sup>3</sup>
	Crushed stone	< 10 mm	m <sup>3</sup>	16,000
		> 30 mm	m <sup>3</sup>	18,000
< 30 mm		m <sup>3</sup>	25,000	
Cement		Common	50 Kg	3,800
Concrete	In situ	T = 300 Kg/cm <sup>2</sup>	m <sup>3</sup>	112,750
		T = 240 Kg/cm <sup>2</sup>	m <sup>3</sup>	98,000
		T = 140 Kg/cm <sup>2</sup>	m <sup>3</sup>	64,000
	mortar		m <sup>2</sup>	40,000
	Concrete Block	300 x 300 x 50	m <sup>2</sup>	16,000
	Concrete Kerb	L = 500	m	11,000
	Pipe Culvert (FC)	φ 200	m	25,000
		φ 300	m	27,000
		φ 500	m	40,000
	Pipe Culvert (FC)	φ 1000	m	53,000
		φ 1000	m	75,000
		φ 1500	m	85,000
Steel	Steel Bar	D± = 9 mm	Ton	810,000
		D± = 19 mm	Ton	780,000
	Plate		Ton	1,200,000
	Angle		Ton	1,055,000
	Pipe	φ 200 mm	6 m	252,000
		φ 400 mm	6 m	751,000
	Guard Rail		m	70,000
Electric Pole	φ 100	m	1,000,000	
Asphalt	Asphalt		l	350
	Hot Mixed Asphalt		m <sup>3</sup>	140,000
Oil	Oil		l	1,650
	Gasolin		l	385
	Paint		l	3,750

Table 5.9.2 List of Labour Cost

1988 Price (Rupiah)

Items	Unit cost per 7 hrs	Remarks
Unskilled Labourer	2,000	
Masonry Labourer	3,000	
Carpenter	3,000	
Steel Labourer	2,750	
Painter	2,750	
Asphalt Labourer	2,250	
Electric Labourer	3,000	
Water Pipe Labourer	3,000	
Guard	2,500	



### 5.9.3 Unit Cost of Main Construction Working Items

The unit cost analysis of main construction working items are examined considering material cost and labour cost in Ujung Pandang area and construction method of the proposed roads.

The unit cost of main construction working items are shown in Table 5.9.3.

### 5.9.4 Land Acquisition and Compensation

The land acquisition and compensation is decided by Ujung Pandang Municipality Government by firstly forming a committee consisting of the following members :

- a) Ujung Pandang city mayor
- b) Head of Agrarian Affairs
- c) Head of Tax Office
- d) Head of Public Works
- e) Head of Kecamatan
- f) Head of Kelurahan
- g) Head of License Sub-section from Agrarian Affairs Office, as a secretary not as a member.

It is generally difficult to decide the land acquisition and compensation cost. However, based on the results of hearing survey on actual site and information obtained from the above mentioned committee members, the compensation cost for a housing is adopted as 100.000 Rupiah and the land acquisition cost is adopted as shown in Table 5.9.4.

Table 5.9.4 Land Acquisition Cost  
unit : 1988 Prices(Rupiah)

Segment	Cost/m <sup>2</sup>	Segment	Cost/m <sup>2</sup>
Segment 1 (1)	34,100	Segment 10	5,000
1 (2)	13,100	11	5,300
2	2,100	12 (1)	42,000
3	45,300	12 (2)	2,100
4	2,600	13	5,000
5	2,600	14	5,000
6	3,200	15	7,000
7	3,200	16	7,000
8	3,200	17	5,000
9	5,000		

Table 5.9.3 List of Main Construction Work Unit Cost

1988 Price (Rupiah)

Item	Sub-Item	Class	Unit	Unit Cost	
Site clearing	Clearing and Demolition	Residential	ha	1,100,000	
		Field	ha	600,000	
	Demolition	Mountain	ha	800,000	
		Concrete	m <sup>3</sup>	17,000	
Excavation	Common Soil		m <sup>3</sup>	2,800	
	Rock		m <sup>3</sup>	23,000	
Embankment	Common Soil	inclde compaction	m <sup>3</sup>	5,000	
Drainage	Concrete	U 0.30 x 0.3	m	20,800	
	"	U 0.50 x 0.50	m	33,800	
	"	U 1.00 x 1.00	m	78,000	
	Earth	1.00 x 1.00	m	5,000	
	Pipe culvert	∅ 300		m	60,000
		∅ 1000		m	120,000
		∅ 1500		m	150,000
	Box culvert	2.00 x 2.00		m	845,000
5.00 x 2.00			m	1,690,000	
Pavement	Carriageway	Asphalt t = 5	m <sup>2</sup>	8,000	
		Base course t = 20	m <sup>2</sup>	4,800	
		Sub-base course t = 20	m <sup>2</sup>	4,000	
	Shoulder	Asphalt t = 3	m <sup>2</sup>	4,800	
		Base course t = 20	m <sup>2</sup>	4,800	
		Sub-base t = 20	m <sup>2</sup>	4,000	
	Side Walk	Concrete t = 5	m <sup>2</sup>	6,400	
		(insitu)	m <sup>2</sup>	6,400	
		Base Course t = 10	m <sup>2</sup>	3,000	
		Plantation	m <sup>2</sup>	3,500	
Additional Facilities	Kerb (L type)	Concrete (in situ)	m	13,000	
		Concrete (in situ)	m <sup>2</sup>	19,000	
	Median	Plantation	m <sup>2</sup>	3,500	
		Steel	m	80,000	
Guard Rail					
	Lighting		vol	1,500,000	
Intersection	At-grade	Signalized	vol	50,000,000	
	At-grade	Non-signalized	vol	10,000,000	
Bridge	L > 50 m	concrete	m <sup>2</sup>	1,500,000	
	10 m < L < 50 m	concrete	m <sup>2</sup>	750,000	
	5 m < L < 10 m	concrete	m <sup>2</sup>	250,000	

Note : Unit cost include material, labor cost, equipment cost, profit tax and others

#### 5.9.5 Project Cost

The construction cost of each segment is estimated based on the material cost and unit cost of main construction working items.

In addition, the construction cost is checked by the actual construction project cost and by the survey data collected from two or three construction companies in Ujung Pandang.

The project cost for 2-lane road and 4-lane dual carriageway road of each segment are estimated as shown in Appendix 5.2 in Interim Report (2).

## CHAPTER 6 SHORT TERM IMPROVEMENT PLAN



## CHAPTER 6 SHORT TERM IMPROVEMENT PLAN

### 6.1 Objectives of Short Term Improvement Plan

#### 6.1.1 Objectives

The short term improvement plan mainly consists of the traffic management plans and improvement plans of public transport facilities, which will make possible the optimum utilization of limited road spaces and traffic/transport facilities more effectively and safely with a limited amount of fund.

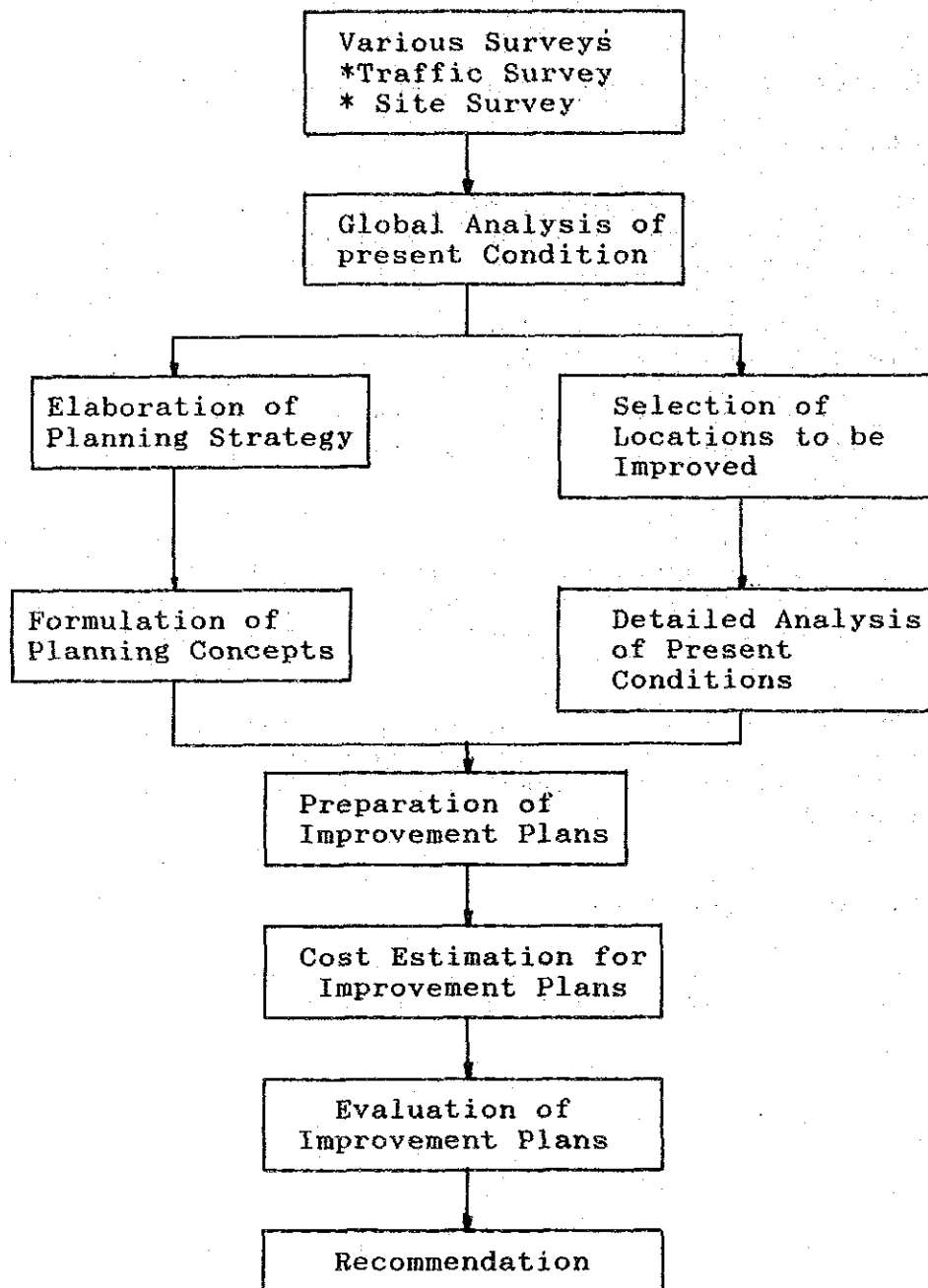
The problems regarding to the traffic conditions in Ujung Pandang can be classified into the following three categories :

- a) Insmooth traffic flows.
- b) High frequency of traffic accidents.
- c) Inadequate utilization of the existing roads and traffic/transport facilities, including public transport facilities.

The objectives of the short term improvement plan is to mainly solve above mentioned existing problems in an early stage. The target year of short term plan is the year 1994.

#### 6.1.2 Planning Procedure

The planning procedure of the short term improvement plan is illustrated as a flow chart shown in Fig. 6.1.1.



**UJUNG PANDANG AREA  
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**Fig.  
6.1.1**

**Flow Chart of Planning Procedure of  
Short Team Improvement Plan**

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## 6.2 Planning Strategy and Concept

### 6.2.1 Planning Strategy

The planning strategy for the short term improvement plan is elaborated in consideration of the existing traffic problems and shown below

- a) To increase traffic capacity
- b) To control traffic demand
- c) To decrease traffic accidents

### 6.2.2 Planning Concept

Based on the planning strategy elaborated above, the following planning concepts for each short term improvement measure are formulated :

- 1) Road and Intersection Improvement Plans
  - a) To prepare the most effective plans for the utilization of the existing road space, without additional land acquisition.
  - b) To secure the safety of road users.
  - c) To prepare improvement plans without large amount of investment.
  - d) To prepare realistic plans for implementation in an early stage.
- 2) Traffic/Transport Facilities Improvement Plans
  - a) To optimize the utilization of existing road spaces as well as traffic/transport facilities.
  - b) To maximize the function of traffic/transport facilities.
  - c) To prepare improvement plans to secure the good urban environment.
- 3) Traffic Regulation Improvement Plans
  - a) To secure smooth traffic flows.
  - b) To secure safety of road users.



## 6.3 Road Widening Plan

### 6.3.1 Basic Concept

The existing road network pattern in urbanized area is a grid pattern in the old part of the city. However, it shows an irregular pattern in the newly developed area as described in Chapter 5.

The arterial roads such as Jl. Bawakaraeng - Jl. Gowa Jaya (Urip Sumoharjo), Jl. Gowa Raya (St. Alauddin) and Jl. Andi Pettarani form the main frame of road network. Naturally, these roads have heavy traffic and congestion occurs in peak hours. The main cause of congestion is shortage of number of lane except some road sections. Furthermore, it is estimated that these congestion become worse in proportion to increase of traffic volume without certain improvement of roads.

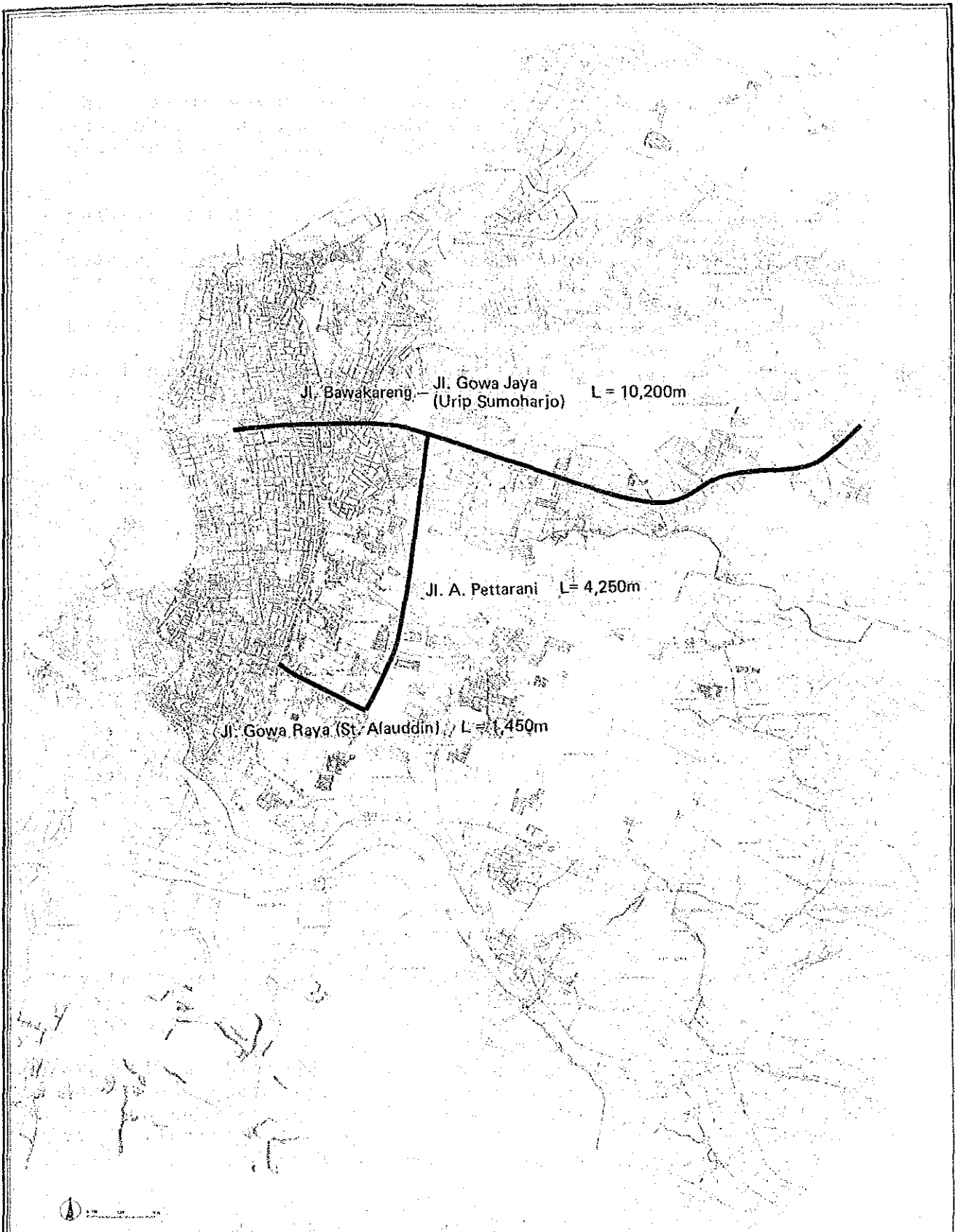
Hence, it is necessary to decrease the congestion as soon as possible. As for improvement measures, the road widening shall be proposed because this measure is the most effective one which can make use of the existing road space and facilities without large amount of investment.

### 6.3.2 Selection of Roads to be Widened

The roads to be widened are selected based on the traffic volume and existing congestion degree (more than 1.0) in peak hours. The selected roads are :

- a) Jl. Bawakaraeng - Jl. Gowa Jaya (Urip Sumoharjo) up to Hasanuddin University
- b) Jl. Andi Pettarani
- c) Jl. Gowa Raya (St. Alauddin) between Jl. Veteran and Jl. Andi Pettarani

The selected roads are illustrated in Fig. 6.3.1. On these roads, the number of existing lanes is insufficient to accommodate the present heavy traffic volume and increasing traffic volume in the near future.



**UJUNG PANDANG AREA  
HIGHWAY DEVELOPMENT STUDY**

**Fig.**  
**6.3.1**

**Road Sections for Road Widening**

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### 6.3.3 Planning Consideration

In making a plan of short term, it is necessary to consider the most effective use of existing road space and structure. The following planning considerations are applied to road widening plan:

- a) Road space for widening shall be within existing right of way.
- b) Existing structure, such as median, drainage system shall be planned in such a way as to optimize its use.
- c) Safety measures for road traffic shall be considered at the same time.
- d) The design criteria for road widening plan shall be referred to the following standards:

- PRODUK STANDAR UNTUK JALAN PERKOTAAN ; Feb. 1987, BINA MARGA.
- Standard Specifications for Geometric Design of Urban Roads; Sep. 1987, BINA MARGA.
- Act of Road Structure of Japan; Feb. 1983.

### 6.3.4 Road Widening Plan

- 1) Jl. Bawakaraeng/Jl. Gowa Jaya (Urip Sumoharjo)

#### (1) General condition

These two roads formulate a west-bound major arterial road connecting the central part with the western suburban area of Ujung Pandang. General conditions of these roads are as follows:

- a) Carriageway width:  $W = 13.5 - 15.7 \text{ m}$
- b) Right of way:  $W = 23.1 - 23.4 \text{ m}$
- c) Number of lane:  
Jl. Bawakaraeng  $N = 2 - 4 \text{ lanes}$   
Jl. Gowa Jaya (Urip Sumoharjo)  $N = 2 \text{ lanes}$
- d) Installation of median:  
A median is installed on Jl. Gowa Jaya (Urip Sumoharjo) with a length of about 1,100 m between intersections of Jl. Veteran and Ex. Kebun Binatang.
- e) Installation of pedestrian overpass  
Two pedestrian overpasses are installed on Jl. Gowa Jaya (Urip Sumoharjo), however, they are not maintained well. Together with one of pedestrian overpasses, guard fence ( $L=200 \text{ m}$ ) is installed to prevent pedestrians to cross carriageway.
- f) Traffic volume:  
 $V = 22,000 - 23,700 \text{ cars/12hrs}$   
 $(V' = 17,100 - 32,500 \text{ motorcycles/12hrs})$
- g) Congestion degree: 2.1
- h) Traffic regulation:

- Prohibition of entry of trucks to this road between 6:00 and 10:00 O'clock for the section between intersection of Jl. Mesjid Raya and Jl. A. Pettarani.
- Full day prohibition of entry of becaks for the whole stretch of these roads, except crossing.

(2) Major problems

- a) Insufficient number of lanes  
Number of lanes on these two roads, especially on Jl. Gowa Jaya (Urip Sumoharjo), is insufficient to accommodate the present heavy traffic volume, which causes severe traffic congestion on these roads.
- b) Unpaved shoulders  
Since the shoulders along these two roads are unpaved, buses and pete-petes/microlets mostly load/unload passengers on the carriageway, which disturbs through traffic flows.
- c) Mixed traffic  
As same as other roads in Ujung Pandang, various types of motor vehicles as well as non-motorized vehicles (even becaks) are running on carriageway together, even though these roads are primary arterial roads. This situation not only generates traffic congestions but also causes traffic accidents.
- d) High frequency of traffic accidents  
Reviews on the traffic accident records reveals that many accidents involving crossing pedestrians occur on Jl. Gowa Jaya (Urip Sumoharjo).

(3) Proposed improvement measures

- a) Widening of Jl. Gowa Jaya (Urip Sumoharjo)  
In order to accommodate increasing traffic volume, widening of Jl. Gowa Jaya (Urip Sumoharjo) between Hasanuddin University and in front of Fa Usaha Baru (widening length = 8,075 m) to 4 lanes is requisite.
- b) Improvement of Jl. Bawakaraeng  
In order to secure smooth and safe traffic flows, the following measures are proposed for the improvement of Jl. Bawakaraeng:
  - To pave shoulders
  - To provide necessary pavement markings
  - To install median
 Length of improvement implementation is 2,125 m.
- c) Improvement of traffic safety measures  
In order to secure the safety of crossing pedestrians, it is necessary to provide crosswalks at intersections as well as on road sections, where many crossing pedestrians are observed. It is also proposed to install guard fences on the median to prevent random crossing of pedestrians on carriageway other than crosswalks.

The widening plan is illustrated in Fig. 6.3.2.

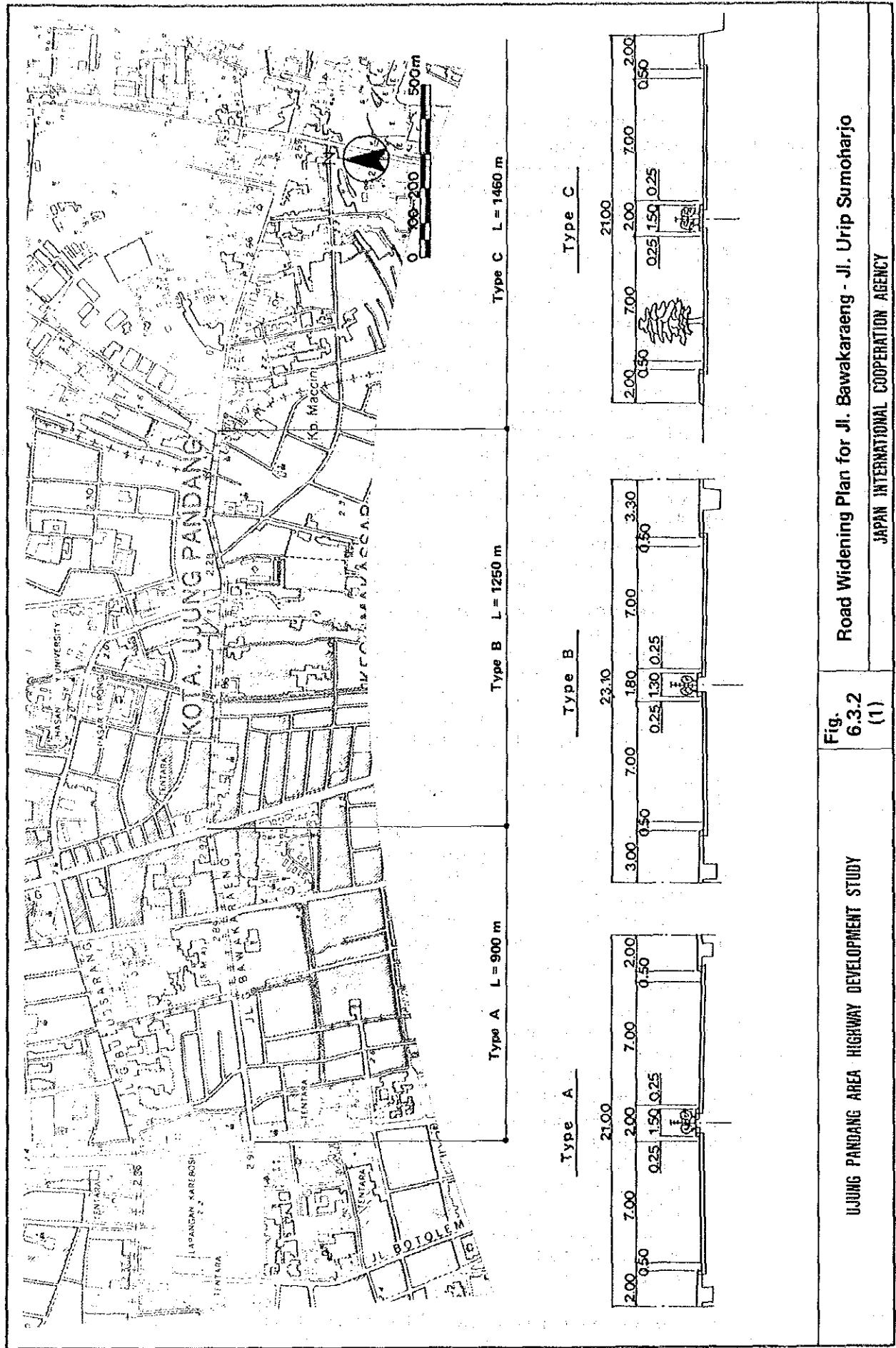
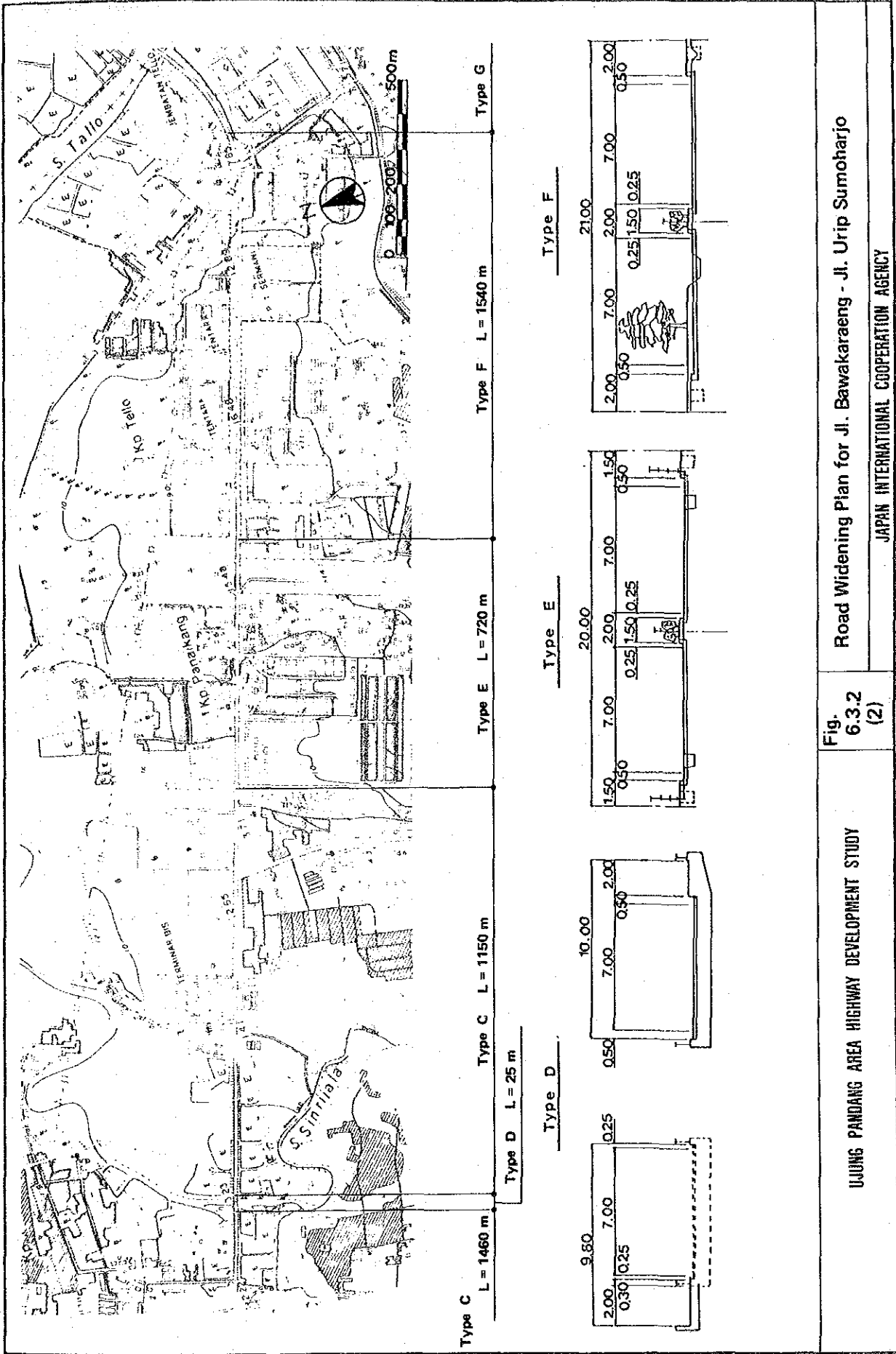


Fig. 6.3.2 (1)

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Road Widening Plan for Jl. Bawakaraeng - Jl. Urip Sumoharjo  
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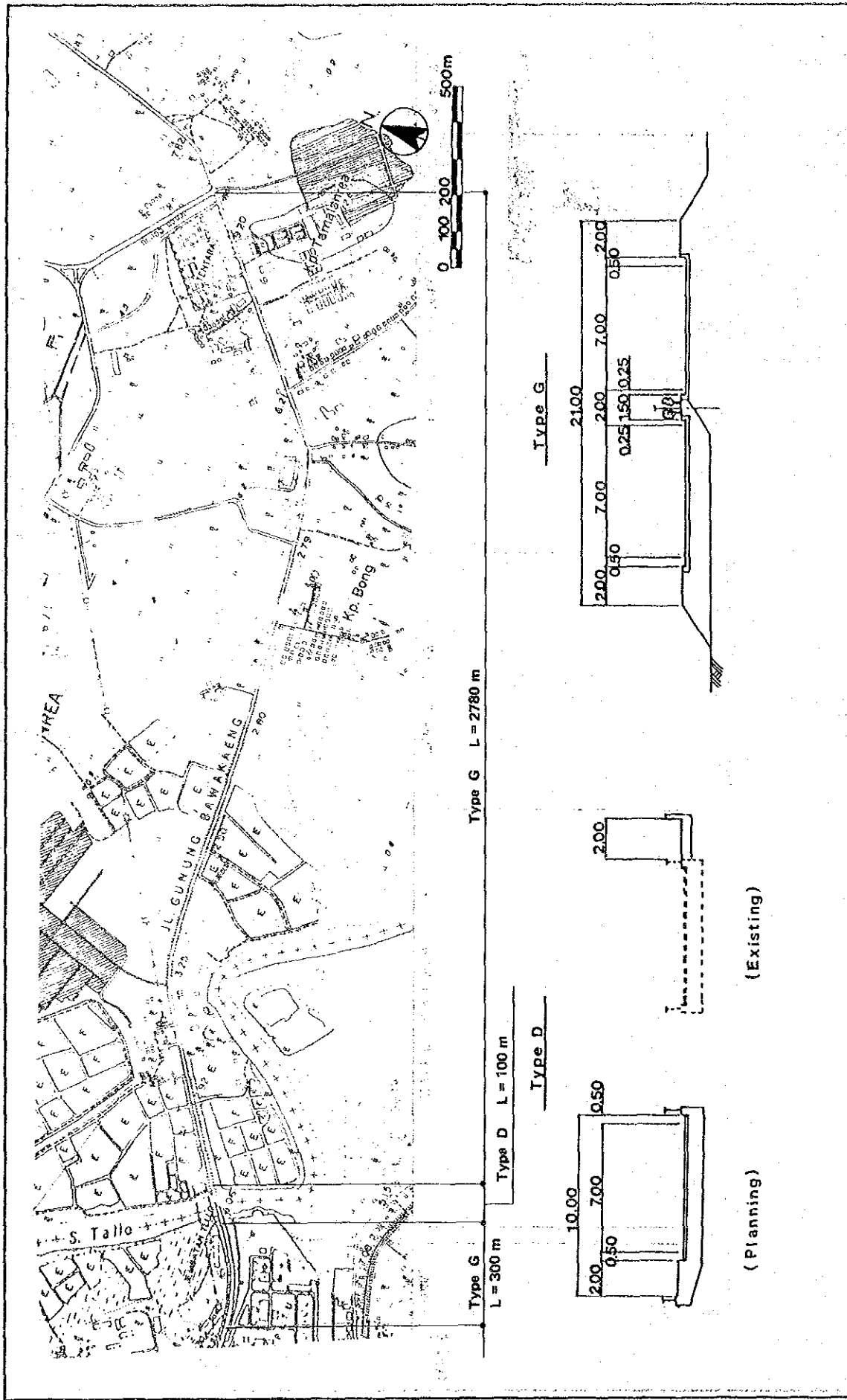


UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY

Fig. 6.3.2 (2)

Road Widening Plan for Jl. Bawakaraeng - Jl. Urip Sumoharjo

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Fig. 6.3.2 (3)

Road Widening Plan for Jl. Bawakaeng - Jl. Urip Sumoharjo

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## 2) Jl. A. P. Pettarani

### (1) General conditions

This road is a part of the inner ring road of Ujung Pandang, and the importance of this road will be increased, if the remaining part of the inner ring road are constructed in the near future. At present, this road is two-lane road, however sufficient right of way has already been acquired for the future widening to four-lane road. General conditions of this road are as follows:

- a) Carriageway width :  $W = 12.3$  m
- b) Right of way :  $W = 40.0$  m
- c) Number of lane :  $N = 2$  lanes
- d) Installation of pedestrian overpass  
In order to secure the safety of students, IKIP installed a pedestrian overpass connecting two campuses located at both sides of Jl.Pettarani.
- e) Traffic volume :  
 $V = 10,200$  cars/12hrs ( $V' = 22,100$  motorcycles/12hrs)
- f) Congestion degree : 1.03

### (2) Major problems

- a) Inadequate installation of traffic control devices  
Traffic control devices such as pavement markings and traffic signals are not adequately provided. This situation may lead to improper driving.
- b) High frequency of traffic accidents  
Many traffic accidents involving pedestrians occur on this road when pedestrians are crossing carriageway.
- c) Insufficient number of lanes  
The number of existing lanes is not sufficient to accommodate increasing traffic volume.

### (3) Proposed improvement measures

- a) Widening of carriageway  
In order to accommodate increasing traffic volume, it is requisite to widen the carriageway to 4 lanes.  
(widening length = 4,250 m)
- b) Provision of traffic control devices  
It is necessary to provide the following traffic control devices on this road:
  - Median (after completion of widening), together with guard fences on the median.
  - Necessary road markings
  - Traffic signals at some of intersections, including maintenance of existing traffic signals at the intersection with Jl. Gowa Raya (St. Alauddin).
- c) Improvement of traffic safety devices  
The following traffic safety devices are necessary to be provided.
  - Crosswalks together with pedestrian signals and/or



pedestrian overpasses at locations with many pedestrians.

The widening plan is illustrated in Fig. 6.3.3.

### 3) Jl. Gowa Raya (St. Alauddin)

#### (1) General conditions

This road is a primary arterial road connecting Ujung Pandang and Sungguminasa. The one-way regulation is implemented on this road near the Pasar Sentral Pa'baeng-baeng. General conditions of this road are as follows:

- a) Carriageway width :  $W = 7.0$  m
- b) Right of way :  $W = 24.0$  m
- c) Number of lane :  $N = 2$  lanes
- d) Traffic volume :  
 $V = 12,700 - 13,000$  cars/12hrs  
 $(V' = 15,700 - 19,400$  motorcycles/12hrs)
- e) Congestion degree : 1.31
- f) Traffic regulation  
One-way regulation between Jl. Veteran and Jl. Andi Tonro (Jl. Andi Tonro is regulated as one-way road for the opposite direction)

#### (2) Major problems

- a) Disturbance of smooth traffic flow in front of Pasar Sentral Pa'baeng-baeng  
There are many stopping/parking pete-petes/microlets and becaks in front of the Pasar, even on the carriageway, and these vehicles disturb the through traffic flow.
- b) Insufficient number of lanes  
The existing number of lanes are not sufficient to accommodate increasing traffic volume.
- c) Unpaved shoulder  
Since the shoulders are unpaved, non-motorized vehicles such as becak and bicycles are running together with motorized vehicles on the carriageway. Hence, these non-motorized vehicles obstruct movements of other vehicles as well as to cause traffic accidents.
- d) High frequency of traffic accidents  
According to the accident records, many accidents involving pedestrians and motorcycles occur on this road.

#### (3) Proposed improvement measures

- a) Widening of carriageway  
In order to accommodate increasing traffic volume, it is requisite to widen the carriageway to four lanes for the section between intersections of Jl. Veteran

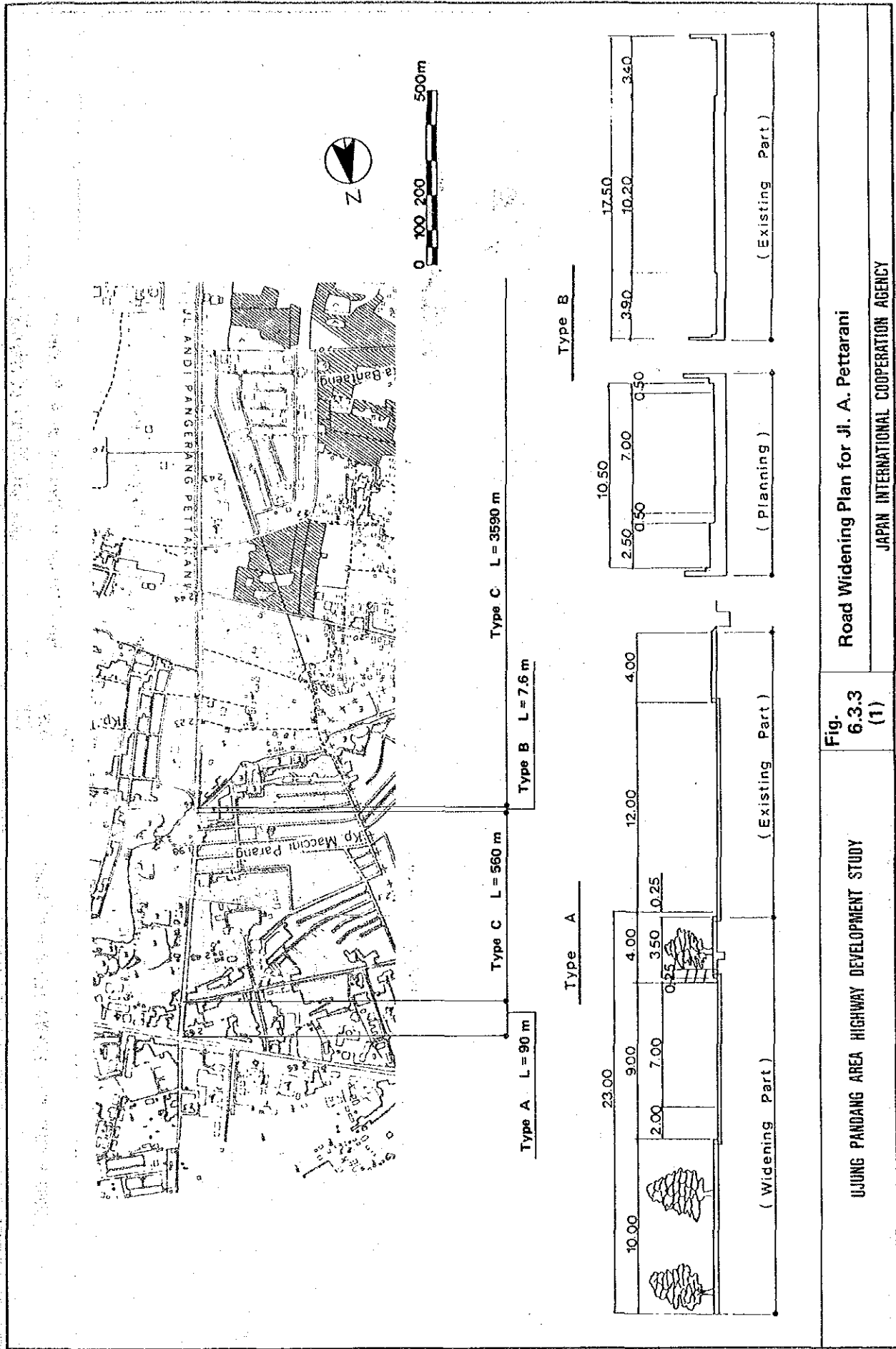
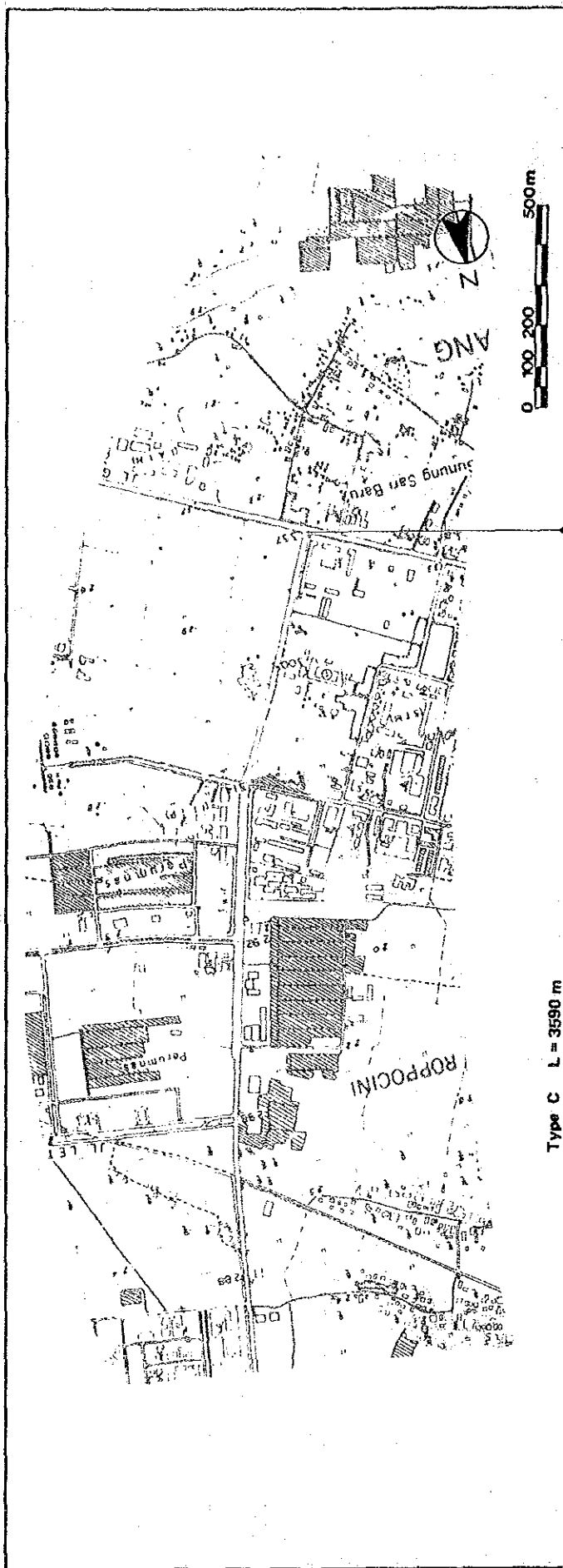


Fig. 6.3.3 (1)

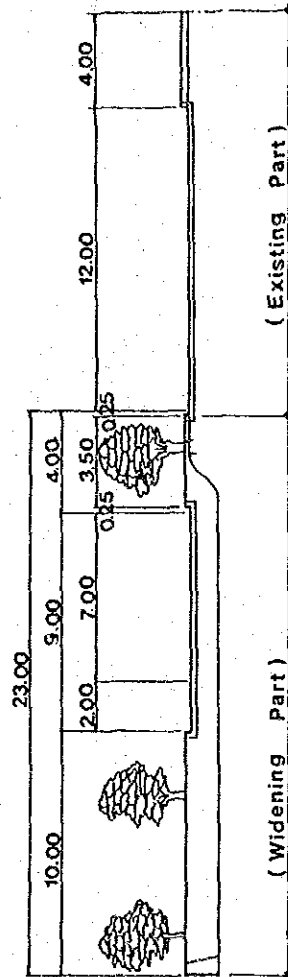
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Type C L = 3590 m

Type C



- and Jl. A. Pettarani (widening length = 1,450 m).
- b) Improvement of traffic safety devices  
 The following safety devices are necessary to be installed:
- Sidewalks on both sides of this road.
  - Crosswalks with signals at locations having many pedestrians.

The widening plan is illustrated in Fig. 6.3.4.

### 6.3.5 Cost Estimation of Road Widening Plan

The total project cost of the road widening plan will be the amount of 7,915 Million Rupiah. The detail of estimated amount is described in the Section 5.9.6 (long term plan).

### 6.3.6 Priority for Road Widening

As a practical means for determination of priority for implementation of road widening, the congestion degree which shows the congested condition at road sections on selected roads were adopted and examined.

Then priority is determined according to the congestion degree. As the result of examination based on the congestion degree, the priority of implementation of road widening was given as follows:

	Congestion Degree
a) Jl. Bawakaraeng - Jl. Gowa Jaya (Urip Sumoharjo) up to Hasanuddin University	2.10
b) Jl. Gowa Raya (St. Alauddin) up to intersection of Jl. A. Pettaran	1.31
c) Jl. Andi Pettarani	1.03

### 6.3.7 Future Plan

In addition, it is necessary to consider the road widening plan for the road section beyond Hasanuddin University on Jl. Gowa Jaya (Urip Sumoharjo) and the road section beyond intersection of Jl. A. Pettarani on Jl. Gowa Raya (Urip Sumoharjo) in proportion to increase traffic volume on those roads in the future. When the road widening plan is designed, the following items shall be considered:

- a) Traffic volume
- b) Traffic composition
- c) Condition of roadside area
- d) Environment of roadside area
- e) Road structure

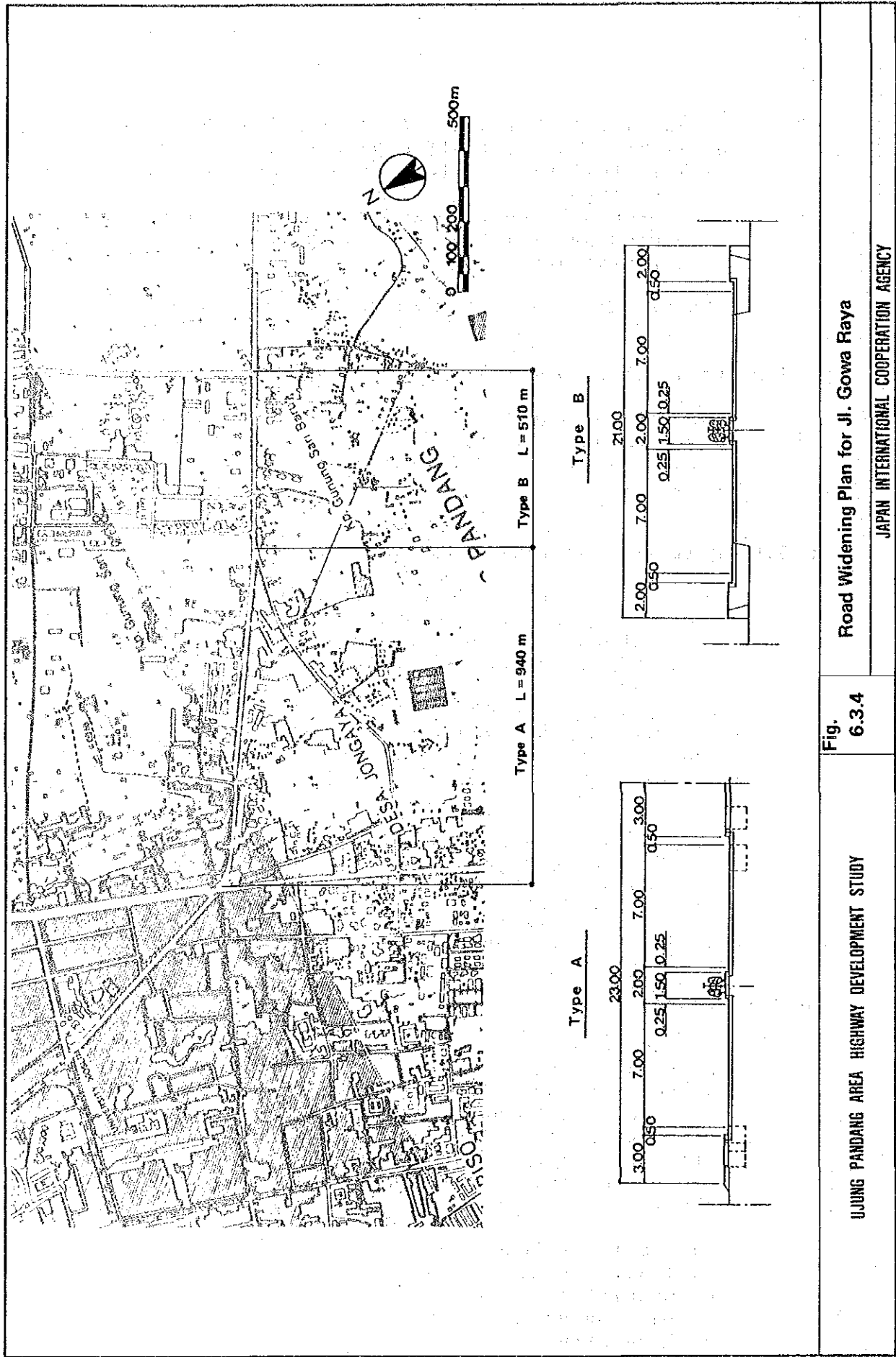


Fig. 6.3.4

UJUNG PANDANG AREA HIGHWAY DEVELOPMENT STUDY

Road Widening Plan for Jl. Gowa Raya

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## **6.4 Intersection Improvement Plan**

### **6.4.1 Basic Concept**

The problems at intersections in Ujung Pandang are classified as follows :

- a) Traffic congestion
- b) Interrupted traffic flow
- c) Poor safety measures

Traffic congestion occurs chronically at some major intersections due to the shortage of lane number, improper traffic regulation and signal phase, etc. Furthermore, owing to insufficient channelization and not functioned signals, traffic flow is obstructed at busy intersections. In addition, many traffic accidents occur at many intersections because of poor safety measures such as insufficient markings, shortage of signals or improper signal phasing.

Therefore, it is necessary to improve the above mentioned intersections with appropriate measures as soon as possible. The planning of this improvement is carried out in consideration of planning strategy as described in the Section 6.2.1.

### **6.4.2 Selection of Intersections to be Improved**

The intersections are selected for improvement planning according to the following criteria :

#### **(1) Heavily congested intersection**

In this study, a heavily congested intersection is defined as follows :

- a) Saturation degree exceeds 0.8 at signalized intersection in consideration of traffic volume increase in the near future.
- b) Bottleneck intersection identified based on travel speed survey.

#### **(2) Important intersection in traffic management**

Important intersection is the location where traffic concentrates and is regarded as an important transportation node on the road network.

#### **(3) Intersection with high frequency of accidents**

The intersection with high frequency of accidents is defined as follows .:

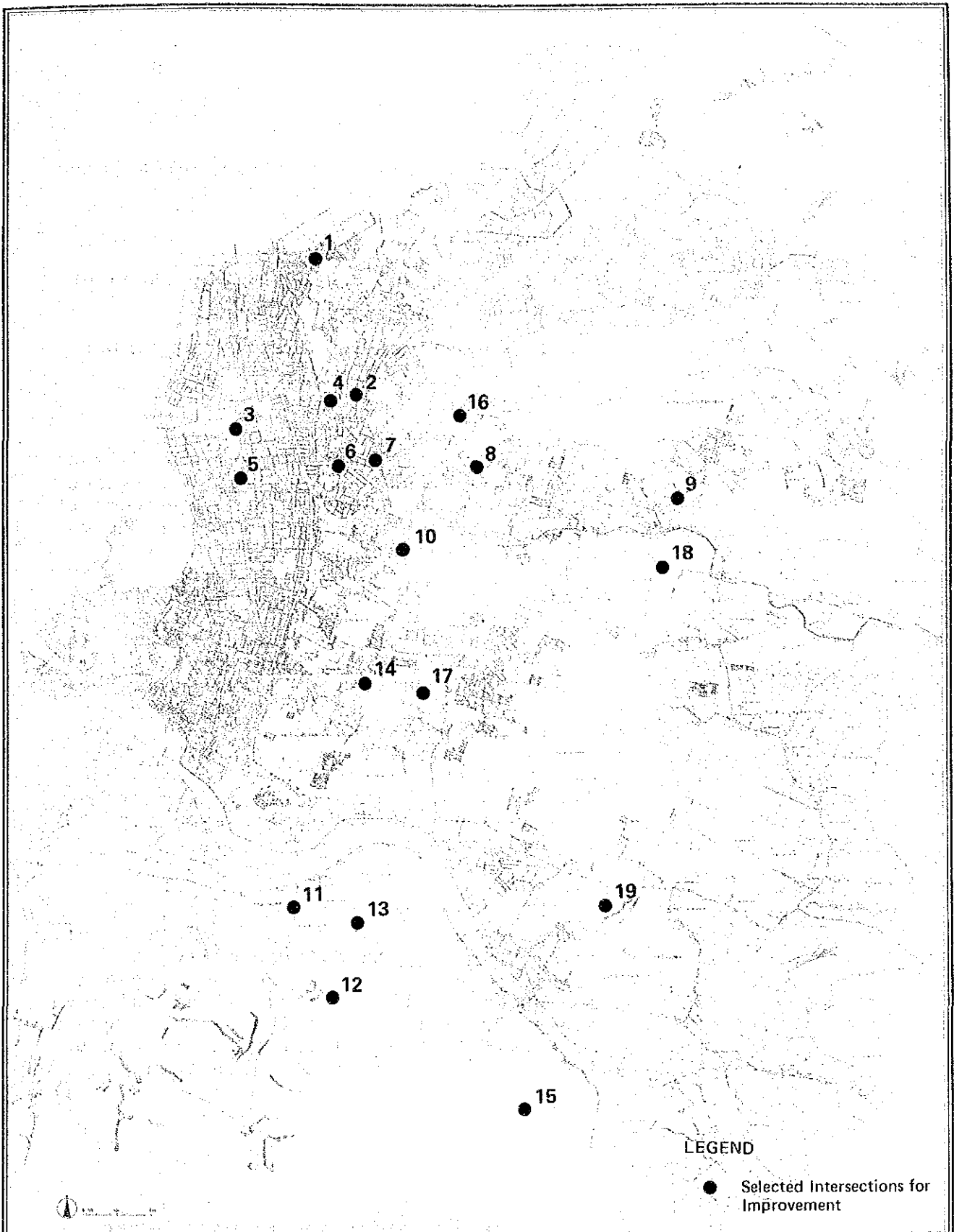
- a) Intersection where more than five (5) traffic accidents occurred during 1986 - 1987.
- b) Intersection where serious accidents occurred

The selection of intersections is carried out based on the above mentioned criteria, careful reconnaissance surveys on geometric condition and signal condition, and through discussion with Kotamadya.

The selected intersections are shown in Fig. 6.4.1 and Table 6.4.1, and major reasons for the selection are also shown in the same table.

Table 6.4.1. Selected Improvement Locations

Criteria	Heavily Congested Intersections	High Frequency of Accident Intersections	Important Intersections in Traffic Management
Selected Intersections			
1. Jl. Bandang/Jl. Ujung	●		●
2. Jl. Bandang/Jl. Mesjid Raya	●	●	●
3. Jl. Jend. A. Yani/Jl. Cokroaminoto/Jl. Sudirman			●
4. Jl. Mesjid Raya/Jl. Andalas			●
5. Jl. Sudirman/Jl. Bawakaraeng			●
6. Jl. Bawakaraeng/Jl. Latimojong	●		●
7. Jl. Bawakaraeng/Jl. Veteran	●	●	●
8. Jl. Mesjid Raya/Jl. Gowa Jaya	●		●
9. Jl. Gowa Jaya/Jl. Andi-Pettarani	●	●	●
10. Jl. Veteran/Jl. Kerung-kerung	●		●
11. Jl. Ratulangi/Jl. Kakatua		●	●
12. Jl. Veteran/Jl. Gowa Raya/Jl. Kusala		●	●
13. Jl. Veteran/Jl. Landak	●	●	●
14. Jl. Rusa/Jl. Monginsidi		●	
15. Jl. Gowa Raya/Jl. A. Pettarani		●	●
16. Jl. Sunu/Jl. Mesjid Raya		●	●
17. Jl. Veteran/Jl. Monginsidi			●
18. Jl. A. Pettarani/Jl. Dg. Sirua			●
19. Jl. A. Pettarani/Jl. Hertasning		●	●



**UJUNG PANDANG AREA  
 HIGHWAY DEVELOPMENT STUDY**

**Fig.**  
 6.4.1

**Improvement Intersection Locations**

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### 6.4.3 Planning Guideline

#### 1) Improvement Measures

The improvement measures in the short term plan are classified into the following items :

- a) Changing signal phase
- b) Improvement of road marking
- c) Improvement of channelization (including provision of turn lane)
- d) Signal installation
- e) Road widening to increase traffic capacity at intersection
- f) Provision of flyover

Items a) to d) are rather small improvement measures of low cost, while items e) and f) normally require land acquisition, land clearance and new construction which needs considerably high cost. Therefore, improvement plan in the short term plan is mainly focused on items a) to d) in accordance with planning strategy.

#### 2) Extent of Improvement

The extent of improvement in the short term plan, in other words, the degree to which the congestion should be decreased can be determined by the saturation degree.

Generally speaking, the congestion degree at a signalized intersection is indicated by saturation degree. If saturation degree exceeds 0.9, it is necessary to consider the improvement of this intersection. In this study, target of saturation degree after improvement is set to be less than 0.9 in one hour peak traffic volume.

#### 3) Criteria for Signalization

In order to examine the necessity for installation of the traffic signals at intersections, the criteria regarding signalization is necessary. Since the prevailing criteria is not available, existing signalized intersection is evaluated by the following simple equations, then the necessity for signal intersection can be determined based on the result of this evaluation:

$$CONF = \sum_i^n V_i/N_i$$

Where: CONF (Conflict factor)

$V_i$  : two directional traffic volume on approach  $i$  in the peak hour

$N_i$  : number of lanes on the approach  $i$

Conflict factor (CONF) on existing signalized intersection is calculated as follows :

Smallest value of CONF = 783  
Largest value of CONF = 2,645  
Mean value of CONF = 1,808

Existing signalized intersections have smallest CONF value of 783 and mean CONF value of 1,808. If the candidate intersection has CONF value of 783 or more, then signalization at that particular intersection is determined.

#### 6.4.4 Improvement Plan

##### 1) Planning Procedure

The planning procedure of improvement plan is as follows:

##### (1) Analysis of existing conditions

Before actually formulating the improvement plan, it is prerequisite to grasp the existing conditions at selected intersection in order to devise the most effective plan coping with these conditions. The analysis of the existing conditions such as geometric conditions and traffic flow were carried out based on road inventory and traffic surveys, the details of which are shown below.

- a) General description  
Location, shape, lane number and function
- b) Traffic flow  
Volume, direction in peak hours
- c) Constraints  
Right of way, buildings and utilities
- d) Degree of congestion  
Saturation degree and stopped delay at signalized busy intersections
- e) Cycle time analysis of signal  
Green time allocation and cycle, length at signalized busy intersections
- f) Traffic Accident  
Location, collision pattern, number of fatality and injury

##### (2) Planning of Improvement Plan

Based on careful analysis of existing conditions at selected intersections, the planning for improvement plan is carried out so as to prepare the most effective plans for road users without drastically changing the existing road spaces.

The design criteria for improvement plan shall be referred to the same criteria as described in the Section 6.3.1 "Road Widening Plan".

### (3) Estimation of Improvement Effect

The following improvement effects are estimated at selected busy intersections:

- a) Congestion degree
- b) Stopped delay time

Congestion degree before and after improvement at selected busy intersections are calculated by using Japanese Standard), while stopped delay time after improvement are estimated by the formula quoted from H.C.M., 1985.

## 2) Improvement Plan for Selected Intersections

The feature of improvement plan for selected intersection are shown below.

### (1) Intersection of Jl. Seram - Jl. Bandang, Jl. Ujung - Jl. Andalas

Since the interval between intersections of Jl. Seram - Jl. Bandang and Jl. Ujung - Jl. Andalas is short at 50 m, it is proposed to prohibit right turn from Jl. Ujung to Jl. Yos Sudarso and Jl. Ujung to Jl. Bandang in order to ensure the safety and to secure smooth traffic. Improvement plan is illustrated in Fig. 6.4.2.

### (2) Intersection of Jl. Bandang - Jl. Mesjid Raya

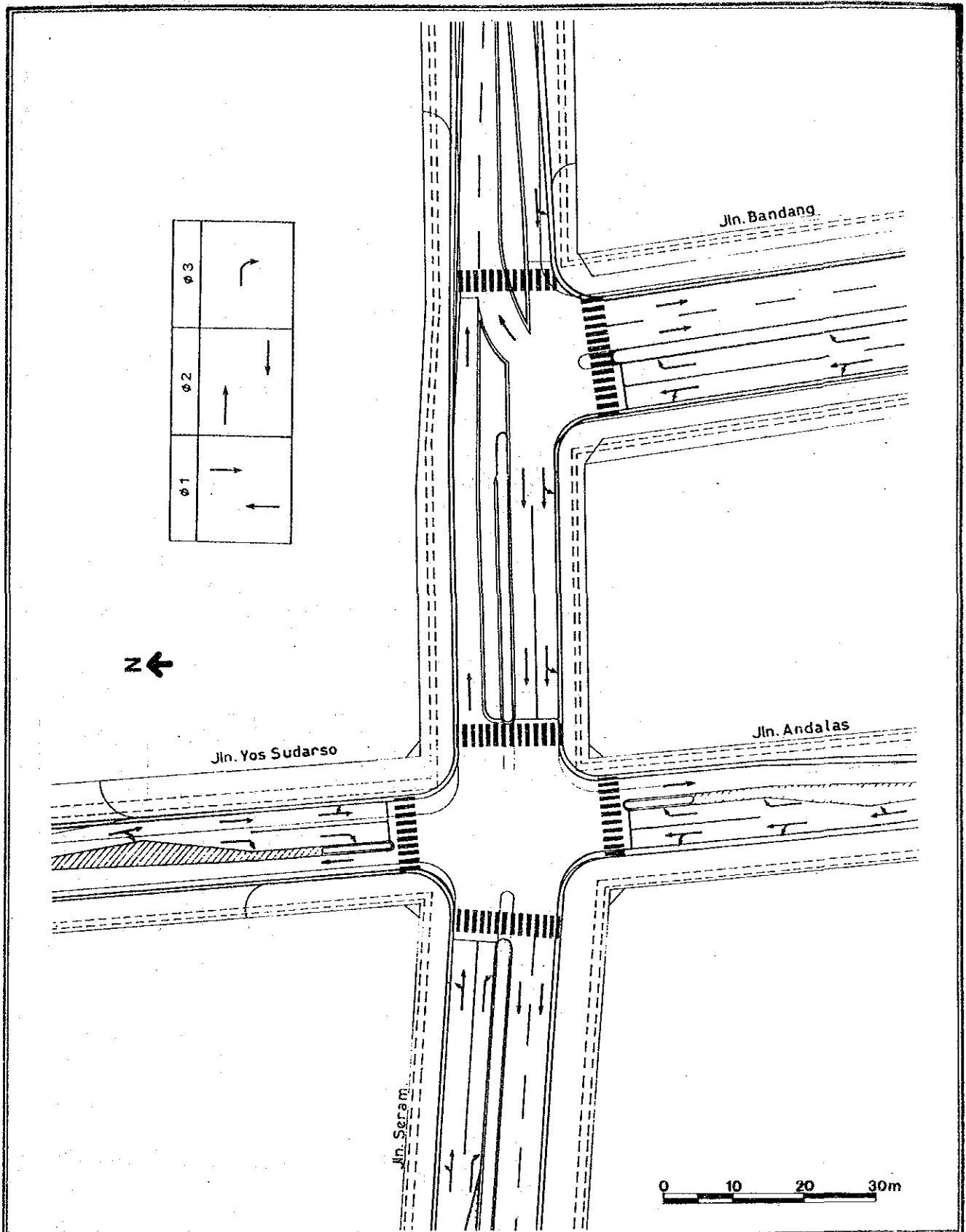
In order to solve the congestion, the exclusive right turn lane shall be provided on Jl. Mesjid Raya. Improvement plan is shown in Fig. 6.4.3.

### (3) Intersection of Jl. J.A. Yani - Jl. Cokroaminoto

Since the dangerous weaving occurs at this intersection due to improper one way section, it is proposed that one way section shall be extended up to Jl. Lombo Battang. Improvement plan is shown in Fig. 6.4.4.

### (4) Intersections of Jl. Mesjid Raya - Jl. Andalas, Jl. Sudirman - Jl. Bawakaraeng, Jl. Rusa - Jl. Monginsidi

The feature of improvement plan on the three intersections are to improve markings at the intersection such as turning lane marking, arrows and so on.

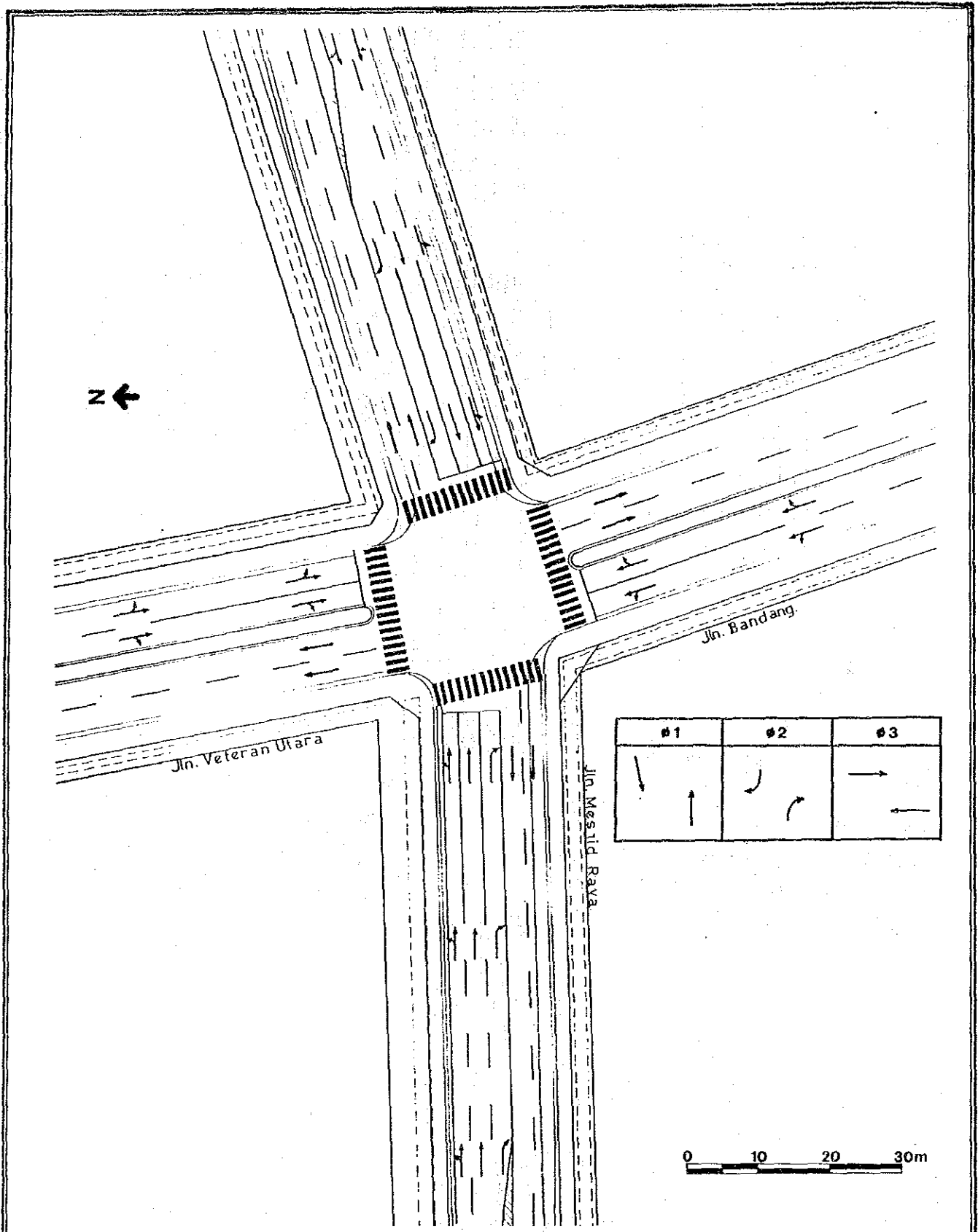


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Fig. 6.4.2

Improvement Plan for Intersection  
of Jl. Seram - Jl. Bandang

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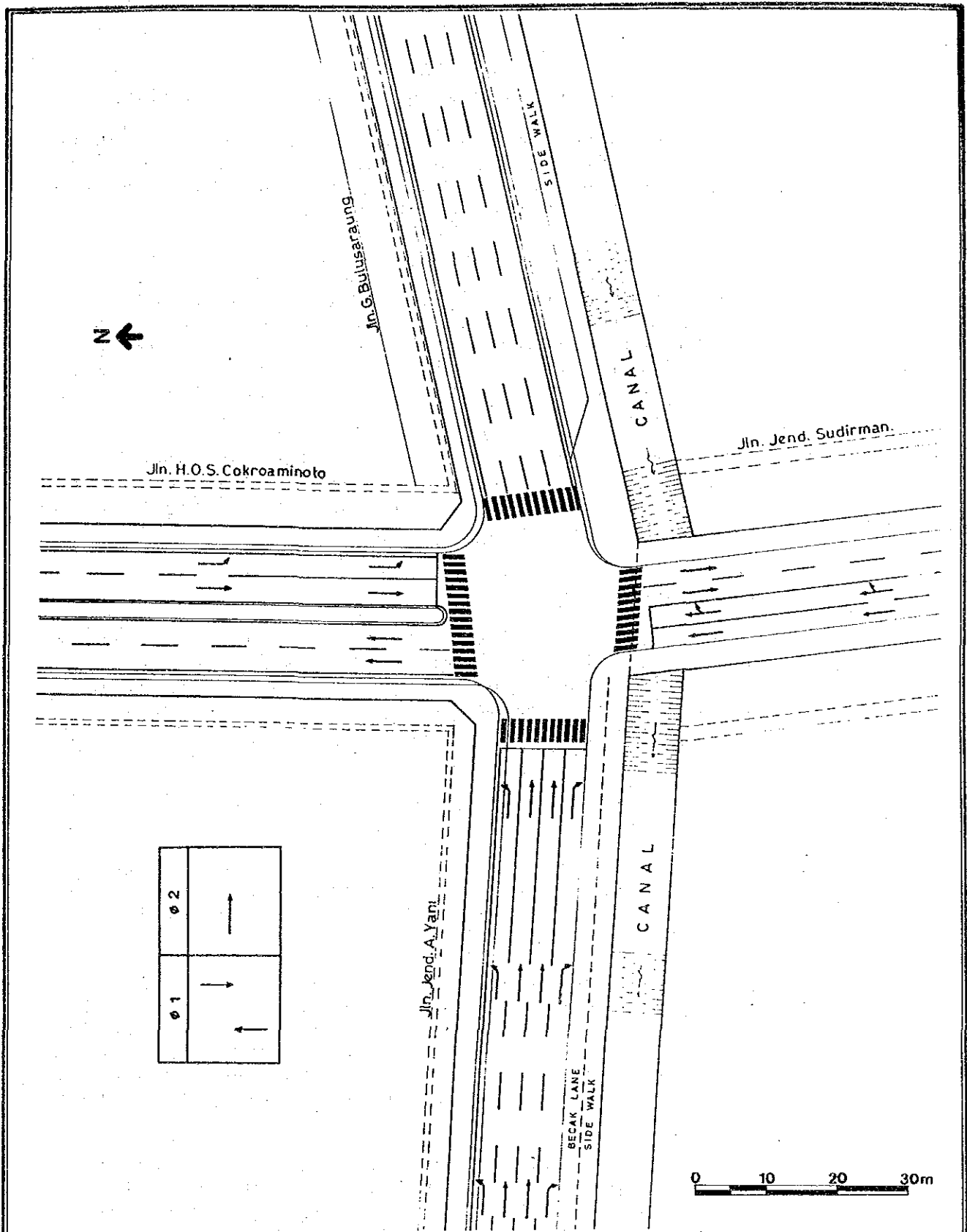


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Fig.  
6.4.3

Improvement Plan for Intersection  
of Jl. Bandang - Jl. Mesjid Raya

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Fig. 6.4.4

Improvement Plan for Intersections  
of Jl. Jend. A. Yani - Jl. Cokroaminoto -  
Jl. Sudirman

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(5) Intersection of Jl. Bawakaraeng - Jl. Latimojong

In order to solve the congestion and to secure smooth right turn traffic on Jl. Latimojong, an exclusive right turn lane shall be provided at Jl. Latimojong. Improvement plan is illustrated in Fig. 6.4.5.

(6) Intersection of Jl. Veteran - Jl. Bawakaraeng

The saturation degree of this intersection exceeds 0.9 due to insufficient added lane. Therefore, it is proposed that an exclusive right turn lane shall be provided at Jl. Veteran and Jl. Bawakaraeng. Improvement plan is shown in Fig. 6.4.6 and its perspective is shown in Fig. 6.4.7.

When the inflow traffic volume will increase about one and a half times as much as the existing traffic volume, it is necessary to consider installation of flyover at this intersection.

(7) Intersection of Jl. Mesjid Raya - Jl. Gowa Jaya (Urip Sumoharjo)

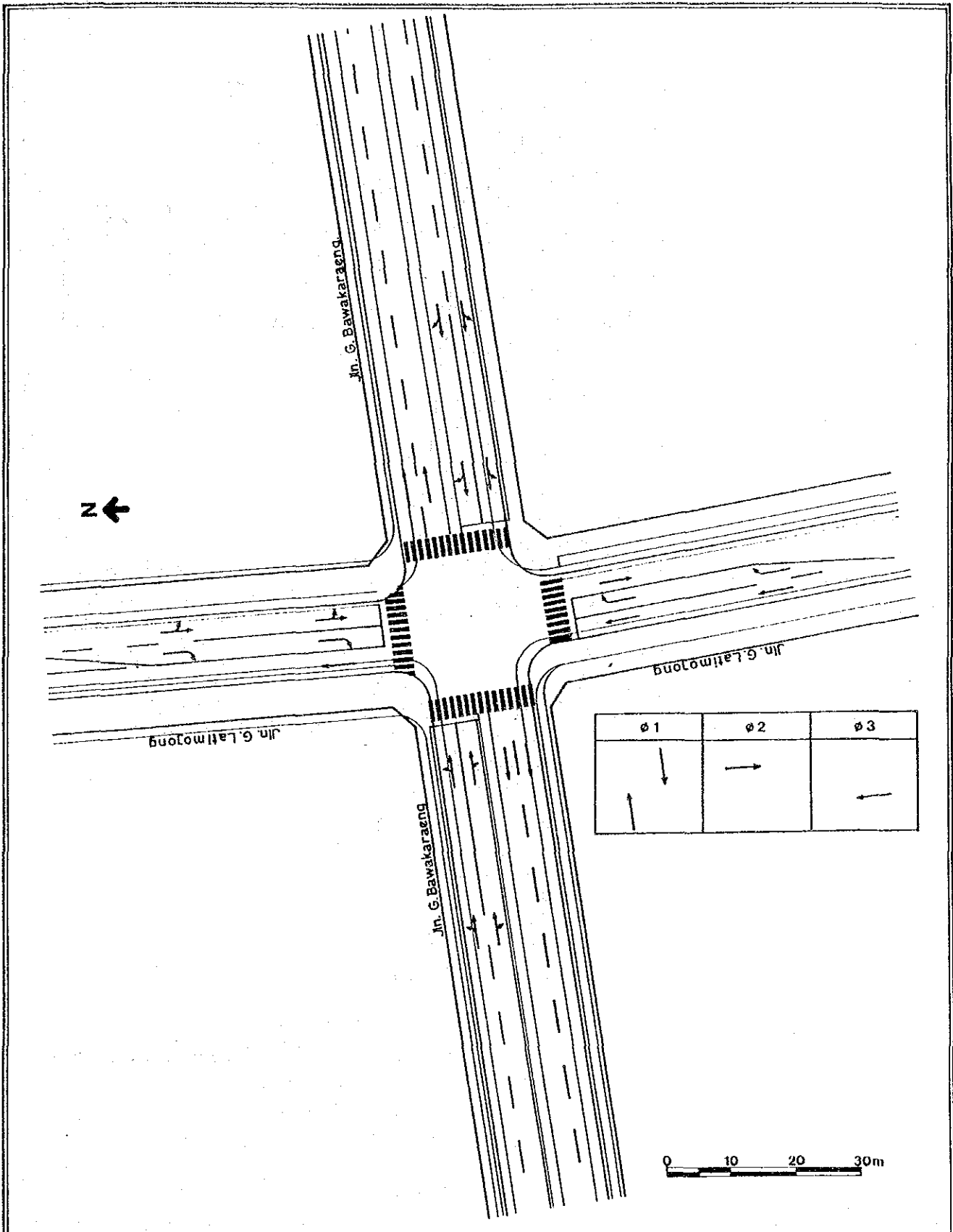
The right turn traffic from Jl. Gowa Jaya (Urip Sumoharjo) to Jl. Mesjid Raya and from Jl. Mesjid Raya to Jl. Urip Sumoharjo are quite heavy. Therefore, provision of an exclusive right turn lane shall be proposed for both roads. Improvement plan is shown in Fig. 6.4.8.

(8) Intersection of Jl. Gowa Jaya (Urip Sumoharjo) - Jl. A.Pettarani

The main cause of congestion at this intersection is insufficient number of turning lanes, hence, improvement measure of this intersection is mainly provision of turning lanes.

In the improvement plan, it is proposed to provide an exclusive right turn lane to both roads in consideration of the location of drainage facilities along the roads. Besides, a left turn lane shall be provided at Jl. Gowa Jaya (Urip Sumoharjo) for east-to-south bound vehicles. Fig. 6.4.9 illustrates improvement plan for this intersection.

Even if improvement plan was carried out, saturation degree will not much decrease (1.409 --> 0.859). Therefore it is necessary to plan the road widening in accordance with increasing traffic volume. The intersection plan after widening is illustrated in Fig. 6.4.10.



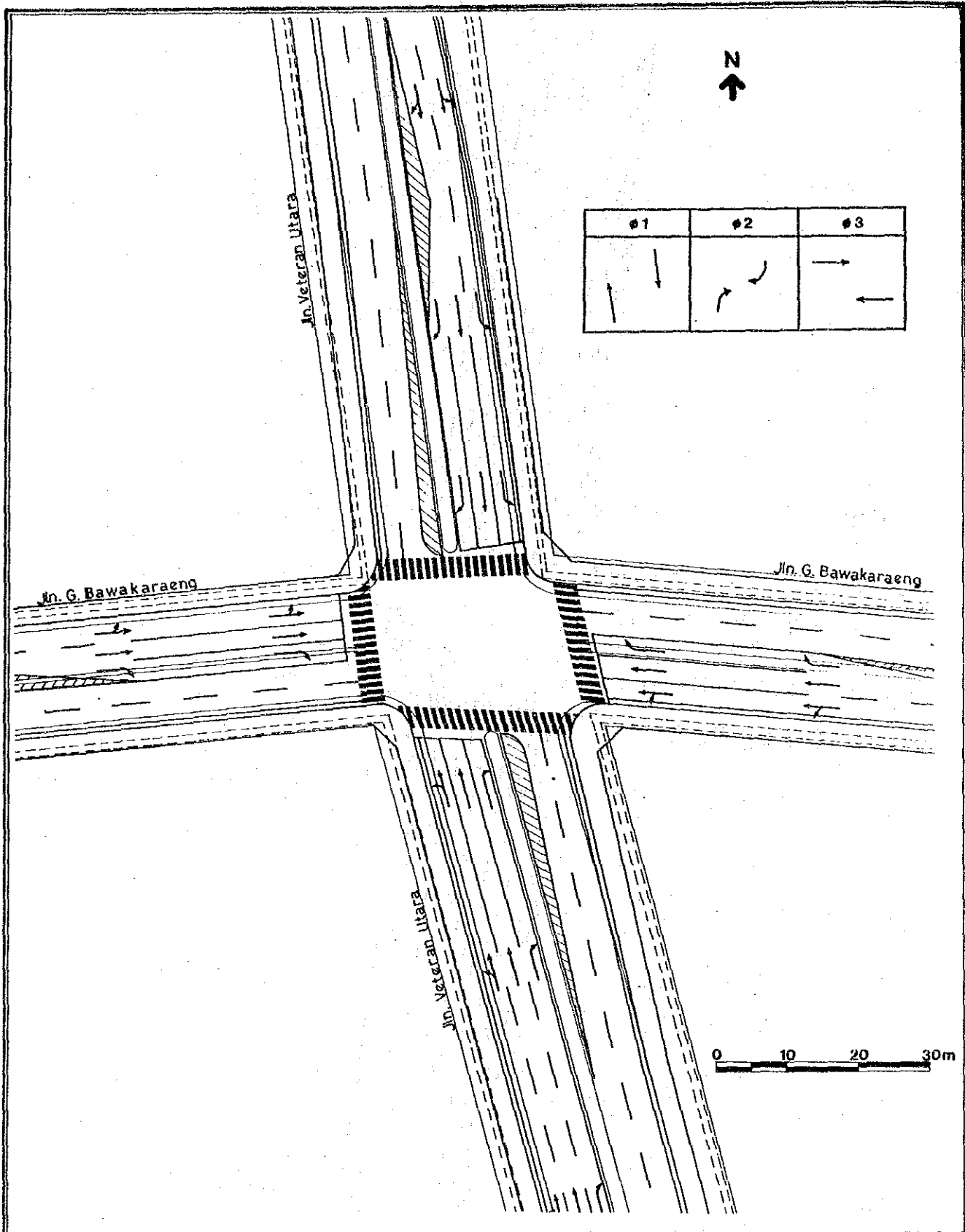
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**Fig.**  
**6.4.5**

**Improvement Plan for Intersection  
of Jl. Bawakaraeng - Jl. Latimojong**

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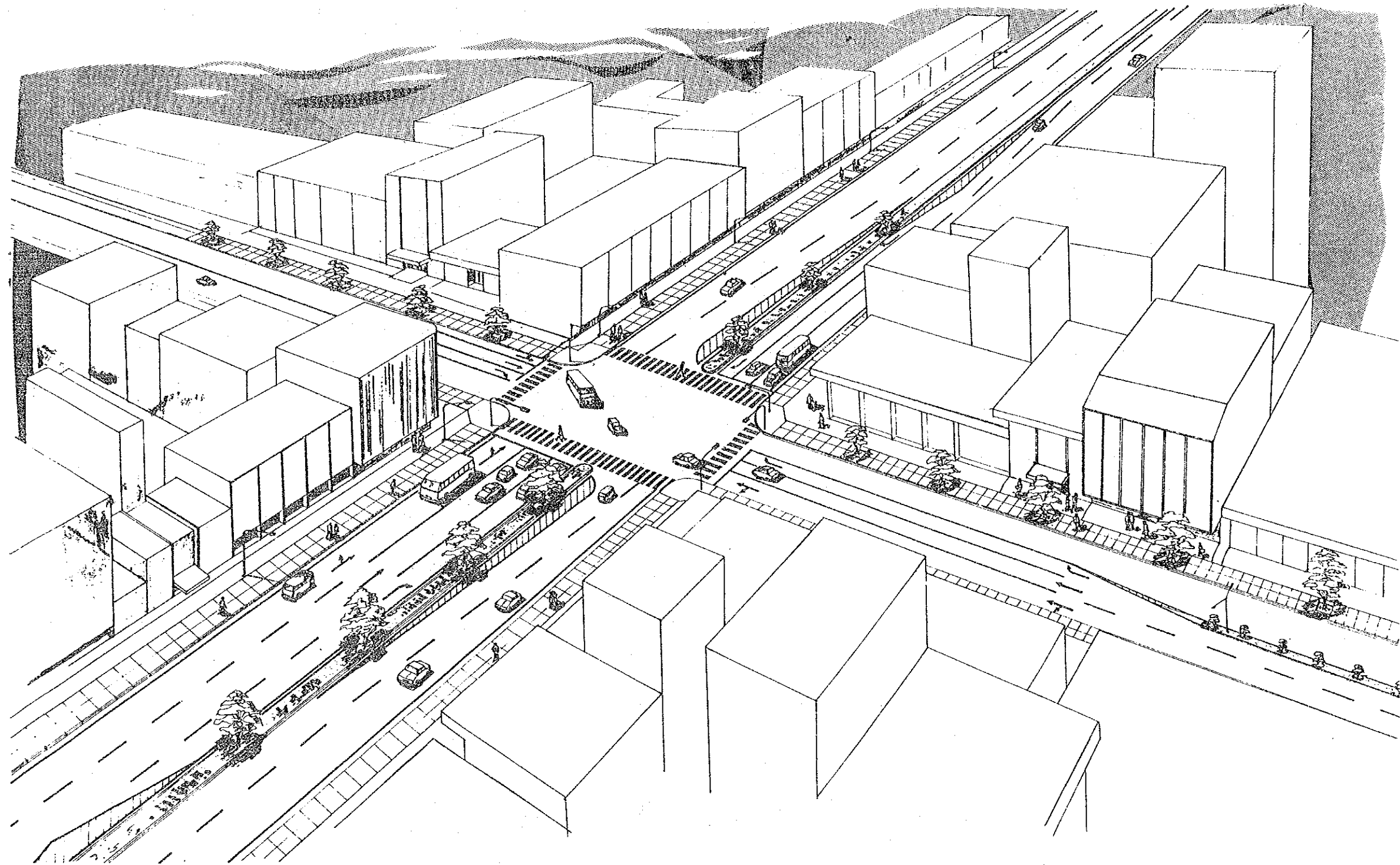


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Fig. 6.4.6

Improvement Plan for Intersection  
of Jl. Bawakaraeng - Jl. Veteran

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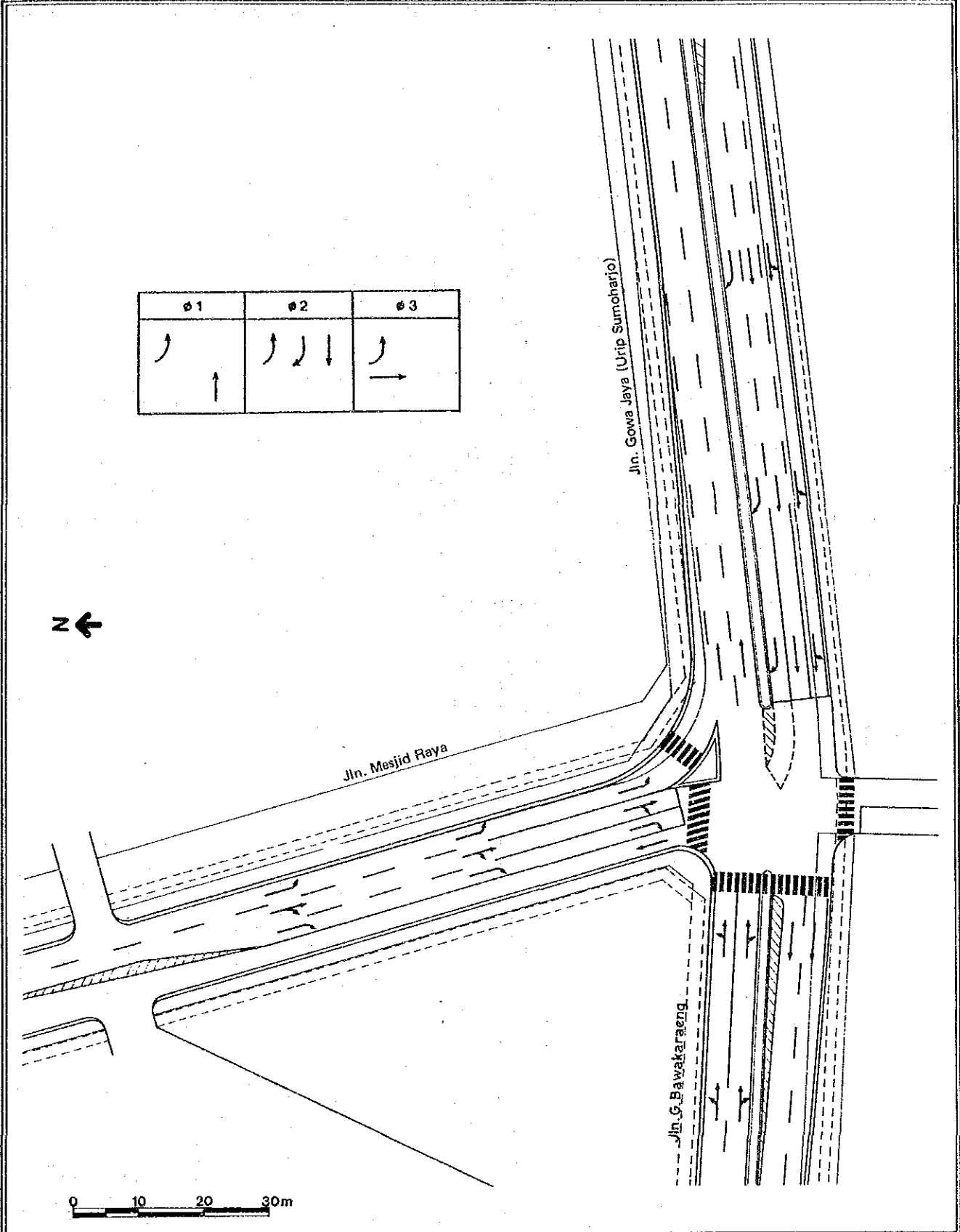
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**Fig.**  
**6.4.7**

Imaginary Perspective at Intersection of Jl. Bawakaraeng - Jl. Veteran

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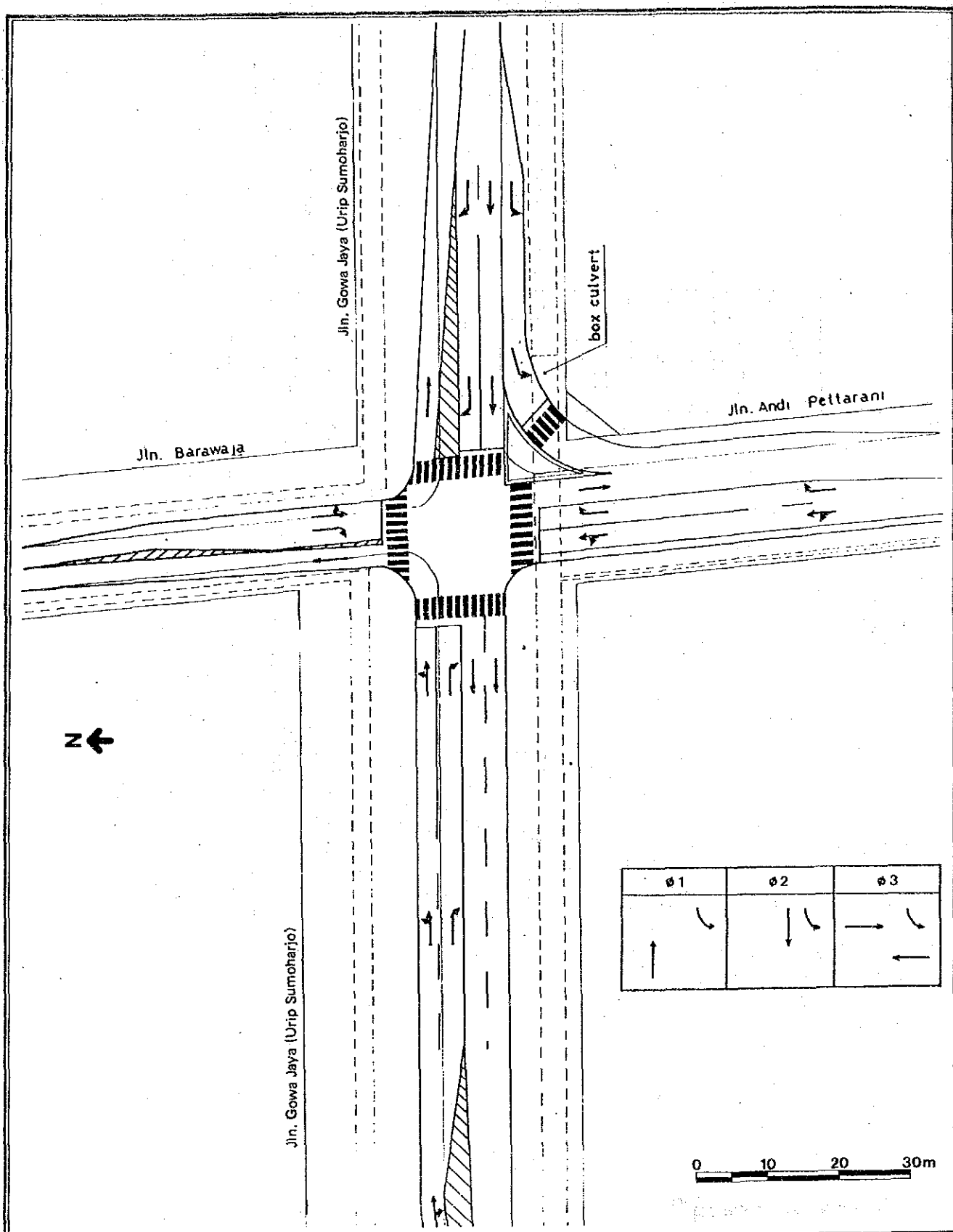


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**Fig. 6.4.8**

**Improvement Plan for Intersection  
of Jl. Masjid Raya Jl. Gowa Jaya  
(Urip Sumoharjo)**

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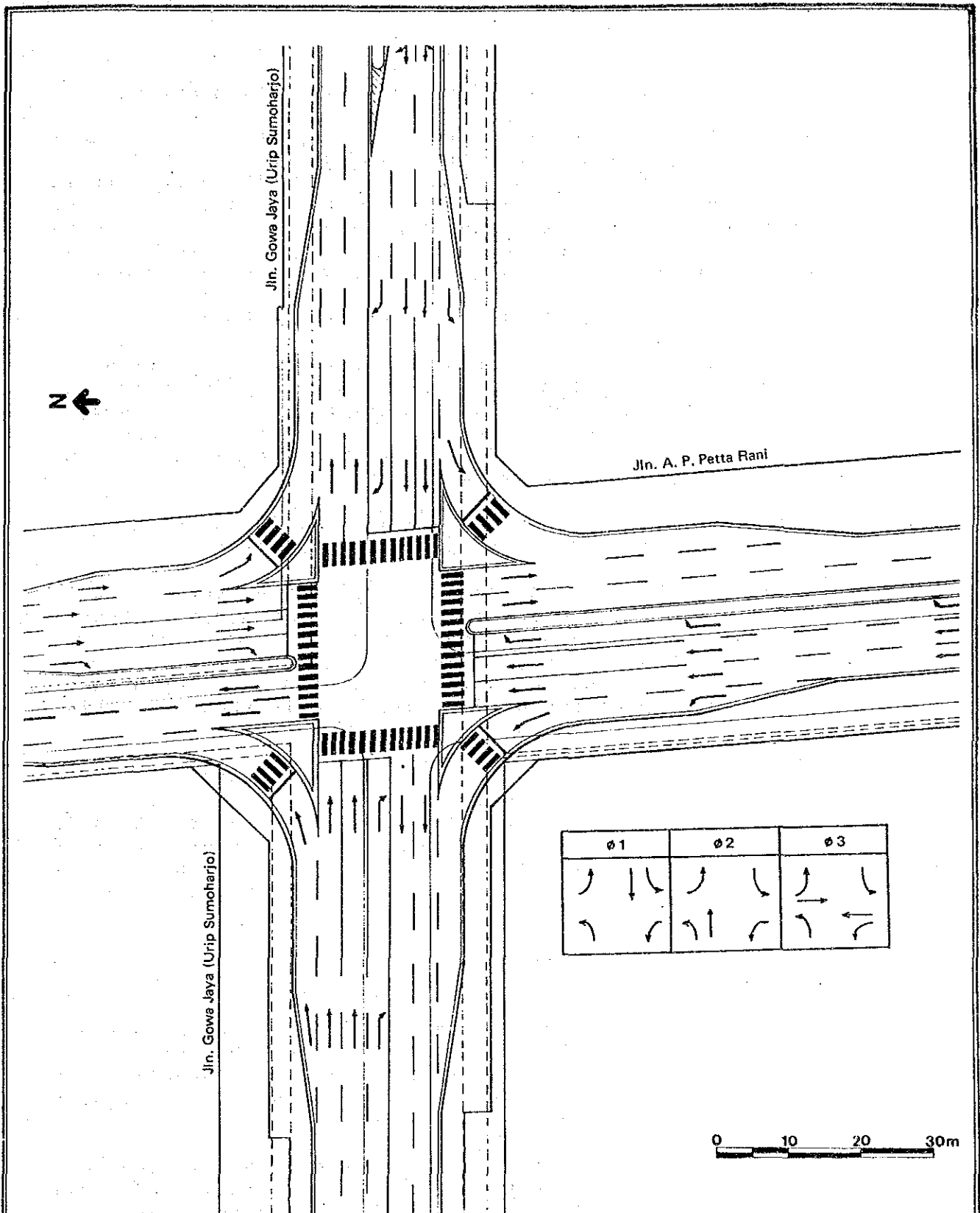


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**Fig. 6.4.9**

**Improvement Plan for Intersection  
of Jl. Gowa Jaya (Urip Sumoharjo)  
Jl. Pettarani**

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After Road Widening of Jl. Gowa Jaya (Urip Sumoharjo) Jl. A. Pettarani

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**Fig.  
6.4.10**

**Improvement Plan for Intersection  
of Jl. Gowa Jaya (Urip Sumoharjo)  
Jl. A. Pettarani**

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(9) Intersection of Jl. Veteran - Jl. Kerung-Kerung

Though there is an exclusive right turn phase in signal cycle time, this intersection is not provided with exclusive right turn lane on Jl. Veteran. Therefore, it is proposed that an exclusive right turn lane shall be provided in order to make the right turn traffic pass through this intersection smoothly and safely. Fig. 6.4.11 shows the improvement plan for this intersection.

(10) Intersection of Jl. Ratulangi - Jl. Kakatua

Many traffic accidents occurred at this intersection. It seems that one of the causes of these accidents is inadequate right turn channelization at Jl. Ratulangi according to accident records. Therefore, channelization improvement is proposed. Fig. 6.4.12 shows improvement plan for this intersection.

(11) Intersection of Jl. Veteran - Jl. Gowa Raya (St. Alauddin) - Jl. Kumala - Jl. Ratulangi

Many traffic conflicts occur at this intersection due to insufficient channelization and five leg shape. Hence, the points of planning are mainly improvement of channelization and changing shape of intersection. Improvement plan is illustrated in Fig. 6.4.13 and improvement plan after widening of Jl. Gowa Raya is shown in Fig. 6.4.14.

(12) Intersection of Jl. Veteran - Jl. Landak

It is proposed to install signal at this intersection in order to alleviate the congestion and to ensure traffic safety. In installation of signal, an approach lane at Jl. Landak Baru shall be widened. Improvement plan is shown in Fig. 6.4.15.

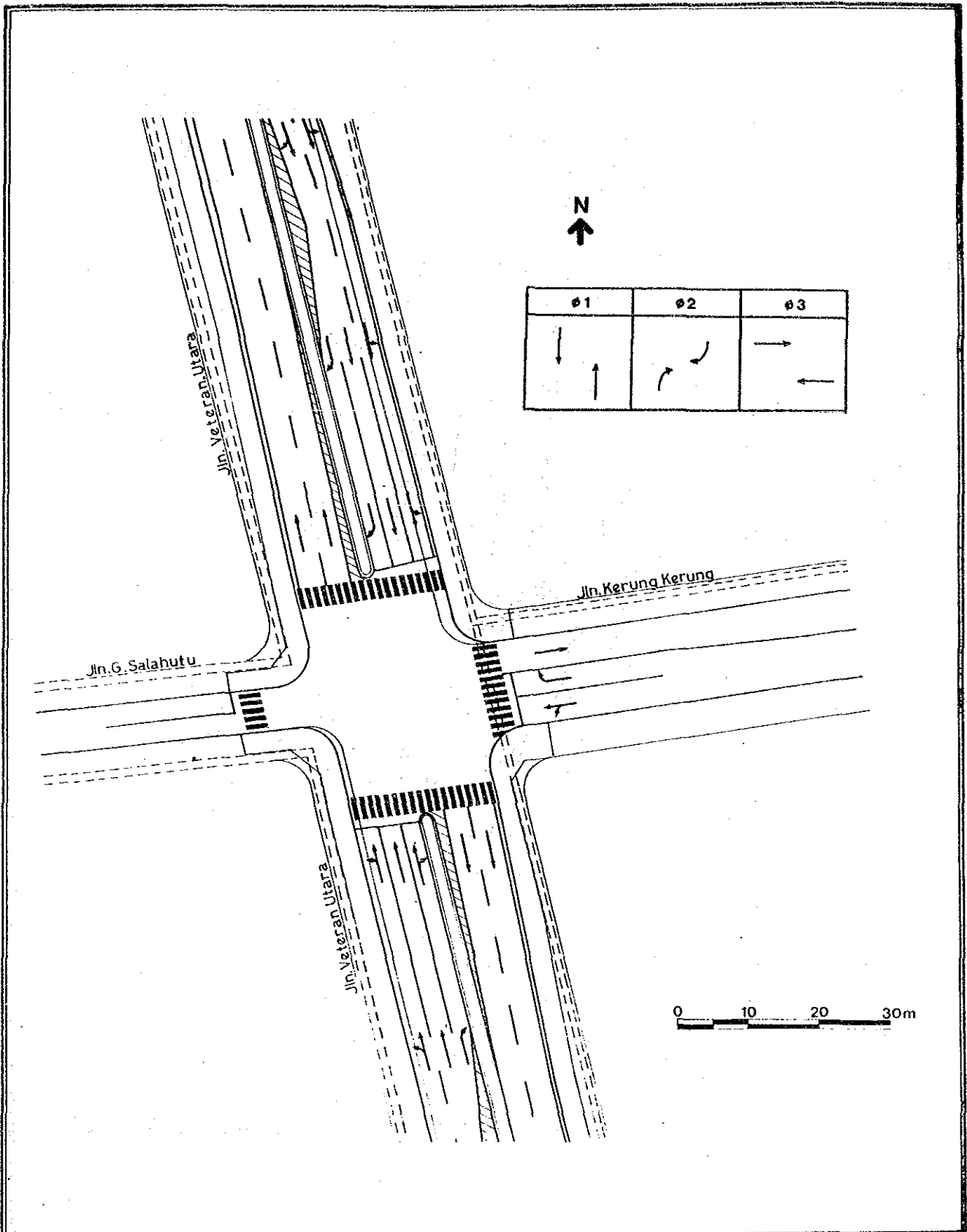
(13) Intersection of Jl. A. Pettarani - Jl. Gowa Raya (St. Alauddin)

Though this intersection is one of the most important ones, it is not provided with sufficient channelization. Therefore, the main measure is to improve channelization to provide right turn lane on both roads, and signals shall be repaired at the same time.

In addition, Fig. 6.4.16 illustrates the improvement plan after road widening of Jl. A. Pettarani and Jl. Gowa Raya (St. Alauddin), which can accommodate the increasing traffic volume in the near future.

(14) Intersection of Jl. Mesjid Raya - Jl. Sunu

The dangerous traffic conflicts occur in this intersec-



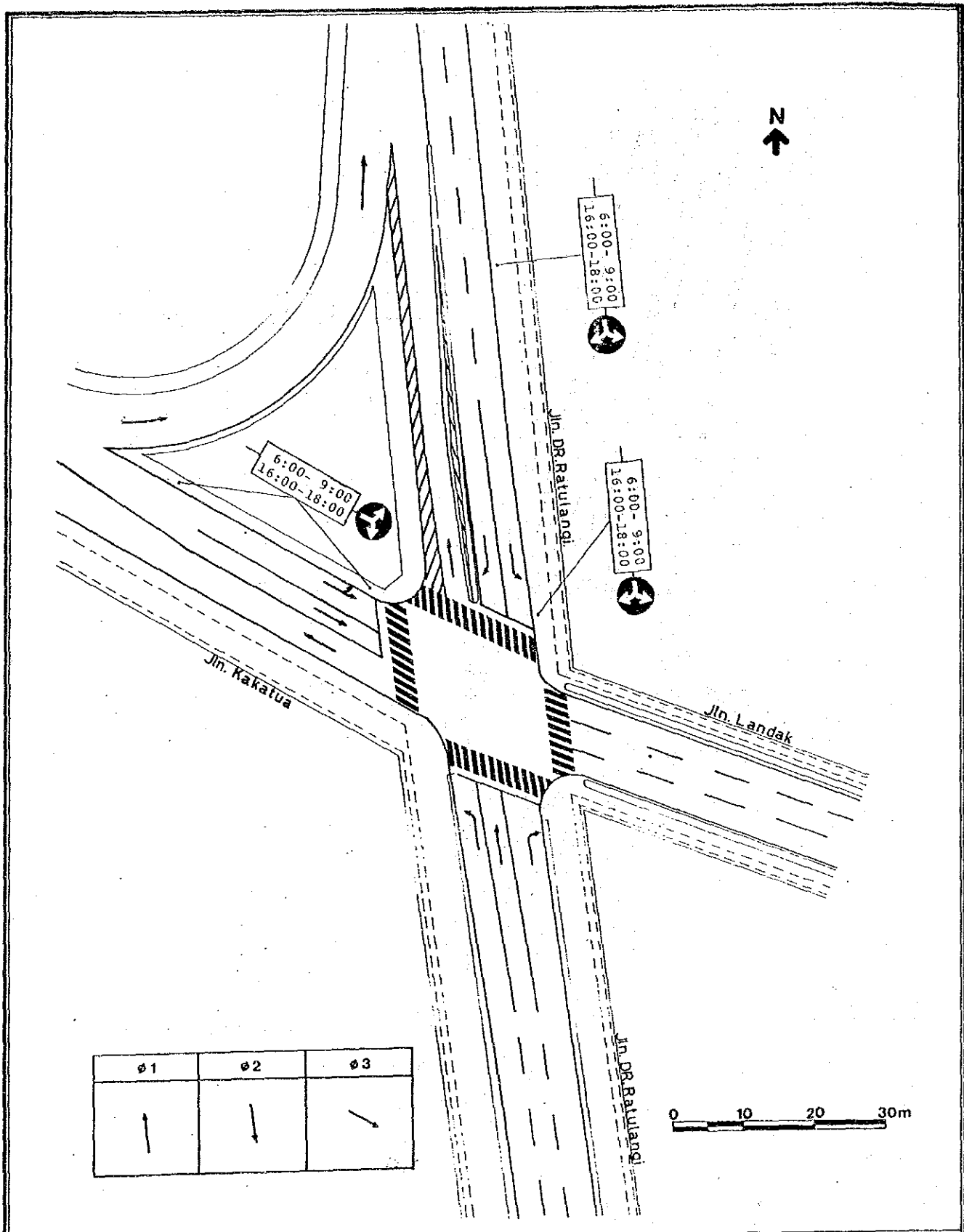
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Fig. 6.4.11

Improvement Plan for Intersection  
of Jl. Veteran - Jl. Kerung-kerung

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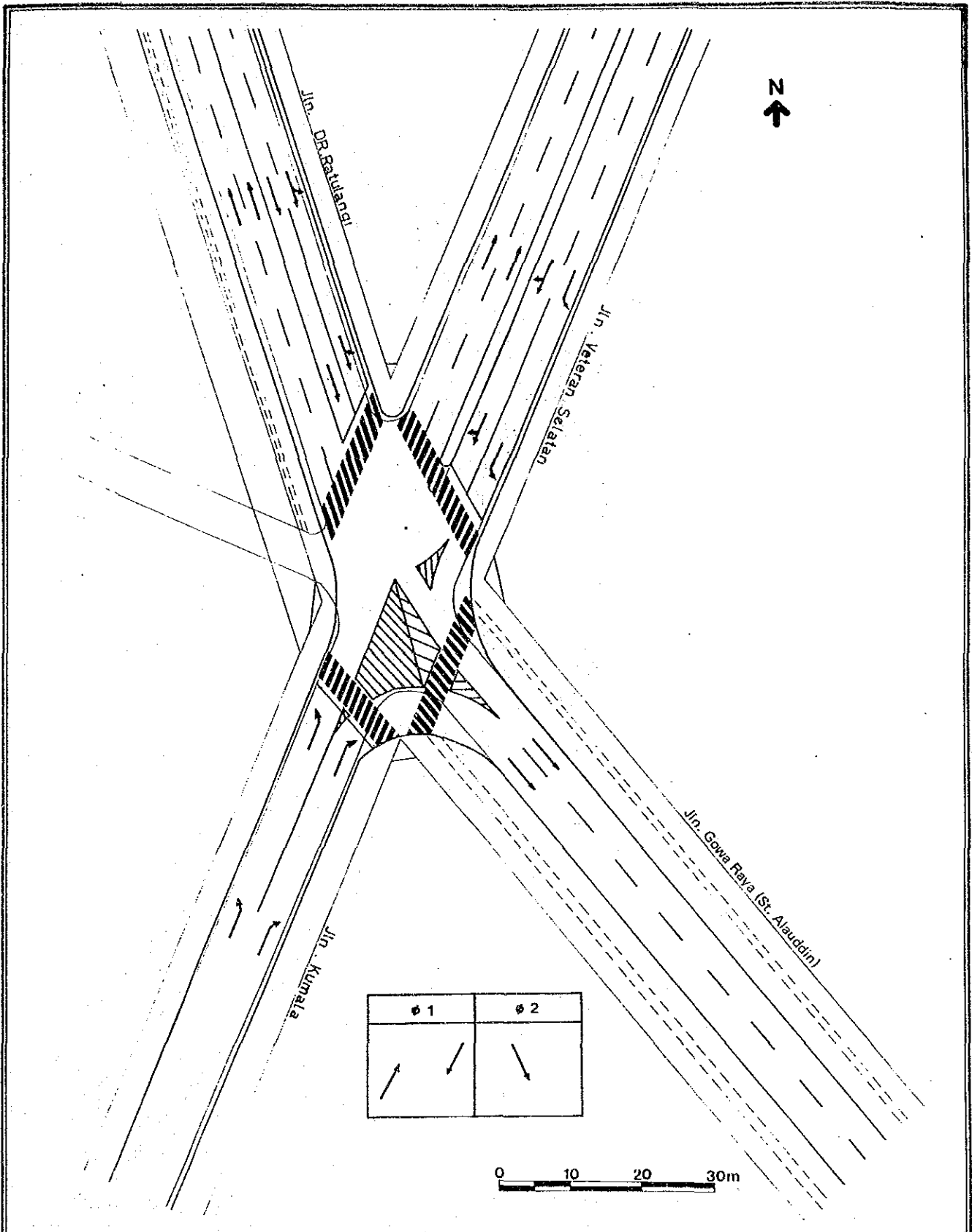


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**Fig. 6.4.12**

**Improvement Plan for Intersection  
of Jl. Ratulangi - Jl. Kakaktua**

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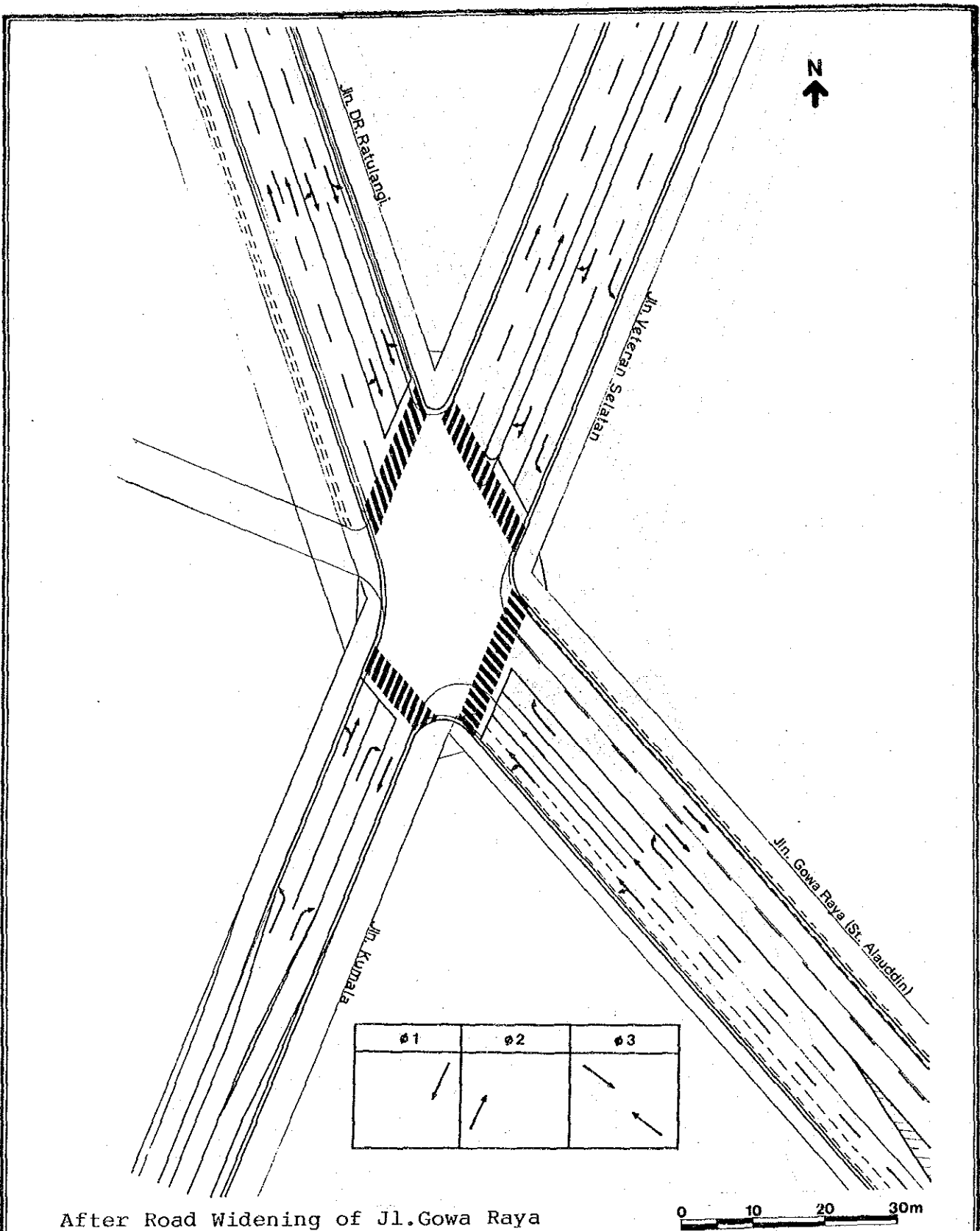


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Fig. 6.4.13

Improvement Plan for Intersection  
of Jl. Veteran-Jl. Ratulangi-Jl. Gowa-  
Raya (St. Alauddin)

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After Road Widening of Jl. Gowa Raya

0 10 20 30m

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**Fig. 6.4.14**

**Improvement Plan for Intersection  
of Jl. Veteran-Jl. Ratulangi-Jl. Gowa-  
Raya (St. Alauddin)**

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