5.3.3 Road Network

Based on the field survey and the interview with the Government authorities concerning the existing and future road networks, several assumptions about the construction schedules of the major planned roads have been determined. The assumptions are summarized in the following Tables.

(1) Regional Freeways

Year	Jagorawi Freeway	JKT - Cikampek Freeway	JKT-Tangerang Freeway
1976	Not Constructed	Not Constructed	Not Constructed
1985	4-lane Freeway	4-lane Freeway	4-lane Freeway
1995	6-lane Freeway	6-lane Freeway	4-lane Freeway
2005	6-lane Freeway	6-lane Freeway	4-lane Freeway

(2) Other Freeways

Year	Outer Ring Road	Harbour Road	Intra Urban Tollway
1976	Not Constructed	Not Constructed	Not Constructed
1985	Not Constructed	Not Constructed	6-lane South-west Link Only
1995	4-lane Southern Section 2-lane Eastern & Western Sections	4-lane Freeway	6-lane South-West & North-South Links Only
2005	4-lane Freeway	4-lane Freeway	6-lane South-West & North-South Links Only

(3) Arterial Roads

The priority for improvement and the construction schedule of the arterial roads in DKI Jakarta by year is based on the existing road condition and future traffic demands. The major assumptions made are as follows:

1976 - Existing Arterial road network.

1985 - Completion of the inter-city arterial roads (Jakarta-Bogor, Jakarta-Tangerang, Jakarta-Bekasi).

- Completion of the access road to the New Jakarta-Cengkareng Airport.

- Improvement of the roads in the vicinity of the Hankam Army Base.

1995 - Completion of the Jakarta-Serpong Highway.

- Improvements of the roads in the suburban area between the Intra Urban Tollway and the Outer Ring Road.

2005 - By this year all the arterial road network is assumed to have been completed.

- Improvement of almost all of the arterial roads within DKI Jakarta to more than 4-lanes.

5.4 Traffic Assignment

5.4.1 Methods of Traffic Assignment

The purpose of the traffic assignment is to simulate route choice. There are various traffic assignment models but in this study two methods are employed and the assignment results are compared with each other in order to derive the most reliable forecast.

One is the network assignment method based on traffic capacity limitation (the Q-V method), which implys that as traffic congestion increases travel costs will increase until a level is reached at which the traveller may begin to try alternative routes in the hope of finding a less congested road.

The other method is to employ a diversion curve which explains how much proportion of the traffic is diverted from the existing road to a new road.

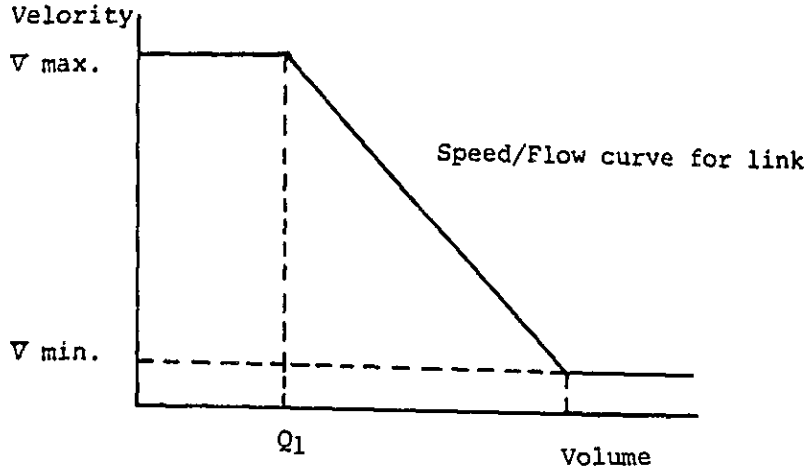
Since the Jagorawi Freeway has been open to traffic from March, 1978 the analysis of the tollway utilization can help to determine the diversion curve applicable to the Jakarta-Tangerang Freeway.

5.4.2 Network Assignment Method (Q-V Model)

(a) Model building

The conceptual model of Q-V is as shown in Fig. 5-8, that is travel speed is determined according to the condition of road congestion and the traveller will select a route which minimizes his perceived costs of travel.

Fig. 5-8 SPEED/FLOW CURVE



When the traffic volume is below Q1, a vehicle may be able to travel at the maximum speed (V max), and when the traffic volume exceeds Q1 the travel speed decreases.

In this study, based on the survey results of travel speed and traffic volume on the several links, the traffic capacity limitation conditions of the road network are divided into 20 different categories according to the nature of the road as shown in Table 5-33.

Table 5-33 TRAFFIC CAPACITY LIMITATION OF ROADS IN Q-V TRAFFIC ASSIGNMENT

No.	Type of Road	Location	No. of Lanes	V1 km/hr.	Q1 veh./2 hours	V2 km/hr.	Q2 veh./2 hours
1.	Ordinary road	Urban Area	2	40	300	5	1,460
2.			4	40	1,760	10	7,040
3.			6	45	3,180	20	10,560
4.	Ordinary road	Suburban Area	2	45	340	10	1,700
5.			4	50	2,120	20	8,480
6.			6	55	3,820	20	12,360
7.	Town Planning Road (Improved)	Urban Area	2	40	380	10	1,880
8.			4	50	2,060	15	8,240
9.			6	50	3,720	20	12,360
10.	Town Planning Road (Improved)	Suburban Area	2	50	380	10	1,880
11.			4	60	2,500	20	10,000
12.			6	60	4,500	20	15,000

(Cont'd)

No.	Type of Road	Location	No. of Lanes	V1 km/hr.	Q1	V2 km/hr.	Q2
13.	Jakarta-Tangerang Freeway and Inter City Expressway	Type A	4	90	3,760	20	15,060
14.		Type B	6	90	6,800	20	22,600
15.	Ring Road	Type A	2	70	680	20	3,400
16.		Type B	4	90	3,760	20	15,060
17.	Intra Urban Tollway	Type A	4	70	3,400	20	13,600
18.		Type B	6	70	6,120	20	20,400
19.	Ramp	Type A	2	40	840	15	4,120
20.		Type B	2	60	840	20	4,120

Notes: V1 : Maximum Travel Speed, V2: Minimum Travel Speed

Q1 : Traffic Volume at which all vehicles can travel at the Maximum Travel Speed (Veh./2 hours)

Q2 : Traffic Capacity (Veh./2 hours)

(b) Assignment alternatives

For the traffic assignment by the Q-V method many alternative cases are considered as follows:

Table 5-34 POSSIBLE TRAFFIC ASSIGNMENT ALTERNATIVES

Category of Alternative	Alternative	Number of Cases
Year	1) 1976 2) 1985 3) 1995 4) 2005	4
Toll system on JKT-Tangerang Freeway	1) Flat tariff System 2) Sectional (Distance proportional) Tariff System	2
Toll on JKT-Tangerang Freeway at 1979 prices	1) Rp.400,-/passenger car unit (PCU) 2) Rp.15,0/KM/PCU	2

(Cont'd)

Category of Alternative	Alternative	Number of Cases
Stage construction of Intra Urban Tollway	1) Construction of South-West Link Only 2) Construction of South-West Link and North-South Link Only	2
Stage Construction of Outer Ring Road	1) Not Constructed 2) All sections constructed	2
Stage Construction of Harbour Road	1) Not Constructed 2) All Sections Constructed	2

(c) Establishment of Factors Affecting the Traffic Assignment

1) Road Condition

The road conditions on each of the links was determined, based on the results of the survey of the existing roads and on future road planning. The "road conditions" refers to the physical characteristics of each link, which consist of the following items such as:

- Number of lanes on each link;
- Maximum capacity of each link;
- Maximum travel speed of each link; and
- Minimum travel speed of each link.

2) Toll Rates and Toll Resistance

The toll rates to be applied are limited by the financial benefits which travellers derive from using the Jakarta-Tangerang Freeway. The toll rates of the regional freeways (tollways) and the Outer Ring Road are also limited for

the same reason. Table 5-35 summarizes the alternative toll rates and toll systems which are to be used for the traffic assignment.

Table 5-35 ALTERNATIVE TOLLS AND TOLL SYSTEMS FOR MAJOR FREEWAYS (Tollways)

Toll Road	Toll System	Alternative Tolls
Jakarta-Tangerang Freeway	Flat Tariff Sectional Tariff	Rp.400/pcu Rp.20/km/pcu
Regional Freeway	Sectional Tariff	Rp.20/km/pcu
Intra Urban Tollway	Flat Tariff	Rp.400/pcu
Outer Ring Raod	Flat Tariff	Rp.400/pcu

For the calculation of the toll resistance by computer, the toll of the toll roads is converted into time by the following formula:

$$Ti = \frac{Di}{Vi} + \frac{Fi}{K}$$

where:

$\frac{Fi}{K}$ = "toll resistance" of link i (min)

Ti = resistance of link i (min)
Di = distance of link i (km)
Vi = travel speed of link i (km/min)
Fi = toll or link i (Rp.)
K = time value (Rp./min)

The flat Tariff system on the tollways assumes that will be collected at each ramp (entrance and exit) for technical reasons.

In the case of the sectional tariff system, toll resistance is calculated by the following formula:

$$\frac{Fi}{K} = \frac{Di \times Tr}{K}$$

where:

$\frac{Fi}{K}$ = "toll resistance" of link i (min.)

Fi = toll for link i (Rp.)

Di = distance of link i (km)

Tr = toll rate per km (Rp./km/Pcu)

K = time value (Rp./min)

The time values adopted in this study are shown in Table 5-36 for sedan, bus and truck. These are basically derived from the Jakarta Intra Urban Tollway study report and up-dated in accordance with the latest information about the costs of vehicle operating components.

Table 5-36 FINANCIAL TIME VALUE, IN 1985

Type of vehicle	Time value
Sedan	Rp.3,408.2/hr.(Rp.56.8/min)
Bus	Rp.4,907.1/hr.(Rp.81.8/min)
Truck	Rp.4,464.6/hr.(Rp.74.4/min)

Generally, when the arterial road is not congested and it is possible to travel at near the maximum travel speed, the traveller will not avail himself of the Jakarta-Tangerang Freeway but as congestion on the arterial road increases, the traveller takes advantages from using the tollway. To simulate this actual situation more closely in the traffic

assignment the assignment is broken down into five steps, so that the degree of congestion can be reassessed at each separate step.

At the same time the toll resistance is decreased congestion increases (see Table 5-37) so that the time values in table 5-36 represent the average values of the total assignment.

Table 5-37 VARIATION OF TOLL RESISTANCE BY STEPS AS CONGESTION OF NETWORK INCREASES

Variation	Step 1	Step 2	Step 3	Step 4	Step 5
Time value	50%*)-1 Reduction	25% Reduction	Average	25% Increase	50%*)-2 Increase

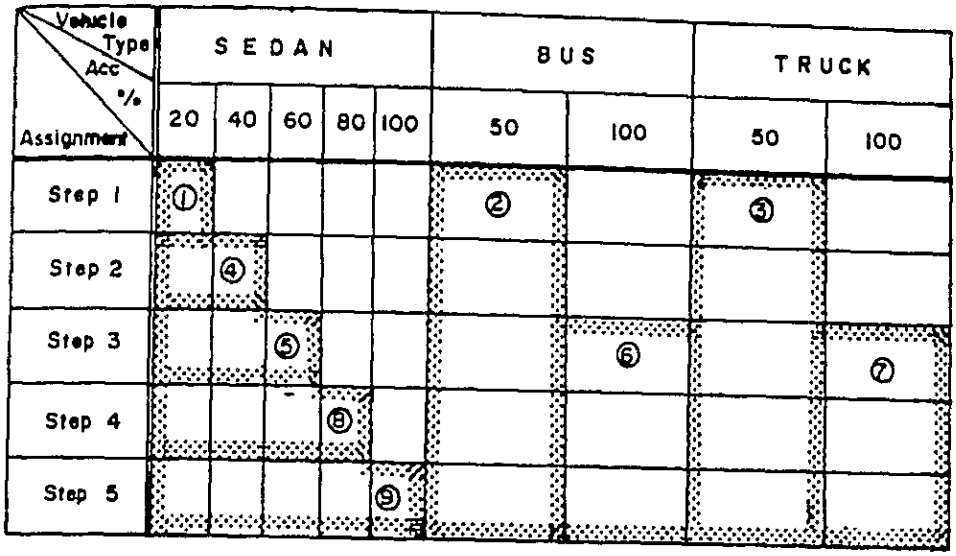
Notes: *)-1 indicates maximum toll resistance
*)-2 indicates minimum toll resistance

3) Frequency of Route Searches

The method of assigning traffic adopted is that in which a trip for a zone pair is allocated to those links forming the minimum time path between the two zone centroids.

Sedan traffic is divided into 5 lots (by 20%) and bus and truck traffics are divided into 2 lots (by 50%). Based on these separate lots, traffic is assigned to the network in nine stages. So that at each stage new speeds are estimated and new networks of optimum routes are built before the route search is made. The nine route searches and the five variations of toll resistance are shown in Fig. 5-9.

Fig. 5-9 METHOD OF TRAFFIC ASSIGNMENT



Notes:

		Accumulated %
1	1st route search for SEDAN (20%)	20%
2	1st route search for BUS (50%)	50%
3	1st route search for TRUCK (50%)	50%
4	2nd route search for SEDAN (20%)	40%
5	3rd route search for SEDAN (20%)	60%
6	2nd route search for BUS (50%)	100%
7	2nd route search for TRUCK (50%)	100%
8	4th route search for SEDAN (20%)	80%
9	5th route search for SEDAN (20%)	100%

5.4.3 Results of Traffic Assignment

The traffic volumes on the Jakarta-Tangerang Freeway by year, type of vehicle and alternative cases for the traffic assignment are calculated by a computer and summarized in Table 5-38 and Fig. 5-10 through 5-14. In this context the traffic volume assigned to the Jakarta-Tangerang Freeway is the volume liable for payment of the toll charge.

Fig. 5–10A **ESTIMATED TRFFFIC VOLUME ON THE JAKARTA TANGERANG FREEWAY**

UNIT: VEH/DAY

Year : 1985
Toll System : Sectional Tariff

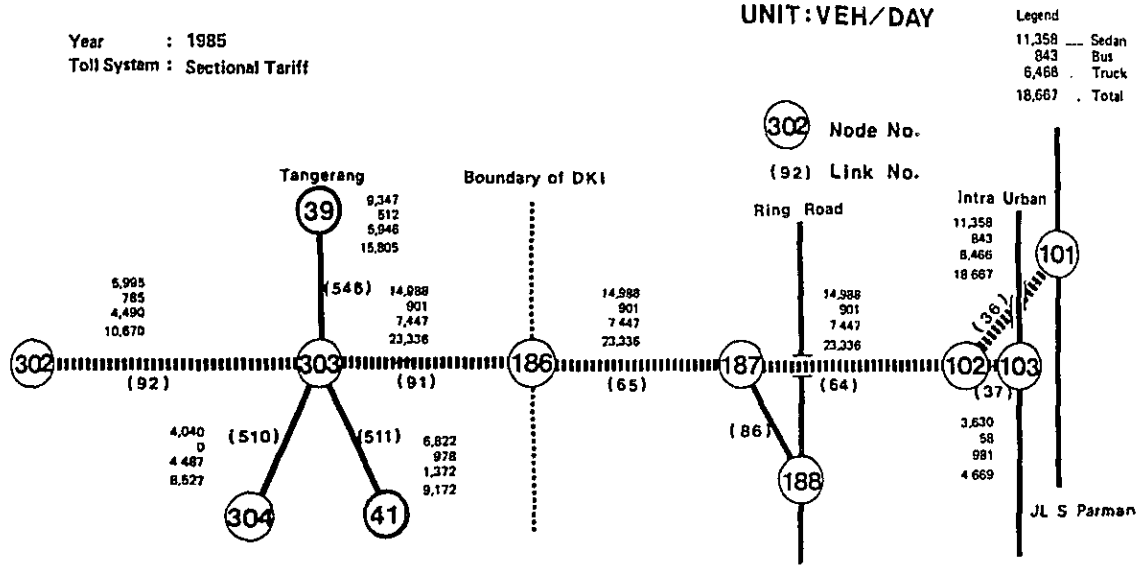


Fig. 5–10B **ESTIMATED TRFFFIC VOLUME ON THE JAKARTA TANGERANG FREEWAY**

UNIT: VEH/DAY

Year : 1995
Toll System : Sectional Tariff

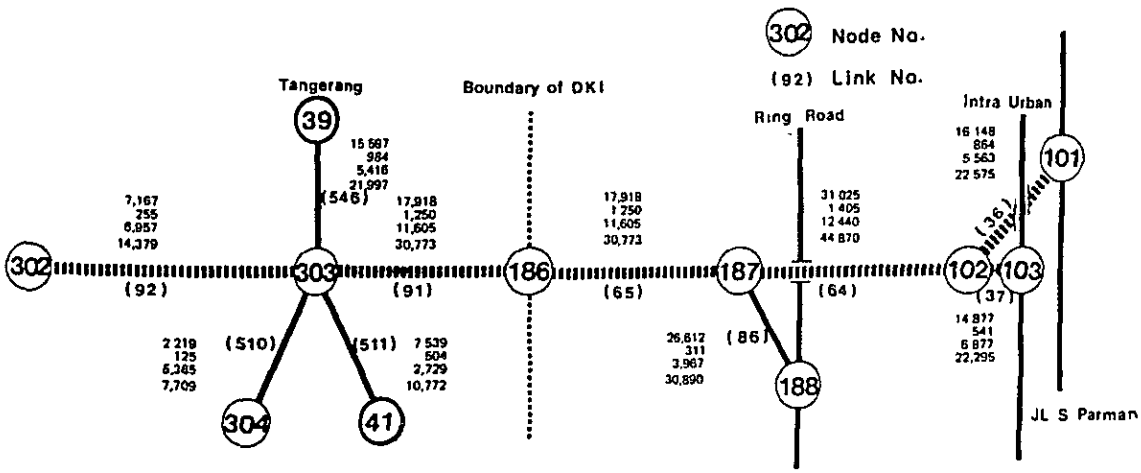


Fig. 5-10C **ESTIMATED TRFFFIC VOLUME ON THE JAKARTA TANGERANG FREEWAY**

UNIT: VEH/DAY

Year : 2005
Toll System : Sectional Tariff

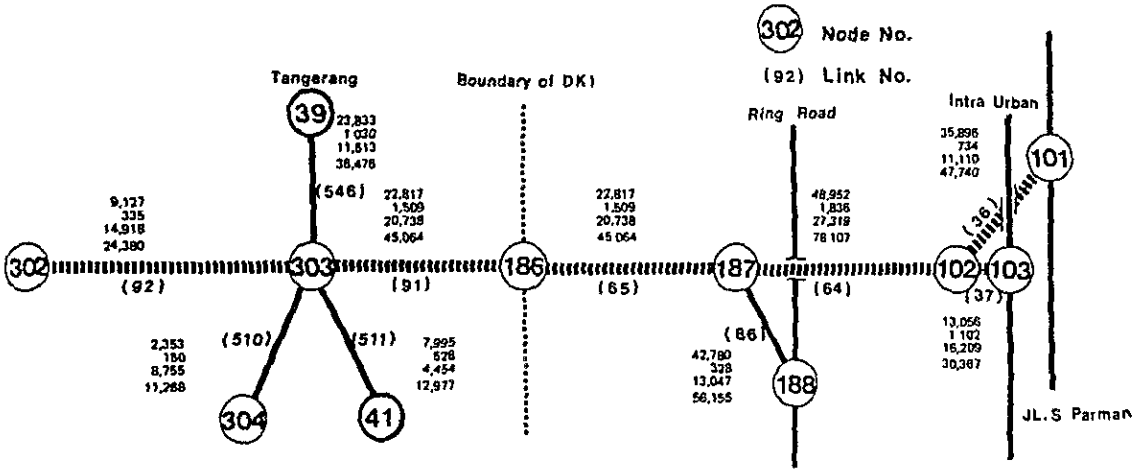


Fig. 5-10D **ESTIMATED TRFFFIC VOLUME ON THE JAKARTA TANGERANG FREEWAY**

UNIT: VEH/DAY

Year : 1985
Toll System : Flat Tariff

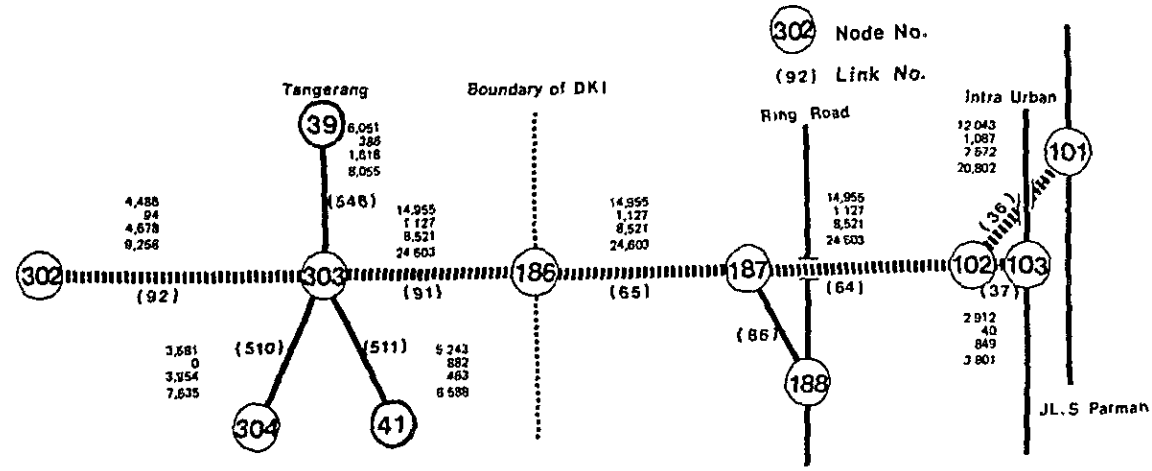


Fig. 5-10E **ESTIMATED TRFFFIC VOLUME ON THE JAKARTA TANGERANG FREEWAY**

UNIT: VEH/DAY

Year : 1995
Toll System : Flat Tariff

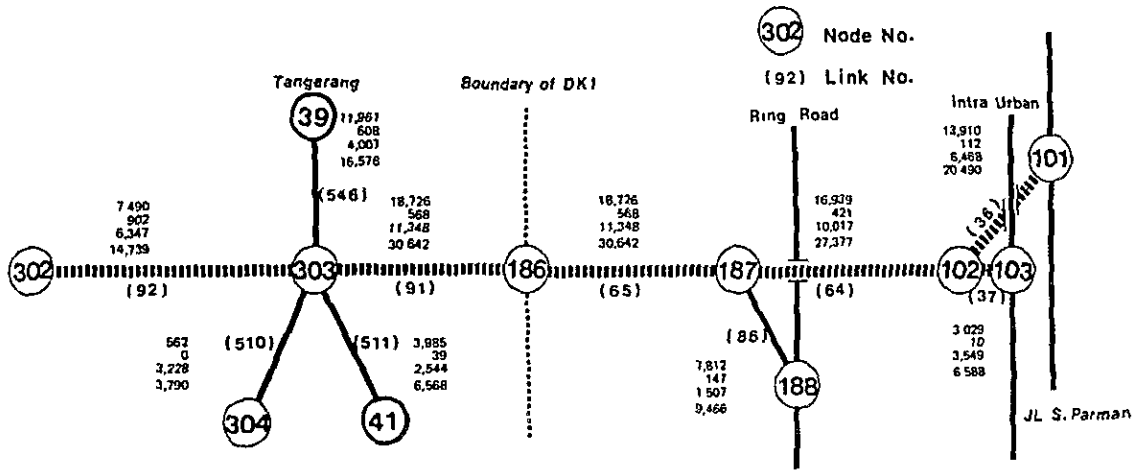


Table 5-38 ASSIGNED TRAFFIC VOLUME ON JAKARTA-TANGERANG FREEWAY

Year	Flat Tariff (Trips/day)			Sectional Tariff (Trips/day)								
				A–B Section			B–C Section			C–D Section		
	Sedan	Bus	Track	Sedan	Bus	Truck	Sedan	Bus	Truck	Sedan	Bus	Truck
1985	14,955	890	8,543	5,995	185	4,490	14,988	901	7,447	14,988	901	7,447
1995	21,738	1,103	11,436	7,167	255	6,957	17,918	7,250	11,605	31,025	1,405	12,440
2005	27,681	1,356	20,436	9,127	335	14,918	22,817	1,509	20,738	48,952	1,836	27,319

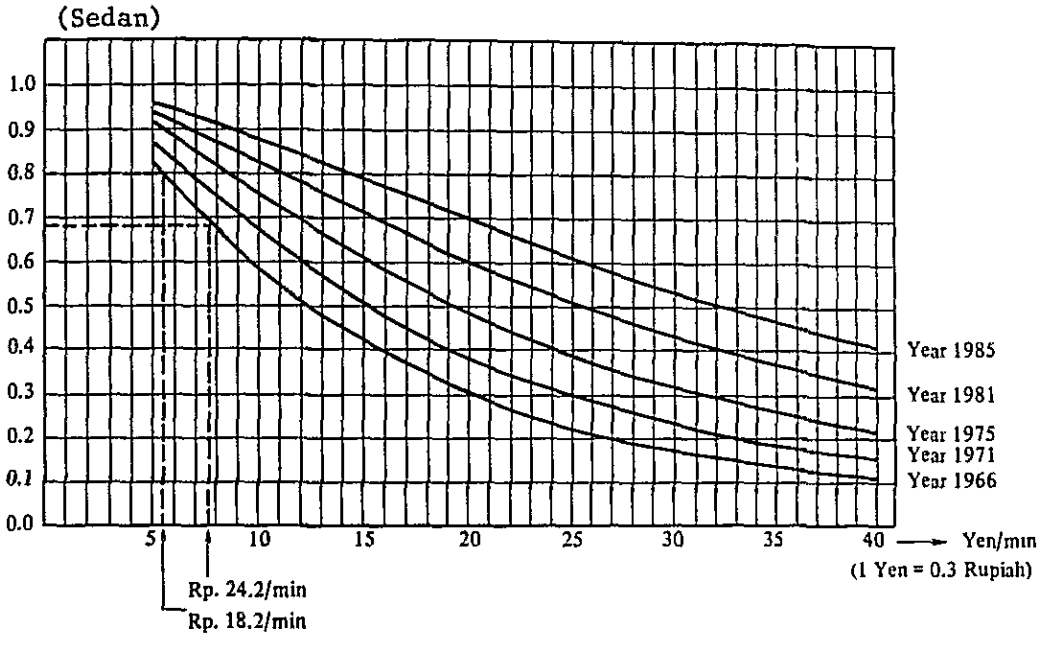
5.4.4 Traffic Diversion Rate

According to the traffic count survey and travel speed survey on the roads between Jakarta and Cibinong the travel time using Jagarawi Freeway is reduced by about 12.4 minutes compared with that using the existing highway, A toll per reduced travel time is, therefore, 24.2 Rupia/min. (Rp.300/12.4 min.). The access road to the Jagarawi Freeway from Cibinong is congested and an average speed is about 34 km/hr. Although the diversion rate to the Jagarawi Freeway is estimated at about 35 percent in April 1979, it will increase to more than 40 percent, if the access road is improved.

The traffic diversion rate for the Jakarta-Tangerang is calculated from the results of the established O-D matrices and the network assignments.

Table 5-39 shows the vehicle trips between Jakarta area and Tangerang area and also those assigned to the Jakarta-Tangerang Freeway in 1985.

Fig. 5-11 DIVERSION RATE FOR TOLLWAY ESTABLISHED BY JAPAN PUBLIC HIGHWAY CORPORATION



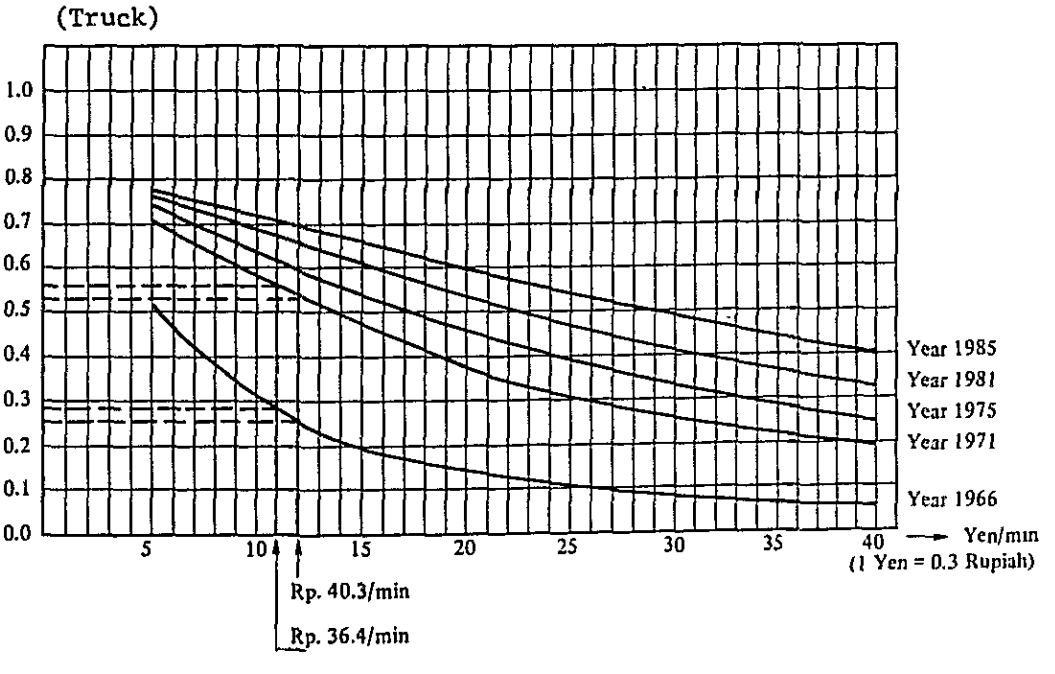


Table 5-39 DIVERSION RATE DERIVED FROM NETWORK ASSIGNMENT IN 1985

(Unit: Trips/day)

Type of Vehicle	Vehicle trips between Jakarta and Tangerang area	Vehicle trips assigned to the Freeway	Diversion rate (%)
Sedan	29.629	14,955	50.5
Bus	1,637	890	54.3
Truck	10,846	8,543	78.8

These results are compared with the Jagarawi Freeway and the diversion curve adopted by the Japan Public Highway Corporation.

The average time saved by using the Jakarta-Tangerang Freeway is about 22 minutes. Since the toll was determined previously at 400 Rupiah per vehicle-trip a toll rate per saved-time is 18.2 Rupiah/min.

In comparison with the Jagorawi Freeway the toll per saved-minute for the Jakarta-Tangerang Freeway is lower so that a diversion rate of the Jakarta-Tangerang Freeway can be higher than that of the Jagorawi Freeway.

Using the curve of 1966 for sedans the diversion rates corresponding to 24.2 Rupiah/min. for the Jagarawi Freeway and 18.2 Rupiah/min. for the Jakarta-Tangerang Freeway are 68% and 80% respectively. And for trucks the diversion rates corresponding to 40.3 Rupiah/min. for the Jagarawi Freeway and 36.4 Rupiah/min. for the Jakarta-Tangerang Freeway are 25% and 28% respectively. From the analysis made so far the diversion rate of trucks which was derived from the network assignment result seems to be over-estimated (Table 5-39). Hence, the future truck trips in the Jakarta-Tangerang Freeway were assumed to be 60% of the link load by the network

assignment method so that the diversion rate for trucks is about 47%.

The diversion rates for sedan and bus which were derived from the network assignment method (see Table 9-39) can be acceptable considering that a diversion curve is generally shifted upward as time goes by.

The vehicle trips and the traffic volumes on each road section are thus estimated and summarized in Table 5-40.

Table 5-40 FUTURE TRAFFIC VOLUME ON JAKARTA-TANGERANG FREEWAY

Year	Flat Tariff (Trips/day)			Sectional Tariff (Trips/day)								
				A–B Section			B–C Section			C–D Section		
	Sedan	Bus	Track	Sedan	Bus	Truck	Sedan	Bus	Truck	Sedan	Bus	Truck
1985	5,459	352	1,282	2,188	68	674	5,471	329	1,117	5,471	329	1,117
1995	7,934	403	1,715	2,616	93	1,043	6,540	456	1,741	11,324	513	1,866
2005	10,104	495	3,065	3,331	122	2,238	8,328	551	3,111	17,867	670	4,098

Chapter 6
TOLL SYSTEM

Chapter 6 TOLL SYSTEM

6.1 Toll Systems Proposed for Tollways in Jakarta Metropolitan Area

Table 6-1 TOLLWAYS PROPOSED FOR JAKARTA METROPOLITAN AREA

(Unit: km)

	Regional	Urban	Total
Jagorawi Freeway *)-1	43	5	48
Jakarta-Cikampek Freeway *)-2	59	8	67
Jakarta-Tangerang Freeway *)-3	16	4	20
Jakarta Intra Urban Tollway			
° South West Arc		11	11
° North South Link		14	14
° East West Link		6	6
Outer Ring Road		89	89
Total:	118	137	255

Source: 'Jakarta-West Jawa Tollway System Feasibility Study'

Notes: *)-1 A part of the Jagorawi Freeway has been open since March, 1978. It is scheduled to be fully open by March, 1979.

*)-2 This freeway is planned to open in 1984.

*)-3 The Jakarta-Tangerang Freeway, between Grogol in Jakarta and Tangerang, is planned to open in 1983 and will form a part of the Jakarta-Merak Freeway.

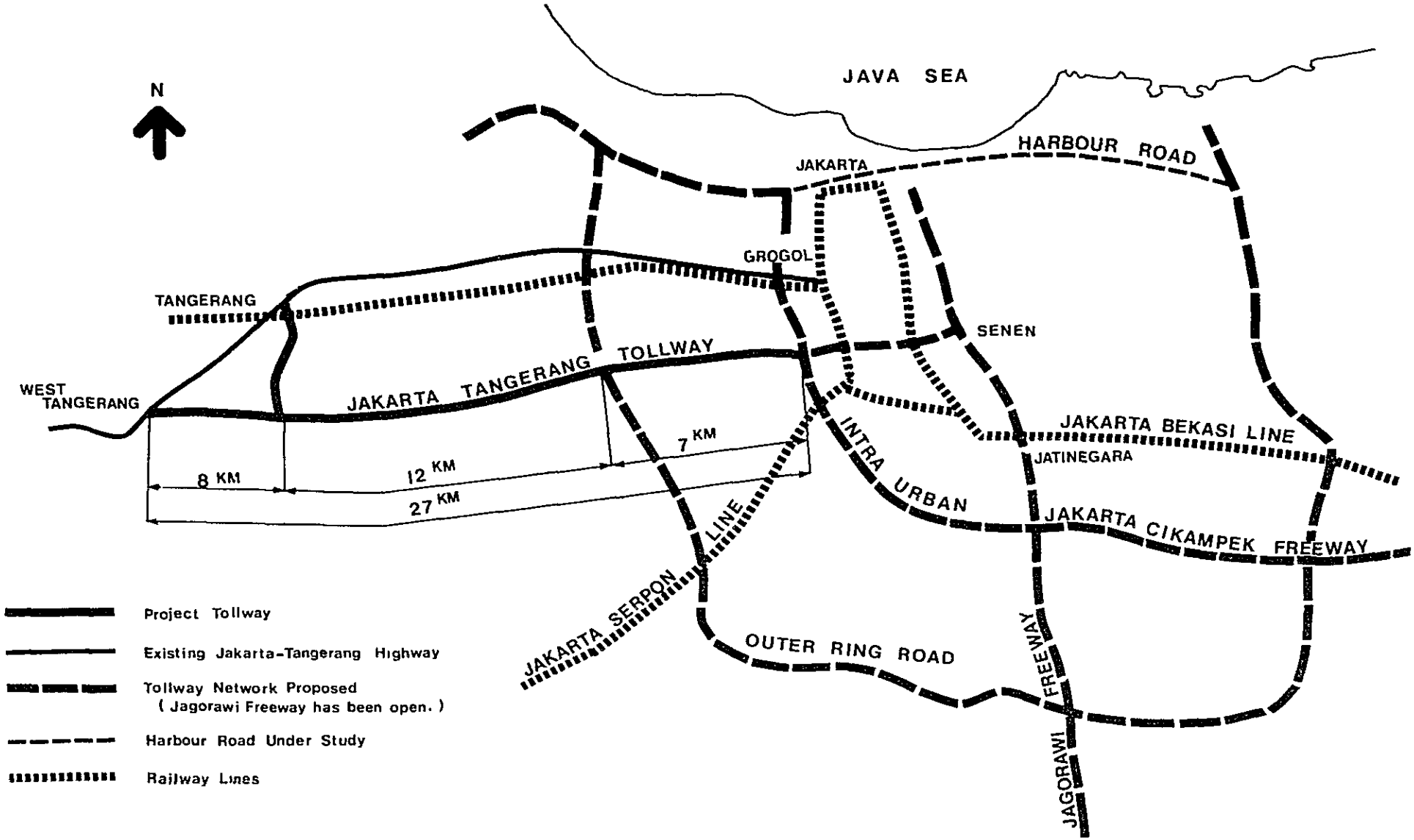
The tollways proposed for the Jakarta metropolitan area are listed in Table 6-1. The toll systems proposed for this network are as follows:

(a) Intra Urban Tollway

The Intra Urban Tollway with a total length of 31 km is in a highly urbanized area throughout its entire length. The number of on-ramps from existing ordinary roads is as many as twenty seven.

Therefore, the uniform toll system would be the most suitable with regard to the disadvantages of the other systems.

Fig. 6-1 TOLLWAY NETWORK PROPOSED IN JAKARTA METOROPOLITAN AREA



(b) Regional Freeways

For the three regional freeways, the distances between the ramps are much longer than on the Intra Urban Tollway. Therefore, the sectional toll system would be suitable. The Jagorawi Freeway is presently operated using a zonal flat tariff.

(c) Outer Ring Road

The Outer Ring Road is planned to run in the periphery of DKI Jakarta, about 15 km away from the city center. Because of its total length, about 48 km, the uniform toll system would not be suitable. Both the sectional and regional toll systems should be considered.

Fig. 6-2
CASE 1-1
(REGIONAL TOLL SYSTEM
FOR OUTER RING ROAD)

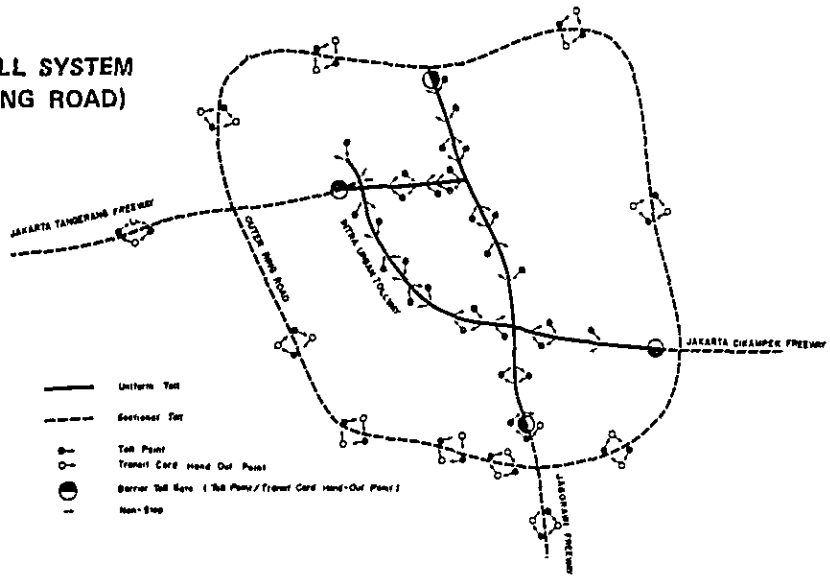


Fig. 6-3
CASE 1-2
(HARBOUR ROAD &
OUTER RING ROAD
EXTENSION NOT TOLLED)

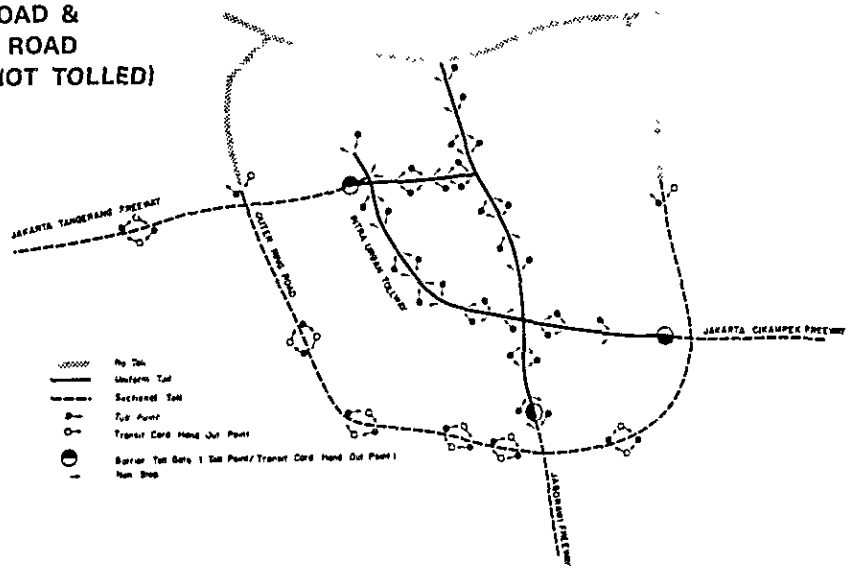
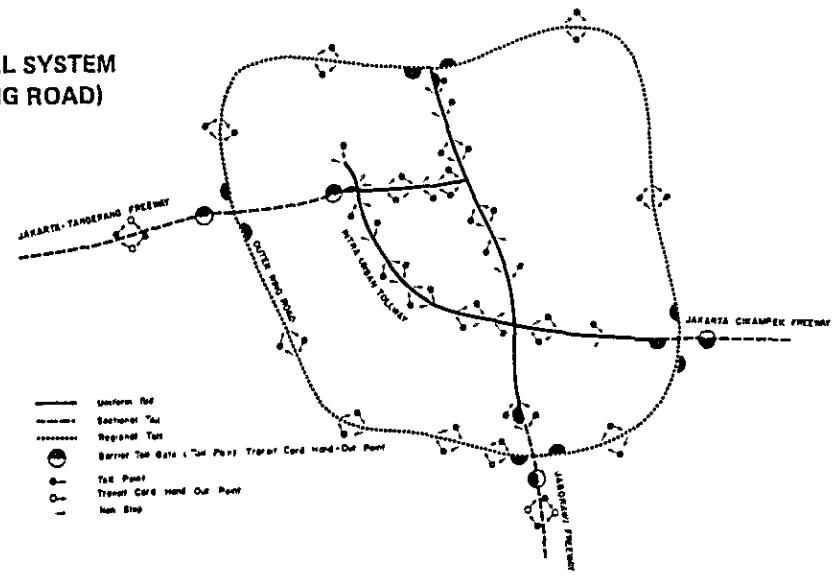


Fig. 6-4
CASE 2
(REGIONAL TOLL SYSTEM
FOR OUTER RING ROAD)



6.2 Toll System for Jakarta-Tangerang Freeway

6.2.1 Toll System Alternatives

After discussions with Bina Marga, alternatives for the toll system and toll plaza locations for the Jakarta-Tangerang Freeway are proposed as shown in Fig. 6-4.

Among conditions for alternative setting, those requested by Bina Marga are summerized as follows:

- It is difficult to prepare sites for toll plazas inside of the proposed Outer Ring Road alignment due to land acquisition problems;
- Staging of toll system development should follow construction of the Intra Urban Tollway and Outer Ring Road; and
- The management body for each tollway should be assumed to be independent at this stage.

Staging of toll system development and alternative toll collection systems for each stage are explained below.

(a) Stage I: The Stage I includes the relatively short period in which both the Intra Urban Tollway and Outer Ring Road are not yet connected with the Jakarta-Tangerang Freeway, and also after connection only with the Intra Urban Tollway.

Type I: For the early period of the Stage I when both of the intersecting tollways are not yet connected, users only for the Section C are not assumed to be taking the

traffic volume and the road capacity of this section is placed on the existing road.

Users for the Section A-B-C and Section A-B are tolled at on and off-ramps at the West Tangerang and Tangerang Interchanges, since there will be no toll gate constructed at the Outer Ring Road interchange. Therefore, the Jakarta side of the Section A and B is open, (Open System).

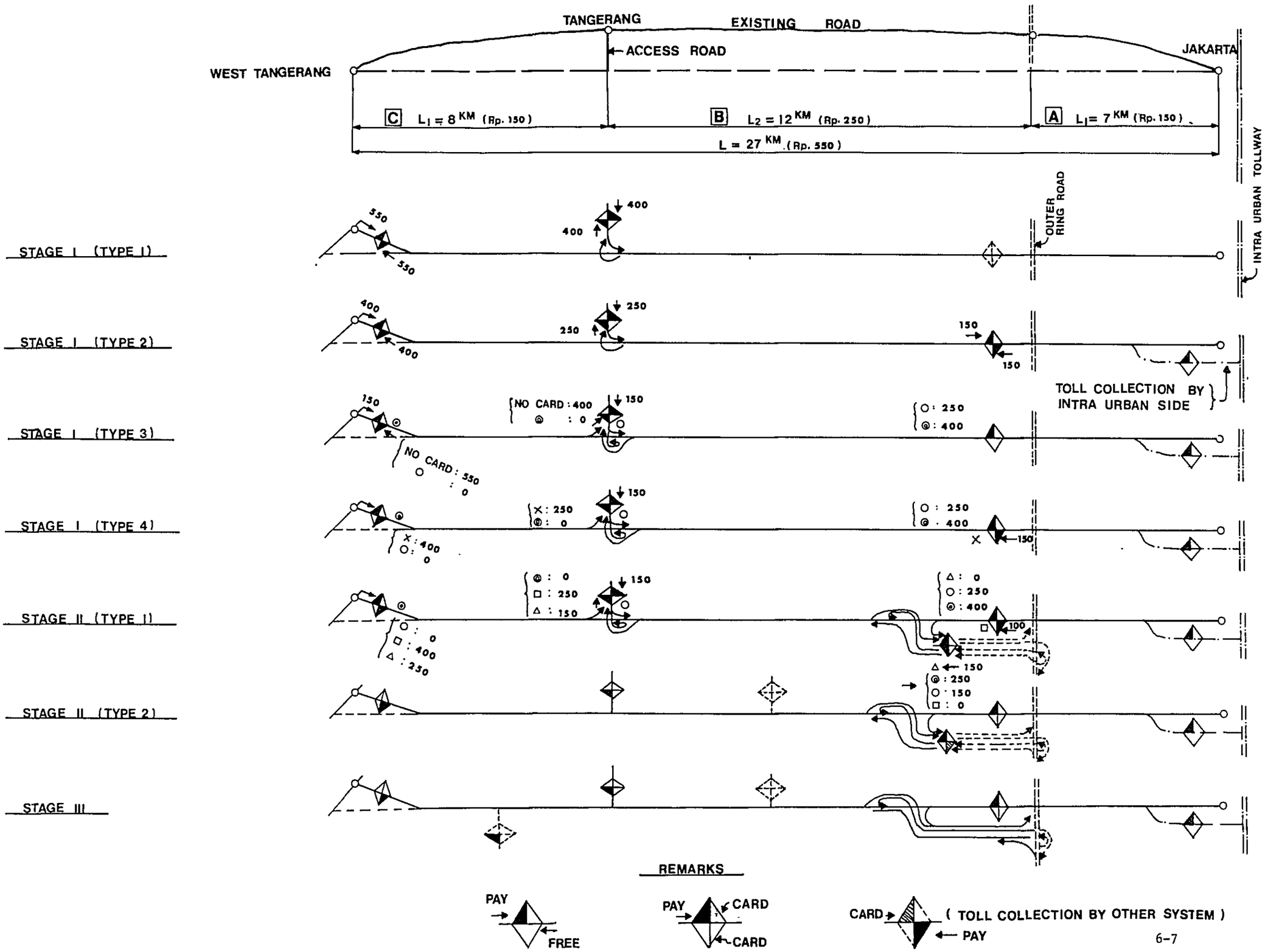
Type 2: After connection with the Intra Urban Tollway a barrier toll gate is constructed at the junction with it. However, operation of this barrier toll gate is included in the Intra Urban Tollway operation, and therefore its construction and operation costs are not considered in this study.

The Type 2 does not assume users only for the Section C as in the case of the Type 1. Since the Outer Ring Road is not connected yet, the barrier toll gate at its junction is not required for toll collection. However, it will become necessary in the later stage, and therefore its construction at this stage is recommended, (Closed System)

Type 3: This type is for the case of completion of a trumpet type interchange at the Tangerang intersection, allowing "Section C only" users.

Users pay the minimum charge at on-ramps receiving a ticket card in exchange, and pay the rest at off-ramps

Fig. 6-5 TOLL COLLECTION SYSTEM ALTERNATIVES FOR JAKARTA-TANGERANG FREEWAY



and at the inbound barrier toll gate, (Semi-Closed/ Ticketing System).

(b) Stage II: In this stage the Outer Ring Road is connected by a trumpet type interchange, and the Jakarta-Tangerang Freeway and Outer Ring Road are independently operated.

Type 1: Toll gates are constructed at the interchange with the Outer Ring Road. This is basically the Closed System/Ticketing System as in the case of Type 4, Stage II. For transference from the Jakarta-Tangerang Freeway to Outer Ring Road a transfer card is handed out at the off-ramp to the Outer Ring Road, (Closed/Ticketing System).

Type 2: A transit card is handed out without paying the toll at on-ramps and the toll is paid at off-ramps. For transference, the transfer card is handed out as in the case of Type 1, Stage III, (Closed/Card System).

(c) Stage III: This is for the case in which the card system is applied for the Jakarta-Tangerang Freeway and Outer Ring Road as one total sectional toll system. Therefore, no toll gate is necessary at the interchange between the Jakarta-Tangerang Freeway and Outer Ring Road, (Closed/Card System).

6.2.2 Toll System and Interchange Types Recommended

After discussions with Bina Marga and P.T. Jasa Marga a sequencial adoption of the following systems is recommended such as:

- Starting with the Type 4 in the Stage I;
- The Type 1 is adopted for the Stage 2; and then
- Develop into the total sectional toll system in the Stage 3.

For the above recommended toll system, the three types of interchanges in Fig. 6-7, 8 and 9 for each inter-section are proposed.

Fig. 6 – 6 TOLL COLLECTION SYSTEM RECOMMEND

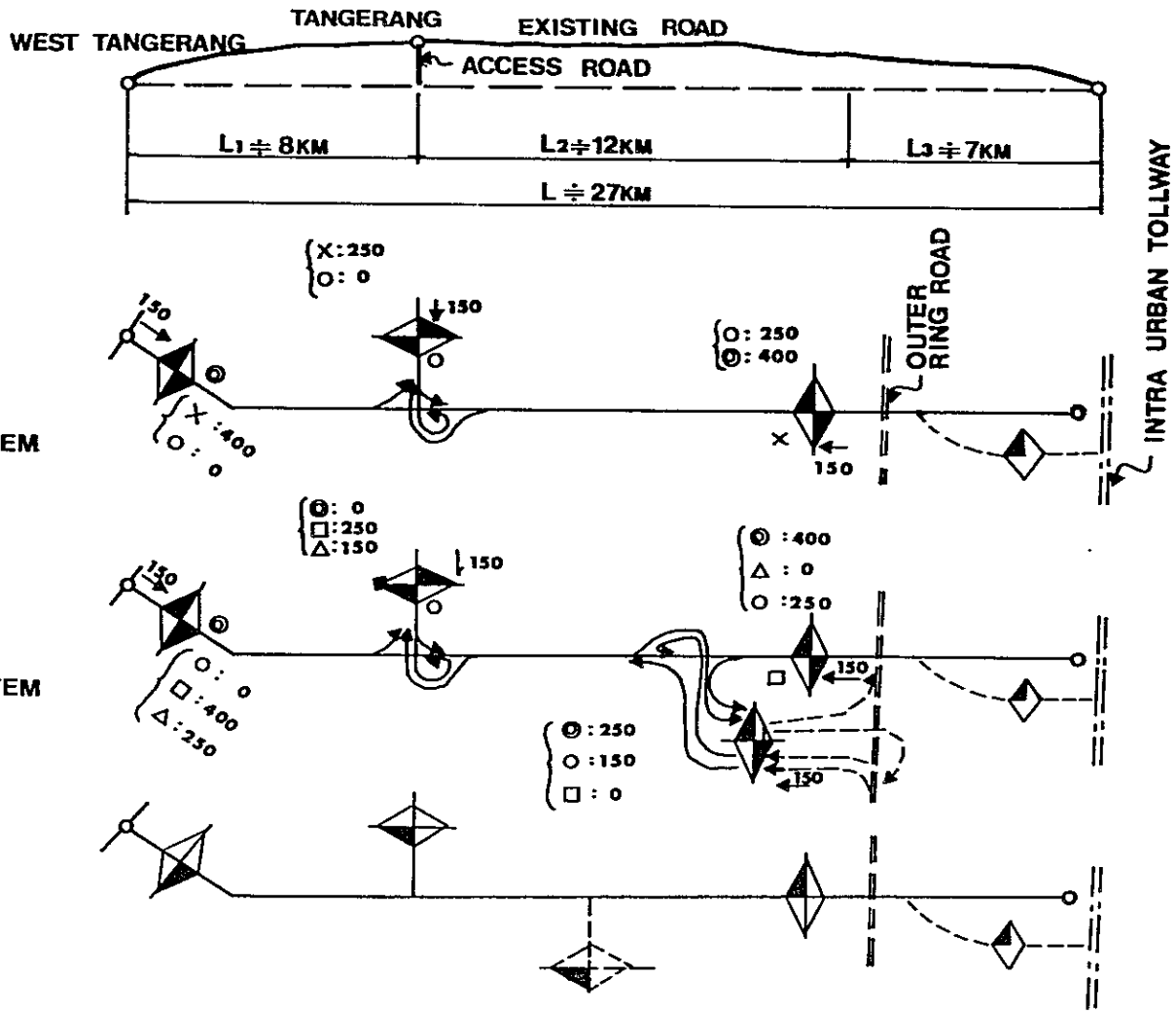


Fig. 6-7 OUTER RING ROAD INTERCHANGE

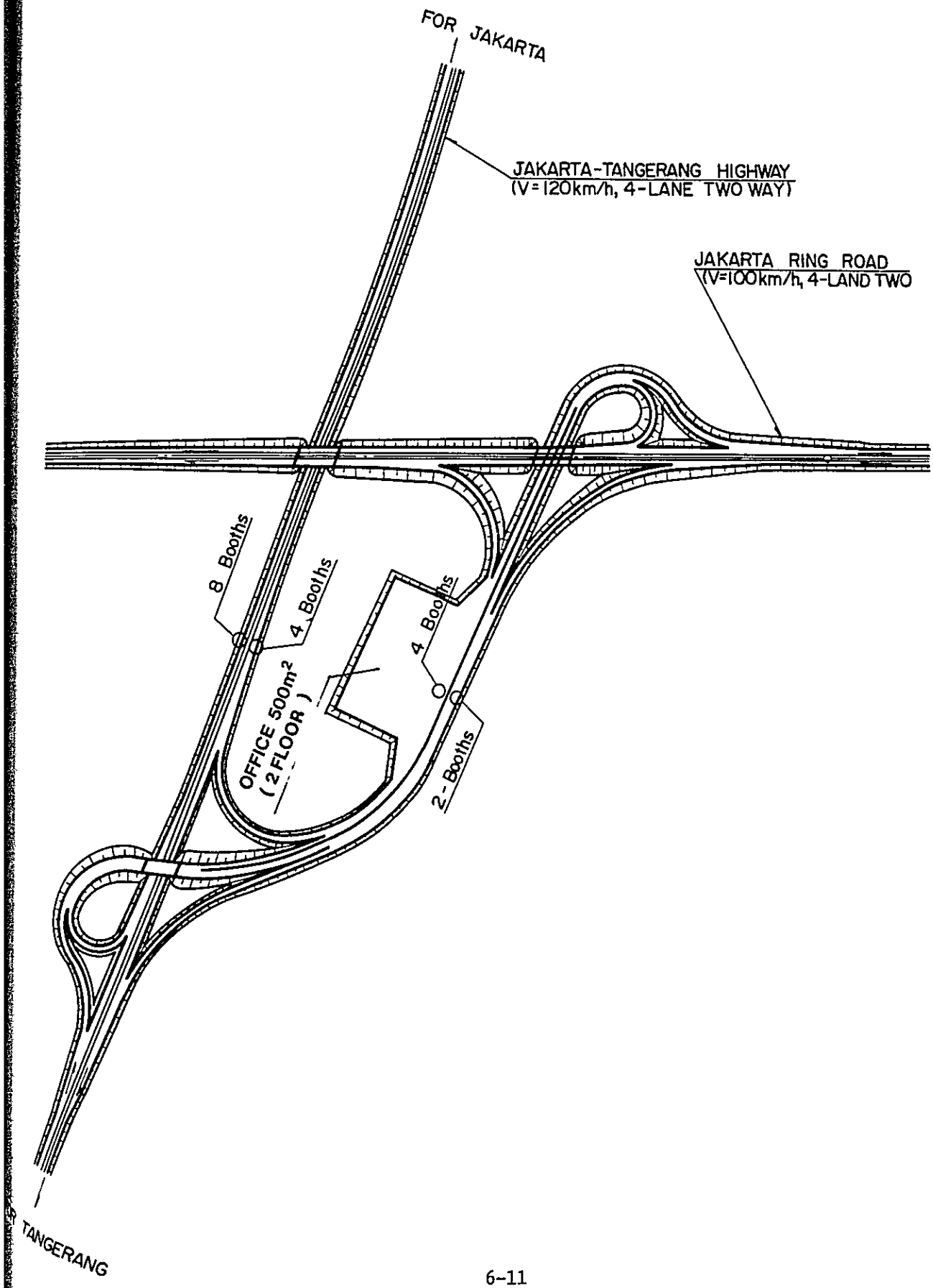


Fig. 6-8 TANGERANG INTERCHANGE

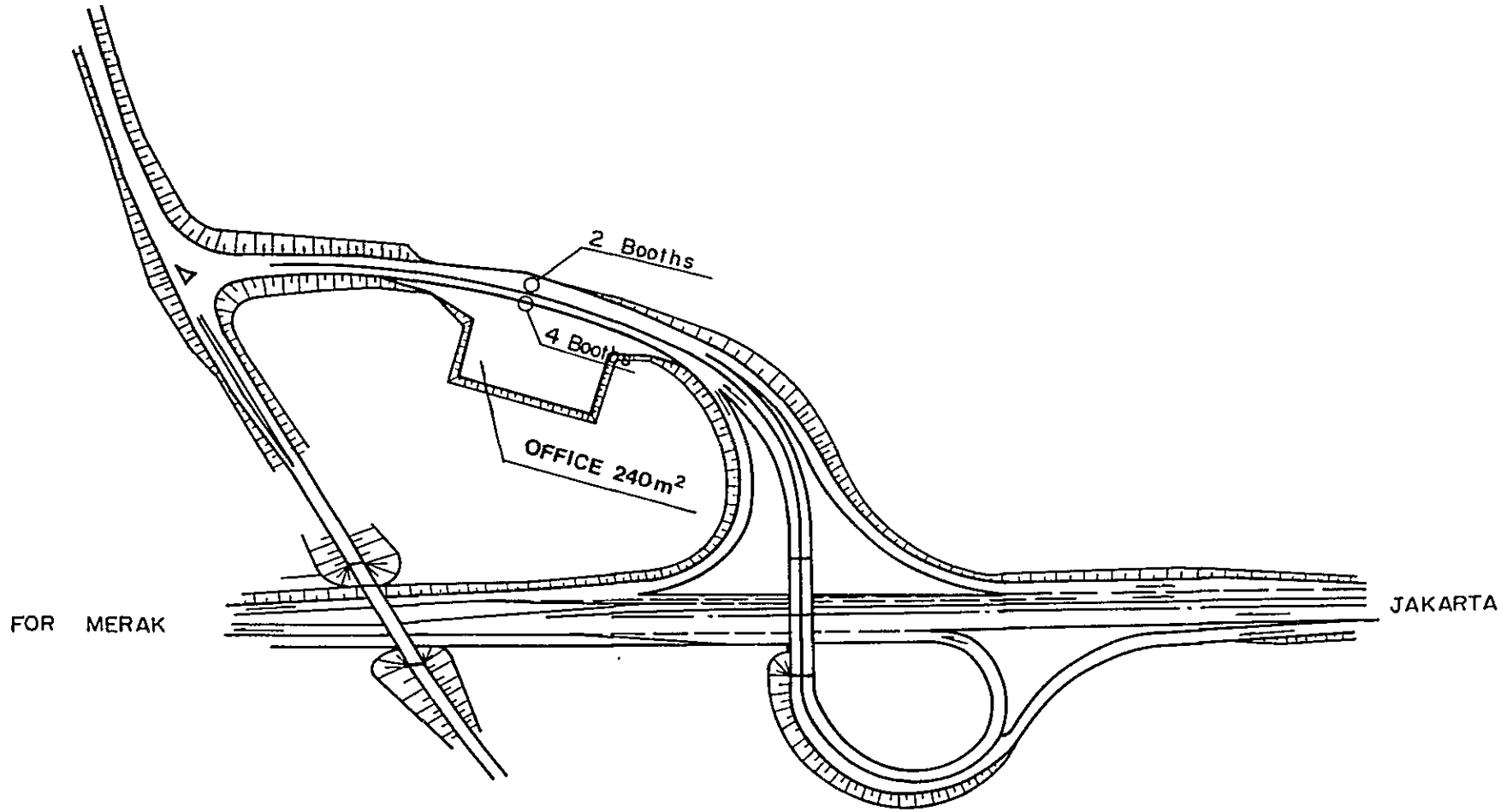
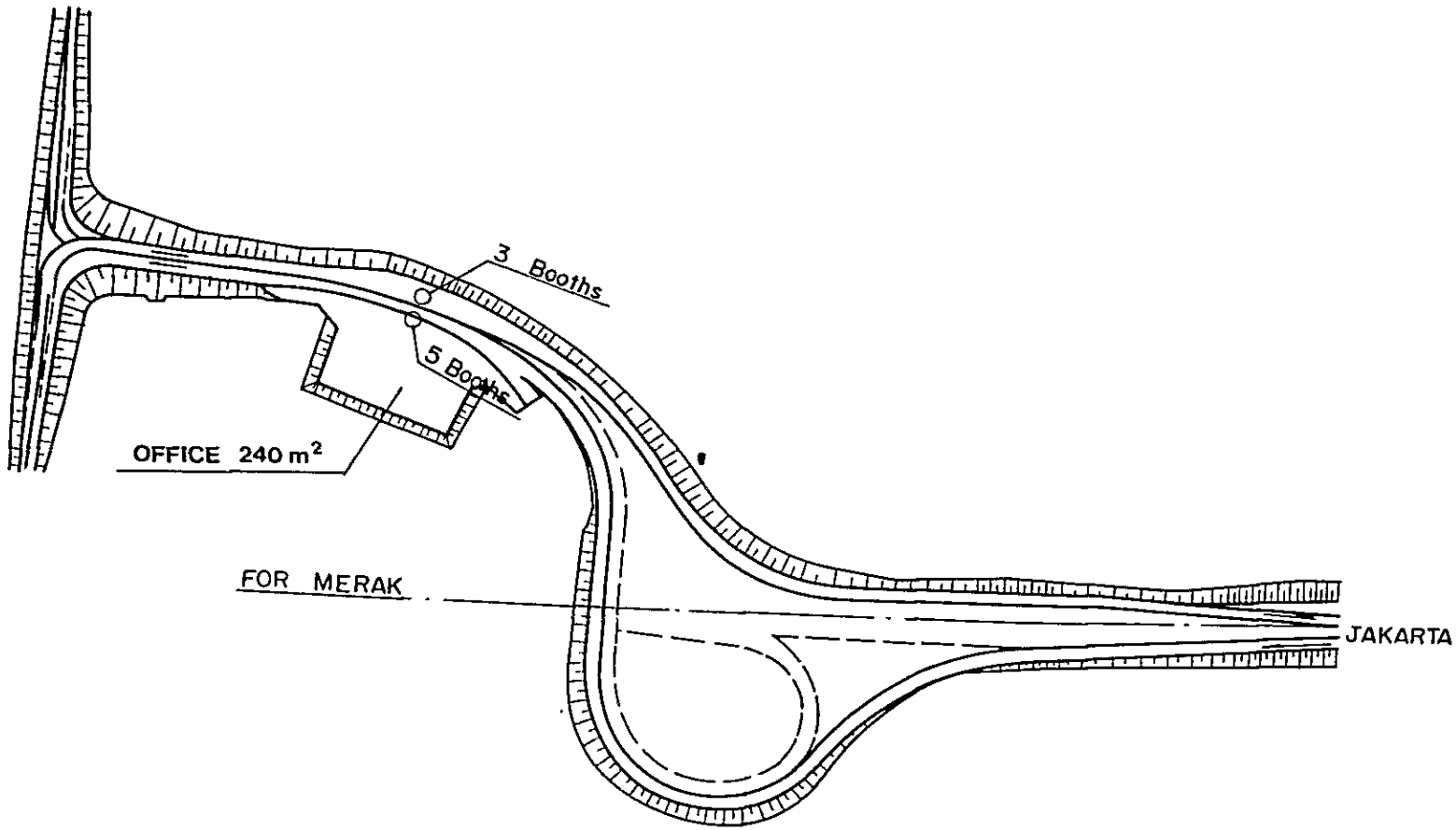


Fig. 6-9 WEST TANGERANG INTERCHANGE



6.3 Toll Plaza Facilities

In this section toll plaza facilities required for the toll collecting system recommended for each stage is reviewed.

6.3.1 Stage 1 and 2

During Stage 1 and 2 period users pay the minimum toll in exchange for a ticket card at on-ramp toll plazas or the outbound barrier toll gate, and pay the rest at off-ramp toll plazas or the inbound barrier toll gate. Therefore, almost the same toll plaza facilities are installed at each toll gate.

The main toll plaza equipment required for each toll gate is listed in Table 6-2.

Table 6-2 EQUIPMENT FOR EACH TOLL GATE

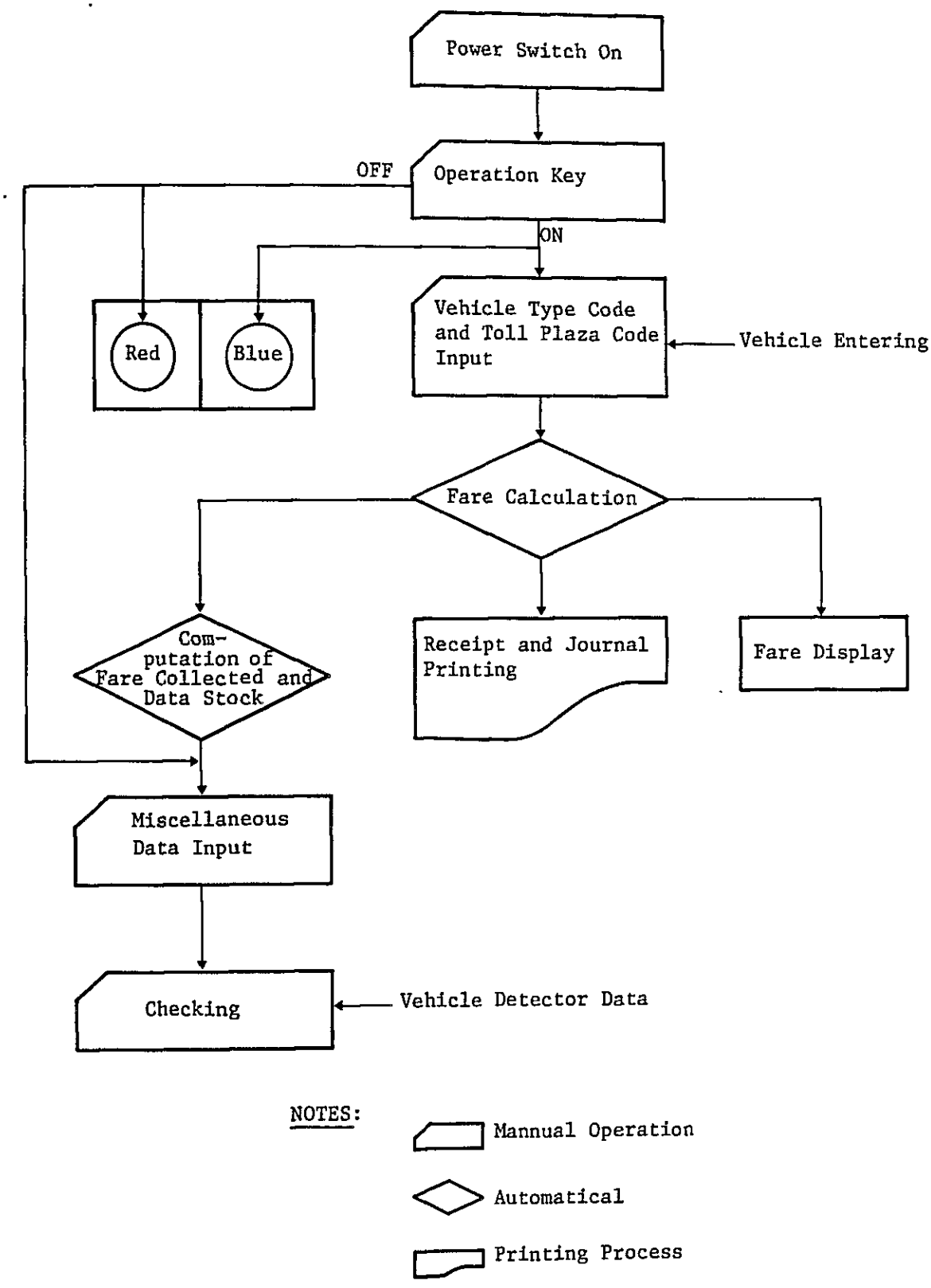
ITEM
Vehicle Class Register Board
Ticket Issuing Unit
Control Box
Fare Display Panel
Signal
Vehicle Detector
Sign Board

Description on toll equipments is as follows:

(a) Vehicle Class Register Board

- Transfer the information on vehicle classes to the ticket issuing unit.
- Calculates the toll fare based on the above information.
- Transfers the toll fare based on the above information.
- Calculates the total amount of toll fare collected, either by each toll booth worker or within a day, and then prints the results.

Fig. 6-10 OPERATION FLOW CHART



- Sends additional information on the toll gate number to the central recording office, when the total operation system is introduced.

(b) Receipt (or Ticket) Issuing Unit

- According to the information from the vehicle class register board, prints a receipt or ticket.
- On a receipt or ticket the information below is printed.
  - Name or Code of Tollway and Section
  - Vehicle Class and Toll Fare
  - Toll Gate and Operator Code
  - Date

(c) Control Box

- A transference device among various equipments such as the signal, fare display panel, etc.
- Distributes the power to equipment.

(d) Fare Display Panel

- Indicates the toll fare based on the information from the vehicle class register board.
- Information displayed is as follows:
  - Toll Fare
  - Toll Gate Code
  - Vehicle Class

(e) Signal

- Red and blue indication for closed and open by key operation on the vehicle class register board.

(f) Vehicle Detector

- Loop Coil Type.

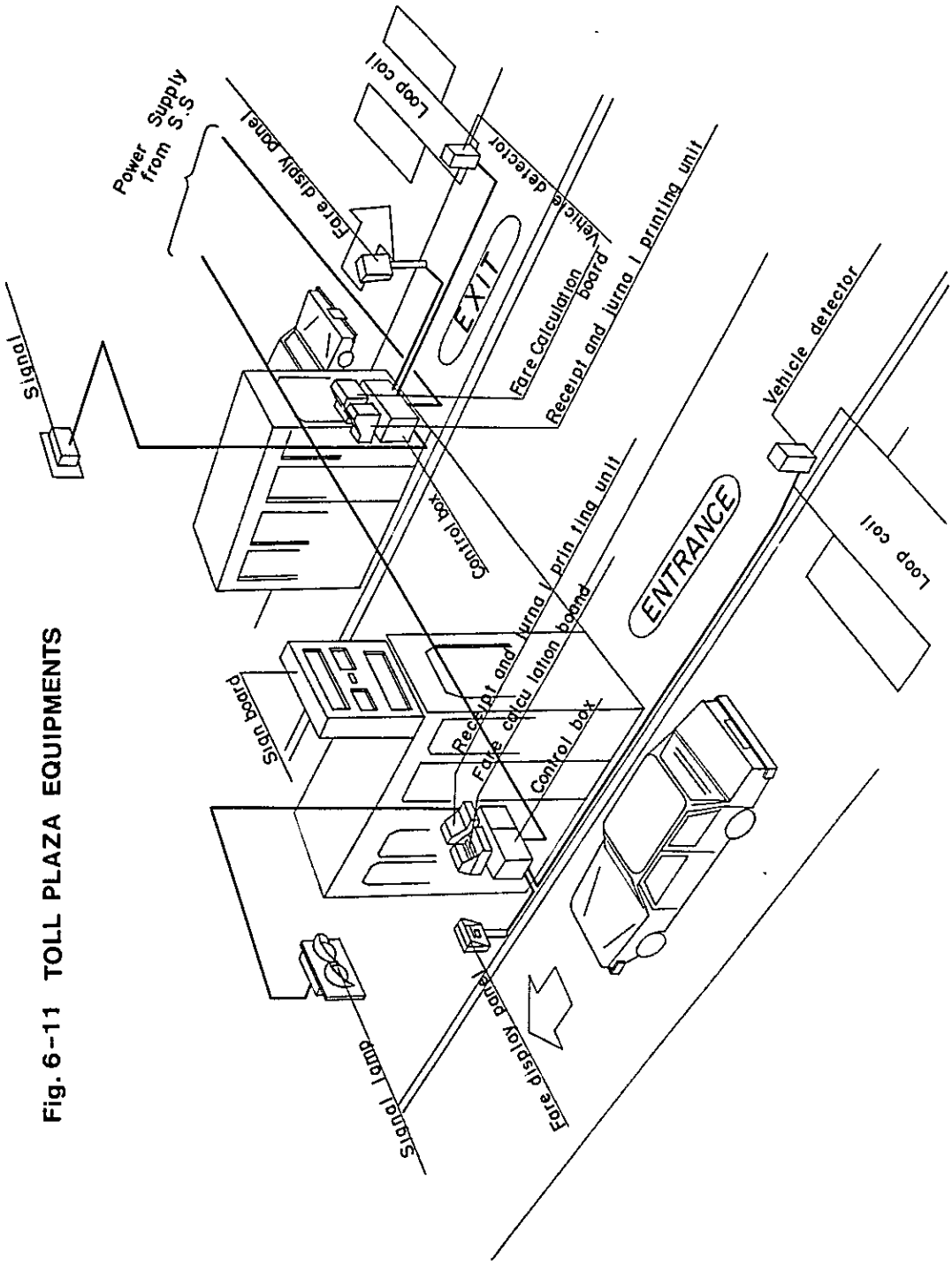


Fig. 6-11 TOLL PLAZA EQUIPMENTS

- Number of vehicles by class is recorded.

(g) Sign Board

- Electric Variable Information Indicator.
- Operated either by each toll plaza or the central operation center.
- Information provided is as follows:
  - Caution, Regulation, etc.
  - Section, Applicable
  - Description of Situation, Causes, etc.

The operation procedure for the above equipment is explained in the flow chart diagram in Fig. 6-9.

The information on the vehicle type and the toll gate code is fed into the control box by the operater, and then the indication of the toll fare and receipt is printed automatically. Also, the number of cars by each vehicle type as well as the toll fare collected are recorded. When the operation key which is carried by each toll booth worker is turned off, the printed information record comes out, and in turning the key on again, the blue light is on and the information memorized is cancelled.

The same operation procedure is applicable for both the entrance and exit toll gates except that it is necessary to check the ticket card in collecting toll fare at exit toll gates. It is also necessary to give some indication of expired ticket, for example by stamps, to prevent re-use of the ticket.

The total amount of toll collected by each worker or within a day is checked by the number of users recorded by the vehicle detector.

6.3.2 Stage 3

When the total toll system for the tollway network is established, the individual recording system for each toll gate adopted in the Stage 1 and 2 is transformed into a central recording system. In the central recording system data collected by each toll gate is compiled for each toll plaza.

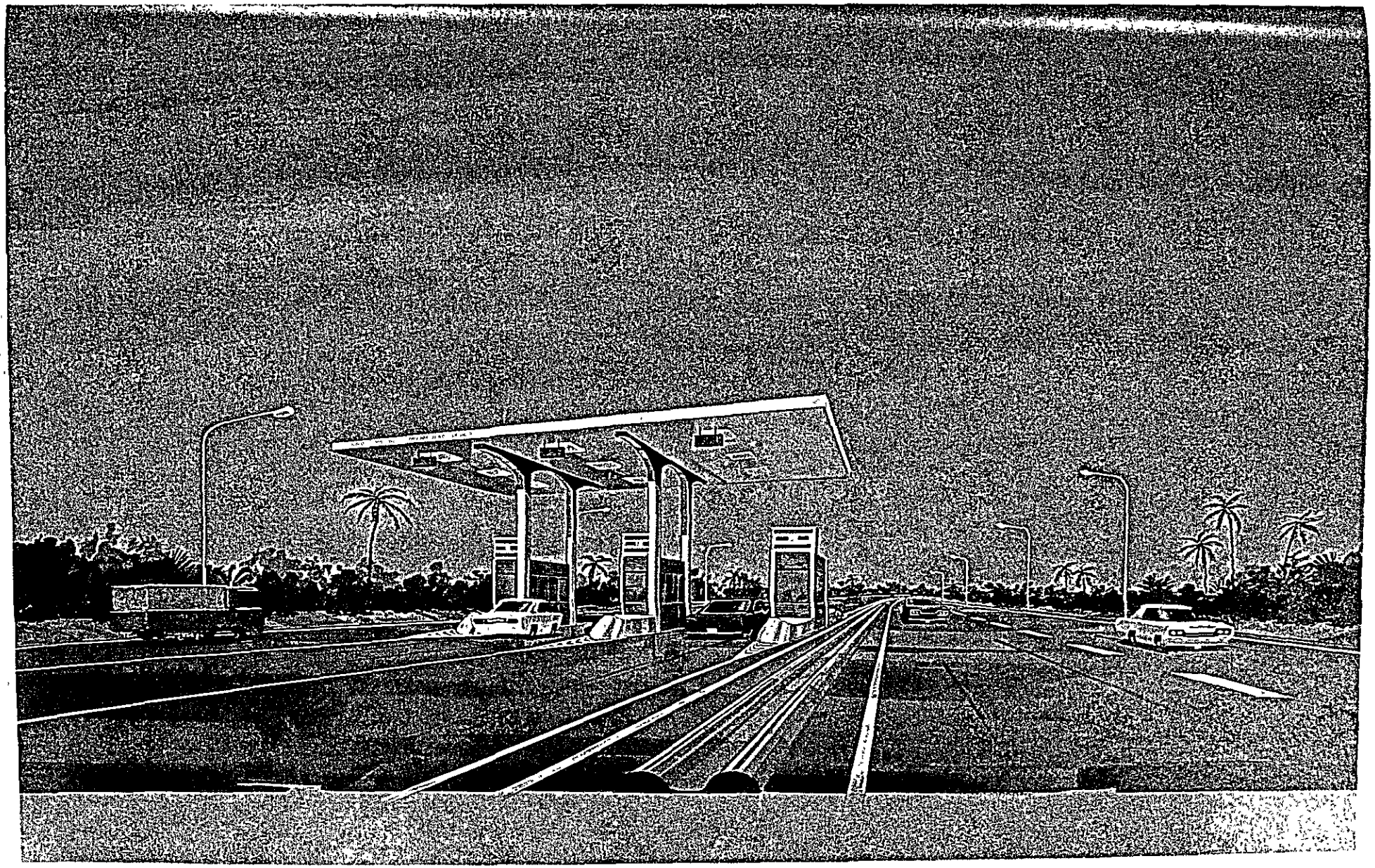
In this case a transit card is handed out at the entrance toll gate and the toll fare is collected at exit toll gates.

6.4 Tollway Office

At present the Jagorawi Operation Center where P.T. Jasa Marga is situated is located at the Taman Mini Toll Plaza. It accommodates not only P.T. Jasa Marga staff but also employees for repair and maintenance of the Jagorawi Freeway.

When the Jakarta-Tangerang Freeway is open, the Jakarta-Tangerang Operation Center will become necessary for operation as well as maintenance and repair of the freeway. In this study the total floor area of 980 m^2 is assumed for tollway offices at each of the three interchanges as shown in Fig. 6-7, 8 and 9. For the organization of the Jakarta-Tangerang Operation Center, please refer Chapter 8: MAINTENANCE, REPAIR AND ADMINISTRATION.

Fig. 6–11 ARTIST'S RENDERING OF TOLL GATE



Chapter 7
CONSTRUCTION COST ESTIMATES AND CONSTRUCTION SCHEDULE

Chapter 7 CONSTRUCTION COST ESTIMATES AND CONSTRUCTION SCHEDULE

7.1 Construction Costs

The unit costs and quantities were estimated after review of the "Implementation Program for the First Stage Construction of the Jakarta-Merak Highway", 1977, with unit costs updated and quantities reestimated.

Recently, the Government of Indonesia took important actions in the economic field. One was the devaluation of Rupiah currency on November 5, 1978, and another was the increase of fuel prices on April 5, 1979.

Besides the general escalation of commodity prices, other changes which have been taken into account for this cost estimate are as follows:

- 1 US$ = Rp.625 (Formerly, 1 US$ = Rp.415)
- Prices of Fuel:
  a) Regular Gasoline: 1 Liter = Rp.100
     (Formerly, 1 Liter = Rp.70)
  b) Diesel Oil (Solar): 1 Liter = Rp.35
     (Formerly, 1 Liter - Rp.25)
  c) Kerosine: 1 Liter = Rp.30
     (Formerly, 1 Liter = Rp.15)

According to our survey and the above changes, the following escalation factors have been obtained.

Items	Escalation Factors from 1977 to April 1979
(1) Local Labour Costs	1.2
(2) Local Equipment Costs	1.2
(3) Foreign Equipment Costs	2.2
(4) Foreign Material Costs	2.35

Table 7-1 UNIT PRICE OF LOCAL LABOURER

(Unit: Rp./Day)

Item	July 1977 (A)	April 1979 (B)	(B)/(A)
Foreman	3,000	3,500	1.17
Plant Operator	3,000	3,500	1.17
Driver	2,000	2,500	1.17
Mechanic	1,500	1,750	1.17
Carpenter	2,000	2,500	1.25
Skilled Labor	2,000	2,500	1.25
Heavy Labor	1,000	1,000	1.00
Common Labor	700	900	1.28
Average			1.19=1.20

Table 7-2 QUANTITY ESTIMATES FOR JAKARTA-TANGERANG FREEWAY

Description	Unit	Quantity	
		Toll-free Road	Additional Quantity for Tollway Conversion
- Clearing and Grubbing	m^2	1,258,000	
- Common Excavation	m^3	615,000	
- Borrow for Embankment	m^3	1,435,000	160,000
- Establishment for Turf	m^2	550,000	
- Steel Girder Bridge	t	307	
- Prestressed Concrete Beam	Each	296	24
- Structural Excavation	m^3	41,500	
- Structural Concrete	m^3	21,400	
- Steel Bar	t	2,200	
- Provide and Drive P.C. Pile	m	17,600	
- Provide and Drive Steel Pile	m	3,700	
- Retaining Wall	m^2	5,000	
- Concrete Box Culvert	m	640	
- Subgrade Preparation	m2	796,000	18,000
- Subbase Course	m^3	227,000	
- Bituminous Steel Coat	m^2	210,000	
- Guard Rail	m	28,000	
- Fence	m	25,000	
- Land Aquisition	m^2		80,000
- Tall Booth	Each		18
- Office	m^2		1,000
- Toll Facility	-		1.0

Applying the unit cost up-dated by the escalation factors to the quantities revised, the estimated construction costs are as shown in Table 7-3.

Table 7-3 ESTIMATED CONSTRUCTION COST (April 1979 Prices)

(Unit: 10^6 Rupiah)

	Tall-freewat Construction Cost (A)			Tallway Conversion Cost (B)			Total Construction Cost (A) + (B)		
	Total	Foreign component	Domestic component	Total	Foreign	Domestic	Total	Foreign	Domestic
A. Highway Construction	31,564	23,901	7,668	716	540	176	32,282	24,441	7,841
1) Clearing & grubbing	120	88	32	-	-	-	120	88	1,187
2) Earth works	4,271	3,174	1,097	357	267	90	4,628	3,441	1,187
3) Bridge, drainage & other structures	10,789	8,021	2,768	70	50	20	10,859	8,071	2,788
4) Paving works	11,394	8,710	2,684	289	223	66	11,683	8,933	2,750
5) Miscellaneous work	2,320	2,050	260	-	-	-	2,320	2,060	260
6) Mobilization & others	2,672	1,848	824	-	-	-	2,672	1,848	824
B. Toll System Construction				1,748	1,538	210	1,748	1,538	210
1) Management office				210	-	210	210	-	210
2) Toll system facility (Stage I)				1,538	1,538	-	1,538	1,538	-
3) Toll system facility (Stage III)				(950)	(950)	-	-		
C. Land Acquisition and Compensation	12,449	-	12,449	80	-	80	12,529	-	12,529
D. Contingencies (A+B+C) x 10%	4,402	2,390	2,012	255	208	47	4,657	2,598	2,059
TOTAL PROJECT AMOUNT	48,417	26,291	22,126	2,799	2,286	513	51,216	28,577	22,639

Notes: The construction costs in parenthesis are those in the Stage III, and are not considered in the financial study.

7.2 Construction Schedule

The Jakarta-Tangerang Freeway is planned to be connected with the Intra Urban Tollway in 1983 and with the Outer Ring Road in 1985. As will be mentioned in Sec. 8.2 Management System for Jakarta Tangerang Freeway, the number of toll booths will have to be increased to meet the future traffic volume as in Fig. 7-1. However, since this portion of additional construction costs is not estimated in this study because of its relatively small amount and its uncertainly.

The construction schedule is summarized in Fig. 7-1.

Fig. 7.1 CONSTRUCTION SCHEDULE

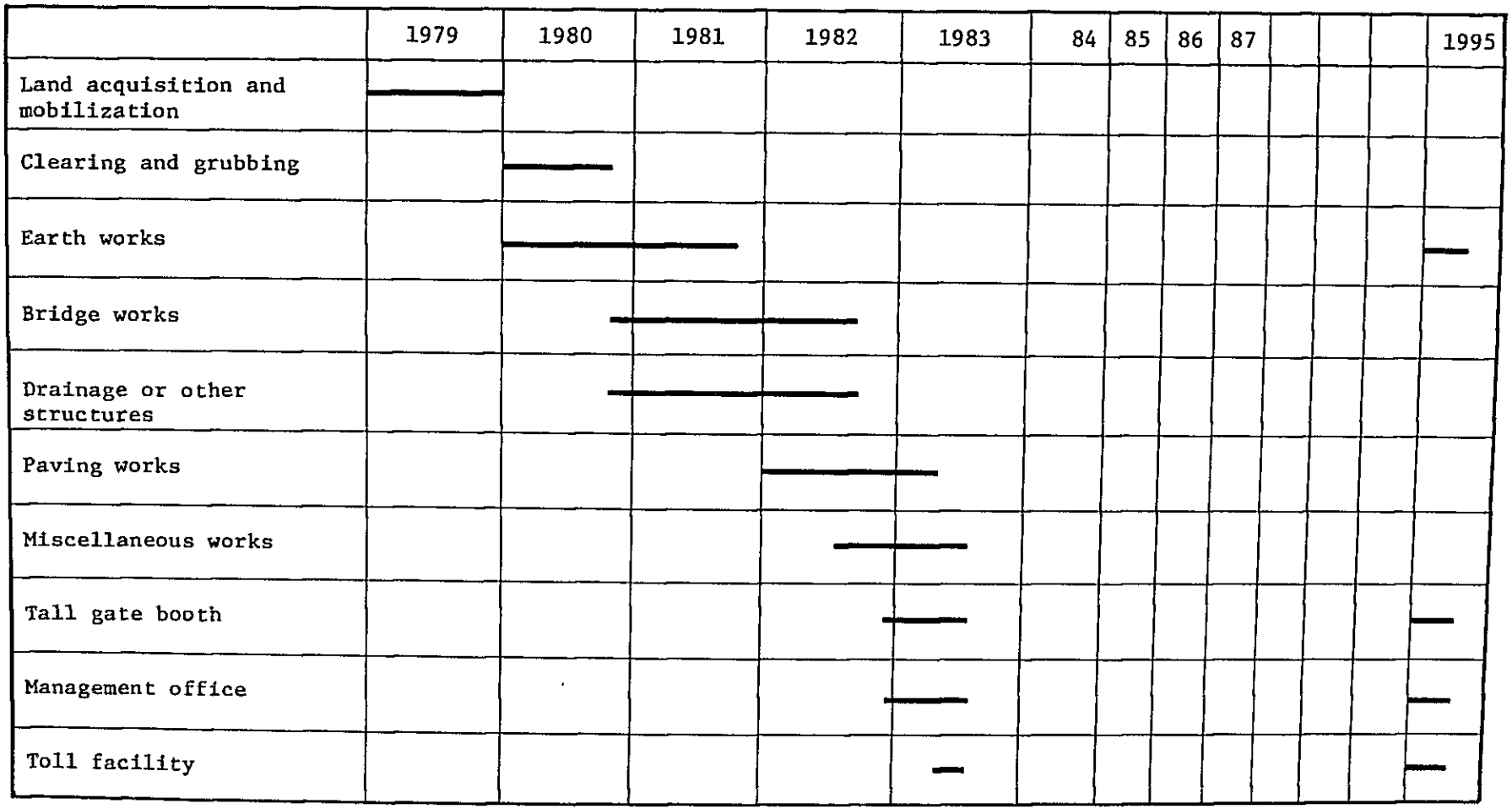


Table 7-4 ANNUAL INVESTMENT PROGRAM

(Unit: 10^6 Rupiah)

	Description	Component	1979	1980	1981	1982	1983	Total
Highway Construction Cost	Land Acquisition and Compensation	Foreign	-					-
		Domestic	12,529					12,529
	Clearing and Grubbing	Foreign		88				88
		Domestic		32				32
	Earth Works	Foreign		2,065	1,376			3,441
		Domestic		712	475			1,187
	Bridge Works	Foreign		807	4,036	3,228		8,071
		Domestic		279	1,394	1,115		2,788
	Paving Works	Foreign				7,146	1,787	8,933
		Domestic				2,200	550	2,750
	Miscellaneous Works	Foreign				1,030	1,030	2,060
		Domestic				130	130	260
	Mobilization, Others	Foreign		500	500	500	348	1,848
		Domestic		250	250	250	74	824
	Total	Foreign	-	3,460	5,912	11,904	3,165	24,441
		Domestic	12,529	1,273	2,119	3,695	754	20,370
Tollway Facility Construction Cost	Management Office	Foreign					-	-
		Domestic					210	210
	Toll Facility	Foreign					1,538	1,538
		Domestic					-	-
	Total	Foreign					1,538	1,538
		Domestic					210	210
Contingency		Foreign	-	346	591	1,190	471	2,598
		Domestic	1,253	127	212	370	97	2,059
Total Cost		Foreign	-	3,806	6,503	13,094	5,174	28,577
		Domestic	13,782	1,400	2,331	4,065	1,061	22,639
Project Cost			13,782	5,206	8,834	17,159	6,235	51,216

Chapter 8
MAINTENANCE, REPAIR AND ADMINISTRATION

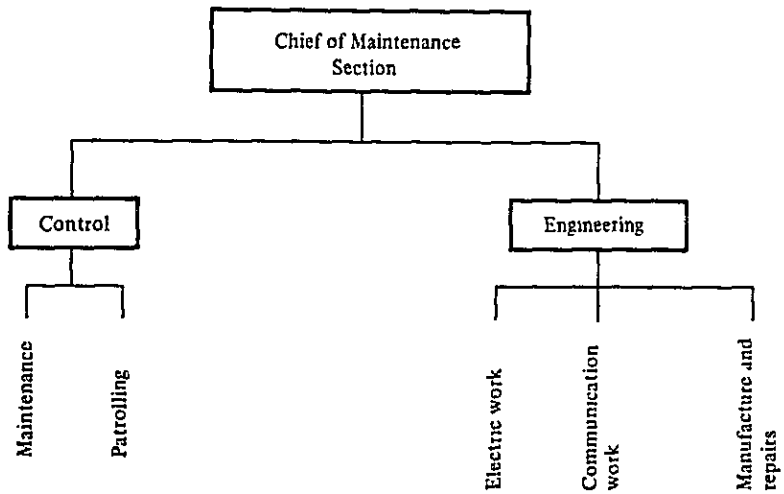
Chapter 8 MAINTENANCE, REPAIR AND ADMINISTRATION

8.1 Maintenance and Repair for Jagorawi Freeway

8.1.1 Maintenance and Repair Section

In the case of maintenance and repairs, there is a Maintenance Section in the Business Sub Division. The Maintenance Section has five tasks under its jurisdiction as shown in Fig. 8-1.

Fig. 8-1 ORGANIZATION OF MAINTENANCE AND REPAIRS SECTION



The scope of these tasks are as follows:

° Manufacture and repairs

To manufacture and repair signs, and to repair machines and tools.

All the signs used in the Jagorawi Freeway are manufactured in Indonesia, and several workers make them manually.

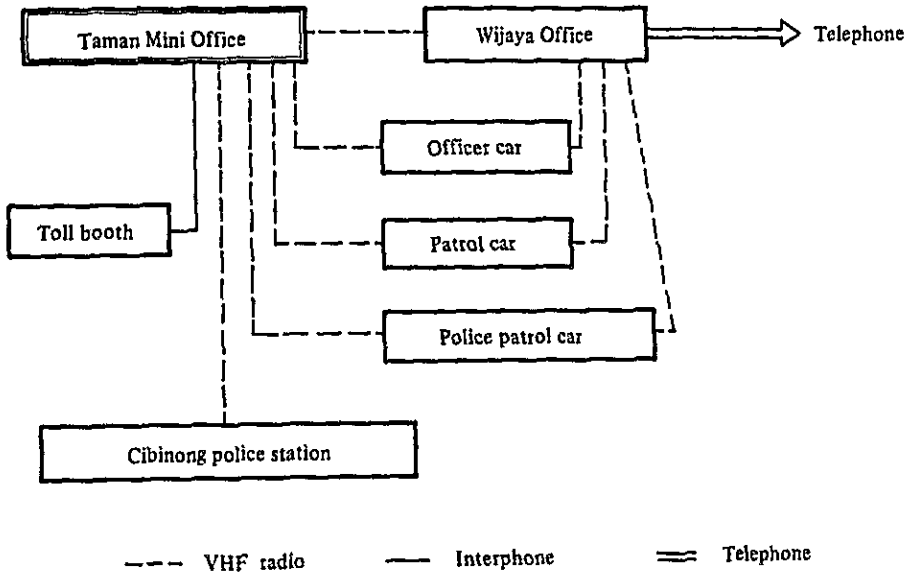
As soon as signs are made, they are installed at the sites.

° Communication

To communicate with patrol cars and other bases, with one VHF radio equipment station.

The communication system now established is as shown below.

Fig. 8-2 COMMUNICATION SYSTEM DIAGRAM



The Cibinong police base shown in the above diagram, is not yet completed, however an antenna is installed in the building for the base use.

At present, ordinary telephones are not installed in the Taman Mini Office, and therefore for communication with outside such as Bina Marga, indirect telephone contact is mode by means of radio communication.

° Electric Work

Responsibility servicing electric apparatus such as lighting, and air conditioning equipment in offices and toll booths, and two generators used as a power source for them.

General commercial power is not supplied at present.

° Patrolling

Responsibility for patrolling for maintenance and traffic control with one passenger patrol car and four small trucks.

° Maintenance

Responsibility for traffic accidents reporting by patrolling, to repair damaged places, to perform cleaning, and to operate the generators.

For the above respective tasks, a 24-hour duty system with three shifts will be established for communication, electric work and generator operation. Communication and electric work will be covered by 4 groups, and generator operation by 5 groups, with one holiday for each four working days.

For patrolling, one group consists of six workers. Two will be on full duty from 6:00 to 18:00; two on full duty from 18:00 to 6:00 and one on standby duty from 6:00 to 14:00; with the remaining two standing by at night. Every day three groups will be on duty, and one group will be off. At the present time, in view of the control length and traffic volume, no tasks have been entrusted to any sub-contractors, and for the time being, this arrangement will persist. Such subcontract arrangement will be considered in the future. The maintenance machines now held by Jasa Marga are as shown in Table 8-2.

Table 8-1 LIST OF MAINTENANCE EQUIPMENT AT PRESENT

NO.	ITEMS	MANUFACTURER	TYPE	REMARK
1	-	Volvo	244 DL/Pass.Car	-
2	Maint. Patrol Car	Datsun	1500/Pick Up	4 cars
3	Sign Car	Scout	Terra 11/Pick Up	-
4	Ambulance	Volks Wagen	Delivery Fan	-
5	Wrecker	International Haruestar	-	15 ton capacity
6	Wrecker	Daihatzu	DV 26 L	3 ton capacity
7	Wrecker	Scout	Terra 11/1	1 ton capacity
8	Utility Car	Scout	Terra 11/Pick Up	1 ton capacity
9	Utility Car	Chevrolet	Flat-Bed Truck	3 ton capacity
10	Gang Mower	Ransome	-	5 gang
11	Gang Mower	Stiph	Portable	5 units
12	Mini Tractor	Kubota	-	27.5 H.P
13	Street Sweeper	Wisconsin	Self Poweved	2 units
14		Isuzu	Water Tank Truck	-
15	Fire brigade	Isuzu	Five Truck	-
16	Heavy Equipment	Sakai	Tire Roller	-
17	Heavy Equipment	IR Misian	Compressor	-
18	Security Patrol Car	Toyota Land Cruiser	Pick Up	-
19	Security Patrol Car	Toyota Kijang	Pick Up	-
20	Generator	Catterpilar Ganset	-	118 KVA 2 units
21	Generator	Yanmar	-	75 KVA
22	Generator	Yanmar	-	5 KVA
23	Arch Welder	Nisihatsu	-	75 KVA 1 unit
24	Gas Welder	Gaya lka Tube	-	5 kg capacity
25	Compressor	Swan	-	7 HP capacity

8.1.2 Outline of P.T. Jasa Marga

Jasa Marga means "Regional Service" in Indonesian (Jasa = service, Marga = region). This name directly expresses the intetion of the governmental authorities concerned to the outside world that this company has been established to pursue a tollway system for the purpose of regional service.

Presumably this name was given because of the close relation with the supervisory office, Bina Marga (meaning "Regional Construction" in Indonesian).

P.T. is an abbreviation with the meaning of "limited liability corporation" in Indonesian, meaning that Jasa Marga is not a Public Corporation but a limited liability corporation legally. Therefore, the organization is called the Indonesian Highway Corporation (I.H.C.) in English. However, Jasa Marga was established based on the respective laws concerning the purpose, business contents, financing, etc. prepared by the government. In light of the background of the establishment, it can be said to be a complete Public Highway Corporation in Indonesia from the point of view of its character and functions.

P.T. Jasa Marga is to be controlled and operated by a Managing Board consisting of one president and maximum of four directors, under the supervision of a Board of Directors consisting of three councilors. The councilors are appointed and discharged by the general meeting of the shareholders.

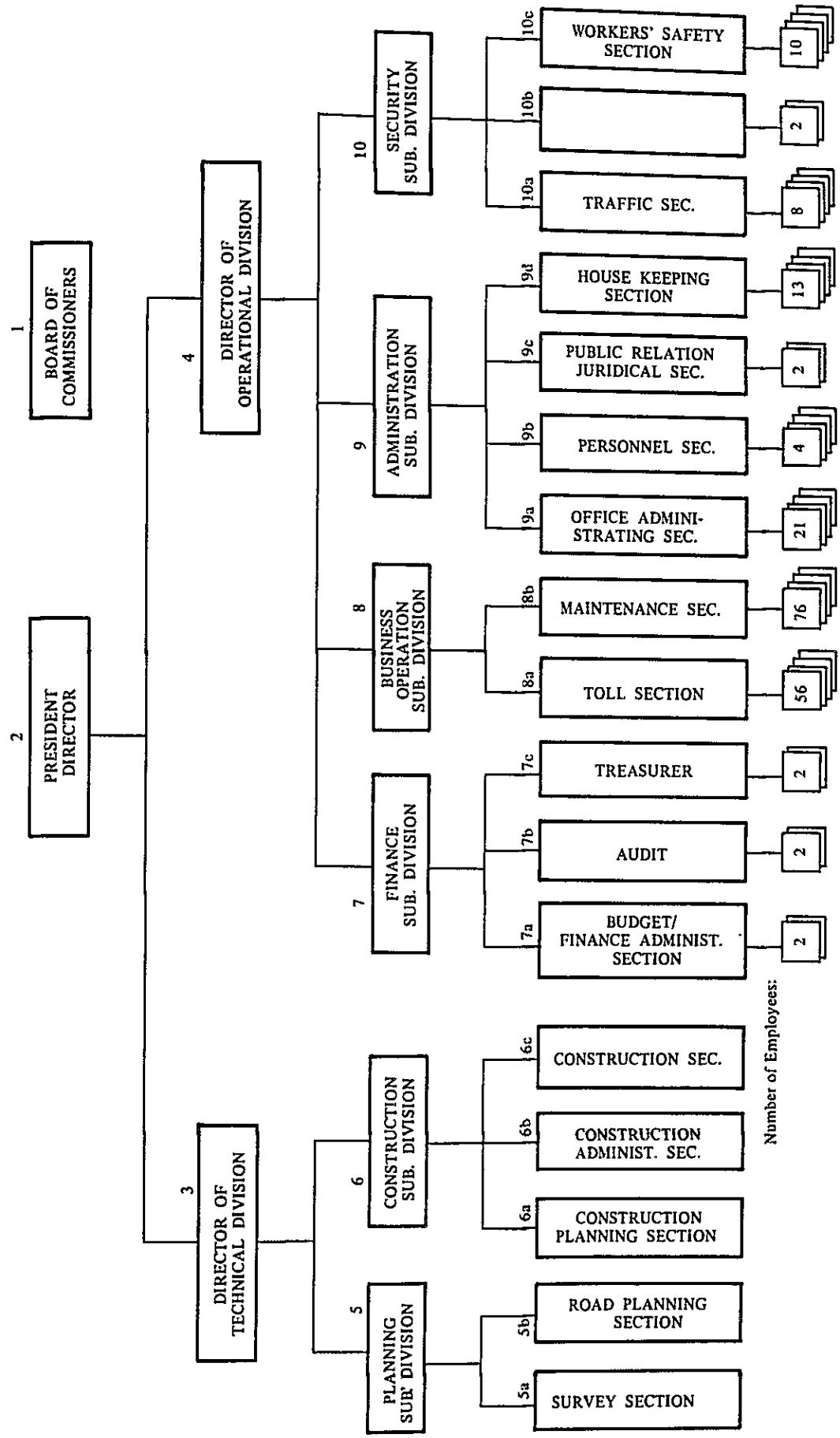
The Board of Directors supervises the activities of the Managing Board, and when necessary, can review the management situations, having the authority to suspend any director from duty, when the director has involved in improper activities.

The Managing Board represents the company legally and in other matters than those stipulated by law, establishes policy, having the authority to execute operational activities as the representative of the company under the approval of the Board of Directors and the meetings of preference shareholders. Directors are appointed and discharged by the general meeting of shareholders.

8.1.3 Relations between Bina Marga and P.T. Jasa Marga

Since the government holds all the shares of P.T. Jasa Marga P.T. Jasa Marga is placed under the control of Bina Marga. In Bina Marga, the Planning Department exercizes administrative control of P.T. Jasa Marga. Business procedures between both of the parties are not clarified, and is supposed to be clarified by Highway legeslation now being prepared and government regulations relating to it. For proper and prompt business operation, the supervisory system for permissions and approvals, standards, etc must be established as soon as possible. With regard to future road projects, it is planned that Bina Marga will supervise from the planning to route selections for each route, and that P.T. Jasa Marga will administer from the feasibility study to detailed design, construction and administration. However, this des a situation where P.T. Jasa Marga functions as a complete organization. In the present situation, Jasa Marga receives, at the time

Fig. 8-3 ORGANIZATION CHART OF P.T. JASA MARGA



of completion, the routes being planned, designed and constructed by Bina Marga under loans from various countries and under the national budget, and covers maintenance, operation and management only. The same method of handling is presumed to continue for the Jagorawi Freeway and succeeding respective routes of Jakarta-Tangerang, Jakarta-Cikampek, Intra Urban, Outer Ring, etc. This method is peculiar to Indonesia. As far as the toll road system of the country is intended to prevent the local unbalance of governmental public investments and for collecting the construction and maintenance costs as a toll charge for the principle of beneficiary charge, there is no problem. However, considering the objective of the establishment of P.T. Jasa Marga, it is desirable to prepare a system which allows for the independent operation as soon as possible. For this purpose, the establishment of a financial prospect is necessary, and it seems to be an impending necessity to provide a planning division for long-term and comprehensive study of management in the organization. This division would form execution of an idea, discuss its prospects, and promote its materialization.

8.1.4 Present System of P.T. Jasa Marga

As mentioned before, P.T. Jasa Marga is a young organization, and is not yet a fully staffed organization. It is therefore difficult, at present for them to construct a new route, and it is planned that when they have sufficient financial capability in future with sufficient prospect as a company, construction funds will be procured fundamentally by introducing private funds, by means of bond issues, etc. Therefore, all the divisions and sub divisions shown

in Fig. 8-1 are not yet established. Divisions and sub divisions for work-site operations such as maintenance and control are established, with emphasis placed on toll collection. Divisions and sub divisions for planning and construction are not yet established.

8.2 Management System for Jakarta-Tangerang Freeway

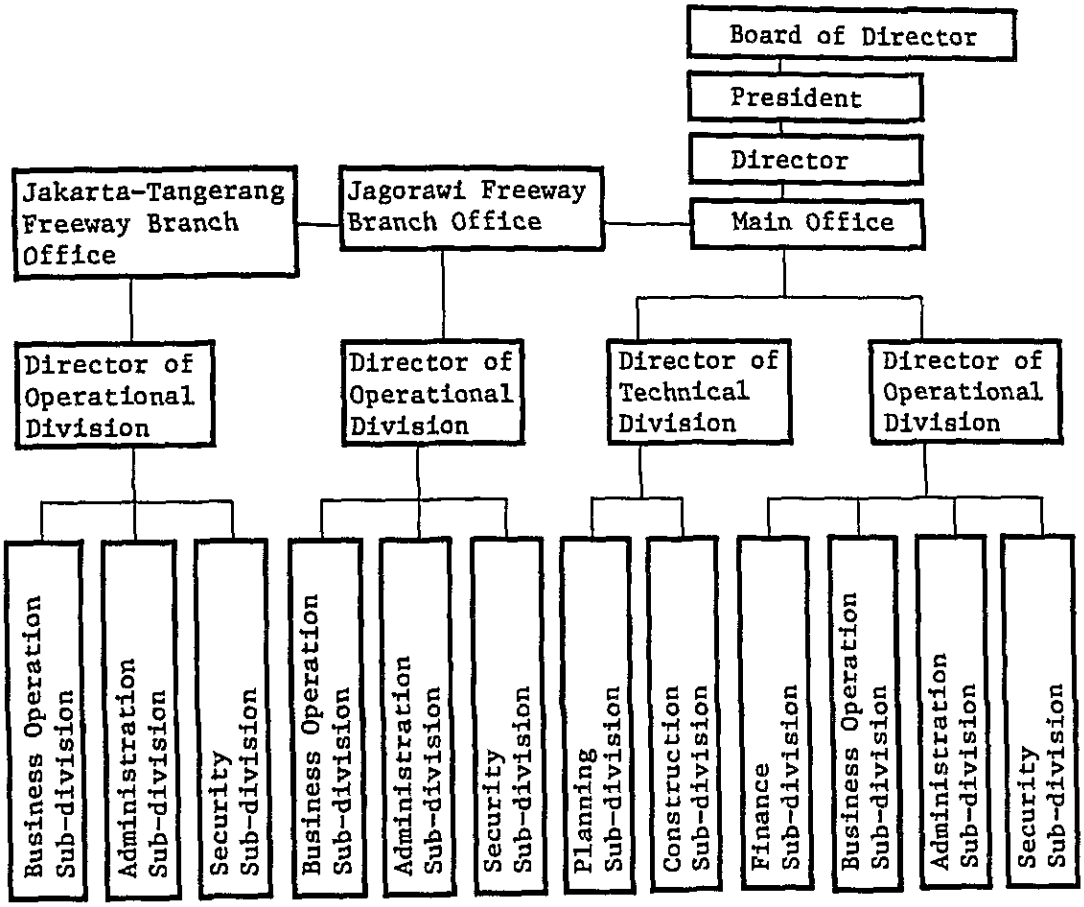
When the Jakarta-Tangerang Freeway is open to the public, the management organization of P.T. Jasa Marga will be extended to include its operation. Besides the existing operational and technical divisions situated in the main office, independent operational divisions should be established for each of Jagorawi and Jakarta-Tangerang Freeways as shown in Fig. 8-4.

The number of toll plazas for the Jakarta-Tangerang Freeway will be 4 during the period 1985 to 2005, and three after 2005 as mentioned in Chapter 6: TOLL COLLECTING SYSTEM. The number of toll booths in each stage changes according to the traffic volume and it is estimated to be 18 for the first stage and 31 thereafter. The toll booth installation schedule is summarized in Table 8-2.

Table 8-2 TOLL BOOTH INSTALLATION SCHEDULE

	Stage I (1983 - 1985)		Stage II (1986 - 1995)		Stage III (1996 - 2005)	
	On-ramp	Off-ramp	On-ramp	Off-ramp	On-ramp	Off-ramp
Jakarta Toll Plaza	2	4	4	8	5	10
Outer Ring Road	1	2	2	4	-	-
Tangerang	1	2	2	4	3	5
West Tangerang I.C.	2	4	3	5	3	6
Total	6	12	11	21	11	21
Grand Tota-	18		32		32	

Fig. 8-4 FUTURE ORGANIZATION CHART FOR P.T. JASA MARGA



A pair of workers are assigned to each toll booth for toll collection work, and they each take a two-hour shift. Therefore, for the Jakarta-Tangerang Freeway 72 workers for Stage I and 124 workers for the Stage II operators are required for toll collection work.

At present, there are approximately 138 employees in the operational division of P.T. Jasa Marga for the Jagorawi Freeway operation including 25% of those working in the main office. For the Jakarta-Tangerang Freeway management about 170 employees are assumed to be recruited for personnel cost estimation perposes.

Based on the experience of the Jagorawi Freeway operation, the operation cost for the Jakarta-Tangerang Freeway is estimated as follows:

- Personnel Cost : $170 \times 12 \times 60{,}000 \overset{*)-1}{\times} 1.35 \overset{*)-2}{=} 165 \times 10^6$
- Maintenance Cost : $4.58 \times 12 = 55 \times 10^6$
- Office Operation Cost : $2.26 \times 12 = 27 \times 10^6$

- Total 274×10^6Rp./year $\fallingdotseq 280 \times 10^6$Rp./year

Notes: *)-1 Average Monthly Wage.
*)-2 Escalation Factor.

Table 8-3 MONTHLY MAINTENANCE AND OFFICE OPERATION COSTS FOR JAGORAWI FREEWAY

(Unit: Rp./Month)

Maintenance Cost for Section B (26km Length)	1	Gasoline: - Palice Patnal Car	440,000
		- Maintenance Patnal Car	1,150,000
	2	Cars Routine Maintenance	700,000
	3	Cars Repair	500,000
	4	Grass Cutting (Manually)	500,000(Start on March 1979)
	5	Tire Replacement	520,000
	6	Medical Service	50,000
	7	Guardrail Maintenance	100,000(Proposed)
	8	Culvert Maintenance	50,000(Proposed)
	9	Road Marking	450,000(Proposed)
	10	Bridge Painting	25,000(Proposed)
	11	Slope Maintenance	100,000(Proposed)
		Sub Total	4,585,000
Office Operation Cost	1	Electricity (Generator Operation Cost)	450,000
	2	Office Operation Cost (Cleaning, Telephone, Lighting, Fotocopy etc.)	780,000
	3	Office Stationery & Office Equipment Maintenance	1,039,000
		Sub Total	2,269,000
		Grand Total	6,854,000

Chapter 9
FINANCIAL ANALYSIS AND REPAYMENT PROGRAM

Chapter 9 FINANCIAL ANALYSIS AND REPAYMENT PROGRAM

9.1 General

The financial aspects of a tollway project are of particular importance in the assessment of the project's merits. In this chapter, the conclusions and comments on the project are made from the financial point of view. The topics discussed are as follows:

- Investment costs (Construction Costs)
- Annual Financial Expenditure and Total Financial Costs
- Revenue
- Financial Revenue/Cost Ratio (Financial B/C Ratio)
- Repayment Program
- Sensitivity Analysis

9.2 Financial Costs

9.2.1 Construction Costs

The construction costs for each year during the construction period based on 1979 prices are estimated in Chapter 7 seperately for the foreign and local currency portions. They are converted to financial construction costs in prices for each investment year by adopting the future price escalation rates of 10% and 7% per annum respectively for both the foreign and local portion, as shown in Table 9-1.

Table 9-1 FINANCIAL CONSTRUCTION COSTS

Escalation Factor [F.C. 7%/year, L.C.10%/year]

(Unit: 10^6Rp.)

Year	Foreign Currency Portion	Local Currency Portion	Total
1979		13,782	13,782
1980	4,072	1,540	5,612
1981	7,445	2,821	10,266
1982	16,041	5,411	21,452
1983	6,782	1,553	8,335
	34,340	25,107	59,447

The construction costs are discounted to 1979 values at discount rates of 10%, 12% and 15% per annum and the results are shown in Table 9-2.

Table 9-2 1979 PRESENT VALUES OF FINANCIAL CONSTRUCTION COSTS

(Unit: 10^6 Rupiah)

Discount Rate	10%	12%	15%
1979 Values	49,178	47,543	45,295

9.2.2 Annual Financial Expenditure

The annual financial expenditure expected after opening consists of annual tollway maintenance costs (including repair costs), annual tollway operation costs and other annual costs.

(a) Maintenance and Operation Costs

The maintenance and operation costs are estimated as 236 x 10^6 Rupiah/year based on 1979 prices in Sec. 8.2 Management System for Jakarta-Tangerang Freeway.

The financial annual maintenance and operation costs in prices each year after opening are computed adopting a price escalation rate of 10% per annum. The 1979 present values of the maintenance and operation costs for a project life-span of 25 years after opening are computed as follows for the different discount rates.

Table 9-3 1979 PRESENT VALUES OF MAINTENANCE AND OPERATION COSTS

(Unit: 10^6 Rupiah)

Discount Rate	10%	12%	15%
1979 Values	5,900	4,380	2,916

(b) Other Annual Financial Costs

Other annual financial costs include the following items:

1) An annual deposit from the revenue to a contingency fund to compensate for unforeseen damages to the tollway.

2) The interest on the various loans required to finance the construction, maintenance and operation of the tollway, and

3) The tax on the revenue.

The total financial costs to be taken into account in deriving the financial revenue cost ratios and internal rates of return under different discounting conditions consist of the construction costs, maintenance and operation costs, and other financial costs referred to above are excluded.

9.2.3 Total Financial Costs in 1979 Present Values

As stated in the previous section, the 1979 present values of the total financial costs to derive the financial revenue cost ratios and internal rates of return are summarized in the following Table 9-4 at discount rates of 10%, 12% and 15% per annual.

Table 9-4 1979 PRESENT VALUES OF TOTAL FINANCIAL COSTS FOR A PROJECT LIFE SPAN OF 25 TEARS

(Unit: 10^6 Rupiah)

Discount Rate	10%	12%	15%
Construction Costs	49,178	4,380	2,916
Annual Expenditure	5,900	4,380	2,916
Total Costs for Project Life	55,078	51,923	48,211

9.3 Revenue Calculation

9.3.1 Toll

A toll shall be determined based on the time value saved by using the tollway. The road length of each section of the project tollway and the existing road is shown below:

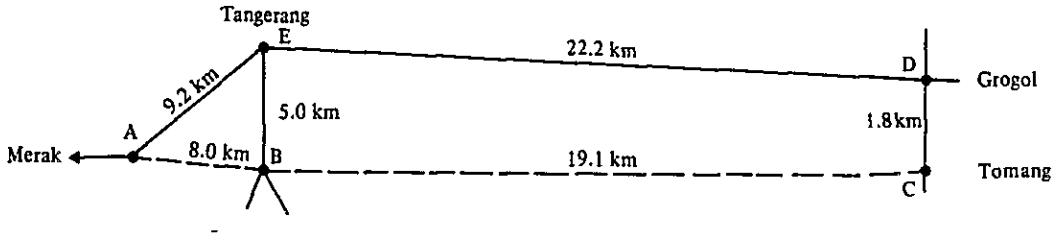


Table 9-5 compares travel time between the two points using the tollway and the existing road by assuming that average travel speeds on the tollway and existing road are 90km/hr. and 40km/hr, respectively.

Table 9-5 COMPARISON OF TRAVEL TIME

Road used	Route	Distance (km)	Travel Time (min)	Time saved (min)
Tollway Existing Road	A-B-C A-E-D-C	27.1 33.2	18.1 49.8	31.7
Tollway Existing Road	B-C B-E-D-C	19.1 29.0	12.7 43.5	30.8
Tollway Existing Road	E-B-C E-D-C	24.1 24.0	20.2 36.0	15.8
Tollway Existing Road	E-D E-B-C-D	22.2 24.9	33.3 22.9	10.4

The financial time values by type of vehicle were estimated at 1979 prices as shown below by up-dating the results of the Intra Urban project.

	Sedan	Bus	Truck
Time Value (Rp./min)	56.0	81.8	94.4

For the section B-C the maximum toll fare from user's side should be determined based on the minimum time saved by using it as follows:

for sedan	Rp. 582/veh. or Rp. 30.5/km/veh.
for bus	Rp. 851/veh. or Rp. 44.6/km/veh.
for truck	Rp. 982/veh. or Rp. 49.3/km/veh.

Based on the above calculation for the maximum toll fare, the toll fare for the Jakarta-Tamgerang Freeway is studied following the very basic policy generally accepted, such as:

(a) The toll fare should benefit the users financially by using the tollway; and

(b) The toll fare should be established to provide as much revenue as possible.

Concerning policy item (a), above according to the calculation of the time value saved by using the least benefitable section, the toll fare should be below Rp. 600/PCU or Rp. 35.4/km/PCU.

Concerning policy item (b), three alternatives of 200, 300 and 400 Rp./PCU are examined. As the toll fare is increased from 200 Rp./PCU to 400 Rp./PCU, the revenue increases, but when it exceeds 400 Rp./PCU the revenue visibly decreases because of the toll registance.*)

Note: *) Toll registance means the effect toll fare has on reduction of the traffic volume on a tollway.

Therefore, in the case of a flat tariff system 400 Rp./PCU is assumed for the revenue calculation.

For the case of a sectional tariff system, the balance with the toll fare set in 1978 for the Jagorawi Freeway currently in operation, 13.0 Rp./km/PCU, is taken into consideration after applying the escalation factor of general prices and users time value.

In addition to the above analysis, the balance with the toll fare in case of a flat tariff system, 400 Rp./PCU, is esamined for the section B-C on which the largest volume of users is expected.

Table 9-6 TOLLS RECOMMENDED FOR JAKARTA-TANGERANG FREEWAY IN 1983

Toll System	Sedan	Bus	Truck
Flat Tariff	Rp. 400/veh.	Rp.800/veh.	Rp.800/veh.
Sectional Tariff	Rp. 20/km/veh.	Rp. 40/km/veh.	Rp. 40/km/veh.

Eventually, sectional tariff is set proportionally to the distance of each section of the tollway as shown below:

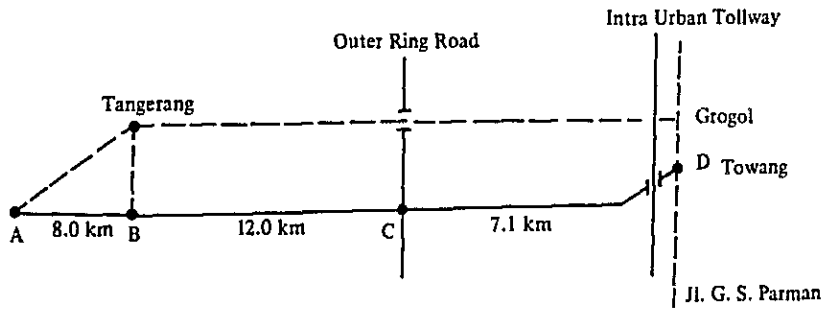


Table 9-7 SECTIONAL TARIFF IN 1979

	Section		
	A - B	B - C	C - D
Sectional Tariff (Rp./pcu)	150	250	150

Escalation rate of 7% per annum was adopted to compute the periodic toll increase every five years.

Consequently, the toll in the future is scheduled as shown in Table 9-8.

Table 9-8 FUTURE TOLLS FOR JAKARTA-TANGERANG FREEWAY

(Rp./pcu at current prices)

Year	A-B Sectional Tariff			Flat Tariff
	A-B Section	B-C Section	C-D Section	
1983 - 1984	150	450		400
1985 - 1989	250	550		600
1990 - 1994	350	550	300	800
1995 - 1999	500	750	450	1,150
2000 - 2004	700	1,050	600	1,650
2005 - 2009	1,000	1,500	900	2,300

9.3.2 Revenue Calculation

The future traffic volume on the Jakarta-Tangerang Freeway is estimated for the years of 1985, 1995 and 2005 in Chapter 5. The Jakarta-Tangerang Freeway is expected to be open in 1983 and the Intra Urban Tollway (S-W Link) in 1985 and the Outer Ring Road in 1990. Taking these into consideration the average annual growth rates of the traffic for different toll systems are derived from the estimated based year traffic. The traffic in the intermediate years are estimated by using the above rates and the results are shown in Table 9-9.

The future tolls for the flat tariff system and the sectional toll system were determined previously in Table 9-8. Therefore, the revenue from the Jakarta-Tangerang Freeway are obtained for each alternative toll system as shown in Table 9-10.

Table 9-9 ESTIMATED FUTURE ANNUAL TRAFFIC ON JAKARTA-TANGERANG FREEWAY

(Unit: 1,000 Veh. Trips/Yr.)

Year	Flat Tariff System			Sectional Tariff System								
				A–B Section			B–C Section			C–D Section		
	Sedan	Bus	Truck	Sedan	Bus	Truck	Sedan	Bus	Truck	Sedan	Bus	Truck
1983	5,066	311	1,209	2,111	64	617	5,279	308	1,022	4,730	301	1,008
1984	5,259	318	1,245	2,149	66	645	5,374	318	1,069	5,087	315	1,061
1985	5,459	325	1,282	2,188	68	674	5,471	329	1,117	5,471	329	1,117
1986	5,667	332	1,319	2,227	70	704	5,570	340	1,168	5,884	344	1,176
1987	5,883	339	1,358	2,268	72	736	5,670	351	1,221	6,328	360	1,238
1988	6,107	347	1,399	2,308	75	768	5,772	363	1,276	6,805	376	1,303
1989	6,340	354	1,464	2,350	77	803	5,876	375	1,334	7,319	393	1,372
1990	6,581	362	1,483	2,392	80	838	5,982	387	1,394	7,871	411	1,444
1991	6,832	370	1,526	2,436	82	876	6,089	400	1,458	8,465	429	1,520
1992	7,092	378	1,572	2,479	85	915	6,199	413	1,524	9,104	449	1,600
1993	7,362	386	1,618	2,524	87	956	6,311	427	1,593	9,791	469	1,684
1994	7,643	394	1,666	2,570	90	999	6,424	441	1,665	10,529	491	1,772
1995	7,934	403	1,715	2,616	93	1,043	6,540	456	1,741	11,324	513	1,866
1996	8,128	411	1,818	2,680	96	1,126	6,700	465	1,844	11,852	527	2,019
1997	8,327	420	1,927	2,746	98	1,216	6,864	474	1,955	12,405	541	2,184
1998	8,531	429	2,042	2,813	101	1,312	7,032	483	2,072	12,984	556	2,363
1999	8,740	438	2,164	2,881	104	1,416	7,204	492	2,196	13,590	571	2,556
2000	8,953	447	2,293	2,952	107	1,528	7,380	501	2,327	14,224	586	2,765
2001	9,173	456	2,430	3,024	109	1,649	7,561	511	2,466	14,888	602	2,992
2002	9,397	465	2,575	3,098	112	1,780	7,746	521	2,614	15,582	618	3,236
2003	9,627	475	2,729	3,174	116	1,921	7,935	531	2,770	16,310	635	3,502
2004	9,863	485	2,893	3,251	119	2,074	8,129	541	2,935	17,071	652	3,788
2005	10,104	495	3,065	3,331	122	2,238	8,328	551	3,111	17,867	670	4,098
2006	10,351	505	3,248	3,412	125	2,415	8,532	562	3,297	18,701	688	4,433
2007	10,605	516	3,443	3,496	129	2,607	8,740	572	3,494	19,573	707	4,796
2008	10,864	526	3,649	3,581	132	2,814	8,954	583	3,703	20,486	726	5,189
2009	11,130	537	3,866	3,669	136	3,037	9,174	594	3,925	21,442	746	5,614
2010	11,402	549	4,098	3,759	140	3,278	9,398	606	4,159	22,443	766	6,073

Table 9-10 REVENUE BY FLAT TARIFF SYSTEM AND SECTIONAL TARIFF SYSTEM

(Unit: 10^6 Rupiah)

Year	Flat Tariff System			Sectional Tariff System									Toll Revenue by Flat Tariff System	Toll Revenue by Sectional Tariff System
				A–B Section			B–C Section			C–D Section				
	Sedan	Bus	Truck	Sedan	Bus	Truck	Sedan	Bus	Truck	Sedan	Bus	Truck		
1983	2,026	249	967	317	19	185	1,320	154	511	710	90	302	3,242	3,608
1984	2,104	254	997	322	20	194	1,344	159	535	763	95	319	3,355	3,751
1985	3,275	390	1,538	547	34	337	1,915	230	782	1,094	132	447	5,203	5,518
1986	3,400	398	1,583	557	35	352	1,950	238	817	1,177	138	470	5,381	5,734
1987	3,530	407	1,630	567	36	368	1,985	246	855	1,266	144	495	5,567	5,962
1988	3,664	416	1,678	577	38	384	2,020	254	893	1,361	150	521	5,758	6,198
1989	3,804	325	1,757	588	39	401	2,057	263	934	1,464	157	548	5,886	6,451
1990	5,265	579	2,372	837	56	587	3,290	426	1,534	2,361	247	866	8,216	10,204
1991	5,466	592	2,442	853	57	613	3,349	440	1,604	2,540	257	912	8,500	10,625
1992	5,674	605	2,515	868	60	641	3,409	454	1,676	2,731	269	960	8,794	11,068
1993	5,890	618	2,589	883	61	669	3,471	470	1,753	2,937	281	1,010	9,097	11,535
1994	6,114	630	2,666	900	63	700	3,533	485	1,832	3,159	295	1,063	9,410	12,030
1995	9,124	927	3,947	1,308	93	1,043	4,905	684	2,611	5,096	462	1,679	13,998	17,881
1996	0.348	045	4.191	1,340	96	1,126	5,025	698	2,767	5,333	474	1,817	14,473	18,676
1997	9,576	966	4,431	1,373	98	1,216	5,148	711	2,932	5,582	487	1,966	14,973	19,513
1998	9,811	987	4,696	1,407	101	1,312	5,274	725	3,108	5,843	500	2,126	15,494	20,396
1999	10,051	1,007	4,976	1,441	104	1,416	5,403	738	3,294	6,116	514	2,300	16,036	21,326
2000	14,772	1,475	7,568	2,066	150	2,140	7,749	1,052	4,886	8,534	703	3,319	23,815	30,599
2001	15,135	1,505	8,019	2,117	153	2,309	7,939	1,073	5,179	8,933	722	3,590	24,659	32,015
2002	15,505	1,535	8,498	2,169	157	2,492	8,133	1,094	5,489	9,349	742	3,884	25,538	33,509
2003	15,885	1,568	9,007	2,222	162	2,690	8,332	1,115	5,816	9,786	762	4,202	26,460	35,087
2004	16,274	1,601	9,545	2,276	167	2,903	8,535	1,136	6,164	10,243	782	4,546	27,420	36,752
2005	23,239	2,277	14,101	3,331	244	4,476	12,492	1,653	9,333	10,720	1,206	7,376	39,617	50,831
2006	23,807	2,323	14,940	3,412	250	4,830	12,798	1,686	9,891	11,221	1,234	7,980	41,070	53,302
2007	24,392	2,374	15,837	3,496	258	5,214	13,110	1,716	10,483	11,734	1,273	8,633	42,603	55,917
2008	24,987	2,420	16,784	3,581	264	5,628	13,431	1,749	11,110	12,292	1,307	9,340	44,191	58,702
2009	25,599	2,470	11,785	3,669	272	6,073	13,761	1,782	11,774	12,865	1,343	10,105	45,854	61,644

The 1979 present values of the revenues at discount rates of 10%, 12% and 15% per annum for a project life span of 25 years are computed as follows in Table 9-11.

Table 9-11 1979 PRESENT VALUES OF TOTAL REVENUE FOR A PROJECT LIFE SPAN OF 25 YEARS

(Unit: 10^6 Rupiah)

Discount Rate	10%	12%	15%
Flat Tariff (1979 values)	67,905	50,056	33,993
Sectional Tariff (1979 values)	84,641	61,875	40,255

9.4 Financial Revenue Cost Ratio

For the financial evaluation, the revenues and costs of the project discounted to 1979 present values at different discount rates are compared over a project life-span of 25 years and expressed as financial revenue cost ratios. The costs of the project, the construction, maintenance and operation costs, and the revenues used for these calculations have been estimated in preceding sections.

The resultant financial revenue cost ratios and financial internal rates of return for the project are shown in Table 9-12.

Table 9-12 REVENUE/COST RATIOS AND FINANCIAL INTERNAL RATES OF RETURN FOR THE PROJECT OVER A LIFE SPAN OF 25 YEARS

	REVENUE/COST RATIOS			IRR (%)
Discount Rate	10%	12%	15%	
Flat Tariff	1.23	0.96	0.68	11.7
Sectional Tariff	1.54	1.19	0.83	13.6

From the above results, the sectional tariff is more beneficial for this tollway and the analysis of the repayment program in Sec. 9.4 will be examined for the case in which the sectional tariff system is applied.

9.5 Repayment Program

9.5.1 Allocation of the Finance and Loan Conditions

a) Costs during construction period

- Construction costs including land acquisition costs
- Interests on loans

b) Costs after opening of the tollway

- Operation and maintenance costs
- Interests on loans
- Costs classified as tax and others including compensation funds for unforeseen damages are assumed to be 7% of the annual revenues.
- Rental fee of 7% of the annual revenue is assumed in the Repayment Program (B).

The costs during construction is scheduled to be financed under the conditions summarized in Table 9-13.

Table 9-13 REPAIMENT CONDITIONS

Financial Source	Amount	Condition
OECF Loan	(10^6Rp.) 24,140	Interest Rate: 3%/year Grace Period : 7 years Repayment Period : 30 years (including grace period)
Other Foreign Bank Loan	10,200 (The rest of the foreign currency portion)	I.R.: 8%/year G.P.: 5 years R.P.: 15 years
Domestic Bank Loan	11,325	I.R.: 13.5%/year G.P.: 5 years R.P.: 15 years

(to be continued)

Financial Source	Amount	Condition
Equity	20,461 (The same amount for the land acquisition) and the interest during construction period.	

The repayments for the loan are calculated according to the above repayment conditions in equal annual allocation after the grace period as in Table 9-14A and 14B.

9.5.2 Repayment Program

The year when a surplus of net revenue occurs for the first time and expected to continue to occur for the rest of the project lift-span is defined as the break-even point.

The break-even point is expected to occur a year after opening and 2 years after opening according to the conditions. The repayment program in cash-flow is shown in Table 9-13A and 9-13B. The year when the repayment is completed, or more specifically when the accumulated net profit exceeds the remaining amount of loans including interest is predicted to be 13 years after opening.

9.5.3 Sensitivity Analysis

For the financial sensitivity analysis, the following topics are analyzed such as:

- Increased rates for toll fares; and
- Loan conditions.

The following conclusions can be drawn.

1) The increased rates for the toll fares which were applied at regular though not frequent intervals is a sensitive factor. Increases of 7% per annum were applied every five years to allow for a general escalation in prices. With escalation of this order of magnitude it is possible to propose that the increased rates should be lower than the rate of general price escalation.

2) As for the loan cinditions, many different sources and conditions may become available after completion of this study. It can be said that under the conditions assumed for this project, the elasticity of the interest rate for the loan is rather high and that there are many possibilities for combinations of loans.

Table 9 - 14A REPAYMENT PROGRAM (A)

(Unit: 10^6 Rupiah)

Fiscal Year	Costs During Construction							Cost Disbursement for Loans				Equity			Costs After Opening									Revenue	Profit	
	Construction Costs		Interest				Total	OECF	Foreign Bank	Domestic Bank	Total	Land Acquisition	Interest for Loan	Total	Operation & Maintenance Costs	Interest				Others			Total		Annual	Accumulated
	Civil Work	Land Acquisition	OECF	Foreign Bank	Domestic Bank	Sub Total										OECF	Foreign Bank	Domestic Bank	Sub Total	Tax & Others	Rental Fee	Sub Total				
1979	–	13,782	–	–	–	–	13,782	–	–	–	–	13,782	–	13,782												
80	5,612	–	122	–	208	330	5,942	4,072	–	1,540	5,612	–	330	330												
81	10,266	–	345	–	589	934	11,200	7,445	–	2,821	10,266	–	934	934												
82	21,452	–	724	273	1,369	2,366	23,818	12,623	3,418	5,411	21,452	–	2,366	2,366												
83	8,335	–	724	816	1,529	3,069	11,404	–	6,782	1,553	8,335	–	3,069	3,069												
84															380	724	816	1,529	3,069	263	–	263	3,712	3,751	39	39
85															418	724	816	1,798	3,338	386	–	386	4,142	5,518	1,376	1,415
86															460	1,468	816	1,798	4,082	401	–	401	4,943	5,734	791	2,206
87															506	1,468	1,192	1,798	4,458	417	–	417	5,381	5,962	581	2,787
88															556	1,468	1,192	1,798	4,458	434	–	434	5,448	6,198	750	3,537
89															612	1,468	1,192	1,798	4,458	452	–	452	5,522	6,451	929	4,466
90															673	1,468	1,192	1,798	4,458	714	–	714	5,845	10,204	4,359	8,825
91															741	1,468	1,192	1,798	4,458	744	–	744	5,943	10,625	4,682	13,507
92															815	1,468	1,192	1,798	4,458	775	–	775	6,048	11,068	5,019	18,526
93															896	1,468	1,192	1,798	4,458	807	–	807	6,161	11,535	5,374	23,900
94															986	1,468	1,192	1,798	4,458	842	–	842	6,286	12,030	5,744	29,644
95															1,084	1,468	1,192	1,798	4,458	1,252	–	1,252	6,794	17,881	11,087	40,731
96															1,193	1,468	1,192	1,798	4,458	1,307	–	1,307	6,958	18,676	11,718	52,449
97															1,312	1,468	1,192	1,798	4,458	1,366	–	1,366	7,136	19,513	12,377	64,826
98															1,443	1,468	1,192	1,798	4,458	1,428	–	1,428	7,329	20,396	13,067	77,893
99															1,588	1,468	1,192	1,798	4,458	1,493	–	1,493	7,535	21,326	13,791	91,684
2000															1,746	1,468	1,192	–	2,660	2,142	–	2,142	6,548	30,599	24,051	115,735
01															1,921	1,468	1,192	–	2,660	2,241	–	2,241	6,822	32,015	25,193	140,928
02															2,113	1,468	–	–	1,468	2,346	–	2,346	5,927	33,509	27,582	168,510
03															2,325	1,468	–	–	1,468	2,456	–	2,456	6,249	35,087	28,838	197,348
04															2,557	1,468	–	–	1,468	2,573	–	2,573	6,598	36,752	22,589	219,937
05															2,813	1,468	–	–	1,468	3,558	–	3,558	2,839	50,831	42,998	262,935
06															3,094	1,468	–	–	1,468	3,731	–	3,731	8,293	53,302	45,009	307,944
07															3,403	1,468	–	–	1,468	3,914	–	3,914	8,785	55,917	47,132	355,076
08															3,744	1,468	–	–	1,468	4,109	–	4,109	9,321	58,702	49,381	404,457
09															4,118	–	–	–	–	4,315	–	4,315	4,315	61,644	57,329	461,786
Total	45,665	13,782	1,915	1,089	3,695	6,699	66,146	24,140	10,200	11,325	45,665	13,782	6,699	20,481												

Table 9 - 14B REPAYMENT PROGRAM (B)

(Unit: 10^6 Rupiah)

Fiscal Year	Costs During Construction							Cost Disbursement for Loans				Equity			Costs After Opening									Revenue	Profit	
	Construction Costs		Interest				Total								Operation & Maintenance Costs	Interest				Others			Total			
	Civil Work	Land Acquisition	OECF	Foreign Bank	Domestic Bank	Sub Total		OECF	Foreign Bank	Domestic Bank	Total	Land Acquisition	Interest for Loan	Total		OECF	Foreign Bank	Domestic Bank	Sub Total	Tax & Others	Rental Fee	Sub Total			Annual	Accumulated
1979	–	13,782	–	–	–	–	13,782	–	–	–	–	13,782	–	13,782												
80	5,612	–	122	–	208	330	5,942	4,072	–	1,540	5,612	–	330	330												
81	10,266	–	345	–	589	934	11,200	7,445	–	2,821	10,266	–	934	934												
82	21,452	–	724	273	1,369	2,366	23,818	12,623	3,418	5,411	21,452	–	2,366	2,366												
83	8,335	–	724	816	1,529	3,069	11,404	–	6,782	1,553	8,335	–	3,069	3,069												
84															33380	724	816	1,529	3,069	263	263	526	3,975	3,751	−224	−224
85															418	724	816	1,798	3,338	386	386	772	4,528	5,518	990	766
86															460	1,468	816	1,798	4,082	401	401	802	5,344	5,734	390	1,156
87															506	1,468	1.192	1,798	4,458	417	417	834	5,798	5,962	164	1,320
88															556	1,468	1,192	1,798	4,458	434	434	868	5,882	6,198	316	1,636
89															612	1,468	1,192	1,798	4,458	452	452	904	5,974	6,451	477	2,113
90															673	1,468	1,192	1,798	4,458	714	714	1,428	6,559	10,204	3,645	5,758
91															741	1,468	1,192	1,798	4,458	744	744	1,488	6,687	10,625	3,938	9,696
92															815	1,468	1,192	1,798	4,458	775	775	1,550	6,823	11,068	4,245	13,941
93															896	1,468	1,192	1,798	4,458	807	807	1,614	6,968	11,535	4,567	18,508
94															986	1,468	1,192	1,798	4,458	842	842	1,684	7,128	12,030	4,902	23,410
95															1,084	1,468	1,192	1,798	4,458	1,252	1,252	2,504	8,046	17,881	9,835	33,245
96															1,193	1,468	1,192	1,798	4,458	1,307	1,307	2,614	8,265	18,676	10,411	43,656
97															1,312	1,468	1,192	1,798	4,458	1,366	1,366	2,732	8,502	19,513	11,011	54,667
98															1,443	1,468	1,192	1,798	4,458	1,428	1,428	2,856	8,757	20,396	11,639	66,306
99															1,588	1,468	1,192	1,798	4,458	1,493	1,493	2,986	9,028	21,326	12,298	78,604
2000															1,746	1,468	1,192	–	2,660	2,142	2,142	4,284	8,690	30,599	21,909	100,513
01															1,921	1,468	1,192	–	2,660	2,241	2,241	4,482	9,063	32,015	22,952	123,465
02															2,113	1,468	–	–	1,468	2,346	2,346	4,692	8,273	33,509	25,236	148,701
03															2,325	1,468	–	–	1,468	2,456	2,456	4,912	8,705	35,087	26,382	175,083
04															2,557	1,468	–	–	1,468	2,573	2,573	5,146	9,171	36,752	27,581	202,664
05															2,813	1,468	–	–	1,468	3,558	3,558	7,116	11,397	50,831	39,434	242,098
06															3,094	1,468	–	–	1,468	3,731	3,731	7,462	12,024	53,302	41,278	283,376
07															3,403	1,468	–	–	1,468	3,914	3,914	7,828	12,699	55,917	43,218	326,594
08															3,744	1,468	–	–	1,468	4,109	4,109	8,218	13,430	58,702	45,272	371,866
09															4,118	–	–	–	–	4,315	4,315	8,630	8,630	61,644	53,014	424,880
Total	45,665	13,782	1,915	1,089	3,695	6,699	66,146	24,140	10,200	11,325	45,665	13,782	6,699	20,481												

Chapter 10
POINTS FOR FURTHER STUDY

Chapter 10 POINTS FOR FURTHER STUDY

10.1 General

The daily traffic volume on the Jagorawi Freeway has reached around 6,000 vehicles recently, and the completion of its further extension has initiated the first full tollway operation in the Republic.

The basic concept of a tollway is to collect tolls from users of a part of the public road network while providing a high standard of services, repaying the cost of tollway construction, operation, etc. and also pooling funds for future construction.

In this chapter the evolution of the tollway system in Japan is outlined and recommended points for further investigation will be described.

10.2 Evolution of Tollway System in Japan

In Japan, the tollway system was introduced for the first time in 1952 by legislation with the Emergency Measure for Highway Construction Law. Long before then, however, adoption of tollway system on a small scale existed, for example:

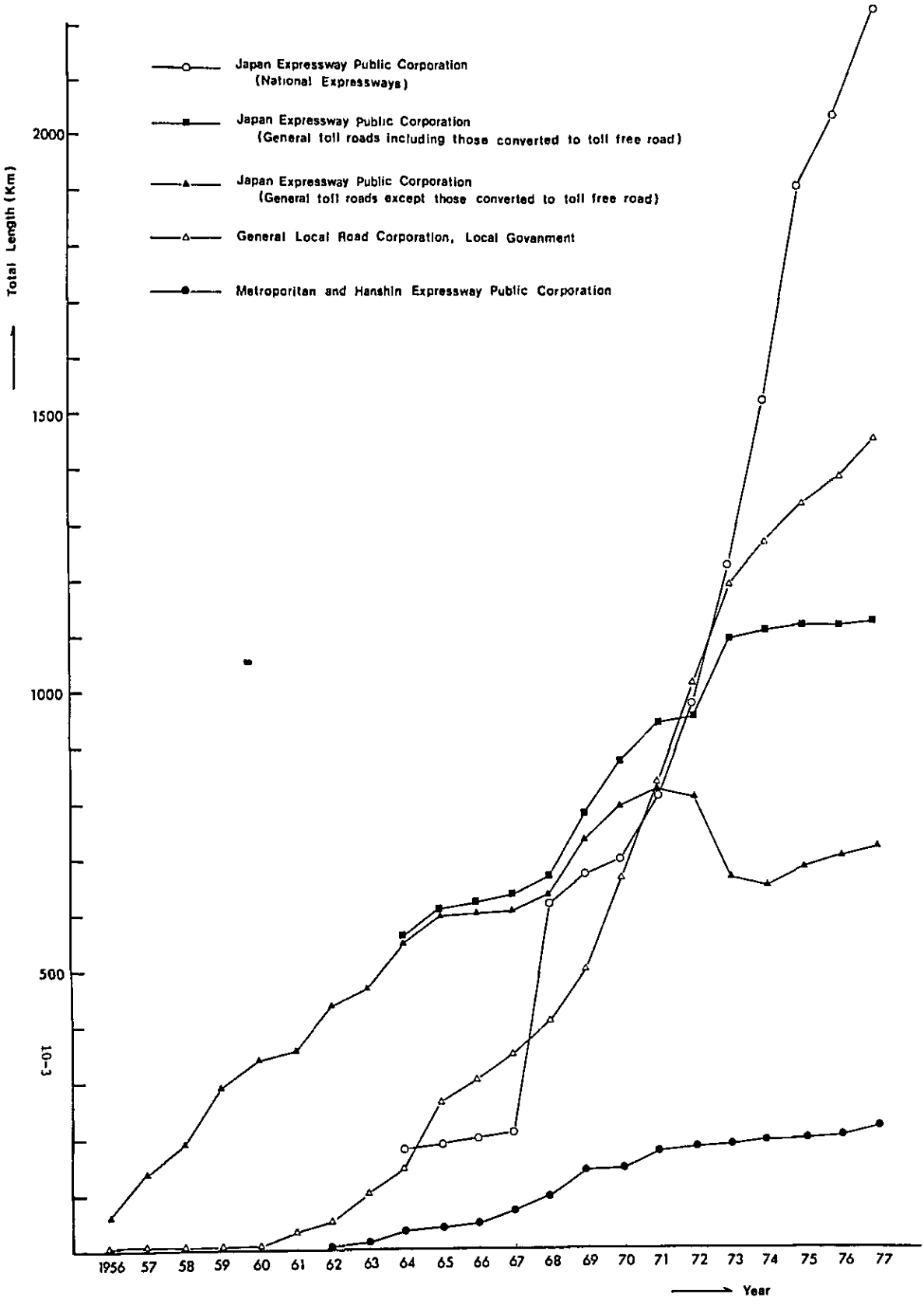
- The ferry fares and bridge tolls along the Tokaido Road were adopted in 1871; and
- The management of toll bridges were established by the Dept. of Interior in 1920.

In 1956 the Emergency Measure for Highway Construction Law was totally revised and it is still valid at present. The Japan

Table 10-1 HISTORY OF TOLLWAY IN JAPAN

Year	General Road Policy	Tollway Policy
1871		- The ferry fares and bridge tolls along Tokaido Highway were introduced.
1920		- The toll bridge management was established by Dept. of Interior.
1952	- The Emergency Measure for Highway Construction Law was legislated.	
1953	- The Gasoline Tax became one of the special revenue sources for highway construction.	
1954	- The First Five-year Roads Improvement Plan was issued.	
1956	- The Emergency Measure for Highway Construction Law was revised.	
		- The Japan Highway Public Corporation was established.
1959		- The Emergency Loss Compensation Fund started.
		- The Metropolitan Expressway Public Corporation was established.
1962		- Repayment items and toll levels were standardized.
		- The Hanshin Expressway Public Corporation was established.
1964	(- The Tokyo Olympic Game.)	
1970	(- The International Exposition in Osaka.)	- The Pool Fund started partially.
1972		- The Pool Fund was adopted for general toll roads by Japan Expressway Public Corporation.

Fig. 10-1 DEVELOPMENT OF TOLLWAY LENGTH IN JAPAN



Highway Public Corporation was established aiming at efficient management of tollway construction and operation, and also at promoting capital investment in the private sector. Additionally, the Metropolitan Expressway Public Corporation and the Hanshin Expressway Public Corporation were set up in 1959 and 1962 respectively to cope with the traffic demand in the Tokyo Metropolitan Area, and Osaka and Kobe Area. Also, in 1970 the Honshu-Shikoku Bridge Corporation was established.

The Emergency Measure for Highway Construction Law prescribes that the purpose of this emergency measure is to legislate special measures for new construction, reconstruction, maintenance, repair and operation of tollways.

10.3 Points for Further Study

As outlined in the previous section, the tollway system in Japan has been improved utilizing experiences through its development to fit into the Japanese situations of politics, economy, financial policy, legal system and administrative institution. In this manner, in Indonesia, the tollway system especially toll collecting system and financial policy should be allowed to evolve adequately reflecting its specific social, economical and political climate.

The points for further study are described below referring to cases in Japan.

10.3.1 Toll Level

From the user's point of view, the primary concern is the toll fare, and so the rational behind the toll level should be convincing

enough for users in Japan the toll level determining policy for national expressways and intra-urban tollway differs slightly from other tollways as explained below.

(a) National Expressway and Intra-urban Tollways

For national expressways and intra-urban tollways, the toll level should cover the expenses for construction, maintenance and repair, and operation. At the same time it should be reasonable compared to costs for other modes of transportation.

(b) General Tollway

For other tollways, the toll is determined based on the benefits derived from the use of them. This benefit is based on savings of time value and running costs.

10.3.2 Repayment Items and Compensation Fund

The prime objective of tollway finance is to select items for repayment. Also, even in the case each tollway is independently financed, it would be better to establish a compensation fund for unexpected losses for the whole tollway network for mutual security.

10.3.3 Mutual Security for Tollway Network Finance

(a) Compensation Fund

In Japan the compensation fund is conventionally approximately 10% of the annual revenue.

(b) Extension of Toll Collecting Period

When the surplus of accumulated net revenue occurs within the expected repayment period, the toll collecting period can be extended within the repayment period, and at the same time, up to the point when the total number of users reaches 115% of then recorded users.

(c) Partial Pool Fund

When an organization finances more than two tollways, in Japan, it is allowed to operate them as an integrated tollway, under the following conditions:

- The tollways are closely related to each other from the operational point of view, for example, one is considered an alternative route for others or one is considered to be a partial section of the whole alignment; or
- It is judged to be adequate to operate those tollways as one tollway line.

10.3.4 Pool Fund

In the beginning of the Japanese tollway era, it was common to operate and finance each tollway independently. As the tollway network developed the pool fund was introduced.

When financial programs are designed independently for each tollway they are likely to bring about an apparent inequity in the toll charges, which should be avoided. The toll should not be set at a level that it is economically disadvantageous to take an alternative route when the route of first choice is overloaded. Thus, the tolls charged should reflect the future traffic con-

ditions and the traffic policy for the whole tollway network. Based on this factor a pool fund or a common fund for the whole tollway network with an integrated financial program would be advantageous.

10.3.5 Repayment Period

To define the repayment period reasonably is as important as fixing the toll level from the point of view of the public. In Japan usually a period of 25 to 30 years is considered.

10.3.6 Change of Toll Level

When it is unavoidable to change the toll level, toll collecting period, etc. because of the unexpected changes in the conditions of the financial program, the changes should be made in a convincing manner.

Hitherto, the major points to be considered for the further study have been described referring to Japanese cases. Other points which will have to be studied are:

- Service Level for Tollways;
- Toll Fare Discount System such as Season Tickets; and
- Mechanical Improvement for the Toll Facilities.

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JICA