3.4.3 Freight Traffic

The volume of freight traffic transported within Java island (excluding DKI Jakarta) was some 3.5 million tons in 1986 and has been generally increasing since 1983 up to 1986. Freight traffic generated is relatively higher in East Java Province than in West and Central Java Provinces as shown in Table 3.4.5.

Table 3.4.5 Freight Movement by Railway in Java

(x1000 tons)

	1980	1981	1982	1983	1984	1985	1986
DKI Jakarta*) Rate of Growth	n.a	n.a	n.a	n.a	n.a	n.a	n.a
West Java Rate of Growth	927	737 -20.5%	612 -17.0%	628 2.6%	746 18.9%	785 5.3%	965 22.9%
Central Java Rate of Growth	684	670 -2.1%	662 -1.1%	682 2.9%	857 25.7%	821 -4.2%	979 19.2%
Yogyakarta Rate of Growth	4	5 34.6%	6 10.9%	6 7.0%	6 -1.3%	n.a	n.a
East Java Rate of Growth	n.a	n.a	1,308	1,114 -14.9%	1,310 17.7%	1,366 4.3%	1,471 7.7%

Source: Buku-buku Statistic

Note: *) excluding Jabotabek Railway Passengers Traffic
n.a = not available

The Land Transport Development Plan reports that the most dominant freight corridor is between Kroya, Yogyakarta, Surakarta, Jombang and Surabaya in Central and East Java provinces. They have average daily flows of about 1800 tons. The freight movement is basically directional towards Surabaya and it is anticipated that future volume will increase by about 300%.

The Jakarta-Cirebon-Semarang corridor is also important and the flows vary between 1,000 and 2,500 tons/day. The future growth pattern of freight volume is anticipated to increase by about 100% between Jakarta-Cirebon.

The Merak and Jakarta corridor is less dominant with freight flows of about 500 tons/day and moderate growth of about 20%. The corridor between Jakarta,

Bandung and Kroya is a less important freight link due to the small amount of freight tonnage generated.

In Java there are 1,032 train-cars/day operations, and less than 20,000 tons/day freight movement. The train-cars/day operations within West Java are only 237 (about 23%) of the total train cars/day in Java and the intra-provincial movements in West Java is about 5,000 tons (about 25%) of the total tonnage transported in Java. The total movements in West Java is 6,300 tons/day in West Java, so that nearly 80% occupies intra-provincial movements and 20% inter-provincial movements.

Table 3.4.6 summarizes the OD Matrix of freight transport. The most generated areas for freight traffic in West Java are Ciamis/Banjaran (Priangan Timur) in the south-east part of West Java and Merak/Cilegon (Banten) in the west part. Jabotabek does not generate as much railway freight but attracts most from the above two regions.

East Java generates and attracts freight traffic evenly and the intra-provincial movements are dominant, accounting for about 68% of the total tonnage.

Table 3.4.6 Summary of Freight Movement by Railway, 1988

(tons/day)

Origin	Destination										
	Banten	Jabotabek	Purwasuka	Cirebon	Sukabumi	Bandung Raya	Priangan Timur	Central Java	East Java	Unknown	Total
Banten	0	2,116	0	0	0	0	0	55	256	0	2,427
Jabotabek	21	6	0	0	0	0	116	0	257	84	484
Purwasuka	21	0	141	115	0	56	89	0	0	0	422
Cirebon	0	0	0	0	0	0	0	0	14	0	14
Sukabumi	0	0	0	0	0	0	0	0	0	0	0
Bandung Raya	0	0	0	0	0	0	0	0	0	0	0
Priangan Timur	0	2,211	2	0	0	3	0	3	0	0	2,219
Central Java	0	12	6	0	0	14	0	2,460	244	0	2,736
East Java	0	304	25	164	0	116	99	276	3,744	2	4,730
Unknown	0	0	0	0	0	0	0	0	0	6,231	6,231
Total	42	4,649	174	279	0	189	304	2,794	4,515	6,317	19,263

Source: PJKR

3.5 Sea Transportation

3.5.1 Port Traffic

The port of Cirebon is situated in the eastern part of the city of Cirebon. The nearest ports are Tanjung Priok to the west (about 250 kms) and Semarang to the east (about 200 kms).

The National Urban Development Strategy Project (NUDS, Final Report, September 1985) classified the port of Cirebon as a trunk or collector port along with those of Semarang and Cilacap in Central Java Province, and Banyuwangi and Sumenep in East Java Province. The ports of Tanjung Priok in Jakarta and Tanjung Perak in Surabaya were classified as gateway ports.

The inner-sphere of influence of Cirebon port is the Development Region (Wilayah Pembanguan) of Cirebon which consists of 4 kabupatens i.e. Cirebon, Kuningan, Majalengka and Indramayu, and the city of Cirebon itself. The outer-sphere consists of adjacent Kabupatens, which have their social-economic development orientation tending towards Cirebon due to the condition of the transportation infrastructure.

The existing Cirebon port is used by the following vessel types:

a) Ocean Going (Samudra)
b) Interinsular (Nusantara)
c) Traditional (Rakyat)
d) Local (Lokal)
e) Special (Khusus)

The vessels for ocean-going traffic have more than 6,000 tons average DWT for both national and foreign vessels. The interinsular vessels have more than 1,000 tons on average, whereas, traditional and local vessels have less than 500 tons. In the case of special traffic the average of DWTs is more than 2,000 tons.

Numbers of total vessel-traffic tended to decrease from the year 1982 to 1984, and to increase in 1986, especially for interinsular, traditional and local traffic. The

highest user proportion by year is held by traditional vessels which average more than 50% of total usage as shown in Table 3.5.1.

Table 3.5.1 Vessel Traffic in Port of Cirebon

Type of Vessel	Year	Number of Vessels	Percentage to Total	Rate of Growth from year 1982	DWT	Average of DWT
Ocean Going (National)	1982	26	1.4%	.0%	228,933	8,807
	1983	22	1.7%	-15.4%	328,129	14,915
	1984	26	2.0%	.0%	213,944	8,229
	1986	20	1.0%	-23.1%	130,601	6,530
Ocean Going (Foreign)	1982	4	.2%	.0%	242,818	60,705
	1983	33	2.5%	725.0%	426,861	12,935
	1984	96	7.4%	2,300.0%	846,252	8,815
	1986	87	4.6%	2,075.0%	652,600	7,501
Interinsular (National)	1982	206	4.8%	.0%	224,250	1,089
	1983	214	.0%	3.9%	425,886	1,990
	1984	162	15.9%	-21.4%	144,068	889
	1986	416	11.2%	101.9%	472,507	1,136
Interinsular (Foreign)	1982	108	6.0%	.0%	663,458	6,143
	1983	107	8.1%	-.9%	670,070	6,262
	1984	48	3.7%	-55.6%	61,902	1,290
	1986	0	.0%	-100.0%	0	0
Traditional (Rakyat)	1982	1,293	72.0%	.0%	93,006	72
	1983	709	54.0%	-45.2%	72,582	102
	1984	851	65.6%	-34.2%	161,638	190
	1986	1,230	64.5%	-4.9%	131,034	107
Local	1982	138	7.7%	.0%	23,571	171
	1983	212	16.1%	53.6%	37,146	175
	1984	104	8.0%	-24.6%	18,589	179
	1986	154	8.1%	11.6%	46,190	300
Special	1982	22	1.2%	.0%	69,649	3,166
	1983	16	1.2%	-27.3%	51,445	3,215
	1984	10	.8%	-54.5%	37,170	3,717
	1986	1	.1%	-95.5%	2,619	2,619
Total	1982	1,797	100.0%	.0%	1,545,745	860
	1983	1,313	100.0%	-26.9%	2,012,119	1,532
	1984	1,297	100.0%	-27.8%	1,483,563	1,144
	1986	1,908	100.0%	6.2%	1,435,551	752

Source: Statistical Year Book of West Java Province

The total cargo volume handled at Cirebon Port in 1986 was about 840 thousand tons, in which cargo loaded was 490 thousand tons or 58% of the total cargo handled, and cargo unloaded was 350 thousand tons or 42% of the cargo handled as shown in Table 3.5.2.

Table 3.5.2 Loading and Unloading Cargo at Cirebon Port

		1982	1983	1984	1985	1986	Growth Rate 1982/86 (% p.a.)
Ocean-Going	Loading	40,003	46,732	78,949	n.a	78,832	18.5
	Unloading	20,908	37,949	70,853	n.a	90,976	44.4
	S-Total	60,911	84,681	149,802	n.a	169,808	29.2
Inter-insular	Loading	79,972	137,471	246,679	n.a	411,506	50.6
	Unloading	304,764	320,325	177,802	n.a	256,326	-4.2
	S-Total	384,736	457,796	424,481	n.a	667,832	14.8
Total	Loading	119,975	184,203	325,628	n.a	490,338	42.2
	Unloading	325,672	358,274	248,655	n.a	347,302	1.6
	Total	445,648	542,481	574,290	n.a	837,650	17.1

Source: Statistical Year Book of West Java Province

Ocean-going cargoes accounted for 20% or 170 thousand tons and interinsular cargoes accounted for 80% or 670 thousand tons of the total cargo handled. Thus, the Cirebon Port has been most used for the interinsular trading. However, the ocean-going trading has enlarged its share from 14% in 1982 to 20% in 1986.

Characteristics of the port traffic in Cirebon is that the loading cargo for the ocean-going trade was larger than unloading in 1982 but this was inverted by the year 1986. For the interinsular trade the loading cargo portion was the larger from 1982 through 1986, but the balance tended to decrease.

Passenger traffic does not predominate in the port of Cirebon. Table 3.5.3 shows passenger numbers from 1982 to 1986 for national (interinsular) and local vessel traffic serving Cirebon port and it clearly indicates that Cirebon port is not used as a normal passenger port.

Table 3.5.3 Vessel-Passenger Traffic in Port of Cirebon

(Passengers)

	Nusantara (National)		Lokal		Total	
	On Board	Off Board	On Board	Off Board	On Board	Off Board
1982	3	225	0	62	3	287
1983	0	204	0	0	0	204
1984	353	0	0	0	353	0
1986	0	0	0	0	0	0

Source: Statistical Year Book of West Java Province

3.5.2 Port Development

The main land use of the Development Region of Cirebon is agriculture, especially paddy fields. The Port Master Plan of Cirebon in 1982 states that the sphere of influence of Cirebon has some potentials for development - mainly concerning the primary and secondary economic sectors, such as:

a) Agriculture production; which is expected to become surplus and could become a supplier to other regions, especially for rice production.

b) Oil and natural gas (including off shore) fields; which contribute more than 90% of GRDP of the mining sector in West Java.

c) The development of the industrial sector in such areas as cement, fertilizer, manganese ore, sheet glass, etc.

The Port Master Plan forecast that the freight traffic volume of the port would increase after year 1982. Table 3.5.4 shows the forecast freight volume, which excludes oil and gas commodities.

Table 3.5.4 Forecast of Outbound and Inbound Trade of the Port of Cirebon

(x 1000 tons)

	1982	1985	1987	1990	2000
O U T B O U N D T R A D E					
EXPORT					
Low	105.1	115.3	470.3	470.0	470.0
Medium	115.7	133.9	557.8	564.0	583.0
High	126.2	152.3	656.1	669.0	713.0
DOMESTIC OUTBOUND TRADE					
Low	5.8	61.6	73.5	89.0	126.0
Medium	5.8	74.1	88.7	103.0	147.0
High	5.8	86.5	102.4	119.0	169.0
OUTBOUND TOTAL					
Low	110.9	176.9	543.8	559.0	596.0
Medium	121.5	208.0	646.5	667.0	730.0
High	132.0	238.8	758.5	788.0	882.0
I N B O U N D T R A D E					
IMPORT					
Low	256.1	183.3	308.8	362.0	395.0
Medium	295.5	351.6	381.9	446.0	485.0
High	319.2	405.7	443.2	525.0	576.0
DOMESTIC INBOUND TRADE					
Low	224	413.8	499.5	536	659
Medium	255.6	493.5	604	666	869
High	303.8	593.9	729.8	814	1093
INBOUND TOTAL					
Low	480.1	597.1	808.3	898.0	1,054.0
Medium	551.1	845.1	985.9	1,112.0	1,354.0
High	623.0	999.6	1,173.0	1,339.0	1,669.0
T O T A L H A R B O U R T R A F F I C					
Low	591.0	874.0	1,352.1	1,424.0	1,650.0
Medium	672.6	1,053.1	1,632.4	1,739.0	2,084.0
High	755.0	1,238.4	1,931.5	2,076.0	2,551.0

Source : *PORT MASTERPLAN STUDY*, Directorate General of Sea Transportation, 1982

CHAPTER 4. PRESENT ROAD TRAFFIC VOLUME AND CHARACTERISTICS

CHAPTER 4. PRESENT ROAD TRAFFIC VOLUME AND CHARACTERISTICS

4.1 Traffic Survey

In order to update the existing road traffic data, traffic surveys were carried out by the Study Team. The surveys consisted of the following three field works:

- Traffic count survey
- Roadside origin-destination interview survey
- Travel speed survey

Each of these surveys was conducted in the manner described in the following sections.

4.1.1 Traffic Count Survey

1) Survey Objective

To ascertain the traffic characteristics on the arterial roads that compete with the proposed tollway, and to obtain expansion factors for the data from the roadside O.D. survey.

2) Survey Locations and Period

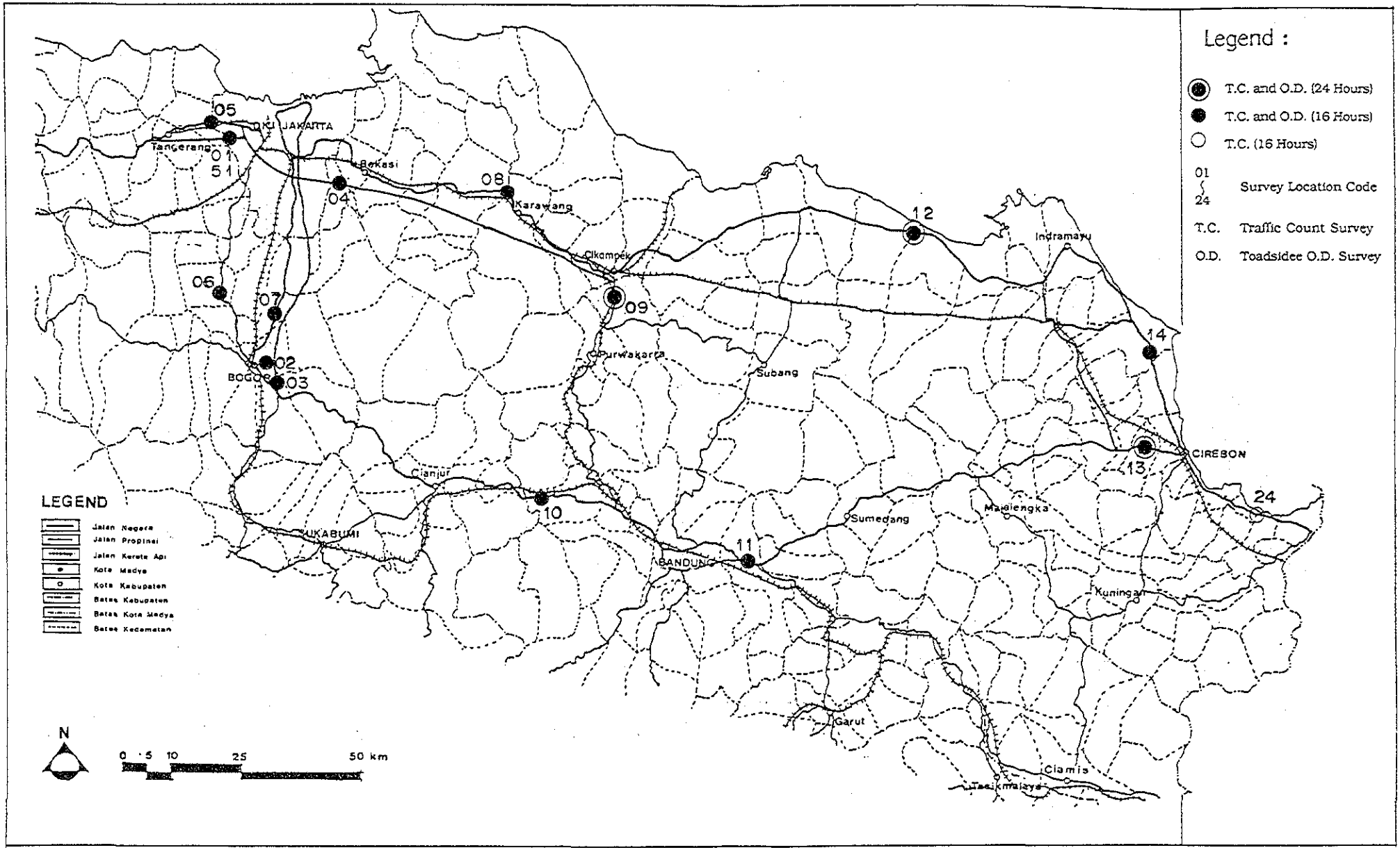
Table 4.1.1 and Fig. 4.1.1 show the total sixteen (16) survey locations and survey periods used within the project study. The traffic count survey was conducted at all sixteen locations and consisted of a survey period for 16 hours (0600 to 2200) at thirteen (13) locations and of a survey period for 24 hours (0600 to 0600) at the other three (3) locations.

3) Survey Method and Items

By relating and analyzing existing traffic volume data (Bina Marga 1979 to 1987) and similar types of traffic surveys, vehicle classification for the purposes of the traffic count survey was established in order to satisfy survey objectives. Vehicle classification is determined as follows:

Table 4.1.1 Traffic Survey Locations and Period

LOCA-TION CODE	DIREC-TION CODE	STREET NAME	DIREC-TION	SURVEY DATE	SURVEY PERIOD (16/24)
01	24	KEBON JERUK TOLL GATE	TO EAST	OCT.20,1988	16 HRS
01	42	TOMANG TOLL GATE	TO WEST	OCT.20,1988	16 HRS
02	13	BOGOR TOLL GATE	TO NORTH	OCT.18,1988	16 HRS
02	31	BOGOR TOLL GATE	TO SOUTH	OCT.18,1988	16 HRS
03	13	CIAWI TOLL GATE	TO NORTH	OCT.18,1988	16 HRS
03	31	CIAWI TOLL GATE	TO SOUTH	OCT.18,1988	16 HRS
04	24	PONDOK GEDE TOLL GATE	TO EAST	OCT.19,1988	16 HRS
04	42	PONDOK GEDE TOLL GATE	TO WEST	OCT.19,1988	16 HRS
05	24	JL. RAYA DAAN MOGOT	TO EAST	OCT.20,1988	16 HRS
05	42	JL. RAYA DAAN MOGOT	TO WEST	OCT.20,1988	16 HRS
06	13	JL. RAYA PARUNG	TO NORTH	OCT.25,1988	16 HRS
06	31	JL. RAYA PARUNG	TO SOUTH	OCT.25,1988	16 HRS
07	13	JL. RAYA BOGOR	TO NORTH	OCT.25,1988	16 HRS
07	31	JL. RAYA BOGOR	TO SOUTH	OCT.25,1988	16 HRS
08	24	JL.RAYA BEKASI/KARAWANG	TO EAST	OCT.19,1988	16 HRS
08	42	JL.RAYA BEKASI/KARAWANG	TO WEST	OCT.19,1988	16 HRS
09	13	DESA BUNGUR	TO NORTH	NOV.10,1988	24 HRS
09	31	DESA CIBENING	TO SOUTH	NOV.10,1988	24 HRS
10	24	RAJAMANDALA	TO EAST	NOV.02,1988	16 HRS
10	42	CIBURUY	TO WEST	NOV.02,1988	16 HRS
11	24	CILEUNYI KULON	TO EAST	NOV.03,1988	16 HRS
11	42	CILEUNYI KULON	TO WEST	NOV.03,1988	16 HRS
12	24	BUGEL	TO EAST	NOV.10,1988	24 HRS
12	42	LEGOK	TO WEST	NOV.10,1988	24 HRS
13	24	JL. KESUGENGAN	TO EAST	NOV.09,1988	24 HRS
13	42	JL. WERU	TO WEST	NOV.09,1988	24 HRS
14	13	SRENGSENG	TO NORTH	NOV.08,1988	16 HRS
14	31	KALIANYER	TO SOUTH	NOV.08,1988	16 HRS
24	24	ENDER	TO EAST	NOV.08,1988	16 HRS
24	42	ENDER	TO WEST	NOV.08,1988	16 HRS
51	24	KEBON JERUK TOLL GATE	TO EAST	OCT.20,1988	16 HRS
51	42	KEBON JERUK TOLL GATE	TO WEST	OCT.20,1988	16 HRS



Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 4.1.1 Traffic Survey Locations

- Passenger Car (Sedan, Jeep, Station Wagon)
- Mini Bus (Private) -- Private use and Public use
- Mini Bus (Public) -- Only Public mini bus
- Medium Bus
- Large Bus
- Pick-Up
- Small Truck -- less than 5 ton
- Large Truck -- more than 5 ton loading capacity (Trailer, Tank Lorry, etc.)

Traffic volumes by the eight categories of vehicle types and by both directions were counted with manual counters.

4.1.2 Roadside Origin-Destination Survey

1) Survey Objectives

- to determine the distribution pattern and volume of traffic related to the proposed tollway

- to obtain data for the analyses of diversion rates to tollway

2) Survey Periods and Locations

- Survey periods for the roadside O.D. survey were the same as for the traffic count survey (refer to Table 4.1.1).

- Location points for the O.D. survey were also at the same positions as the traffic count survey, excluding location point 24. Thus fifteen locations were used for the roadside O.D. survey (refer to Fig. 4.1.1).

3) Survey Method

The interview survey was targeted on the following vehicle types:

- Passenger car (Sedan, Jeep, Station-Wagon, Taxi)
- Mini bus, except those for public use

- Small (Micro) Truck ... less than 5 ton
- Large Truck ... more than 5 ton

At each survey location the object vehicles were stopped, with traffic police cooperation, and the drivers interviewed at the roadside. It would have been desirable if the drivers of all vehicles could have been interviewed at the roadside, but this is mostly impracticable. Therefore, a target figure for sample rates was established so as to conduct the survey smoothly and efficiently and to minimize traffic congestion. The criteria used to establish sample rates is shown below:

Traffic Volume (Unit: Vehicles/day)	Target of the Sample (Unit: %)
Less than 5,000	100
5,000 - 10,000	50
More than 10,000	25

Mini buses for public transport service were excluded from this survey, because their service is confined to a local area and the possibility for them to use the project tollway must be quite small.

The operational routes of medium and large buses were recorded by surveyor's observation at each survey location.

4) Survey Items

The roadside interview obtained the following information from drivers:

- Type of vehicle
- Classification of vehicle registration (private, public and others)
- Origin and destination addresses of the trip
- Trip purpose
- Number of passengers
- Type/weight of cargo (for trucks only)

The survey form is shown in Fig. 4.1.2.

BINA MARGA

WAWANCARA ASAL TUJUAN KENDARAAN

JICA JICA

NO POS : ☐☐☐☐ ARAH : _____ → _____ ☐☐ CUACA : 1. Terang 2. Mendung 3. Hujan ☐

JENIS KENDARAAN
1. Sedan/Station-wagon/Jeep /Taxi
2. Mini-bus/Kijang/Hi-Ace/Combi
3. Pick-up/Mobil Hantaran
4. Mikro Truk
5. Truk besar/ Trailer/Mobil-Tangki

WARNA PLAT NOMOR
1. Plat Hitam (Pribadi)
2. Plat Kuning (Umum)
3. Lain-lain

ASAL PERJALANAN
Desa : _____
Kecamatan : _____
Kabupaten : _____ ☐☐☐☐

TUJUAN PERJALANAN
Desa : _____
Kecamatan : _____
Kabupaten : _____ ☐☐☐☐

MAKSUD PERJALANAN
1. Bekerja
2. Sekolah (Pergi Sekolah)
3. Berdagang/Bisnis/Antar-Ambil Barang
4. Pribadi/Sosial
5. Rekreasi
6. Pulang kerumah
7. Mengangkut Penumpang
8. Lain-lain ☐

JUMLAH PENUMPANG
_____ Orang ☐☐

JENIS MUATAN
1. K O S O N G
2. Makanan yang tidak tahan lama (Sayur/Ikan)
3. Hasil Pertanian/Hutan,Laut yang tahan lama
4. Makanan yang sudah diproses (Kalengan/Roti)
5. Bahan konstruksi (Semen,Pasir,Besi,Kayu)
6. Barang tambang yang tidak termasuk untuk bahan konstruksi
7. Barang industri kimia,kecuali bahan bakar minyak
8. Bahan bakar minyak (Oli, Bensin, Solar)
9. Barang logam dan Mesin barang
10. Barang aneka industri (Meubel, Karet, Kulit)
11. Peternakan
12. Air
13. Lain-lain ☐☐

VOLUME MUATAN
1. Kosong
2. 1/4
3. 1/2
4. 3/4
5. 1
6. >1 ☐

DAYA ANGKUT
_____ Ton ☐☐

JAM	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	00-01	01-02	02-03	03-04	04-05	05-06

JENIS KENDARAAN
1. Sedan/Station Wagon/Jeep /Taxi
2. Mini bus/Kijang/Hi-Ace/Combi
3. Pick-up/Mobil Hantaran
4. Mikro Truk
5. Truk besar/ Trailer/Mobil-Tangki

WARNA PLAT NOMOR
1. Plat Hitam (Pribadi)
2. Plat Kuning (Umum)
3. Lain-lain

ASAL PERJALANAN
Desa : _____
Kecamatan : _____
Kabupaten : _____ ☐☐☐☐

TUJUAN PERJALANAN
Desa : _____
Kecamatan : _____
Kabupaten : _____ ☐☐☐☐

MAKSUD PERJALANAN
1. Bekerja
2. Sekolah (Pergi Sekolah)
3. Berdagang/Bisnis/Antar-Ambil Barang
4. Pribadi/Sosial
5. Rekreasi
6. Pulang kerumah
7. Mengangkut Penumpang
8. Lain-lain ☐

JUMLAH PENUMPANG
_____ Orang ☐☐

JENIS MUATAN
1. K O S O N G
2. Makanan yang tidak tahan lama (Sayur/Ikan)
3. Hasil Pertanian/Hutan,Laut yang tahan lama
4. Makanan yang sudah diproses (Kalengan/Roti)
5. Bahan konstruksi (Semen,Pasir,Besi,Kayu)
6. Barang tambang yang tidak termasuk untuk bahan konstruksi
7. Barang industri kimia,kecuali bahan bakar minyak
8. Bahan bakar minyak (Oli,Bensin,Solar)
9. Barang logam dan Mesin barang
10. Barang aneka industri (Meubel,Karet,Kulit)
11. Peternakan
12. Air
13. Lain - lain. ☐☐

VOLUME MUATAN
1. Kosong
2. 1/4
3. 1/2
4. 3/4
5. 1
6. >1 ☐

DAYA ANGKUT
_____ Ton ☐☐

JAM	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	00-01	01-02	02-03	03-04	04-05	05-06

JENIS KENDARAAN
1. Sedan/Station Wagon/Jeep /Taxi
2. Mini bus/Kijang/Hi-Ace/Combi
3. Pick-up/Mobil Hantaran
4. Mikro Truk
5. Truk besar/ Trailer/Mobil-Tangki

WARNA PLAT NOMOR
1. Plat Hitam (Pribadi)
2. Plat Kuning (Umum)
3. Lain-lain

ASAL PERJALANAN
Desa : _____
Kecamatan : _____
Kabupaten : _____ ☐☐☐☐

TUJUAN PERJALANAN
Desa : _____
Kecamatan : _____
Kabupaten : _____ ☐☐☐☐

MAKSUD PERJALANAN
1. Bekerja
2. Sekolah (Pergi Sekolah)
3. Berdagang/Bisnis/Antar-Ambil Barang
4. Pribadi/Sosial
5. Rekreasi
6. Pulang kerumah
7. Mengangkut Penumpang
8. Lain-lain ☐

JUMLAH PENUMPANG
_____ Orang ☐☐

JENIS MUATAN
1. K O S O N G
2. Makanan yang tidak tahan lama (Sayur/Ikan)
3. Hasil Pertanian/Hutan,Laut yang tahan lama
4. Makanan yang sudah diproses (Kalengan/Roti)
5. Bahan konstruksi (Semen,Pasir,Besi,Kayu)
6. Barang tambang yang tidak termasuk untuk bahan konstruksi
7. Barang industri kimia,kecuali bahan bakar minyak
8. Bahan bakar minyak (Oli,Bensin,Solar)
9. Barang logam dan Mesin barang
10. Barang aneka industri (Meubel,Karet,Kulit)
11. Peternakan
12. Air
13. Lain-lain ☐☐

VOLUME MUATAN
1. Kosong
2. 1/4
3. 1/2
4. 3/4
5. 1
6. >1 ☐

DAYA ANGKUT
_____ Ton ☐☐

JAM	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	00-01	01-02	02-03	03-04	04-05	05-06

FEASILITY STUDY ON CIKAMPEK CIREBON TOLLWAY PROJECT

OCT - NOV, 1988

Fig. 4.1.2 Roadside Origin-Destination Survey Form

5) Sampling Rates for the Roadside O.D. Survey

The numbers of traffic volume interviewed for this survey are shown in Table 4.1.2 and the derived expansion factors are shown in Table 4.1.3.

4.1.3 Travel Speed Survey

1) Survey Objective

The object of the travel speed survey is to determine the travel speed and travel situation for each road section. Travel speed data are especially important for obtaining diversion rates for the projected tollway and for traffic assignment.

2) Survey Method

- The travel speed survey was carried out during a weekday on the arterial roads between Jakarta and Cirebon (including the existing tollway).

- Survey date: (1) 1-3 November, 1988
  (2) 8-10 November, 1988

- The distance and the time taken between each check point from the starting point were observed.

- The driver of the travel speed survey was instructed to travel at the normal speed of each road section.

- Data were collected during the daytime period and the survey driver travelled back and forth along the survey routes at least two to three times.

Table 4.1.2 Results of Roadside Origin-Destination Survey (1)

unit : veh / day

LOCATION CODE	NUMBER OF SAMPLES						TRAFFIC VOLUME					
	PASS.CAR*	BUS	**PICKUP	M.TRUCK	L.TRUCK	TOTAL	PASS.CAR	BUS	PICKUP	M.TRUCK	L.TRUCK	TOTAL
0124	1248	350	288	201	309	2396	3258	500	929	424	780	5891
0142	1848	345	509	320	569	3591	3863	508	975	480	995	6821
01	3096	695	797	521	878	5987	7121	1008	1904	904	1775	12712
0213	966	300	221	76	35	1598	3650	451	815	149	73	5138
0231	1164	279	228	97	37	1805	4025	455	740	193	55	5468
02	2130	579	449	173	72	3403	7675	906	1555	342	128	10606
0313	1055	417	194	133	102	1901	4938	561	966	352	301	7118
0331	1184	409	310	196	105	2204	4916	663	1193	416	268	7456
03	2239	826	504	329	207	4105	9854	1224	2159	768	569	14574
0424	1548	341	289	418	339	2935	5037	482	1129	1511	1301	9460
0442	1298	348	244	170	346	2406	5541	548	983	549	970	8591
04	2846	689	533	588	685	5341	10578	1030	2112	2060	2271	18051
0524	1348	551	692	663	535	3789	7471	909	3712	2454	1972	16518
0542	994	556	880	660	558	3648	3694	789	2493	2275	1939	11190
05	2342	1107	1572	1323	1093	7437	11165	1698	6205	4729	3911	27708
0613	1362	193	620	296	174	2645	1760	242	866	478	274	3620
0631	1332	207	746	266	162	2713	2001	311	1117	469	334	4252
06	2694	400	1366	562	336	5358	3761	553	1983	947	608	7852
0715	1388	620	672	819	456	3875	2634	831	1796	1289	753	7305
0731	1246	636	816	785	355	3838	2322	882	1559	17486	853	23102
07	2554	1256	1488	1604	811	7713	4956	1713	3357	2775	1606	14407
0824	302	626	343	459	630	2360	874	1193	884	1255	1844	6050
0842	236	1124	303	579	758	3000	982	1754	1060	1628	3102	8726
08	538	1750	646	1038	1388	5360	1856	2947	1944	3083	4946	14776
0913	881	---	382	459	733	2455	1022	106	488	545	827	2988
0931	750	---	371	345	629	2095	1028	100	520	425	770	2843
09	1631	---	753	804	1362	4550	2050	206	1008	970	1597	5831
1024	1325	479	509	282	133	2728	2401	586	960	536	210	4673
1042	1427	446	674	412	297	3256	2830	592	1539	771	479	6211
10	2752	925	1183	694	430	5984	5231	1178	2479	1307	689	10884
1124	1702	606	776	785	452	4321	5098	1024	2042	1511	1480	11155
1142	1452	676	608	596	399	3731	5122	1099	2113	1537	1190	11061
11	3154	1282	1384	1381	851	8052	10220	2123	4155	3048	2670	22216
1224	662	993	342	781	1118	3896	861	1006	449	913	1355	4584
1242	771	919	410	875	1148	4123	1056	933	522	998	1483	4992
12	1433	1912	752	1656	2266	8019	1917	1939	971	1911	2838	9576
1324	1105	1111	648	646	902	4412	1730	1242	938	956	1339	6205
1342	1626	1169	990	768	1297	5850	2228	1230	1245	1112	1536	7351
13	2731	2280	1638	1414	2199	10262	3958	2472	2183	2068	2875	13556
1413	384	---	229	261	192	1066	631	33	356	409	256	1685
1431	402	---	265	278	214	1159	586	78	330	391	282	1667
14	786	---	494	539	406	2225	1217	111	686	800	538	3352
5124	418	0	114	28	8	568	545	1	150	34	13	743
5142	618	0	133	66	53	870	791	1	184	78	63	1117
51	1036	0	247	94	61	1438	1336	2	334	112	76	1860

Note : TRAFFIC VOLUME are data of the traffic count survey

* Pass. Car includes private mini bus
** Bus includes only medium and large buses

Table 4.1.3 Results of Roadside Origin-Destination Survey (2)

LOCATION CODE	EFFECTIVE SAMPLE RATE <a>						EXPANSION FACTOR <b>					
	PASS.CAR *	BUS**	PICKUP	M.TRUCK	L.TRUCK	TOTAL	PASS.CAR	BUS	PICKUP	M.TRUCK	L.TRUCK	TOTAL
0124	38.3	70.0	31.0	47.4	39.6	40.7	2.61	1.43	3.23	2.11	2.52	2.46
0142	47.8	67.9	52.2	66.7	57.2	52.6	2.09	1.47	1.92	1.50	1.75	1.90
01	43.5	68.9	41.9	57.6	49.5	47.1	2.30	1.45	2.39	1.74	2.02	2.12
0213	26.5	66.5	27.1	51.0	47.9	31.1	3.78	1.50	3.69	1.96	2.09	3.22
0231	28.9	61.3	30.8	50.3	67.3	33.0	3.46	1.63	3.25	1.99	1.49	3.03
02	27.9	63.9	28.9	50.6	56.3	32.1	3.60	1.56	3.46	1.98	1.78	3.12
0313	21.4	74.3	20.1	37.3	33.9	26.7	4.68	1.35	4.98	2.65	2.95	3.74
0331	24.1	61.7	26.0	47.1	39.2	29.6	4.15	1.62	3.85	2.12	2.55	3.38
03	22.7	67.5	23.3	42.8	36.4	28.2	4.40	1.48	4.28	2.33	2.75	3.55
0424	30.7	70.7	25.6	27.7	26.1	31.0	3.25	1.41	3.91	3.61	3.84	3.22
0442	23.4	63.5	24.8	31.0	35.7	26.0	4.27	1.57	4.03	3.23	2.80	3.57
04	26.9	66.9	25.2	28.5	30.2	29.6	3.72	1.49	3.96	3.50	3.32	3.38
0524	18.0	60.6	18.6	27.0	27.1	22.9	5.54	1.65	5.36	3.70	3.69	4.36
0542	26.9	70.5	35.3	29.0	28.9	32.6	3.72	1.42	2.83	3.45	3.47	3.07
05	21.0	65.2	25.3	28.0	27.9	26.3	4.77	1.53	3.95	3.57	3.58	3.73
0615	77.4	79.8	71.6	61.9	63.5	73.1	1.29	1.25	1.40	1.61	1.57	1.37
0631	66.6	66.6	66.8	56.7	48.5	64.1	1.50	1.50	1.50	1.76	2.06	1.56
06	71.6	72.3	68.9	59.3	55.3	68.2	1.40	1.38	1.45	1.69	1.81	1.47
0713	49.7	74.6	57.4	63.5	60.6	53.0	2.01	1.34	2.68	1.57	1.65	1.89
0731	53.7	72.1	52.3	4.5	41.6	16.6	1.86	1.39	1.91	22.28	2.40	6.02
07	51.5	73.3	44.3	57.9	50.5	53.5	1.94	1.36	2.26	1.73	1.98	1.87
0824	34.6	52.5	38.3	35.6	34.2	39.0	2.89	1.91	2.58	2.73	2.93	2.56
0842	24.0	64.1	28.6	31.7	24.4	34.4	4.16	1.56	3.50	3.16	4.09	2.91
08	29.0	59.4	33.2	35.7	28.1	36.3	3.45	1.68	3.01	2.97	3.56	2.76
0913	86.2	---	78.3	84.2	88.6	82.2	1.16	---	1.28	1.19	1.13	1.22
0931	73.0	---	71.3	81.2	81.7	75.7	1.37	---	1.40	1.23	1.22	1.32
09	79.5	---	74.7	82.9	85.3	78.0	1.26	---	1.34	1.21	1.17	1.28
1024	55.2	81.7	54.1	52.6	63.3	58.4	1.81	1.22	1.85	1.90	1.58	1.71
1042	50.4	75.3	43.3	53.4	62.0	52.4	1.98	1.33	2.28	1.87	1.61	1.91
10	52.6	78.5	47.7	53.1	62.4	55.0	1.90	1.27	2.10	1.88	1.60	1.82
1124	33.4	59.2	36.0	52.0	30.5	38.7	3.00	1.69	2.65	1.92	3.27	2.58
1142	28.3	61.5	28.8	38.3	33.5	33.7	3.53	1.63	3.48	2.58	2.98	2.96
11	30.9	60.4	33.5	45.3	31.9	36.2	3.24	1.66	3.00	2.21	3.14	2.76
1224	76.9	98.7	76.2	85.5	82.5	85.0	1.30	1.01	1.31	1.17	1.21	1.18
1242	73.0	98.5	78.5	87.7	77.4	82.6	1.37	1.02	1.27	1.14	1.29	1.21
12	74.9	98.6	77.4	86.7	79.9	83.7	1.34	1.01	1.29	1.15	1.25	1.19
1324	63.9	89.5	69.1	67.6	67.4	71.1	1.57	1.12	1.45	1.48	1.48	1.41
1342	73.0	95.0	79.5	69.1	84.4	79.6	1.37	1.05	1.26	1.45	1.18	1.26
13	69.0	92.2	75.0	68.4	76.5	75.7	1.45	1.08	1.33	1.46	1.31	1.32
1413	60.9	---	64.3	63.3	75.0	63.3	1.64	---	1.55	1.57	1.33	1.58
1431	68.6	---	80.3	71.1	75.9	69.3	1.46	---	1.25	1.41	1.32	1.44
14	64.6	---	72.0	67.4	75.5	66.4	1.55	---	1.39	1.48	1.33	1.51
5124	76.7	0.0	76.0	82.4	61.5	76.4	1.30	---	1.32	1.21	1.63	1.31
5142	78.1	0.0	72.3	34.6	84.1	77.9	1.28	---	1.38	1.18	1.19	1.28
51	77.5	0.0	74.0	83.9	80.3	77.3	1.29	---	1.35	1.19	1.25	1.29

note : <a> = NUMBER OF SAMPLES / TRAFFIC VOLUME * 100
<b> = TRAFFIC VOLUME / NUMBER OF SAMPLES

* Pass. Car includes private mini buses
** Bus includes only medium and large buses

4.2 Characteristics of Road Traffic

4.2.1 Traffic Volume and Fluctuation

1) Traffic Volumes in Study Area

The traffic count survey result is summarized in Table 4.2.1 and presented in Fig. 4.2.1. According to the result, the traffic volume becomes larger at the survey locations near to Jakarta, Bandung and Cirebon cities.

The approximate traffic volume for Jakarta is about 120,000 vehicles/day, for Bandung it is about 50,000 vehicles/day and for Cirebon about 30,000 vehicles/day.

The traffic volume which runs through the northern route (via Pamanukan) of the project area between Cikampek and Cirebon is about 10,000 vehicles per day, and this volume can be conceived as traffic that will convert to the project tollway.

Fig. 4.2.2 shows some traffic volume results data derived from annual traffic count surveys undertaken by Bina Marga during 1979-1987 and carried out at locations very close to the Study Team survey locations.

Most of the Bina Marga's survey locations indicate an upward trend of traffic volume, except for No. A024 which is located between Cirebon city and Palimanan. Other survey locations around Cirebon City i.e. Nos. C012, B025 and B013 present increasing traffic volumes. Therefore, it can be presumed that some particular reasons lie in the drops of traffic volume since 1982. The level of traffic in 1988 as counted by the Study Team seems to be almost the same as that in 1985.

As most of the arterial roads (National and Provincial roads), except for the tollways, have only one traffic lane in each direction it is reasonable to assume that generally the surveyed roads must be considerably crowded, if judged from the traffic volume counts.

2) Hourly Fluctuations

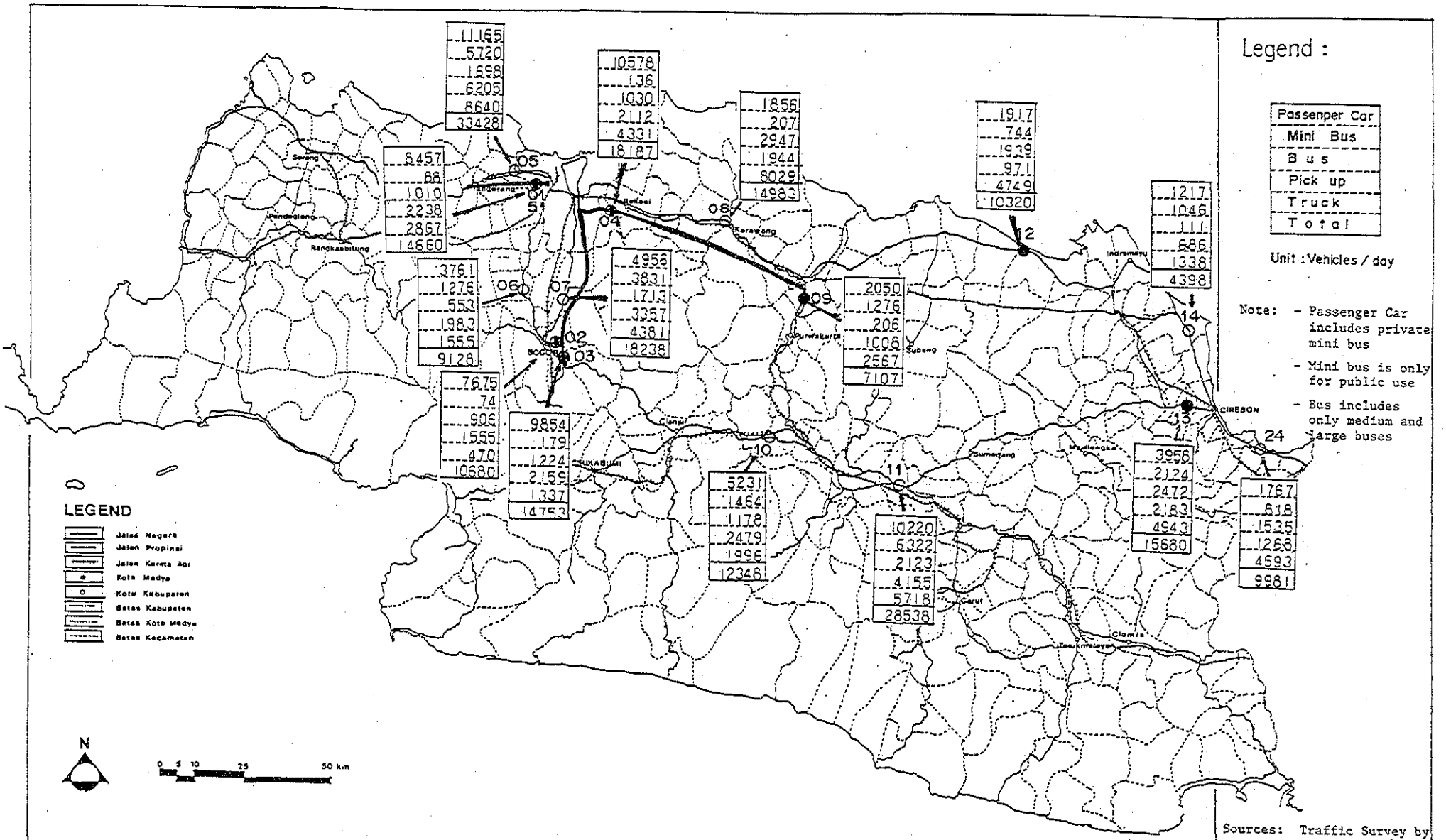
Fig. 4.2.3 shows the hourly fluctuations at several of the survey locations. These location points are along the "Jakarta-Cikampek-Cirebon" corridor. Most of the

Table 4.2.1 Results of Traffic Count Survey

Unit: Number of Vehicles in 24 hours

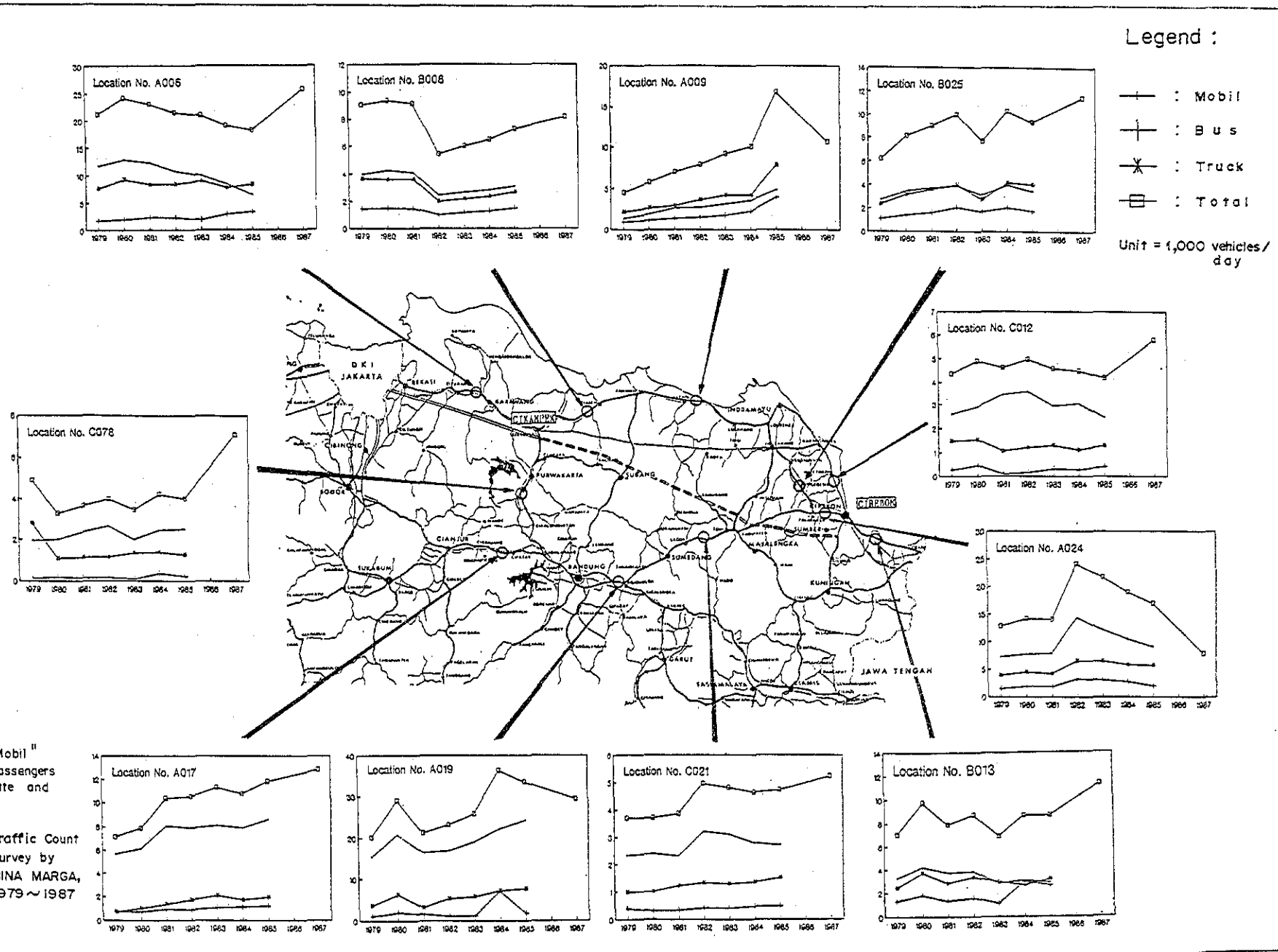
Location Code	Priv. Cars		Public Bus			Truck			Private Passenger Car	Mini Bus (Public)	Medium Large Bus	Pick-up	Micro Large Truck	Total
	Pass. Veh.	Mini Bus	Mini	Medium	Large	Pick-up	Micro	Large						
0124	1846	1412	44	49	451	929	424	780	3258	44	500	929	1204	5935
0142	2473	1390	43	31	477	975	480	995	3863	43	508	975	1475	6864
01	4319	2802	87	80	928	1904	904	1775	7121	87	1008	1904	2679	12799
0213	2407	1243	45	35	416	815	149	73	3650	45	451	815	222	5183
0231	2688	1337	29	30	425	740	193	55	4025	29	455	740	248	5497
02	5095	2580	74	65	841	1555	342	128	7675	74	906	155	470	10680
0313	3084	1854	134	105	456	966	352	301	4938	134	561	966	653	7252
0331	3215	1701	45	22	641	1193	416	268	4916	45	663	1193	684	7501
03	6299	3555	179	127	1097	2159	768	569	9854	179	1224	2159	1337	14753
0424	3303	1734	91	35	447	1129	1511	1301	5037	91	482	1129	2812	9551
0442	3510	2031	45	34	514	983	549	970	5541	45	548	983	1519	8636
04	6813	3765	136	69	961	2112	2060	2271	10578	136	1030	2112	4331	18187
0524	3340	4131	3237	299	610	3712	2454	1972	7471	3237	909	3712	4426	19755
0542	2158	1536	2483	203	586	2493	2275	1939	3694	2483	789	2493	4214	13673
05	5498	5667	5720	502	1196	6205	4729	3911	11165	5720	1698	6205	8640	33428
0613	933	827	562	120	122	866	478	274	1760	562	242	866	752	4182
0631	1197	804	714	193	113	1117	469	334	2001	714	311	1117	803	4946
06	2130	1631	1276	313	240	1983	947	608	3761	1276	553	1983	1555	9128
0713	1274	1360	1932	553	278	1798	1289	753	2634	1932	831	1798	2042	9237
0731	1185	1137	1899	596	286	1559	1486	853	2322	1899	882	1559	2339	9001
07	2459	2497	3831	1149	564	3357	2775	1606	4956	3831	1713	3357	4381	18238
0824	384	490	99	793	400	884	1255	1844	874	99	1193	884	3099	6149
0842	395	587	108	999	755	1060	1828	3102	982	108	1754	1060	4930	8834
08	779	1077	207	1792	1155	1944	3083	4946	1856	207	2947	1944	8029	14983
0913	538	484	655	24	82	488	545	827	1022	655	106	488	1372	3643
0931	488	540	621	18	82	520	425	770	1028	621	100	520	1195	3464
09	1026	1024	1276	42	164	1008	970	1597	2050	1276	206	1008	2567	7107
1024	1439	962	370	1	585	940	536	210	2401	370	586	940	746	5043
1042	1689	1141	1094	8	584	1539	771	479	2830	1094	592	1539	1250	7305
10	3128	2103	1464	9	1169	2479	1307	689	5231	1464	1178	2479	1996	12348
1124	2064	3034	3131	32	992	2042	1511	1480	5098	3131	1024	2042	2991	14286
1142	2024	3098	3191	43	1056	2113	1537	1190	5122	3191	1099	2113	2727	14252
11	4088	6132	6322	75	2048	4155	3048	2670	10220	6322	2123	4155	5718	28538
1224	350	511	297	185	821	449	913	1355	861	297	1006	449	2268	4881
1242	527	529	447	180	753	522	998	1483	1056	447	933	522	2481	5439
12	877	1040	744	365	1574	971	1911	2838	1917	744	1939	971	4749	10320
1324	735	995	1072	237	1005	938	956	1339	1730	1072	1242	938	2295	7277
1342	974	1254	1052	226	1004	1245	1112	1536	2228	1052	1230	1245	2648	8403
13	1709	2249	2124	463	2009	2183	2068	2875	3958	2124	2472	2183	4943	15680
1413	280	351	557	18	15	356	409	256	631	557	33	356	665	2242
1431	280	306	489	21	57	330	391	282	586	489	78	330	673	2156
14	560	657	1046	39	72	686	800	538	1217	1046	111	686	1338	4398
2424	422	489	451	1	769	636	1005	1092	911	451	770	636	2097	4865
2442	448	408	367	12	753	632	1154	1342	856	367	765	632	2495	5116
24	870	897	838	13	1522	1268	2159	2434	1767	818	1535	1268	4593	9981
5124	359	486	0	1	0	150	34	13	545	0	1	150	47	743
5142	574	217	1	1	0	184	78	63	791	1	1	184	141	1118
51	933	403	1	2	0	334	112	76	1336	1	2	334	188	1861

Note: Each of the 16 hours survey locations data were converted into the 24 hours data based on the results of the existing traffic volume data.



Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 4.2.1 Classified Traffic Volumes

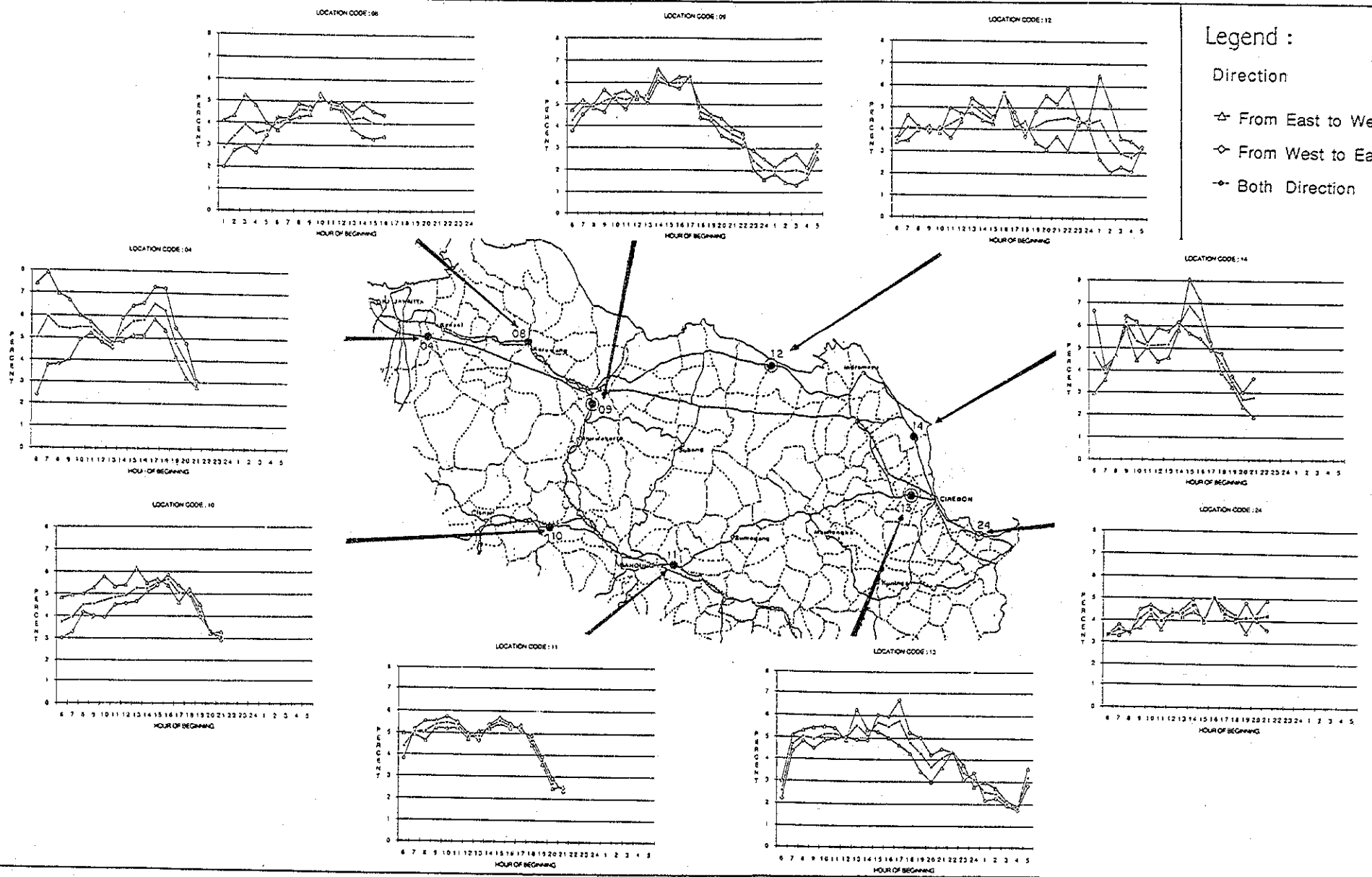


Note : " Mobil " includes Passengers Car, Opiette and Pick up

Source : Traffic Count Survey by BINA MARGA, 1979 ~ 1987

Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 4.2.2 Annual Fluctuation of Traffic Volumes



Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 4.2.3 Hourly Fluctuation of Traffic Volumes

locations do not show much fluctuation, particularly points 24 and 12 which are located in the suburban area and have peak hour ratios in the range of almost 5%-7%.

3) Composition of Vehicles

The composition of vehicles (through traffic in the study area) on the arterial roads is presented in Fig. 4.2.4.

Location point 04 is the toll-gate position for "Jakarta-Cikampek Tollway" and location point 08 lies on a route parallel to the existing tollway. A comparison between point 04 and point 08, shows that, at point 4, small vehicles (Sedan, Private mini bus, Pick-up) form the majority of traffic volume, at 70% of the total, whilst at point 08, heavy vehicles form the majority at 62% of total traffic volume.

Also, higher percentages of heavy vehicles are present on the existing arterial roads from Jakarta to Cirebon (Jkt-Cikampek-Pamanukan-Cirebon).

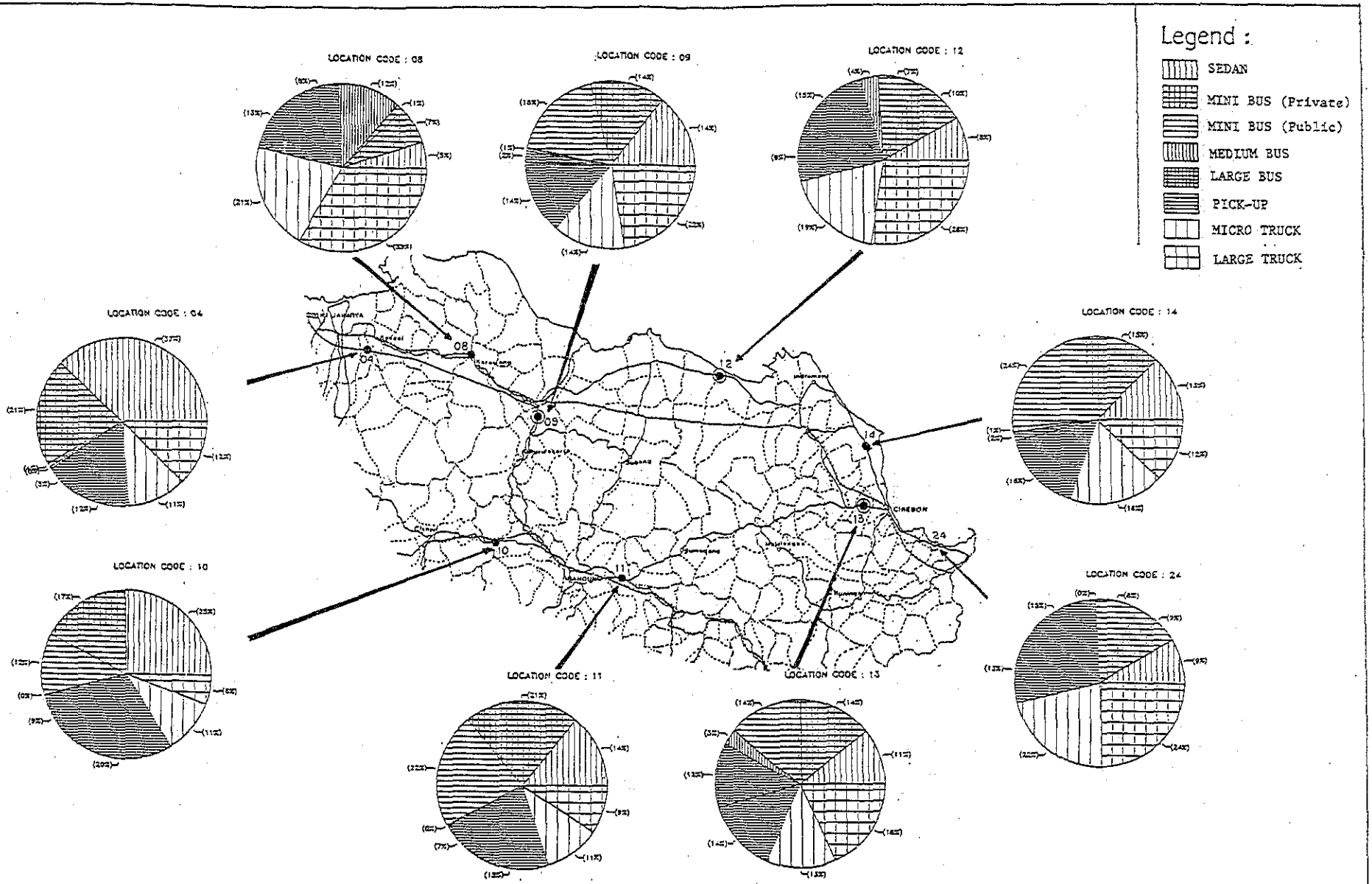
However at location point 10, which is sited on the Puncak section of the route falling between Jakarta and Bandung, a smaller percentage of heavy vehicles is found, due to the prohibition of trucks of more than 13 ton along the Puncak section.

4.2.2 Trip Distribution Analysis

The distribution pattern of traffic in the study area was derived from the roadside O.D. interview survey. The characteristic of such pattern explicits desirable linkages between places of trip generation and attraction. Thus, the importance of the Cikampek-Cirebon linkage can be evaluated from this O.D. survey result.

As previously stated 15 survey locations were used for O.D. survey purposes in order to obtain overall distribution characteristics. However, some location points are less relevant data-wise when specifically related to the effect they will directly have upon tollway route selection.

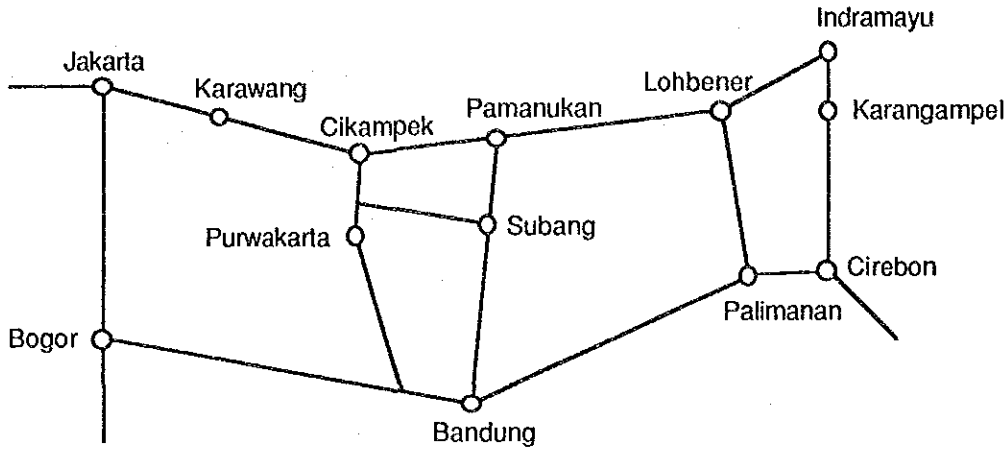
Six survey locations are specifically relative data-wise to the project tollway siting and potential usage. The trip distribution pattern for these locations are



Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 4.2.4 Composition of Vehicles

diagrammatically presented as desire lines in Appendix Figs. AP 4.2.1 through AP 4.2.6. Also a brief summary of the main distribution patterns characteristics for each location is presented below.



Location Point 09 (Cikampek - Purwakarta)

The traffic flow between Cikampek and Purwakarta is mainly distributed to its O.D. of Karawang and Purwakarta followed by that of Karawang and Bandung and that of Jakarta and Bandung in this order. (Refer to Fig. AP 4.2.1)

Location Point 10 (Cianjur - Padalarang)

Main traffic flows distribute, with Bandung as a nodal point, along three route corridors namely between Bandung and Jakarta (via Puncak route), Bandung and Cianjur and between Bandung and Bogor. By comparing distribution results between locations 10 and 9, it is shown that almost all traffic travelling between Bandung and Jakarta chose the Puncak-Bogor route. (Refer to Fig. AP 4.2.2)

Location Point 11 (Bandung - Cileunyi)

Bandung is again a dominant nodal point for the traffic distributing through this survey location. The main distribution pattern is between Bandung and Sumedang, Bandung and Garut, Bandung Ciamis, Tasikmalaya. A lower distribution pattern is between Bandung and Cirebon, and Bandung to locations within Central and East Java. (Refer to Fig. AP 4.2.3)

Location Point 12 (Pamanukan - Lohbener)

The main traffic distribution through this location was the longer distance trip traffic between Jakarta (via Cirebon) and locations in Central and East Java, this traffic had a very high volume density. The actual distribution flow of the traffic travelling between only Jakarta and Cirebon was lower in volume (<50%) than the main traffic distribution. The distribution results clearly show that traffic between Jakarta and Cirebon mostly use the Cikampek-Pamanukan-Cirebon route. (Refer to Fig. AP 4.2.4)

Location Point 13 (Palimanan - Cirebon))

The main distribution through this point is quite similar to that of location 12, with the additional traffic distribution between Cirebon and such Kabupatens as Majalengka, Bandung, Subang and Indramayu; and between Bandung and Central/East Java. (Refer to Fig. AP 5.2.5)

Location Point 14 (Karangampel - Cirebon)

Only one major traffic flow distribution occurs through this location and that is traffic specifically travelling between Indramayu and Cirebon. Unlike survey location 13 there is very little traffic volume associated with Jakarta. (Refer to Fig. AP 4.2.6)

The results of all the traffic distribution patterns obtained at each survey location are collectively brought together, as a composite of overall trip distributions (desired traffic lines) for analysis purposes, refer to Fig. 6.2.5 in Chapter 6. The broad results of the desired traffic line composite of the study area, is that three main towns act as distribution centers for traffic flow pattern; they are Jakarta, Bandung and Cirebon, with traffic flows between centers as follows:

Jakarta to : a) Bogor b) Bandung c) Cirebon d) Central and East Java
Cirebon to : a) Jakarta b) Indramayu c) Bandung d) Central and East Java
Bandung to : a) Jakarta b) Bogor c) Garut d) Cirebon e) Central and East Java

Chapter 6 discusses further the OD matrix and analysis; specifically in sub-section 6.2.2 and 6.2.3.

4.2.3 Travel Speed Analysis

1) Average Travel Speed

Fig. 4.2.5 shows the overall average travel speeds and distances of the road section surveyed. The travel speed survey is targeted on inter-city arterial roads.

Ordinary Road

The general average speed for the inter-city sections of ordinary roads was 53 km/hour. On some sections of the ordinary roads the average speed was lower but never less than 20 km/hour.

However on sections in parts of the city areas of Jakarta and Bandung the overall average speed was only between 20 - 30 km/hour.

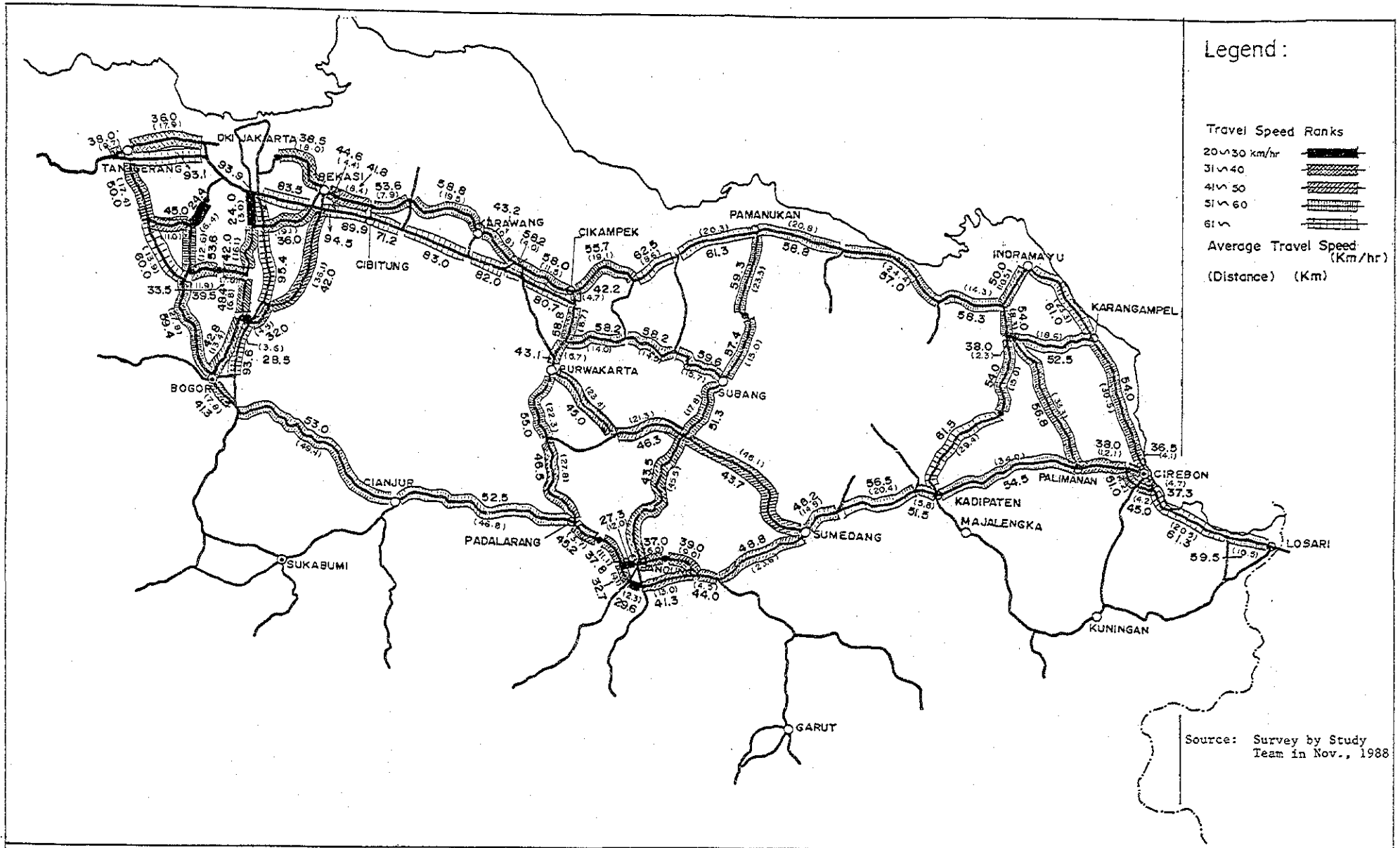
Provincial Road

There is only one provincial road route falling within the traffic speed survey and this is the route between Cikampek and Bandung via Purwakarta and Padalarang. The maximum overall average speed for any section on this road was less than 60 km/hour.

National Road

On the national road section from Cikampek - Pamanukan - Cirebon the overall average speed is more than 55 km/hour, except for the final 12 km section between Palimanan and Cirebon (see comment on Bandung - Cirebon section below).

On the national road section from Bandung - Cirebon the overall average speed was 50.3 km/hour. However the final section (12.1 km) from Palimanan to Cirebon only averaged at 38 km/hour. This lower average is due to the heavier traffic volume generated by the close proximity of a large town.



Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 4.2.5 Average Travel Speed

Existing Tollways

On the existing Jakarta - Tangerang and Jagorawi tollways the overall average speeds are almost identical at about 94 km/hour. On the Jakarta - Cikampek tollway the overall average speed ranges between 70 to 90 km/hour.

By comparison with other existing tollways it would appear that the average speed of the Jakarta - Cikampek tollway is slower than normally expected for a tollway. However, it must be noted that this tollway has a regulatory speed of 80 km/hour between Cibitung and Cikampek (48.5 km). Also this section only contains a 2 lane-2 way carriageway whilst the section from Jakarta to Cibitung consists of a 4 lane-2 way carriageway.

2) Travel Situation

An outline of the present travel situations for three traffic route corridors are outlined below.

a) Jakarta - Cikampek - Pamanukaan - Palimanan - Cirebon

A part of this route is parallel to the existing Jakarta - Cikampek tollway and this part is often crowded; particularly in the local urban areas, where pedestrian crossing of the arterial road, for access to Pasars and shopping centers, causes traffic congestion.

By contrast, the section between Cikampek and Palimanan has few areas of traffic congestion. However this section does contain the portion between Cikampek and Pamanukan which has poorer road conditions with large trucks and other vehicles travelling too fast for the road condition.

Between Palimanan and Cirebon it is particularly conspicuous that the addition of the local small lightweight traffic, such as becaks, bajaj, bicycles, etc. do cause obstruction and prevent any smooth flow of traffic.

b) Jakarta - Bogor - Bandung - Palimanan - Cirebon

On the Jakarta to Bogor road there are numerous cross roads and traffic signals; this results in a travel situation which is not generally representative of an inter-city transportation route.

Between Bogor and Padalarang most of the route is between the hills and road conditions are fairly good, however many stretches are difficult for overtaking with safety.

The sections close to Bandung city are affected by the city generated traffic and this influence continues along the section to Sumedang. After Sumedang the route becomes generally more rural with few access roads until Palimanan.

The section between Palimanan and Cirebon is previously described in section a).

c) Cikampek - Purwakarta - Sumedang

After leaving the central area of Cikampek for Purwakarta there are extremely rough road sections which are not so long individually, but are intermittently scattered throughout this route section to Purwakarta.

The section from Purwakarta to Sumedang is routed between hills and parts of the road have very tight curves. As a consequence the traffic flow is quite light and average travel speed is not so high.

CHAPTER 5. DEVELOPMENT FRAMES AND PLANNING PARAMETERS

CHAPTER 5. DEVELOPMENT FRAMES AND PLANNING PARAMETERS

5.1 Pelita V - National and Regional Development Plan

The fifth Five Years National Development Plan (Pelita V) will extend from April 1989 until March 1994:

The Provincial Government of West Java have prepared their Pelita V Regional Development Plan based on the National Development Plan and emphasize the continuation of policies from previous Pelita.

5.1.1 Fifth Five-Year National Development Plan (Pelita V)

1) Basic Development Policy

The Pelita V is the last plan which completes the first 25-year long-term development plan and forms the basis to establish the second 25-year long-term development plan.

It is intended at the outset of the Pelita V that the success of Pelita V will realize the economic "take-off" during the subsequent Pelita VI.

However, current issues to be tackled in Pelita V are increasing population and the provision of sufficient employment opportunities for them.

The population growth rates were 2.3% per annum in 1978 (last year of Pelita II), 2.2% per annum in 1983 (last year of Pelita III), 2.1% per annum in 1988 (last year of Pelita IV); and in 1993 (last year of Pelita V) it is expected to be 1.8% per annum or during the Pelita V period the growth rate is anticipated to average at 1.9% per annum.

In order to create job opportunity for the increased population in Pelita V, real economic growth is required to average 5% per annum.

To attain such a growth of economy at 5% p.a. the contribution of manufacturing industrial development is largely expected.

Reflecting the current stagnation of investment in the oil and gas industry, investment capital required for the target economic growth is planned to be derived from the increase in export of non-oil and gas products (about twofold during the 5-year period) and the increase in general taxes (about threefold during the 5-year period).

Further, the government expects the private sector to supplement the lack of government budget for development. In order to stimulate economic activities of the private sector such institutional improvements as the "deregulation" policy should be emphasized further and continuously.

The remaining shortage of the required investment capital is expected to be obtaind from foreign aid which is planned to amount to 239,100 billion Rupiah in total for the 5-year period.

2) Planned Development Target

The average population growth in Pelita V is projected at 1.9% per annum and its regional distribution of growth in Java and other regions is estimated as shown in Table 5.1.1.

Table 5.1.1 Population Growth in Pelita V

	Area (1000 km^2)	Population (million persons)				Density (persons/km^2)	
		1988		1993		1988	1993
Java	132.2	105.8	(60.3%)	114.1	(59.1%)	800	864
Others	1,787.2	69.8	(39.7%)	78.8	(40.9%)	39	44
Total	1,919.4	175.6	(100.0%)	192.9	(100.0%)	91	101

The population growth rates are estimated at 1.52% p.a. for Java and 2.46% p.a. for other regions. The growth discrepancy in the regional population is very large, and the population growth in urban areas is assumed to be much higher than that in rural areas. The urbanization speed is likely to be enhanced during Pelita V.

The population in 1988 is 175.6 million and it is projected to increase to 192.9 million in 1993. The increment during this 5 years is 17.4 million or 3.5 million per year on average.

The labor force during the same period is estimated to increase from 74.5 million in 1988 to 86.4 million in 1993. The growth is 11.9 million in total or 2.4 million per year on average.

The age structure of population, as shown in Table 5.1.2, slants to the young age group, so that the growth rate of labor force is estimated at 3% per annum. Among others, the women's labor force is assumed to grow at 3.9% per annum, which is higher than the men's labor force growth rate of 2.4% per annum. The women's participation in the labor force market seems to play an imperative role in the economic development of Indonesia.

Table 5.1.2 Age Structure of 1988 and 1993 Population

Age Group (Years)	1988 (1000 persons)	(%)	1993 (1000 persons)	(%)
0 - 4	23,047.9	13.1	23,019.3	11.9
5 - 9	21,285.3	12.1	22,418.2	11.6
10 - 14	21,553.9	12.3	21,529.0	11.2
15 - 44	79,982.0	45.6	91,770.4	47.6
45 - 64	23,165.0	13.2	26,076.4	13.5
65 and over	6,554.8	3.7	8,122.0	4.2
Total	175,588.9	100.0	192,935.3	100.0

The real economic growth during the previous Pelita IV was 4% per annum on average. The target growth rate of Gross Domestic Product (GDP) is 5% per annum on average for Pelita V and that of National Income per Capita is 3.1% per annum.

The economic development by industrial sector is targeted as shown in Table 5.1.3 and the sectoral composition in 1988 and 1993 is projected as shown in Table 5.1.4.

Table 5.1.3 Target Economic Growth by Industrial Sector in Pelita V

Industrial Sector	Average Annual Growth Rate (% p.a.) During Pelita V
1. Agriculture	3.6
2. Mining	0.4
3. Manufacturing	8.5
4. Construction	6.0
5. Commerce	6.0
6. Transport/ Communication	6.4
7. Others	6.1
GDP	5.0

Table 5.1.4 Target Sectoral Composition of GDP in 1988 and 1993

(%)

Industrial Sector	1988	1993
1. Agriculture	23.2	21.6
2. Mining	15.9	12.6
3. Manufacturing	14.4	16.9
4. Construction	5.6	5.8
5. Commerce	15.9	16.7
6. Transport/ Communication	5.7	6.0
7. Others	19.3	20.4
GDP	100.0	100.0

5.1.2 Regional Development Problems

The Regional Pelita V mainly focuses on the remaining unsolved problems from previous Pelitas, such as:

1) Quality of Human Resources is not yet well established due to the poor development of social support systems in areas such as education, public health and environmental conditions.

   Furthermore labor force participation rate increases and lower productivity rates, especially in rural areas, bring about an imbalance between labor supply and demand. The current market mechanism for manpower supply and demand is inadequate, thus there exists a requirement to coordinate and plan the labor force coupled with the need for further job creation.

2) Economic Activities are generally not operated effectively by commercial and government economic organizations and this is especially so within the non-oil and gas industries where it holds back development growth. This poor economic performance affects not only the economic welfare of persons within these industries but also indirectly the economic base of the people as a whole.

BUMN (National Economic Board) and BUMD (Regional Economic Board) are not yet sufficiently professional or efficient in carrying out their activities. Also business conditions and climate are not yet developed so as to encourage the participation of entrepreneurs into the regional economic development and thus provide support for the integration and inter-connection of economic organizations.

3) Effective Government in unable to be effectively applied due to the following factors, which are:

   a) Imbalance between population numbers and administrative areas at DT II or Kecamatan/Desa levels.

   b) Insufficient numbers and non-availability of government officers required for administrative purposes.

   c) Under-developed government facilities and infrastructure especially at Kedimatan/Desa levels.

   d) Lack of government officers being assigned to the more underdeveloped/ remote areas.

4) Environmental imbalance problems occur due to usage of natural resources which have a decreasing natural capacity for self-recovery; the unplanned and mis-directed urban and rural development; the uncontrolled landuse and certificate issuance for land and property development by planning authorities. Also monitoring systems and preventive measures against environmental disruption/degradation are not functioning effectively.

5.1.3 Strategic Policy in Regional Pelita V

Development strategies in West Java Province, which are in accord with the National Development Policy, are as follows:

- to enhance the quality of human resources
- to encourage economic activities by supporting the development of economic organizations, especially cooperatives.

- to create broader employment opportunities, especially in rural areas.
- to effectively increase the number of regional government officers.
- to adequately balance the use of natural resources and the environment

5.1.4 Objectives of Regional Pelita V

The objectives of the fifth Five Year Regional Development Plan in West Java Province is as follows:

1) To raise living standards, intelligence and welfare of all people, fairly and equally.

2) To maintain hydrological functions by preserving existing areas performing this function in order to guarantee continuous and sustainable development.

3) To improve the efficiency of government systems in order to effective control and monitor development activity and its affects, and also to adequately administrate services to the public.

4) To prepare the basic framework for subsequent development phases.

5.1.5 Priority for Regional Development

According to the region's long-term development policy, priority of the fifth West Java Development Plan is given to the economic sector, particularly to the agricultural and industrial sectors.

5.2 Regional Structural (Spatial) Plan

5.2.1 Policy on Regional Structural (Spatial) Plan

In accordance with national level policies the West Java regional spatial planning policy has objectives to do away with the inequalities that currently exist between regions, especially with regards to population density, economic conditions, the use of natural resources and the development of local potential. These objectives are not only applied to the West Java structure plan as a whole but also within each development region.

Spatial planning policies are directed to achieve the following main objectives:

- balanced economic development for each development region
- improvement in the quality of living by overcoming the main problems occuring in daily life
- Optimal use of natural resources while also taking account of environmental protection factor
- Proportional and rational use of available land so that main objectives can be achieved by development activities requiring land.

5.2.2 Planning Frames for Spatial Development

1) Development Regions

West Java Province has, since Pelita II, been divided into 7 development regions and these are still relevant for the application and control of planned development.

Each development region structure plan will contain policies to ensure functional guidance on the following; general landuse, the structure and hierarchy of cities/towns, other supporting factors.

2) Main Landuse Zoning

Generally, spatial structure plan development in West Java is concerned with four (4) landuse categories which are; non-plantation land, wet land, dry land and non-agricultural land.

a) Non-plantation land is land for conservation purposes, productive forestry, natural and wild life reserves.
(This category is for maintaining hydrological balance, forest production and natural reserve areas.)

b) Wet land is land for rice fields (sawah), inland fishing and fish ponds.
(This category is directed to increasing agricultural products and is specially aimed at rice fields which have higher potential and technical irrigation systems.)

c) Dry land is plantation land, second crop land, horticultural land, vegetation land and land for raising livestock and poultry.
(This category is directed to increasing agricultural and others food products.)

d) Non-agricultural land is areas of urbanization, industry and mining.
(This category is directed to the development of urban areas or cities in order that a proper structure and hierarchy can be developed to create a dynamic balance between urban and rural development.)

5.2.3 Development Policies in the Development Regions

Four (4) of the seven (7) development regions in West Java will be directly influenced by the tollway project. The four regions are Botabek, Purwasuka, Bandung Raya and Cirebon Development Region.

The development policies of the four influenced regions above are summarized as follows:

1) Botabek Development Region

This region consists of Kabupaten (Kab.) Bogor, Kab. Tangerang, Kab. Bekasi, Kotamadya (kodya) Bogor, Kota Administrative (kotif) Tangerang, Kotif. Bekasi and Kotif Depok.

a) Zoning and landuse policies in this region are as follows:

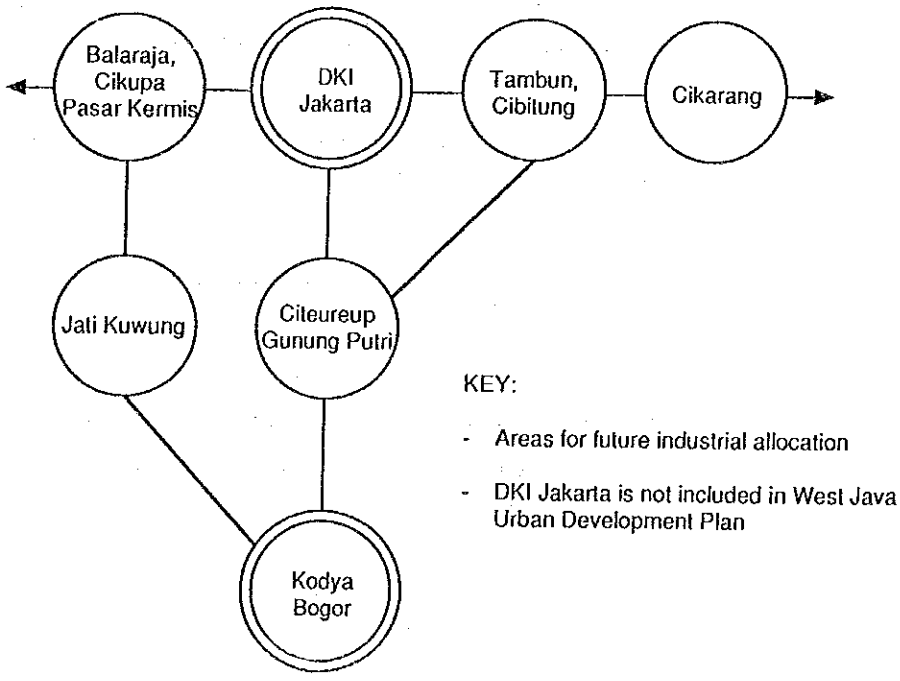
i) The development of the region is directed to support the development of DKI Jakarta.

ii) Conservation areas designated in the region are, the aquifer conservation zone, Puncak zone, Salak Mountain and the coastal forest in the northern area.

iii) Wet land development is directed to the northern parts of Kab. Tangerang and Kab. Bekasi, and the northern and western parts of Kab. Bogor.

iv) Dry land or non-agricultural land development is directed to areas other than the above mentioned.

v) Industrial development is planned as a future allocation of large and medium industries to towns as shown below:



The region is planned to absorb not more than an additional 6 million in population by the year 2005.

vi) The maximum design capacity of the urban population (which includes additional 6 million population) is as follows:

Cities	Population (x1000)	
Kodya Bogor	1,000	
Tangerang and Balaraja	850	(each)
Serpong and Bekasi	100	(each)
Cikarang	750	
Depok	400	
Ciledug		
Pondok-Aren		
Tiga Raksa		
Ciputat	150	250
Cibinong		
Citeureup		
Pondok Gede		
Other Kecamatan Capitals	25	50

vii) Infrastructure development is based on the following policies:

- The improvement and strengthening of social services is an important aspect to enhance the development of the region.

- The infrastructure for communications development largely contributes to supporting industrial and service activities.

  - Conservation of the hilly areas and aquifer zone

    This is one of the most critical planning factors and is necessary for flood control in the plain areas and also to secure water supply for industrial uses and for peoples daily needs.

2) Purwasuka Development Region

This region is comprised of Kab. Purwakarta, Kab. Subang and Kab. Karawang. Attention is focused on the region because it acts as a "rice-barn" for West Java and it also has higher potential for plantations, fishery and small/home industry development.

a) Zoning and landuse policies in the region are as follows:

i) Conservation areas are designated at:

- Burangrang Mountain area
- Tangkuban Perahu
- Sanggabuana
- Forest area along northern coast

ii) Wet land development is directed to the northern parts of Kab. Purwakarta, Kab. Subang, Kab. Karawang: Kec. Wanayasa and Kec. Segalaherang.

iii) Dry land or non-agricultural land development is directed to areas other than the above mentioned.

iv) Large and medium industries are planned to be located in Cikampek and Jatiluhur areas, and small industries in Plered area.

v) Tourism development is planned for Jatiluhur, Ciater, Cirata and Tangkubanparahu areas.

Jatiluhur area has high potential for tourism development; in order to realize this potential it is required that the communications sector and facilities/services for tourism be developed.

vi) Urban development

Cikampek is a growth center directed to develop as a commercial center. Secondary growth centers are defined to be Karawang, Purwakarta, Subang

and Pamanukan, because of their advantages in having more urban and social facilities than other cities.

vii) A monitoring system should be established to control changes in landuse especially from agricultural land; this is to ensure that rice production can be maintained or even encouraged to increase. A key factor in supporting the considerable rice production in this region is the degree of efficiency and effectiveness of management and maintenance of the considerable drainage/irrigation systems within the rice areas.

viii) Conservation (Forest area)

The forest area along the northern coast should be considered to be re-zoned in parts in order to protect current fish pond production.

3) Bandung Raya Development Region

This development region encloses Kodya Bandung, Kab. Bandung, Kab. Cianjur, Kab. Garut and Kab. Sumedang. The region functionally comprises two sub-regions, i.e. a core region and an influence region. The core region covers Kodya Bandung and Kab. Bandung, and the influence region covers Kab. Cianjur, Kab. Garut and Kab. Sumedang.

The urban structure of the core region forms a metropolitan system centering around Bandung City whose area covers about 17,000 hectares. The metropolitan area reaches about 15 to 20 kilometers in radius from Bandung city and contains batches of small towns that have urban development potential.

a) Zoning and landuse policies in the development region are as follows:

i) The core region is directed to function as:

- administrative center
- higher educational/research center
- industrial development district
- conservation district

- agricultural development district
- energy development district

ii) Natural reserve hilly and mountainous forest areas encircle Bandung Plain.

iii) Conservation areas, including the hydrological functioning zone, for the core region fall to the north and south of Bandung City.

iv) Wet land development is intended to take place in the intermediate areas of small towns in Bandung Plain.

v) Dry land development is allocated to Lembang, Pangalengan, Ciwidey and their surroundings.

vi) Tourism development is planned in Lembang, Ciwidey, Kodya Bandung and the surrounding area of Suguling Lake.

4) Cirebon Development Region

This region covers Kodya Cirebon, Kab. Cirebon, Kab. Indramayu, Kab. Majalengka and Kab. Kuningan.

The region is intended to develop in balance with the growth of Jakarta and is also to function as a transport connection point for Jakarta, Bandung and central Java. In addition, the region is directed to grow as a center of industrial, commercial and agricultural development.

a) Zoning and landuse policies in this region are as follows:

i) Conservation zone covers the mountainous areas which include Gunung Ciremai and the south of Kab. Kuningan.

ii) Wet land development is directed to the surrounding areas of Kuningan and Talaga.

iii) Dry land development is intended for areas other than above mentioned.

iv) Large and medium industries are planned at Pegambiran industrial estate, Palimanan, Indramayu and Kadipaten districts.

v) Mining Development is oriented to the potential areas of Palimanan and Jatiwangi districts.

vi) Cirebon city is defined as a development center of the Cirebon Development Region and it functions as an industrial and tourism development center as well as the administrative, commercial and service center.

vii) Secondary development centers are appointed to Kadipaten, Kuningan, Jatibarang and also Sumber, which was recently designated as such when it became the capital city of Kab. Cirebon.

viii) The Cirebon development region contains extensive areas of fields and oil/gas fields. A key factor to successful agricultural development of the region is the provision of adequate agro-infrastructure, as well as the carrying out of production intensification programs in most of the irrigated areas of Tarum Timur and Rentang.

To be able to designate Cirebon area as an industrial area, it will first be necessary to develop supporting sectors such as energy, services and communications so as to encourage the use of Cirebon port.

ix) A skilled labor supply is an essential factor to support industrial development, therefore the development of the education sector in Cirebon area should be encouraged.

5.3 Urban and Regional Development Strategy

5.3.1 Urban Development and Control

1) Urbanization

In 1980, urban population ratios in Indonesia were as follows:
22.1% for total Indonesia; 25.1% for Java and 34.9% for DKI Jakarta plus West Java. These percentage figures are projected to increase to 36.1%, 43.7% and 55.4% respectively by the year 2000, according to the study of National Urban Development Strategy (NUDS) by IBRD and Cipta Karya in 1985.

DKI Jakarta plus West Java region, at around the year 2000, will become the first area in Indonesia to exceed more than 50% urban population over total population. Therefore by the year 2000 the weighting of development policies will have shifted to the economic importance of the urban society over that of a rural society. However, the era when Indonesia is totally occupied by more than 50% of urban population will come later at around the year 2015.

Urbanization expansion can prove drastic when all available land has been developed as in Java island. The urbanization of the densely populated Java island is conceived to expand in core cities that have already accumulated their urban facilities.

DKI Jakarta and Bandung are sufficiently mature to function as national development centers. In consequence these cities have been adopting policies to control urbanization in their regions. Conversely however, the surrounding areas of these cities are extensively urbanized and are now creating sub-development centers.

From an inter-regional point of view, it is urgently required that the West Java structure plan contains proposals to strengthen the urban development of Cirebon, so as to limit an excessive concentration of urban growth in DKI Jakarta by encouraging future development growth to/in Cirebon City which is planned as a regional development center.

Accordingly, it is projected that the growth of urban population in Cirebon and its surroundings will expand rapidly under the urban development policies initiated by both national and West Java Governments.

Future urban population projections (by NUDS) for key cities are shown in Table 5.3.1.

Table 5.3.1 Projected Future Urban Population for DKI Jakarta and West Java

Classification of Key Cities	Urban Population (x1000)	
	Year 1980	Year 2000
(I) Mature National Development Centers:		
1) Jabotabek Central City: DKI Jakarta	6,072	12,009
Major Sub-centers:		
Bogor	545	2,252
Bekasi	144	905
Tangerang	97	609
Depok	127	794
Cibinong/Citeureup	88	432
2) Bandung Raya Central City: Bandung	1,795	3,367
Major Sub-centers:		
Cimahi	(Included with Bandung)	
Ciparay	67	176
Majalaya	87	174
(II) Emerging National Development Center		
Central City: Cirebon	266	571
Major Sub-center: Klangenang	64	137
(III) Inter-Regional Development Centers:		
Cilegon/Merak/Serang	144	375
Indramayu	32	69
(IV) Regional Development Centers I:		
Sukabumi	215	462
Tasikmalaya	192	361
Garut	146	313
Karawang	72	155
Purwakarta	62	133
Regional Development Centers II:		
Subang	52	98
Banjar	37	65
Labuan	21	55
Kadipaten	20	37
Rangkasbitung	19	35

Source: NUDS Survey 1985

5.3.2 Economy and Employment

1) General Views

It is appreciated that Indonesia has a population control policy and the most important economic policy at present is to create employment opportunities.

According to the analytical result of the NUDS study, rural development under traditional policies for Indonesia cannot afford to absorb the increasing demand for employment if the limited available/suitable land is all developed. However the urban areas hold the most potential to create job opportunities.

As the study team shares almost the same understanding of the above points it has projected future urban analysis based on the NUDS study, but has modified the NUDS projections where required to fit to the latest population data of the 1985 intermediate census.

It is a salient characteristic in Indonesia that tertiary sector employment in the urban area, and primary sector employment in the rural area account for high proportions of their respective total employment figures; also manufacturing employment in both urban and rural areas occupy quite small proportions.

This is because the intermediate production sector remains poorly developed in the context of industrial input-output relationship. However industrialization policies will have to succeed in the long term to provide the background support to agricultural intensification schemes. Furthermore it is assumed that industrialization will grow in the urban area and that urbanization will expand extensively so as to absorb the industrial employment and other related activities and facilities.

2) Regional Context

The project study covers four (4) of the seven (7) development regions in West Java, but the project Tollway only actually falls within two (2) regions, namely Purwasuka and Cirebon regions. These two regions lie between Pemali Comal Development Region in Central Java (to the east) and Bandung Raya/Priatim Development Regions in West Java (to the south).

According to the West Java Structure Plan the development center for Purwasuka Development Region is Cikampek and sub-development centers are Karawang, Purwakarta, Subang and Pamanukan. Cirebon Development Region has its development center in Cirebon and sub-development centers in Kuningan, Kadipaten Jatibarang and Sumber which was incorporated into the sub-development centers, when recently designated as a new capital city of Kab. Cirebon.

Large and medium industries are planned to develop in Cikampek and Jatiluhur of the Purwasuka Development Region, and in Cirebon, Palimanan and Indramayu of the Cirebon Development Region.

The planned development centers and industrial districts mentioned above will function as cores to attract employment and urbanization within the study area.

5.3.3 Inter-Regional Relationship and Transportation

1) General Views

The shift of development weight onto the urban economy means that efficient and rational use of resources must be pursued; this eventually leads to fostering closer links among urban economic zones. Simultaneously these closer links will require a higher level of communication system such as transportation, telephone, mail services etc. in order to effectively connect one region or town to another.

2) Regional Context

The NUDS Study Projects the distribution of development centers at different levels and with differing strengths of linkages among these centers; refer to Fig. 5.3.1.

The figure shows that Cirebon City will be heavily linked inter-regionally with Jabotabek Region, Bandung Raya Region and Pekalonagn Region which includes the cities of Tegal and Pekalongan in Central Java.

Pekalongan and Banyumas regions in the western part of Central Java and these regions, together with Cirebon region in West Java, are located between the defined transportation regions of Jakarta and Semarang, see Figs. 5.3.2 and 5.3.3.

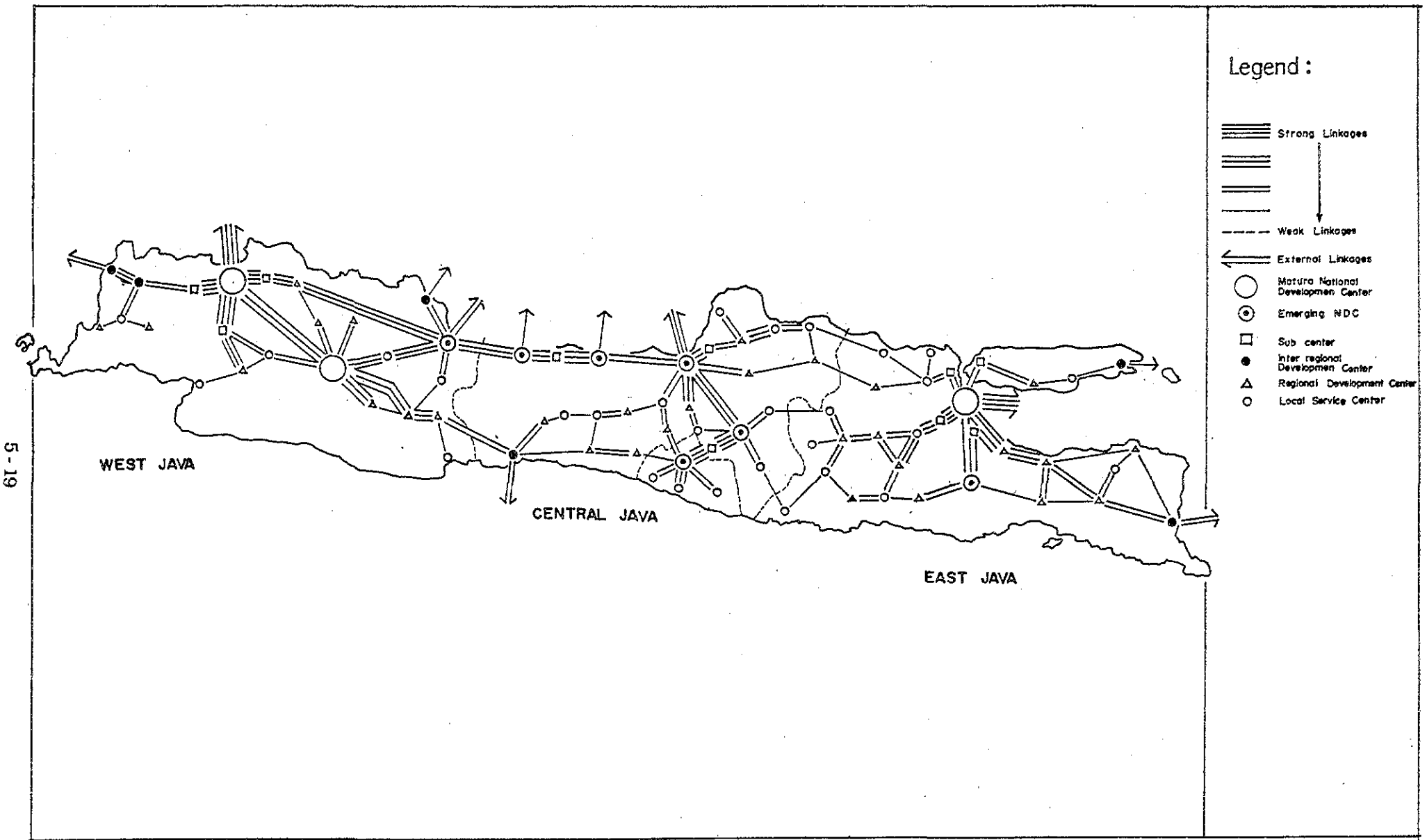


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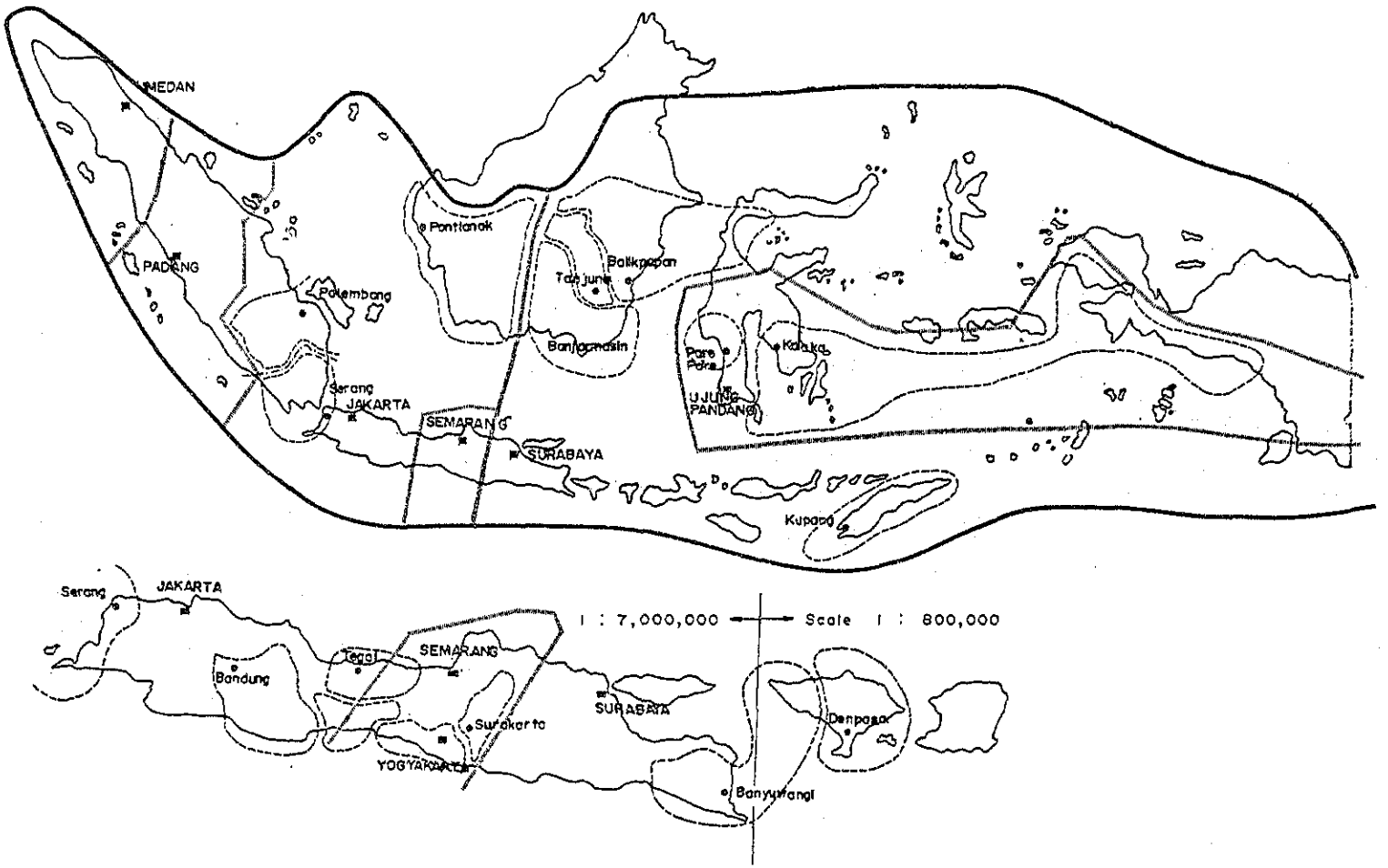
Fig. 5.3.1 Java Urban Systems



Legend :

- Main Regional Boundaries (15 or more Kabupatens)
- Sub Regional Boundaries (5 or more Kabupatens)
- Main Regional Centres
- Sub Regional Centres

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Fig. 5.3.2 Transportation Regions by 1982 OD Surveys

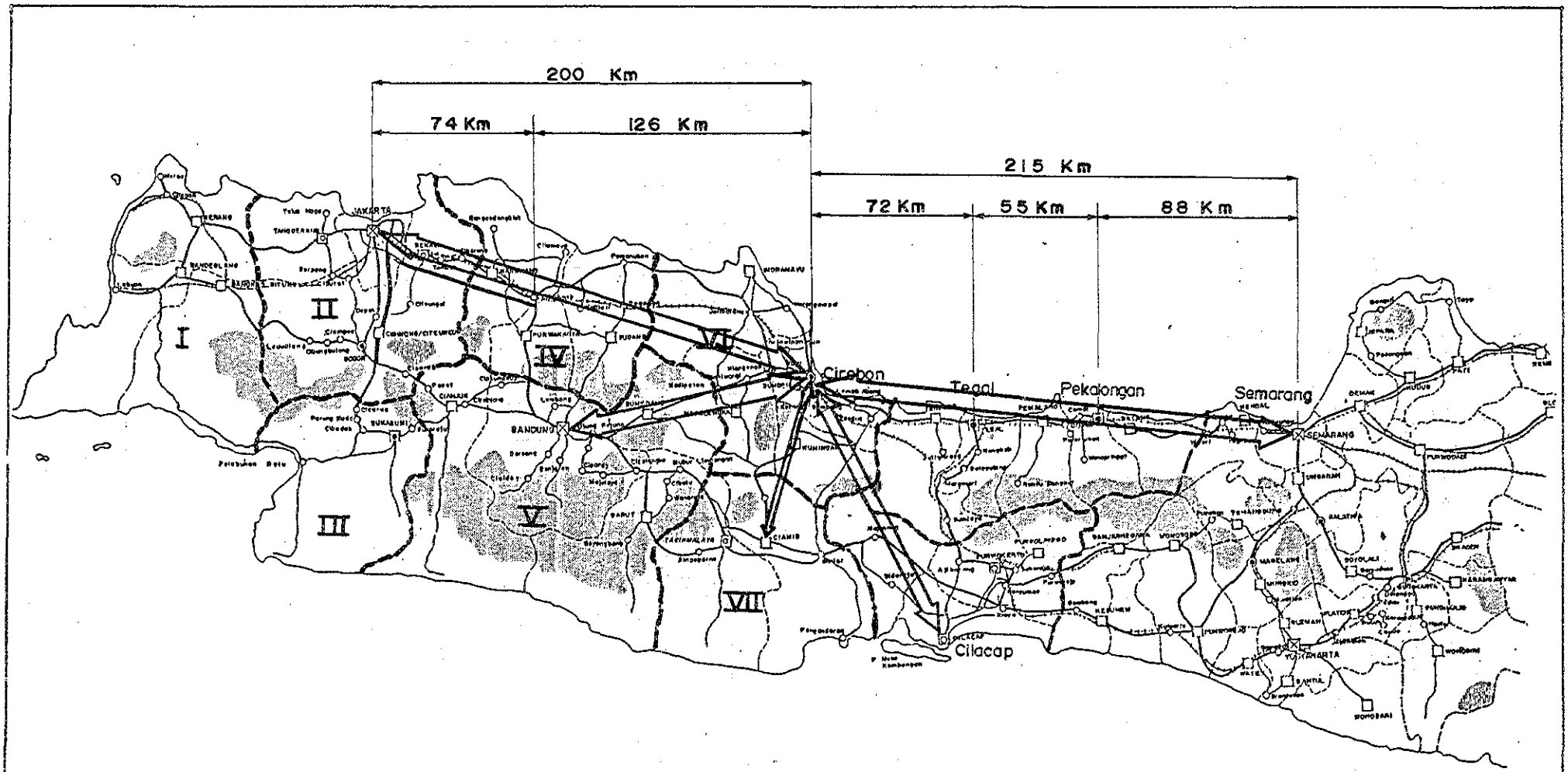

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Fig. 5.3.3 Function of Cirebon City for West Java and Central Java Linkage

The port master plan study for Cirebon (year 1981) designed the port capacity under the assumption that it would function to supplement Jakarta Tg. Priok Port in the future. In addition, Cilacap Port which is located in Banyumas region and faces the Indonesian Sea is planned to function as a supplement to Cirebon Port which faces the Java Sea.

Relationship between the development center and sub-development centers in the respective development regions are presented in Figs. 5.3.4 through 5.3.6.

5.3.4 On-Going Projects

On-going projects related to the study, as of January, 1989, are enumerated by sector as shown in Table 5.3.2.

Table 5.3.2 Project Related On-Going Studies

Project Name	Length (km)	F/S	F/E
I. Roads:			
1) Tangerang-Merak (Jawa Barat)	75	Completed	Underway
2) Surabaya-Cresik (Jawa Timur)	9	Completed	Completed
3) Semarang arteri section C	17	Completed	Completed
4) Cikampek-Padalarang (Jawa Barat)	60	Completed	-
5) Surabaya-Mojokerto (Jawa Timur)	39	Completed	-
6) Semarang-Bawen (Jawa Tengah)	21	PFS*	-
7) Yogyakarta-Solo (Jawa Tengah)	60	PFS	-
8) Cirebon-Tegal (Jawa Tengah)	69	PFS	-
9) Semarang-Batang (Jawa Tengah)	75	PFS	-
10) Cikampek-Cibitung (Jawa Barat) (Widening of JKT-Cikampek Tollway)	47.5	Completed	Completed
II. Sea Road:			
1) Cirebon Port Project	Construction Underway		

*PFS: Pre-feasibility study stage is completed.

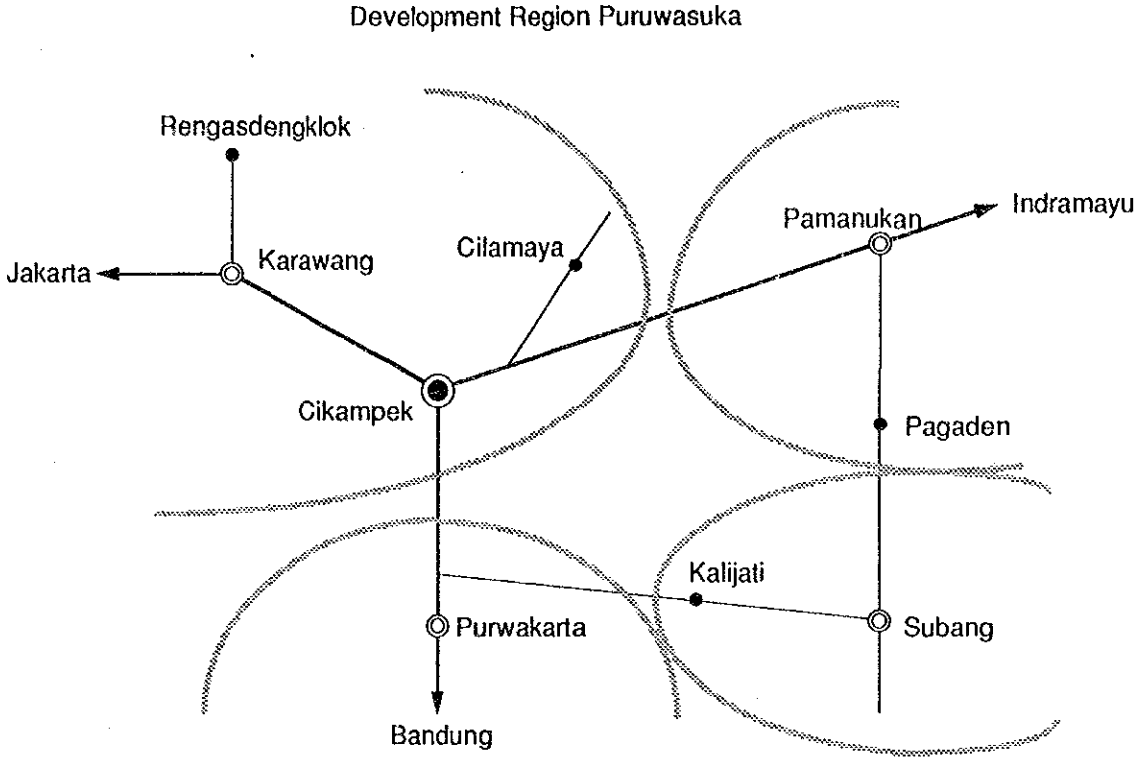

Fig. 5.3.4 Development Centers in Purwasuka Region

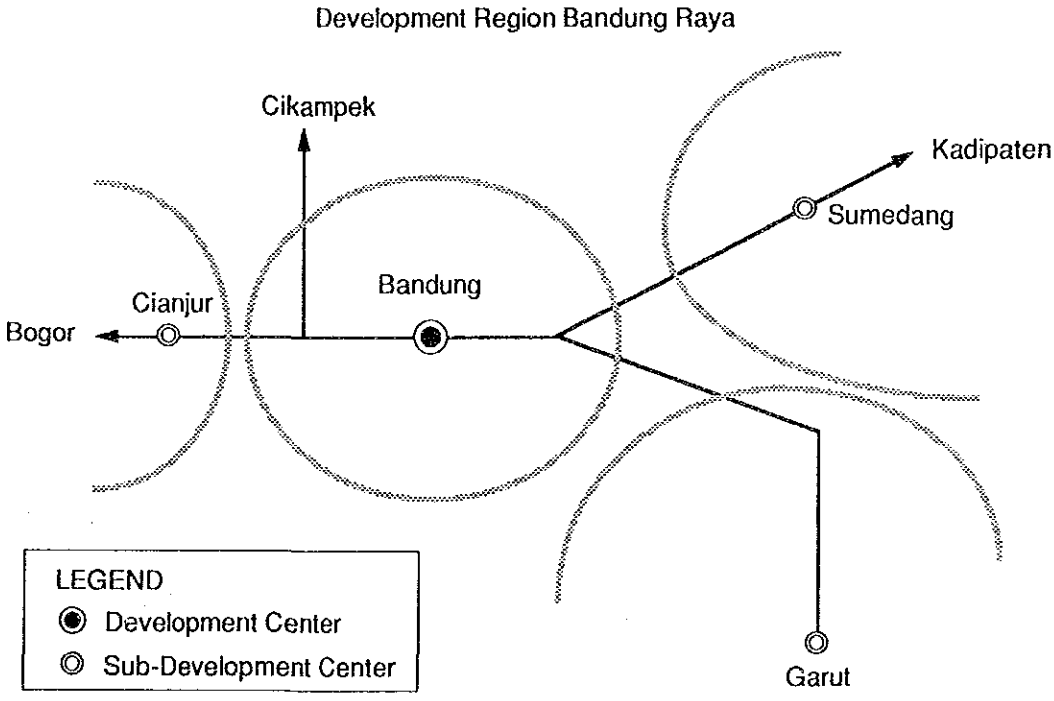

Fig. 5.3.5 Development Centers in Bandung Raya Region

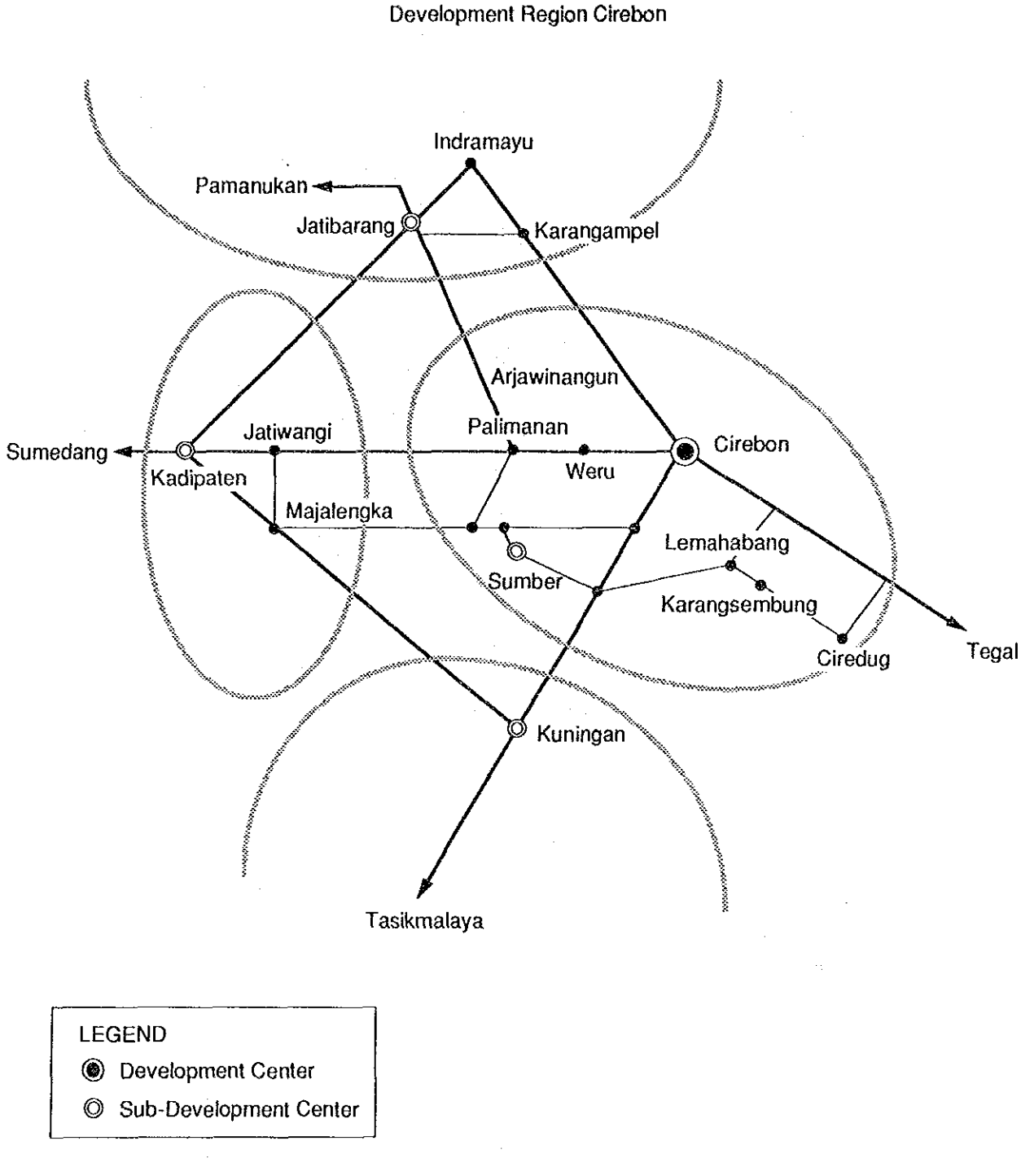

Fig. 5.3.6 Development Centers in Cirebon Region

5.4 Future Development Framework

5.4.1 Population - Urban and Rural

1) Total Population

Future population frameworks for the major islands and the provinces in Java Island are based on the strategically planned projections by NUDS. The project uses NUDS population projections as the main basis for economic and social planning aspects. However, because of differences in various statistical data sources and updating requirements, some modification and revision is carried out before the NUDS figures are applied to the project planning.

a) The future total Indonesian population for the year 2000 is projected by NUDS to be 209,841,000, this is based on the 1980 population census figure. However this projected figure required updating because of new data obtained from "Results of the 1985 Intercensal Population Survey", series SUPAS No. 5 and from the "Statistical Year Book of Indonesia 1987" both published by the Central Bureau of Statistics (CBS). These publications give differing values to the total population of Indonesia for the year 1985, viz. 164,047,000 and 164,630,000 respectively. Therefore the growth rates estimated in the Statistical Year Book of Indonesia 1987 were applied to SUPAS's total population figure in order to project the future population of Indonesia, which resulted in a population of 215,350,000 in the year 2000, refer to Table 5.4.1.

b) NUDS's planning population projections (published in 1985) for Central Java (including Yogyakarta) and East Java provinces are respectively 30,965,000 and 32,505,000 persons for the year 2000; however the current (1988) population numbers for these provinces are estimated to be almost at the level of the year 2000 projections. Thus, NUDS's projections for these provinces are too low to absorb the trend growth in population.

The planned population projections by NUDS is depressing the trend growth of population in Java Island and conversely, encouraging it in Sumatra and other islands.

In consequence, NUDS's planned projected populations in Sumatra, other islands and West Java (including DKI Jakarta) were adopted as proposed. However, those in Central Java and East Java were revised to absorb more population, though their populations have to be controlled so as not to exceed the trend growth and to be in accordance with the modified control figure for the total population of Indonesia for the year 2000. The results are shown in Table 5.4.1.

By adopting the above projected target populations of the islands and provinces for the year 2000, projected target population figures for years 1995, 2005 and 2015 have been interpolated or extrapolated based on the estimated 1988 population and the targeted year 2000 population and then finally adjusted to the total control figure for the population of Indonesia as estimated by the Study Team, refer to Table 5.4.2.

Table 5.4.1 Year 2000 Target Population Revised from NUDS

(million persons)

	1971	1980	1985	1988	NUDS 2000	Revised 2000
Sumatra	20,801 (-)	27,996 (3.36)	32,604 (3.09)	35,700 (3.07)	51,368 (3.08)	51,368 (3.08)
DKI/West Java	26,167 (-)	33,931 (2.93)	38,716 (2.67)	41,876 (2.65)	50,060 (1.50)	50,060 (1.50)
Central Java and Yogyakarta	24,354 (-)	28,117 (1.61)	29,875 (1.22)	30,961 (1.20)	30,965 (0.00)	33,430 (0.62)
East Java	25,508 (-)	29,169 (1.50)	31,262 (1.38)	32,566 (1.37)	32,505 (-0.02)	35,549 (0.75)
Java Total	76,029 (-)	91,217 (2.04)	99,853 (1.83)	105,403 (1.82)	113,530 (0.62)	119,039 (1.02)
Other Islands	21,538 (-)	27,563 (2.78)	31,590 (2.76)	34,267 (2.76)	44,943 (2.29)	44,943 (2.29)
Indonesia	118,368 (-)	146,776 (2.42)	164,047 (2.25)	175,370 (2.25)	209,841 (1.51)	215,350 (1.73)

Notes: 1) Source: "Sensus Pendukuk 1971, Seri D" March 1975, CBS
2) Source: "Hasil Penduduk 1980, Seri S/No. 2" Feb. 1983, CBS
3) Source: "Hasil Survei Penduduk Antar Sensus 1985, Seri/SUPAS No. 5" Jan. 1987
4) Source: Consultant's estimate
5) Growth rate projected by CBS in the "Statistical Year Book of Indonesia, 1987" forms the calculation base.
Figures in ( ) show annual growth rates (%) from the figures in the preceding left side column.

Table 5.4.2 Future Population Framework

(Unit: million persons)

	1988	1995	2005	2015
Sumatra	35,700 (-)	44,728 (3.27)	57,707 (2.58)	69,578 (1.89)
DKI/West Java	41,876 (-)	46,792 (1.60)	53,020 (1.26)	58,088 (0.92)
Central Java and Yogyakarta	30,961 (-)	32,477 (0.69)	34,269 (0.54)	35,637 (0.39)
East Java	32,566 (-)	34,393 (0.78)	36,569 (0.62)	38,241 (0.45)
Java Total	105,403 (-)	113,662 (1.08)	123,662 (0.86)	131,966 (0.64)
Other Islands	34,267 (-)	40,550 (2.43)	49,028 (1.92)	56,344 (1.40)
Indonesia	175,370 (-)	198,940 (1.82)	230,593 (1.49)	257,888 (1.12)

2) Urban and Rural Population

Future urban population projections are also based on NUDS figures for the year 2000. Differences in total population revised figures used by the Study Team and NUDS's figures when applied to Central Java and East Java were assumed to be absorbed within the urban population totals.

The total urban population of Indonesia beyond the year 2000 was estimated to grow along a straight line projection obtained from the urban ratios (urban population divided by total population between the years 1988 and 2000). Similarly the respective regional urban population growth estimations were based on the same straight line projection method but using the respective regional urban ratios. These regional growth readings (for years 1995, 2005 and 2015), taken from the straight lines projection, are then adjusted correspondingly with the estimated Indonesian total urban population figures in order to give actual estimation figures.

Rural population figures were obtained by deducting the urban population from the total population as shown in Table 5.4.3.

Table 5.4.3 Framework of Urban and Rural Population

(Unit: million person)

	1988		1995		2005		2015	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Sumatra	7,575	22,515	10,233	34,495	14,317	43,390	18,526	51,052
DKI/W. Java	16,015	22,143	20,919	25,873	30,623	22,406	39,539	18,558
Central Java & Yogyakarta	6,413	22,754	8,531	23,946	14,636	19,633	19,871	15,766
East Java	6,266	23,449	8,518	25,875	16,584	19,985	23,595	14,646
Java Total	28,694	68,346	37,968	75,694	61,843	162,024	83,005	48,970
Other Islands	5,376	23,070	7,850	32,700	15,465	33,563	22,979	33,365
Indonesia	41,645	113,931	56,051	142,889	91,625	138,977	124,510	133,387

5.4.2 Employment - Primary and Other Sectors

1) Total Employment

Employment is directly related to the population's age structure and the labor force participation rate, which is derived from the economically active population (i.e. total working population and the unemployed) divided by the number of population aged 10 years and over.

The 1985 intercensal population survey estimates the Indonesian population aged 10 years and over to be 73.4%, and which is estimated by CBS to rise to 77.1%, 79.0% and 80.5% in 1995, 2000 and 2005 respectively. The increase in this age population is assumed to further increase beyond 2005 and to reach 83.5% in 2015.

The labor force participation rates in Indonesia are slowly increasing from 51.3% in 1971, 50.0% in 1980 and 53.0% in 1985. The future ratios are assumed to be 54.5%, 56.0% and 57.5% in 1995, 2005 and 2015 respectively.

Future regional employment was estimated by using a straight line change in employment rates (employment divided by population) between 1971 and 1980, and was eventually adjusted to the 'control total' employment figure of Indonesia. The results are presented as shown in Table 5.4.4.

Table 5.4.4 Future Total Employment Framework

(Unit: million persons)

	1988	1995	2005	2015
Sumatra E.R. (%).	13,294 (37.2)	19,262 (43.1)	27,881 (48.3)	35,300 (50.7)
DKI/West Java E.R. (%)	14,526 (34.0)	17,885 (38.2)	21,569 (40.7)	26,250 (45.2)
Central Java & Yogyakarta E.R. (%)	13,756 (43.8)	14,502 (44.7)	15,743 (45.9)	17,016 (47.7)
East Java E.R. (%)	14,639 (45.0)	15,321 (44.5)	16,769 (45.9)	18,292 (47.8)
Java Total E.R. (%)	42,922 (40.7)	47,708 (42.0)	54,081 (43.7)	61,558 (46.6)
Other Islands E.R. (%)	13,713 (40.0)	16,624 (41.0)	21,989 (44.8)	26,960 (47.8)
Indonesia E.R. (%)	69,929 (39.8)	83,594 (42.0)	103,951 (45.1)	123,818 (48.0)

Note: * E.R. = Employment Rate (Employment/Population)

2) Primary Sector Employment

The future employment in 2000 is also projected by NUDS study, in which the employment is divided into the primary sector and other sector.

NUDS study estimates, based on the cultivatable land analysis, that there is no more land in Java to create any additional primary sector employment. This estimation was basically adopted in the current study. Ratios of primary sector employment over the rural population in year 2000 were derived from NUDS figures and were applied to the revised rural populations, other than Java.

The primary sector employment in 2005 was assumed for Sumatra and other Islands to grow at the same rate as obtained between the year 1995 and 2000, but beyond 2005 it was assumed to remain constant.

Consequently, future other sector employment was projected by deducting the primary employment from the previously estimated total employment as shown in Table 5.4.5.

Table 5.4.5 Future Framework of Primary and Other Sector Employment

(x 1000 person)

	1988		1995		2005		2015	
	Primary	Other	Primary	Other	Primary	Other	Primary	Other
Sumatra	8,214	5,080	12,183	7,079	14,326	13,555	14,326	20,974
DKI/W. Java	4,593	9,932	4,593	13,292	4,593	16,976	4,593	21,657
Central Java & Yogyakarta	6,546	7,210	6,546	7,956	6,546	9,197	6,546	10,470
East Java	6,706	7,933	6,706	8,615	6,706	10,063	6,706	11,586
Java Total	17,845	25,075	17,845	29,863	17,845	36,236	17,845	43,713
Other Islands	7,132	6,583	9,340	7,284	9,058	12,931	9,058	17,902
Indonesia	33,191	36,738	39,368	44,226	41,229	62,722	41,229	82,589

5.4.3 Vehicle Ownership

In order to estimate future total traffic demand the future growth rate of vehicle ownership was employed, because the growth rate in vehicle ownership during 1982/1988 indicated nearly the same growth rate as the average traffic volumes during the same period.

The existing ownership level in Java is quite low compared to other countries. A regression analysis was made using such socio-economic variables as population, per capita income, GRDP (Gross Regional Domestic Product) as an explanatory variable, and the number of registered vehicles and ownership rates (registered vehicles per 1000 population) as an independent variable.

As a consequence, the following regression model was adopted and the future vehicle ownership in Java was estimated as shown in Table 5.4.6.

Curve Formula: $Y = a \cdot X + b$

where, Y = Vehicles per 1000 population
X = Per Capita GRDP

Vehicle Type	Parameters		Corelation Co-efficient (r)
	a	b	
Passenger Car	0.086474	-2.86885	0.993
Bus	0.020982	-0.96438	0.947
Truck	0.068185	-3.10717	0.996

Table 5.4.6 Estimated Future Vehicle Ownership in Java

Veh. Type	1988		1995		2005		2015
Passenger Car	927,800		1,363,900		2,399,000		4,117,300
(% p.a.)		(5.7)		(5.8)		(5.6)	
Bus	210,900		295,500		544,100		963,400
(% p.a.)		(4.9)		(6.3)		(5.9)	
Truck	643,100		977,500		1,793,100		3,140,800
(% p.a.)		(6.2)		(6.3)		(5.8)	
Total	1,781,800		2,636,900		4,736,200		8,221,500
(% p.a.)		(5.8)		(6.0)		(5.7)	
Ownership Rate (Veh./1000 pop.)	16.9		23.2		38.3		62.3

5.5 Zonal Planning Parameters

5.5.1 Population - Urban and Rural

1) Total Population

a) West Java Province and DKI Jakarta

The West Java Government estimates future population, by Kabupaten, from 1989 to 1995. These estimated population growth rates for the respective Kabupatens were reviewed/adopted and then adjusted to the previously determined future population framework of West Java.

In the above estimated process, the authorized population framework of Jakarta and Botabek region in the year 2005 (Jabotabek Structure Plan) was taken into account.

As a basis to estimate future traffic demand, several Kabupatens in West Java are sub-divided into smaller zones and the remaining Kabupatens are consolidated to form larger zones.

Future population of the smaller zones was obtained by applying the zonal population growth rates during 1980/1988 into the future and the resulting preliminary figures were adjusted to accord with the previously determined future Kabupaten population.

b) Central Java (including Yogyakarta Province) and East Java

Zonal population growth rates obtained from 1980 and 1988 figures were applied to the future years and the resulting preliminary estimates were adjusted eventually to the future frameworks of Central Java and East Java populations.

2) Urban Population

NUDS study predicts a future distribution of urban population in year 2000 based on their urban development strategy. This is broken down to Kabupaten levels throughout Indonesia. Accordingly, the future zonal urban population used for traffic demand forecast adopted the NUDS's urban populations and consolidated them into the traffic zones.

Several Kabupaten in West Java Province are further divided into smaller traffic zones. Therefore, the total increment of the Kabupaten's urban population was distributed proportionally to the respective increment of each zonal population.

After the above estimation process, fluctuations of zonal urbanization rates in future target years are checked in order to avoid obvious unnatural urban growth and to control the excessive urban population increase around such large metropolitan cities as Jakarta and Bandung.

The urbanization rates in Bogor and Bandung regions, which include both Kotamadya and Kabupaten, were assumed not to exceed 80% by the year 2015, and those in Tangerang and Bekasi not to exceed 60% by the year 2015.

Zonal rural populations were calculated by deducting the zonal urban population from the total population.

5.5.2 Employment - Primary and Other Sectors

1) Total Employment

a) Rural and Urban Employment Framework

Employment ratios in urban and rural areas are generally different, because of differences in their age structures, labor force participation rates of women and the elderly.

Taking this into account, the urban and rural employment were estimated separately.

According to the NUDS study, a ratio of rural employment against primary sector is estimated to increase by 0.4% per annum. Based on this rate, a future rural employment of the framework region was estimated, and the urban employment of the region was derived from the previously determined regional total employment as shown in Table 5.5.2.

b) Zonal Urban and Rural Employment

By assuming that the 1980 employment rates in the urban and rural areas of each Kabupaten remain constant for the future, the future urban and rural employment by Kabupaten were derived and the results adjusted to fit the regional employment framework.

For traffic zones smaller than Kabupaten, the Kabupaten's urban and rural employment rates were applied.

For traffic zones larger than Kabupaten, the estimated Kabupaten's urban or rural employment rates were consolidated to form the relevant traffic zone.

2) Primary and Other Sectors Employment

Zonal primary sector employment was estimated by dividing the regional framework of primary employment proportionally to the previously estimated zonal rural employment population.

Consequently, zonal other sector employment was derived from the zonal total employment, which was a total of zonal urban and rural employment.

CHAPTER 6. TRAFFIC DEMAND PROJECTION

CHAPTER 6. TRAFFIC DEMAND PROJECTION

6.1 Present Vehicle OD Matrix

6.1.1 Methodology

The 1982 nation-wide traffic origin-destination (OD) survey results were employed in order to utilize the derived traffic distribution pattern that was unobtainable from the traffic surveys conducted in 1988 by the Study Team, which mainly covered the direct influence area of the project tollway.

The 1988 OD matrix was estimated according to the flow chart diagram shown in Fig. 6.1.1.

The main procedure to estimate future traffic volume on the project tollway is as follows:

1) Up-dated and Consolidated Nation-wide OD Matrix

   The matrix is based on 1982 National OD Matrix, 1988 Road-side OD survey and Socio-economic data in 1982 and 1988.

2) Future Traffic OD Matrix

   The analysis is conducted using the estimated 1988 OD matrix, other traffic data and socio-economic data. Major aspects in this stage are to analyze the total traffic demand, zonal traffic generation/attraction models and traffic distribution modes.

3) Tollway Diversion Model

   A diversion model to separate tollway users from the total road users is estimated based on the 1988 traffic survey result.

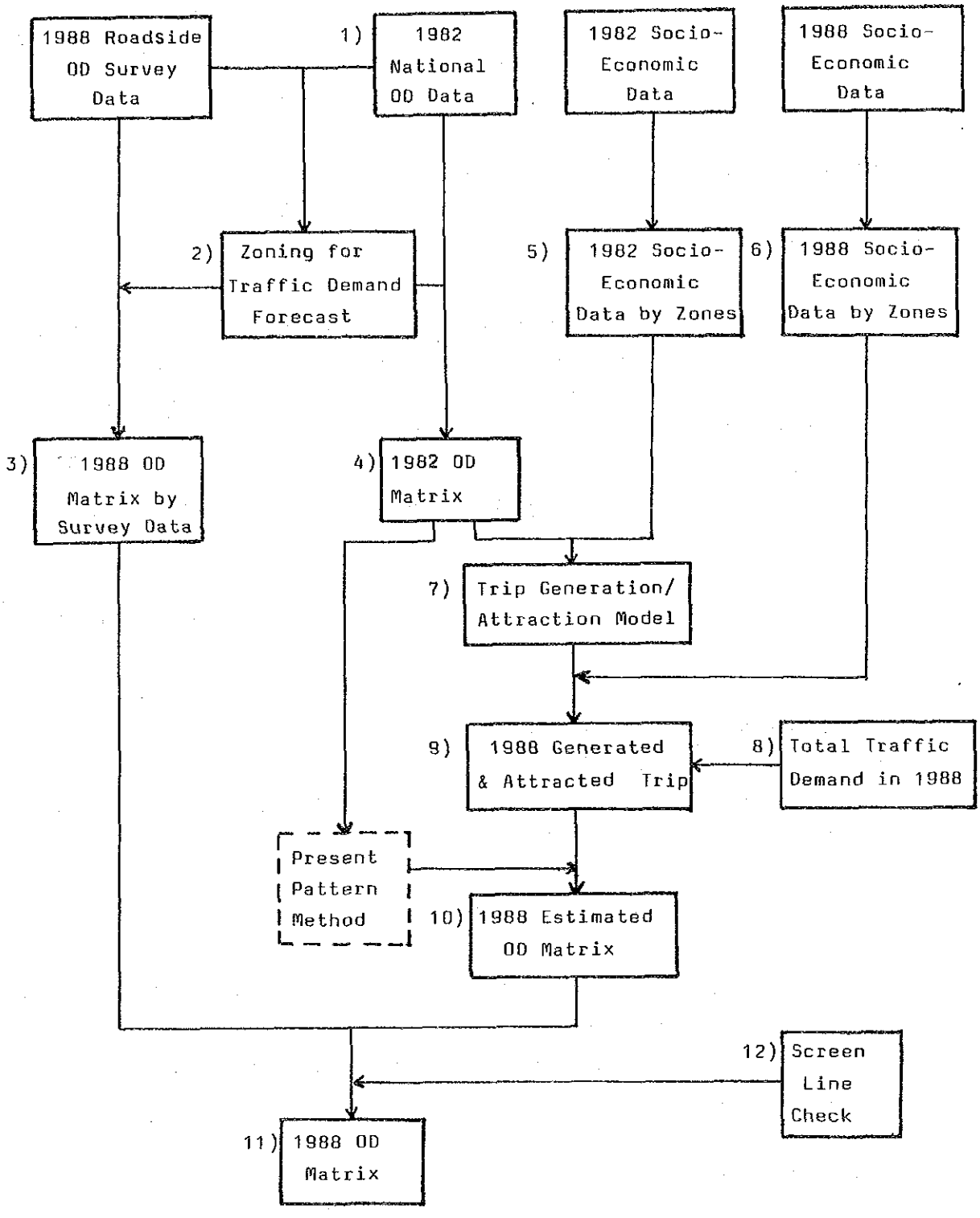

Fig. 6.1.1 Flow Chart to Estimate 1988 OD Matrix

4) Traffic Assignment on Road Network

The future road network and its conditions are determined and on which basis the estimated future OD matrix (Traffic) is assigned and the future link traffic on the project tollway is derived.

A more detailed explanation about the estimation method is presented in the sections below.

6.1.2 Review of 1982 National Origin-Destination Matrix

Note: The numbering of the sub-sections 1) through 12) correspond to the data box numbers of the Flow Chart to Estimate 1988 OD Matrix shown at Fig. 6.1.1.

1) 1982 National OD Data

Traffic OD data of the 1982 National Survey was obtained from the computer master file kept by Bina Marga. It is stored by different vehicle types namely sedan, mini-bus, bus, pick-up truck, small truck and large truck.

2) Zoning for Traffic Demand Forecast

Traffic zones are determined depending upon analytical purposes. These are therefore developed into three different zoning systems.

The first is those applied to the 1982 National OD data and the address coding for the 1989 roadside OD survey results. This amounted to 130 zones as shown in Figs. 6.1.2 (1) and (2), and are referred as Survey Zones.

The second is zones applied to the traffic demand analysis and consists of 55 zones which result from consolidating into larger zones the survey zones of Central Java, East Java and other remote areas from the project as shown in Figs. 6.1.3 (1) and (2). These zones are referred as OD Analysis Zones.

The third is zones specially designed for the analysis of tollway diversion model. Therefore, this zoning was made smaller in areas most likely generating tollway users, which usually lie in areas adjacent to the tollway ramps. Eventually, the

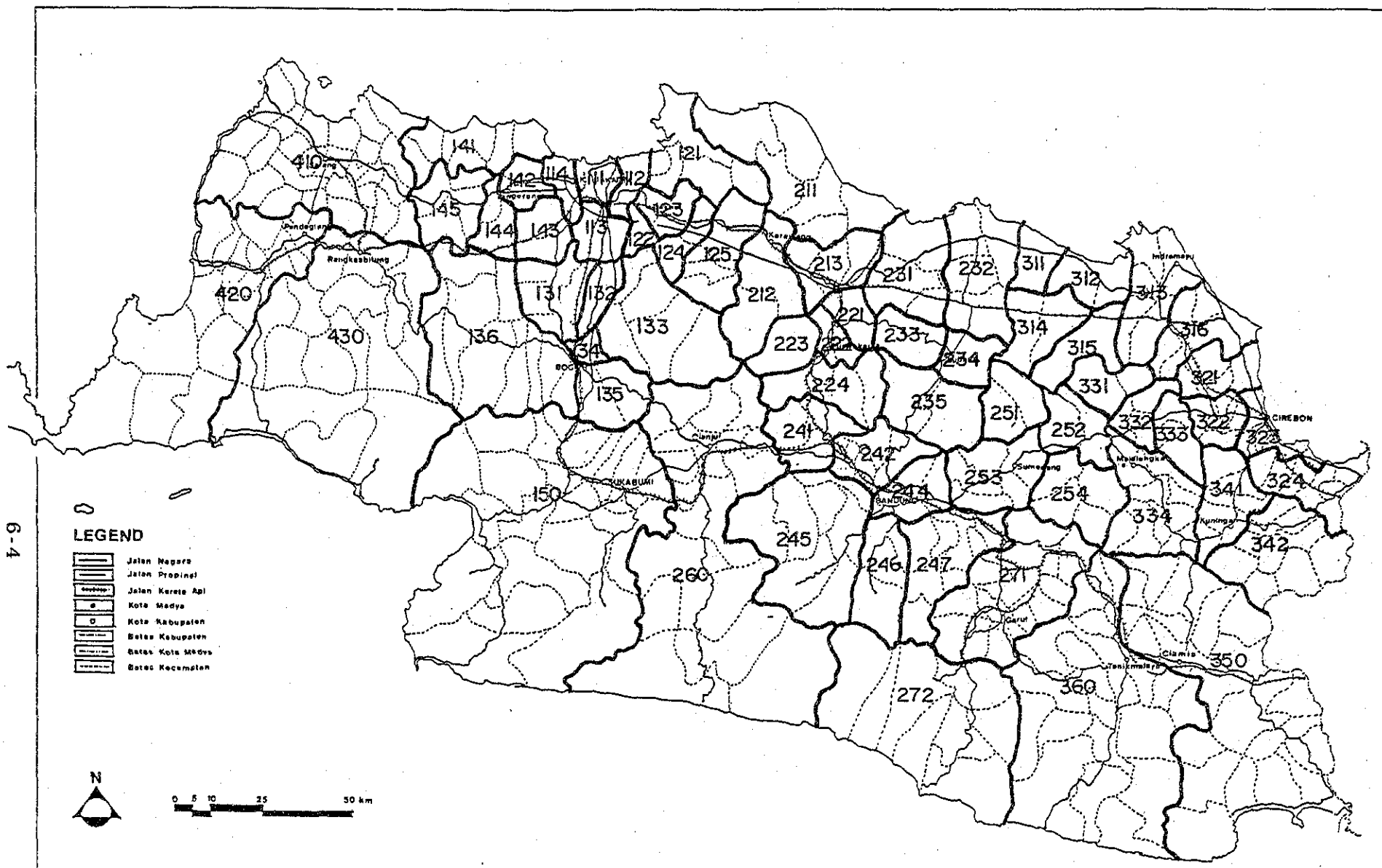

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Fig. 6.1.2 (1) Survey Zones (1)

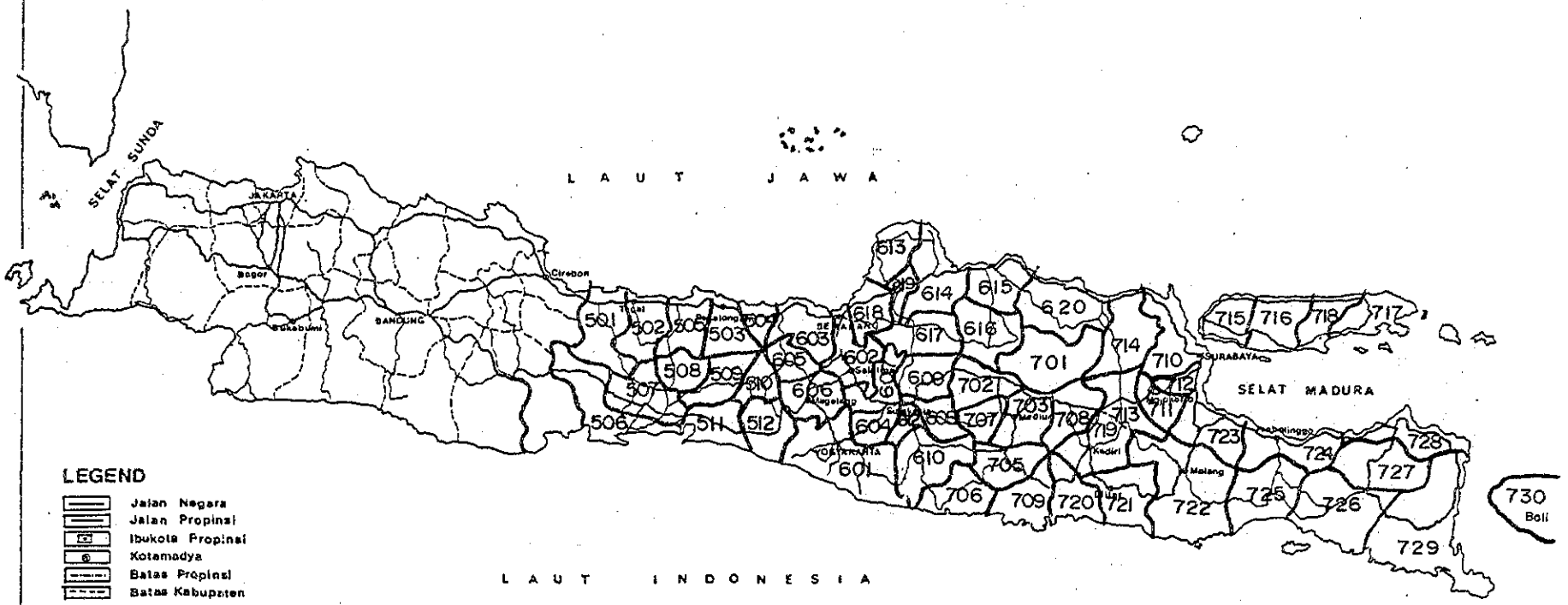

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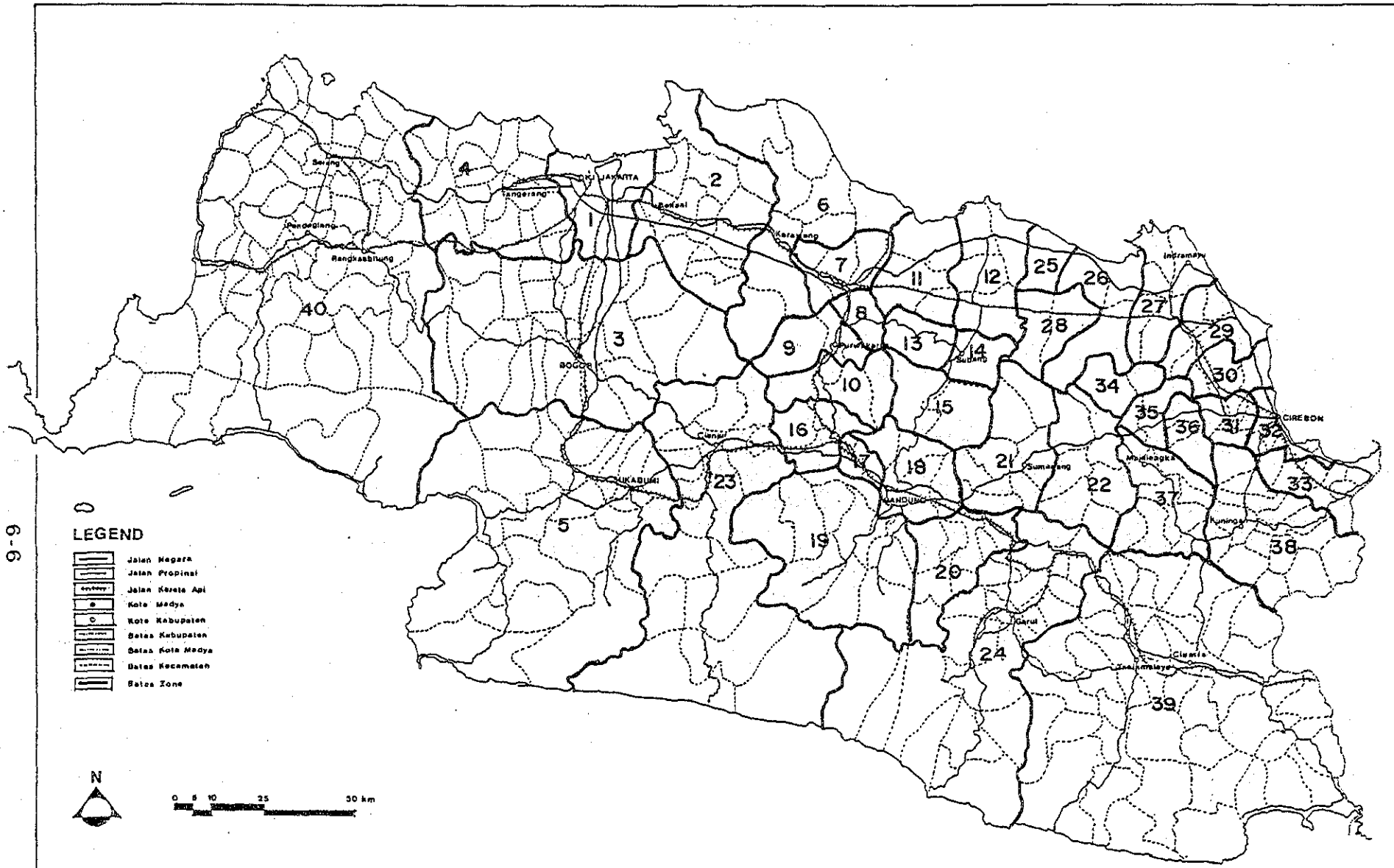
Fig. 6.1.2 (2) Survey Zones (2)



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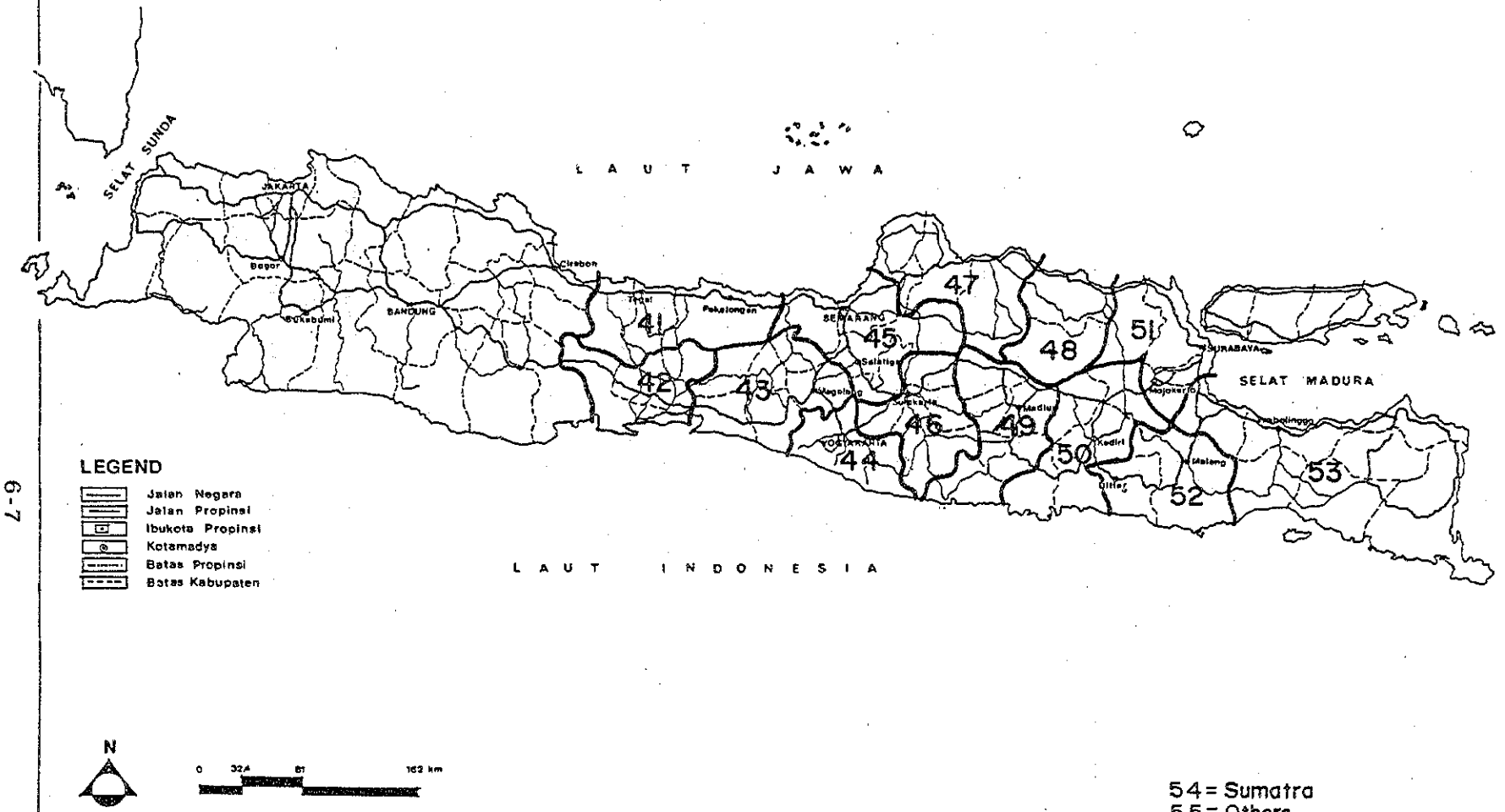
Feasibility Study on Cikampek – Cirebon Tollway Project

Fig. 6.1.3 (1) OD Analysis Zones (1)



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Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 6.1.3 (2) OD Analysis Zones (2)

number of zones used for this analysis amounted to 48 as shown in Figs. 6.1.4 (1) and (2). These zones are referred as Diversion Analysis Zones.

3) Estimation of 1988 OD Matrix for Project Area

Traffic OD data obtained from the roadside interview survey by the Study Team were compiled for every survey location. The survey locations were selected to capture most of the likely users of the project tollway. Origin and destination addresses of the trip were identified by the survey zones and accumulated for the respective survey locations. Subsequently, the derived traffic movement between a particular zone pair (OD traffic) was consolidated to the OD analysis zones.

In order to avoid double counting of the traffic at different survey locations, every box of the OD matrix was given a unique reference for the specifically selected survey location(s).

The survey locations mainly cover the project area, so that the intending OD Matrix is not completed, i.e. all the matrix boxes, particularly outside the project area, are not filled in by the 1988 team survey data.

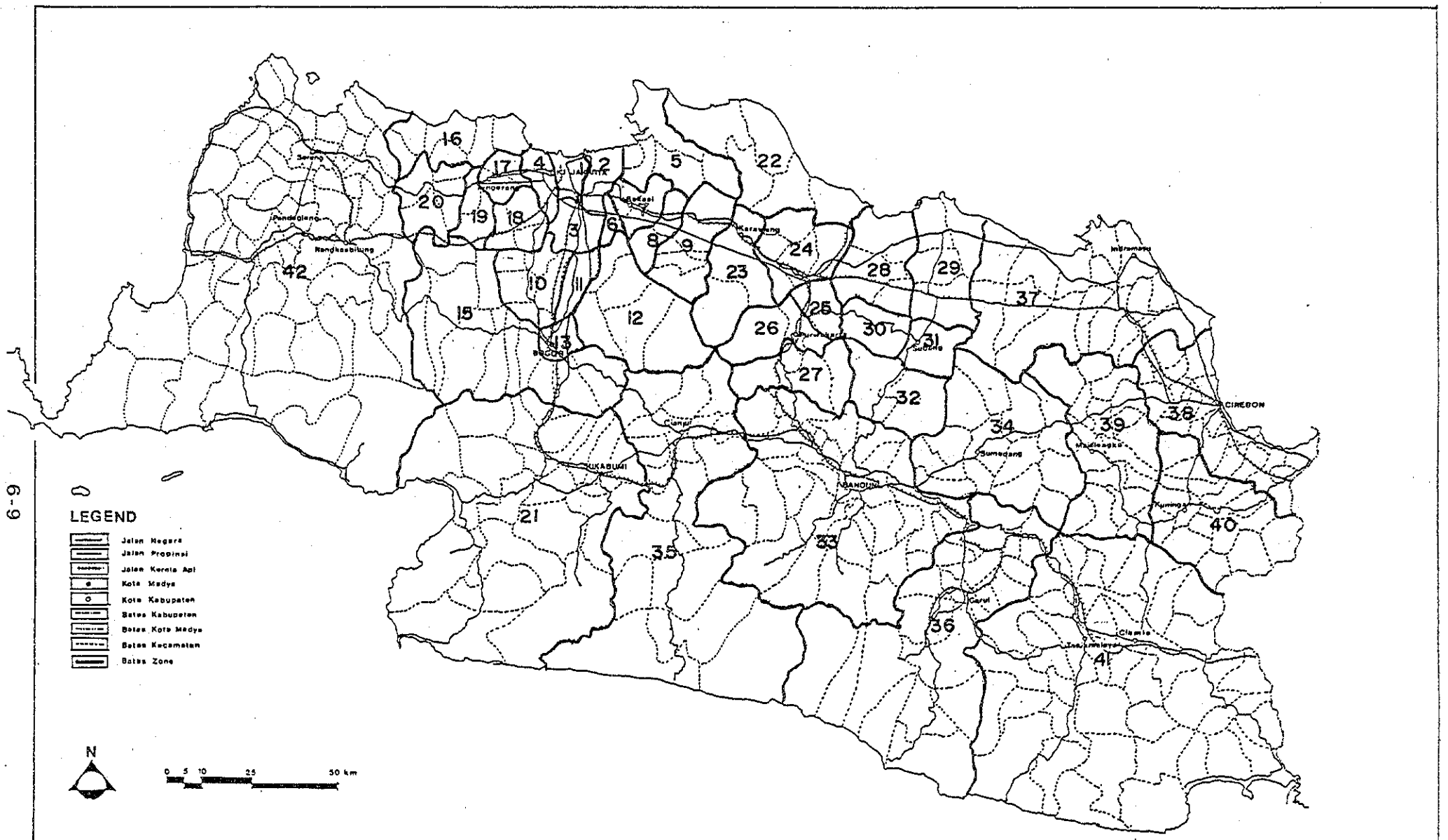
4) 1982 National OD Matrix

This OD matrix covers the whole of Indonesia and most of the inter-city traffic flows in Indonesia. In order to supplement the previously estimated 1988 OD matrix, the 1982 OD matrix was compiled to match the OD analysis zones, the desire lines of which are diagrammatically shown in Fig. 6.1.5.

6.1.3 Estimated 1988 Origin-Destination Matrix

Note: Sub-section numbers are continued in order to correspond with Flow Chart Box numbering as in Fig. 6.1.1.

5), 6) Socio-economic data in 1982 and 1988 were estimated for the OD analysis zones, based on the existing statistical data. The data include zonal population (urban and rural) and employment (primary industrial sector and other industrial sector).



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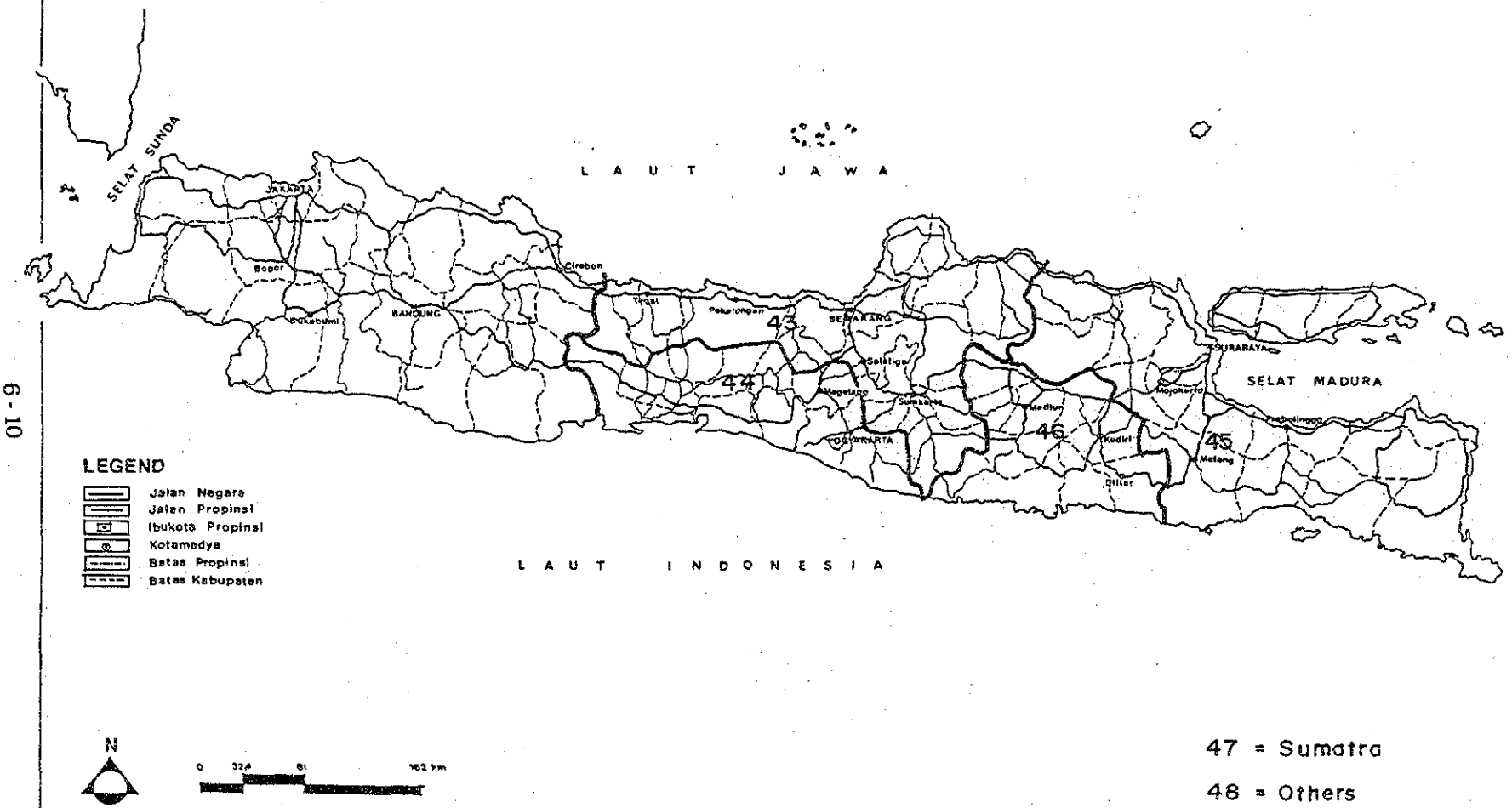
Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 6.1.4 (1) Diversion Analysis Zones (1)



Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 6.1.4 (2) Diversion Analysis Zones (2)

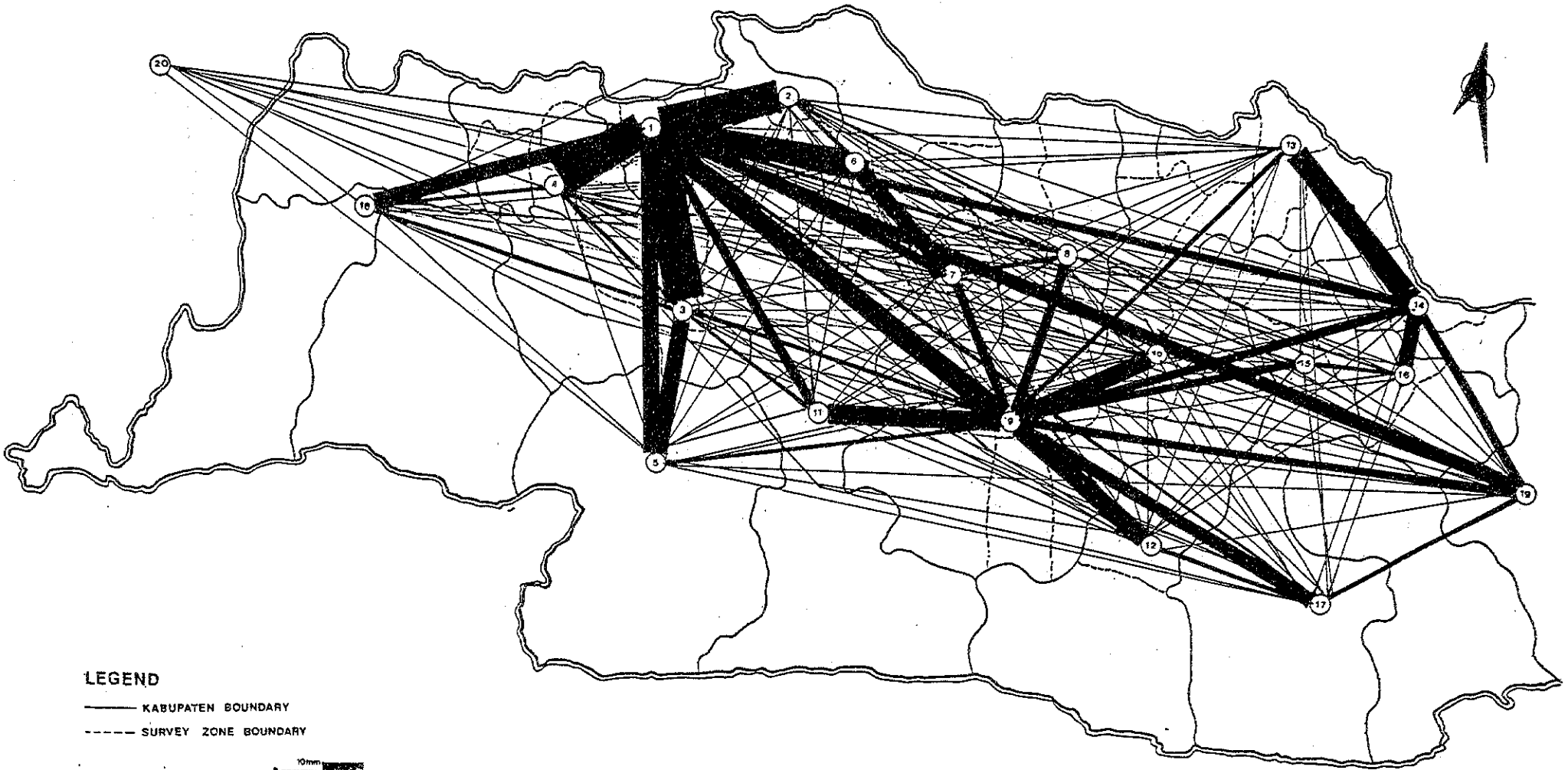


Fig. 6.1.5 1982 Desired Traffic Lines

The vehicle ownership by type was also analyzed to find relationships between its growth and other socio-economic growth parameters by region.

7) Trip Generation/Attraction Model

Based on the 1982 zonal traffic data and zonal 1982 socio-economic data, a zonal trip generation/attraction model was estimated and resulted as shown in Table 6.1.1.

Table 6.1.1 Traffic Generation/Attraction Model by 1982 OD Matrix

Type of Vehicle	Estimated Equation	Correlation Coefficient (r^2)
Passenger Car	Ti = 0.004383 x UP + 872.4236	0.9679
Pick-up truck	Ti = 0.001436 x UP + 1096.082	0.8977
Truck	Ti = 0.002919 x UP + 0.000304 x STE + 1809.949	0.9301
Bus	Ti = 0.000671 x UP + 0.000658 x STE - 9.4205	0.9274

Ti : Generated and Attracted Trips by Zone
UP : Urban Population by Zone
STE : Secondary and Tertiary Sector Employment

8) Total Traffic Demand in 1988

A comparison was made between the growth rate of vehicle ownership during 1982-1988 and that of traffic volumes counted by survey during the same period. Both have eventually indicated a similar growth rate as shown below:

Vehicle ownership growth rate,

1982 over 1988 = x 1.60 (+ 8.1% p.a.)

Traffic volume growth rate,

1982 over 1988 = x 1.58 (+ 7.9% p.a.)

Therefore, it was decided to employ the growth rate of vehicle ownership during 1982/1988 to estimate the 'control figure' of the total traffic demand in 1988.

9) 1988 Zonal Trip Generation/Attraction

This was estimated using the trip generation/attraction model and the 1988 zonal socio-economic parameters. The derived zonal trips were finally adjusted to coincide with the "control figure" of 1988 total traffic demand which was obtained from the previous item 8).

10) Up-dating of 1982 National OD Matrix

The 1982 national OD matrix was up-dated by using the result of the above item 9) and a present pattern method and derived from the nation-wide 1988 OD matrix.

11) Establishment of 1988 OD Matrix

The Study Team's up-dated 1988 national OD matrix could cover overall traffic movements in Java particularly, but not so precisely in the project area. This is because its original 1982 OD matrix contains fewer traffic data within Kabupaten zones of the study area.

The estimated 1988 OD matrix (see item 3)) for the project area explains in more detail the traffic flow within the Kabupaten of the project area, because OD traffic data within the Kabupaten can be captured by smaller zones inside the Kabupaten. Conversely, it could not cover the traffic movement generated and attracted outside the project area.

Accordingly, the above two 1988 OD matrices were combined so as to supplement each other and thus provide the basis of a more complete final OD matrix.

12) Screen Line Check

The finally estimated 1988 OD matrix was checked with the 1988 traffic count data on principal screen lines. The estimated traffic volumes passing through these screen lines were compared with the corresponding actual traffic volumes and the results were evaluated to be acceptable as shown in Fig. 6.1.6.

Desired traffic lines resulting from the selected survey locations are diagrammatically shown in Fig. 6.1.7.

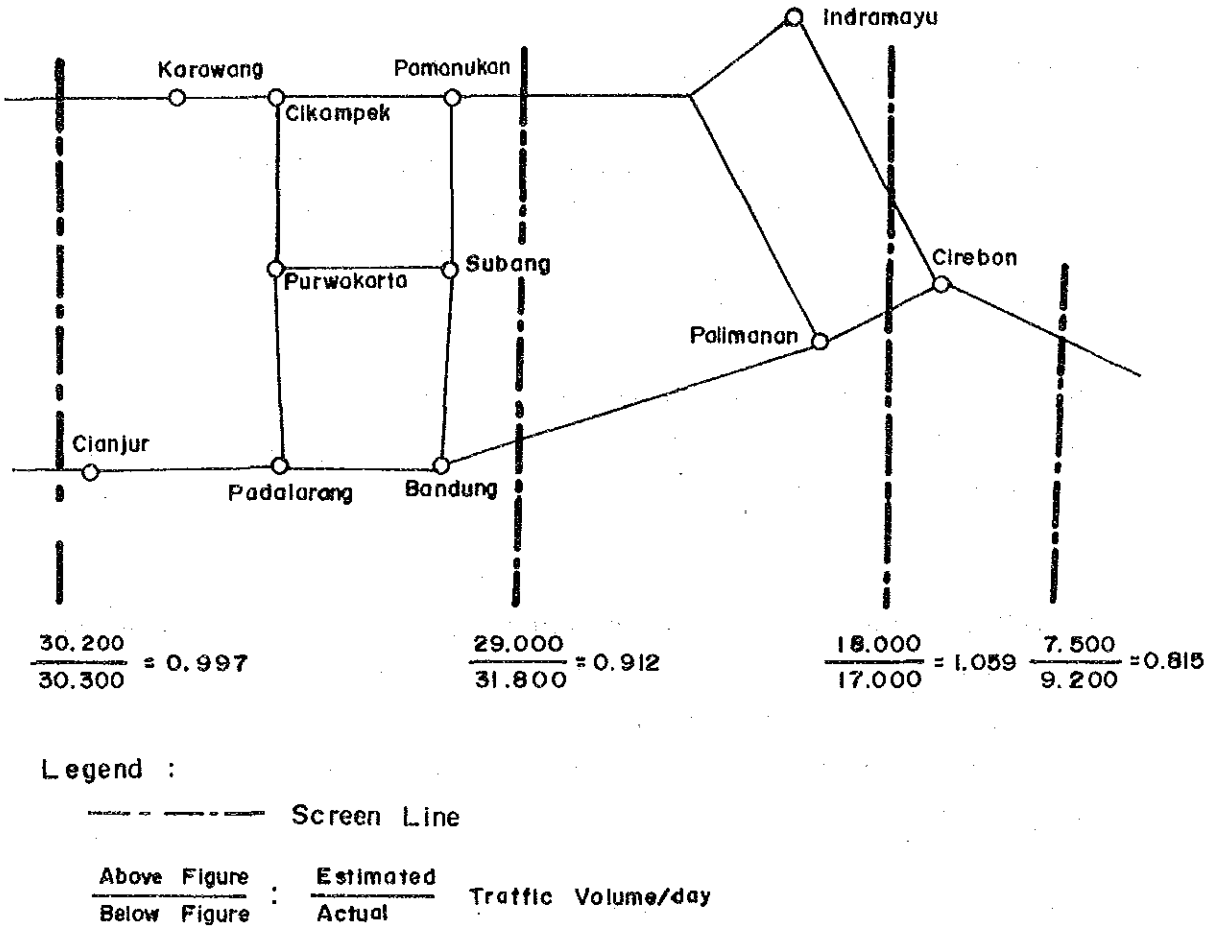


Fig. 6.1.6 Results of Screen Line Check

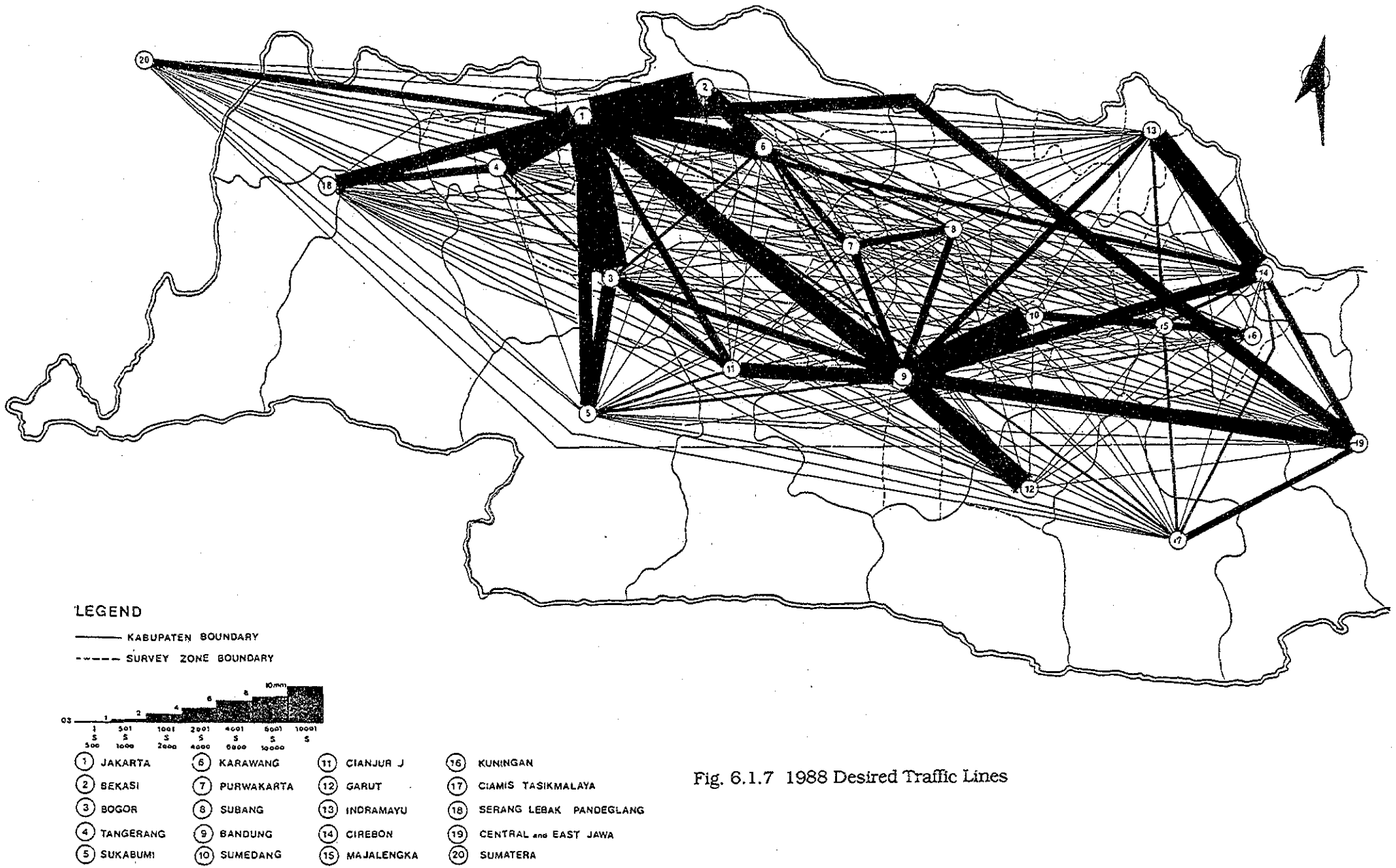


Fig. 6.1.7 1988 Desired Traffic Lines

6.2 Tollway Diversion Model

6.2.1 Methodology

It is generally accepted that there are more than one criteria when a driver chooses a route among possible alternatives to his destination. The criteria will include such factors as travel time, travel distance, tollway tariff, vehicle operating costs, safety, comfort, roadside landuses/facilities, travel purpose, area characteristics and traffic conditions.

Among the above factors it is possible to quantify some but not others. Thus, diversion model building is not just a simple task of incorporating the factors comprehensively into the analysis of the tollway traffic diversion. The more that explanatory type factors are employed in the diversion model, then the more impractical is its use.

Widely adopted in diversion model analysis are the factors of travel distance, travel time and tollway tariff. The quality/quantity of available data is also taken into account in addition to the above mentioned factors.

Therefore, models with the above three explanatory factors were examined to find the most suited equation from which to derive a traffic diversion model for the tollway.

The model analysis was conducted according to the flow chart diagram shown in Fig. 6.2.1.

6.2.2 Estimated Diversion Model

1) Diversion Model Formula-1

This model was estimated with the independent variables of difference between travel times through an arterial route and a tollway route, toll rate and vehicles time value as shown below:

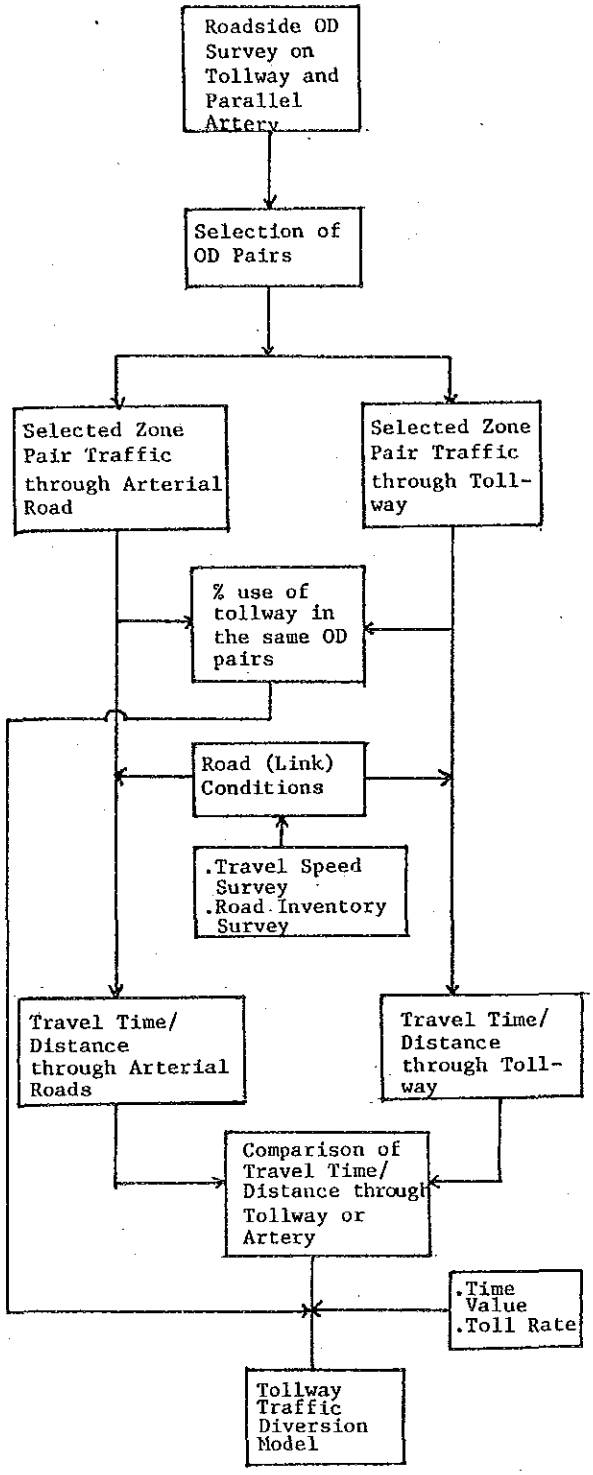


Fig. 6.2.1 Flow Chart for Tollway Diversion Model

$$P = c \cdot \Delta T^{b}$$

$$\log P = a + b \cdot \log \Delta T \qquad (a = \log c)$$

where, P : Tollway diversion rate (%)
A : Travel time through arterial route (min.)
T : Travel time through tollway route (min.)
TR : Toll rate (Rp./vehicle)
TV : Time value of the vehicle (Rp./min.)
a,b,c : Constant parameters
ΔT : A - (T + TR/TV)

Fig. 6.2.2 shows the correlation between the tollway diversion rate and the travel time difference. These are selective data that have more than 30 samples of a particular OD pair traffic. The diagram indicates a relatively scattered pattern of samples.

Therefore, the samples were grouped by a certain range of time difference and the correlation with the diversion rate was obtained as in diagram, Fig. 6.2.3.

Eventually, a diversion model was estimated by using the above preceding selective samples and resulted in the formula below:

Passenger car : $\log P = 1.7638 + 0.10301 \cdot \log \Delta T$
(if $1.0 < \Delta T < 60.0$)
$P = 90.0$ (if $\Delta T > 60.0$)
If $0 < \Delta T < 1.0$, then $\Delta T = 1.0$

Pick-up : $\log P = 1.5964 + 0.11992 \cdot \log \Delta T$
(if $1.0 < \Delta T < 60.0$)
$P = 65.0$ (if $\Delta T > 60.0$)
If $0 < \Delta T < 1.0$, then $\Delta T = 1.0$

Truck : $\log P = 1.4229 + 0.14706 \cdot \log \Delta T$
(if $1.0 < \Delta T < 60.0$)
$P = 50.0$ (if $\Delta T > 60.0$)

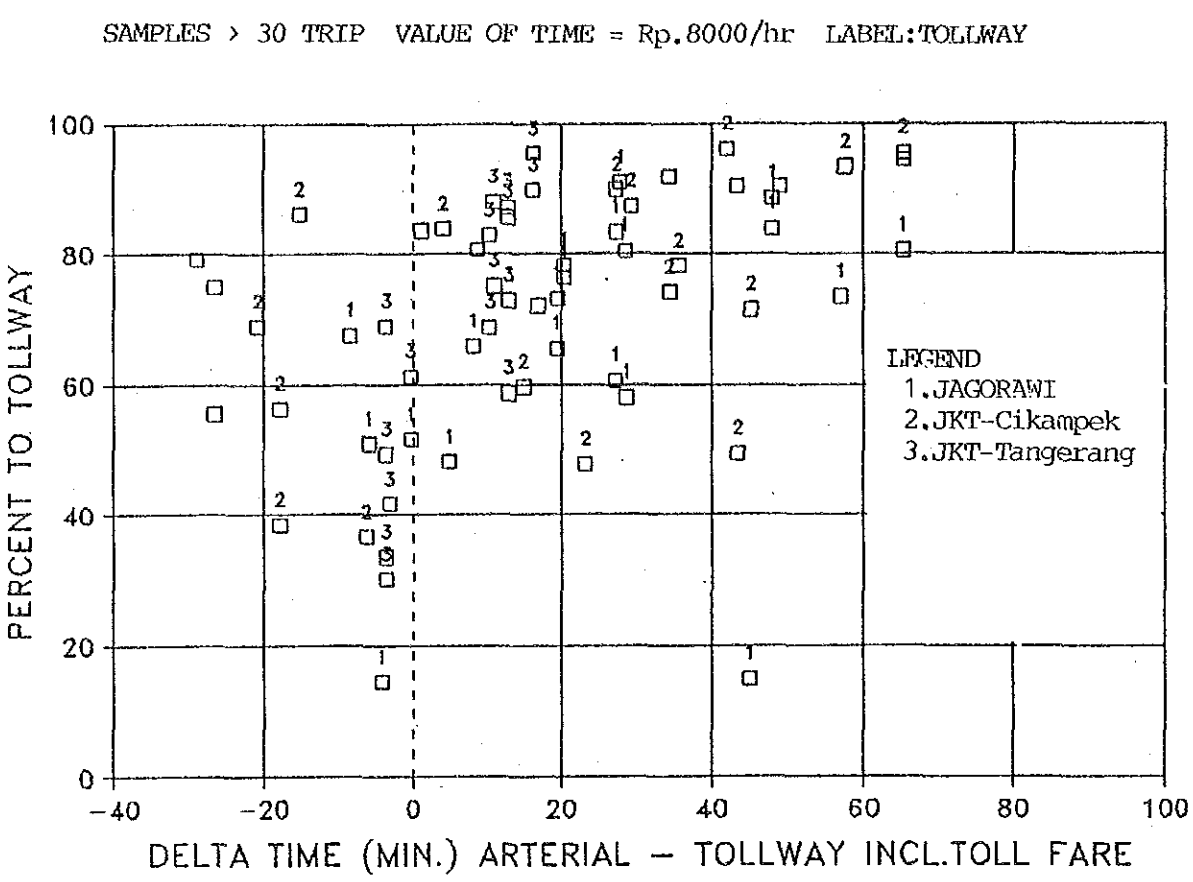


Fig. 6.2.2 Correlation between Diversion Rate and Time Difference

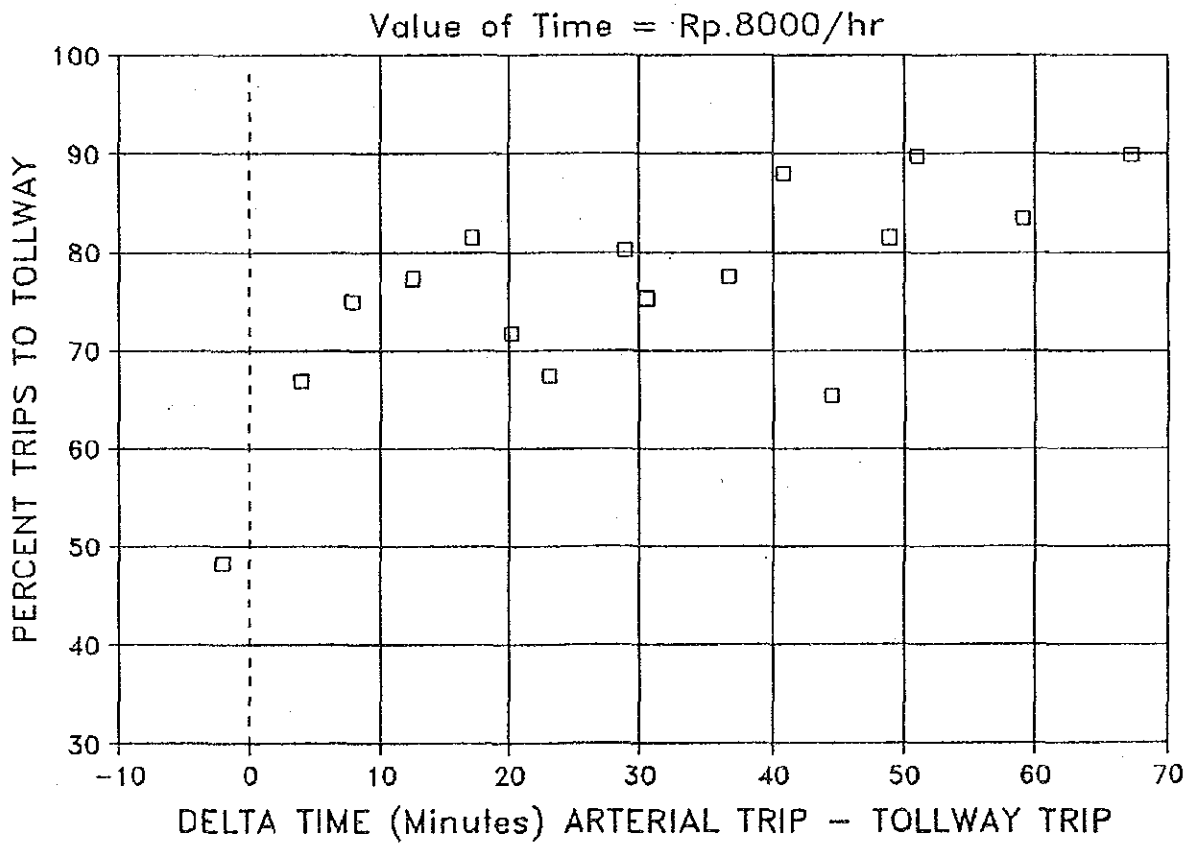


Fig. 6.2.3 Correlation between Diversion Rate (Range Average) and Time Difference (Ranges)

For buses, samples are completely scattered and a good correlation was not obtained. Therefore, an average diversion rate was derived from the samples and found to be 30%.

The estimated diversion curves are presented in Fig. 6.2.4.

2) Diversion Model Formula-2

This model takes into account the factor derived from a toll rate divided by the corresponding travel time difference, i.e. the derived diversion curve implies a distribution for time values of vehicles.

In this model, a shift factor is introduced in order to reflect an increasing willingness to pay for a toll in accordance with a rise in income level.

The model formula was calibrated from the data samples used for the model formula-1, and were derived as follows:

Passenger car : $P = \frac{100}{1 + 2.77992 \times 10^{-5} \times (T/S)^{2.080629}}$ (r^2 : 0.8767)

Pick-up : $P = \frac{90}{1 + 2.20822 \times 10^{-4} \times (T/S)^{1.803121}}$ (r^2 : 0.8460)

Truck : $P = \frac{80}{1 + 2.07866 \times 10^{-5} \times (T/S)^{2.276770}}$ (r^2 : 0.8839)

where, P : Diversion rate (%)
T : Toll rate/Travel time difference (Rp./min.)
S : Shift factor (ratio of per capita GDP/Income of the year in question to that of 1988)
r : Cor. Coefficient

The correlation of diversion rates and toll/travel time difference is shown in Figs. 6.2.5, 6.2.6 and 6.2.7.

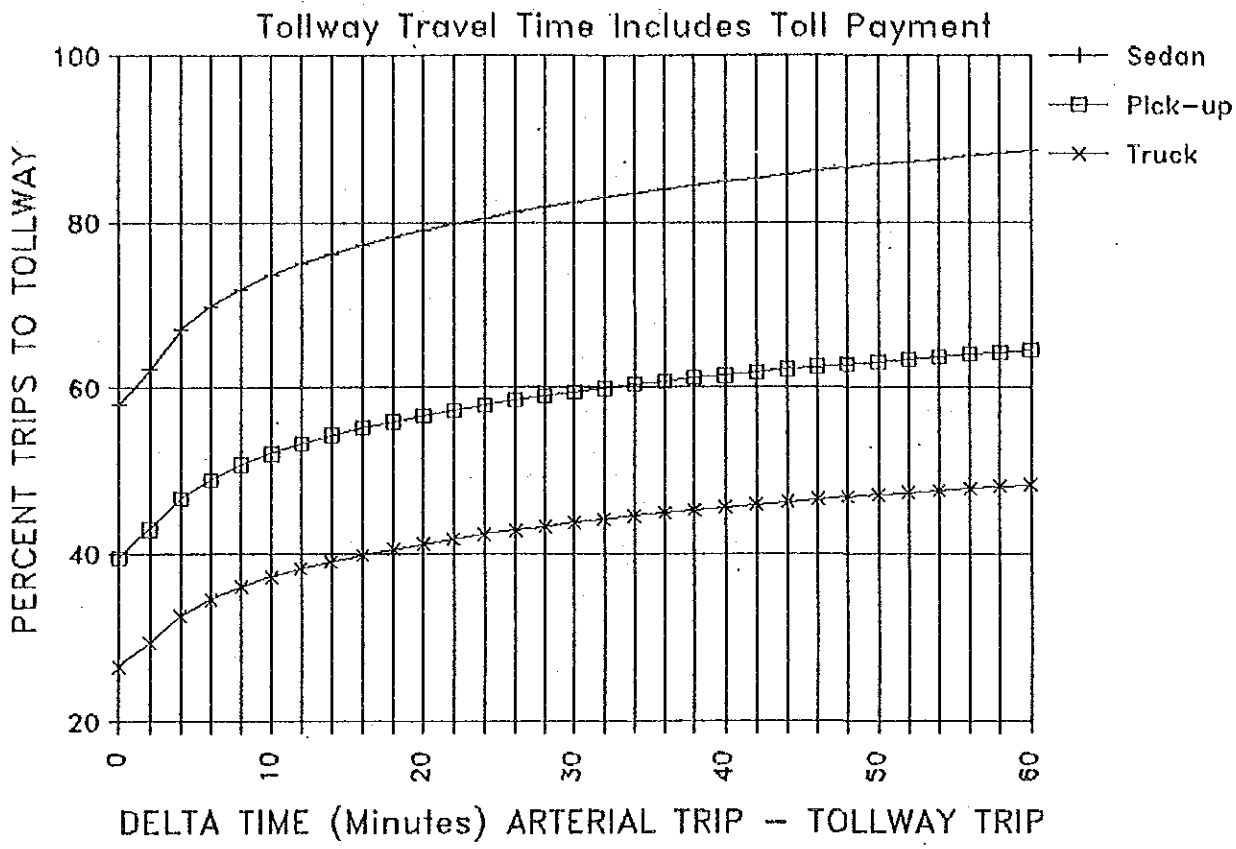


Fig. 6.2.4 Empirical Diversion Curves

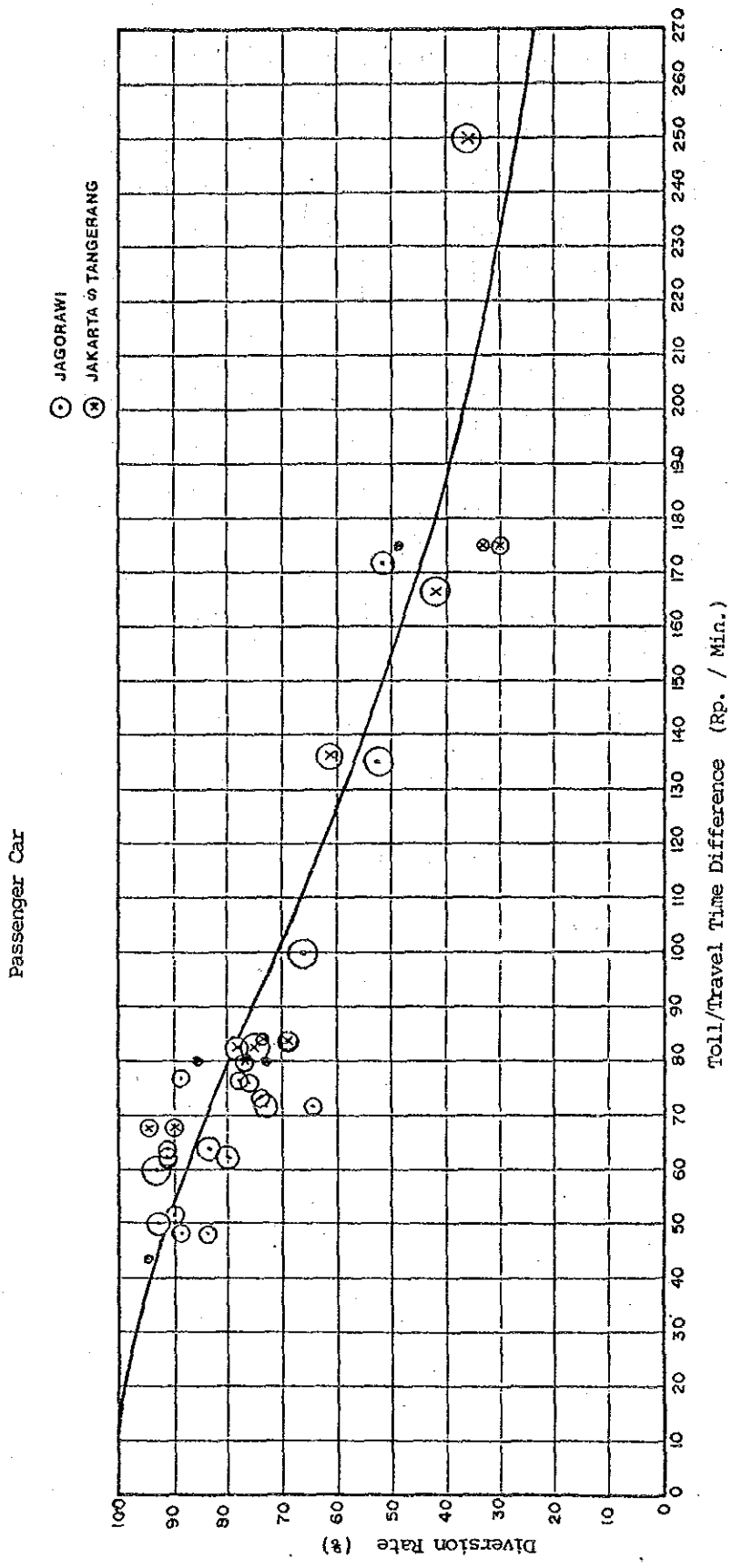


Fig. 6.2.5 Diversion Curve (Passenger Car)

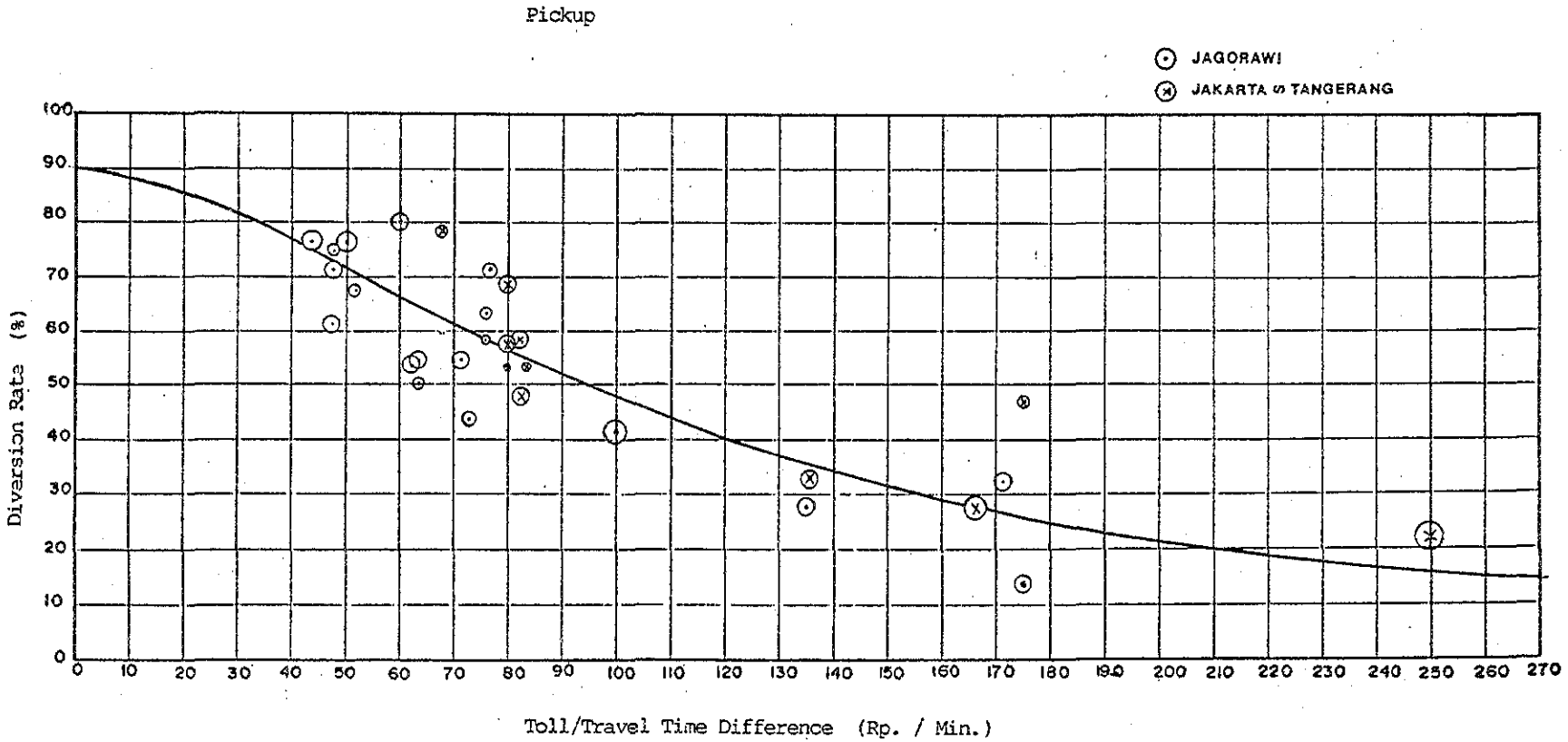


Fig. 6.2.6 Diversion Curve (Pickup)

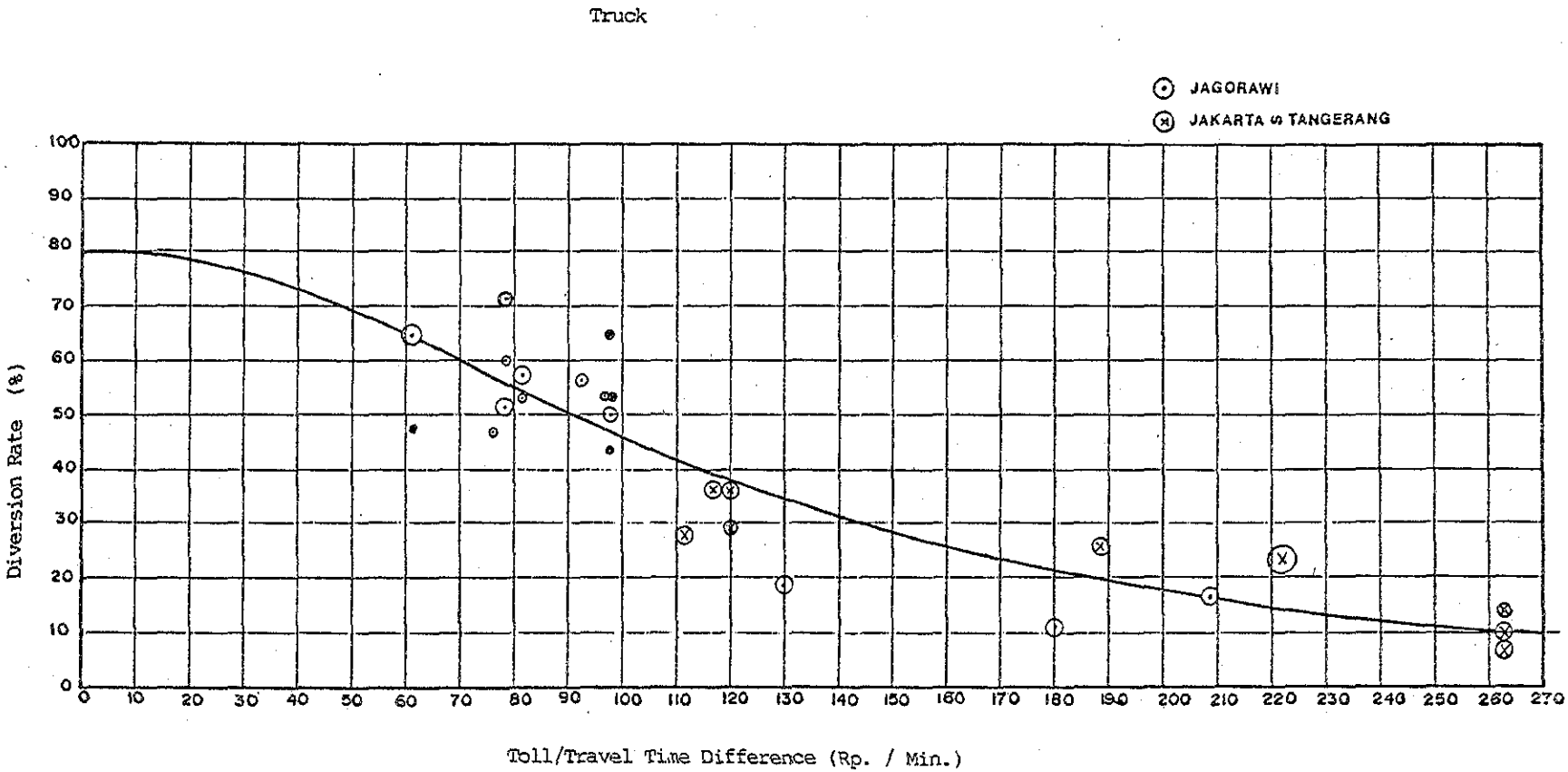


Fig. 6.2.7 Diversion Curve (Truck)

6.3 Future Vehicle Traffic Demand

6.3.1 Methodology

A future traffic demand was forecast as diagrammatically shown in the methodological flow chart of Fig. 6.3.1, a description of which is presented in the following sections.

6.3.2 Future Origin-Destination Matrix

A future OD matrix was based on the analytical results of future socio-economic parameters, trip generation/attraction model, future road network and trip distribution model. Detailed estimation procedure and results are explained below:

Note: The number for each text sub-section corresponds to the sequential numbering of the data boxes shown on Flow Chart for Traffic Demand Forecast in Fig. 6.3.1.

1) Future Framework

Please refer to Section 5.4.1 and 5.4.2.

2) Future Zonal Parameters

Please refer to Section 5.5.1 and 5.5.2.

3) Control Total of Future Traffic Demand

In order to determine a 'control total' figure of future traffic demand a correlation analysis was made between the growth of traffic volumes and that of vehicle ownership.

As a result, it was found that these factors are directly correlated, so the future growth rate of vehicle ownership was adopted to forecast a future total traffic demand. The estimated growth rates obtained for respective vehicle types are as shown in Table 6.3.1.

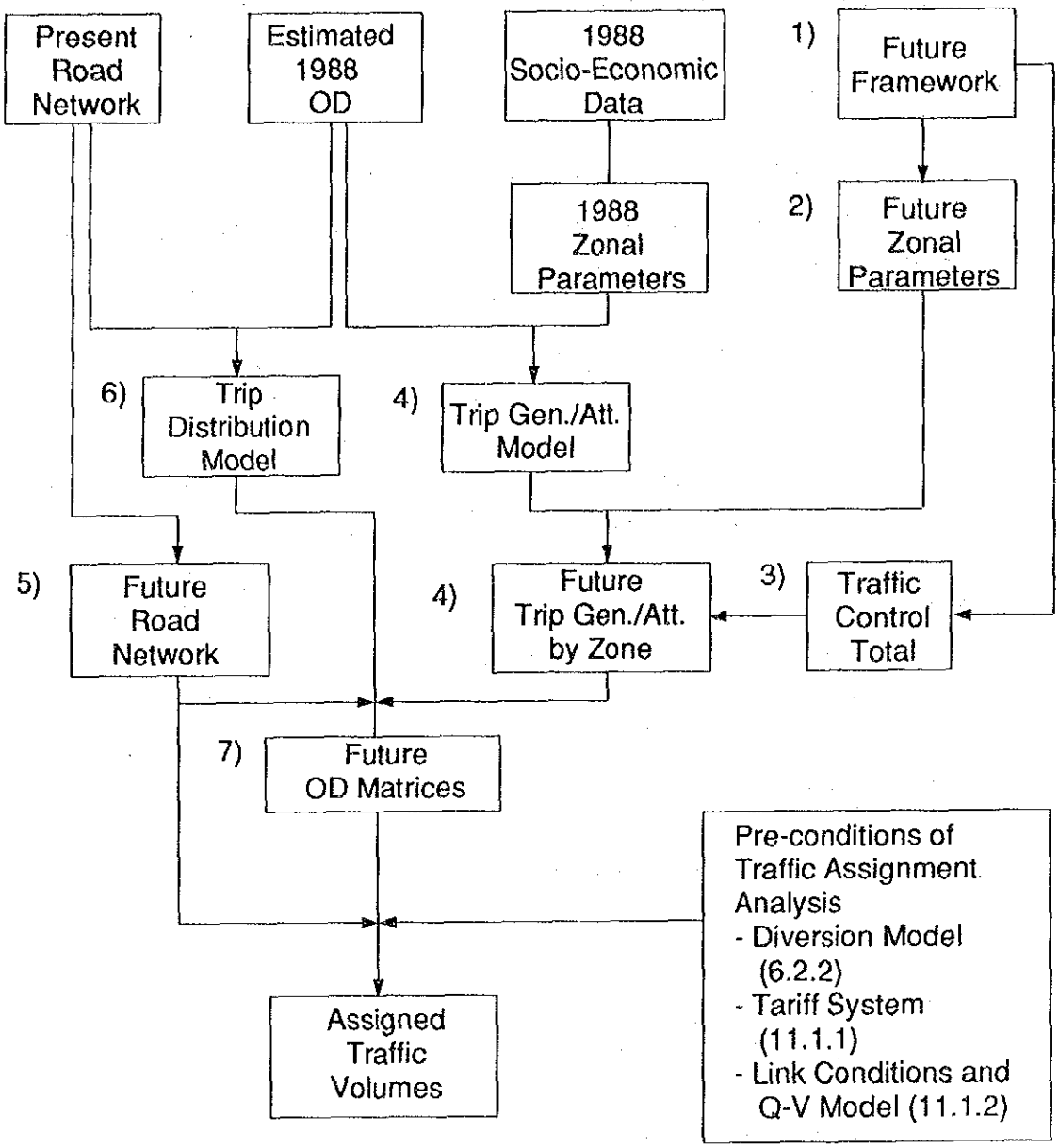


Fig. 6.3.1 Flow Chart for Traffic Demand Forecast

Note: The sequential numbers shown against the flow chart data boxes correspond to the text sub-section numbers 6.3.1, 1) to 6.3.2, 8) and also to sections 6.2.2, 11.1.1 and 11.1.2.

Table 6.3.1 Growth Rates of Future Total Traffic Demand

Vehicle Type		1988	1995	2005	2015
Passenger Car & Pick-up	Growth Index	100	147	256	447
	Growth Rate (% p.a.)		5.7	5.8	5.6
Truck	Growth Index	100	152	279	488
	Growth Rate (% p.a.)		6.2	6.3	5.8
Bus	Growth Index	100	140	258	457
	Growth Rate (% p.a.)		4.9	6.3	5.9
Total	Growth Index	100	148	266	461
	Growth Rate (% p.a.)		5.8	6.0	5.7

4) Trip Generation and Attraction Model

A trip generation/attraction model was derived from the 1988 vehicle OD Matrix for the respective vehicle types. To examine zonal parameters which are most suited to explaining zonal trip generation/attraction a correlation analysis was made. Consequently the following zonal parameters were adopted; urban population and secondary plus tertiary sector employment.

The model formulae derived from the above analysis are shown in Table 6.3.2.

Table 6.3.2 Model Formulae for Trip Generation/Attraction

Vehicle Type	Model Formulae	Correlation Coefficient
Passenger Car	Ti = 0.005929 x UP + 537.8939	0.9317
Pick-up	Ti = 0.002057 x UP + 738.4111	0.9177
Truck	Ti = 0.002358 x UP + 0.002948 x STE + 817.4718	0.9572
Bus	Ti = 0.000929 x UP + 0.000418 x STE - 55.56639	0.9637

Ti : Trip Generation/Attraction (Tripends/day)
UP : Urban Population
STE : Secondary and Tertiary Sector Employment

5) Future Road Network

A future road network is required for estimation of the future traffic volumes on the road links to the tollway. Accordingly it was assembled with the following network components:

a) The existing tollways and their access roads; national and provincial roads were assumed to remain as they are for the future.

b) Such established projects as the Tangerang-Merak Tollway, Cikampek-Padalarang Tollway and Bandung By-pass were incorporated into the network.

c) Alternative routes being studied in this report were incorporated into the network.

d) Proposed interchanges of Cikampek-Cirebon Tollway are all considered in the network.

e) In Central Java and East Java the major arterial roads are all considered to constitute the network.

Based on the above network components, the networks used for study analysis were assumed as shown in Figs. 6.3.2, 6.3.3 and 6.3.4.

The planned tollways have been assumed to develop as follows:

By the year 1995: Cikampek-Cirebon Tollway
Tangerang-Merak Tollway
Cikampek-Padalarang Tollway
Bandung By-pass

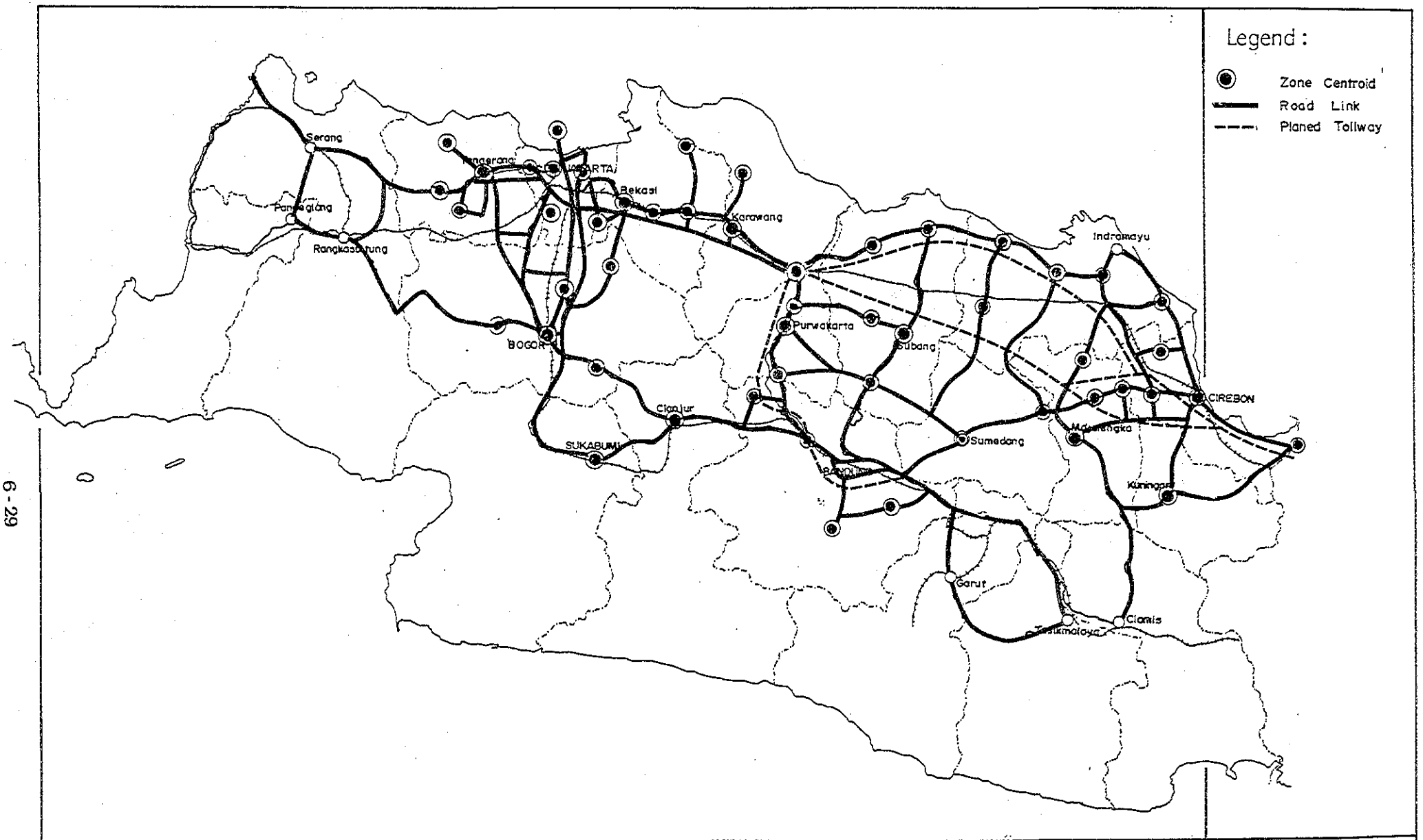


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Fig. 6.3.2 Road Network in West Java for Traffic Demand Analysis

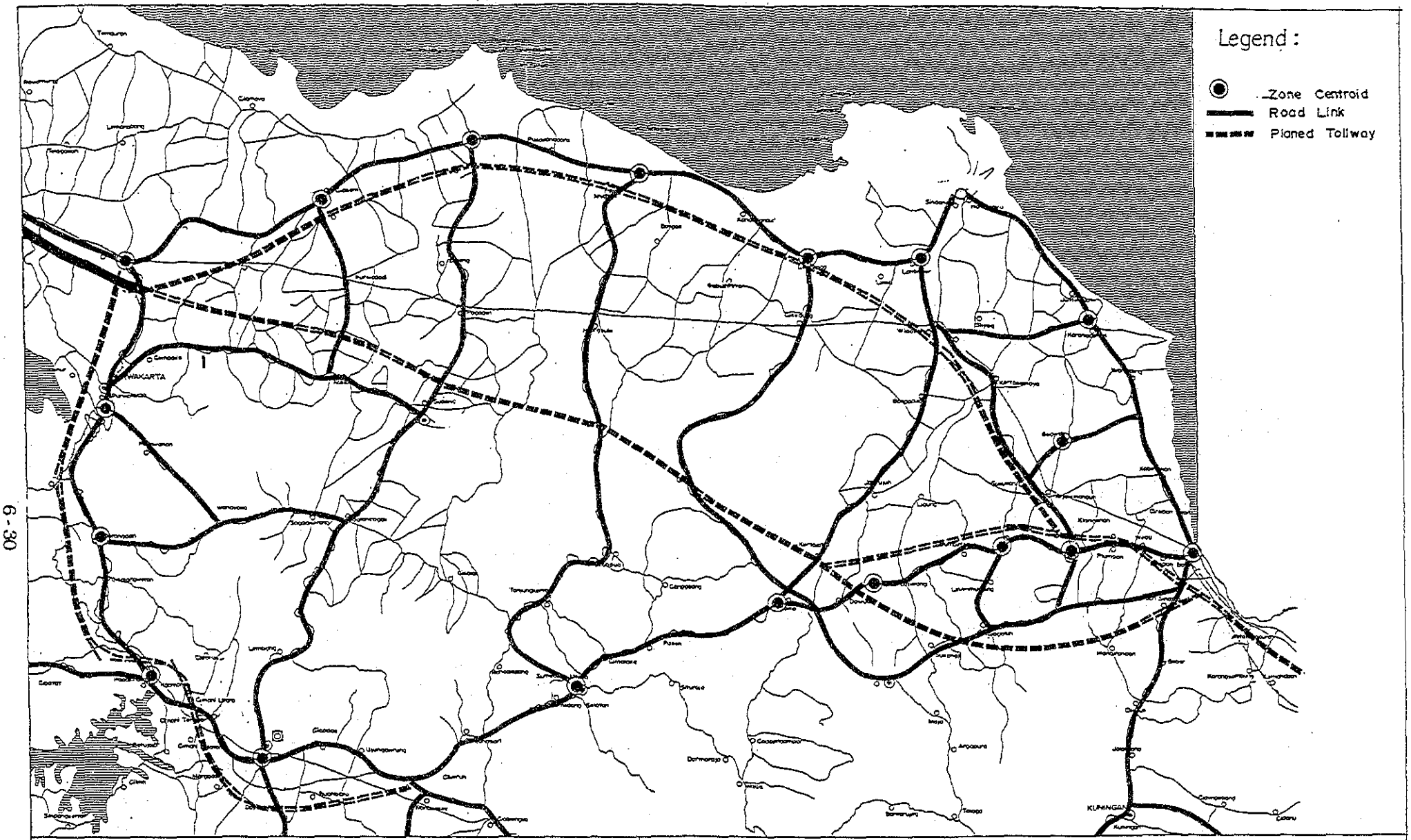

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Fig. 6.3.3 Road Network in Study Area for Traffic Demand Analysis

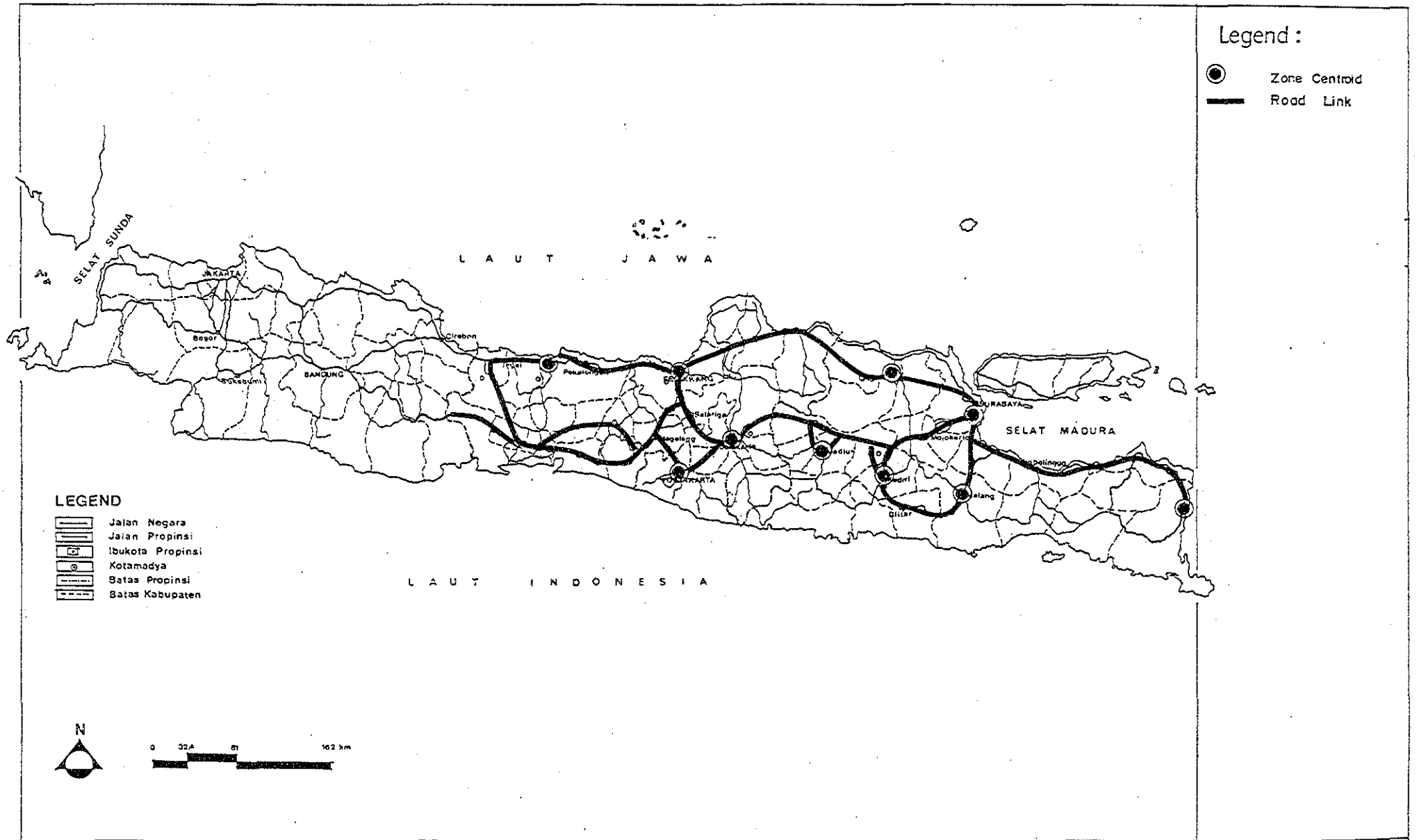

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Fig. 6.3.4 Road Network in Java for Traffic Demand Analysis

6) Trip Distribution Model

The construction of the project tollway will have significant impact upon the region and enhance the development potential. Therefore, a gravity model that reflects such impacts as shorter travel distance, higher travel speed and less traffic congestion on the project region was selected from which to estimate future trip distribution.

The model formula is derived for each type of vehicle as presented in Table 6.3.3.

Gravity Model: $$Tij = K \cdot \frac{Gi^{\alpha} \cdot Aj^{\beta}}{Dij^{t}}$$

where, Tij : OD pair traffic volumes
Gi : Generated trips
Aj : Attracted trips
Dij : OD pair distance
K, α, β, t : Regression parameters
r : Correlation Coefficient

Table 6.3.3 Regression Parameters by Vehicle Type

Vehicle Type	K	α	β	t	r
Passenger Car	4.25641	0.51243	0.76010	1.67397	0.7641
Pick-up	13.89817	0.52069	0.67355	1.76047	0.7229
Truck	6.03465	0.61015	0.65379	1.72214	0.7362
Bus	1.98011	0.57713	0.70926	1.14382	0.7296

The gravity model, however, was only applied to DKI Jakarta and West Java Province where the project tollway will most probably influence their regional development.

The trip distribution model applied to regions other than DKI Jakarta and West Java Province was a present pattern model so as not to overestimate the tollway impact on the indirect influence area. In addition, the present pattern model was also applied to all the region for estimating 1995 OD matrix, because the project tollway was assumed to be open to traffic in 1998.

7) Future OD Matrices

In order to estimate the tollway traffic at the opening year (intermediate year between 1995 and 2005), the OD matrix for the year 2005 was also estimated by the present pattern. Accordingly, the present pattern model was applied to estimating the 1995 and 2005 OD matrices and the gravity model was applied to estimating the 2005 and 2015 OD matrices.

The OD matrices for the traffic zones (55 x 55) are presented in Appendix Tables AP 6.3.1 through 6.3.3 for the total vehicles.

CHAPTER 7. ENGINEERING STUDY

CHAPTER 7. ENGINEERING STUDY

7.1 Aerial Photographic Survey

7.1.1 General

1) Aerial Photography

Aerial photography was successfully completed during October 1988 by taking full advantage of favorable weather.

2) Ground Control Survey

In consideration of severe topographic conditions and changeable weather, Global Positioning System (G.P.S) has been employed to allow simultaneous observation at each two (2) stations.

3) Mapping

a) Most careful attention is paid to the following detail which incorporates areas to be indemnified, specified by development schemes and covered by existing law.

- Railways, rivers, main roads
- Paddy fields, cultivated land, plantations, cemeteries, factories, golf courses
- Public buildings, military facilities, airports
- Afforestation areas, development/conservation areas, restricted areas

b) First priority for mapping is the area of Cikampek-Subang, followed by Cirebon towards the west.

c) Map sheet format is unified with the standard of the Directorate General of Highways, Ministry of Public Work, (Direktorat Jenderal Bina Marga, Departmen Pekerjaan Umum).

d) During the course of the mapping operations technical meetings were held between the counterpart and survey team as occasion demanded.

7.1.2 Extent and Accuracy of the Survey and Mapping

1) Work Extent

a) Aerial Photography

Photo signals for control points were established as shown in Fig. 7.1.1. Aerial photography was executed as shown in Fig. 7.1.2.

Work period:

Sept. 30, 1988 to Nov. 18, 1988.

Work volume:

Photo signal.....	37 points
Aerial Photography.....	12 runs, 624 photos (2100 km^2)
Photo mosaicing at.....	1:25,000 for Route B

b) Ground Control Point Survey

Ground control survey was executed as shown in Fig. 7.1.3 and Fig. 7.1.4.

i) G.P.S. Survey

Work period: Oct. 24, 1988 to Nov. 20, 1988

Work volume:
- 37 new control points (monumental)
- 3 existing control points (T 156, D 1078, D 1014)

ii) Minor Order Levelling

Work period: October 6, 1988 - December 8, 1988

Work volume: 210 km and 23 bench marks

c) Aerial Triangulation

Aerial triangulations were executed as shown in Fig. 7.1.5.

Work period:

Nov. 16, 1988 to Dec. 24, 1988

Work volume:

3 blocks, 477 models

d) Mapping

1/5,000 scaled plotting work has been started for road design by PT. AEROKARTO INDONESIA as shown in Fig. 7.1.6.

Work period:

Jan. 13, 1988 to end of May, 1989

Work volume:

840 km^2, 282 models, 117 sheets

2) Accuracy

a) Aerial Photography

Aerial photography without any cloud influence covers the whole study area. All photographs were checked and passed for stereo machine plotting purposes.

b) G.P.S. Survey

3 G.P.S. stations were observed simultaneously, using differential method and each point was fixed by three dimensional coordinates which were related to existing control points. Misclosure error for relationship triangles of the 3 G.P.S. points were satisfied within the following limits:

Horizontal	±2 ppm x Distance (±2 cm per 10 km)
Vertical	±5 ppm x Distance (±5 cm per 10 km)

c) Levelling

All levelling traverses were satisfactory for height purposes of the topographic map accuracy and discrepancies fell within the following condition.

Discrepancy: ± 3 cm x S (S = km)

d) Aerial Triangulation

Aerial triangulation computations were carried out using the PATMR program. Standard deviation and maximum difference between original control points and adjusted control points were satisfied within limit of JICA regulations.

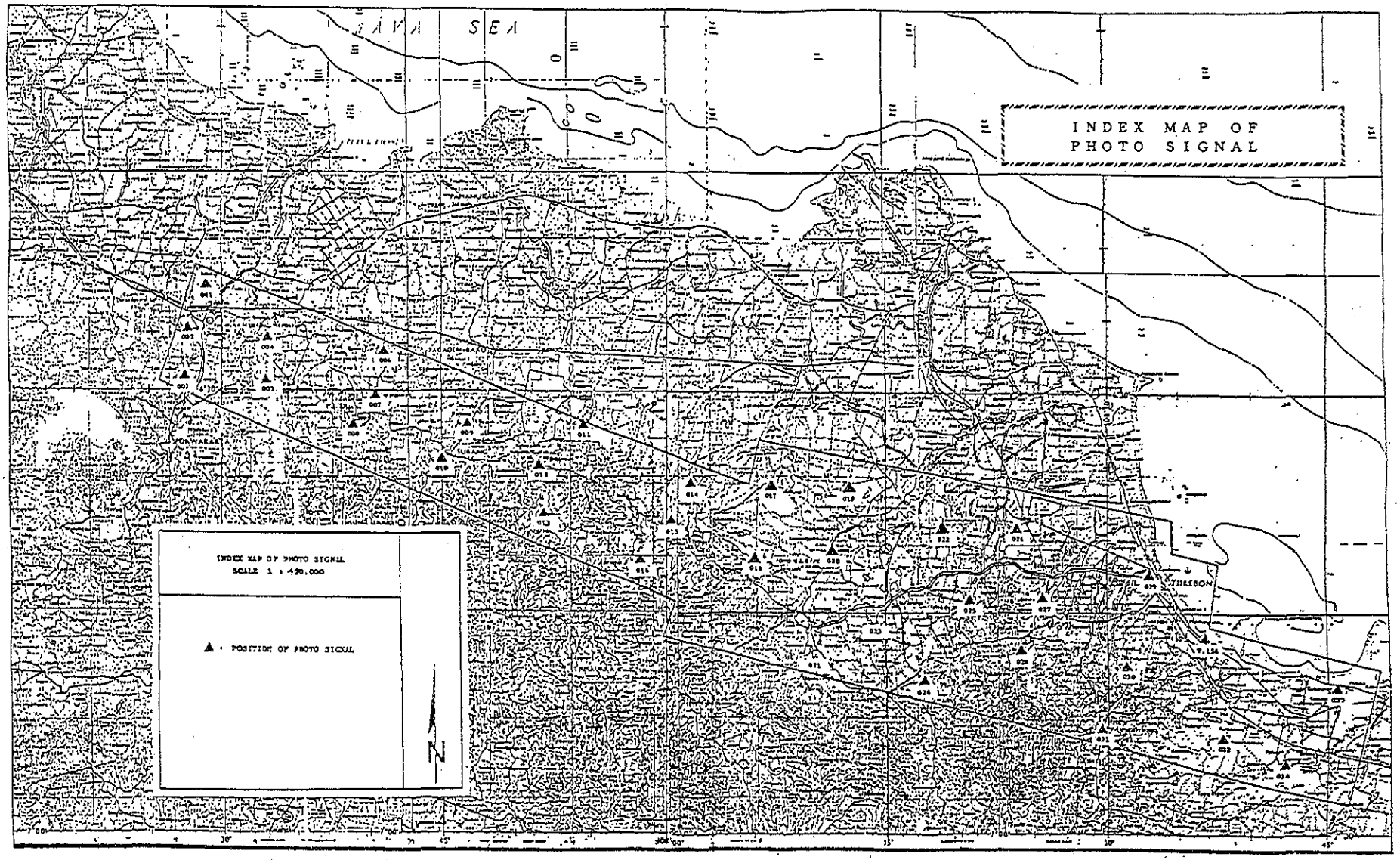

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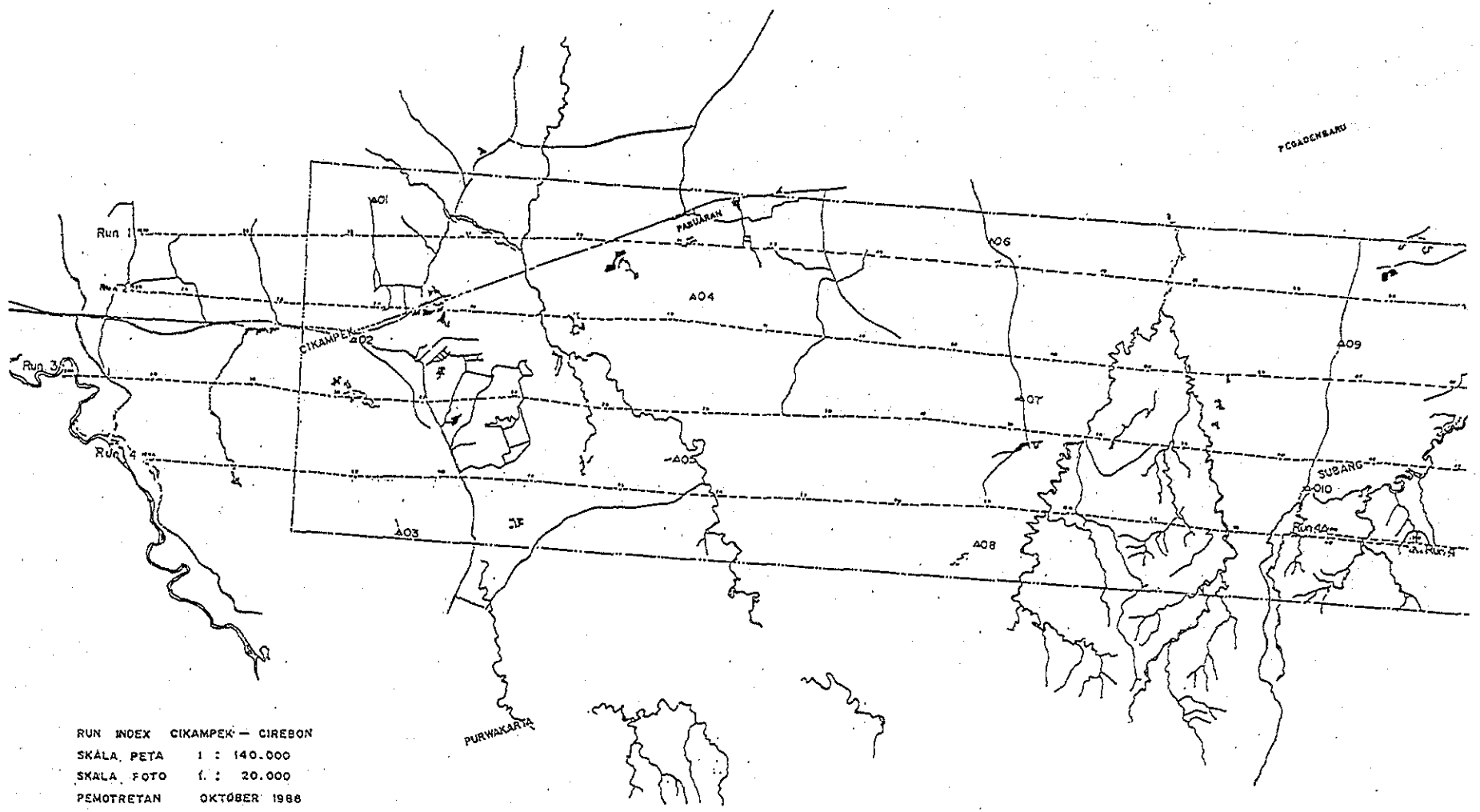
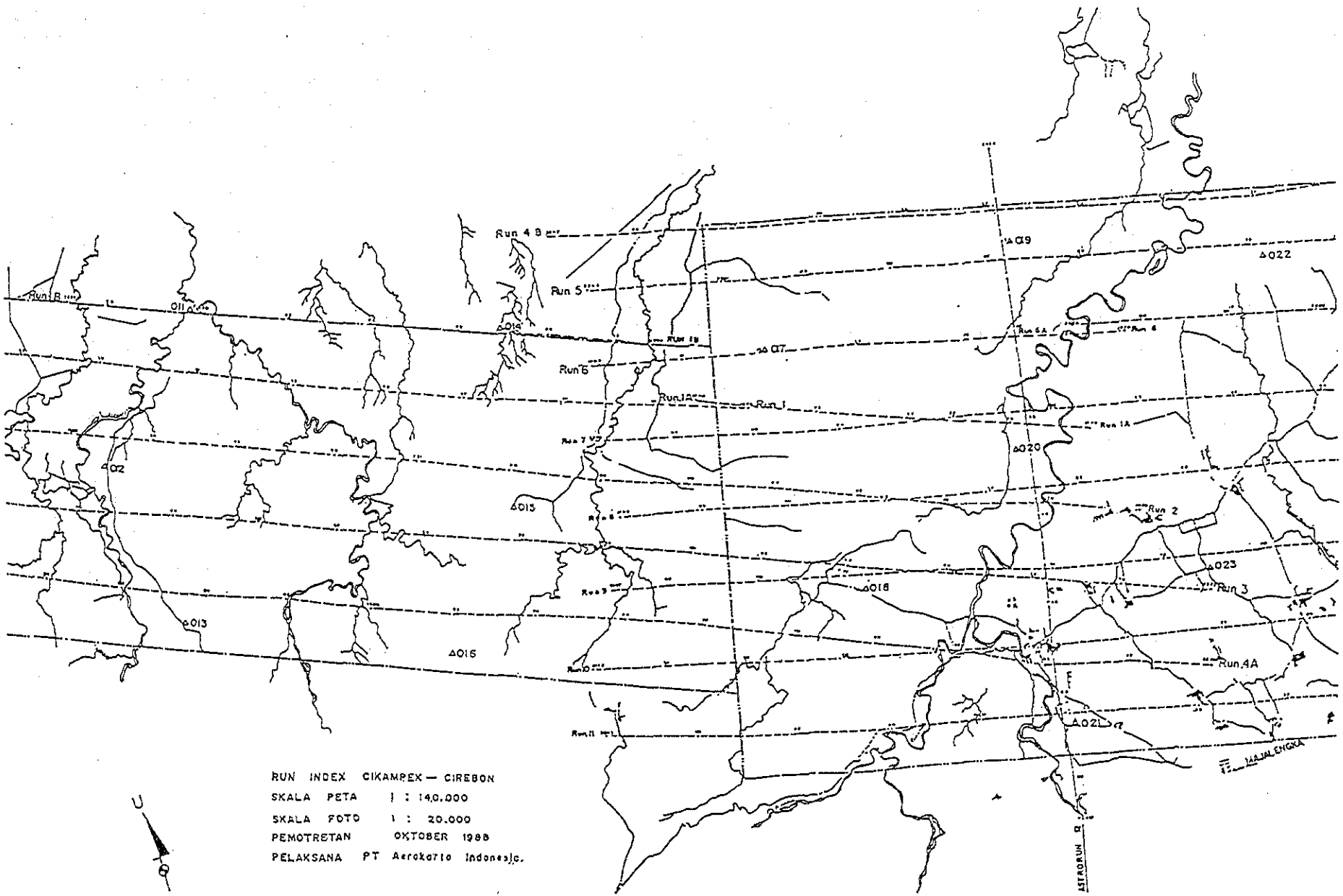
Fig. 7.1.1 Index Map of Photo Signal



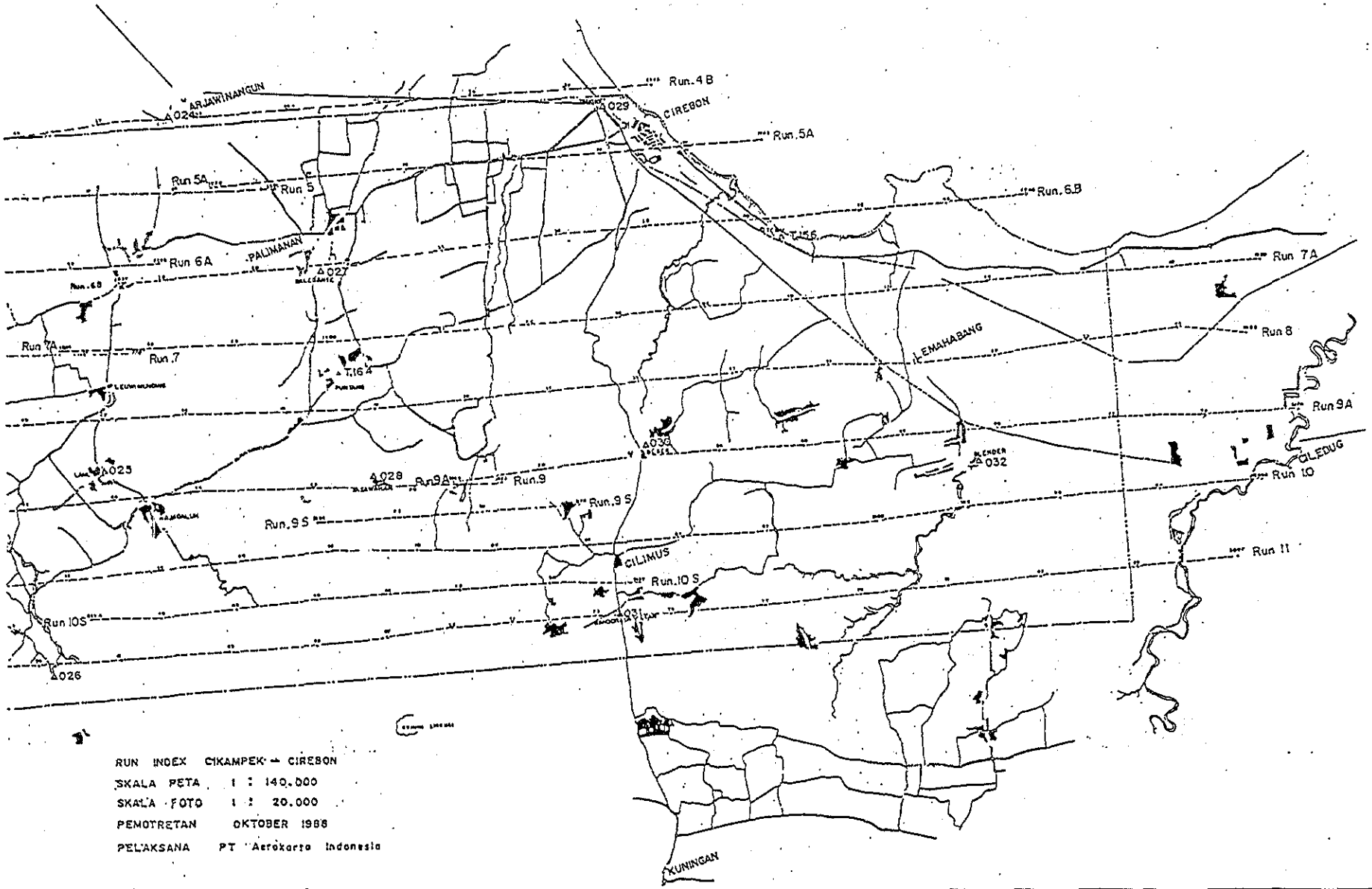
Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 7.1.2 (1) Flight Index Chart



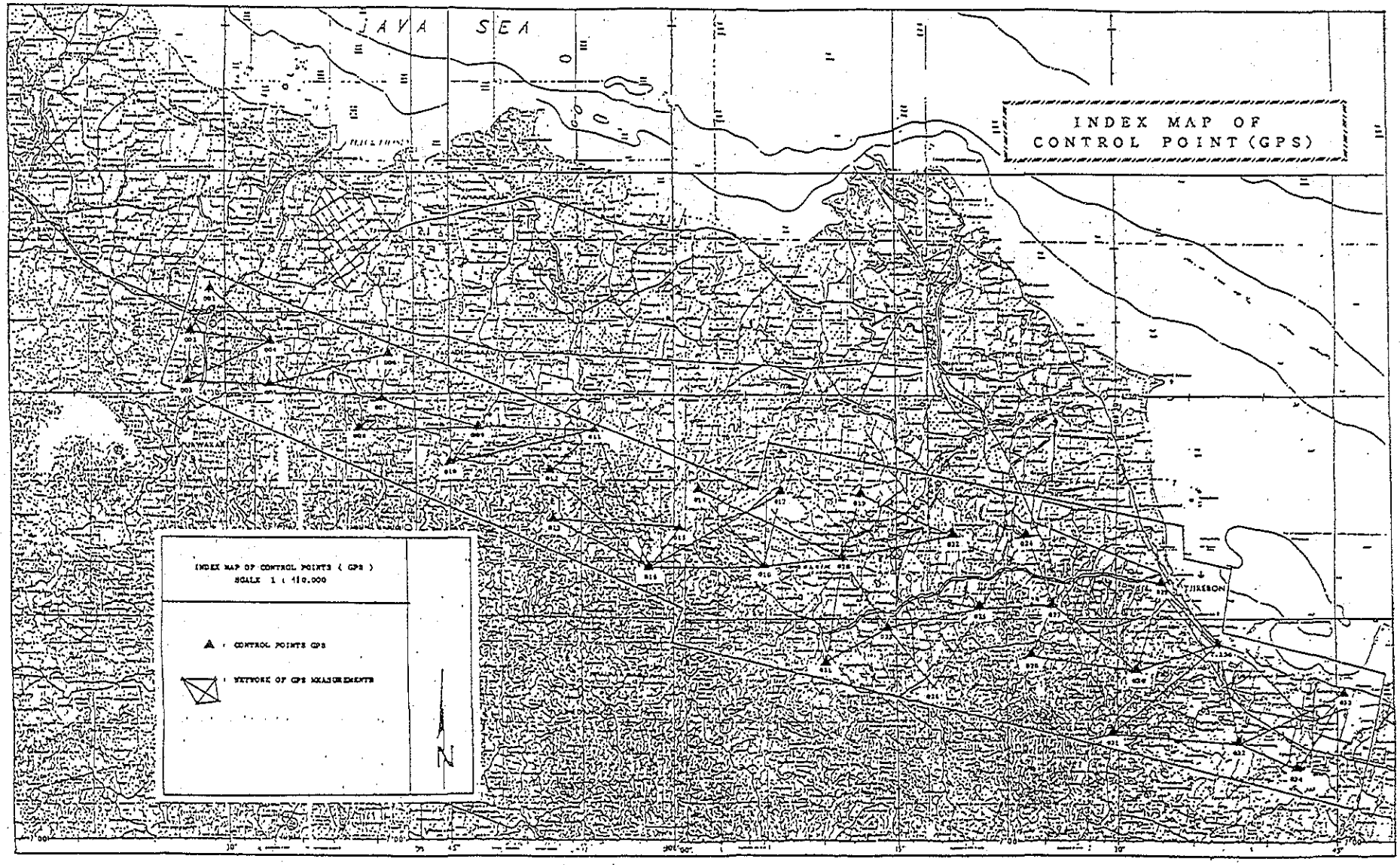
Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 7.1.2 (2) Flight Index Chart (Continued)



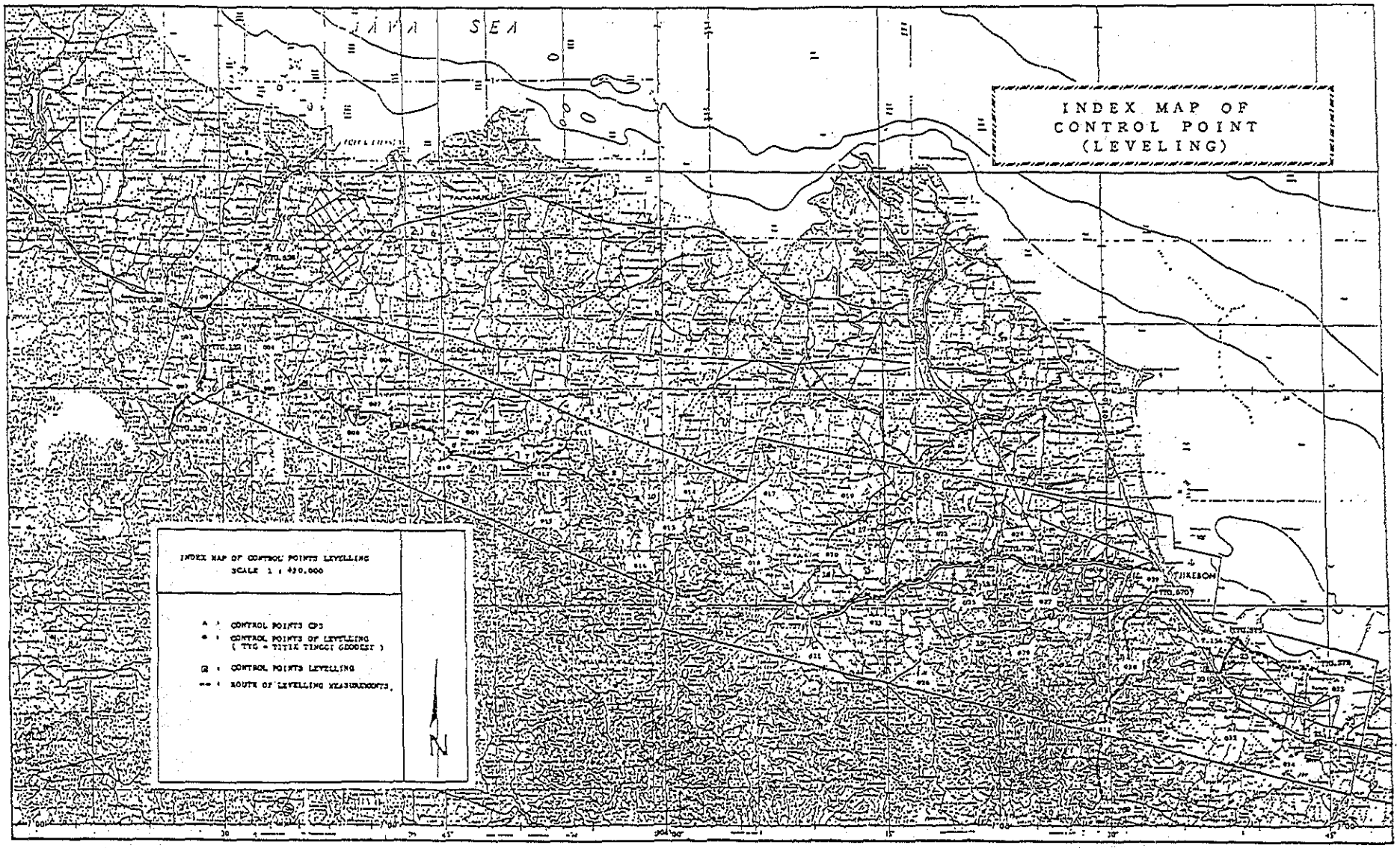
Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 7.1.2 (3) Flight Index Chart (Continued)



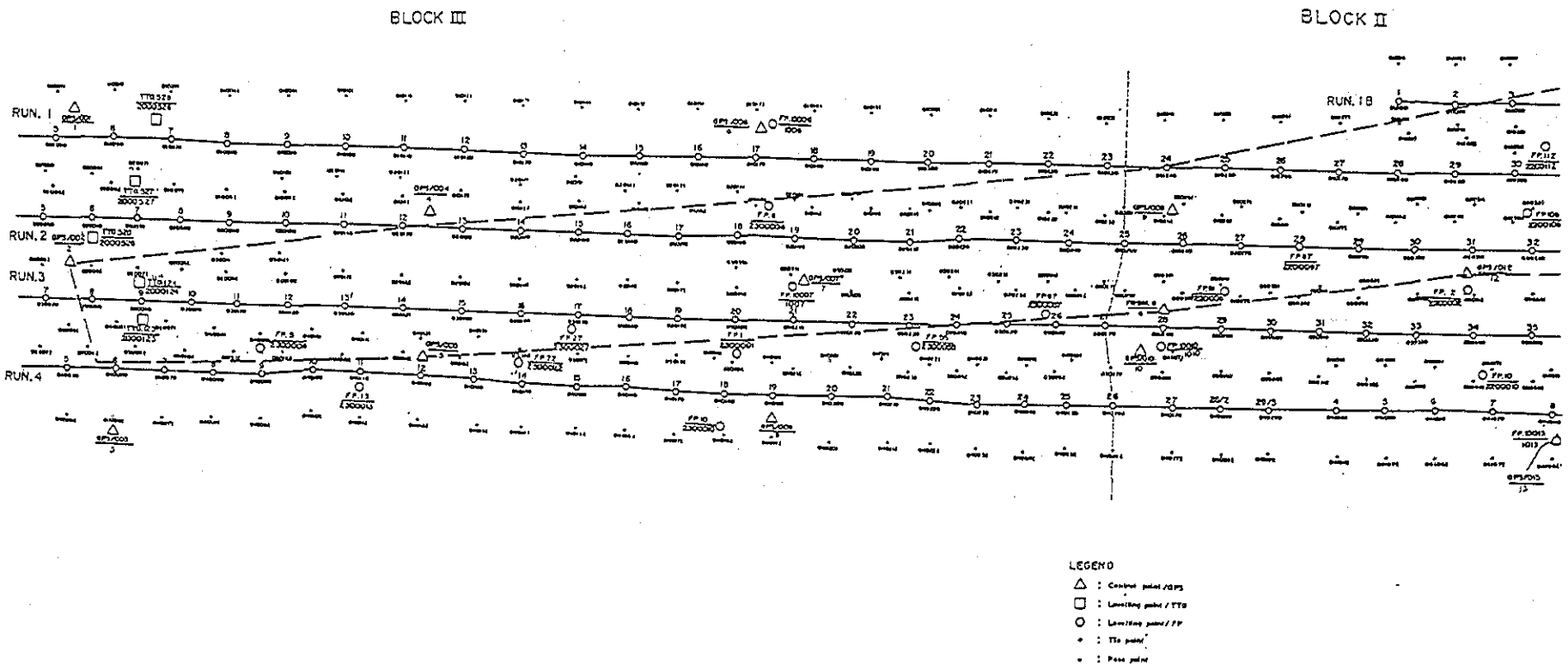
Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 7.1.3 Index Map of Control Points (GPS)



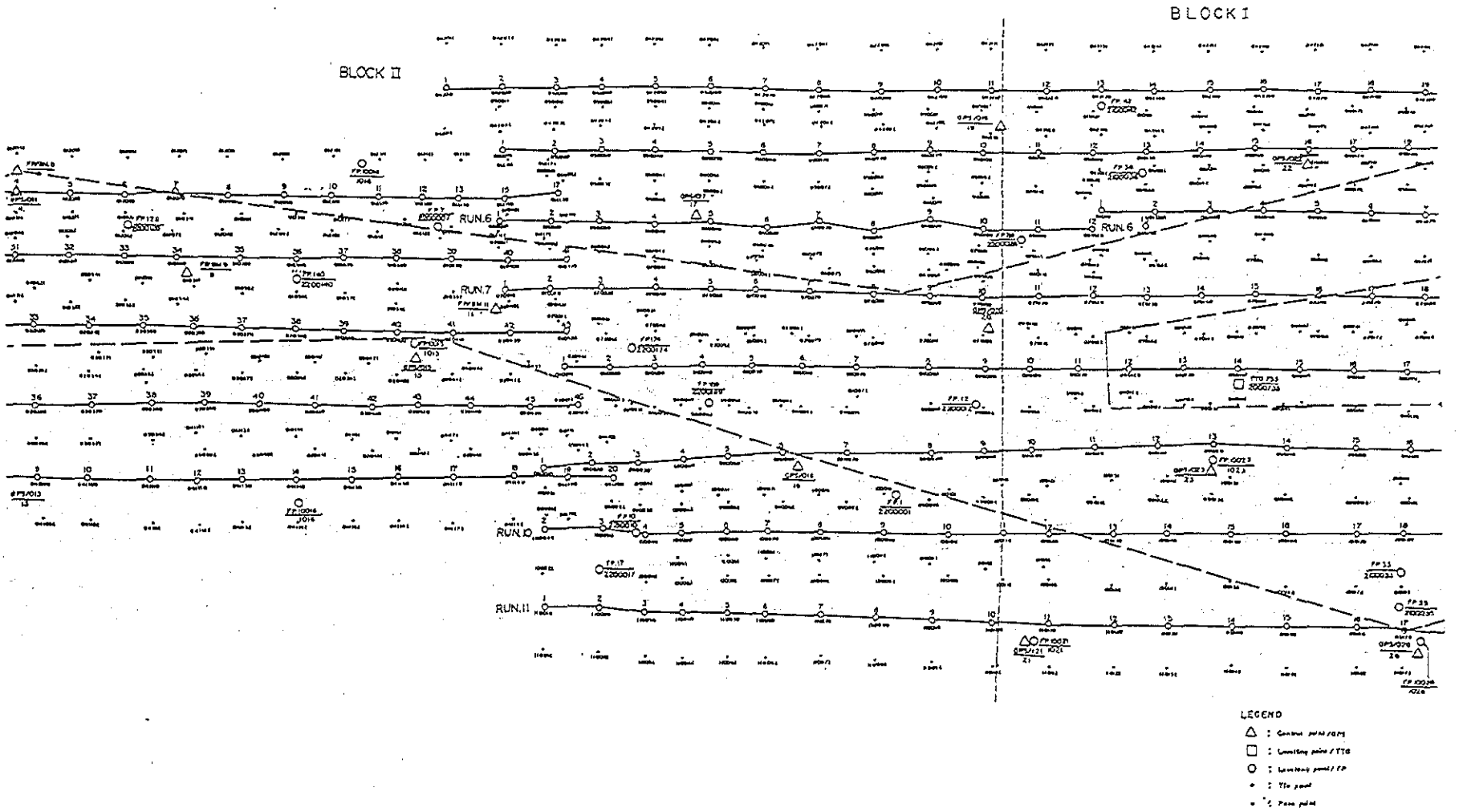
Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 7.1.4 Index Map of Control Points (Levelling)



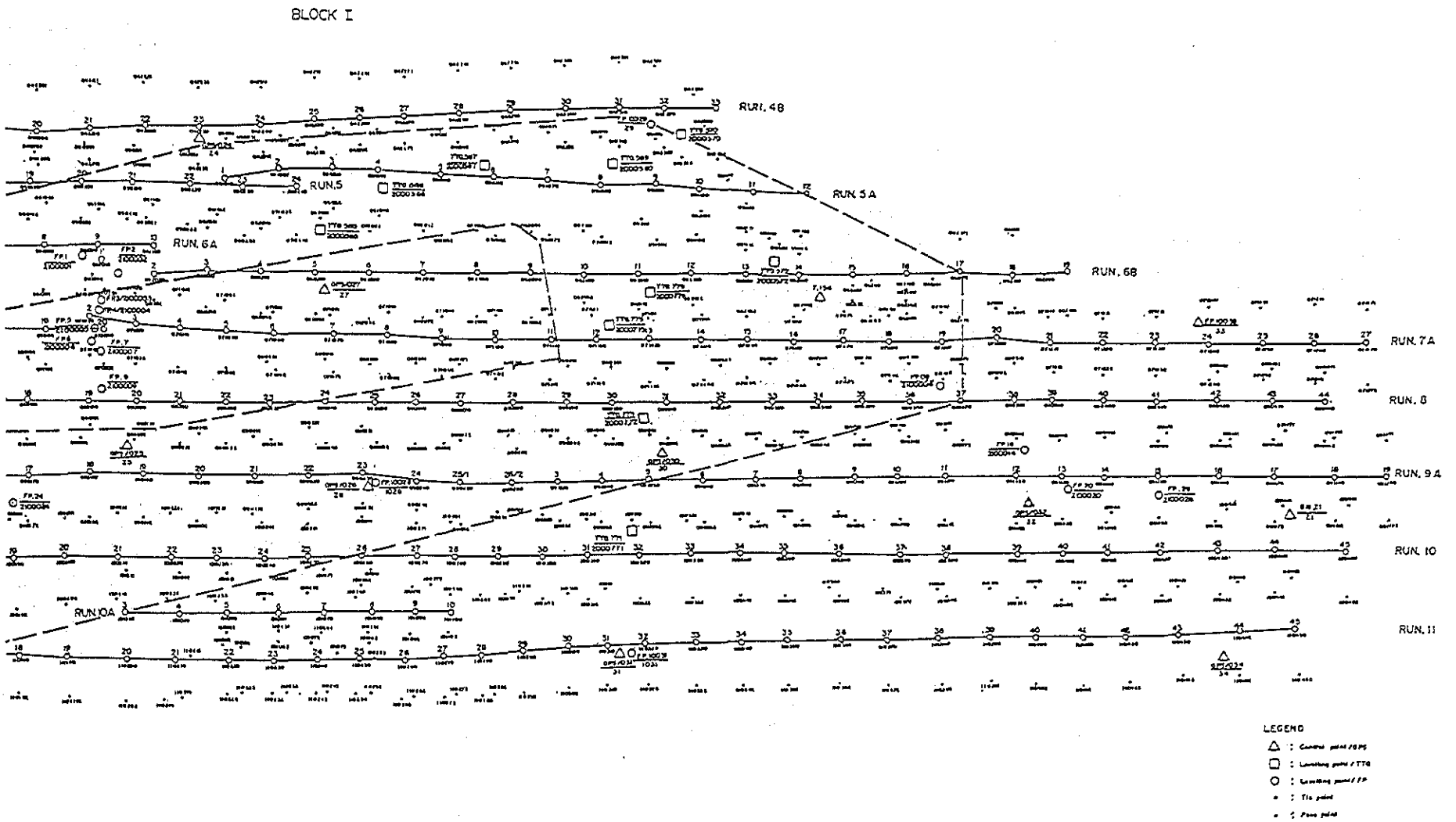
Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 7.1.5 (1) Aerial Triangulation Index Chart

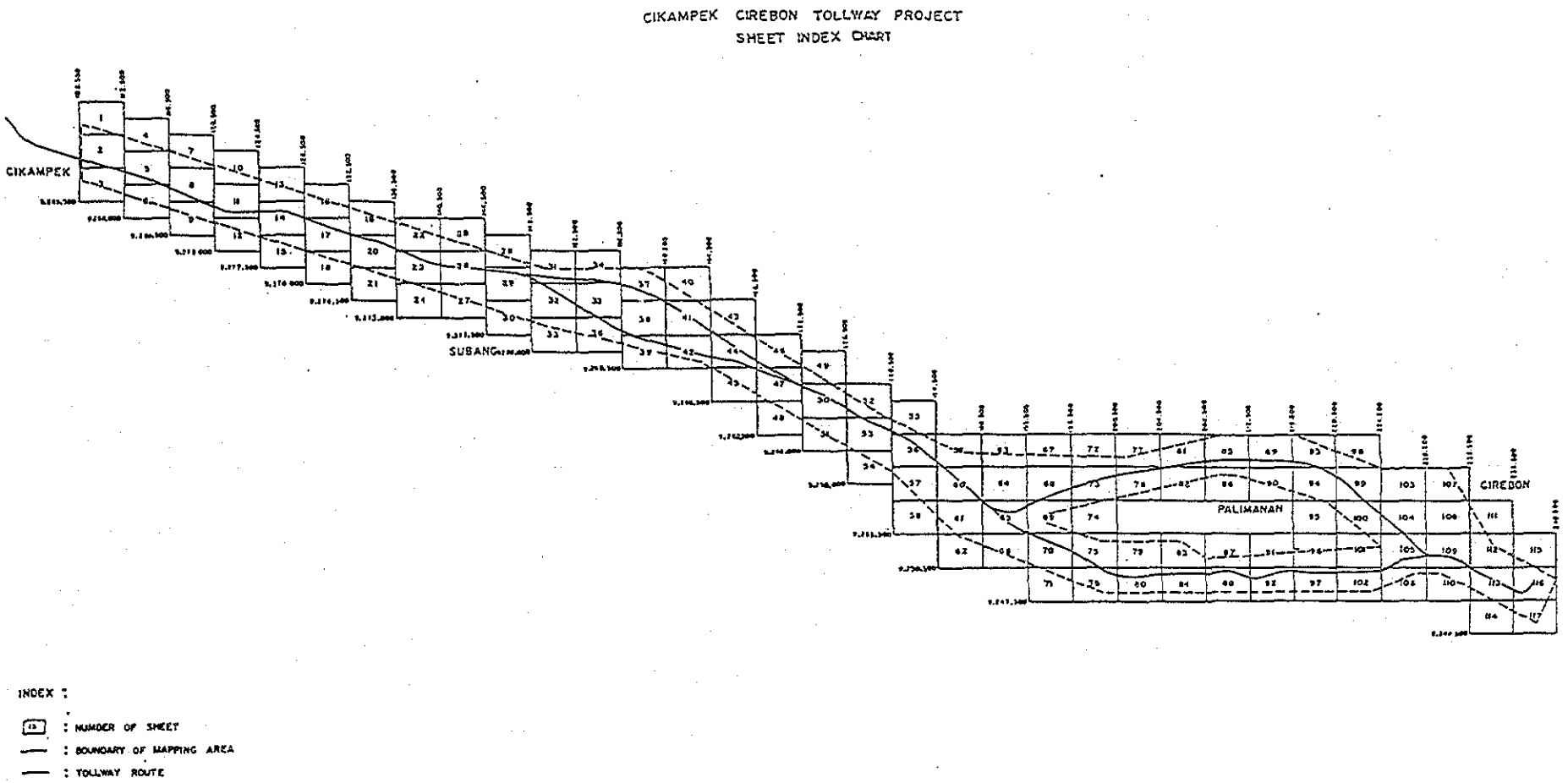


Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 7.1.5 (2) Aerial Triangulation Index Chart (Continued)



Feasibility Study on Cikampek - Cirebon Tollway Project	Fig. 7.1.5 (3) Aerial Triangulation Index Chart (Continued)



Feasibility Study on Cikampek - Cirebon Tollway Project

Fig. 7.1.6 Sheet Index Chart