CHAPTER 3 TRAFFIC DEMAND FORECAST

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3.1 Existing Situations of Halim and Kemayoran Airports

There are two airports in DKI Jakarta, namely, Halim Perdana Kusuma Airport used mainly for international flights and Kemayoran Airport mainly for domestic flights. The number of aircraft movements of Halim Airport in 1981 accounted for 36.4 thousand flights per year and that of Kemayoran Airport accounted for 109.1 thousand flights.

3.1.1 Airline Passengers

The number of airline passengers of Halim Airport in 1981 amounted to 2.1 million persons per year excluding transit passengers. 78.4% of the passengers was for international flights and 21.6% was for domestic flights. The number of airline passengers of Kemayoran Airport in 1981 amounted to 3.7 million persons per year, 99.9% of which was for domestic flights and 0.1% for international flights. The total passengers of both airports amounted to 5.8 million persons per year or 15.9 thousand persons per day.

The number of airline passengers in the recent years shows a steady increasing trend. The growth rate from 1976 to 1981 accounted for 13.9% per annum for the total at Halim and Kemayoran airports. The growth rate of domestic passengers accounted for 14.8% p.a. while that at international passengers accounted for 11.8% p.a.

The yearly transition of airline passengers from 1976 to 1981 is as shown in Table 3.1.1.

Table 3.1.1 Total Airline Passengers of Halim and Kemayoran Airports

	Yearly (1000)			Daily		
	INT	DOM	TOTAL	INT	DOM	TOTAL
1976	964.6	2067.0	3031.6	2643	5663	8306
1977	1124.4	2499.6	3624.0	3080	6848	9928
1978	1328.2	2926.3	4254.5	3639	8016	11655
1979	1334.3	3077.9	4412.2	3656	8432	12088
1980	1518.6	3468.3	4986.9	4162	9501	13663
1981	1684.4	426.6	5811.0	4615	11306	15920

Note: 1) INT - International, DOM - Domestic
2) "Transit Passengers" excluded.
3) Data Source : Perum Augkasa Pura

3.1.2 Air Freight

Air freight handled at Halim Airport in 1981 amounted to 38.0 thousand tons per year including cargo and mail. 61% of the freight was for arrival and 39% was for departure. Air freight handled at Kemayoran Airport amounted to 46.1 thousand tons per year, 73% of which was for departure and 27% for arrival. The total air freight of both airports amounted to 84.1 thousand tons per year or 230.5 tons per day.

The tonnage of air freight in recent years shows a steady increasing trend. The growth rate from 1976 to 1981 accounted for 15.3% p.a. for the total of Halim and Kemayoran Airports. The growth rate of international freight accounted for 16.6% p.a. while that of domestic freight accounted for 14.3% p.a.

The yearly transition of air freight is as shown in Table 3.1.2.

Table 3.1.2 Total Air Freight of Halim and Kemayoran Airports

	Yearly (1000 ton)			Daily (ton)		
	INT	DOM	TOTAL	INT	DOM	TOTAL
1976	17780	23504	41284	48.7	64.4	113.1
1977	19879	28238	48117	54.5	77.4	131.9
1978	20176	30670	50846	55.3	84.0	139.8
1979	22460	35187	57647	61.5	96.4	157.9
1980	33253	40625	73878	91.1	111.3	202.4
1981	38272	45859	84131	104.9	125.6	230.5

Note: 1) INT - International, DOM - Domestic
2) The table shows the total of cargo and mail
3) Data source : Perum Augkasa Pura

3.1.3 Airport Survey Performed

Interview survey and its associated traffic count survey were carried out in this study to get the exact information of the airport related trips. The survey was held at Kemayoran Airport on October 12, 1982 (Tuesday) and at Halim Airport on October 13, 1982 (Wednesday) for 16 hours from 6:00 to 22:00.

(1) Contents of the survey

The survey consisted of the following items:

Interview Survey

- Interview to departing passengers
- Interview to visitors to the airports excluding passengers and airport employees
- Interview to the offices in the airports
- Interview to the employees in the airports

Counting Survey

- Counting survey of airline passengers at the entrance and exit of passengers lounge
- Counting survey of persons at the entrance and exit of terminal building
- Counting survey of persons to and from airport at the entrance and exit of the airports
- Counting survey of vehicles to and from airport at the entrance and exit of the airports

Format of each kind of Interview Survey are shown in Appendix 1.

(2) Result of Interview Survey

The main purpose of carrying out the Interview Survey was to obtain the zonal distribution pattern of the airport related trips and to obtain the present selection pattern of transportation makes by three categories, namely, airline passengers, visitors to the airport and airport employees who are considered to have different preference to the distribution and selection.

The number of samples obtained amounted as shown below:

- Airline Passengers 807
- Visitors to the airports 823
- Airport employees 500

i) Airline Passengers

Trip characteristics of airline passengers are briefly summerized as shown in Table 3.1.3, 3.1.4 and 3.1.5.

The average number of baggages which airline passengers carry to the airport accounted for 1.6 pieces for domestic flight and 1.8 pieces for international flight.

The average number of well wishers who accompany airline passengers to the airports accounted for 0.88 persons for both domestic and international flights.

The transportation means that airline passengers prefer is taxis and passenger cars (private and official). The share of private transportation means amounts to 95% of transportation means excluding truck, bicycle and pedestrian. "Time saving" is the determinant factor for airline passengers in choosing transportation means.

Table 3.1.3 Number of Baggages / Airline Passenger

Bags	Domestic		International		Total	
	Samples	%	Samples	%	Samples	%
0	56	9.3	10	5.0	66	8.2
1	252	41.9	67	33.7	319	39.9
2	178	29.6	85	42.7	263	32.8
3	82	13.6	30	15.1	112	14.0
4	34	5.6	7	3.5	41	5.1
TOTAL	602	100.0	199	100.0	801	100.0

Table 3.1.4 Number of Well Wishers / Airline Passenger

Person	Domestic		International		Total	
	Samples	%	Samples	%	Samples	%
0	343	57.8	109	56.2	452	57.4
1	125	21.1	40	20.6	165	20.9
2	69	11.6	30	15.5	99	12.6
3	30	5.0	9	4.6	39	5.0
4	8	1.3	2	1.0	10	1.3
5	9	0.1	1	0.5	10	1.3
6	9	0.1	3	1.6	12	1.5
Total	593	100.0	194	100.0	787	100.0

Table 3.1.5 Reasons for Modal Choice by Airline Passengers

Means \ Reason	1	2	3	4	5	6	7	8	9	Total Sample	Total %
Private Car	154	12	4	25	3	1	9	1	7	216	29.1
Official Car	45	10	0	3	1	34	5	1	9	108	14.5
Taxi	266	7	15	14	8	0	44	16	10	380	51.2
Route Bus	5	3	0	0	0	2	0	0	0	10	1.4
Hotel's Bus Service	0	2	2	3	0	1	5	0	0	13	1.7
Motorcycle	0	0	0	0	0	0	0	0	0	0	0.0
Truck	0	0	0	0	0	0	0	0	0	0	0.0
Bicycle, Tricycle	0	3	0	0	0	0	1	0	0	4	0.5
Walking	0	0	0	0	0	0	0	0	2	2	0.3
Railway	3	1	1	0	0	0	1	0	0	6	0.8
Others	0	0	0	1	0	0	1	0	2	4	0.5
Total Sample	473	38	22	46	12	38	66	18	30	743	100.0
%	63.7	5.1	3.0	6.2	1.6	5.1	8.9	2.4	4.0	100.0	

Note: Reason:
1. Less traveling time
2. Less traveling cost
3. Easy baggage carrying
4. Comfortable
5. Few changes of means
6. Fixed by group's schedule
7. No other transportation means
8. Not acquainted with transportation system
9. Others

ii) Visitors to the Airports

Trip characteristics of visitors to the airports excluding airline passengers and airport employees are briefly summerized as shown in Table 3.1.6 and 3.1.7.

Though the visitors to the airports comprises of persons of various purposes, well wishers and greeters are the major part of the visitors. The composition of well wishers and greeters accounts for 77% of all the visitors.

The transportation means that the visitors to the airports prefer is passenger cars (private and official) and taxis. The share of private transportation means amounts to 85% of transportation means excluding truck, bicycle and pedestrian. "Time saving" is the determinant factor for airport visitors in choosing transportation means, too.

Table 3.1.6 Trip Purpose of the Visitors to the Airports

Trip Purpose / Transporation Means	Well Wish-ing	Greet-ing	Sight Seeing	Busi-ness	Others	Total	
	1	2	3	4	5	Sample	%
Private Car	132	146	10	18	23	329	40.7
Official Car	33	69	4	10	9	125	15.5
Taxi	84	56	6	5	24	175	21.7
Route Bus	20	38	25	16	7	106	13.1
Hotel's Bus Service	2	3	0	0	0	5	0.6
Motorcycle	10	18	3	8	5	44	5.4
Truck	0	0	0	0	0	0	0.0
Bicycle, Tricycle	2	3	1	2	1	9	1.1
Walking	2	0	5	1	1	9	1.1
Railway	1	1	0	0	0	2	0.3
Others	2	0	0	2	0	4	0.5
Total Sample	288	334	54	62	70	808	100.0
%	35.6	41.3	6.7	7.7	8.7	100.0	

Table 3.1.7 Reasons for Modal Choice by Visitors to the Airports

Means \ Reason	1	2	3	4	5	6	7	8	9	Total	
										Sample	%
Private Car	289	6	8	14	6	1	2	0	5	331	41.2
Official Car	61	11	8	3	3	31	3	0	3	123	15.3
Taxi	148	6	11	2	3	0	5	1	1	177	22.0
Route Bus	14	82	4	0	0	1	5	0	0	106	13.2
Hotel's Bus Service	1	1	1	1	0	1	0	0	0	5	0.6
Motorcycle	37	3	0	0	0	0	2	0	1	43	5.4
Truck	0	0	0	0	0	0	0	0	0	0	0.0
Bicyle, Tricycle	1	6	0	0	0	0	1	0	1	9	1.1
Waling	1	2	0	0	0	0	2	0	1	6	0.8
Railway	1	1	0	0	0	0	0	0	0	2	0.2
Others	1	1	0	0	0	0	0	0	0	2	0.2
Total Sample	554	119	32	20	12	34	20	1	12	804	100.0
%	68.9	14.8	4.0	2.5	1.5	4.2	2.5	0.1	1.5	100.0	

Note: Reason:
1. Less traveling time
2. Less traveling cost
3. Easy baggage carrying
4. Comfortable
5. Few change of means
6. Cargo transportation
7. No other transportation means
8. Not acquainted with transportation system
9. Others

iii) Airport Employees

Most of the airport employees use public transportation means as shown in Table 3.1.8. The share of public transpotation accounts for 63%, which is far higher than those of airline passengers and visitors. "Cost saving" is the utmost concern of those who use route buses, but most part of their transportation costs are born by their employers.

The reasons of "Time saving" and "Offered by office" follow "Cost saving".

Table 3.1.8 Reasons for Modal Choice by Employees

Means \ Reason	1	2	3	4	5	6	7	Total Sample	Total %
Private Car	24	0	2	2	0	2	0	30	6.0
Official Car	2	2	1	0	35	0	0	40	8.0
Taxi	1	0	0	0	0	0	0	1	0.2
Route Bus	11	165	4	2	1	33	5	221	44.4
Special Commuting Means	3	2	2	1	56	1	1	66	13.3
Motorcycle	67	2	3	1	19	4	2	98	19.7
Bicycle, Tricycle	8	3	2	2	1	0	1	17	3.4
Walking	6	4	0	5	0	3	3	21	4.2
Railway	1	2	0	0	0	0	0	3	0.6
Others	0	0	0	0	0	1	0	1	0.2
Total Sample	123	180	14	13	112	44	12	498	100.0
%	24.7	36.2	2.8	2.6	22.5	8.8	2.4	100.0	

Note: Reason:
1. Less traveling time
2. Less traveling cost
3. Few change of means
4. Comfortable
5. Offered by office
6. No other transportation means
7. Others

(3) Result of Counting Survey

Hourly fluctuation patterns of airline passengers and all the persons to and from the existing airports are as shown in Table 3.1.9 and 3.1.10, respectively. The most busy hour band of departing passengers falls on 7:00 - 8:00 when the composition ratio accounts for 11.6%. The most busy hour band of arriving passengers falls on 16:00 - 17:00 when the composition ratio accounts for 16.1%. The hourly fluctuation pattern of all the persons to and from the airports is rather flat compared with that of airline passengers. The most busy hour band of persons coming to the airports falls on 7:00 - 8:00 when the composition ratio accounts for 10.2%. The most busy hour band of persons leaving the airports falls on 16:00 - 17:00 when the composition ratio accounts for 11.8%.

The counted number of all the persons to and from the airports is considered to be rather distorted because the survey date fell on so-called Haji pilgrimage season. October of 1982 was the month when most of the Haji pilgrimage came back from Mecca and many greeters for them gathered to the airport.

Table 3.1.9 Hourly Fluctuation Pattern of Airline Passengers

(Total of Halim and Kemayoran Airports)

Air line / Hour Band	Domestic				International				Total			
	Departure		Arrival		Departure		Arrival		Departure		Arrival	
	Persons	%	Persons	%	Persons	%	Persons	%	Persons		Persons	%
6-7	488	10.4	17	0.3	124	5.4	0	0.0	612	8.8	17	0.2
7-8	456	9.8	44	0.8	354	15.4	0	0.0	810	11.6	44	0.5
8-9	487	10.4	342	6.4	128	5.6	0	0.0	615	8.8	342	4.2
9-10	614	13.2	194	3.6	130	5.7	188	6.9	744	10.7	382	4.7
10-11	458	9.8	136	2.5	57	2.5	0	0.0	515	7.4	136	1.7
11-12	498	10.7	426	8.0	37	1.6	0	0.0	535	7.7	426	5.3
12-13	546	11.7	346	6.5	156	6.8	125	4.6	702	10.1	471	5.8
13-14	426	9.1	578	10.8	52	2.3	147	5.4	478	6.9	725	9.0
14-15	268	5.8	439	8.2	138	6.0	0	0.0	406	5.8	439	5.4
15-16	113	2.4	511	9.5	208	9.1	247	9.1	321	4.6	758	9.4
16-17	168	3.6	911	17.0	487	21.3	391	14.3	655	9.4	1302	16.1
17-18	122	2.6	592	11.0	167	7.3	211	7.7	289	4.2	803	9.9
18-19	20	0.5	375	7.0	238	10.4	659	24.2	258	3.7	1034	12.8
19-20	7	0.2	221	4.1	13	0.6	182	6.7	20	0.3	403	5.0
20-21	0	0.0	231	4.3	0	0.0	129	4.7	0	0.0	360	4.5
21-22	0	0.0	0	0.0	0	0.0	448	16.4	0	0.0	448	5.5
6-22	4671	100.0	5363	100.0	2289	100.0	2727	100.0	6960	100.0	8090	100.0
6-18	4644	99.4	4536	84.6	2038	89.0	1309	48.0	6682	96.0	5845	72.2
7-9	943	20.2	386	7.2	482	21.1	0	0.0	1425	20.5	386	4.8

Table 3.1.10 Hourly Fluctuation Pattern of Persons to and from Airport

(Total of Halim and Kemayoran Airports)

Directions / Hour Band	to the Airports		from the Airports		Total	
	Persons	%	Persons	%	Persons	%
6 - 7	2113	6.8	829	3.5	2942	5.4
7 - 8	3163	10.2	971	4.1	4134	7.6
8 - 9	2198	9.5	1351	5.7	4269	7.8
9 - 10	2522	8.2	1400	5.9	3922	7.2
10 - 11	1859	6.0	1182	4.9	3041	5.6
11 - 12	2103	6.8	1418	5.9	3521	6.4
12 - 13	2104	6.8	1367	5.7	3471	6.3
13 - 14	1997	6.5	1753	7.3	3751	6.8
14 - 15	1413	4.6	1755	7.4	3168	5.8
15 - 16	2141	6.9	1927	8.1	4068	7.4
16 - 17	2103	6.8	2688	11.3	4791	8.8
17 - 18	1635	5.3	1738	7.3	3373	6.2
18 - 19	1256	4.1	2047	8.6	3303	6.0
19 - 20	1316	4.3	1416	5.9	2732	5.0
20 - 21	1281	4.2	912	3.8	2193	4.0
21 - 22	936	3.0	1107	4.6	2043	3.7
6 - 22	30860	100.0	23861	100.0	54721	100.0
6 - 18	26071	84.5	18379	77.0	44450	81.2
7 - 9	6081	19.7	2322	9.7	8403	15.4

3.1.4 Present Persons Trips of the Airports

(1) Person Trip Generation and Attraction

i) Airline Passengers

The number of airline passengers in recent years shows an increasing trend as previously shown in Table 3.1.1. The total number of airline passengers in 1981 amounted to 5,811 thousand persons per year or 15,920 persons per day.

By extrapolating the number of airline passengers from 1976 to 1981, the number of airline passengers in 1982 was estimated to be 6,619 thousand persons per year or 18,130 persons per day.

The total number of airline passengers of Halim and Kemayoran Airports are estimated to be slightly less than that of Kloten airport in Zürich.

There is, however, some discrepancy between this estimated number and the counted number as shown in Table 3.1.9. In this study, the estimated number of airline passengers was adopted because the counted number is considered to involve some distortion caused by seasonal, monthly and weekly deviation.

ii) Visitors to the Airports

The number of visitors to the airports excluding airline passengers and employees was estimated based on the following formula:

Number of visitors

= (Number of passengers x Ratio of well wishers and greeters per passenger)/Composition ratio of well wishers and greeters of all visitors

- Number of airline passengers : 18,130
- Ratio of well wishers and greeters per passengers (from the Interview Survey) : 0.88

- Composition ratio of well wishers and greeters of all visitors (from the Interview Survey) : 0.77

Number of visitors = (18,130 x 0.88)/0.77 = 20,720

iii) Employees

The number of ground employees in the airport area amounted to 6,310 persons according to the "Interview survey to the offices in the airport area". Considering the effective working day ratio and the off-duty after 12-hour shift work, the number of ground employees on the average daily working basis was estimated to be 5,830 persons.

The number of flight employees on the average daily working basis was estimated to be 1,780 persons in consideration of the average number of flight per day.

The number of airport employees on the daily working basis was thus estimated to be 7,610 persons.

iv) Total Person Trip/Day

The total number of person trip per day in 1982 was estimated as shown below based on the above estimated number of airline passengers, visitors to the airports and airport employees:

Airline passengers (departure and arrival)	18,130 x 1 = 18,130
Visitors to the airports	20,720 x 2 = 41,440
Airport employees	7,610 x 2 = 15,220
Total person trips/day	74,790

(2) Traffic Zoning of the Study Area

For this study purpose, the study area was divided into traffic zones considering the following:

i) The Kecamatan districts which are administrative unit in JABOTABEK area are adopted as the basis for zone division.

ii) The zones closely related to this Project are subdivided based on the Kelurahan boundary and the zones which are considered to have comparatively little influence by this project are composed of some Kecamatans.

iii) Railway network and road network are taken into consideration for zone division as well as the above mentioned administrative boundary and traffic zoning by "Feasibility Study on Jakarta Harbour Road" (by JICA, 1981).

The traffic zoning map is as showing in Figs. 3.1.1 and 3.1.2 and the zoning code list is as shown in Table 3.1.11.

The relationship between traffic zones and administrative zones is as shown in Appendix 2.

DKI Jakarta	Central	12 zones	No. 1 - 12
	North	8 zones	No. 13 - 20
	West	22 zones	No. 21 - 42
	South	4 zones	No. 43 - 46
	East	4 zones	No. 47 - 50
	Total	50 zones	
BOTABEK	Tangerang	5 zones	No. 51 - 55
	Bogor	3 zones	No. 56 - 58
	Bekasi	2 zones	No. 59 - 60
Others		3 zones	No. 61 - 63
Total		63 zones	

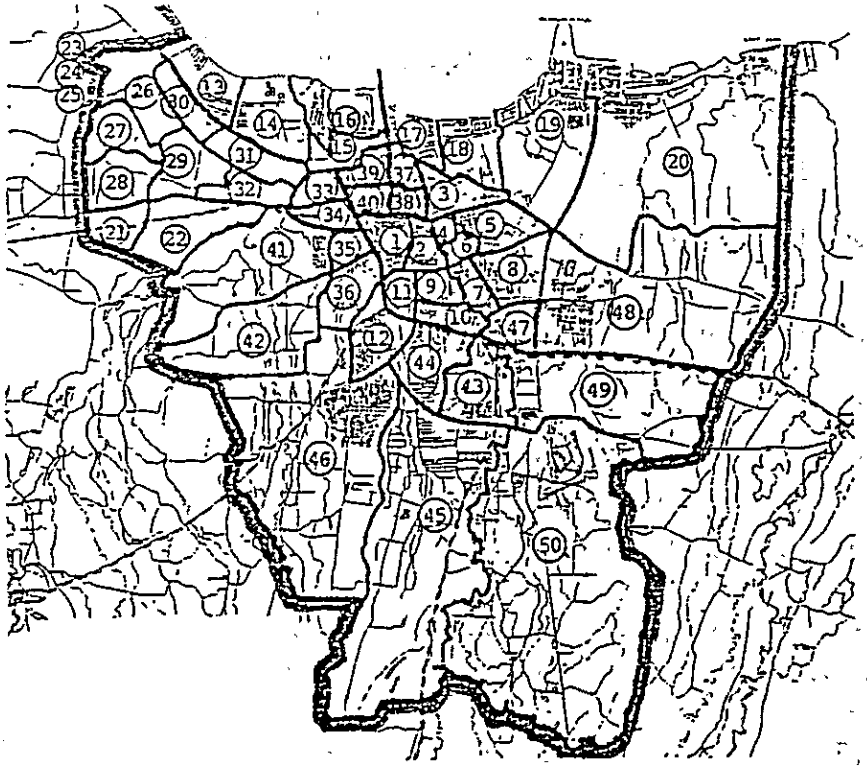


Fig. 3.1.1 Traffic Zones in DKI Jakarta

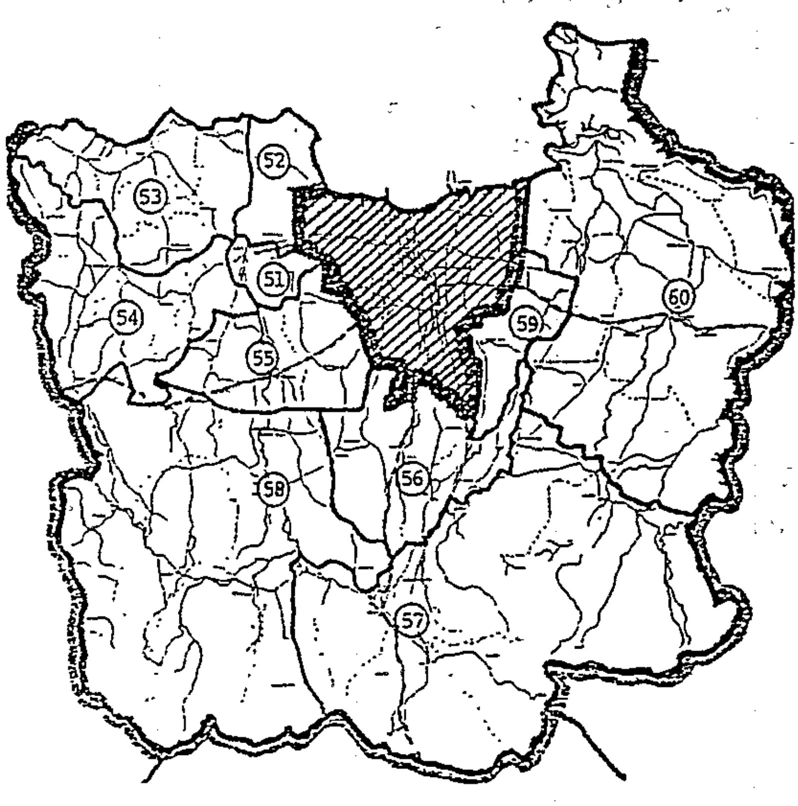


Fig. 3.1.2 Traffic Zones in BOTABEK Area

Table 3.1.11 Traffic Zone Code List

No.	Zone Name	No.	Zone Name
1	Cideng	33	Jelambar Utara
2	Gambir	34	Jelambar Selatan
3	Sawah Besar	35	Tomang
4	Pasar Baru	36	Slipi
5	Kemayoran	37	Mangga Besar
6	Senen	38	Tamansair
7	Kramat	39	Tambora
8	Cempaka Putih	40	Duri
9	Cikini	41	Kembangan
10	Menteng	42	Kebon Jeruk
11	Kebon Melati	43	Tebet
12	Karet Tengsin	44	Setia Budi
13	Kanal Muara	45	Mampang Prapatan
14	Kapuk Muara	46	Kebayoran Baru
15	Penjagalan	47	Matraman
16	Penjaringan	48	Pulo Gadung
17	Mangga Dua Utara	49	Jatinegara
18	Pademangan	50	Kramat Jati
19	Tanjung Priok	51	Tangerang
20	Cilincing	52	Batu Ceper
21	Semanan	53	Mauk
22	Rawa Buaya	54	Cikupa
23	JIAC (Passengers)	55	Serpong
24	JIAC (Visitors)	56	Depok
25	JIAC (Employees)	57	Bogor
26	Kamal	58	Parung
27	Pegadungan	59	Bekasi
28	Kali Deres	60	Cikarang
29	Cengkareng	61	West Side
30	Kapuk Barat	62	Central Side
31	Kapuk Timur	63	East Side
32	K.K. Angke		

(3) Person Trip Distribution

The estimated number of person trips of Halim and Kemayoran Airports in 1982 was then distributed to the established traffic zones.

The present zonal distribution patterns of the airport related trips were obtained through the Interview Survey by three categories, namely, airline passengers, visitors to the airport and airport employees. The estimated number of person trips by these categories was distributed to the traffic zones based on the above mentioned distribution pattern of corresponding categories. The result is as shown in Fig. 3.1.3 and Table 3.1.12.

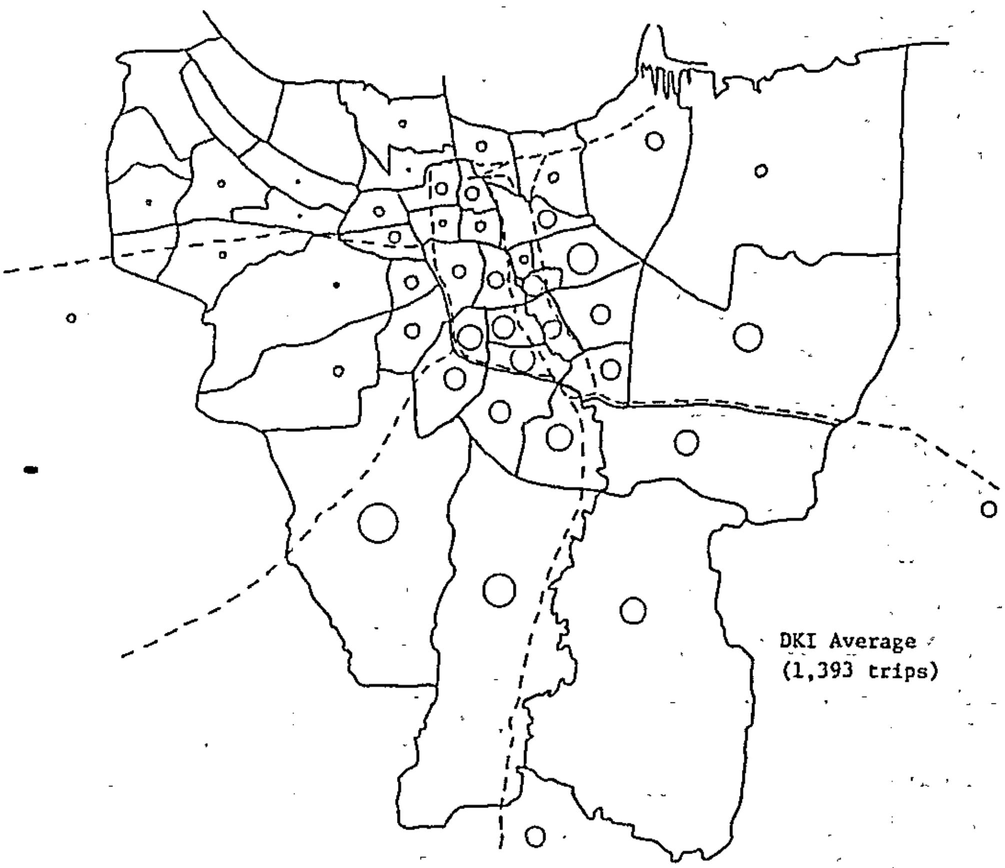


Fig. 3.1.3 Person Trip Distribution of Halim and Kemayoran Airports

Table 3.1.12 Present Person Trip Distribution of Airports

No.	Zone Name	1982 Airport Related Trips/Day			
		Passengers	Visitors	Employees	Total
1	Cideng	382	322	91	795
2	Gambir	586	751	122	1459
3	Sawah Besar	102	590	1156	1848
4	Pasar Baru	127	215	30	372
5	Kemayoran	280	1985	2675	4940
6	Senen	1274	1019	91	2384
7	Kramat	229	966	547	1742
8	Cempaka Putih	433	1395	425	2253
9	Cikini	1123	1556	61	2740
10	Menteng	969	1878	182	3029
11	Kebon Melati	1326	1180	30	2536
12	Karet Tengsin	1174	805	182	2161
13	Kanal Muara	2	2	2	6
14	Kapuk Muara	2	2	2	6
15	Penjagalan	25	2	30	57
16	Penjaringan	127	107	2	236
17	Mangga Dua Utara	76	322	30	428
18	Pademangan	25	376	61	462
19	Tanjung Priok	357	912	486	1755
20	Cilincing	102	376	243	721
21	Semanan	2	2	2	6
22	Rawa Buaya	2	161	30	193
23	JIAC Passenger	-	-	-	-
24	JIAC Visitors	-	-	-	-
25	JIAC Employees	-	-	-	-
26	Kamal	2	2	2	6
27	Pegadungan	2	2	2	6
28	Kali Deres	2	54	30	86
29	Cengkareng	153	54	61	268
30	Kapuk Barat	2	2	2	6
31	Kapuk Timur	2	54	2	58
32	K.K. Angke	2	54	2	58
33	Jelambar Utara	153	322	30	505
34	Jelambar Selatan	178	376	30	584
35	Tomang	229	590	61	880
36	Slipi	357	697	152	1206
37	Mangga Besar	306	536	30	872
38	Tamansari	127	322	61	510
39	Tambora	255	376	2	633
40	Duri	76	107	30	213
41	Kembangan	2	54	61	117
42	Kebon Jeruk	255	215	61	531
43	Tebet	535	2896	365	3796
44	Setia Budi	714	1394	243	2351
45	Mampang Prapatan	1225	3808	729	5762
46	Kebayoran Baru	2270	5149	851	8270
47	Matraman	229	1073	760	2062
48	Pulo Gadung	586	2467	820	3873
49	Jatinegara	535	1716	1034	3285
50	Kramat Jati	408	1501	1672	3581
DKI Jakarta Total		17332	38745	13573	69650
51	Tangerang	25	2	91	118
52	Batu Ceper	2	2	2	6
53	Mauk	2	2	2	6
54	Cikupa	2	2	2	6
55	Serpong	25	161	30	216
56	Depok	76	322	547	945
57	Bogor	178	644	273	1095
58	Parung	2	2	30	34
59	Bekasi	25	429	668	1122
60	Cikarang	2	2	2	6
61	West Side	51	54	0	105
62	Central Side	306	966	0	1272
63	East Side	102	107	0	209
(JMA) TOTAL		18130	41440	15220	74790

As summarized in Table 3.1.13, Central Jakarta has the largest number of the airport related trips with South Jakarta the second and East Jakarta the third.

Table 3.1.13 Summarized Distribution Pattern

unit : 1000 trips/day

		Pas.	Vis.	Emp.	Total
DKI Jakarta	Central	8.0	12.7	5.6	26.3
	North	0.7	2.1	0.9	3.7
	West	2.1	4.0	0.6	6.7
	South	4.7	13.2	2.2	20.1
	East	1.8	6.7	4.3	12.8
	Total	17.3	38.7	13.6	69.6
Outside DKI Jakarta	Tangerang	0.1	0.2	0.1	0.4
	Bogor	0.3	1.0	0.8	2.1
	Bekasi	0.0	0.4	0.7	1.1
	Others	0.5	1.1	0.0	1.6
	Total	0.9	2.7	1.6	5.2
Total		18.2	41.4	15.2	74.8

3.2 Future Traffic Demand of the New Airport

3.2.1 Estimation of Future Person Trip Generation and Attraction

Person trip generation and attraction of the New Airport are estimated in three categories, namely, airline passengers, visitors to the airport (excluding airline passengers and airport employees) and airport employees.

(1) Airline passengers

The number of airline passengers in the future is referred to the planning framework established for Jakarta International Airport Cengkareng (JIAC). As shown in Table 3.2.1, the total number of departing and arriving airline passengers is estimated to be 39 and 86 thousand persons per day for 1990 and 2000, respectively.

Table 3.2.1 Estimated Airline Passengers of JIAC

	1985	1990	2000
Passengers per Year (1,000)	8,968	14,142	31,380
Passengers per Day	24,570	38,750	85,970
Growth Rate (% p.a.)	9.5		8.3

The estimated number of airline passengers in 2000 is supposed to be approximately 5 times of the present airline passengers of Halim and Kemayoran airports or to fall between the total number of airline passengers of Heathrow and Gatwick airports in London and that of Narita and Haneda airports in Tokyo of 1981.

(2) Visitors to the New Airport

The number of well wishers and greeters tends to decrease when an airport is situated far from the center of a city.

The ratio of well wishers and greeters per passenger is 0.88 for the average of existing Halim and Kemayoran airports, while the ratio is 0.19 for Tokyo International Airport Narita (TIAN) which is located at about 60 km from Tokyo.

The composition ratio of well wishers and greeters of all visitors to the airports is 0.77 for the average of Halim and Kemayoran airports, while the ratio is 0.39 for TIAN. It is expected that the said two ratios of JIAC will be lower than those of the average of Halim and Kemayoran airports because JIAC is located considerably far from the center of the city, that is, at about 20 km to the west of the city center.

Based on the above considerations, these ratios for JIAC are assumed as follows in this study;

- Ratio of well wishers and greeters per passenger 0.70
- Composition ratio of well wishers and greeters of all visitors 0.65

The number of visitors to JIAC was estimated to be 42 and 93 thousand persons per day for 1990 and 2000, respectively, as shown in Table 3.2.2.

Table 3.2.2 Estimated Visitors to JIAC

Unit : Persons/day

	1985	1990	2000	Calculation
(A) Passengers	24,570	38,750	85,970	Table 3.2.1
(B) Well wishers and Greeters	17,199	27,125	60,179	(A)*0.70
(C) All visitors	26,460	41,730	92,580	(B)/0.65

(3) Airport employees

The future number of airport employees is estimated base on the planned airline passengers and air freight for JIAC. The Assessment Report on JIAC had an estimated number of airport employees in it, but the framework of passengers and freight has been revised in the succeeding studies. In this study, the number of airport employees is estimated by the same method with the Assessment Report reflecting the most recent framework. The method of estimation is as shown in Table 3.2.3 and 3.2.4 and the estimated number of daily commuting employees is 22 and 45 thousand persons for 1990 and 2000, respectively as shown in Table 3.2.5.

Table 3.2.3 Estimated Ground Employees in JIAC

	1985	1990	2000	Calculation
(A) Passenger Traffic Unit	8,968	14,142	31,830	Passengers/1000
(B) Freight Traffic Unit	1,338	2,375	7,183	Tonnages/100
(C) Total Traffic Unit	10,306	16,517	38,563	(A) + (B)
(D) Employees per Traffic Unit	1.65	1.55	1.40	
(E) Number of Employees	17,000	25,600	53,990	(C)*(D)
(F) Daily Working Employees	12,920	19,460	41,030	(E)*(0.40+3/5*0.60)

Table 3.2.4 Estimated Flight Employees in JIAC

	1985		1990		2000		Calculation
	DOM	INT	DOM	INT	DOM	INT	
(A) Aircraft (1000)/year	114	24	140	28	207	46	
(B) Aircraft/day	312	66	384	77	567	124	(A)/365
(C) Aircraft (one way)	156	33	192	38	284	62	(B)/2
(D) Crew/Aircraft	9	15	9	15	9	15	
(E) Crew	1,404	495	1,728	570	2,556	930	(C)*(D)
(F) Total Crew	1,900		2,300		3,490		(E) DOM+INT

(Note) DOM : Domestic, INT : International

Table 3.2.5 Estimated Total of Daily Working Employees in JIAC

Unit : Persons/day

	1985	1990	2000	Remarks
Ground Employees	12,920	19,460	41,030	from Table 3.2.3
Flight Employees	1,900	2,300	3,490	from Table 3.2.4
Total	14,820	21,760	44,520	

(4) Estimated person trips/day

Based on the above estimation, the total number of person trips departing from and arriving at JIAC per day is estimated to be 107, 166, 360 and 531 thousand for 1985, 1990, 2000 and 2010, respectively as shown in Table 3.2.6. Person trips for 2010 is estimated by applying 1/2 of the growth rate from 1990 to 2000 for each category.

Table 3.2.6 Estimated Person Trips/Day of JIAC

	1985	1990	2000	2010	Remarks
(A) Number of Passengers	24,570	38,750	85,970	-	from Table 3.2.1
(B) Number of Visitors	26,460	41,730	92,580	-	from Table 3.2.2
(C) Number of Employees	14,820	21,760	44,520	-	from Table 3.2.5
(D) Trips of Passengers	24,570	38,750	85,970	128,050	(A)*1
(E) Trips of Visitors	52,920	83,460	185,160	275,790	(B)*2
(F) Trips of Employees	29,640	43,520	89,040	127,360	(C)*2
(G) Total Person Trips	107,130	165,730	360,170	531,200	(D)+(E)+(F)
Growth Rate (% p.a.)	9.1	8.1	4.0		

3.2.2 Estimation of Future Person Trip Distribution

Present trip distribution pattern of Halim and Kemayoran airports was obtained by the Interview Survey for airline passengers, visitors to the airports and airport employees as already described.

When the existing airports are moved to the New Airport, it is expected that origin distribution pattern of airline passengers and visitors will have little change for the time being. But it is also expected that their origin distribution pattern will be considerably changed during such a long time that the present land use in each zone is significantly changed. It is found through correlation analysis that trip distribution pattern of airline passengers and visitors to the airports has a close relationship with zonal trip ends, which had been estimated by "Feasibility Study on Jakarta Harbour Road" (by JICA, 1981).

Considering the above, it is assumed that the present pattern of origin distribution is a major factor in deciding the trip distribution pattern of the New Airport in the near future while the future zonal trip ends is a major factor in deciding the trip distribution pattern in the remote future. The estimated person trips of airline passengers and visitors to the airport in 1990, 2000 are distributed based on the present distribution pattern with decreasing rates at 75%, 50% and 25%, respectively. The remaining person trips is distributed to each zone based on the estimated zonal trip ends in the future.

The airport employees who are responsible for airport operation will be offered their accommodation to live in the vicinity of the airport when the New Airport is open to traffic. There is a program to construct an accommodation unit for 2,000 households in the southern part of the New Airport. There will be other accommodation construction programs in due course of time. But those who are now offered accommodation in Halim and Kemayoran airport area accounts for only 8% of the total employees in the airport. This percentage will be slightly increased for the New Airport because of its long distance from the city area, but most part of the employees will commute to the New Airport from their present houses. In the remote future, it is expected that the employees will tend to move their residence to the vicinity of the New Airport and that the newly employed will be supplied from Tangerang district to avoid commuting losses.

Considering the above, it is assumed that the present pattern of origin distribution of employees is a major factor in deciding their distribution pattern in the near future while the future zonal residential population is a major factor in deciding the distribution pattern in the remote future. The estimated person trips of airport employees in 1990, 2000 and 2010 are distributed based on the present distribution pattern with decreasing rates at 75%, 50% and 25%, respectively. The remaining trip ends is distributed to each zone based on the estimated zonal residential population in the future.

The estimated trip distribution patterns of airline passengers, visitors to the airport and airport employees are as shown in Table 3.2.7 and they are illustrated in a summarized form as shown in Table 3.2.8 and Fig. 3.2.1.

Airport related person trips are considerably increased for each zone from 1982 to 2000. Though the airport related person trips of the existing CBD are estimated to increase considerably, the airport related person trips of south and east Jakarta are estimated to increase further.

Table 3.2.7 Estimated Person Trip Distribution of JIAC

unit : person trips/day

No.	Zone Name	1990				2000				2010			
		Passengers	Visitor	Employees	Total	Passengers	Visitor	Employees	Total	Passengers	Visitor	Employees	Total
1	Cideng	703	681	219	1603	1323	1617	343	3283	1613	2558	331	4502
2	Gambir	1328	1972	366	3666	3168	5509	692	9369	5032	9859	858	15749
3	Sawah Besar	306	1198	2602	4106	858	2645	3789	7292	1559	3952	3162	8673
4	Pasar Baru	229	378	85	692	410	715	159	1284	470	887	192	1549
5	Kemayoran	623	3373	5911	9907	1311	5830	8371	15512	1877	6281	6569	14727
6	Senen	2105	1674	239	4018	3261	2796	396	6453	2770	2817	419	6006
7	Kramat	478	1698	1252	3428	975	3087	1835	5897	1332	3605	1551	6488
8	Cempaka Putih	891	2531	1107	4529	1868	4932	1909	8709	2653	6389	2124	11166
9	Cikini	1933	2638	183	4754	3197	4628	351	8176	3142	5085	444	8671
10	Menteng	1722	3202	456	5380	2979	5663	751	9393	3189	6308	772	10269
11	Kebon Melati	2269	2093	156	4518	3657	3741	382	7780	3412	4269	591	8272
12	Karet Tengsin	2080	1642	486	4208	3566	3481	851	7898	3738	4925	971	9634
13	Kanal Muara	7	13	7	27	28	54	20	102	66	137	41	244
14	Kapuk Muara	21	39	16	76	83	171	54	308	187	398	116	701
15	Penjagalan	119	172	102	393	396	730	250	1376	774	1575	416	2765
16	Penjaringan	428	644	114	1186	1265	2315	466	4046	2303	4656	1014	7973
17	Mangga Dua Utara	215	687	83	985	610	1644	113	2367	1099	2613	105	3817
18	Pademangan	94	684	215	993	197	1138	406	1741	345	1274	523	2142
19	Tanjung Priok	923	2134	1285	4342	2451	5493	2332	10276	4235	9281	2987	16503
20	Cilincing	419	1120	875	2414	1681	3940	2364	7985	3492	7758	4162	15412
21	Semanan	22	44	25	91	110	230	106	446	279	595	262	1136
22	Rawa Buaya	38	317	101	456	200	780	275	1255	528	1397	558	2483
23	JIAC Passenger	-	-	-	-	-	-	-	-	-	-	-	-
24	JIAC Visitors	-	-	-	-	-	-	-	-	-	-	-	-
25	JIAC Employees	-	-	-	-	-	-	-	-	-	-	-	-
26	Kamal	26	52	30	108	83	171	90	344	176	374	149	699
27	Pegadungan	12	19	13	44	30	58	33	121	59	121	50	230
28	Kali Deres	19	117	83	219	70	261	159	490	162	430	196	788
29	Cengkareng	286	169	176	631	508	432	317	1257	516	619	357	1492
30	Kapuk Barat	16	29	17	62	51	103	49	203	85	177	79	341
31	Kapuk Timur	28	137	34	199	97	320	95	512	162	430	149	741
32	K.K. Angke	21	119	23	163	70	261	70	401	132	366	125	623
33	Jelambar Utara	353	718	104	1175	772	1599	220	2591	1135	2400	350	3885
34	Jelambar Selatan	446	914	123	1483	1034	2158	289	3481	1612	3422	504	5538
35	Tomang	589	1368	209	2166	1446	3263	470	5179	2340	5152	739	8231
36	Slipi	849	1650	480	2979	1862	3745	988	6595	2739	5702	1461	9902
37	Mangga Besar	555	951	125	1631	978	1743	264	2985	1090	2077	362	3529
38	Tamansari	294	680	216	1190	651	1473	417	2541	979	2163	523	3665
39	Tambora	502	769	115	1386	1035	1765	307	3107	1415	2703	515	4633
40	Duri	205	341	161	707	561	1060	357	1978	988	2018	508	3514
41	Kembangan	145	388	261	794	895	2039	932	3866	2028	4450	1845	8323
42	Kebon Jeruk	519	561	255	1335	1210	1784	800	3794	1796	3257	1504	6557
43	Tebet	1096	4887	1007	6990	2131	8330	1818	12279	2742	8689	2385	13816
44	Setia Budi	1348	2546	702	4596	2550	4959	1274	8783	3157	6402	1489	11048
45	Mampang Prapatan	2410	6713	2011	11134	4974	12966	4106	22046	6846	16422	5935	29203
46	Kebayoran Baru	4581	9805	2430	16816	9873	21177	5063	36113	14157	30423	7499	52079
47	Matraman	519	1949	1804	4272	1241	3900	2759	7900	1966	5150	2529	9645
48	Pulo Gadung	1708	5382	2084	9174	5227	13777	3719	22723	9926	23251	4637	37814
49	Jatinegara	1283	3508	2581	7372	2938	7430	4533	14901	4565	10650	5426	20641
50	Kramat Jati	1200	3442	4023	8665	3521	8853	6834	19208	6536	15024	7924	29484
	DKI Jakarta Total	35963	76148	34952	147063	77402	164766	62178	304346	111404	238491	75408	425303
51	Tangerang	210	369	1746	2325	778	1552	7053	9383	1793	3770	15125	20688
52	Batu Ceper	56	115	1784	1955	225	478	7795	8498	539	1156	17140	18835
53	Mauk	10	18	70	98	34	67	297	398	77	161	641	879
54	Cikupa	41	82	338	461	158	333	1465	1956	382	816	3221	4419
55	Serpong	327	861	1370	2558	1270	2968	5805	10043	2989	6610	12646	22245
56	Depok	478	1254	1173	2905	1778	4157	1600	7535	3486	7755	1144	12385
57	Bogor	424	1272	585	2281	1046	2784	799	4629	1623	3892	571	6086
58	Parung	16	30	64	110	64	130	88	282	125	264	63	452
59	Bekasi	286	1177	1433	2896	1224	3467	1954	6645	2754	6551	1397	10702
60	Cikarang	57	116	5	178	254	541	6	801	583	1251	4	1838
61	West Side	113	149	0	262	259	419	0	678	405	769	0	1174
62	Central Side	557	1602	0	2159	1020	2794	0	3814	1215	3060	0	4275
63	East Side	212	267	0	479	458	704	0	1162	675	1244	0	1919
	GRAND TOTAL	38750	83460	43520	165730	85970	185160	89040	360170	128050	275790	127360	531200

Table 3.2.8 Summarized Distribution Pattern of JIAC

Unit : 1000 person trips/day

		1990				2000				2010			
		Pas.	Vis.	Emp.	Total	Pas.	Vis.	Emp.	Total	Pas.	Vis.	Emp.	Total
DKI Jakarta	Central	14.7	23.1	13.0	50.8	26.6	44.6	19.8	91.0	30.8	56.9	18.0	105.7
	North	2.2	5.5	2.7	10.4	6.7	15.5	6.0	28.2	12.5	27.7	9.4	49.6
	West	4.9	9.3	2.6	16.8	11.7	23.2	6.2	41.1	18.2	37.9	10.2	66.3
	South	9.4	24.0	6.1	39.5	19.5	47.4	12.3	79.2	26.9	61.9	17.3	106.1
	East	4.7	14.3	10.5	29.5	12.9	34.0	17.8	64.7	23.0	54.1	20.5	97.6
	Total	35.9	76.2	34.9	147.0	77.4	164.7	62.1	304.2	111.4	238.5	75.4	425.3
Outside DKI Jakarta	Tangerang	0.6	1.4	5.4	7.4	2.5	5.5	22.4	30.4	5.8	12.5	48.8	67.1
	Bogor	0.9	2.6	1.8	5.3	2.9	7.1	2.5	12.5	5.2	11.9	1.8	18.9
	Bekasi	0.4	1.3	1.4	3.1	1.5	4.0	2.0	7.5	3.3	7.8	1.4	12.5
	Others	0.9	2.0	0.0	2.9	1.7	3.9	0.0	5.6	2.3	5.1	0.0	7.4
	Total	2.8	7.3	8.6	18.7	8.6	20.5	26.9	56.0	16.6	37.3	52.0	105.9
Total		38.7	83.5	43.5	165.7	86.0	185.2	89.0	360.2	128.0	275.8	127.4	531.2

Note: Pas. - Airline Passengers

Vis. - Visitors to JIAC

Emp. - Airport Employees

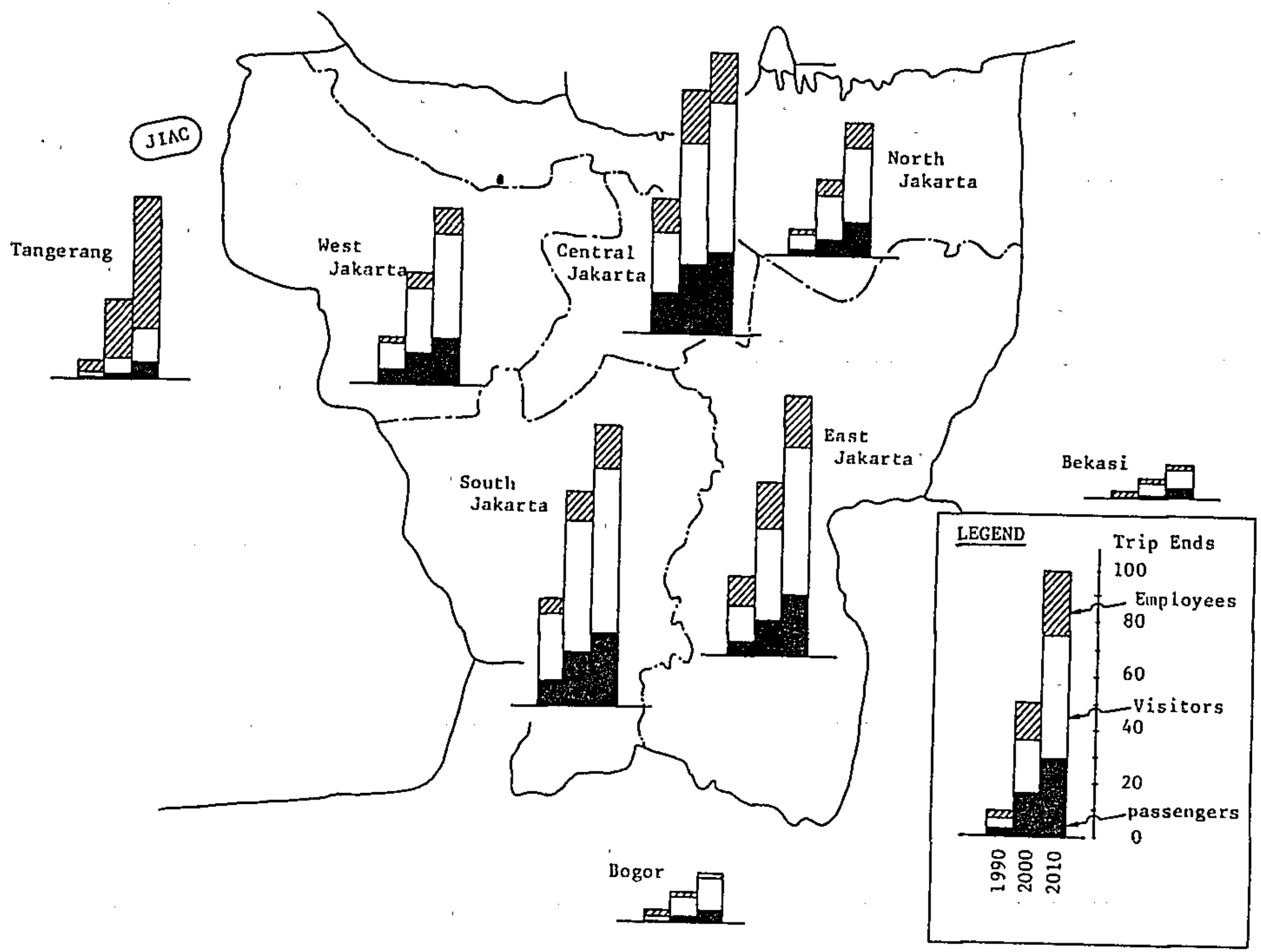


Fig. 3.2.1 Trip Distribution Pattern of JIAC

3.2.3 Estimation of Future Air Freight Transportation

Future cargo transportation by air in DKI Jakarta is estimated by JIAC Project as shown in Table 3.2.9. By the year 1990, total volume of cargo transportation by air is estimated to be 2.7 times that of 1982 and 8.0 times by 2000.

A significant change compared with the present situation is that domestic air freight share will be increased to about 80% while it is slightly higher than 50% at present.

According to the Broad Outline of the State Policy (Garis-garis Besar Haluan Negara), there are so many development programs outside Java Island to develop upstream/basic and key industries processing basic materials into raw materials/semi finished products. Achieving this goal, transmigration to outside Java Island is to be promoted to comply with the manpower demand in each industrial growth center. This will eventually increase cargo transportation by domestic airlines. Main flow of air cargo transportation at the time is supposed that multifarious cargoes such as spare parts, food stuffs, household needs, government shipment, etc. will be dispatched from DKI Jakarta to other islands.

These cargoes are characterized as high valued goods requiring urgent delivery in small lot. The function of air cargo agents will be further strengthened especially to collect cargoes in small lot from a large number of consignors for the earliest dispatch.

Judging from both the characteristics of air cargoes and the estimated total tonnage of daily handled air cargoes in JIAC, truck is considered to be the most suitable transportation means to carry the goods from various parts of JABOTABEK area to JIAC or vice versa.

The New Railway Line for Cengkareng Airport is, therefore, designed only for passenger transportation but not for cargo transportation.

Table 3.2.9 Estimated Air Cargo Transportation of JIAC

Unit: ton

	Per Year				per Day			
	1985	1990	2000	2010	1985	1990	2000	2010
Domestic	95,100	175,200	570,800	1,030,300	260,55	480.00	1,563.84	2,822.74
International	38,700	62,300	147,500	227,000	106,03	170.68	404.11	621.92
Mail	11,800	21,100	57,800	95,700	32.33	57.81	158.36	262.19
Total	145,600	258,600	776,100	1,353,000	398.91	708.49	2,126.31	3,706.85
Growth rate (% p.a.)					12.2	11.6	5.7	

Note: Tonnage of 2010 is estimated by applying 1/2 of growth rate from 1990 to 2000.

3.3 Forecast of Railway Passengers on the New Railway Line

3.3.1 General

(1) Characteristics of the New Railway Line

The functions and conditions of the New Railway Line for Cangkareng Airport are presumed as follows in forecasting the future number of railway passengers:

i) The New Railway Line is planned to be a rapid transit system connecting JIAC with the C.B.D./residential area of DKI Jakarta through full utilization of the existing railway network.

ii) The New Railway Line has no intermediate stations between JIAC and the junction station with the existing railway network so as to offer rapid transportation service to the airport related trips and so as not to give development impetus to the wayside area of the New Railway Line because most of the area is planned to be a conservation area.

iii) The Airport Train is to be operated from JIAC to Jatinegara station as a rapid transit system. The Train operated on Route A is to stop at such selective stations as Kota Intan, Jayakarta, Sawah Besar, Gambir, New Cikini and Manggarai. The Train operated on Route C is to stop at such selective stations as Rawa Buaya, Tanah Abang, Dukuh and Manggarai.

(2) Procedure of Traffic Demand Forecast

The estimated person trips related to JIAC are then distributed among transportation means by following the procedure shown in Fig.3.3.1.

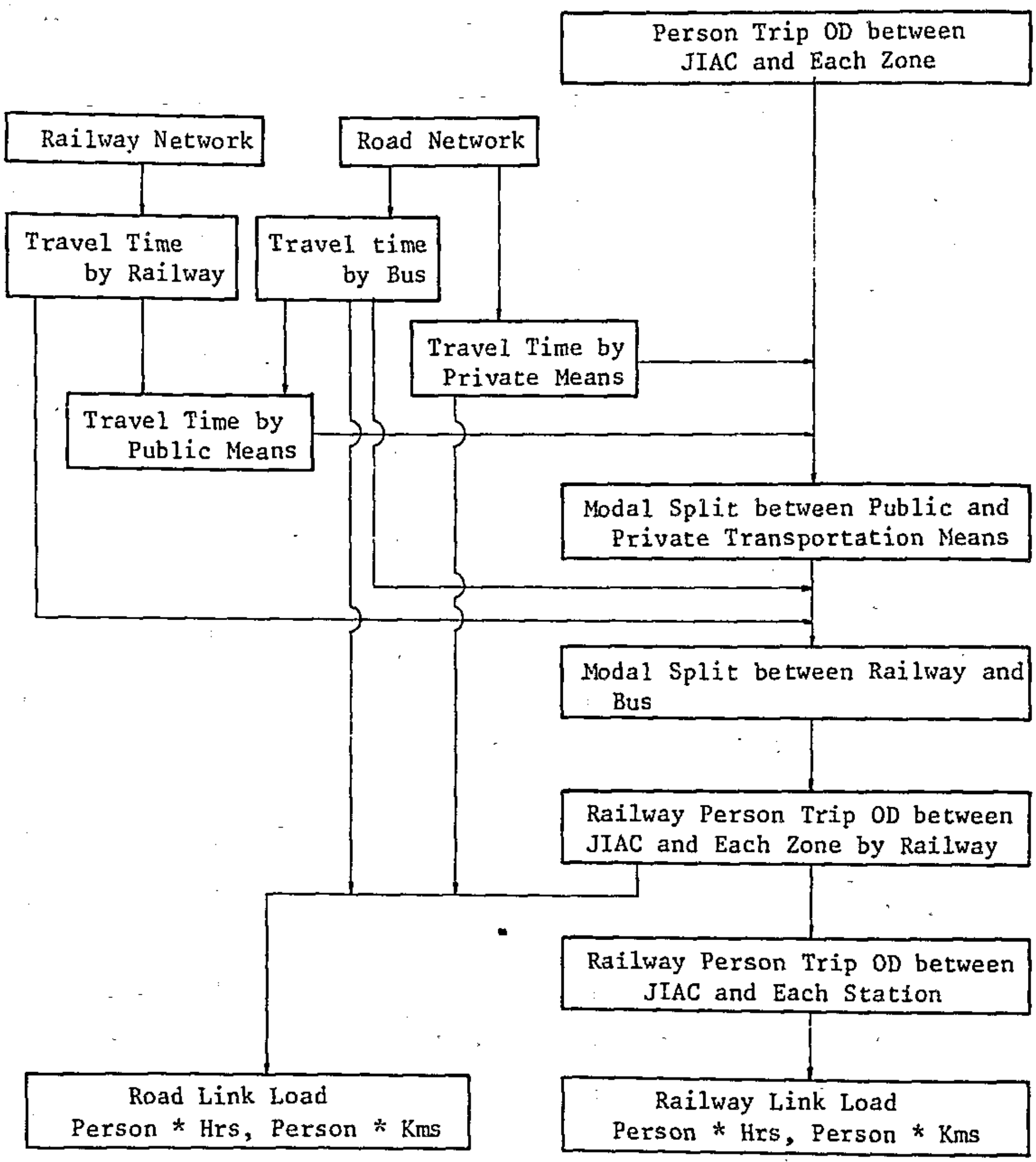
i) Person trips between JIAC and each zone are distributed to public and private transportation means by reflecting the travel time of each transportation means. Travel time by railway consists of access time from the terminal building at JIAC to the railway station, waiting time for train, time necessary for changing train from the New Railway Line to the existing railway network if any, travel time by train from the origin station to the destination station and access time from railway station to the desitnation zone. Travel time by bus and private transportation means is estimated by the minimum route search on the road network. Travel time by public transportation means is calculated as the average travel time by railway and bus.

ii) The zonal number of person trips by public transportation means is estimated by multiplying the estimated zonal person trips by zonal public transportation share which has been obtained based on both the travel time ratio of public transportation means over private ones and the established modal split curve for airline passengers, visitors and airport employees.

iii) The zonal number of person trips by railway is estimated by multiplying the estimated zonal number of passengers by public transportation means by zonal railway share which has been obtained based on both the travel time ratio of railway over bus and the established modal split curve for airline passengers, visitors and airport employees.

iv) Person trip OD tables by railway are established through the above mentioned procedure. These OD tables are then converted to railway station OD tables. Total travel distance (person * kms) and travel time (person * Hrs) generated by the New Railway Line are estimated as a result of assigning the railway station OD tables on the established railway network.

v) Total person * kms and person * Hrs that might be appeared on the road network in case of "Without the Project" case are estimated as a result of assigning person trip OD tables by railway on the established road network.



Note: JIAC - Jakarta International Airport, Cengkareng
OD - Origin and Destination

Fig. 3.3.1 Procedure of Traffic Demand Forecast

(3) Transportation Network

For the purpose of traffic demand forecast, transportation network has been established as shown in Fig. 3.3.2 in consideration of the future development plan of the transportation network.

The railway network in DKI Jakarta is composed of a circular line encompassing the central business district and four radiating lines extending to the rural areas of Tangerang, Serpong, Bogor and Bekasi. The total length of the railway network in DKI Jakarta amounts to 91 km. The existing railway network is expected to be improved in compliance with the JABOTABEK Railway Master Plan. However, the development of the railway network is mainly composed of its improvement. The New Railway Line for Cengkareng Airport is the only additional line for passenger transportation. The total length of the future railway network is estimated all 111 km in case of Route A and at 106 km in case of Route C.

The total length of road network in DKI Jakarta amounts to about 3,000 km. The road length per square kilometer is approximately 5 km, which is considerably low when compared with those of highly motorized cities abroad. The low density of road network requires arterial streets to fulfill the functions of arterial, collector and local streets at the same time. This fact entails to deter the effective traffic flow in the center of DKI Jakarta. The deficiency of the street network connecting the east and the west causes to deter the effective traffic flow, too. The tollway now open to traffic is JAGORAWI Freeway extending from Cililitan to Ciawi.

The future development plan of road network is now being materialized step by step. Construction of Cengkareng Access Highway will be started this year and the highway will be open to traffic when JIAC starts its operation at the end of 1984. The future tollway network will be composed of two circular tollways, namely, Jakarta Intra Urban Tollway and Jakarta Outer Ring Road and three regional freeways, namely, JAGORAWI Freeway, Jakarta-Cikampek Freeway and

Jakarta-Tangerang Freeway. The whole tollway network will be completed by 2000. The tollways scheduled to be open to traffic by 1990 are assumed as follows:

Jakarta Intra Urban Tollway	: Grogol - Halim - Tg. Priok
Jakarta Harbour Road	: Tg. Priok - Ancol (a part of Jakarta Intra Urban Tollway)
Jakarta Outer Ring Road	: Ciputat - JAGORAWI, JKT=Cikampek-Cakung
Three regional tollways	

Future development plans of transportation network described above have been duly incorporated into the traffic demand forecast. Fig. 3.3.2 shows the outline of transpotation network of DKI Jakarta in 2000 established for the purpose of traffic demand forecast.

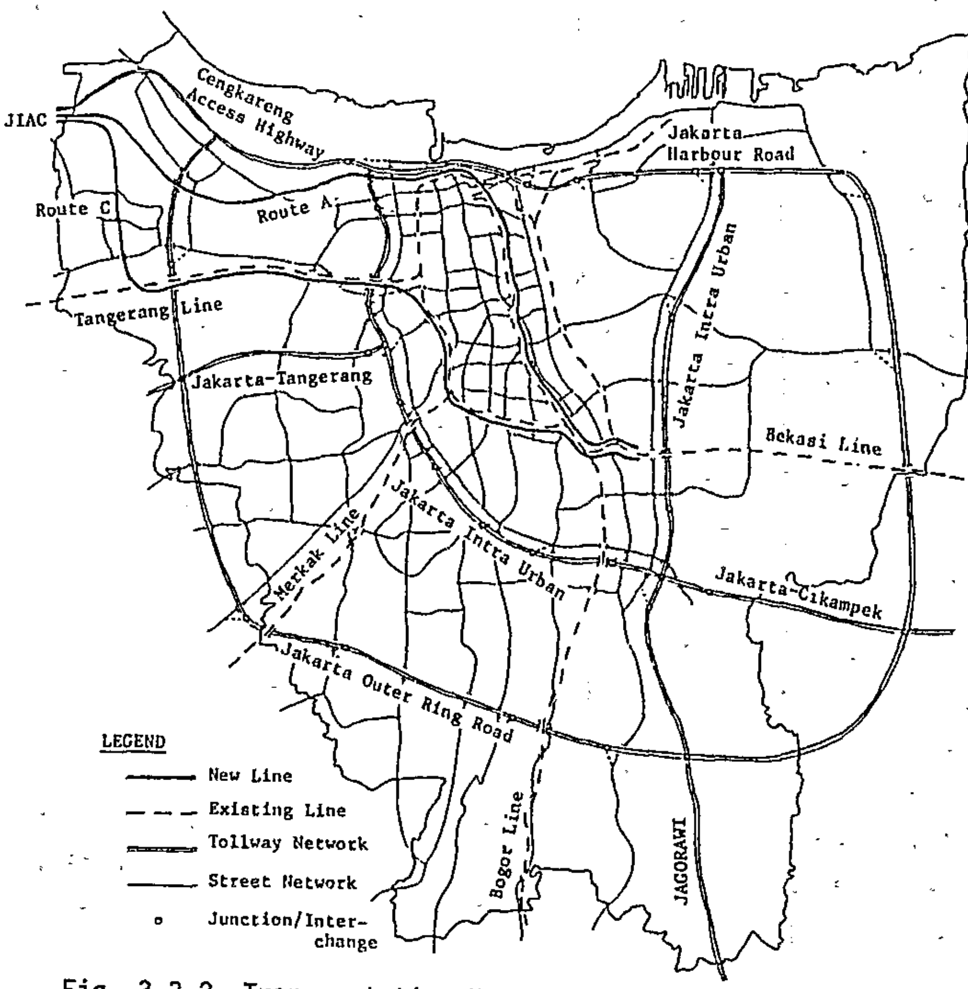


Fig. 3.3.2 Transportation Network of DKI Jakarta in 2000

3.3.2 Modal Split

On estimating the number of passengers on the New Railway Line, the procedure is divided into two steps. The first step is to estimate modal split between public and private transportation means of the airport related trips and the second is to estimate modal split between railway and bus of the passengers by public transportation means.

As previously shown in Table 3.1.5, 3.1.7 and 3.1.8, there are many factors affecting the modal choice. Among these factors, travel time is considered to be the most determinant factor for the modal choice of the trips related to the existing airports. As to the airport employees, travel cost is another determinant factor for their modal choice. However, from the viewpoint that the cost factor varies in large extent according to the public transportation policy, it was concluded in this study that the cost factor should not be taken into account at this stage when the tariff system related to the New Airport has not been coordinated among the authorities concerned.

Discussions on the modal split model is to be concentrated solely on time factor, accordingly.

(1) Modal Split between Public and Private Transportation Means

It is desirable to derive a modal split curve between public and private transportation means from the empirical data obtained by the survey at Halim and Kemayoran Airports. Unfortunately, however, public transportation means are not well provided to and from the airports and especially, railway does not function as an access transportation means at all.

In order to establish a modal split curve, the below-mentioned phenomena have been taken into account:

i) Private transportation means is preferred in short distance trip while public transportation means, especially railway, is preferred in long distance trip.

In short distance trip, private transportation means has such advantages as direct access from origin to destination and rather less influence of traffic congestions. Public transportation means, however, involves access time to and from a station and waiting time for train/bus. Travel time by public transportation means tends to be longer than that by private transportation means. In long distance trip, on the other hand, travel time by private transportation means tends to be greatly increased because of the possible influence of traffic congestions between origin and destination.. Travel time by public transportation means, especially railway, tends to be far less than that by private transportation means because travel time on the main line predominates in the whole travel time between origin and destination.

ii) Though the tollway network will be developed for the future, the total length of street network in future will remain almost same with at present. Tollway network will help ease traffic congestions as a whole but traffic congestions on the access streets to the tollway network will be considerably increased. This will cause travel time between JIAC and each zone increased and fluctuated. Public transportation means will be preferred to private transportation means on this account, too.

iii) It will be in a remote future that the car ownership ratio of about 50 vehicles per thousand persons (excluding motorcycle) in 1980 will be increased to the ratio of around 30 vehicles which has been attained in highly motorized cities abroad. Low car ownership will impose a restriction to the preference of private transportation means.

iv) Judging from the result of the interview survey held at Halim and Kemayoran airports and some examples of overseas airport, employees has the highest tendency to use public transportation means with airline passengers the second and visitors the last. Visitors to the airport are mostly composed of well-wishers, greeters and persons of business purpose who are considered to have special necessity to use private transportation means.

Based on the above consideration and some examples in Japan, a modal split curve between public and private transportation means is established as shown in Fig. 3.3.3.

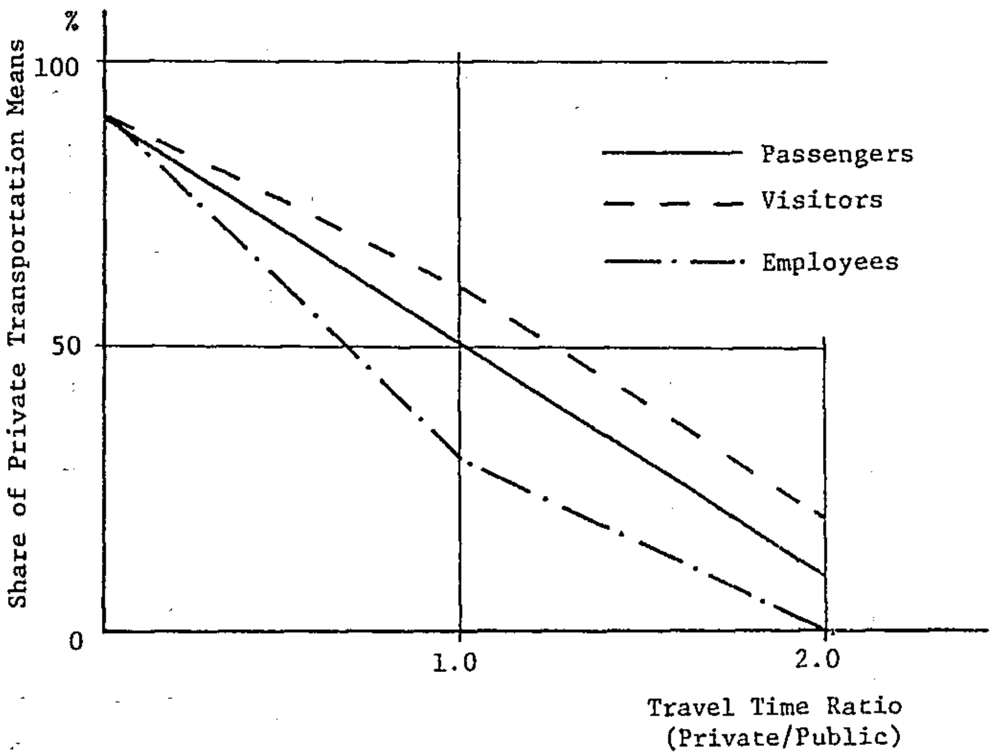


Fig. 3.3.3 Modal Split Curve between Public and Private Transportation Means

In short distance trip, it is usual that the travel time by private transportation means is less than that by public transportation means. This phenomenon is expressed by the travel time ratio of less than 1.0 in the Figure. In long distance trip, on the other hand, it is usual that the travel time by private transportation means is more than that by public transportation means. This phenomenon is expressed by the travel time ratio of more than 1.0 in the Fig. 3.3.3.

(2) Modal Split between Railway and Bus

By the same reason described in the preceeding paragraph, the below-mentioned phenomena have been taken into account to establish a modal split curve between railway and bus:

i) Airport bus system will have bus stops just in front of the terminal buildings and frequent operation service to its passengers. On the other hand, Airport Access Railway necessitates feeder transportation from the terminal buildings to Airport Railway Station and less frequent operation service to its passengers during the period of single track operation. This fact will advantage bus system in short distance trip.

ii) Airport bus destinated to the center of the city will be operated on Cengkareng Access Highway and other related tollways up to the most convenient interchange to the city bus terminal. From the city bus terminal, feeder transportation to the every part of Jakarta will be necessary. Compared with Airport Access Railway of which feeder transportation is composed of wideranging JABOTABEK Railway system, airport bus system is considered to have interior feeder transportation in the city area. If airport bus is operated on plural bus routes to improve the feeder transportation in the city area, frequent bus service will inevitably be lowered within the limit of the available number of airport bus. This fact will promote the transfer of passengers from bus to railway.

iii) The velocity of bus will be maintained at high speed level on tollways but will be considerably lowered on street network due to the traffic congestions. The travel time by bus from JIAC to each zone will be considerably increased, accordingly.

Although the average velocity of railway will be lowered if passengers change train from the rapid Airport Train to the ordinary train on the existing lines, the travel time by railway from JIAC to each zone is estimated to be less than that by bus in long distance trip.

iv) Judging from some examples of overseas airport, employees have the highest tendency to use railway with airline passengers the second and visitors the last.

Based on the above mentioned considerations and also some examples in Japan, a modal split curve between railway and bus is established as shown in Fig. 3.3.4.

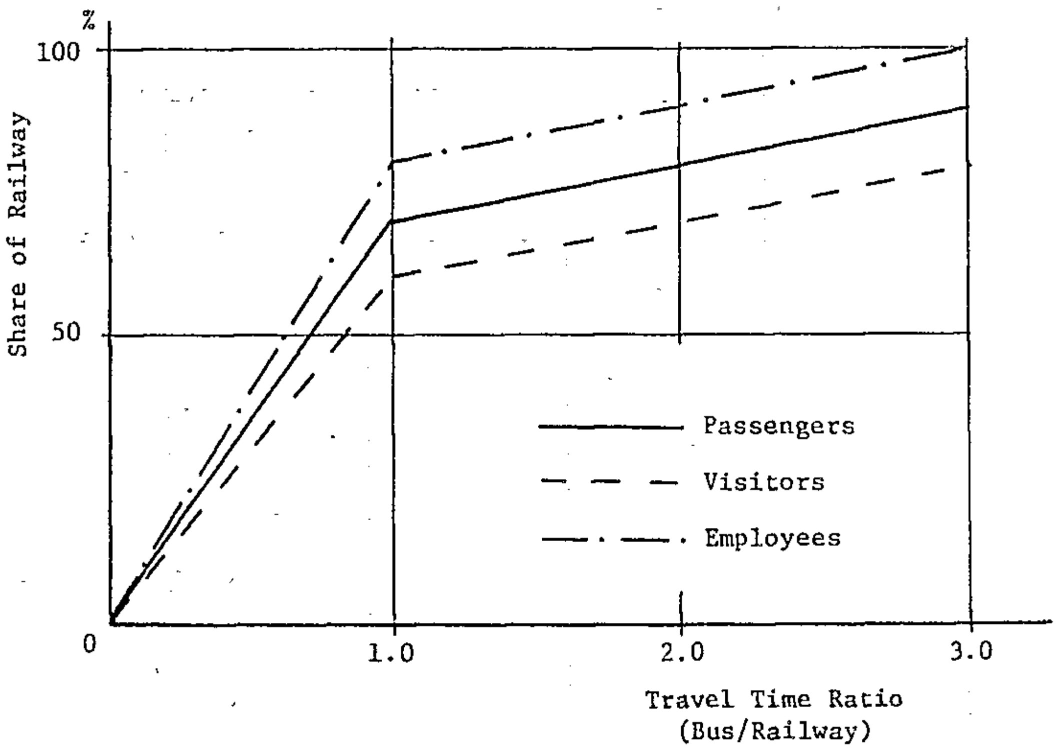


Fig. 3.3.4 Modal Split Curve between Railway and Bus

In the Figure, the range of travel time ratio of less than 1.0 means that travel time by bus is less than that by railway, and the range of travel time of more than 1.0 means that travel time by bus is more than that by railway. The former corresponds to the rather short distance trip and the latter corresponds to the long distance trip on the whole.

(3) Estimation of Travel Time

Travel time between JIAC and each zone is estimated as follows:

i) Railway

RTi = RAm + RWm + RSmm + RC + RAni

RTi : Travel time by railway between JIAC and zone i

RAm : Access time between airport terminal building and airport railway station m

Access time	1990	2000	2010
RAm (min.)	8	8	8

RWm : Waiting time for train at airport railway station m

Waiting time	1990	2000	2010
RWm(min.)	10	10	5

Rsmn: Time required to travel between airport railway station m and station n nearest to zone i

Scheduled speed (Km/H)	1990	2000	2010
Route A	51	51	51
Route C	53	53	53
Existing Lines	30	30	30

RC : Time required to change train if necessary 5 min. per train change

Times of train change depend on each zone

RAni: Access time between station n and zone i

RAni depends on the distance between n and i

Access traveling speed 20 Km/H

ii) Bus

BTi = BAm + BWm + BSmn + BC + BAni

BTi : Travel time between by bus JIAC and zone i

BAm : Access time between airport terminal building and airport bus stop m

Access time	1990	2000	2010
BAm (min.)	3	3	3

BWm : Waiting time for bus at airport bus stop m

Waiting time	1990	2000	2010
BWm (min.)	5	5	5

BSmn: Time required to travel between JIAC and bus top n nearest to zone i

Average Speed (km/H)	1990	2000	2010
Street	24.0	22.0	20.0
Tollway	60.0	57.5	50.0
Interchange	25.0	25.0	25.0

The average speed has been assumed based on the results of traffic assignment performed by transportation studies in Jakarta.

BC : Time required to change bus if necessary
5 min. per bus change
Times of bus change depend on each zone

BAni: Access time between bus stop n and zone i
5 min.
Airport bus route is not fixed on some particular route.

iii) Private Transportation Means

PTi = PAm + PSi

PTi : Travel time by private transportation means between JIAC and zone i

PAm : Access time between airport terminal building and parking lot m

Access time	1990	2000	2010
PAm (min.)	5	5	5

PSi : Time required to travel between JIAC and zone i

Average Speed (Km/H)	1990	2000	2010
Street	30.0	27.5	25.0
Tollway	60.0	57.5	50.0
Interchange	25.0	25.0	25.0

The average speed has been assumed based on the results of traffic assignment performed by transportation studies in Jakarta.

(4) Result of the Modal Split

By following the above explained modal split, person trips related to JIAC have been distributed among transportation modes. The estimated modal split is as shown in Table 3.3.1 and Fig. 3.3.5.

Route A

Public transportation share is estimated to be 43, 47 and 54% for 1990, 2000 and 2010, respectively. The number of daily railway passengers to and from JIAC is estimated to be 36, 85 and 168 thousand passengers for the respective years and railway share is estimated to be 22, 34 and 32%, respectively.

Route C

Public transportation share is estimated to be 41, 44 and 48% for 1990, 2000 and 2010, respectively. The number of daily railway passengers to and from JIAC is estimated to be 33, 76 and 138 thousand passengers for the respective years and railway share is estimated to be 20, 21 and 26%, respectively.

The estimated number of railway passengers on Route A is greater than that on Route C by 3, 9 and 30 thousand passengers for 1990, 2000 and 2010, respectively.

Railway share is estimated to increase in due course of time. The main reasons are that the airport train operation frequency is increased when the double track operation is started, and that the travel speed on road network is lowered due to the traffic congestions for the future.

The estimated railway share falls in the range of 20 - 32% for both routes and for the respective years. Of the examples of airport access railway in the world, the railway share of Frankfurt Airport and Kloten Airport show approximately the same share with this estimated result. The railway share of Gatwick Airport and Haneda Airport account for the higher share of 40 - 55%. It would involve some difficultes to compare the estimated result directly with the overseas examples of different situations. However, judging from the density of airport access road network and car ownership, the New Railway Line for Cengkareng Airport will inevitably share high portion of the traffic demand to and from the airport.

The estimated modal split of each traffic zone is as shown in Appendix 3.

Table 3.3.1 Estimated Modal Split of JIAC Related Trips

Unit : 1000 trips/day

	Route A			Route C		
	1990	2000	2010	1990	2000	2010
Private	95.1	191.4	247.5	97.2	199.9	274.3
Public	70.7	168.8	283.7	68.5	160.3	256.9
- Bus	34.7	83.5	115.3	35.4	84.6	118.8
- Railway	36.0	85.3	168.4	33.2	75.7	138.1
Total	165.7	360.2	531.2	165.7	360.2	531.2
Public Share (%)	42.7	46.9	53.4	41.3	44.5	48.4
Railway Share (%)	21.7	23.7	31.7	20.0	21.0	26.0

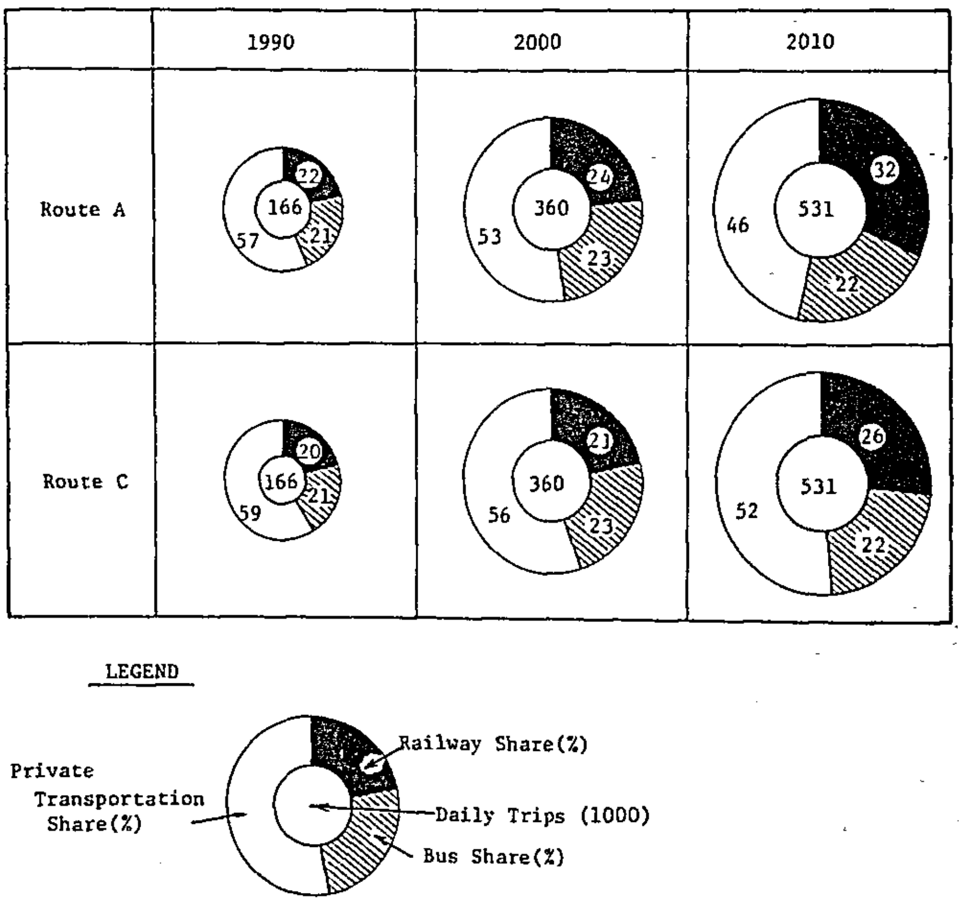


Fig. 3.3.5 Estimated Transportation Share of JIAC Related Trips

3.3.3 Estimated Railway Passengers on New Railway Line

(1) Estimated Passengers on Railway Network

The estimated number of railway passengers to and from JIAC has been distributed on JABOTABEK railway network. The results are as shown in Fig. 3.3.6 - 3.3.8.

Route A

Of the total number of railway passengers to and from JIAC, the composition ratio of passengers up to Gambir Station accounts for 39, 40 and 44% for 1990, 2000 and 2010, respectively. The ratio up to Manggarai Station accounts for 51, 54 and 55% for the respective years.

Manggarai station is the largest origin and destination station on this route with 20.5 thousand passengers in 2010. Gambir station is the second largest with 10.7 thousand passengers in 2010.

The composition ratio of passengers to and from Bogor and Bekasi lines approximately amounts to 30% for the respective years.

Kota Intan Station provides a junction to the existing railway lines other than Central Line. The composition ratio of passengers who use this junction accounts for 32, 33 and 36% for 1990, 2000 and 2010, respectively. Kota Intan Station is concluded as an important junction station to provide good accessibility to the New Railway Line.

Route C

Of the total number of railway passengers to and from JIAC, the composition ratio of passengers up to Tanah Abang Station accounts for 14, 17 and 19% for 1990, 2000 and 2010, respectively. The ratio up to Manggarai Station accounts for 40, 44 and 49% for the respective years.

Manggarai Station is the largest origin and destination station on this route with 19.4 thousand passengers in 2010. Tanah Abang Station is the second largest with 10.2 thousand passengers in 2010.

The composition ratio of passengers to and from such directions as Kota, Gambir and Pasar Senen amounts to 15, 15 and 14% for the respective years.

Compared with Route A, it is concluded that Route C has rather limited accessibility to and from the existing railway network. Persons who want to go to such areas as Kota, Gambir and Pasar Senen from JIAC will prefer private transportation means or bus railway.

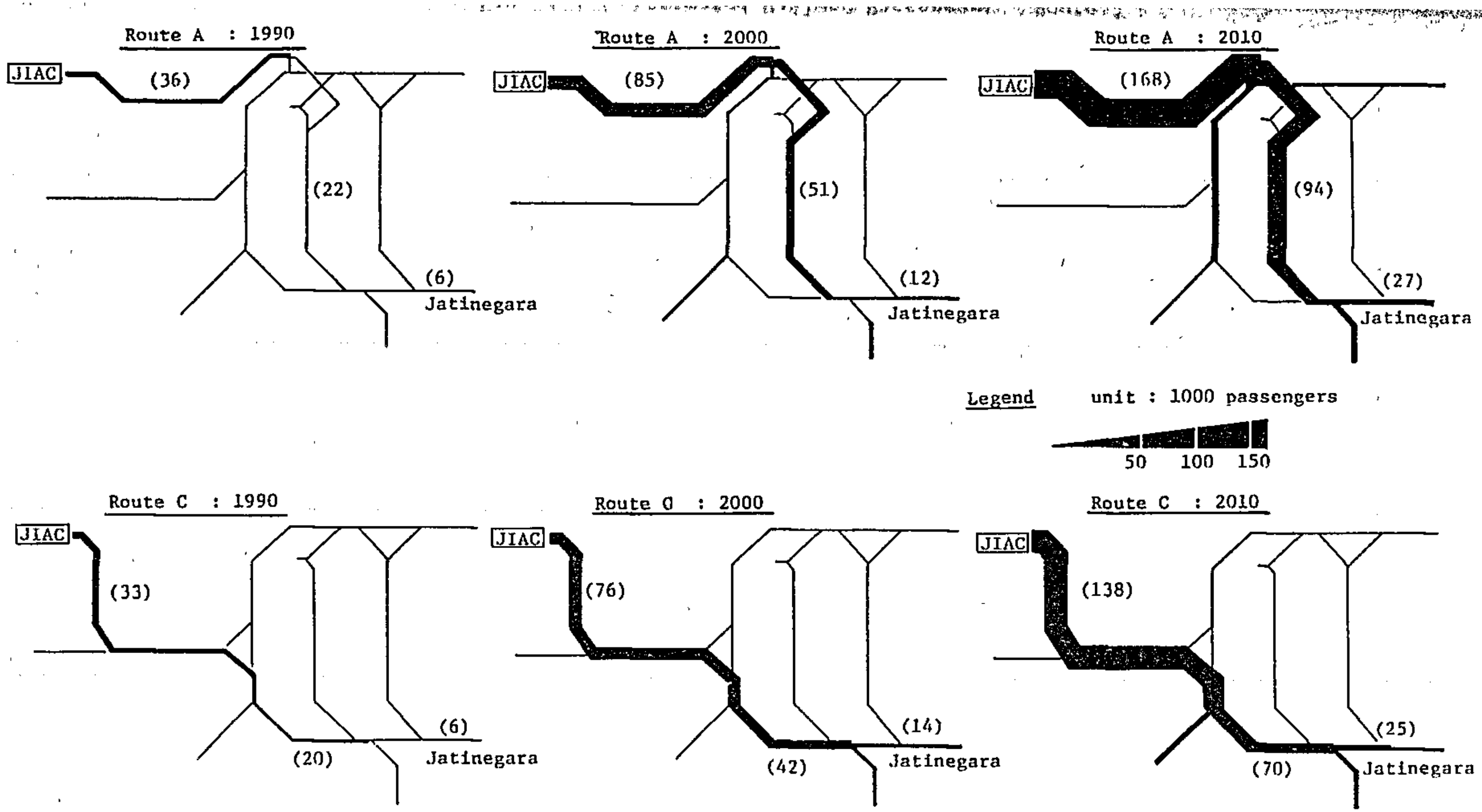


Fig. 3.3.6 Estimated Railway Passengers/Day (2 ways)

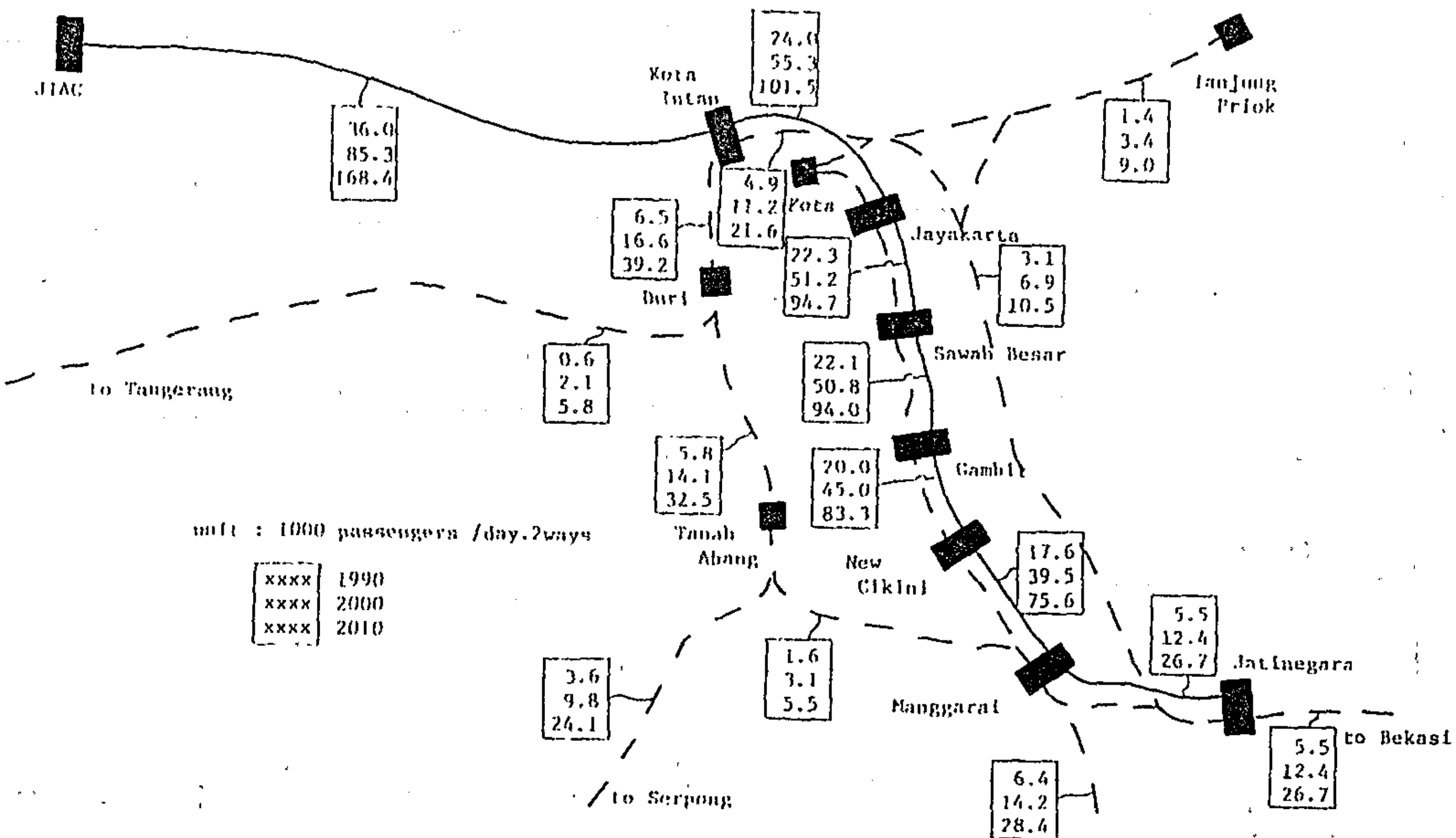


Fig. 3.3.7 Estimated Railway Passengers Route A

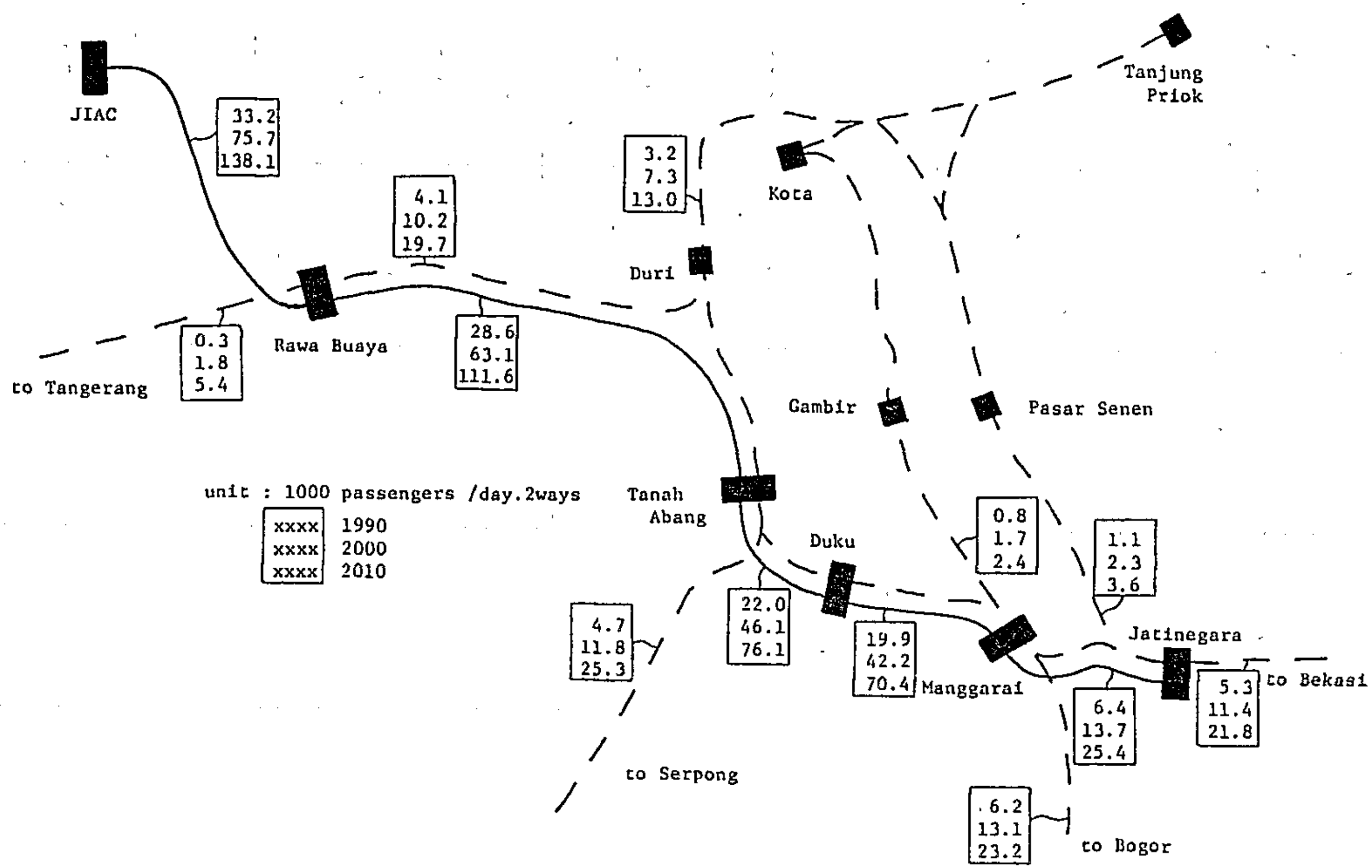


Fig. 3.3.8 Estimated Railway Passengers Route C

(2) Trip Characteristics of Railway Passengers

The average trip length of railway passengers to and from JIAC is estimated at about 33 km for Route A and about 36 km for Route C as shown in Table 3.3.2. The New Railway Line for Cengkareng Airport is concluded very useful to attract passengers at distant locations from JIAC, considering that the total length of Route A and Route C from JIAC to Jatinegara Station is 31 km.

The average trip length of Route A is slightly shorter than that of Route C. This is due to the fact that Route A attracts passengers through 6 intermediate stations in the central area while Route C has less attraction than Route A through only 4 intermediate stations, 3 in the central area and 1 in the suburban area.

Table 3.3.2 Trip Characteristics of Railway Passengers

	Route A			Route C		
	1990	2000	2010	1990	2000	2010
Passengers (1000/day)	36.0	85.3	168.4	33.2	75.7	138.1
Person * Km (1000/day)	1187.7	2851.3	5594.2	1210.3	2769.7	4937.3
Person * Hr (1000/day)	27.4	66.6	131.2	27.6	64.0	114.2
Velocity (Km/H)	43.3	42.8	42.6	43.9	43.3	43.2
Trip length (Km)	33.0	33.4	33.2	36.5	36.6	35.8
Trip Hour (min)	46.0	47.0	47.0	50.0	51.0	50.0

3.4 Estimated Benefit Generated by the New Railway Line

3.4.1 Railway Users' Benefit

Railway users' benefit is defined as the volume of savings of travel distance (person * kms) and travel time (Person * Hrs) generated by the New Railway Line. As previously shown in Fig. 3.3.1, the estimated "JIAC Person Trip OD by Railway" was distributed on the railway network and the total volume of person * kms and person * Hrs was calculated for the case of "With the Poject", resultantly. The same OD table, which shows the number of railway passengers generated by the New Railway Line, was distributed on the road network so as to estimate the total volume of person * Kms and person * Hrs for the case of "Without the Project". The balance of these estimated volume contributes to "Railway users' benefit".

The estimated volume of person * Kms and person * Hrs for both routes is as shown in Table 3.4.1.

Table 3.4.1 Estimated Railway Users' Benefit

Unit : 1000/day

		Route A			Route C		
		1990	2000	2010	1990	2000	2010
With	Person * km	1188	2851	5594	1210	2770	4937
	Person * Hr	27.4	66.6	131.2	27.6	64.0	114.2
Without	Person * km	1346	3329	6480	1274	3000	5322
	Person * Hr	38.4	80.6	175.9	36.6	73.7	147.1
Benefit	Person * km	158	478	886	64	230	385
	Person * Hr	11.0	14.0	44.7	9.0	9.7	32.9

As to Route A, the average saving of person * km per passenger is estimated at 4.4, 5.6 and 5.3 km for the year 1990, 2000 and 2010, respectively and the average saving of person * Hr per passenger is estimated at 18, 10 and 16 minutes for the respective years. Owing to the difference of tollway network between 1990 and 2000 as described in 3.3.1 (3), both savings do not show some regular tendency from 1990 to 2010. In 1990, most of the time minimum route between JIAC and each zone correspond to the distance minimum route between the two because the time minimum route by way of tollway network is incomplete. In 2000, however, due to the completion of the whole tollway network, the average saving of person * Hr becomes less than that of 1990 though the average saving of person * km increases.

As to Route C, the average saving of person * km per passenger is estimated at 1.9, 3.0 and 2.8 km for the year 1990, 2000 and 2010, respectively and the average saving of person * Hr per passenger is estimated at 16, 8 and 14 minutes for the respective years.

Railway users' benefit by Route A is greater than that of Route C from the aspects of both total volume and volume per passenger.

3.4.2 Road Users' Benefit

Road users' benefit is defined as the travel time saving of the road users caused by the traffic converted from road to railway. The traffic volume on road network in the case of "With the Project" is expected to be less than that in the case of "Without the Project". The reduced traffic will contribute to ease the road traffic congestion, which results in higher traveling speed of the remaining vehicles.

This effect is expected to prevail on the whole road network. However, the number of trips by the New Railway Line is so trifle compared with the total number of trips in JABOTABEK area that this effect will be negligible on the whole road network. In this study, this effect is, therefore, estimated only on Cengkareng Access Highway of which traffic volume is mostly composed of JIAC related trips.

Based on the estimated traffic volumes on Cengkareng Access Highway for "With the Project" case and "Without the Project case, road users' benefit is estimated as shown in Table 3.4.2. In 1990 when the traffic volume is still small, road users' benefit amounts to only 5.8 and 5.2 thousand person * Hrs for Route A and Route C, respectively. However, in accordance with the increase of JIAC-related trips, the road users' benefit of Route A jumps to 54.5 and 79.2 thousand person * Hrs for 2000 and 2010, respectively and that of Route C to 46.1 and 58.4 thousand person * Hrs for the respective years. Road users' benefit by Route A is greater than that of Route C by 12, 18 and 36% for 1990, 2000 and 2010, respectively.

Table 3.4.2 Estimated Road Users' Benefit

Unit : 1000 person * Hrs/day

		Route A			Route C		
		1990	2000	2010	1990	2000	2010
With	Bus	5.7	17.9	33.5	5.7	18.0	35.3
	Sedan	15.6	41.1	72.2	15.6	42.5	81.1
	Total	21.3	59.0	105.7	21.3	60.5	116.4
Without	Bus	7.7	36.8	65.1	7.5	33.5	57.2
	Sedan	19.4	76.7	119.8	19.0	73.1	117.6
	Total	27.1	113.5	184.9	26.5	106.6	174.8
Without -with	Bus	2.0	18.9	31.6	1.8	15.5	21.9
	Sedan	3.8	35.6	47.6	3.4	30.6	36.5
	Total	5.8	54.5	79.2	5.2	46.1	58.4

CHAPTER 4 GEOLOGICAL AND TOPOGRAPHICAL CONDITIONS

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4.1 Topography

4.1.1 General

Topography of DKI Jakarta and its surrounding area is featured by the flat coastal plain in the north and hills in the south.

The coastal plain is at an elevation of P.P.[*1] 1.0∿3.0 m forming a long narrow strip piece of distribution in parallel with the coast line, in a width of 5 to 6 km, around the river mouth delta of Ci Liwung. In the vicinity of Cengkareng in the west of the delta and Tanjung Priok in its east, beach ridges at an elevation of about P.P. 3.0 to 4.0 m are developed in parallel with the old coastline. Outside each of those areas, flood sediments of P.P. 4.0 to 6.0 m in elevation are distributed as micro ridges along the trace of meander from the rivers of Ci Sadane and Kali Cakung.

Hills in the inland area are of P.P. 5 to 25 m in elevation, featured by dissection being progressed under influence of all those rivers and their tributaries and by gentle inclination of the slope surface. Since all those rivers are flowing toward the north through the hills, having each river head in the mountainous district, ridges of the hills run in parallel with each other likewise in the direction of north-south.

*1 P.P.: Priok Peil

Low Low Water Level = P.P. 0 m
Mean Sea Level = P.P. + 0.60 m

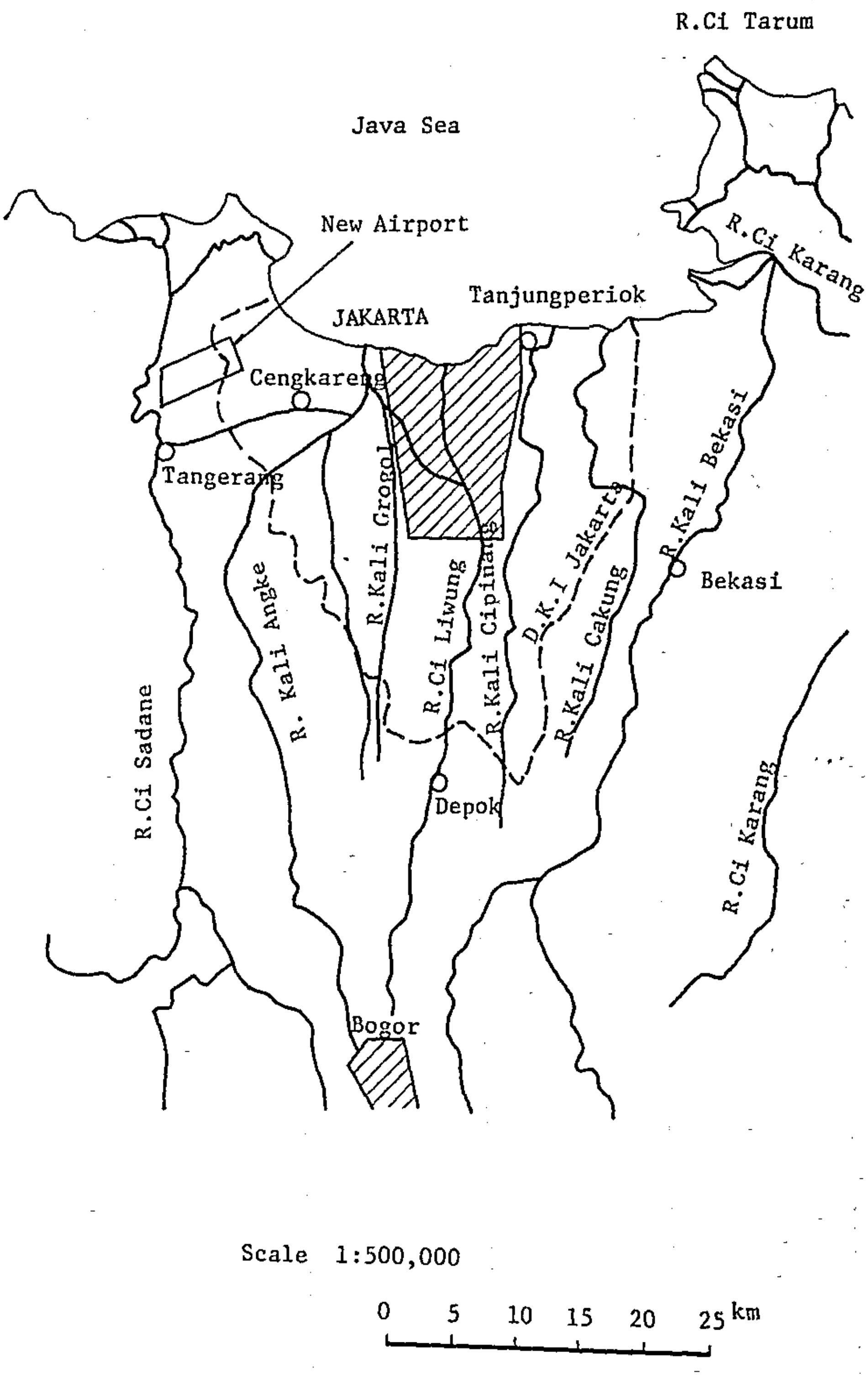

Fig. 4.1.1 Rivers in "JABOTABEK Area"

4.1.2 Topography along the Alternative Routes

The proposed area for Routes is situated in the coastal plain, whose topographic feature may be classified into the three patterns by districts:

- Airport and its vicinity (Western zone)

  Floor micro ridge and backmarsh consisting of natural levees and point bars

- Airport ∿ Suburban area of Jakarta (Central zone)

  Beach ridges and swamps between ridges

- Urban area of Jakarta (Eastern zone)

  Delta plain

(1) Airport and its vicinity

The basin of Ci Sadane, the major river in this district, forms a flood plain and has a lot of micro ridges consisting of natural levees and point bars along the clear-cut trace of meander. A relative elevation by comparison between micro ridges and lowlands may be less than 2 to 3 m. Most of micro ridges is used as farm land and housing settlement while lowland is used as paddy fields or remains as swamps.

Natural levees are the remain of overflow sediments, comprised of sand and silt. A levee of original cross section shape usually takes unsymmetrical form with steep slope on the river side and gentle slope on the outer side. However, those levees existing in this district do not show any clear-cut shape distinctly. Grain size of sediments tends to be reduced gradually into fine grain from the natural levee crest down to its back slope.

Point bar is a sort of micro ridge being formed up with sediments of earth and sand over the inside of river bent. It consists of sandy soil in many instances.

Lowland is named in terms of 'back marsh' and is formed up behind the aforesaid micro ridge, with sediments of fine materials including silt and clay. Surface running water is retarded by micro ridges on the river bank. Furthermore, such fine materials prevent underground permeation of surface water. Because of these conditions, surface water is ill drained, resulting in a high ground water level. As swampy plants are easy to grow in lowland, organic matters are brought into sediments in many instances.

(2) Airport ∿ Suburban area of Jakarta

This zone is featured by formation of a typical ridged beach plain, being distributed with beach ridges in parallel and furrows between ridges.

Beach ridges form up a long-continued micro ridge zone alongside the shoreline, by accumulation of fine sand deposits drifted from the river mouth to the reaching limit of waves. Since the sedimental environment is exposed to the open sea of high waves, the ridge is featured by its cross section of unsymmetrical shape with steep slope on the sea side. Since the coastline moved backward after formation of beach ridges on the utmost outer side, there remains a distance of about 2 to 4 km from the existing shoreline to those ridges.

The zone of such beach ridges is utilized as the housing area and the farm land because of the dried-up conditions with a relative elevation of less than 2 to 3 m as compared with the furrow between ridges. Besides, many of the existing public roads run on those beach ridges taking advantage of their long continuity in a narrow strip shape.

In those furrows existing between ridges, the out-flow of surface running water on the inland side is interrupted, which therefore cuases to form up the topography of similar characteristics to those swamps behind the ridges. The zone of such furrows is used as paddy fields or remains as swamps because of its high ground water level.

(3) Urban area of Jakarta

The city of Jakarta is situated on the delta at the river mouth of Ci Liwung. This delta zone is featured by such environmental condition as may easily induce sedimentation of fine-grain soil of clay and silt because of declined flow velocity of river water toward the delta. Originally, the river of Ci Liwung must have been meandering as supposed far back in the past. Today, as the result of river repair and improvement on a far and wide basis, it has become difficult to identify the clear trace of old river course. Furthermore, it is inferrable that the city area would have been developed to take its original shape on micro ridges as represented by those natural levees along the river. Afterwards, however, as the result of rapid progress of urbanization, the city seems today to be closely settled with building structures on the land after readjustment. Therefore, the present configuration is featured by all the event falt land except the reclaimed area, which makes it almost impossible to locate micro ridges.

4.2 Geology

4.2.1 Constitution of Geology

The constitution of geology for the proposed Routes is as shown in Table 4.2.1 and its distribution map, as shown in Fig. 4.2.1.

Table 4.2.1 Constitution of Geology

Geological Period		Formation	Description
Quartenary	Helocene	Alluvium	Unconcrete sediments consisting of clayey and sandy soil, which forms coastal plain
	Pleistocene	Diluvium	This is volcanic ash soil of wide distribution over hills in the southern part, being affected by laterization to a considerable depth.
Neogene	Pliocene	Genteng Formation	The basement in the project area has its upper layer mostly covered, consisting of sandstone and mudstone and featured by remarkably varied degree of con-creting.

The alluvium formation takes a shape of coastal plain, consisting of clayey soil and sand soil, on top of which swampy sediments, beach ridge sediments and flood sediments are distributed.

The diluvium formation constitutes unconcrete pyroclastic sediments, looking white-gray on a fresh zone of considerable depth from the earth surface. However, the surface is laterized in brown-red color by weathering and featured by intensified adhesion.

The Genten formation is partially tufaceous, consisting of mudstone and sendstone. Most of the project area is covered with the upper Quaternary system. In many instances, it holds soil bearing capacity in sufficiency to be required as the bearing layer, though the degree of concreting to be required as soft rock is still low.

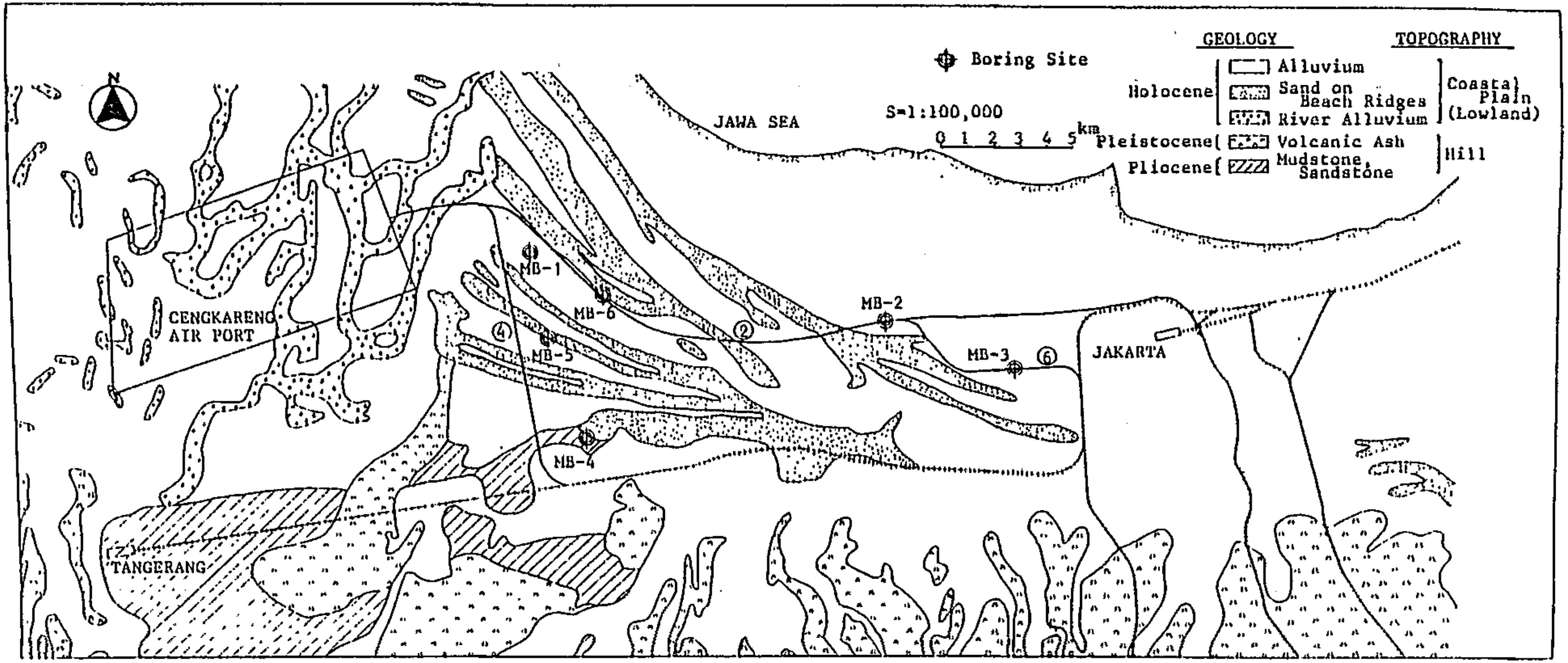

Fig. 4.2.1 Location Map

4.2.2 Land subsidence

In DKI Jakarta, each house has its own well for withdrawal of water, since the existing city water supply system often falls into extreme shortage of supply, especially at night. In addition to that, there have been increase of wells newly drilled as exclusive use for those large industrial plants and high-rise buildings which have been constructed increasingly in recent years. Under such circumstance, therefore, it is estimated that total pumping volume in both urban and suburban areas may be tremendous, which is likely to cause ground subsidence due to drainage of underground water.

Shown in Table 4.2.2, Fig. 4.2.2 and Fig. 4.2.3 are the remeasured results of bench marks (DKI)[*2] as set up alongside the Western Line under "Electrification Program of Western Line"[*1] (by OECF, 1980). As clarified by the Table, the volume of displacement (as settlement) at the alluvial lowland is more than that at the diluvial upland. Even at the alluvial lowland it is observed that the volume of displacement is increased more and more toward the north coast where there is a thick formation of alluvial layer.

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*1: Consulting Engineering Service for Jakarta Metropolitan Transportation (Intermediate Program), Draft Phase I Report, Vol. III, April 1981

*2: Dinas Pemataan Dan Pengukran Tanah DKI (Topography and Land Measurement Section of DKI)

Table 4.2.2 Vertical Displacement of Bench Marks (Topography and Land Measurement Section of DKI)

Location of Bench Marks (Ref. Fig. 4.2.3)	Registered D.K.I. Height (m)	Displacement (Settlement) (mm)	Remarks
PP787 (JAKARTA KOTA)	2,959	-137	Alluvium
PP137 (KAMPUNG BANDAN)	1,611	-84	"
PP797 (DURI)	3,050	-65	"
PP912 (DURI ∿ TANAH ABANG)	5,862	-46	"
PP923 (DURI ∿ TANAH ABANG)	4,452	-32	"
PP954 (TANAH ABANG ∿ MANGGARAI)	8,879	0	Diluvium
PP965 (TANAH AGANG ∿ MANGGARAI)	5,150	-10	"
PP951 (TANAH ABANG ∿ MANGGARAI)	12,844	-16	"
PP628 (TANAH ABANG ∿ MANGGARAI)	12,896	-19	"
PP948 (TANAH ABANG ∿ MANGGARAI)	9,448	-12	"

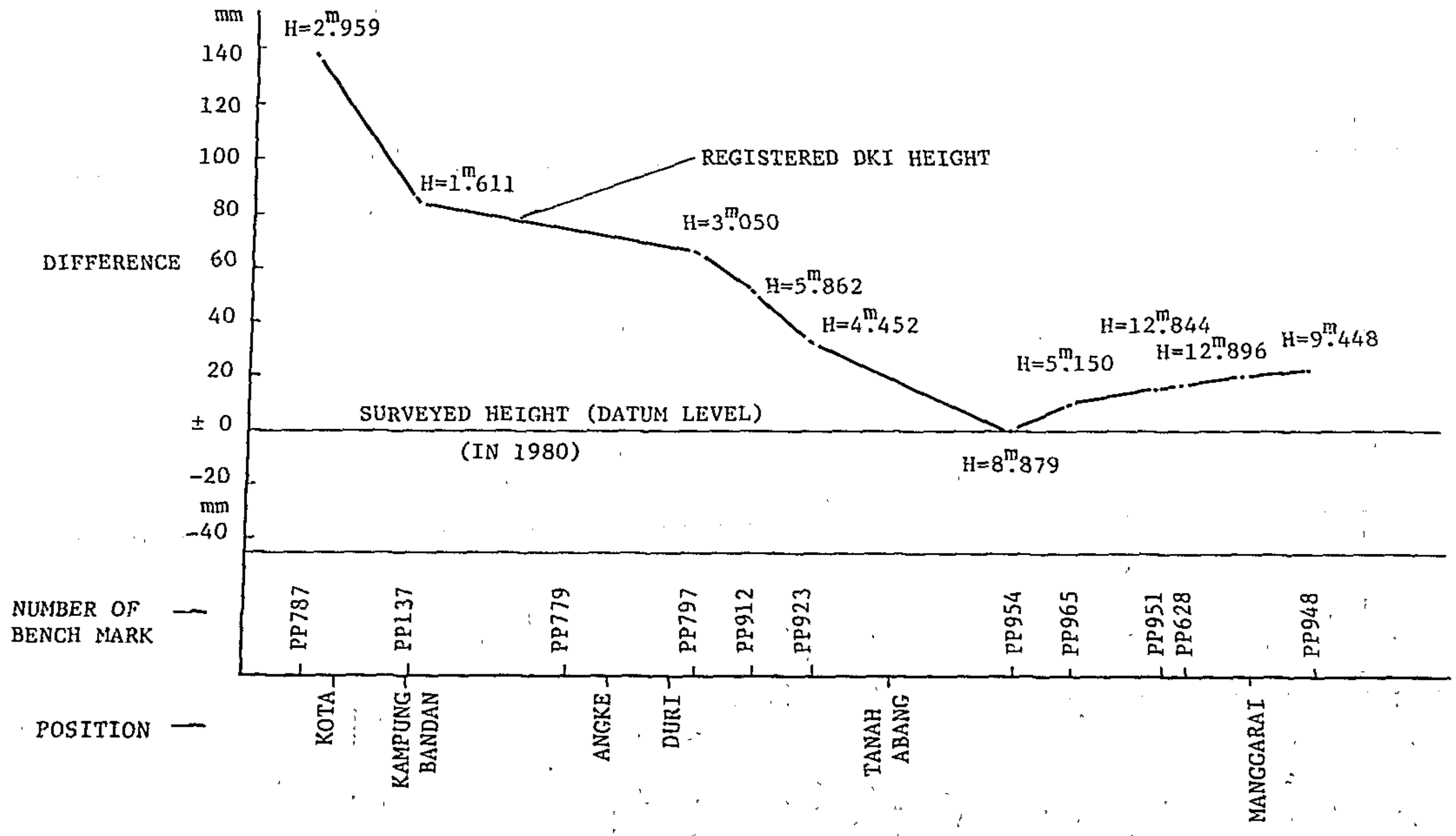

Fig. 4.2.2 Difference of Ground Height

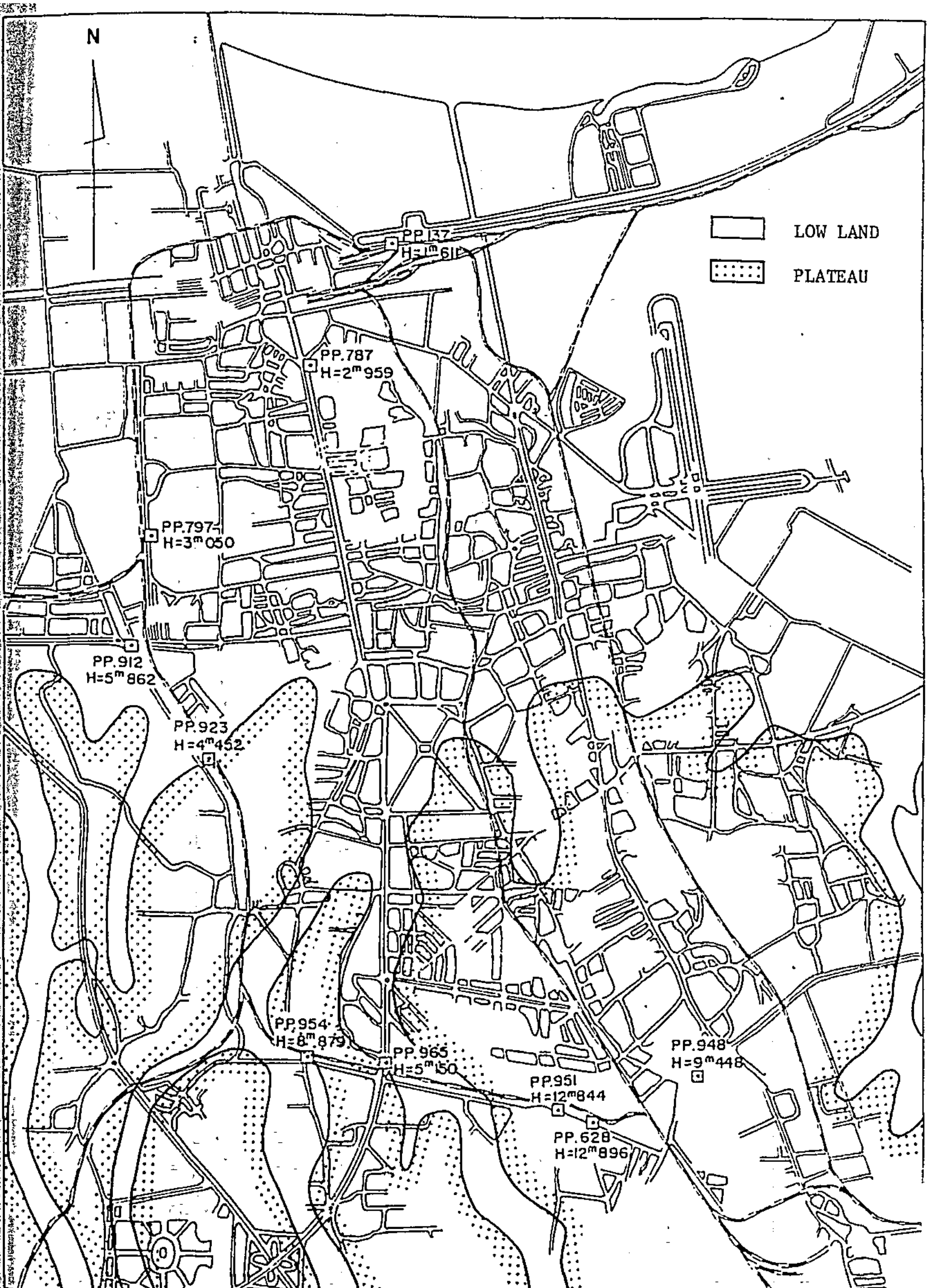

Fig. 4.2.3 DKI Bench Mark Location & Elevation

4.2.3 Ground Water Level

It is told that the ground water level may fluctuate by a range of a few meters between the rainy and dry seasons. When this study was conducted, it was in the transitional period from the dry season to the rainy season. However, because of delay behind the start of the rainy season in normal years, the surface of micro ridges was dried up to a considerable extent.

Wells for supply of water for household use on the beach ridge or on the natural levee are all of unsupported drilling type at the ground water level to a depth of 2 to 3 m. The lowland between beach ridges is used as the paddy field or remains as the swamp, where the ground water level is kept at a range of ±0 to +0.1 m to the original ground surface and the water volume is regulated for rice crop. Since it was observed that there was water supply still in abundance for irrigation and residential uses during the full period of study activities, despite the fact that there was only very little rainfall, it is anticipated that the ground water level would rise up to a considerably high level in the rainy season.

In the meanwhile, although wells for residential use at the lowland in the urban area of Jakarta are drilled to a depth of about 20 m so as to take water from the aquifer existing at the deep stratum, it seems that the ground water level at the shallowest position may not go deeper than 1 to 3 m in depth, same as the water level of rivers running in all directions.

4.3 Foundation Ground

4.3.1 Mechanical Boring

Boring investigation was conducted by approval of the DKI authority*1 at the typically selected points alongside the alternative routes, in order to observe the realities of ground situation. This investigation work may be outlined as follows:

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*1: Biro Bina Pemebangunan Pemda DKI Jakarta
(The Improvement of Development Bureau of DKI Jakarta)

Purpose:

To confirm distribution of strata and determine soil bearing capacity

Period:

October ∿ November 1982

Test Contents:

Rotary mechanical boring at six (6) points to total length of 200 m (including standard penetration test)

Location of each point:

See Fig. 4.2.1.

MB-1 .... Alternative C
MB-2 .... Alternative A
MB-3 .... Alternative A
MB-4 .... Alternative C
MB-5 .... Alternative C
MB-6 .... Alternative A

In respect of Alternative ① (see Fig. 5.2.1), the rough distribution of soil layers could be determined in general from "Feasibility Study on Jakarta Harbor Road Project Final Report - Main Report, November 1981, JICA."

4.3.2 Ground Situation

The ground situation for each alternative route of ①, A and C can be summarized as follows by reference to the boring and other exisitng data available in relation to this study.

(1) Alternative Route ①

This Route runs alongside Cengkareng Access Highway, closest to the sea coast among all the alternative Routes. Here, there exist thick sediments of new soil layer on the seaside with a large expansion of soft ground formation.

In the section between the airport and the coastal side there exist distributions of flood micro ridges and beach ridges, where the ground situation is relatively favorable though it has some swamps here and there. Along the coastal line, however, there exist sedimentations of soft soil layers of 8 to 12 m thickness at the N value of 0 to 5 by the standard penetration test. Soil consists mainly of clayey soil with high natural water content ratio, partly with insertion of sandy soil layers.

This Route should require special consideration for design and construction in respect of settlement due to consolidation and sliding failure of the embankment. Furthermore, the foundation for structures should be based upon the bearing ground to be located at a depth in excess of 20 to 35 m, if the firm ground is set at a N value = 50 or over.

(2) Alternative Route A

This Route passes through mainly the zone distributed with beach ridges in the section from Cengkareng to the suburb of Jakarta. After the beach ridge zone the Route will enter into the soft-ground zone on the seaside, same as in the case of Alternative Route (1).

Because of the favorable ground condition of the micro ridge, the beach ridge zone is mostly occupied by the existing roads and houses. Alternative Route A is selected in the area of paddy fields alongside the beach ridge, bypassing those existing roads and houses. The paddy field is situated in the swamp, whose upper layer is covered with sediments in thickness of 2 to 5 m of soft clayey soil at N-value = $0 \sim 2$. The lower layer consists of clayey and sandy soil in continuous formation of layers of N-value = $10 \sim 50$ or over.

The Route has a relatively short length of traverse over the beach ridge. The beach ridge consists of sandy sediments without any soft clayey soil. It will therefore serve well as the good bearing ground against light structures. The Route passes through the zone of soft ground on the seaside in the section between the beach ridge zone and the urban area of Jakarta. The ground condition is same as mentioned in the case of Alternative ①.

Since the zone which this Route passes through in the swamp alongside the beach ridge will be in close approach to the edge of swamp, it is well conceivable that the soft soil layer would be relatively thin as compared with the layer in the center of swamp. However, the existing depth of the firm bearing layer at N-value of 50 or over covers a wide range of 10 to 50 m in large diversity.

(3) Alternative Route C

Since this Route passes over in traverse the beach ridge area, both beach ridges and furrows come to appear alternately.

Characteristic features of furrows and beach ridges are same as stated in the preceding case of Alternative Route A. Because of passing across the swamp, the maximum layer thickness of soft soil layer in the center of swamp is estimated at about 5 m.

4.4 Views for Design and Construction

4.4.1 Embankment

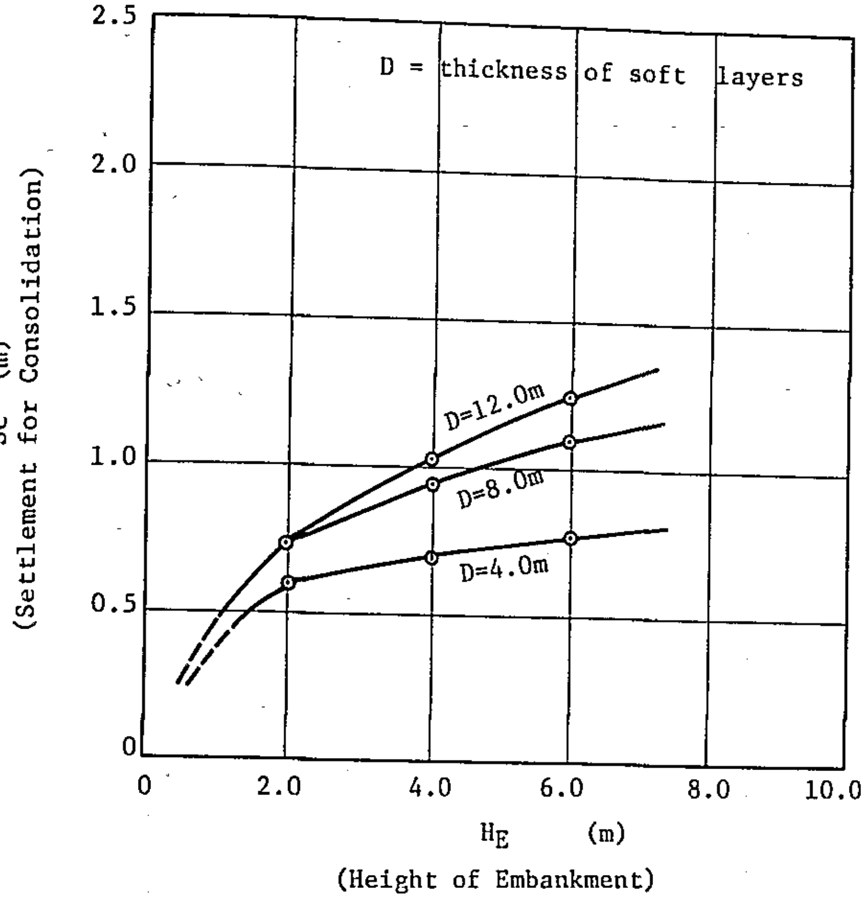
Many soft ground zones are distributed over the project area. Because of sliding failure due to shortage of ground strength or excessive settlement due to consolidation from embankment load, the soft ground may possibly give rise to damages, not only to the railway alone, but also to all its wayside area.

Fig. 4.4.1 shows rough relationship between the embankment height considering train load and the settlement due to consolidation. Since any such value of laboratory soil test as may be required for this comparative check is not available from thsi investigation, the existing data*1

*1: The soils survey and material investigations for Jakarta Harbor Road, Final Report, Feb. 1981 available has been used for this purpose. As noted from the Figure, it seems that the degree of settlement may be increased with higher embankment or thickner layer of consolidated soil. The rate in percentage of settlement against embankment height is estimated at a range of 10 to 40 percent.

The phenomenon of settlement due to consolidation should need increase of soil for embankment. Still more, it may cause vertical or horizontal displacement to bridge abutments, retaining walls and undercrossing structures and affect the surrounding ground by involving the ground at the slope toe into such displacement. Therefore, for execution of construction works it is most desirable that installation works of track and other structures should start only after the ground settlement has been advanced to a possible extent or, otherwise, after any preventive measures have been taken to control such settlement from the very beginning of construction. At the same time, it is also necessary to consider adoption of the construction method reflecting full consideration to the extent of influence as may be exercised upon the surrounding ground.

Fig. 4.4.2 shows the result of simple calculation with regard to embankment failure. As noted from the said Figure, the critical height of embankment is limited to about 2 to 4 m if ground cohesion is calculated at 0.8 to 1.5 ton per sq.m. Therefore, if embankment is raised to or within the limit of this height, no problem would occur against any construction process for embankment even though it may be done at a quick tempo. However, if embankment exceeds such limit, prior study in detail would be required to seek any appropriate measures for execution of works. The counterplan method includes a method by direct improvement of the ground and a method by an adjusted pattern of embankment as represented by such alternative method of slow embanking or counterweight fill. As a normal practice, it is effective in many instances to choose the former if there is such particular limit as time element and land acquisition and to adopt the latter if there is no limit for such conditions.



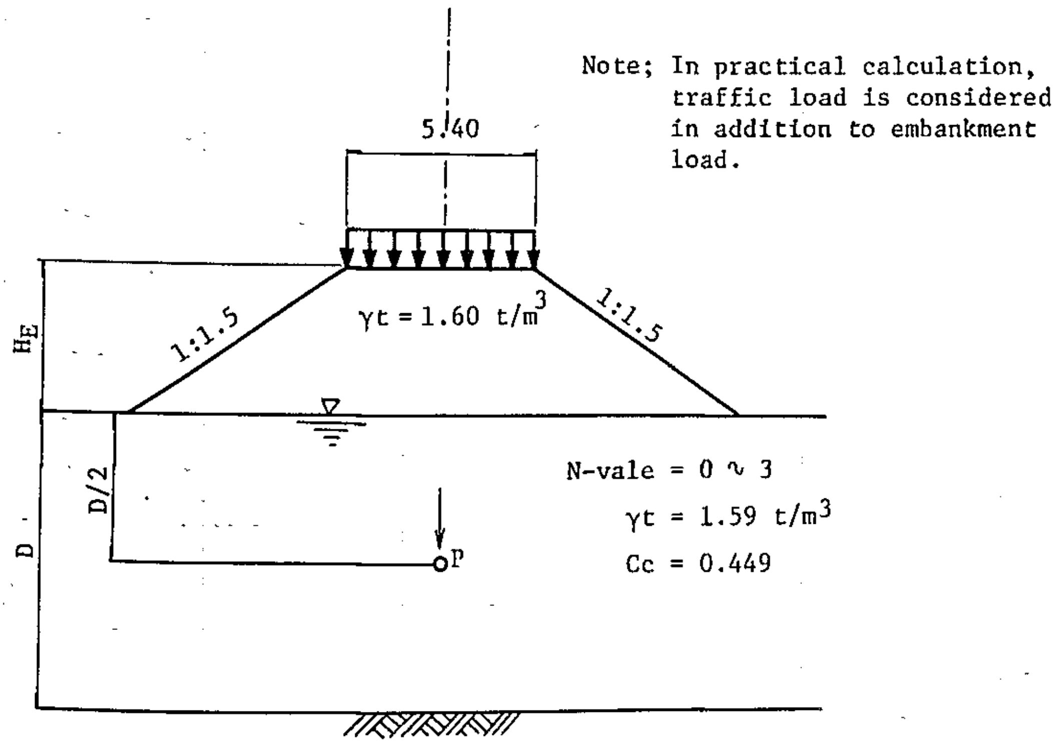
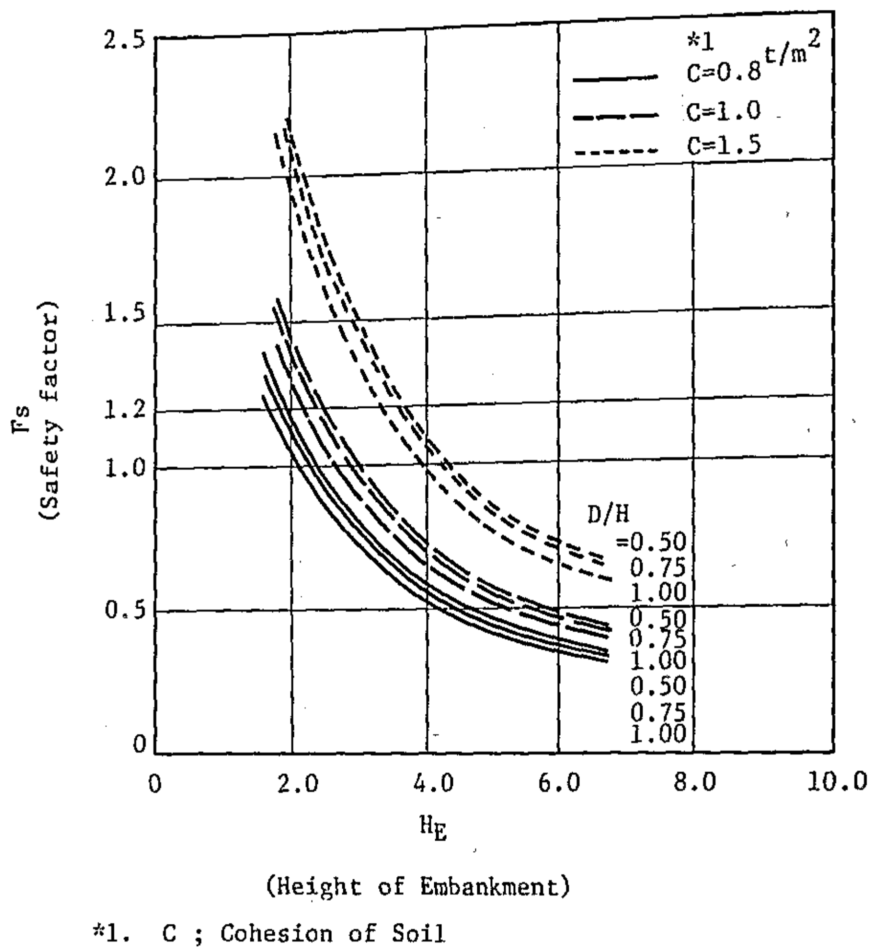


Fig. 4.5.1 Settlement of Embankment



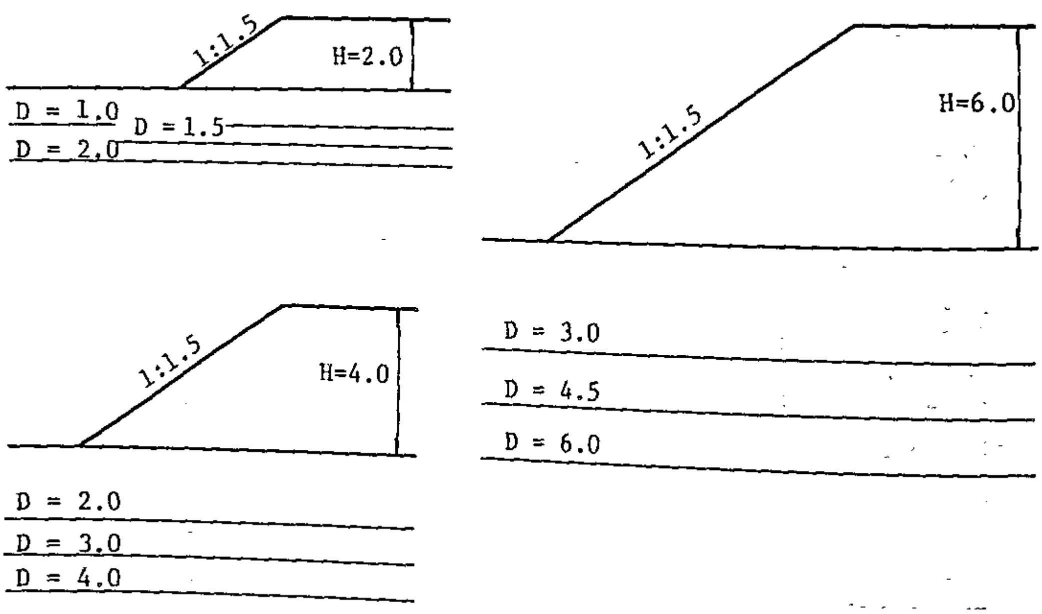


Fig. 4.5.2 Stability of Embankment

4.4.2 Structures

The Alternative Routes run across many existing roads, rivers and existing railway lines. The route should pass through them by use of bridge structures, box culverts and corrugated pipes. In fact, however, no supportable ground to those structures exist on or near the surface of the earth. Still more, no spled foundation can be used as the applicable type of foundation for the structure because of high ground water level and the existing depth of bearing ground being limited to a depth of GL minus 15 to 20 m. All those things considered, piles are only dependable substitutes for the ground foundation.

The existing depth for the continuous bearing ground indicating N-values over 30 and 50, as proved after this investigation, is as shown in Table 4.4.1. Values are varied largely depending upon points of boring.

Table 4.4.1 Existing Depth of Bearing Layer

Boring No.	Topography	Depth (m)	
		N ≤ 30	N ≥ 50
MB-1	Furrow	14	-
MB-2	Seaside lowland	-	10
MB-3	Seaside lowland	-	14
MB-4	Micro ridge	8	28
MB-5	Furrow	22	34
MB-6	Furrow	8	-

Especially, at MB-1 (64 m at final depth) and MB-6 (26 m at final depth) no continuous bearing layer of 50 or over in N-value could be confirmed, only with the long continued layer of 10 to 30 in N-value reaching to a considerable depth.

In the soft ground area, the structure adjacent to embankment tends to be easily influenced by negative friction or biased load due to settlement of embankment, for which special consolidation should be required.

As far as the construction term allows for sufficient time, it is most advisable to encourage advancement of consolidation by means of preceding embankment. Furthermore, in anticipation of possible settlement of the small crossing waterway over embankment as the direct foundation after completion of its setting in the position, full countermeasures must be taken against any such settlement.

4.4.3 Construction Materials

As far as coarse aggregate is concerned, it may be of good quality in any and all areas. However, from the viewpoints of exploitable reserve, transportable distance and economy, most recommendable material for use will be andesite macadam of Gunung Dago situated in the south of Serpong and reverbed gravel in Ci Sadane at Gunung Sindur. Both of them are produced from the modernized plant facilities at equalized quality of superiority.

As fine aggregate available, old river deposits in Kemplang in the north of the proposed Routes and marine sand in Muara Karang will be most advantageous in respect of the transportable distance. However, the future exploitable reserve in Kemplang may probably be limited to some extent, because the place of reserve is neighbored to houses and cultivated land. Marine sand in Muara Karang is not suitable as concrete material unless it is washed by clean water. Besides, it is not produced so much in terms of quantity. In the meanwhile, both of riverbed deposits in Gunung Sindur and terrace deposits in Sungai Ciapus can be produced by the modernized plant facilities up to a satisfactory level of quantity in production. Especially, the former is advantageous over the latter in respect of transportability.

Hill Soil in Ciputat is most encouraging as embankment material for the present. However, in the long run the productive capacity may be tapering because of brisk demand for reclamation and fill formation of the lowland in the vicinity of Jakarta. Notwithstanding this future prospect, even if there exists no suitable borrowing pit in operation in close approach to the construction site, the local construction contractors are allowed, by consultation with the land owner, to divert with relative easiness the unexploited hill area near the site into the farming land after excavation and land readjustment. Therefore, as far as embankment material supplies are concerned, it is sure that no serious problem to impede execution of works may not take place.

Table 4.4.2 is taken from the existing laboratory soil test data*1 by use of soil of equivalent quality.

Table 4.4.2 Soil Engineering Value

Location	Natural Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (t/m^3)	Soaked CBR (%)
Bintaro	48	36.5	1.32	6
Ciputat	57	35	1.34	8
Halim	48	30	1.35	13

As noted from the Table above, it is understandable that soil as laterized clayey soil is somewhat lower in the ratio of natural water content while it is of pretty heavier weight in terms of unit volume density. Furthermore, the CBR value is relatively high, thus making the quality of soil suitable as embankment material.

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*1: Jakarta Intra Urban Tollway Study Part II Report Vol. 1; Test, March 1979, Pacific Consultants International

CHAPTER 5 ROUTE SELECTION

CHAPTER 5 ROUTE SELECTION

5.1 Introduction

The basic aim of route selection is to find out the optimum route location and the most efficient junction with the existing railway network in pursuit of the convenience for passengers. To achieve this aim it is necessary to make effective use of the existing railway network to the possible maximum. Equally important is the method of approach between the airport terminal building and the railway station inside the airport area. In this connection, it is advisable to have frequent bus services to and from the airport terminal building, together with the proper location of bus stop at the terminal building.

The project area is situated in the northwest of Java Island with a total area of about 120 km^2 by extension of about 6 km in the north-south direction and about 20 km in the east-west direction, having Cengkareng Airport in the west, the city center of Jakarta in the east, Tangerang Line in the south and Java Sea in the north.

In carrying out this study, the possible railway passengers in the North West area of Jakarta were excluded from the scope of this study, because the area is designated as the restrictive zone against any development schemes. Fig. 5.1.1 shows the scope of project area for this study.

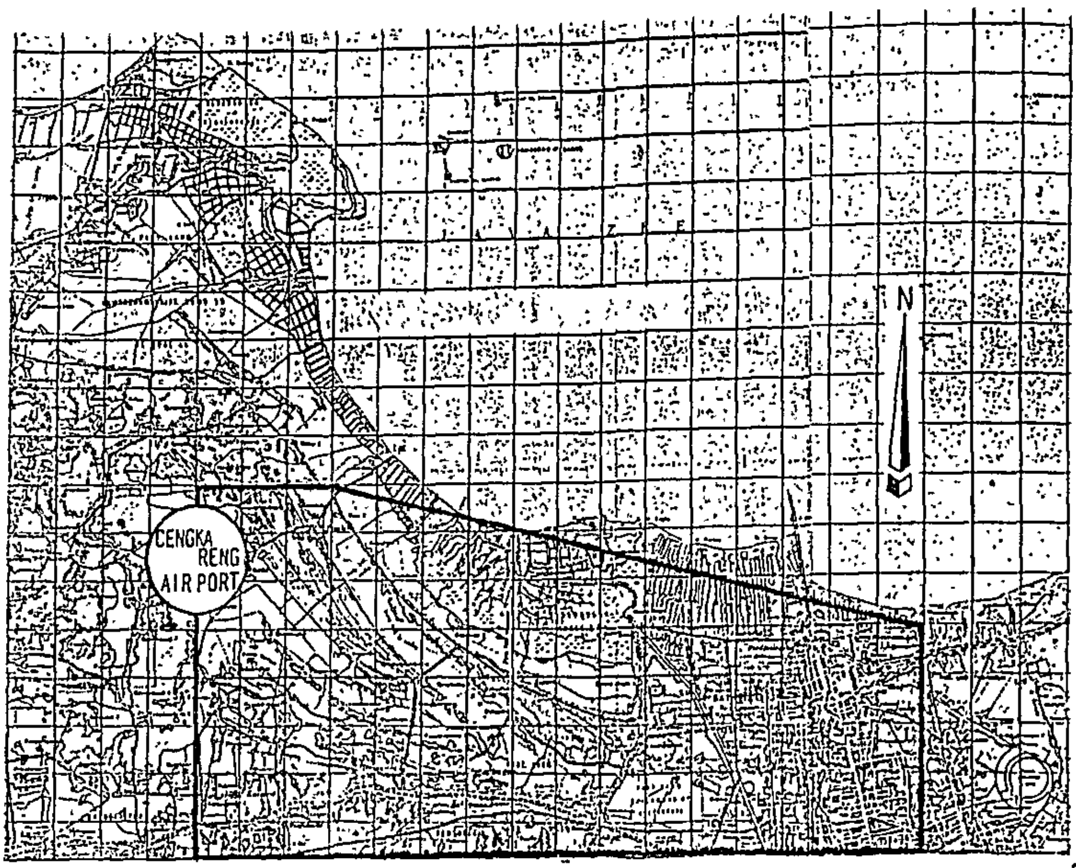


Fig. 5.1.1 Project Area for Study

5.2 Preliminary Study for Route Selection

Alternative routes have been selected on the maps with the following matters taken into consideration, by use of 1/5,000 aerial photographs, 1/5000 plan maps and geological plan maps.

- Conveniences for railway passengers
- Position for trackage into the city cenker (junction with the existing railway network)
- Present status of land use
- Topographic and geological conditions
- Climatic conditions

- Existing road network and its future development plan
- Coordination with Master Plan on JABOTABEK Railway

Prior to the preliminary study, site reconnaissance was conducted by motor car on the existing lines such as Central Line, Western Line and Tangerang Line.

For the alternatives for preliminary study, three (3) alternative plans were drafted as the main route from Cengkareng Airport to the urban area of Jakarta and eight (8) alternatives were proposed as the junction with the existing lines to admit trackage from the main route into the city center. With all of them combined, ten (10) alternative plans can be proposed. Fig. 5.2.1 shows the schematic location of alternative routes and Table 5.2.1 shows main features of each alternative routes.

Comparative study has been made on each alternative route in consideration of such factors as railway passengers' conveniences, train operation plan, geological conditions, constructional problems inclusive of land acquisition, investment cost and traffic demand forecast. As the result, the following two alternative routes have been selected as the prospective plan with the highest possibility.

- Route A (Alternative route ② - ②)
- Route C (Alternative route ③ - ④)

Table 5.2.3 shows the result of comparison on the ten (10) alternative routes.

The evaluation criteria for judging the suitability of each alternative route are as given in Table 5.2.2.

Major characteristics of each alternative route are as follows:

Route 1 is of same characteristic features as Route 2. However, it needs higher construction cost at less easiness of construction work as compared with Route 2, since it passes through the soft ground area along the coastal line.

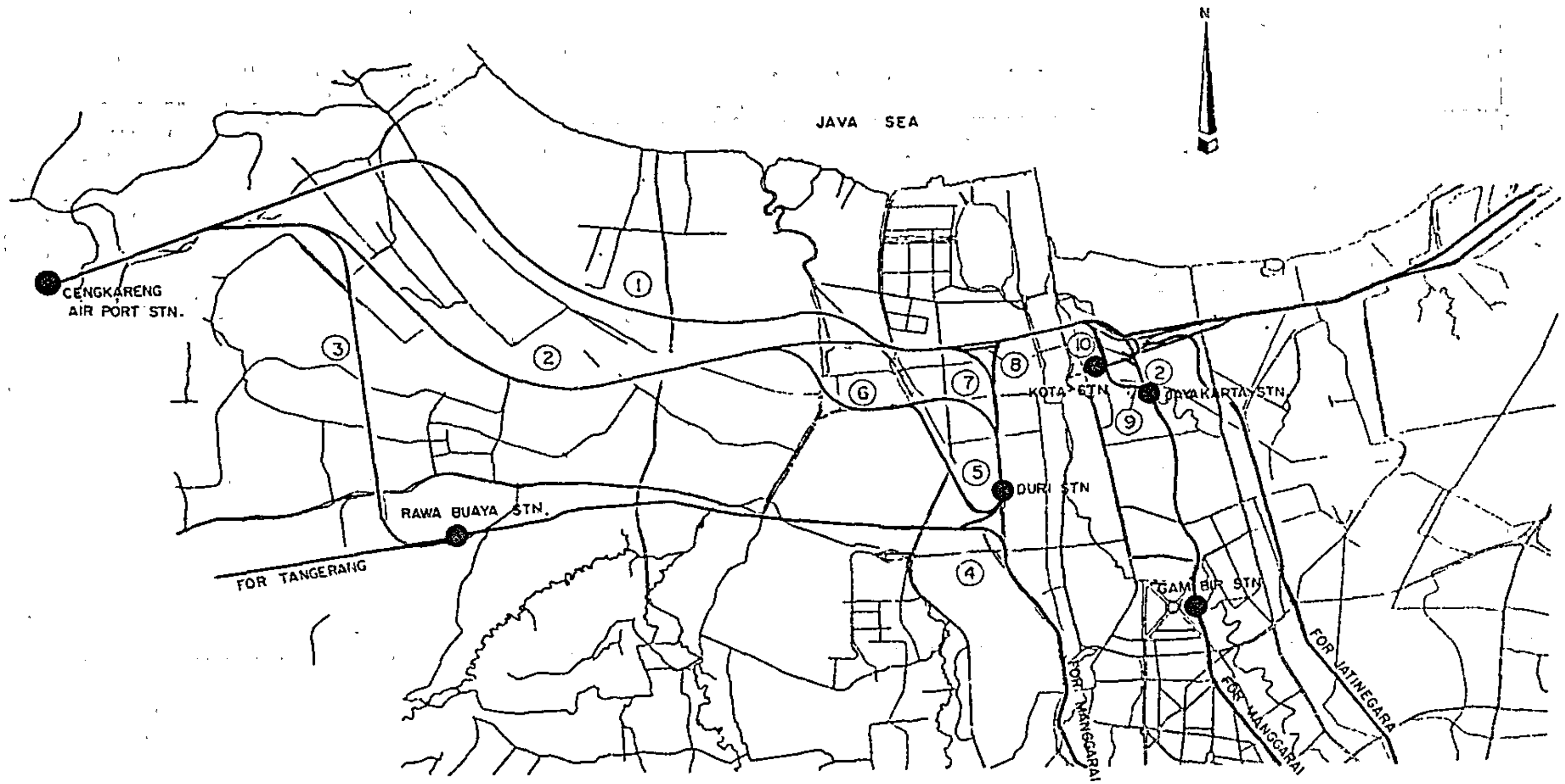
Route 3 joints the Western Line from the north of Duri, where train operation density is estimated very high. Still more, since the train directs to Kota Station after being turned back of Kp. Bandan, the operation time will be prolonged. Furthermore, because the train does not go far beyond Kota Station, this alternative route involves inconvenience to the passengers to and from south part of Jakarta. This route does not have good linkage with radial lines, too.

Routes 5, 7 and 8 involve same problems as in the case of Route 3.

Route 6 may require vast sum of construction cost for improvement of Duri Station.

Route 9 is located near to Kota Station. Because of many obstructive houses near Kota Station, construction cost is estimated to be very high.

Route 10 may cause much inconveniece to passengers since it terminates at Kota Station.



LEGEND ; (N) CASE NUMBER

Fig. 5.2.1 Plan of Alternatives

Table 5.2.1 Summary of Alternative Route Plans

Case		①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
Route		①-②	②-②	③	③-④	②-⑥-⑤	②-⑥	②-⑦	②-⑧	②-⑨	②-⑩
Junction station		Jayakarta (Central Line)	Jayakarta (Central Line)	Rawa Buaya (Tangerang Line)	New Station (Western Line)	Duri (Western Line)	Duri (Western Line)	New Station (Western Line)	New Station (Western Line)	Jayakarta (via Kota) (Central Line)	Kota
Track aligment	(In City) Min. radius	R=500m	R= 500m		R=300m	R=300m	R=600m	R= 400m	R=600m	R= 200m	R= 200m
	(In Suburb) Min. radius	R=800m	R=1000m	R=600m	R=600m	R=600m	R=800m	R=1000m	R=1000m	R=1000m	R=1000m
Route length (approx)		20.8km	19.8km	11.3km	14.6km	18.4km	19.7km	16.6km	16.9km	19.9km	19.8km
Approx. length of structure	Elevated Structure	4.5km	4.8km	1.9km	4.7km	3.0km	4.3km	1.6km	1.9km	4.9km	4.8km
	Embankment	16.3km	15.0km	9.4km	9.9km	15.4km	15.4km	15.0km	15.0km	15.0km	15.0km
Length of obstruction		5.8km	5.3km	1.2km	7.0km	4.9km	6.2km	3.4km	3.7km	5.4km	4.8km

Note 1: All figures indicated above are roughly calculated.

Table 5.2.2 Evaluation Criteria

Item	Content	Judgement
Convenience for passengers	Excellence in access transportation between airport and city center and also in convenience for airline passengers	o
	Poor access transportation and frequent transfers required to and from other means of transport	×
Train operation	Accessibility to city center in a short travel time and easy availability of through train operation direct to Jatinegara including track capacity of the existing line	o
	Plan which needs shuttling service of trains or confronts with shortage of track capacity on the existing line	×
Traffic demand forecast	Many railway passengers to be estimated from the view point of route location and train operation plan	o
	Insufficient passengers to be estimated	×
Constructional problems	No serious problems involved in the construction works on geological condition and track rearrangement of the existing railway line	o
	Long stretch of unfavorable geological condition quantity of and necessity of great track rearrangement of the existing line	×
Construction cost	Low construction cost	o
	High construction cost	×

Note: Some items evaluated at the medium degree are marked with Δ (normal).

Table 5.2.3 Comparison on 10 Alternative Routes

Case	Route	Passengers' convenience	Train operation	Traffic demand	Constructional problem	Construction cost	Evaluation
①	① → ②	o	o	o	×	×	
②	② → ②	o	o	o	Δ	Δ	Good
③	③	×	×	×	o	o	
④	③ → ④	Δ	o	Δ	Δ	Δ	Good
⑤	② ← ⑥ ← ⑤	Δ	×	Δ	×	×	
⑥	② → ⑥	Δ	Δ	Δ	×	×	
⑦	② → ⑦	Δ	×	Δ	Δ	Δ	
⑧	② → ⑧	×	×	Δ	Δ	Δ	
⑨	② → ⑨	o	o	o	×	×	
⑩	② → ⑩	×	×	Δ	Δ	Δ	

o; Good Δ; Normal ×; Bad

5.3 Comparative Study in Alternative Routes

5.3.1 Route Location Plan

The selected two alternative routes have been studied to further details after fully surveying the proposed site. The basic concept adopted was that the track alignment should be straight-lined to the possible extent with gentle grade to ensure high speed operation of trains and that the embankment structure should be adopted as much as possible for the sake of construction cost saving.

(1) Route outline

- Route A

The Route directs to the southeast after leaving the Cengkareng Airport so as to pass through the area of good geological conditions. The area between Cengkareng Access Highway and Tangerang Railway Line has better geological conditions than the area along the coastal line. After directing to the east for several kilometers, the Route goes up to Jakarta Utara. At near Kali Angke, already developed area, the Route goes near to Cengkareng Access Highway and runs parallel with this highway for some distance. Then the Route directs to the south and crosses over Western Line, Jakarta Gudang freight station yard and Kota Station yard by grade separation. At Jayakarta Station, the Route connects to Central Line which is planned to be elevated.

The Route has a total length of 19.8 km from Cengkareng Airport to Jayakarta Station. It is planned that the structure of embankment accounts for 75 percent of the total structure and that the rest constitute the elevated track structure with viaducts and bridges.

This Route is planned with the aim to ensure that the transportation of passengers between the airport and the city center is performed in comfortable condition and in short travel time by direct connection to Central Line which passes through the centers of administration and commerce.

- Route C

This Route directs to the south after leaving Cengkareng Airport and passes through the rural area for some kilometers. This Route connects to Tangerang Line at Rawa Buaya Station after passing through the industrialized area between JL. Daan Mogot and Tangerang Railway Line.

On the section between Rawa Buaya and near Grogol, the Route uses Tangerang Line. At the intermediate point between Pesing and Grogol, the Route diverges from Tangerang Line to the south direction and connects to Western Line for the direction of Tanah Abang after crossing over Tangerang Line and Western Line by grade separation. A signaling station is provided at the junction with Western Line.

Total length of the Route extents to 14.6 km for the new line portion and 20.6 km if included the intermediate section of Tangerang Line. 67 percent of the new line is constructed with embankment structure and the rest with elevated structure.

This Route is planned with the aim to carry passengers to and from the airport by full utilization of the existing line, making the length of the new railway line shortest.

The track conditions of the existing lines are, however, very bad with high density of obstructive houses inside the right of way.

Therefore, in order for the Route to perform the function as the new airport access line, it is a prerequisit that the improvement of both Tangerang Line and Western Line should have been completed prior to the completion of the Route.

(2) Intermediate stations

Because of the needs to ensure high speed operation of trains to and from the airport and, besides, because of the necessity to avoid the development impetus on the North-West area, Kota Intan Station is the only one intermediate station on Route A. However, the signalling station is to be established at every interval of 5 to 6 km for crossing work of trains during the single track operation period.

The reason for constructing Kota Intan Station on Route A is to provide convenience for those passengers to and from Tanah Abang and Merak directions and to comply with the proposal of new station construction at this section by the JABOTABEK Master Plan.

The plan view of Route A and Route C is as shown in Fig. 5.3.1, and the outline of each alignment is as shown in Table 5.3.1 Line profiles for Route A and Route C are as shown in Fig. 5.3.2 and Fig. 5.3.3.

5.3.2 Evaluation on Alternative Routes

In selecting the most suitable route, decision must be made from the overall aspect of things with due consideration to the junction point and accessibility to the city center together with its effect, passengers' convenience, train operation plan, economy of the new line, constructional problems including construction schedule and improvement plan of existing railway network in the whole JABOTABEK area in connection with the schedule.

The result of evaluation on the alternative routes is compared in Table 5.3.2.

After integrated judgement on all those factors, it is recommendable that Route A is superior to Route C.

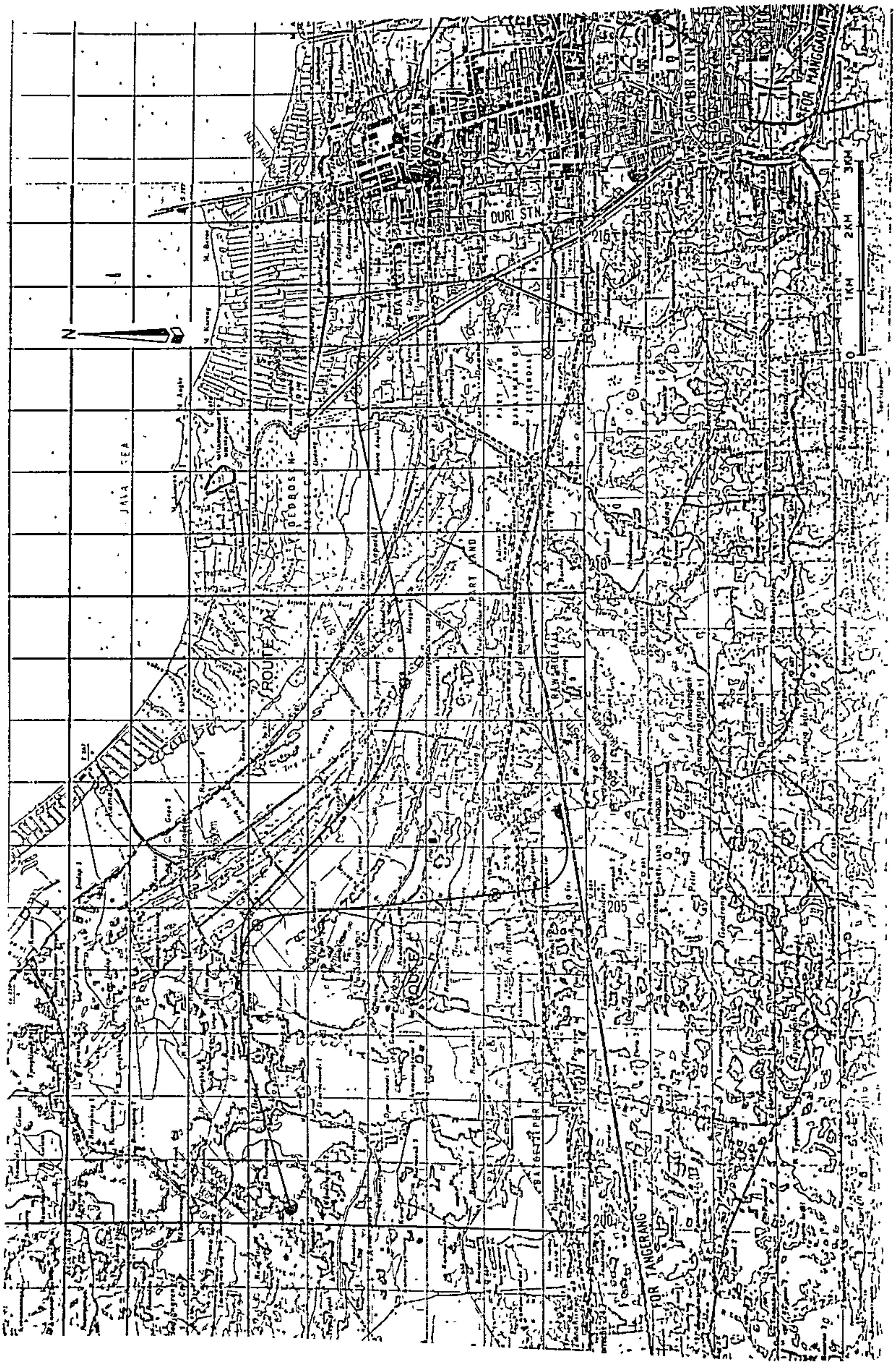
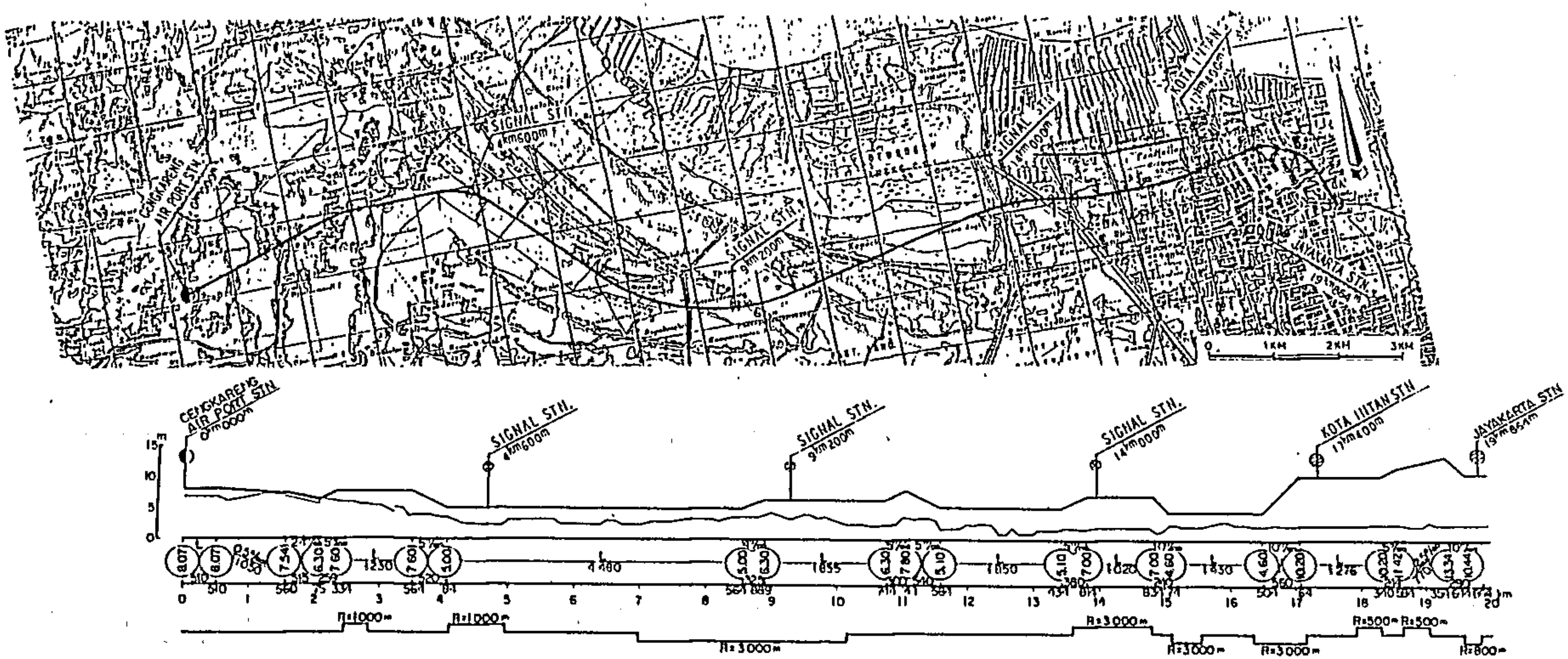

GAMBIR STN.
KOTA STN.
DURI STN.
FOR MANGGARAI
FOR TANGERANG
ROUTE A
JAVA SEA
0
1KM
2KM
3KM
N
205
210
215

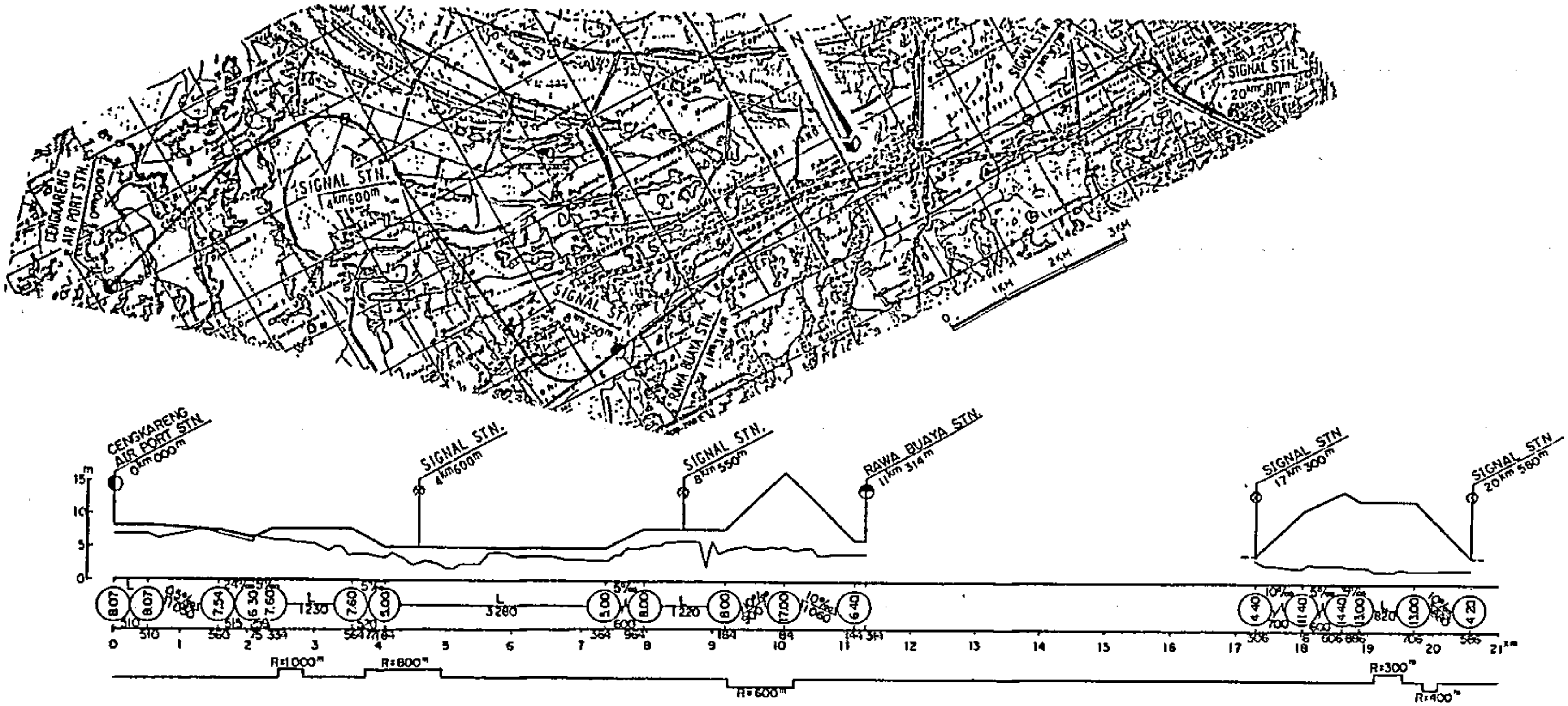
Table 5.3.1 Alignment Outline of Alternative Routes

Item	Alternative	Route A	Route C	Remark
Alignment (Curvature)	Tangent	13.3 km	11.4 km (15.8 km)	( ) includes Tangerang Line
	2000m and over	3.9	0 (0)	
	1000m and over	1.5	0.3 (1.9)	
	800m and over	0.3	1.2 (1.2)	
	500m and over	0.8	1.0 (1.0)	
	Less than 500m	0	0.7 (0.7)	
Grade	Horizontal level	13.9 km	7.2 km (12.4 km)	( ) includes Tangerang Line
	Less than 5°/oo	2.6	1.6 (2.1)	
	5°/oo and over	2.2	2.3 (2.6)	
	10°/oo and over	1.1	3.5 (3.5)	
Structure type	Embankment	15.0 km	9.9 km	Viaduct and bridge
	Elevated structure	4.8	4.7	
Station	Station	3	2	
	Signal station	3	4	



Note: Height = P.P. standards

Fig. 5.3.2 Plan and Profile - Route A



Note: Height = P.P. standards

Fig. 5.3.3 Plan and Profile - Route C

Table 5.3.2 Comparison on Alternative Routes

Route	Merits	Demerits
(A)	1. Smooth connection between city center and airport by direct trackage into the Central Line passing through the centers of administration and commerce, without any passage on the existing line on the way to join the Central line. This Route can enter into commercial operation earlier than Route C. 2. Convenient to railway passengers traveling over rather long distance to Bogor and Bekasi. Other passengers to and from Tanah Abang and Merak directions can utilize the new line on this Route by Kota Intan Station. Therefore, this Route will attract more passengers than Route C. 3. Because of close coordination with the track elevation of Central Line of high feasibility, operation on Route A will be stabilized earlier than on Route C. Besides, tickets can be strictly checked and collected because of the elevation. 4. Easy work performance as compared with Route C.	1. Higher construction cost than Route C. 2. Track rearrangement may be required as the Route passes through the freight yard and the station yard of Kota on the existing line.
(C)	1. Lower construction cost than Route A. 2. Direct linkage to each radial line is possible.	1. New line is scheduled to start up operation at the completion of improvement work of existing lines (Western and Tangerang Lines). If such work is delayed, it would cause delay to New Line. 2. Being far from city center, this Route will be inconvenient to passengers to and from north and northeast of Jakarta. 3. Construction cost of flyover of Jl. Khhasym Asyhari will be expensive. 4. Land acquisition will be more difficult than Route A because the section of high density inhabitance is longer. 5. Because of longer section of passage on the existing line as compared with Route A, the airport access train will be affected easily by interference of trains running on the existing line.