Fig. AP 3-4 EASTERN LINE

Fig. AP 3-5   SOUTHERN LINE

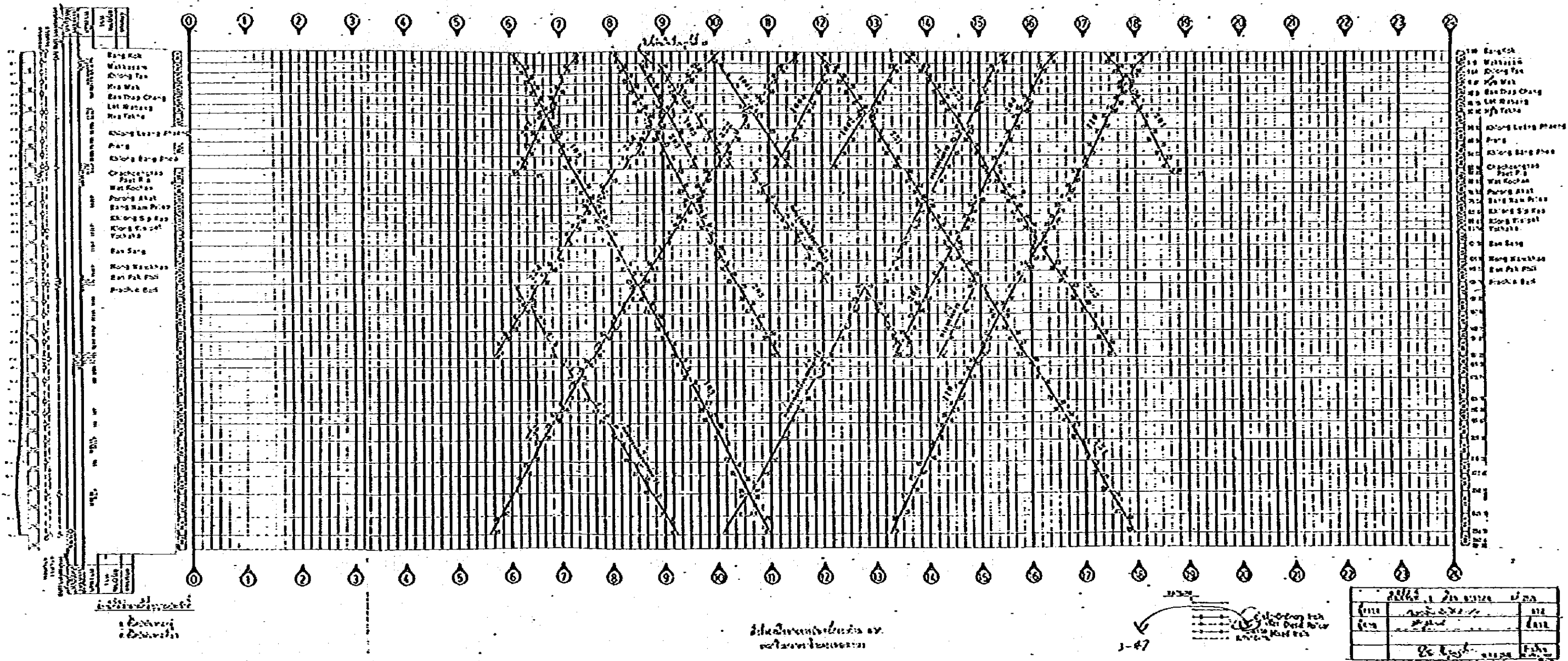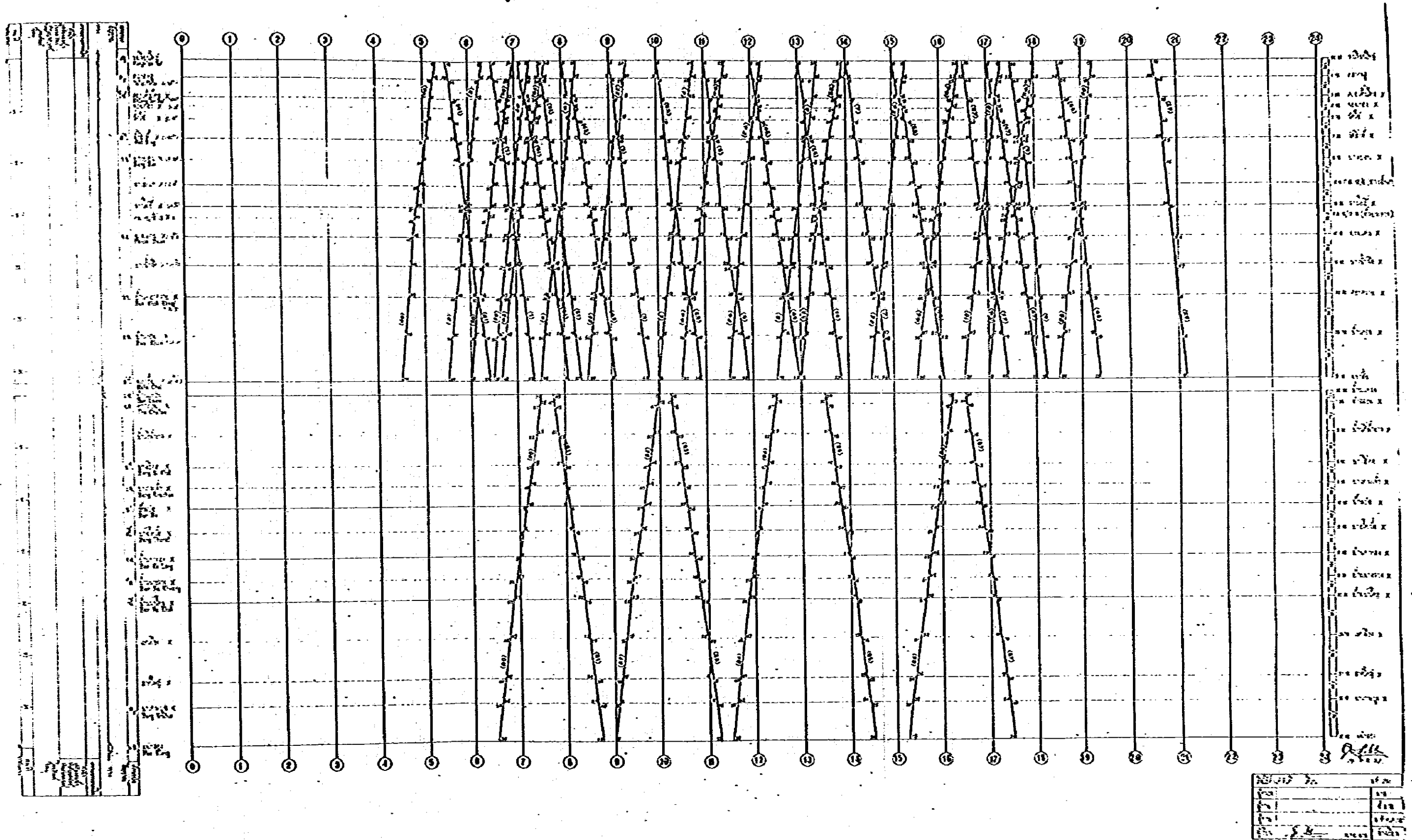# Fig. AP 3-6   MAE KLONG LINE

APPENDIX
CHAPTER 4   LAND USE

Table AP4-1   OFFICIAL SYSTEM OF ROMANIZATION OF THAI PLACE NAMES

(Sources: Expressway & Rapid Transit Authority of Thailand
and the Thai Supreme Military Map Division)

Thai Consonants	Romanization		Thai Vowels	Roman- ization
	Initial	Final		
ข	B	p	Xา , Xะ , X̆	a
ฅ, ฉ, ช, ฌ	Ch	t	แX, แXะ	ae
ฎ, ฏ	D	t	แXา	aeo
ฝ, ฟ	F	–	ไx, ใx, X̆ย, Xาย, ไxย	ai
ห, ฮ	H	–	X̊า	am
ก	K	k	เXา, Xาา	ao
ข, ค, ฆ	KH²	k	เX, เXะ, เX̆	e
ล, ฬ	L	n	เXา , เX̆า	eo
ฦ, ฦๅ	Lu	–	X̂ , X̃	i
ม	M	m	เX̃ย, เX̃ยะ	ia
ณ, น	N	n	เX̃ยา	ieo
ง	Ng	ng	X̊า	iu
บ	P	p	โx , โxะ, เXาะ, Xอ	o
ผ, พ, ภ	PH²	p	เX̂ , เX̃, เXอ, เXอะ	oe
ร	R	n	เXย	oei
ฤ, ฤๅ	Ri, Ru	–	โxย, xอย	oi
ซ, ศ, ษ, ส	S	t	X̍ , X̖ , X̃ , X̃ , X̃อ	u
ฐ, ฒ	T	t	X̃ว , เX̃อ, Xว	ua
ฑ, ฒ, ธ, ฐ, ฏ	TH²	t	Xวย, เX̃อย	uai
ว	W	vowel	X̖ย	ui
ย	Y	vowel			

Special vowels	Without final	With final
ญ	Y	n	omitted letter understood	a	o
อ	–	vowel	รร	an	a

Notes: 1) When the symbol " ่ " is written above a consonant, do not
transcribe the consonant.

2) The transcribed letter "H" in combination with the letters
"P, T or K" represents aspiration, not the consonant "H".

AP 4-1

Table AP4-2   TRANSFORMATION OF OTHER PROJECT ZONES TO BSTP ZONES

BSTP[1] ZONE	HTS ZONE [2]	OMTP ZONE [3]	OBRR ZONE [4]
1	2x0.65, 3x0.55, 4x0.5 5x0.75, 21∿24, 54, 55	2∿16, 20∿28, 30∿35	11
2	1, 2x0.35, 25∿28, 53, 122, 123	105∿110, 112∿116	12
3	63x0.7, 64x0.2, 65x0.2	100∿104	21
4	29∿31, 35, 42x0.5, 44x0.5, 50∿52	120∿124, 125x0.5, 127∿129, 131, 135∿138, 139x0.5, 141x0.25	13, 23x0.75
5	3x0.45, 4x0.5, 5x0.25, 6∿8, 9x0.4, 10x0.25, 11x0.4, 12x0.2, 32∿34, 56	40∿47, 49∿51, 60∿68	14, 15x0.45
6	11x0.6, 12x0.8, 57, 108, 121	80, 81, 83∿85, 87∿89	15x0.55, 17
7	9x0.6, 10x0.75, 46, 107	82, 86, 90, 91	16, 28x0.5
8	37, 39	141x0.75	25
9	41, 42x0.5, 43, 44x0.5, 67x0.3, 126, 127	125x0.5, 126, 139x0.5, 140, 174x0.4	23x0.25, 24x0.55
10	63x0.3, 64x0.8 65x0.8, 66	153, 161∿164	22
11	68 x 0.7	151	39 x 0.35
12	69 x 0.65	150	39 x 0.4
13	68x0.3, 69x0.25, 74x0.05, 75x0.05	152 x 0.85	39 x 0.25
14	69x0.1, 74x0.55 75x0.50	152 x 0.15, 156 ∿ 158	40 x 0.45, 41
15	74x0.40, 75x0.45	159, 160	40x0.55, 42x0.4
16	76	170	42 x 0.6
17	67x0.7, 77x0.3	174x0.6, 175	24x0.45, 44

1) Bangkok Suburban Transportation Project
2) First Stage Mass Transit System
3) Bangkok Transportation Study
4) Outer Bangkok Ring Road Study

- to be cont'd -

BSTP ZONE	MTS ZONE	OMTP ZONE	OBRR ZONE
18	77 x 0.7	172	43
19	81 x 0.5	173x0.5, 190x0.15	46 x 0.5
20	81 x 0.5	173 x 0.5	46 x 0.5
21	36, 38, 40, 45, 47~49, 124, 125	180~186, 188, 196, 197	26, 27, 28x0.5
22	82	189	45
23	84	191 ~ 194	29, 30
24	85x0.1, 90	195, 245x0.1	50 x 0.5
25	83	190 x 0.85	48
26	78	200, 201	a part of Zone No. 69, 70 (Out of BKK)
27	80	202	47 x 0.35
28	91	220	49 x 0.35
29	79, 92	210, 211, 221	47x0.65, 49x0.65
30	58, 59	330 ~ 332	20 x 0.55
31	17x0.5, 18x0.5, 60~62	334~340, 350~352	19
32	13~16, 17x0.5, 18x0.5, 19, 20	360~368, 380~386	18
33	119 x 0.15	320x0.9, 321x0.65	32x0.2, 33x0.3
34	119xx 0.35	320x0.1, 321x0.35, 322, 323	58
35	109x0.1, 113, 115	294x0.15, 310~313	33 x 0.7
36	109x0.9, 114	292, 293, 294x0.85, 295	34
37	105	281, 282	35 x 0.75
38	106	280	61 x 0.4
39	110, 111	290, 291, 300	60, 61x0.6
40	112, 119x0.5	314, 315	59
41	116 x 0.55	230 x 0.55	32 x 0.3
42	116 x 0.45	230 x 0.45	32 x 0.35

- to be cont'd -

BSTP ZONE	HTS ZONE	OMTP ZONE	OBRR ZONE
43	117, 118x0.1	231, 232x0.3	32x0.15, 56x0.15
44	118 x 0.25	232 x 0.7	56 x 0.25
45	86 x 0.35	233	31 x 0.4
46	86 x 0.4	234	31 x 0.6
47	87 x 0.15	244 x 0.3	53 x 0.3
48	87 x 0.3	244x0.4, 246x0.25	53 x 0.4
49	85x0.45, 87x0.15	244x0.15, 245x0.45, 246x0.15	50 x 0.3
50	86 x 0.25	243	53 x 0.3
51	87x0.3, 88x0.4	246x0.5, 247x0.2 248x0.45	54 x 0.4
52	87x0.1, 88x0.2	244x0.15, 246x0.1 247x0.8	54 x 0.25
53	88x0.4, 95x0.1	248x0.55, 262x0.2	54x0.35, 55x0.1
54	85 x 0.45	245 x 0.45	50 x 0.2
55	89 x 0.55	260 x 0.55	51 x 0.3
56	95 x 0.3	262 x 0.55	55 x 0.3
57	89x0.1, 93x0.2	260x0.1, 261x0.2	51 x 0.1
58	89x0.35, 93x0.3	260x0.35, 261x0.3	51 x 0.3
59	93 x 0.5	261 x 0.5	51 x 0.3
60	94, 95x0.6	262x0.25, 270v272	52, 55x0.6
61	118 x 0.65	241	56 x 0.6
62	120	240, 242	57
63	102x0.05, 103	431x0.1, 442	20 x 0.45
64	104 x 0.3	440x0.25, 441	35x0.25, 62x0.1
65	104 x 0.25	440 x 0.75	62 x 0.45
66	73 x 0.5	434, 435	37 x 0.25
67	73 x 0.5	433	37 x 0.2

BSTP ZONE	HTS ZONE	OMIP ZONE	OBRR ZONE
68	98x0.5, 102x0.7	430x0.8, 431x0.55, 432	36 x 0.9
69	71, 72	412, 413	37 x 0.55
70	97x0.6, 98x0.45	400x0.45, 410x0.95, 411x0.8, 430x0.2	64 x 0.35
71	97x0.4, 98x0.05, 99∿101, 102x0.25, 104x0.45	390, 391, 400x0.65, 401, 402, 410x0.05, 411x0.2, 431x0.35, 420∿422	36x0.1, 62x0.45, 63, 64x0.65, 65
Re-marks	Excluding Zone No. 96 (Pathum Thani) Zone No. 1 ∿ 127	Excluding PZ 101∿104 (Pathum Thani)	Excluding Zone No. 38, 66, 67, 68 (Pathum Thani) and 91∿98 (External Zones)

APPENDIX
CHAPTER 5

TRANSPORTATION PLANNING AND
FORECASTS OF FUTURE TRAFFIC DEMAND

AP5 Analysis of Air Passengers

AP5-1 Existing Air Passengers to and from Bangkok Airport in 1977

The data on the 1977 air passengers to and from Bangkok Airport is not yet available at present. Since the data on embarking foreign tourists and Thai air passengers is available from 1973 to 1977, the analysis was started with the classification of tourists and non-tourists among the international air passengers.

AP5-1-1 Foreign Tourists

According to the data from Tourist Organization of Thailand, the number of foreign tourists visiting Thailand amounted to 1.221 million in 1977. However, some tourists from Malaysia did not use air transport but use other means of transport. The modal split of the Malaysian tourists to Thailand was found to be 41,069 persons using air and 176,343 persons using other modes of transport, in other words, 18.9% and 81.7% respectively of the total Malaysian tourists of 217,412. When this proportion is applied to the other years, the Malaysian tourists using air transport are as shown in Table AP5-1.

Table AP5-1   MALAYSIAN TOURISTS VISITING THAILAND

(Unit: Passenger)

	1973	1974	1975	1976	1977
Total Malaysian Tourists	190,827	197,508	227,826	161,183	217,412
by air*	36,047	37,309	43,036	30,447	41,069
by other transport means	154,780	160,199	184,790	130,736	176,343

* Estimated by using the proportion as in 1977.
1] Source: Tourist Organization of Thailand

Accordingly, the foreign tourists using air transport are estimated from the data on total foreign tourists visiting Thailand as presented in Table AP5-2.

Table AP5-2   FOREIGN TOURISTS ARRIVING AT BANGKOK AIRPORT

(Unit: 1,000 persons)

	1973	1974	1975	1976	1977
Total Foreign Tourists [1]	1,038	1,108	1,180	1,098	1,221
Malaysian Tourists by other other than Air	155	160	185	131	176
Foreign Tourists by Air Transport	883	948	995	967	1,045

1] Source: Tourist Organization of Thailand

The foreign tourists occupied the major part of the total foreign air passengers carried to and from Bangkok Airport, on 97.8% in 1973 and 88.0% in 1976 as shown in Table AP5-3.

Table AP5-3 INTERNATIONAL AIR PASSENGERS TO AND FROM BKK AIRPORT

(Unit: 1,000 passengers)

	1973	1974	1975	1976	1977
International Air-[1] passengers	1,966	2,119	2,371	2,486	(2,683)
(1) Foreign passengers:	1,805	1,924	2,129	2,197	(2,348)
(a) Tourists [2]	1,766	1,896	1,990	1,934	2,090
(b) Non-tourists	39	28	139	263	(258)
(2) Thai passengers [3]	161	195	242	289	335
(3) (a)/$_{(1)}$ (%)	97.8	98.5	93.5	88.0	(89.0)

Source: 1] Airport Traffic, 1973 - 1976, ICAO
        2] Twice the relevant figures in Table AP5-2.
        3] Tourist Organization of Thailand

Note : The figures in parentheses were estimated in this study.

AP5-1-2 Foreign Non-Tourists

The number of foreign tourists decreased in 1976, despite of the steady growth in the previous years, but again increased in 1977. On the other hand, foreign non-tourists grew markedly in 1975 and 1976 as shown in the above table. Taking these facts into consideration, it was assumed that the foreign tourists in 1977 corresponded to 89% of a total foreign air passengers, or 2.348 million passengers. Accordingly, international air passengers were estimated at 2.683 million passengers for 1977.

AP5-1-3 Domestic Air Passengers

The domestic air passengers to and from Bangkok Airport accounted for about 79% of the total domestic air passengers carried during 1973 - 1976 as shown in Table AP5-4. By using this proportion, the domestic air passengers to and from Bangkok Airport were estimated at 209,000 passengers in 1977.

Table AP5-4 DOMESTIC AIR PASSENGERS

(Unit: 1,000 passengers)

	1973	1974	1975	1976	1977
(1) Total Domestic Air [1] passengers carried	272	252	263	297	265
(2) Domestic air passengers to & from BKK Airport	215	203	210	233	(209)
(3) (2)/$_{(1)}$ (%)	79.0	80.6	79.8	78.5	(79.0)

Source: 1] Quarterly Bulletin of Statistics, Dec., 1977 NSO.
        2] Airport Traffic, 1973 - 1976, ICAO
Note: The figures in parentheses were estimated in this study.

A summary of estimated International and domestic air passengers is shown in Table AP5-5.

Table AP5-5 AIR PASSENGERS TO AND FROM BKK AIRPORT

(Unit: 1,000 passengers)

Air Traffic	1973	1974	1975	1976	1977*
International passengers	1,966	2,119	2,371	2,486	2,683
Domestic passengers	215	203	210	233	209
Total	2,181	2,322	2,581	2,719	2,892

* Estimated in this study.

AP5-2 Forecast of Future Air Passengers to and from Bangkok Airport

AP5-2-1 Estimation of Future International Air Traffic

A forecast of future International tourist arrivals was made for Thailand as well as for the World and Pacific and Asia in the report of "Feasibility Study of Pattaya Tourism Development, 1978" by Japan International Cooperation Agency. According to this, the international tourist arrivals in Thailand, as shown in Table AP5-6, will amount to 3 million in 1996, excluding the Malaysian tourists arriving by land and sea transport means.

Table AP5-6 FORECAST OF INTERNATIONAL
TOURIST ARRIVALS

(Unit: million passengers)

	1976	1981	1986	1991	1996
World	221.7	268.3	309.3	360.5	417.0
Pacific & Asia	7.4	9.0	11.1	13.5	16.0
Thailand	0.967	1,600	2,000	2,500	3,000

To estimate future tourist arrivals in Thailand for the target years of this study, an average annual growth rate in each five-year period was used. Consequently, International arrivals were estimated at 2.400 million for 1990 and 3.500 million for 2000.

The number of foreign tourists embarking and disembarking at the airport was considered to be double of the above number, assuming the foreign tourists arriving at Bangkok Airport also depart from the same airport.

AP5-2-2 Estimation of Future Non-tourists International Traffic

The number of International non-tourists to and from Thailand grew about ten-fold from 1974 to 1976 as seen in Table AP5-3.

It has been presumed that business trips account for the majority of trips in this category. The development of such international trips will be influenced by international economic and political situations

as well as domestic ones. Therefore, it was assumed that the future growth of the international non-tourists would correspond to the growth of future Thai economy. Based on the average annual growth rate of 6 percent from 1977 to 1990, the future projections are for 544,000 passengers in 1990, and based on 5 per cent growth from 1991 to 2000 the projection is 886,000 passengers.

AP5-2-3 Estimation of Future Thai Segment of International Traffic

Thai air passengers embarking from Bangkok Airport, as shown in Table AP5-7, grew at an average annual rate of 18.87%.

Table AP5-7 THAI AIR PASSENGERS EMBARKING FROM THAILAND

Year	Embarking Passengers	GDP (million Baht at 1972 constant prices)
1970	50,081	145,579
1971	58,356	157,014
1972	68,331	163,349
1973	80,547	180,146
1974	97,643	189,191
1975	120,987	203,751
1976	144,669	220,450
1977	169,451	234,123

Source: Tourist Organization of Thailand (TOT) and NESDB

To estimate the future Thai air passengers, a linear regression equation was established between the variables of Thai passengers embarked and the Gross Domestic Product (GDP) in Thailand.

From this equation and the future GDP of Thailand previously estimated Thai passengers embarking from Bangkok Airport were estimated as shown in Table AP5-8. The total Thai passengers embarking and disembarking was assumed to be double the embarking amount.

Table AP5-8 FORECAST OF FUTURE THAI PASSENGERS IN INTERNATIONAL AIR TRAFFIC

Year	GDP* (million Baht)	Embarking (x 1,000 pass.)	Embarking and Disembarking (x 1,000)
1990	513,634	539	1,078
2000	836,656	973	1,946
Equation:	Y = 1.346 X - 152,801 (γ=0.993)		
where,	*Y : Thai air passengers embarked from Thailand		
	X : GDP at 1972 constant prices		

AP5-2-4 Estimation of Future Domestic Air Passengers

According to the statistics domestic air traffic in Thailand grew at an average rate of about 7.5 per cent per annum from 1967 to 1977 as seen in Table AP5-9.

Table AP5-9 THAI AIRLINE OPERATIONS FOR DOMESTIC TRANSPORT

Year	Domestic pass. carried (x1,000)	Average Annual Growth Rate
1970	201	
1971	216	
1972	239	
1973	272	7.5%
1974	252	
1975	263	
1976	297	
1977	265	

Source: Statistical Year Book and Bulletin of Statistics, Dec., 1977, NSO.

Taking this into account, the future traffic up to 1990 at the same annual rate was calculated to be 7.5 percent per year on an average, or 679,000 passengers in 1990, from 1991 to 2000, the growth rate was 6 per cent, or 1.215 million passengers in 2000.

Of the above domestic passengers carried, arriving and departing passengers of Bangkok Airport were assumed to occupy 75 per cent of the total domestic air traffic in 1990 and 70 percent in 2000. Although the statistics show that the share of Bangkok's Airport was constant at 79 percent from 1973 to 1976 as seen in Table AP5-4, it is expected that the future share of local airports will increase in proportion with the local economic development. Consequently, the future domestic air passengers were estimated and are summarized in Table AP5-10.

Table AP5-10 FORECAST OF FUTURE DOMESTIC AIR PAS-
SENGERS TO AND FROM BANGKOK AIRPORT

Year	(A) Total Domestic Passengers (x1,000)	(B) Domestic Passengers to & from BKK Airport (x1,000)	(B)/(A)
1976	297*	233*	78.5%
1977	265*	209	79.0%
1990	679	509	75.0%
2000	1,215	851	70.0%

* Actual

A summary of the estimated Bangkok Airport passengers is shown in Table AP5-11.

Table AP5-11 SUMMARY OF FUTURE AIR PASSENGERS TO AND
FROM BANGKOK AIRPORT

(Unit: 1,000 passengers)

	1977	1990	2000
International Traffic	2,683	6,422	9,832
Foreign Passengers:	2,348	5,344	7,886
Tourists	2,090	4,800	7,000
Non tourists	258	544	886
Thai Passengers:	335	1,078	1,946
Domestic Passengers:	209	509	851
Total	2,892	6,931	10,683

AP5-3   Forecast of Future Aircraft Movements at Bangkok Airport

AP5-3-1 International Transit Passengers

The future air passengers embarking and disembarking from the airport
have been estimated at 6.442 million in 1990 and 9.832 million in 2000
as shown in Table AP5-11. The growth of direct transit passengers pre-
viously introduced in the text (Table 2-13, section 2.3.3) shows that
transit passengers in 1973 accounted for about 48 per cent of the total
international air passengers. This figure gradually decreased to 44
per cent in 1976. However, it was supposed that such proportion will
not change greatly in future, because of the importance of Bangkok
Airport in the international airway network, particularly in the Asian
region. Therefore, the proportion of transit passengers in future was
assumed to be 45 percent of the future international passengers in
Bangkok. Consequently, the forecast was made as presented in Table
AP5-12.

Table AP5-12 FORECAST OF FUTURE TRANSIT PASSENGERS

(x1,000 passengers)

	1973	1974	1975	1976	1977	1990	2000
International air Passengers	3,758	3,916	4,241	4,448	4,878	11,676	17,876
Embarking & Disembarking	1,966	2,119	2,371	2,486	2,683	6,422	9,832
Direct Transit x 2	1,792	1,800	1,870	1,962	2,195	5,254	8,044

AP5-3-2 Average Passenger Load and Aircraft Movement

(1) International Traffic

According to Table 2-13 in the Text section 2.3, the average
passenger load per aircraft for the international scheduled

traffic has increased steadily from 86 passengers in 1973 to 112 passengers in 1976. On the other hand, the volume of international non-scheduled traffic has fluctuated from a low of 42 passengers to a high of 79 passengers during the same period. The share of non-scheduled traffic is minor and only accounts for 4 to 7 per cent of the total international traffic. Therefore, as a major international airport it was considered that the past rising trend of the average load would continue and would reach the level of 120 and 140 passengers per aircraft in 1990 and in 2000 respectively. As a result, the number of aircraft both taking-off and landing at Bangkok Airport was estimated at 97,300 in 1990 and 127,686 in 2000.

(2) Domestic Traffic

Regarding the domestic air traffic, the future passenger traffic demand was already estimated in section AP5.2.4 as 509,000 persons in 1990 and 851,000 persons in 2000. The average load is about 34 passengers per aircraft and has changed little from 1973 to 1976 as shown in Table 2-12. For domestic air transport, frequent services will be provided prior to introducing larger size aircraft to the domestic service. Accordingly, passenger load will not reach the load level of the international traffic soon. Taking this into consideration, it was assumed that the average load in 1990 and in 2000 would be 50 and 65 passengers per aircraft respectively.

(3) All Other Aircraft Movement

Other aircraft movements include such activities as crop dusting, serial photography, pilot training, business and executive reconnaisance. The aircraft movements for such purposes are not likely to increase in future unless the capacity of the airport is improved enough to meet the future international and domestic transport demand. Therefore, the frequency of these aircraft movements was assumed to grow slowly as shown in Table AP5-13.

AP5-4   Capacity of Existing Bangkok Airport

AP5-4-1 Flights at Peak Hours in 1978

Bangkok Airport has been used as military as well civil aviation base. The airport has one run way and provides services to international and domestic transport for both scheduled and non-scheduled flights.

Table AP5-14 shows the average hourly number of flights (arriving + departing) at Bangkok Airport in 1978.

Table AP5-13   FORECAST OF FUTURE PASSENGER TRAFFIC AND AIRCRAFT FLIGHTS* AT BANGKOK AIRPORT

		1990	2000
(A)	International Air Passenger (x1000 pass.):	11,676	17,876
	(1) Embarking & Disembarking (x1000 pass.)	6,422	9,832
	(2) Direct transit x 2 (x1000 pass.)	5,254	8,044
	(3) Aircraft flights	97,300	127,686
	(4) Average load (pass./aircraft)	120	140
(B)	Domestic Air Passenger (x1000 pass.):	509	851
	(1) Embarking & Disembarking (x1000 pass.):	509	851
	(2) Aircraft fligths	101,180	13,092
	(3) Average load (pass./aircraft)	50	65
(C)	Total aircraft flights	107,480	140,778
(D)	All other aircraft flights	9,000	10,000

* Arrivals + Departures

According to the right above table, the peak hour is from 10 to 11 in the morning. During this period, the number of flights is about 12 on an hourly average or about 12 percent of the daily average.

Future aircraft movements have been estimated in the previous section AP5.3.2, Table AP5-13. Assuming that the future variation of hourly aircraft movements will be similar to the present pattern, with the peak ratio of 12 per cent, peak aircraft movements in 1990 and in 2000 are claculated to be 36 and 47 flights per hour respectively. These peak hour movements at Bangkok Airport only consist of commercial aircraft excluding military and all other aircraft movements.

Bangkok Airport has only one run way which generally handles 40 to 60 flights per hour for both arriving and departing aircraft. Therefore, a new international airport which has been projected in the Greater Bangkok Plan will be necessary by the year 2000.

AP5-5   Influence of Airport Traffic on Land Transport

An airport generates and attracts person-trips for both air transport and land transport. From the viewpoint of land transport, disembarking air passengers generate person-trips, while those embarking attract person-trips. Based on the assumptions established in the text section 5.1.2, person-trip generation and attraction at the airport was calculated as explained in Tables AP5-15 through AP5-18.

Table AP5-15   PERSON-TRIPS GENERATED* AND ATTRACTED**
AT BANGKOK AIRPORT IN 1977

(A)	Air passengers at Bangkok Airport [1]	
	(1) International air traffic:	2,683 thousand passengers per year
	Departing (Attracted)	2,683 ÷ 2 ÷ 365 x 0.053 = 0.195 (x 1000 pass./hr.)
	Arriving (Generated)	2,683 ÷ 2 ÷ 365 x 0.016 = 0.059 (x 1000 pass./hr.)
	(2) Domestic air traffic:	209 thousand passengers per year
	Departing (Attracted)	209 ÷ 2 ÷ 365 x 0.164 = 0.047 (x 1000 pass./hr.)
	Arriving (Generated)	None
(B)	Persons who welcome (PW) or send off (PS) air passengers at the airport	
	(1) International air traffic:	2,683 thousand passengers per year
	Foreign tourists:	2,090 thousand passengers per year
	PW (Generated)	2,090÷2 ÷ 365x0.016x0.5=0.023 (x1000 persons/hr.)
	PS (Attracted)	2,090÷2 ÷ 365x0.053x0.5=0.076 (x1000 persons/hr.)

Table AP5-15   PERSON-TRIPS GENERATED* AND ATTRACTED**
AT BANGKOK AIRPORT IN 1977   (Cont.)

Other air passengers:	593 thousand passengers per year	
PW (Generated)	593÷2÷365x0.016x1.0=0.013 (x 1000 persons/hr.)	
PS (Attracted)	593÷2÷365x0.053x1.0=0.043 (x 1000 persons/hr.)	
(2) Domestic air traffic	209 thousand passengers per year	
PW (Generated)	None	
PS (Attracted)	209÷2÷365x0.164x0.5=0.023 (x 1000 persons/hr.)	

(C) Total person-trip generation from Airport	95 persons/hr.***	
Total person-trip attraction to Airport	384 persons/hr.***	

*   Person-trips generated from the airport and attracted to the
residents, etc. by land transport.

** Person-trips attracted to the airport from the residents, etc. by
land transport.

*** During road peak hour from 7 to 8 a.m.

Note[1] Quoted from Table AP5-11.

Table AP5-16   PERSON-TRIPS GENERATED* AND ATTRACTED** AT BANGKOK
AIRPORT IN 1990

(A) Air passengers at Bangkok Airport 1]		
(1) International air traffic:	6,422 thousand passengers per year	
Departing (Attracted)	0.466 thousand passengers per hour	
Arriving (Generated)	0.141 thousand passengers per hour	
(2) Domestic air traffic:	509 thousand passengers per year	
Departing (Attracted)	0.114 thousand passengers per hour	
Arriving (Generated)	None	
(B) Persons who welcome (PW) or send off (PS) air passengers at the airport		
(1) International air traffic:	6,422 thousand passengers per year	
Foreign tourists:	4,800 thousand persons per year	
PW (Generated)	0.053 thousand persons per hour	
PS (Attracted)	0.174 thousand persons per hour	
Other air passengers:	1,622 thousand passengers per year	
PW (Generated)	0.036 thousand persons per hour	
PS (Attracted)	0.118 thousand persons per hour	
(2) Domestic air traffic:	509 thousand passengers per year	
PW (Generated)	None	
PS (Attracted)	0.057 thousand persons per hour	
(C) Total person-trip generation from Airport	230 persons per hour***	
Total person-trip attraction to Airport	929 persons per hour***	

Note: Refer to the footnote under Table AP5-15.

From the viewpoint of the existing Bangkok Airport capacity, it will be necessary to construct a new international airport by the year 2000 at the location projected in the Greater Bangkok Plan (Zone 58 in this study). It was assumed that the new international airport would start operation for international civil aviation in 2000. Accordingly, person-trip generated and attracted at the existing airport and also at the new airport are calculated as shown in Table AP5-17 and Table AP5-18.

Table AP5-17 PERSON-TRIP GENERATED* AND ATTRACTED**
AT NEW INTERNATIONAL AIRPORT IN 2000

(A)	Air passengers at the new airport 1]		
	International air traffic:	9,832	thousand passengers per year
	Departing (Attracted)	0.714	thousand passengers per hour
	Arriving (Generated)	0.215	thousand passengers per hour
(B)	Persons who welcome (PW) or send off (PS) air passengers at the new airport		
	International air traffic:	9,832	thousand passengers per year
	Foreign tourists:	7,000	thousand passengers per year
	PW (Generated)	0.077	thousand persons per hour
	PS (Attracted)	0.254	thousand persons per hour
	Other air passengers:	2,832	thousand passengers per year
	PW (Generated)	0.062	thousand persons per hour
	PS (Attracted)	0.206	thousand persons per hour
(C)	Total person-trip generation from Airport	354	persons per hour***
	Total person-trip attraction to Airport	1,174	persons per hour***

Note: Refer to the footnote under Table AP5-15.

Table AP5-18 PERSON-TRIPS GENERATED* AND ATTRACTED**
AT BANGKOK AIRPORT IN 2000

(A)	Air passengers at Bangkok Airport 1]		
	Domestic air traffic:	851	thousand passengers per year
	Departing (Attracted)	0.191	thousand passengers per hour
	Arriving (Generated)		None
(B)	Persons who welcome (PW) or send off (PS) air passengers at the airport		
	Domestic air traffic	851	thousand passengers per year
	PW (Generated)		None
	PS (Attracted)	0.096	thousand persons per hour
(C)	Total person-trip generation from Airport		None
	Total person-trip attraction to Airport	287	persons per hour ***

Note: Refer to the footnote under Table AP5-15.

Table AP 5-19   ESTIMATED REGRESSION EQUATIONS AND COMMERCIAL VEHICLES BY CHANGWAT in 2,000

Changwat	Estimated Regression Equations Y: Commercial Vehicles X: Year '70, '71 ..... '90,100		Commercial Vehicles in 1977	Calibrated Commercial Vehicles in 2000	Adjusted Commercial Vehicles in 2000
Nonthaburi	Y = 194X - 12,814	(r: 0.98)	2,044	6,586	14,335
Samut Prakan	Y = 301X - 20,465	(r: 0.96)	2,631	9,635	20,971
	Total of the above		4,675	16,221	35,306
	Control Total (Frame)		4,675	35,306	35,306
GBA without M. BKK					
Pathum Thani	Y = 89X - 6,120	(r: .97)	810	2,780	4,976
Nakhon Pathom	Y = 1,369X - 92,523	(r: .96)	14,244	44,377	79,438
Ratchaburi	Y = 394X - 25,201	(r: .99)	5,676	14,199	25,417
Phetchaburi	Y = 501X - 33,290	(r: .98)	5,842	16,810	30,091
Singburi	Y = 138X - 9,374	(r: .74)	1,383	4,426	7,923
Kanchanaburi	Y = 914X - 61,230	(r: .90)	10,109	30,170	54,006
Chonburi	Y = 3,153X - 210,878	(r: .95)	32,253	104,422	186,921
Chanthaburi	Y = 516X - 33,935	(r: .98)	6,406	17,665	31,621
Chai Nat	Y = 66X - 3,997	(r: .84)	1,199	2,603	4,660
Prachuap Khiri Khan	Y = 224X - 14,915	(r: .97)	2,578	7,485	13,399
Chachoengsao	Y = 236X - 15,960	(r: .98)	2,444	7,640	13,676
Samut Sakhon	Y = 91X - 5,845	(r: .93)	1,284	3,255	5,827
Samut Songkhram	Y = 84X - 5,868	(r: .92)	663	2,532	4,532
Lopburi	Y = 456X - 30,403	(r: .97)	5,203	15,197	27,204
Suphanburi	Y = 591X - 39,669	(r: .96)	6,451	19,431	34,783
Phra Nakhon Si Ayutthaya	Y = 171X - 10,954	(r: .99)	2,445	6,146	11,002
Ang Thong	Y = 101X - 6,916	(r: .93)	951	3,184	5,700
Nakhon Nayok	Y = 45X - 2,693	(r: .63)	853	1,807	3,235
Trat	Y = 165X - 11,109	(r: .98)	1,764	5,391	9,650
Saraburi	Y = 369X - 22,550	(r: .70)	6,479	14,350	25,687
Prachinburi	Y = 153X - 10,119	(r: .98)	1,837	5,181	9,274
Rayong	Y = 565X - 36,965	(r: .95)	7,227	19,535	34,969
Central Region outside	Total of the above		121,101	348,586	623,991
GBA	Control Total (Frame)		121,101	623,991	623,991

Fig. AP 5-1

PROPOSED TRANSPORTATION FACILITIES

- (T) TRUCK TERMINALS
- OUTER RING ROAD & FIRST STAGE EXPRESSWAYS
- SECOND STAGE EXPRESSWAYS
- MAJOR RADIAL HIGHWAYS & MEDIUM OUTER RING ROAD
- RAILWAY

N

5   10 KM

(T) RANGSIT

OUTER RING ROAD

MEDIUM RING ROAD

FIRST STAGE EXPRESS-WAY

BANG KLE
(T)

(T)
BANG NA

AP5-13
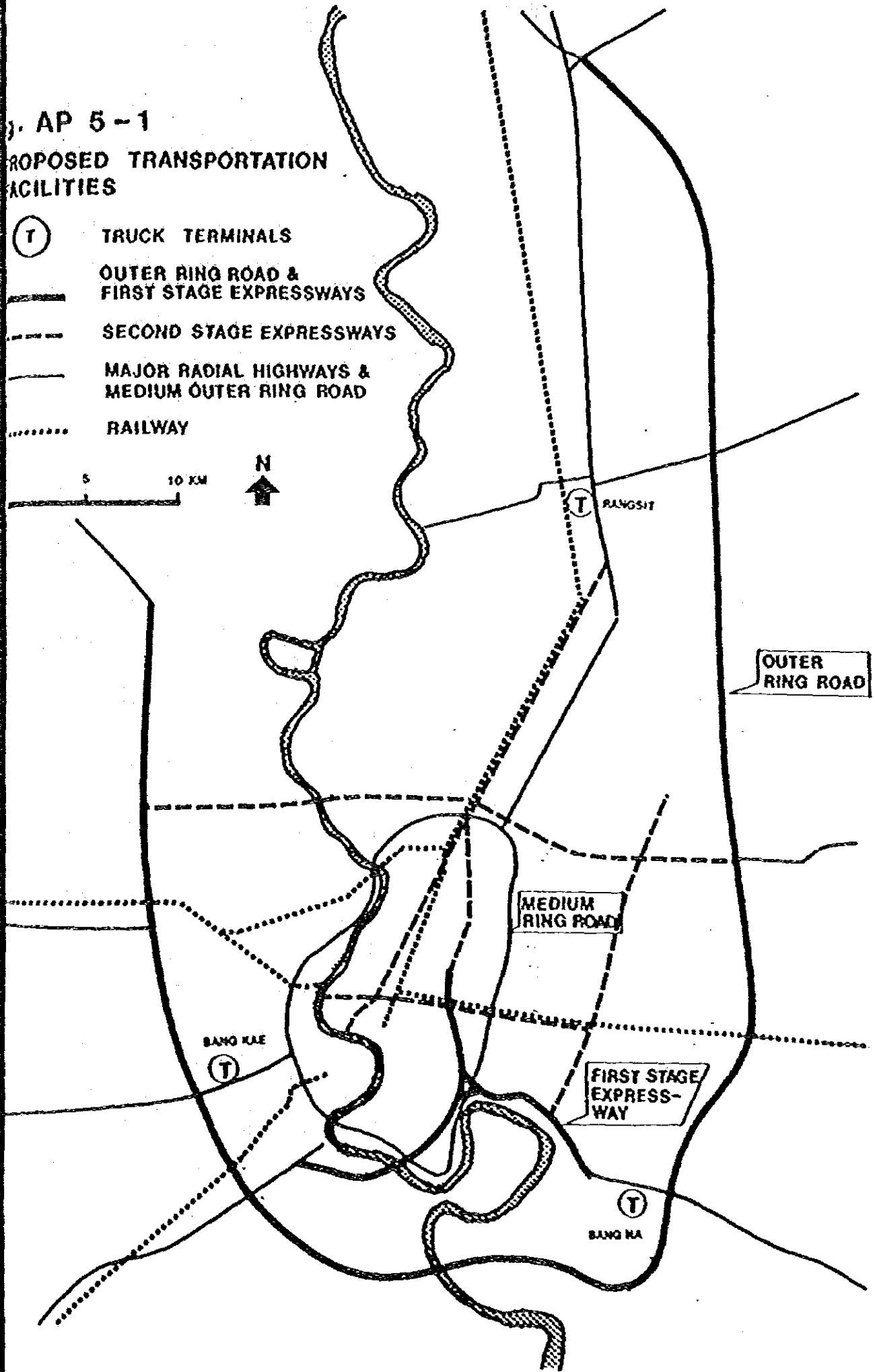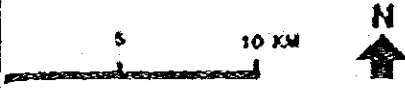
AP5-6   Estimated Traffic Volume on the Transportation
        Network in Typical Alternative Cases, 2000

Fig. AP5-2   Case 2   Toll Rate: 0.078 Baht/km
                    Whole sections of suburban HIS were constructed

Fig. AP5-3   Case 5   Toll Rate: 0.078 Baht/km
                    Whole sections of suburban HIS were not constructed

Fig. AP5-4   Case 14   Toll Rate: 0.296 Baht/km
                    Whole section of suburban HIS were constructed

Fig. AP5-5   Case 5'   Toll Rate: 0.296 Baht/km
                    Whole section of suburban HIS were not constructed

Fig. AP5-6   Assigned Traffic Volume on the future planning road
                    network in the Case 5'.
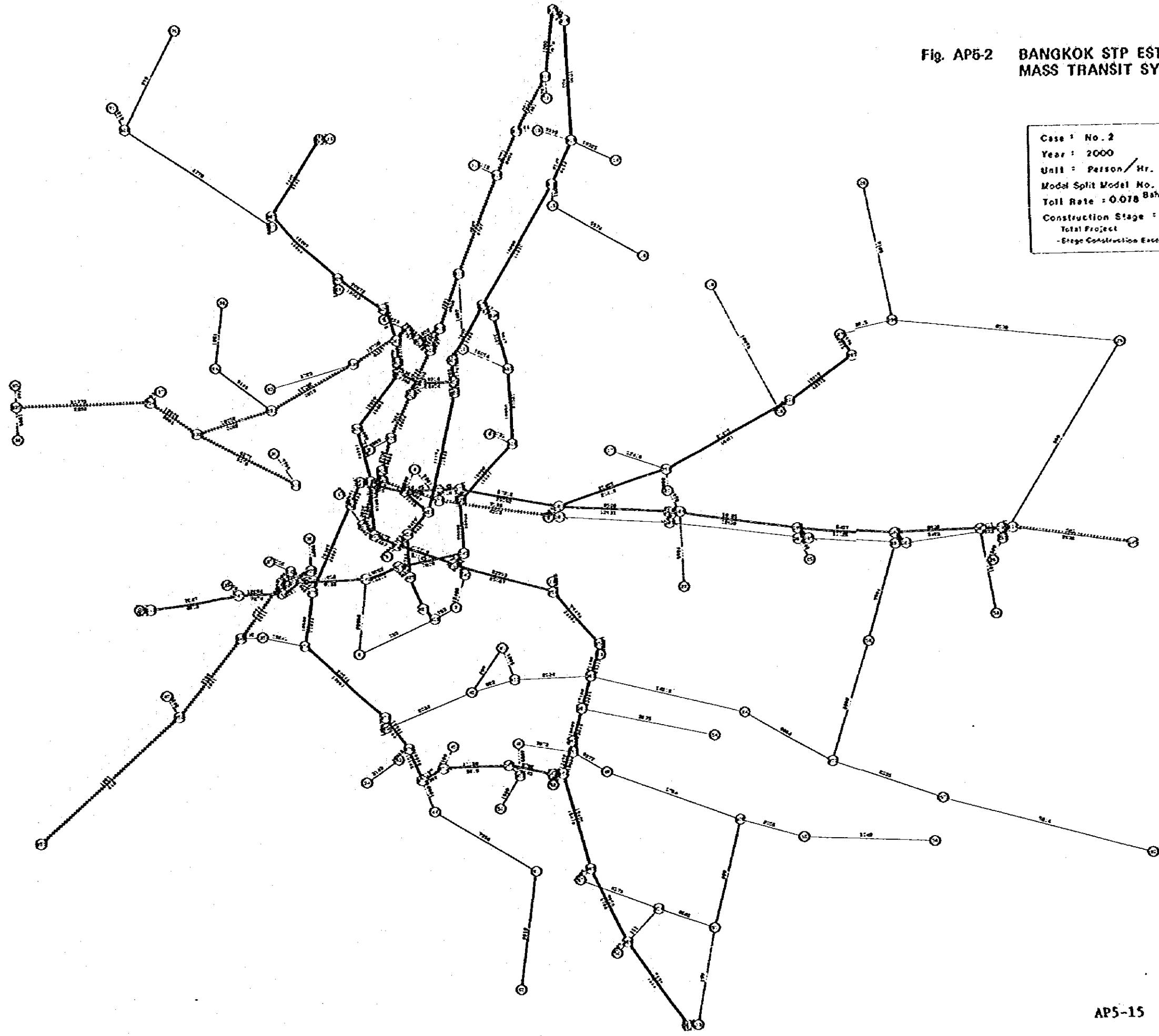
Case : No. 2
Year : 2000
Unit : Person / Hr.
Model Split Model No. 2
Toll Rate : 0.078 Baht / Km
Construction Stage :
    Total Project
    -Stage Construction Except Route-Ke-

Fig. AP5-3 BANGKOK STP ESTIMATED TRAFFIC MASS TRANSIT SYSTEM NETWORK
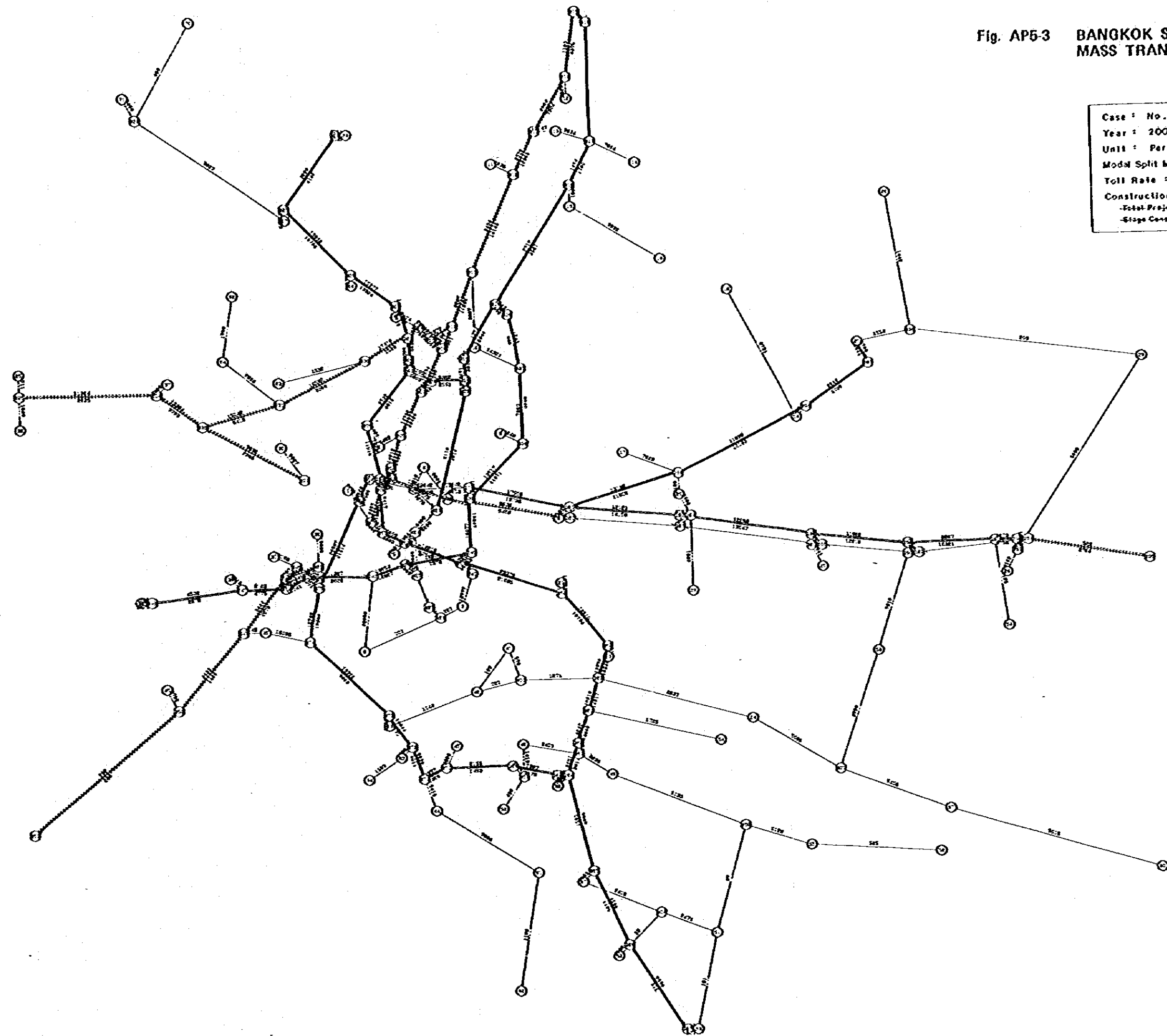
Case : No. 5
Year : 2000
Unit : Person/Hr.
Model Split Model No. 2
Toll Rate : 0.078 Baht/Km
Construction Stage :
  —Total Project— Not Constructed
  —Stage Construction Except Route -Ka—

Fig. AP5-4   BANGKOK STP ESTIMATED TRAFFIC
MASS TRANSIT SYSTEM NETWORK
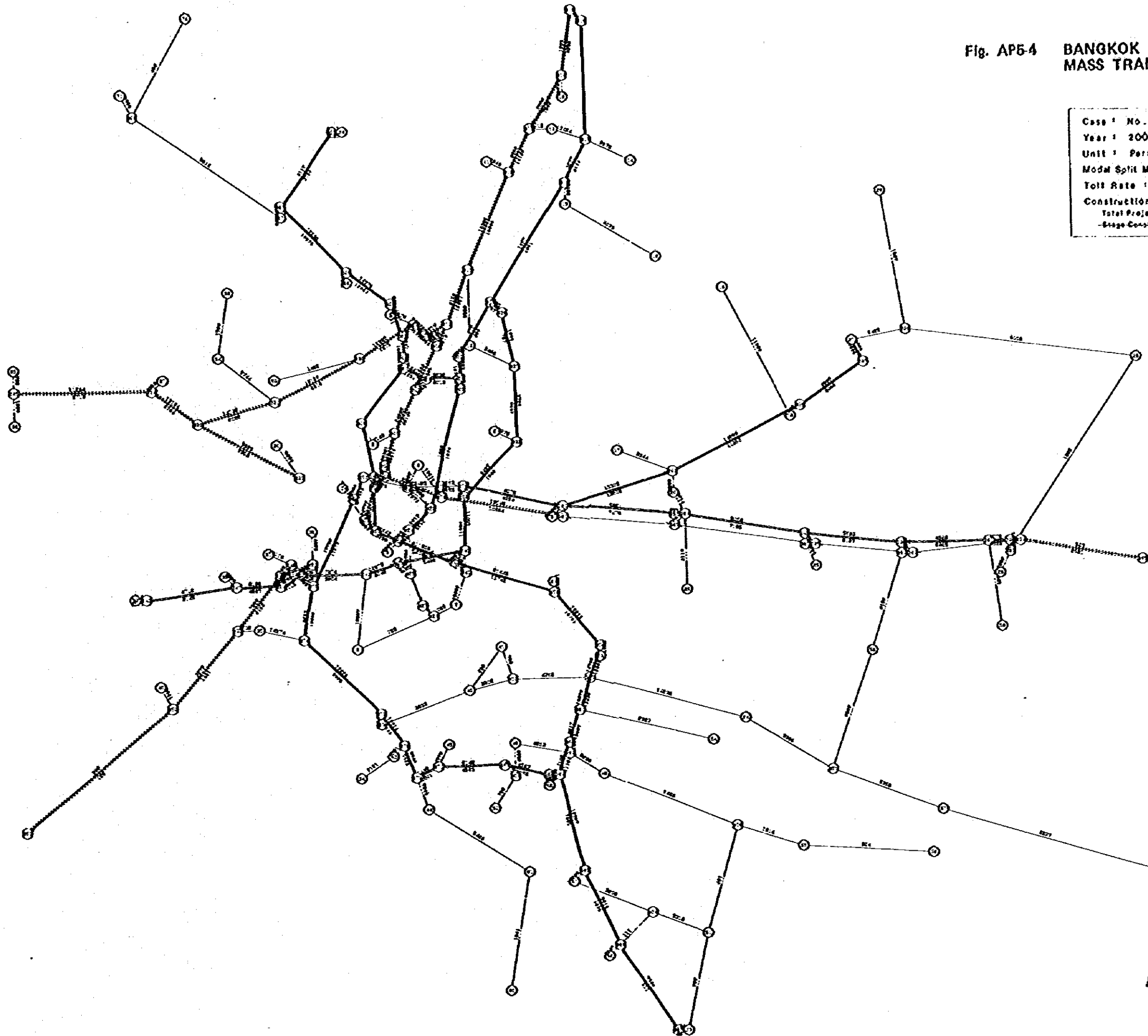
Case : No. 14
Year : 2000
Unit : Person/Hr.
Model Split Model No. 2
Toll Rate : 0.206 Baht/Km
Construction Stage :
    Total Project
    Stage Construction Except Route No.

Fig. AP5-5 BANGKOK STP ESTIMATED TRAFFIC
MASS TRANSIT SYSTEM NETWORK
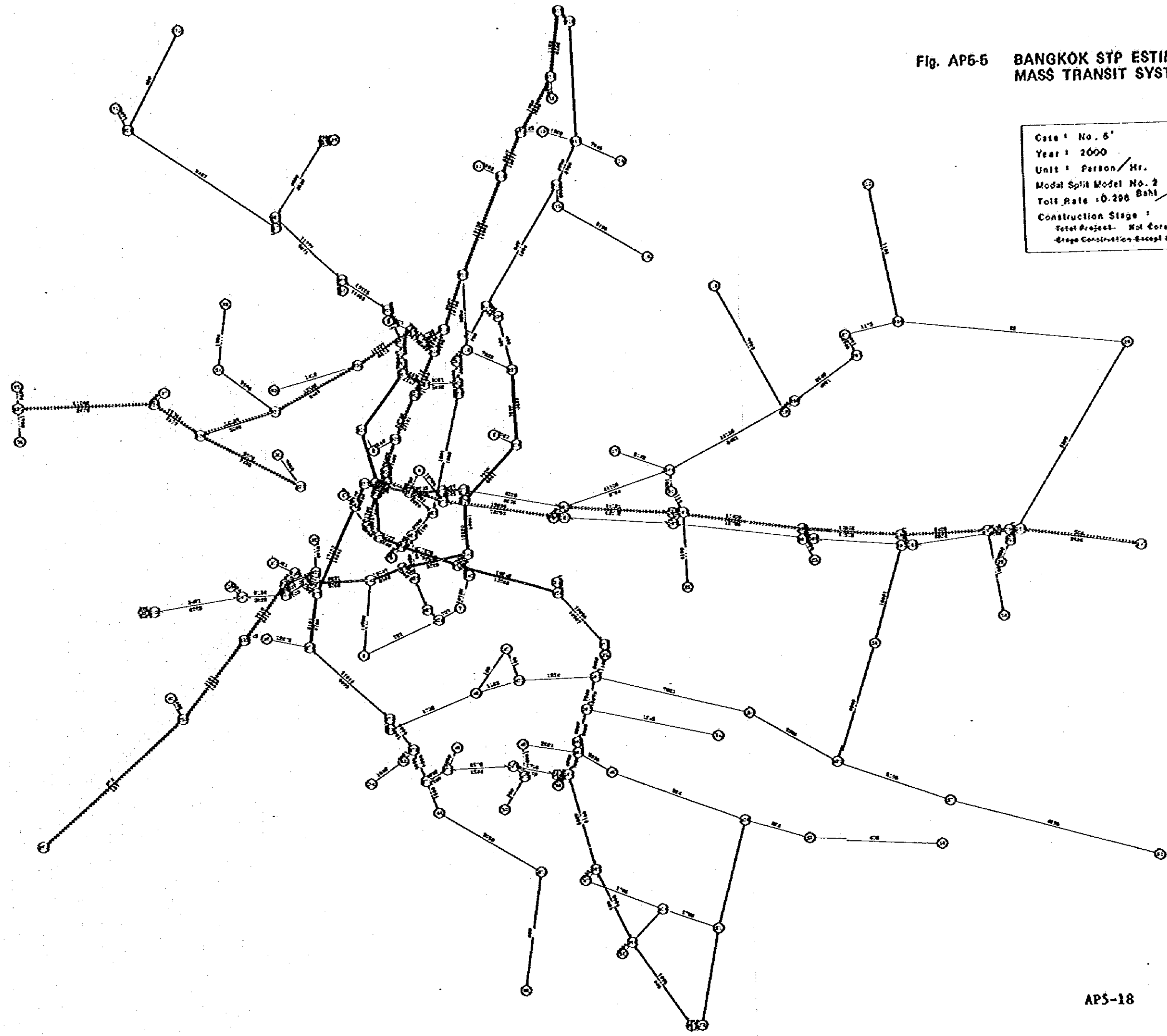
Case : No. 5'
Year : 2000
Unit : Person/Hr.
Modal Split Model No. 2
Toll Rate : 0.296 Baht/Km
Construction Stage :
    Total Project - Not Constructed
    Stage Construction Except Route No.

APS-18

**APPENDIX
CHAPTER 6**

**TRANSPORTATION FACILITIES
PLANNING**

Table AP6-1 BREAKDOWN OF INVESTMENT COSTS FOR DIFFERENT TRANSPORT MODES

(Unit : 10⁶ Baht)

		Civil Eng.	Rolling Stock	Power Supply Sys.	Sig. Tel. System	Work Shop eq.	Equip. for Track maintenance	Sub-Total	Land acquisition	Total
Light Rail	(1)	5,615.2	3,735.6	919.0	1,060.0	34.5	32.4	11,396.7	501.5	11,898.2
	(2)	"	6,622.2	1,004.0	"	51.8	"	14,385.6	"	14,887.1
	(3)	"	8,829.6	1,089.0	"	80.9	"	16,707.1	"	17,208.6
Heavy Rail	(1)	6,070.8	5,460.0	693.0	1,060.0	41.8	32.4	13,358.0	524.9	13,882.9
	(2)	"	6,483.8	709.0	"	54.5	"	14,410.5	"	14,935.4
	(3)	"	10,920.0	984.0	"	88.2	"	19,155.4	"	19,680.3
Monorail	(1)	7,699.8	6,857.0	1,150.0	1,060.0	50.0	20.0	16,836.8	549.9	17,386.7
	(2)	"	8,081.7	1,176.0	"	58.0	"	18,095.5	"	18,864.6
	(3)	"	10,040.9	1,424.0	"	70.0	"	20,314.7	"	20,864.6
New guideway	(1)	6,064.1	1,308.5	219.0	1,060.0	19.6	10.0	8,681.2	498.2	9,179.4
	(2)	"	1,942.9	219.0	"	29.1	"	9,325.1	"	9,823.3
	(3)	"	2,616.9	219.0	"	39.1	"	10,009.1	"	10,507.3

Source: "First Stage Mass Transit System in Bangkok" Volume I, Dec., 1978

Table AP6-2   BREAKDOWN OF THE OPERATION & MAINTENANCE COSTS FOR DIFFERENT TRANSPORT MODES

(Unit : 10⁶ Baht/yr.)

		Personnel Cost for System Operation	Personnel Cost for Work Shop	Personnel Cost for Power Supply	Personnel Cost for Operation of Sig. & Tel.	Personnel Cost for Track & Str. Maint.	Personnel Cost for Staff Training	Energy Cost	Cost of Work-Shop Materials & Supplies	Tire Consumption	Maintenance for Structure Permanent Way	Materials & Supplies for Maintenance of Sign. & Tele.	Materials & Supplies for Power Supply System	Adm, Materials & Supplies	Total of Op. & Main. Costs per year
Light Rail	(1)	48.4	7.1	1.3	3.4	0.9	0.9	61.0	7.5	–	37.9	2.7	1.5	2.7	174.3
	(2)	51.1	13.0	1.4	3.4	"	0.9	108.0	13.2	–	"	"	1.6	1.8	235.9
	(3)	55.4	17.3	1.5	3.4	"	0.9	146.0	17.7	–	"	"	1.7	1.9	287.2
Heavy Rail	(1)	37.5	12.4	1.3	3.4	0.9	0.7	92.0	10.9	–	40.0	2.7	1.4	1.3	204.5
	(2)	38.1	14.8	1.4	3.4	"	0.7	109.0	13.0	–	"	"	1.4	1.4	226.8
	(3)	45.5	23.5	1.6	3.4	"	1.0	173.0	21.8	–	"	"	1.9	1.5	316.8
Monorail	(1)	36.6	15.1	1.5	3.4	0.9	0.7	136.0	13.7	11.8	54.4	2.7	1.9	1.3	280.0
	(2)	37.7	18.0	1.5	3.4	"	0.7	162.0	16.2	14.3	"	"	1.9	1.3	315.0
	(3)	40.4	22.1	1.7	3.4	"	0.7	200.0	20.1	18.3	"	"	2.3	1.4	368.0
New Guideway	(1)	39.4	5.0	1.2	3.4	0.9	0.4	20.3	2.6	–	40.6	2.7	1.1	1.5	119.1
	(2)	39.4	7.7	1.3	3.4	"	0.4	25.9	3.9	–	"	"	1.1	1.5	128.7
	(3)	39.4	9.8	1.4	7.4	"	0.4	31.0	5.2	–	"	"	1.2	1.5	141.5

Source: "First stage Mass. Transit System in Bangkok" Volume I, Dec., 1978

**APPENDIX
CHAPTER 8**

ECONOMIC AND FINANCIAL EVALUATION

Chapter 8 ECONOMIC AND FINANCIAL EVALUATION

AP8-1   Time Values Calculated by Herbert Mohring's Method

The computation of time value involves many uncertain factors and is very difficult. The time values used in the Feasibility Study for the Outer Bangkok Ring Road are about 30% lower than those calculated in this study.

The difference in time values between the two atributes to whether the calculation of time values is based on the average income of a car (or non-car) owner or the median income of a car (or non-car) owner as is stated in the text page XVII-9 of the Outer Bangkok Ring Road Report. Although the data source is not clearly indicated, the Outer Bangkok Ring Road Study analyzed the income distribution and the percentage of car owning households at each income level.

Since data on income distribution was not obtained in this study, three methods of the calculation of time values were examined. Two of them were already explained in the section 8.1.1 and the other one called Herbert Mohring's method is introduced below in order to veryfy the time values determined in Table 8-10.

Generally, it is clear that, as far as the road user's inclinations are concerned, they will use better roads to avoid traffic congestion. It is considered that this kind of inclination can be fundamentally assessed on the basis of the time value of individual road users.

Time value can thus be estimated using the same theory as Herbert Mohring's which is that in deciding which route to select for a trip, road users have an inclination for minimizing the total operating costs of their trips, if enough alternatives are available in urban areas.

The following formula expresses the total trip costs for a vehicle

$$C = F\,(S,\ N,\ \overline{Z}) + \frac{P}{S\,(S*,\ N,\ \overline{Z})}$$

where: P = time value for road users (Baht/hour)
   F = trip operating costs except time costs (Baht/km)
   C = total trip operating costs (Baht/km)
   S = actual travel speed (km/hr)
   $S*$= driver's desired travel speed (km/hr)
   N = traffic volume
   $\overline{Z}$ = other factors

Since the above equation does not involve factors which cannot be directly measured such as the value of comfort or lower accident risks, the calculated time value will probably be under-estimate of the real situation.

For intra urban trips, the travel time, a constituent of trip operating costs, will be a very important factor in deciding which route to select for a trip. In the case of an urban road network, it is assumed that the trip cost would not vary much with the traffic volume, so far as

It does not cause a lower running speed. Because if the growth of
traffic volumes is followed by the development of the network, the average
density of traffic volume will not be very different on different routes.
Under such circumstances it is assumed that there will be little dif-
ference between the desired travel speed and the actual travel speed.

Therefore, it will result that $S* = S$ in the formula and that the
factors N and Z are not really relevant to the trip costs. In this case,
the above mentioned equation can be simplified as follows:

$$C = F(S) + P/S$$

If an individual road user intends to minimize total trip operating costs
a necessary condition is as follows:

$$\frac{\partial C}{\partial S} = \frac{\partial F}{\partial S} - \frac{P}{S^2} = 0$$

therefore,

Time value/vehicle $P = S^2 \cdot \frac{\partial F}{\partial S} = S^2 \cdot a \cdot \frac{\partial F'}{\partial S}$

where: F' = direct operating costs and $a = F/F'$

It should be noted that the time value derived from the above method is
concerned with a unit time value of a vehicle (Baht/hour/vehicle). The
time value does not directly depend on the passenger occupancy rates for
passenger vehicles. If a lower passenger occupancy rate requires a
larger total number of vehicle-trips to meet the total traffic demand the
total time value will increase.

In this analysis, the fuel consumption was considered only the element
of the direct operating costs. According to the investigation carried
out by the Express Highway Research Foundation of Japan, the fuel con-
sumption on urban roads in Hanshin (Osaka – Kobe) and Keihin (Tokyo –
Yokohama) metropolitan areas was found as follows:

Passenger car (1000 cc – 1600 cc):

$$G = 0.08563S^2 - 6.136S + 208.34$$

Bus:

$$G = 0.4863S^2 - 27.939S + 672.27$$

where,

G = Fuel consumption volume (cc/km)
S = Speed (km/hr.)

The coefficient of a was calculated based on the result of cost element
analysis for vehicle operation in GBA which was originally derived from
the Outer Bangkok Ring Road Report.

The weighted average values of time at the drivers' desired speed can be
obtained on the assumption that the desired speeds will form a normal

disttribution curve centering around the actual average speed, which was found to be about 45 km/hr. by the travel speed survey in the GBA's major roads.

Based on this assumption the calculation was made as shown in the below tables.

Table AP8-1   EXPECTED TIME VALUES FOR PASSENGER CAR BY SPEED

(Passenger Car)

Speed (Km/h)	(1) S^2	(2) Economic Cost of the fuel (B/cc)	(3) dG/dS	(4) α	(5) Normal Distribution	(6) Expected Time Value (Baht/hr./veh.) (1).(2).(3).(4).(5)
10	100	2.9/1000	0.17126S−6.136	3.70	.001350	−0.006
20	400	2.9/1000	0.17126S−6.136	3.33	.021400	−0.224
30	900	2.9/1000	0.17126S−6.136	3.20	.135905	−1.134
40	1600	2.9/1000	0.17126S−6.136	3.14	.341345	3.549
50	2500	2.9/1000	0.17126S−6.136	3.01	341345	18.072
60	3600	2.9/1000	0.17126S−6.136	2.82	.135905	16.559
70	4900	2.9/1000	0.17126S−6.136	2.64	.021400	4.697
80	6400	2.9/1000	0.17126S−6.136	2.51	.001350	0.476
				Total	1.000000	41.989

Table AP8-2   EXPECTED TIME VALUES FOR BUS BY SPEED

(Bus)

Speed (Km/h)	(1) S^2	(2) Economic Cost of the fuel (B/cc)	(3) dG/dS	(4) α	(5) Normal Distribution	(6) Expected Time Value (Baht/hr./veh.) (1).(2).(3).(4).(5)
10	100	2.32/1000	0.9726S−27.939	4.58	.001350	−0.026
20	400	2.32/1000	0.9726S−27.939	4.08	.021400	−0.688
30	900	2.32/1000	0.9726S−27.939	3.97	.135905	1.395
40	1600	2.32/1000	0.9726S−27.939	3.96	.341345	55.015
50	2500	2.32/1000	0.9726S−27.939	3.88	341345	158.935
60	3600	2.32/1000	0.9726S−27.939	3.66	.135905	126.361
70	4900	2.32/1000	0.9726S−27.939	3.40	.021400	33.203
80	6400	2.32/1000	0.9726S−27.939	3.14	.001350	3.139
				Total	1.000000	377.344

According to the Harbert Mohring's method, the time values per vehicle-hour were estimated at 42.0 Baht/passenger car-hour and 377.0 Baht/bus-hour. Based on the survey result of the occupancy rates, 1.75 persons per passenger car and 20.00 persons per bus, the time values for private car passengers and for public transport passengers were estimated at 24.0 Baht/passenger-hour and 18.9 Baht/passenger-hour respectively. To summarize the above, the time values in 1978 were tabulated below:

Table AP8-3 TIME VALUES IN 1978 BY HARBERT MOHRING'S METHOD

Private Car	Per passenger hour Per vehicle hour	24.0 Baht 42.0 Baht
Public Transport	Per passenger hour Per vehicle hour	18.9 Baht 377.0 Baht

The time values calculated by the Herbert Mohring's method resulted in similar values which were derived from the first method explained in the section 8.1.1(A). The comparison of time values calculated so far by the different methods was presented in Table AP8-4. A critical factor of the Herbert Mohring's method is the formulation of the cost elements for vehicle operation with speeds. The fuel consumption formula used here were based on the experience in the metropolitan area of Japan. Therefore, the time values calculated here by the Herbert Mohring's method would be only a reference purpose to those results obtained in the text, section 8.1.1.

Table AP8-4 COMPARISON OF TIME VALUES IN 1978 BY
DIFFERENT METHODS

Type of Transport	Time Value Basis	By First Method*	By Second Method**	By Herbert Mohring's Method
Private Car	Per Passenger Hour	27.6	16.6	24.0
	Per Vehicle Hour	48.3	29.1	42.0
Public Transport	Per Passenger Hour	12.0	8.3	18.9
	Per Vehicle Hour	240.0	166.0	377.0

Note * ** Please refer to the section 8.1.1.

Table AP8-5 ECONOMIC CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICES

Alternative 1
(Elevated)

Case 2

Tariff of MTS : 0.078 Baht/km
Tariff of SRT : 0.078 Baht/km

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					347.78							347.78
84					1,072.35		265.91					1,338.26
85		172.36				426.81	865.04		175.96			1,640.17
86	173.96	172.36				1,102.54			544.27			2,003.13
87	551.27	1,007.36								193.32	260.17	2,012.12
88								332.05		386.63	1,001.61	1,720.29
89			173.77					415.06		1,093.11		1,681.94
90			347.55					1,669.12				2,016.67
91			608.22	118.32								726.54
92			900.96	428.09								1,329.05
Total	725.23	1,352.08	2,030.50	546.41	1,420.13	1,529.35	1,130.95	2,416.23	730.23	1,673.06	1,261.78	14,815.95

Table AP8-6 ECONOMIC CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICES

Alternative 2
(At Grade)

Case 2

[Tariff of MTS : 0.078 Baht/Km]
[Tariff of SRT : 0.078 Baht/Km]

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					242.72							242.72
84					912.12		186.09					1,098.21
85		119.68				295.82	750.63		123.41			1,289.54
86	121.40	119.68				945.34			475.44			1,661.86
87	472.44	865.13								141.66	182.40	1,661.63
88								228.12		283.33	864.22	1,375.67
89			119.81					285.16		987.23		1,392.20
90			239.61					1,513.23				1,752.84
91			419.31	90.60								509.91
92			771.43	350.45								1,121.88
Total	593.84	1,104.49	1,550.16	441.05	1,154.84	1,241.16	936.72	1,026.51	598.85	1,412.22	1,046.62	12,106.46

Alternative 3
(Elevated & At Grade)

Case 2
[Tariff of MTS = 0.078 Baht/km]
[Tariff of SRT = 0.078 Baht/km]

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					347.78							347.78
84					1,072.35		265.91					1,338.26
85		119.68				295.82	865.04		175.96			1,456.50
86	173.96	119.68				954.34			554.27			1,793.25
87	551.27	865.13								141.66	260.17	1,818.23
88								228.12		283.33	1,001.61	1,513.06
89			173.77					285.16		987.23		1,446.16
90			347.55					1,513.23				860.78
91			608.22	90.60								698.82
92			900.96	350.45								1,251.41
Total	725.23	1,104.49	2,030.50	441.05	1,420.13	1,241.16	1,130.95	2,026.51	730.23	1,412.22	1,261.78	13,524.25

Table AP8-8 ECONOMIC CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICES

Alternative 1
(Elevated)

Case 14

[Tariff of MTS : 0.296 Baht/km]
[Tariff of SRT : 0.078 Baht/km]

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					347.78							347.78
84					946.53		265.91					1,212.44
85		172.36				426.81	681.16		175.96			1,456.29
86	173.96	172.36				976.72			447.81			1,770.85
87	444.81	823.48								193.32	260.17	1,721.78
88								332.05		386.63	798.37	1,517.05
89			173.77					415.06		822.12		1,410.95
90			347.55					1,243.29				1,590.84
91			608.22									608.22
92			600.94									600.94
Total	618.77	1,168.21	1,730.48	-	1,294.31	1,403.53	947.07	1,990.4	623.77	1,402.07	1,058.54	12,237.14

Note: Including the cost of rolling stock.

Table AP8-9 ECONOMIC CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICES

Alternative 2
(At Grade)

Case 14
[Tariff of MTS : 0.296 Baht/km]
[Tariff of SRT : 0.078 Baht/km]

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					242.72							242.72
84					786.30		186.09					972.39
85		119.68				295.82	566.75		123.41			1,105.66
86	121.40	119.68				819.52			368.98			1,429.58
87	365.98	681.25								141.66	182.40	1,371.29
88								228.12		283.33	660.98	1,172.43
89			119.81					285.16		716.29		1,121.26
90			239.61					1,087.40				1,327.01
91			419.31									419.31
92			471.41									471.41
Total	487.38	920.61	1,250.14		1,029.02	1,115.34	752.84	1,600.68	492.39	1,141.28	843.38	9,633.06

Table AP8-10 ECONOMIC CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICE

Alternative 3
(Elevated & At Grade)

Case 14
[Tariff of MTS : 0.296 Baht/km]
[Tariff of SRT : 0.078 Baht/km]

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					347.78							347.78
84					946.53		265.91					1,212.44
85		119.68				295.82	681.16		175.96			1,272.62
86	173.96	119.68				819.52			447.81			1,560.97
87	444.81	681.25								141.66	260.17	1,527.89
88								228.12		283.33	798.37	1,309.82
89			173.77					285.16		716.29		1,175.22
90			347.55					1,087.40				1,434.95
91			608.22									608.22
92			600.94									600.94
Total	618.77	920.61	1,730.48		1,294.31	1,115.34	947.07	1,600.68	623.77	1,141.28	1,058.54	11,050.85

Table AP8-11   FINANCIAL CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICES

Alternative 1
(Elevated)

Case 2
[Tariff of MTS : 0.078 Baht/km]
[Tariff of SRT : 0.078 Baht/km]

	A1	A2	B1	BC	C1	C2	D1	D2	E1	E2	F	Total
1983					346.64							346.64
84					2,166.18		265.00					1,431.18
85		171.79				425.38	949.08		175.31			1,721.56
86	173.38	171.79				1,204.95			604.51			2,154.63
87	601.62	1,101.39								192.72	259.29	2,155.02
88								330.87		385.46	1,095.64	1,188.97
89			173.21					413.58		1,214.82		1,801.61
90			346.40					1,873.89				2,220.29
91			606.20	117.90								724.1
92			984.93	443.97								1,428.9
Total	775.0	1,444.97	2,110.74	561.87	1,512.82	1,630.33	1,214.08	2,618.34	779.82	1,793.0	1,354.93	15,795.9

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Table AP8-12 FINANCIAL CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICES

Alternative 2
(At Grade)

Case 2

[Tariff of MTS : 0.078 Baht/km]
[Tariff of SRT : 0.078 Baht/km]

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					242.03							242.03
84					1,006.67		185.55					1,192.22
85		119.34				294.97	835.19		123.00			1,372.5
86	121.06	119.34				1,048.45			526.05			1,814.9
87	523.15	959.78								141.32	181.88	1,806.13
88								227.42		282.63	958.88	1,468.93
89			119.47					284.27		1,109.42		1,513.16
90			238.92					1,718.72				1,957.64
91			418.12	90.28								508.4
92			855.96	366.65								1,222.61
Total	644.21	1,198.46	1,632.47	456.93	1,248.7	1,343.42	1,020.74	2,230.41	649.05	1,533.37	1,140.76	13,098.52

Table AP8-13 FINANCIAL CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICES

Alternative 3
(Elevated & At Grade)

Case 2
[Tariff of MTS : 0.078 Baht/km]
[Tariff of SRT : 0.078 Baht/km]

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					346.64							346.64
84					1,166.18		265.00					1,431.18
85		119.34				294.97	949.08		175.31			1,538.7
86	173.38	119.34				1,048.45			604.51			1,945.68
87	601.62	959.78								141.32	259.29	1,962.01
88								227.42		282.63	1,095.64	1,605.69
89			173.21					284.27		1,109.42		1,566.9
90			346.40					1,718.72				2,065.12
91			606.20	90.28								696.48
92			984.93	366.65								1,351.58
Total	775.0	1,198.46	2,110.74	456.93	1,512.82	1,343.42	1,214.08	2,230.41	779.82	1,533.37	1,354.93	14,509.98

Table AP8-14   FINANCIAL CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICES

Alternative 1
(Elevated)

Case 14

[Tariff of MTS : 0.296 Baht/km]
[Tariff of SRT : 0.078 Baht/km]

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					346.64							346.64
84					1,018.18		265.00					1,283.18
85		171.79				425.38	732.77		175.31			1,505.25
86	173.38	171.79				1,056.94			479.28			1,881.39
87	476.39	885.08								192.72	259.29	1,813.48
88								330.87		385.46	856.56	1,572.89
89			173.21					413.58		896.04		1,482.83
90			346.40					1,372.95				1,719.35
91			606.20									606.20
92			632.00									632.00
Total	649.77	1,228.66	1,757.81		1,364.82	1,482.32	997.77	2,117.40	654.59	1,474.22	1,115.85	12,843.21

Table AP8-15   FINANCIAL CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICES

Alternative 2
(At Grade)

Case 14
Tariff of MTS : 0.296 Baht/km
Tariff of SRT : 0.078 Baht/km

	A1	A2	B1	B2	C1	C2	C3	D1	D2	E1	E2	F	Total
1983					242.03								242.03
84					858.67			185.55					1,044.22
85		119.34					294.97	618.88		123.00			1,156.79
86	121.06	119.34					900.44			400.82			1,541.66
87	397.92	743.47									141.32	181.88	1,646.59
88									227.42		282.63	719.80	1,229.85
89			119.47						284.27		790.44		1,194.38
90			238.92						1,217.78				1,456.70
91			418.12										418.12
92			503.03										503.03
Total	518.98	982.15	1,279.54		1,100.70		1,195.41	804.43	1,729.47	523.82	1,214.59	901.68	10,250.77

Table AP8-16 FINANCIAL CONSTRUCTION COSTS FOR EACH SECTION OF SUBURBAN MTS BY YEAR IN 1978 PRICES

Alternative 3
(Elevated & At Grade)

Case 14
[Tariff of MTS : 0.296 Baht/km]
[Tariff of SRT : 0.078 Baht/km]

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					346.64							346.64
84					1,018.18		265.00					1,283.18
85		119.34				294.97	732.77		175.31			1,322.39
86	173.38	119.34				900.44			479.28			1,672.44
87	476.39	743.47								141.32	259.29	1,620.47
88								227.42		282.63	856.56	1,366.61
89			173.21					284.27		790.64		1,248.12
90			346.40					1,217.78				1,564.18
91			606.20									606.20
92			632.00									632.00
Total	649.77	982.15	1,757.81		1,364.82	1,195.41	997.77	1,729.47	654.59	1,214.59	1,115.85	11,662.23

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Table AP8-17   ECONOMIC CONSTRUCTION COSTS FOR EACH SECTION OF SRT
BY YEAR IN 1978 PRICES

Alternatives 1, 2, 3

Case 2

$$\left[\begin{array}{l}\text{Tariff of HIS : 0.078 Baht/km}\\\text{Tariff of SRT : 0.078 Baht/km}\end{array}\right]$$

	Southern Line	North & North-Eastern Line	Eastern Line	Improvement of BKK Station	Total
1985	65.00				65.0
86	65.00				65.0
87	377.35	6.66	47.00	18.00	449.01
88		6.66	47.00	18.00	71.66
89		71.72	348.31	23.97	444.0
Total	507.35	85.04	442.31	59.97	1,094.67

Table AP8-18   ECONOMIC CONSTRUCTION COSTS FOR EACH SECTION OF SRT
BY YEAR IN 1978 PRICES

Alternatives 1, 2, 3   Case 14

$$\left[\begin{array}{l}\text{Tariff of HIS : 0.296 Baht/km}\\\text{Tariff of SRT : 0.078 Baht/km}\end{array}\right]$$

	Southern Line	North & North-Eastern Line	Eastern Line	Improvement of BKK Station	Total
1985	65.00				65.00
86	65.00				65.00
87	377.35	11.94	47.00	18.00	454.29
88		11.94	47.00	18.00	76.94
89		96.5	218.31	23.97	338.78
Total	507.35	120.38	312.31	59.97	1,000.01

Table AP8-19 FINANCIAL CONSTRUCTION COSTS FOR EACH SECTION
OF SRT BY YEAR IN 1978 PRICES

Alternative 1, 2, 3

Case 2

[Tariff of HTS : 0.078 Baht/km]
[Tariff of SRT : 0.078 Baht/km]

	Southern Line	North & North-Eastern Line	Eastern Line	Improvement of BKK Station	Total
1985	70.0				70.0
86	70.0				70.0
87	444.71	6.86	50.0	19.00	520.57
88		6.86	50.0	19.00	75.86
89		83.33	411.53	28.31	523.17
Total	584.71	97.05	511.53	66.31	1,259.6

Table AP8-20 FINANCIAL CONSTRUCTION COSTS FOR EACH SECTION OF
SRT BY YEAR IN 1978 PRICES

Alternative 1, 2, 3

Case 14

[Tariff of HTS: 0.296 Baht/Km]
[Tariff of SRT: 0.078 Baht/Km]

	Southern Line	North & North-Eastern Line	Eastern Line	Improvement of BKK Station	Total
1985	70.0				70.0
86	70.0				70.0
87	444.71	12.14	50.0	19.0	525.85
88		12.14	50.0	19.0	81.14
89		111.55	258.59	28.31	398.45
Total	584.71	135.83	358.59	66.31	1,145.44