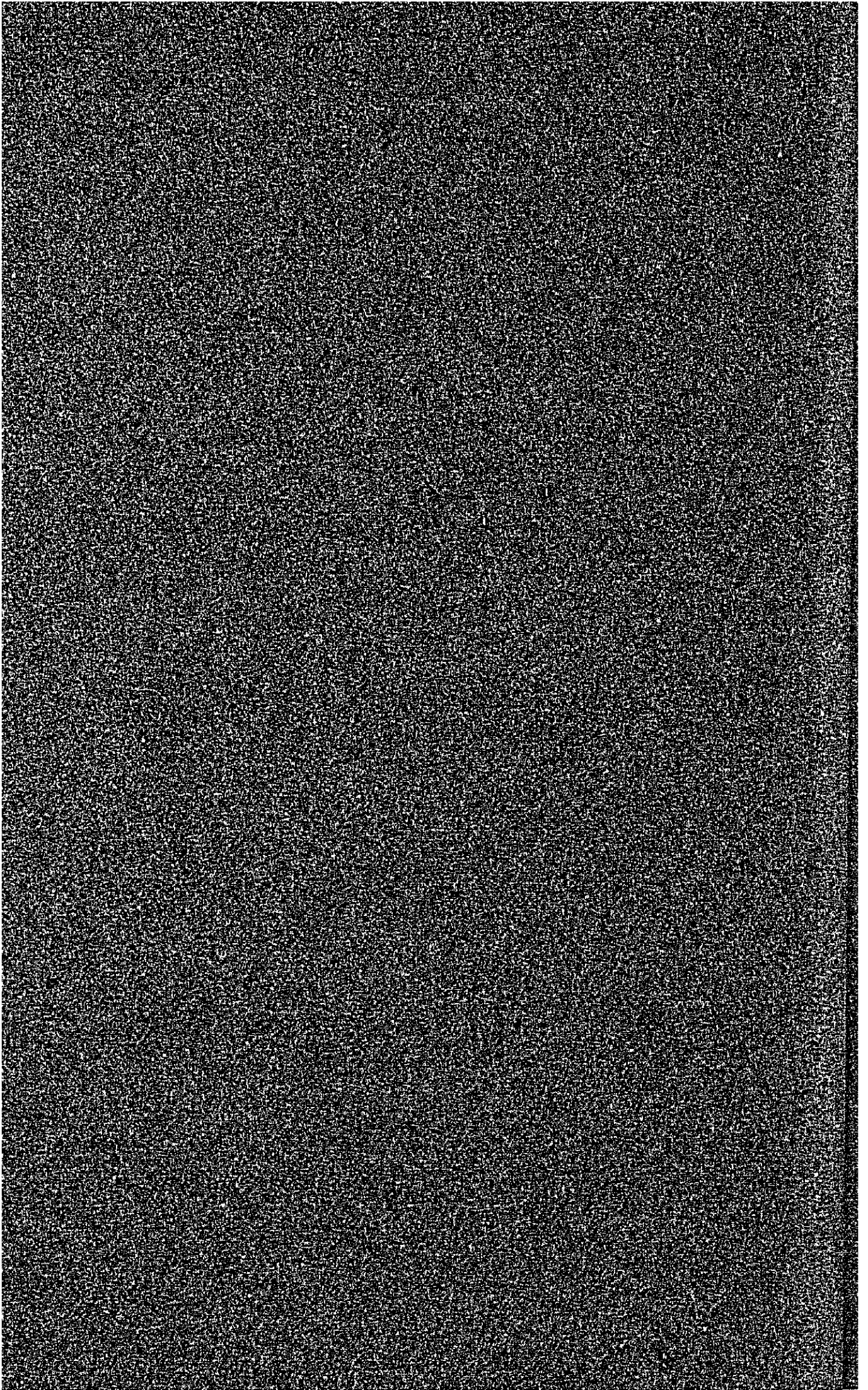


CHAPTER 2

EXISTING TRANSPORT SYSTEM AND TRAFFIC SURVEY

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Chapter 2 EXISTING TRANSPORT SYSTEM AND TRAFFIC SURVEY

2.1 Road Transport

2.1.1 General

Vehicular traffic in Bangkok mainly consists of private passenger cars, motorcycles, taxis, samlos (three-wheeled passenger vehicles), minibuses, light trucks for passenger transport, buses (conventional and air-conditioned), light and heavy trucks for cargo transport. The demand for road transport has increased in proportion to both the economic growth of Bangkok and Thailand. However, road improvement and construction, in spite of the every effort by the authorities, have not kept pace with the increase of motorization and vehicular traffic demand. Many road sections are continually saturated with vehicles and the environmental pollution has concurrently increased.

The road construction recently completed or under implementation in the GBA are the Riverside Road, which forms a part of the Middle Ring Road enclosing the center of City, and roads in the Din Daeng area to the Port Section of the Expressway System in Bangkok.

Subsequent road construction such as the Outer Bangkok Ring Road will soon be executed to ease the present traffic congestion in Bangkok. Besides the construction of roads, it is also imperative and urgent to establish more efficient traffic regulations, traffic control system and city plans.

Most of the person-trips depend on public transport, particularly the bus system. Bus services in the Metropolitan area are controlled by a fully state-owned enterprise called the Bangkok Mass Transit Authority (BMTA). The BMTA was established in 1976 and operates 105 routes which total about 2,000 kilometers. The BMTA also operates 14 routes of air-conditioned bus services covering a total length of 507 kilometers.

Minibuses are also playing a role as a means of public transport in the GBA. About 2,500 authorized minibuses are operated by independent groups on BMTA routes. In addition, about 7,000 minibuses are illegally operated.

Bus services for inter-city movements are supplied by the Transport Company under the control of the Land Transport Department. There are 19 inter-city bus routes connected to Bangkok, extending about 1,700 kilometers in total.

The existing major road network in the Study Area is presented in Fig. 2-1.

2.1.2 Traffic Survey

(1) Traffic Count Surveys

Traffic count surveys using both manual counts by vehicle type and automatic counts for the total flow have been conducted every year by the Department of Highways and Department of Town and Country Planning.

Traffic data collected from the Department of Highways represents the cross sectional average daily traffic volumes on national highways from 1972 to 1977. Among 380 count stations established by the Department of Highways in the whole kingdom, 29 were selected in the light of study context. The locations of these count stations are shown in the Appendix, Fig. AP2-1. The average daily traffic volumes obtained from the traffic count surveys are also presented in the Appendix Table AP2-1. The growth of the daily traffic and the variation of the vehicle composition are presented in Tables 2-1 and 2-2.

Table 2-1 VARIATION OF VEHICLE COMPOSITION BY YEAR

AVERAGE DAILY TRAFFIC BY TYPE (%)							
YEAR	CAR & TAXI	LIGHT BUT	HEAVY BUS	LIGHT TRUCK	HEAVY TRUCK	TRUCK OVER 2 AXLES	TOTAL
1972	54.1	7.6	8.9	11.6	12.6	5.3	100.0
1973	54.7	6.6	8.1	11.5	13.0	6.1	100.0
1974	52.2	6.9	9.0	11.0	13.2	7.8	100.0
1975	52.4	8.7	8.4	9.6	14.1	6.8	100.0
1976	51.6	9.2	8.6	10.1	13.9	6.6	100.0
1977	46.2	10.1	9.0	11.5	14.3	8.9	100.0

Source: "Traffic Volume and Flow Maps, National Highways under Maintenance, 1972-1977", Department of Highways.

(2) Travel Speed Survey

A travel speed survey was carried out by driving a test car continuously from 7:00 a.m. to 18:00 p.m. on the 20th and 21st of December, 1978 along the routes shown in Fig. 2-2. The first day survey covered the eastern half of the GBA to the Super-Highway and the second day survey covered the western half of the GBA.

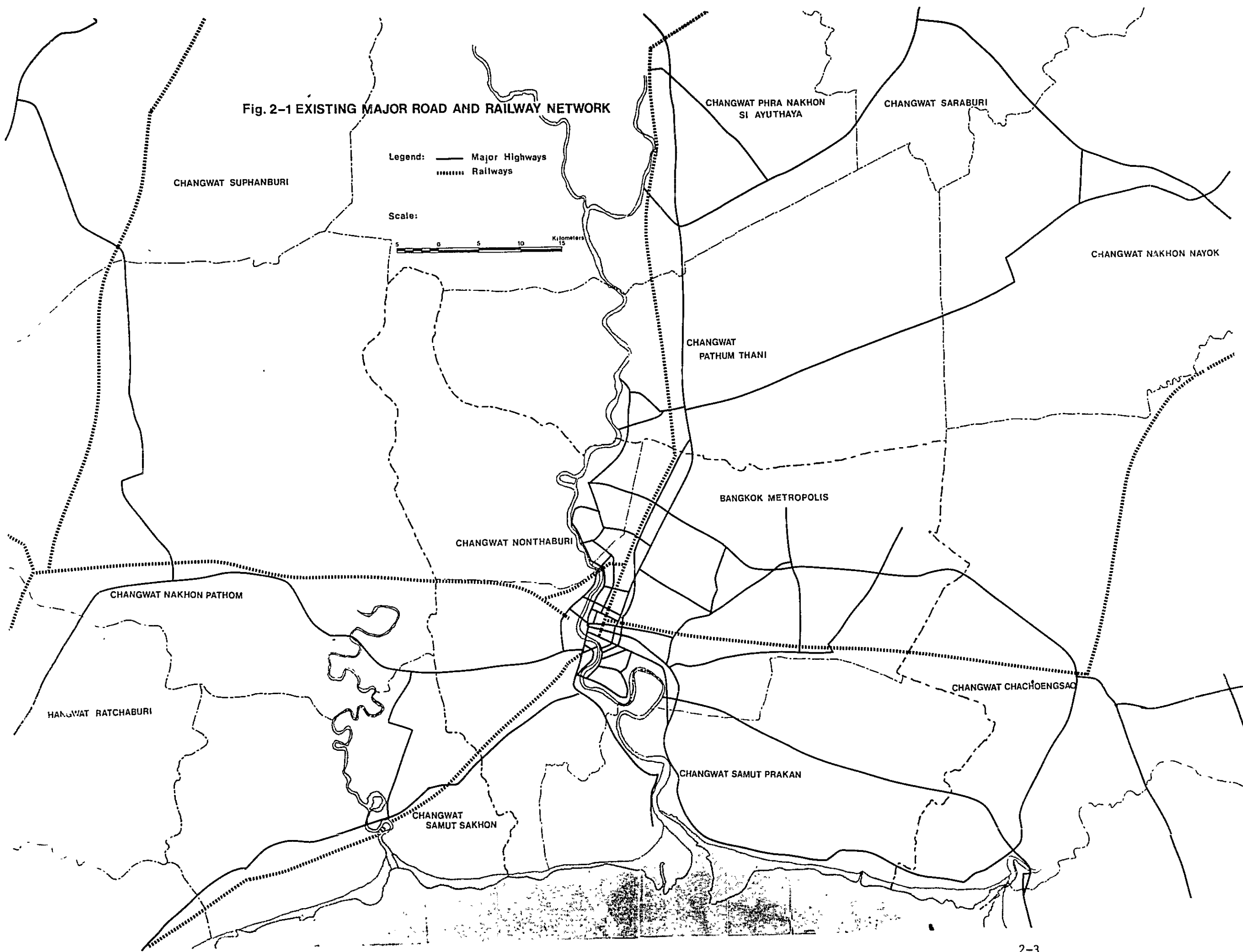
Travel speed (and delay) survey was undertaken to collect precise information about impediments to traffic stream flow within the road section. This survey was also needed to evaluate existing levels of service in transportation planning study and in economic study.

The test vehicle used in this survey was driven over the determined route continuously in an attempt to obtain representative travel times. The driver, therefore, had to travel at a speed along with the main traffic stream that, in his opinion, was representative of all traffic at a point and time.

During the survey period, the distance and travel time in a specific road section were measured by the car trip meter and a stop watch. Every time the vehicle was stopped by some traffic interference, the stopped-time delay and its cause were recorded.

The survey results are summarized in Tables 2-3 and 2-4. According to the survey, the travel speed in the central city area was

Fig. 2-1 EXISTING MAJOR ROAD AND RAILWAY NETWORK



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Table 2-2 SUMMARY OF TRAFFIC FLOWS BY VEHICLE TYPE ^{1/}

YEAR	AVERAGE DAILY TRAFFIC BY TYPE							INCREASE INDEX 1972 = 100	% BUS & TRUCK
	CAR & TAXI	LIGHT BUS	HEAVY BUS	LIGHT TRUCK	HEAVY TRUCK	TRUCK OVER 2 AXLES	TOTAL		
1972	36,377	5,113	5,959	7,796	8,492	3,534	67,271	100	27
1973	40,181	4,860	5,915	8,430	9,561	4,475	73,422	109	27
1974	37,489	4,945	6,487	7,876	9,469	5,600	71,866	107	30
1975	40,653	6,775	6,488	7,479	10,920	5,288	77,603	115	29
1976	45,992	8,159	7,612	8,978	12,344	5,846	88,931	132	29
1977	44,233	9,720	8,662	10,988	13,726	8,545	95,874	143	32
1977/1972	1.22	1.90	1.45	1.41	1.62	2.42	1.43	-	1.19

2-4

^{1/} Results from 9 count stations where the data was available consecutively from 1972 to 1977. Refer to Appendix Fig. AP 2-1 for details of count station location.

Source: "Traffic Volumes and Flow Maps, National Highways under Maintenance 1972-1977", Department of Highways.

28.3 km/h and in the suburban area 55.9 km/h. Moreover, natural congestion, usually created in the central city area, accounted for 45% of the total stopped-time. This figure is quite high as compared with 24% for Jakarta according to a similar survey carried out in 1977.

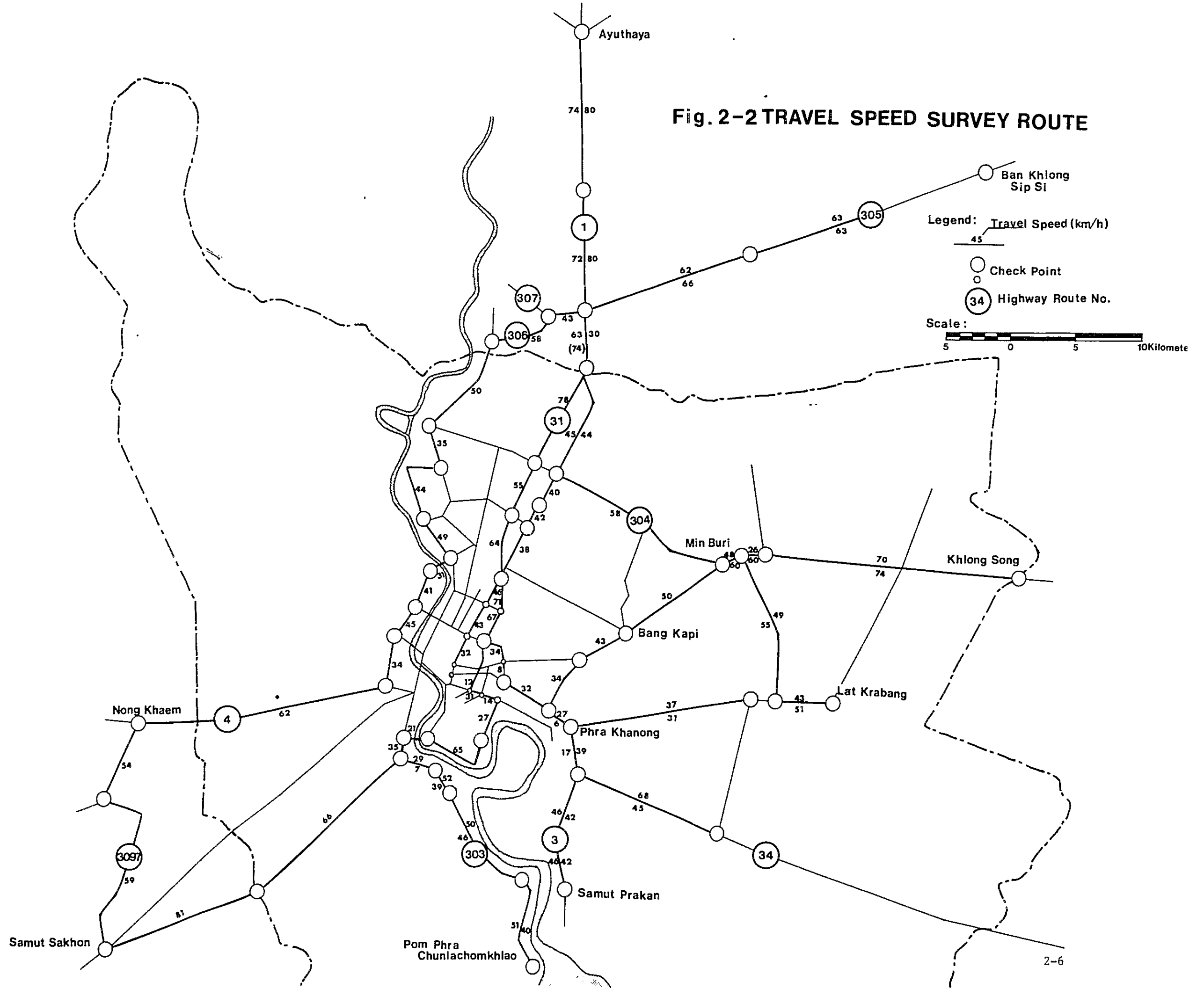
Table 2-3 TRAVEL SPEED SURVEY RESULTS

Total Trip distance:	1st day	386.5 km		
	2nd day	221.6 km		
	Total	608.1 km		
Total Trip time:	1st day	hr.	min.	sec.
	2nd day	7	41	06
	Total	12	37	46
Overall travel speed:	1st day	50.3 KPH		
	2nd day	44.8 KPH		
	Average	48.1 KPH		
	Central city area	28.3 KPH		
	Suburban area	55.9 KPH		

Table 2-4 STOPPED-TIME CAUSE

		Period (sec)	Percent	Frequency
1st day :				
1.	Traffic signal	940	54.4	18
2.	Natural traffic congestion	480	27.8	15
3.	Traffic accident	-	-	-
4.	Pedestrians	25	1.4	4
5.	Bus stopping	26	1.5	3
6.	Road improvement	31	1.8	2
7.	Railway crossing	-	-	-
8.	Right-turning vehicle	115	6.7	11
9.	Other obstacles	110	6.4	3
	Sub-total A	1,727	100.0	56
2nd day :				
1.	Traffic signal	1,171	41.6	15
2.	Natural traffic congestion	1,572	55.8	21
3.	Traffic accident	-	-	-
4.	Pedestrians	1	0.0	1
5.	Bus stopping	13	0.5	2
6.	Road improvement	11	0.4	1
7.	Railway crossing	7	0.2	1
8.	Right-turning vehicle	3	0.1	1
9.	Other obstacles	40	1.4	4
	Sub-total B	2,818	100.0	46
Total				
1.	Traffic signal	2,111	46.4	33
2.	Natural traffic congestion	2,052	45.1	36
3.	Traffic accident	-	-	-
4.	Pedestrians	26	0.6	5
5.	Bus stopping	39	0.9	5
6.	Road improvement	42	0.9	3
7.	Railway crossing	7	0.2	1
8.	Right-turning vehicle	118	2.6	12
9.	Other obstacles	150	3.3	7
	Grand total (A+B)	4,545	100.0	102

Fig. 2-2 TRAVEL SPEED SURVEY ROUTE



... ..

2.1.3 Vehicle Ownership

(1) Passenger Cars

The number of registered passenger cars (including private passenger cars and taxis) has increased at an average of 5.0% and 7.2% annually during 1970-1976 in the GBA and Central Region respectively. Passenger car ownership as expected is concentrated in the Metropolitan Bangkok and accounts for about 84% of the total in the Central Region. The motorization rate, in terms of passenger cars per 1,000 population, is outstandingly higher in Bangkok than other Changwats of the Central Region as shown in Table 2-5.

Data on registered passenger cars for all Changwats are available from 1970 to 1976 and up to 1977 for Bangkok. In order to derive 1977 passenger car ownership in the Changwats of the Central Region, the annual average growth rates of motorization in each Changwat was used and the estimated results are given in Table 2-5 and Table 2-6.

Table 2-5 PASSENGER CAR OWNERSHIP AND MOTORIZATION BY REGION

Region		1972	1973	1974	1975	1976	1977 **
GBA	Passenger Cars	186,297	178,365	246,131	214,346	224,301	(250,464)
	Motorization *	41.6	38.1	50.5	41.8	42.0	(45.0)
Nonthaburi & Samut Prakan	Passenger Cars	5,191	5,640	6,111	7,782	8,702	(9,826)
	Motorization *	7.6	7.9	8.1	10.0	10.9	(12.0)
Metropolitan Bangkok	Passenger Cars	181,106	172,725	240,020	206,564	215,599	240,638
	Motorization *	47.7	43.5	58.2	47.4	47.4	50.7
Total Central Region	Passenger Cars	209,070	204,873	275,022	245,427	257,754	(287,144)
	Motorization *	16.6	15.9	20.7	17.9	18.3	(19.8)

Note : * Passenger cars per 1,000 population

** Figures in parentheses show the estimation by the Team

Source : Vehicle Registration Division, Police Department

(2) Zonal Allocation of Passenger Cars

a) Greater Bangkok Area

The number of passenger cars owned in each zone is one of the fundamental planning parameters for traffic analysis. Such detailed information, however, is only available for 1972 from the Bangkok Transportation Study (BTS). Therefore, BTS zones are first transformed to Bangkok Suburban Transportation Project (BSTP) zones and then the zonal car-ownership and motorization from the BTS zone data are derived for 1972. Supposing these zonal motorizations in 1972 remain unchanged even in 1977, passenger cars in each zone are tentatively calculated by multiplying 1977 zonal populations by the above motorization rates. Eventually, such tentative parameters are used as zone weights for the distribution of total passenger cars by Changwat, which has been already estimated in Table 2-6. The results are tabulated in Table 2-7A.

Table 2-6 PASSENGER CARS REGISTERED IN CENTRAL REGION BY CHANGWAT

Changwat	1970	1971	1972	1973	1974	1975	1976	1977	Average Annual Growth 1976/1970 (%)
Bangkok	163,376	177,765	181,106	172,725	240,020	206,564	215,599	240,638	5.7
Nonthaburi	2,032	2,167	2,487	2,778	3,190	4,485	4,788	(5,584)	15.4
Samut Prakan	1,906	1,976	2,704	2,862	2,921	3,297	3,914	(4,242)	12.7
Pathum Thani	350	413	422	529	680	859	1,078	(1,328)	20.6
Nakhon Pathom	1,488	1,722	1,971	2,265	2,584	2,683	3,425	(3,923)	14.9
Ratchaburi	1,746	1,711	1,859	1,944	1,805	2,013	1,926	(1,959)	1.6
Phetchaburi	731	736	777	834	904	947	1,025	(1,058)	5.8
Sing Buri	220	230	320	361	447	711	506	(562)	14.9
Kanchanaburi	991	1,039	1,123	1,122	1,034	1,134	1,406	(1,450)	6.0
Chon Buri	5,053	5,282	5,456	5,776	7,363	7,693	8,289	(8,616)	
Chanthaburi	973	1,042	1,598	1,428	1,454	1,449	1,472	(1,514)	7.1
Chai Nat	304	322	337	371	398	432	474	(519)	7.7
Prachuap Khiri Khan	355	461	470	565	496	640	607	(621)	9.4
Chachoengsao	575	545	607	613	677	700	831	(922)	6.3
Samut Sakhon	195	228	278	360	422	717	1,192	(1,707)	35.2
Samut Songkhram	166	145	192	237	229	239	303	(350)	10.5
Lop Buri	1,489	1,202	1,409	1,657	2,006	2,141	2,230	(2,523)	7.0
Suphan Buri	674	643	700	729	757	802	880	(967)	4.5
Phra Nakhon Si Ayutthaya	540	556	596	1,585	1,008	1,056	1,215	(1,476)	14.5
Ang Thong	345	348	329	419	432	465	551	(627)	8.1
Nakhon Nayok	309	347	339	392	369	302	402	(431)	4.5
Trat	233	251	290	394	335	432	410	(423)	9.9
Saraburi	857	947	1,717	2,386	3,323	3,122	2,811	(3,223)	21.9
Prachin Buri	444	547	588	658	738	700	670	(702)	7.1
Rayong	1,453	1,173	1,395	1,883	1,430	1,844	1,750	(1,779)	3.1

Source: Vehicle Registration Division, Police Department

Note : Figures in parentheses show the estimation by the Team

Table 2-7A ESTIMATED PASSENGER CARS BY ZONE IN GBA, 1977

Zone No.	Name of Zone	Passenger Cars* 1972	Population (x 1,000) 1972	Motorization (Cars/1,000 pop.) 1972	Population (x 1,000) 1977	Estimated Passenger Cars** 1977	Motorization (Cars/1,000 pop.)** 1977
1	Phra Nakhon	32,323	435.7	74.186	407.1	31,994	78.6
2	Dusit	9,662	194.2	49.753	284.8	15,011	52.7
3	Bang Su	3,354	87.6	38.288	146.3	5,933	40.6
4	Phayathai	21,436	271.5	78.954	547.5	45,793	83.6
5	Pathumwan	22,658	285.3	79.418	350.2	29,463	84.1
6	Yannawa	9,501	187.6	50.645	257.9	13,836	53.6
7	Bang Pong Pang	5,132	66.5	77.173	110.7	9,050	81.8
8	Bang Kapi	701	17.6	39.830	24.6	1,038	42.2
9	Samsen	2,537	80.6	31.476	93.8	3,127	33.3
10	Lat Yao	5,944	124.2	47.858	142.8	7,240	50.7
11	Thung Song Hong	703	11.1	63.333	14.4	966	67.1
12	Thung Si Kan	660	16.7	39.521	26.3	1,101	41.9
13	Talat Bang Khen	661	13.9	47.554	42.5	2,141	50.4
14	Khlong Thanon	1,257	31.8	39.528	79.9	3,345	41.9
15	Thareng	860	22.2	38.739	36.5	1,498	41.0
16	Lat Phrao	344	8.6	40.000	33.8	1,432	42.4
17	Khlong Chan	1,107	28.9	38.304	69.8	2,833	40.6
18	Khlong Kum	801	25.8	31.047	32.9	1,082	32.9
19	Saphan Sung	210	6.4	32.813	9.0	313	34.8
20	Huamak	210	6.4	32.813	21.7	754	34.7
21	Phra Khanong	17,485	216.1	80.912	259.4	22,234	85.7
22	Suan Luang	657	25.3	25.968	50.1	1,378	27.5
23	Bang Na	3,361	71.6	46.941	119.6	5,947	49.7
24	Nong Bon	237	10.8	21.944	20.9	486	23.3
25	Prawet	157	15.7	10.000	24.8	263	10.6
26	Bang Chan	43	20.5	2.049	22.7	50	2.2
27	Minburi	158	19.8	7.980	25.7	217	8.4
28	Lat Krabang	145	16.2	8.951	20.7	196	9.5
29	Nong Chok	101	60.9	1.658	65.3	114	1.7
30	Bang O	2,571	116.7	22.031	126.5	2,952	23.3
31	Sirirat	6,287	252.0	24.948	342.2	9,044	26.4
32	Thonburi	9,413	332.1	28.344	390.6	11,728	30.0
33	Rat Burana	212	10.8	19.630	75.1	1,562	20.8
34	Thung Khru	495	25.1	19.721	23.3	487	20.9
35	Bang Khun Tian	1,008	73.2	13.770	123.5	1,802	14.6
36	Phasi Charoen	1,287	76.0	16.934	99.3	1,782	17.9
37	Taling Chan	124	41.5	2.988	47.1	149	3.2
38	Sala Than Masop	18	9.2	1.957	13.3	28	2.1
39	Nong Khaem	900	66.6	13.514	100.2	1,434	14.3
40	Bang Bon	726	55.3	13.128	60.0	835	13.9
	Sub-total Bangkok	165,446	3,438.0	48.123	4,742.8	240,638	50.7
41	Bang Ko Bua	52	17.5	2.971	15.2	62	4.1
42	Bang Yo	43	14.4	2.986	14.1	58	4.1
43	Bang Talat	208	16.0	13.000	40.9	728	17.8
44	Bang Chak	60	7.0	8.571	8.9	104	11.7
45	Bang Ya Phraek	84	12.7	6.614	16.5	150	9.1
46	Samrong Tai	96	14.5	6.621	29.8	270	9.1
47	Samut Prakan	93	9.1	10.220	48.4	679	14.0
48	Bang Muang	185	18.2	10.165	23.9	333	13.9
49	Samrong Nua	228	20.4	11.176	32.8	503	15.3
50	Bang Duan	60	9.1	6.593	11.1	100	9.0
51	Phraek Sa	258	27.9	9.247	6.6	84	12.7
52	Thai Ban	98	10.9	8.991	19.0	235	12.4
53	Bang Pumai	79	13.2	5.985	15.6	128	8.2
54	Bang Kaeo	136	11.3	12.053	8.5	140	16.5
55	Bang Phli Yai	19	9.8	1.939	13.9	37	2.7
56	Bang Pla	17	10.2	1.667	9.9	22	2.2
57	Bang Chalong	11	5.5	2.000	8.0	22	2.8
58	Racha Thewa	23	11.8	1.949	11.1	30	2.7
59	Srisa Charakhe	19	9.4	2.021	8.8	25	2.8
60	Bang Bo	113	59.5	1.899	72.6	189	2.6
61	Bang Pakok	155	18.1	8.564	22.8	268	11.8
62	Laem Fa Pha	36	18.2	1.978	27.7	75	2.7
	Sub-total Samut Prakan	2,073	344.7	6.014	466.1	4,242	9.1
63	Wat Chalo	94	19.3	4.870	22.6	215	9.5
64	Bang Khanum	16	9.6	1.667	18.6	61	3.3
65	Bang Kruai	13	8.0	1.625	7.3	24	3.3
66	Nonthaburi	520	41.0	12.683	74.2	1,842	24.8
67	Bang Kraso	520	41.0	12.683	44.8	1,112	24.8
68	Bang Krang	98	22.6	4.336	29.5	251	8.5
69	Pak Kret	518	35.6	14.551	37.7	1,075	28.5
70	Om Kret	104	16.8	6.190	22.2	268	12.1
71	Bang Bua Thong	350	92.0	3.804	98.8	736	7.5
	Sub-total Nonthaburi	2,233	285.9	7.810	355.7	5,584	15.7
	Total Greater Bangkok Area	165,752	4,068.6	41.722	5,564.6	250,464	45.0

Note: * Derived from Bangkok Transportation Study
 ** Estimated by the Team

b) Central Region Outside the GBA

The planning parameters available for the zones in the Central Region outside the GBA are areas and populations. Tambon population in 1977 was obtained with reference to the Special Report for the First Stage Mass Transit System in Bangkok. Accordingly, passenger cars in each Changwat can be distributed to the Tambons proportionally by populations. The estimated passenger cars by Tambon are consolidated for each zone as presented in Table 2-7B.

(3) Commercial Vehicles

Commercial vehicles in this study are defined as vehicles carrying goods including vans, pick-ups, light and heavy trucks but excluding passenger trucks, rollers, tractors and fire engines.

Similar to the passenger car ownership, Metropolitan Bangkok still holds the first position among Changwats in the ownership of commercial vehicles which accounted for about 68,500 vehicles in 1977 or 35% of the Central Region total. However, from the view point of the ownership rates of commercial vehicles per 1,000 population, it is found generally that the distribution of the ownership is biased to the industrial areas. The ownership rates in Changwat Nakhon Pathom, Kanchanaburi, Chonburi, Chanthaburi and Saraburi are 24.4, 17.2, 45.4, 19.0 and 13.8 respectively in 1976, while in Bangkok it is 13.5.

The commercial vehicles registered in the Changwats of the Central Region were obtained from the Vehicle Registration Division of Police Department as shown in the Appendix Table AP2-2 during 1970-1976. Regarding Bangkok, 1977 data is available. For other Changwats, however, commercial vehicle ownership has to be estimated for 1977.

As a growth factor of regional commercial vehicle ownership, the average annual growth rates from 1970 to 1976 were taken for the GBA and Central Region. These are 11.3% and 13.7% respectively so that for 1977 the resulting estimates are 73,254 vehicles in the GBA and 194,355 vehicles in the Central Region. Since the 1977 ownership in Bangkok is known, the total for Changwats Samut Prakan and Nonthaburi can be derived from the GBA estimate and then allotted to each Changwat proportionally according to the levels of 1976 commercial vehicle ownership.

To estimate the ownership in other Changwats of the Central Region linear regression equations were used for each Changwat calculated against the variable of time. Such estimates are subsequently adjusted to the total commercial vehicles of Central Region estimated previously.

The estimated number of commercial vehicles in 1977 are summarized for Regions in Table 2-9 and for Changwats in the Appendix, Table AP2-2.

Table 2-7B ESTIMATED PASSENGER CARS BY ZONE
IN CENTRAL REGION OUTSIDE GBA, 1977

Zone Number	Name of Zone	Population (x1000) 1977	Passenger Cars 1977	Motorization (Cars/1000 pop.) 1977
72	Pathum Thani	59.2	260	4.4
73	Sam Khok	65.4	288	4.4
74	Khlong Luang	177.2	780	4.4
75	Suphanburi	784.6	1,374	1.8
76	Ayuthaya	615.2	1,476	2.4
77	Saraburi	454.0	3,223	7.1
78	Nakhon Nayok	196.1	431	2.2
79	Chachoengsao	177.6	337	1.9
80	Chonburi	321.0	2,789	8.7
81	Samut Sakhon	251.1	1,707	6.8
82	Nakhon Pathom	530.1	3,923	7.4
83	Ratchaburi	499.4	1,598	3.2
84	Samut Songkhram	1,004.9	2,390	2.4
85	Kanchanaburi	467.6	1,450	3.1
86	Lopburi	1,297.0	3,824	2.9
87	Prachinburi	585.3	702	1.2
88	Rayong	1,415.4	10,128	7.2
Sub-Total	Central Region Outside GBA	8,901.1	36,680	4.1
Total	Central Region	14,465.7	287,144	19.8

Table 2-8 SUMMARY OF ESTIMATED PASSENGER CARS
IN THE CENTRAL REGION, 1977

Changwat	Population (x1000) 1977	Passenger Cars 1977 (%)	Motorization 1977 (Cars/1000 pop.)
Metro. Bangkok	4,742.8	240,638 (84)	50.7
Samut Prakan	466.1	4,242 (1)	9.1
Nonthaburi	355.7	5,584 (2)	15.7
GBA	5,564.6	250,464 (87)	45.0
Outside GBA	8,901.1	36,680 (13)	4.1
Central Region	14,465.7	287,144 (100)	19.8

Table 2-9 COMMERCIAL VEHICLE OWNERSHIP BY REGION

Year	1970	1971	1972	1973	1974	1975	1976	1977
Metropolitan Bangkok								
Comm. Vehicles ^{1/} Population (x1000)	33,020 3,493	43,675 3,644	43,260 3,794	46,189 3,968	48,216 4,127	43,199 4,359	61,474 4,546	68,579 4,743
Ownership rate (Comm. Veh./1000 pop.)	9.5	12.0	11.4	11.6	11.7	9.9	13.5	14.5
GBA Outside Metro Bangkok								
Comm. Vehicles ^{1/} Population (x1000)	1,689 627	1,722 653	1,995 680	2,821 711	3,359 751	3,952 775	4,366 795	(4,675) 822
Ownership rate (Comm. Veh./1000 pop.)	2.7	2.6	2.9	4.0	4.5	5.1	5.5	(5.7)
Sub-Total Greater Bangkok Area (GBA)								
Comm. Vehicles ^{1/} Population (x1000)	34,709 4,120	45,397 4,297	45,255 4,474	49,010 4,679	51,575 4,878	47,151 5,134	65,840 5,341	(73,254) 5,565
Ownership rate (Comm. Veh./1000 pop.)	8.4	10.6	10.1	10.5	10.6	9.2	12.3	(13.2)
Central Region outside GBA^{1/}								
Comm. Vehicles ^{1/} Population (x1000)	44,370 7,740	48,717 7,912	51,591 8,084	58,563 8,243	79,063 8,425	89,399 8,555	105,085 8,731	(121,101) 8,901
Ownership rate (Comm. Veh./1000 pop.)	5.7	6.2	6.4	7.1	9.4	10.4	12.0	(13.6)
Total Central Region								
Comm. Vehicles ^{1/} Population	79,079 11,860	94,114 12,209	96,846 12,558	107,573 12,922	130,638 13,303	136,550 13,689	170,925 14,072	(194,355) (14,466)
Ownership rate (Comm. Veh./1000 pop.)	6.7	7.7	7.7	8.3	9.8	10.0	12.1	(13.4)

Note: Figures in parentheses show the estimation by the Team

Source: ^{1/} Vehicle Registration Division, Police Department

(4) Zonal Allocation of Commercial Vehicles

a) Greater Bangkok Area

It is evident that commercial vehicle traffic is closely related to economic activities. The most simple pattern of commercial vehicle-trip is from goods-producing places, such as factories and mines, to goods-consuming places which are generally wholesale and retail centers.

Taking this into consideration, the number of jobs in both secondary and tertiary sectors by zone are used as the factor to allocate the estimated 1977 commercial vehicle numbers to each zone of the three Changwats of Metropolitan Bangkok, Samut Prakan and Nonthaburi. The result is summarized in Table 2-10A.

b) Central Region outside GBA

As to the zones in Central Region outside GBA it was assumed that the jobs per population are constant in every zone. Therefore, based on the Tambon population the commercial vehicles of each Changwat were distributed to the Tambons and then consolidated to the relevant zones as shown in Table 2-10B.

Table 2-10A ESTIMATED COMMERCIAL VEHICLES BY ZONE IN GBA, 1977

Zone Number	Name of Zone	Jobs in Secondary and Tertiary Sectors (x 1,000)	Estimated Comm. Vehicles 1977	Zone Number	Name of Zone	Jobs in Secondary and Tertiary Sectors (x 1,000)	Estimated Comm. Vehicles 1977
1	Phra Nakhon	105.7	6,150	38	Sala Than Masop	1.0	58
2	Dusit	88.0	5,120	39	Nong Khaem	11.8	686
3	Bang Su	26.5	1,542	40	Bang Khun Tian	6.9	401
4	Phayathai	138.6	8,064	Sub-total	Bangkok Metropolis	1,178.8	68,579
5	Pathumwan	111.0	6,459	41	Bang Ko Bua	2.8	49
6	Yannawa	64.4	3,747	42	Bang Yo	3.9	68
7	Bang Pong Pang	30.9	1,798	43	Bang Talat	21.5	375
8	Bang Kapi	8.6	500	44	Bang Chak	10.1	176
9	Samsen	22.5	1,309	45	Bang Ya Phraek	8.5	148
10	Lat Yao	51.9	3,019	46	Samrong Tai	27.7	485
11	Thung Song Hong	3.8	221	47	Samut Prakan	17.0	297
12	Thung Si Gan	3.2	186	48	Bang Muang	2.7	47
13	Talat Bang Khen	12.9	750	49	Samrong Nua	8.8	154
14	Khlong Thanon	13.7	797	50	Bang Duan	1	19
15	Thareng	9.4	547	51	Phraek Sa	0.6	10
16	Lat Phrao	3.3	192	52	Thai Ban	8.8	154
17	Khlong Chan	13.6	791	53	Ban Puma	9.6	168
18	Khlong Kum	8.7	506	54	Bang Kaeo	0.7	12
19	Saphan Sung	0.6	35	55	Bang Phi Yai	1.6	28
20	Huamak	7.6	442	56	Bang Pla	0.7	12
21	Phra Khanong	97.7	5,684	57	Bang Chalong	2.1	37
22	Suan Luang	8.6	500	58	Racha Thewa	0.9	16
23	Bang Na	34.4	2,001	59	Srisa Charakhe	1.4	24
24	Nong Bon	2.9	169	60	Bang Bo	6.9	120
25	Pravet	8.0	465	61	Bang Pakok	8.6	150
26	Bang Chan	1.8	105	62	Laem Fa Pha	4.7	82
27	Minburi	5.3	308	Sub-total	Samut Prakan	150.7	2,631
28	Lat Krabang	4.5	262	63	Wat Chalo	3.6	132
29	Nong Chok	4.8	279	64	Bang Khanum	1.4	51
30	Bang O	28.6	1,664	65	Bang Kruai	0.6	22
31	Sirirat	79.1	4,602	66	Nonthaburi	15.2	556
32	Thonburi	87.6	5,096	67	Bang Kraso	9.0	330
33	Rat Burana	24.2	1,408	68	Bang Krang	3.4	125
34	Thung Khru	2.7	157	69	Pak Kret	11.7	428
35	Bang Khun Tian	25.0	1,454	70	Om Kret	2.8	103
36	Phasi Charoen	14.3	832	71	Bang Bua Thong	8.1	297
37	Taling Chan	4.7	273	Sub-total	Nonthaburi	55.8	2,044
				Total	Greater Bangkok Area	1,385.3	73,254

Table 2-10B ESTIMATED COMMERCIAL VEHICLES BY ZONE
IN CENTRAL REGION OUTSIDE GBA, 1977

Zone Number	Name of Zone	Jobs in Secondary & Tertiary Sectors (x 1,000)	Estimated Comm. Vehicles
72	Pathum Thani	59.2	159
73	Sam Khok	65.4	176
74	Khlong Luang	177.2	476
75	Suphanburi	784.6	5,938
76	Ayuthaya	615.2	2,445
77	Saraburi	454.0	6,479
78	Nakhon Nayok	196.1	853
79	Chachoengsao	177.6	894
80	Chonburi	321.0	11,093
81	Samut Sakhon	251.1	1,284
82	Nakhon Pathom	530.1	14,244
83	Ratchaburi	499.4	4,631
84	Samut Songkhram	1,004.9	10,128
85	Kanchanaburi	467.6	10,109
86	Lopburi	1,297.0	9,249
87	Prachinburi	585.3	1,837
88	Rayong	1,415.4	41,106
Sub- Total	Central Reg. outside GBA	8,901.1	121,101
Total	Central Region	10,286.4	194,355

Table 2-11 SUMMARY OF ESTIMATED COMMERCIAL VEHICLES
IN THE CENTRAL REGION, 1977

Area	Jobs in Secondary & Tertiary Sectors (x1,000)	Est. Commercial Vehicles, 1977 (%)
Bangkok	1,178.8	68,579 (35)
Samut Prakan	150.7	2,631 (2)
Nonhaburi	55.8	2,044 (1)
Total GBA	1,385.3	73,254 (38)
Outside GBA	8,901.1	121,101 (62)
Total Central Region	10,286.4	194,355(100)

2.2 Railway Transport

Analysis of railway transport is one of the major time-consuming parts in the study period. Therefore, this is elaborated separately in Chapter 3.

2.3 Other Transport Systems

2.3.1 Water Transport

Water transport is still an important mode of internal transportation in the GBA. Particularly in the northwest and northeast of the GBA, boat travel plays an essential role in the movement of goods and people.

According to the Bangkok Transportation Study, person-trips made by boat accounted for 3.8% of all person-trips in the GBA in 1972.

Boat travel will not be easily substituted by a mode of land transport. However, it is not conceivable that the water transport will contribute greatly to the improvement of the seriously congested road traffic in Bangkok. Since data on water transport was neither obtainable nor of much importance for the study, detailed analysis on water transport was not made except for reference to the previous studies.

2.3.2 Sea Port

The prime international and commercial sea port in Thailand is the Bangkok Port located in Khlong Toei, downstream in the Chao Phraya River. Overseas cargo which was loaded and unloaded at the Port in 1976, amounted to about 12 million tons and 13 million tons respectively.

Vessels entering and clearing at the Port in 1976 were 3,284 and 3,271 respectively. Sixteen berths are owned by the Government and which include six container berths newly constructed in 1978.

Containerization has developed recently in Thailand. Containers handled in 1970 were only 668 units. This increased dramatically to 24,168 units in 1977. Delay of the modernization of cargo handling and the lack of berths, warehouses and trucks have caused the piling-up of freight and the heavy congestion of vessels.

For the development of polar regions and rationalization of cargo movements, the Government has been studying the feasibility of new deep sea ports at Songkhla, Phuket, Satahip and Laem Chabang to function as a supplementary port to the Bangkok Port.

2.3.3 Airport

Civil aviation in Thailand is operated by Thai Airways Co., Ltd., and Thai Airways International Ltd. Bangkok Airport is located at Don Muang, in the proximity of Changwat Pathum Thani. There are two more international airports in Chiang Mai and Hat Yai. For domestic air transport services, 28 local airports are scattered over Thailand.

Bangkok Airport holds an important position in the international airways network in Southeast Asia. Accordingly, direct transit passengers, as shown in Table 2-12, account for a considerable proportion of the total air passengers.

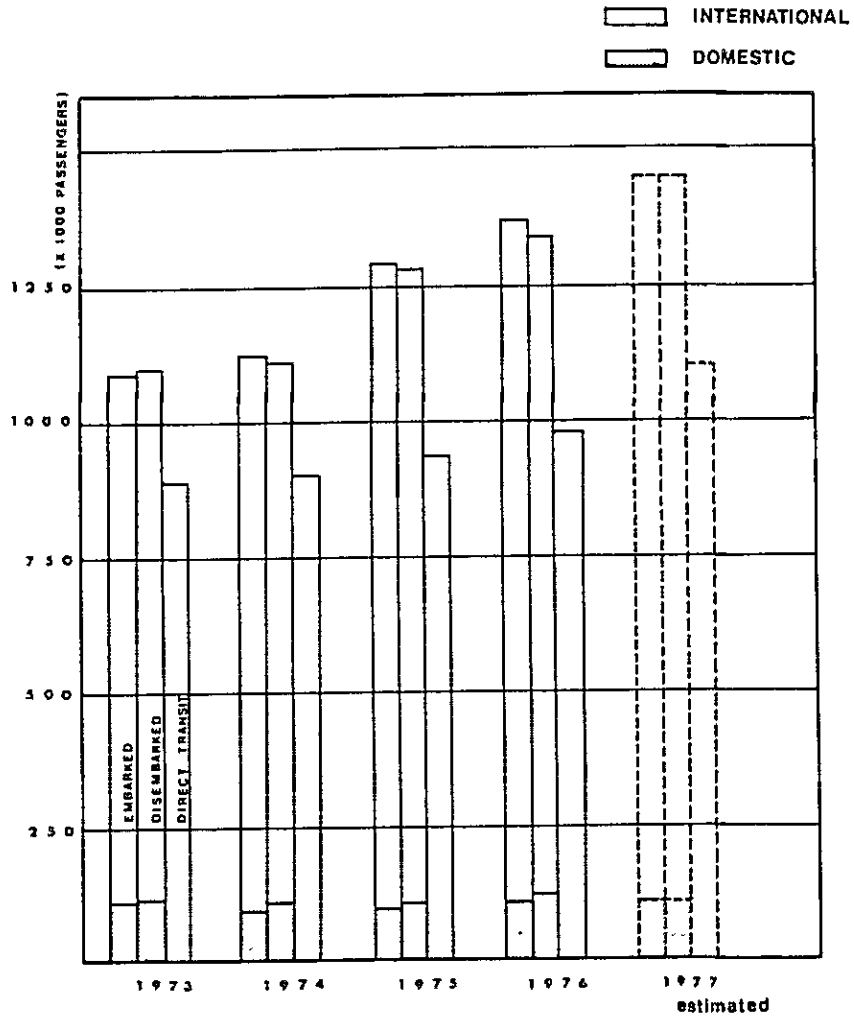
The amount of international air passengers who both embarked and disembarked at the airport in 1976 was about 2.5 million, of which foreign tourists are estimated to be 2 million. Domestic air passengers using Bangkok Airport amounted to about 230 thousand or 10 percent of the international air passengers. The growth of air passengers to and from Bangkok Airport is summarized in Table 2-12 and graphed in Fig. 2-3.

Table 2-12 PASSENGER TRAFFIC AT BANGKOK AIRPORT

	(flights x 1) (passengers x 1,000)			
	1973	1974	1975	1976
(a) International scheduled [(1)+(2)]	3,512	3,658	4,056	4,237
(1) Embarked & Disembarked	1,840	1,984	2,250	2,385
(2) Direct transit x 2	1,672	1,674	1,806	1,852
(3) Aircraft movement (Flights)	40,696	40,036	38,484	37,861
(4) Average load (a)/(3) (Passengers x 1)	86	91	105	112
(b) International non-scheduled [(1)+(2)]	246	258	185	211
(1) Embarked & Disembarked	126	132	121	101
(2) Direct transit x 2	120	126	64	110
(3) Aircraft movement (Flights)	3,105	3,592	4,427	3,386
(4) Average load (b)/(3) (Passengers x 1)	79	72	42	62
A. Total international [(a)+(b)]	3,758	3,916	4,241	4,448
(1) Embarked & Disembarked	1,966	2,116	2,371	2,486
(2) Direct transit x 2	1,792	1,800	1,870	1,962
(3) Aircraft movement (Flights)	43,801	43,628	42,911	48,016
(4) Average load A/(3) (Passengers x 1)	86	90	99	93
B. Total domestic	215	202	210	233
(1) Embarked & Disembarked	215	202	210	233
(2) Aircraft movement (Flights)	6,395	6,089	6,152	6,769
(3) Average load B/(2) (Passengers x 1)	34	33	34	34
C. Total commercial (A + B)	3,973	4,118	4,451	4,681
(1) Embarked & Disembarked	2,181	2,318	2,581	2,719
(2) Direct transit x 2	1,792	1,800	1,870	1,962
(3) Aircraft movement (Flights)	50,196	49,717	49,063	48,016
(4) Average passenger load per aircraft (x 1)	79	83	91	97
D. All other aircraft movement	10,047	10,647	7,328	7,800
E. Total aircraft movement	60,243	60,364	56,491	55,816

Source: AIRPORT TRAFFIC 1973 ~ 1976, International Civil Aviation Organization.

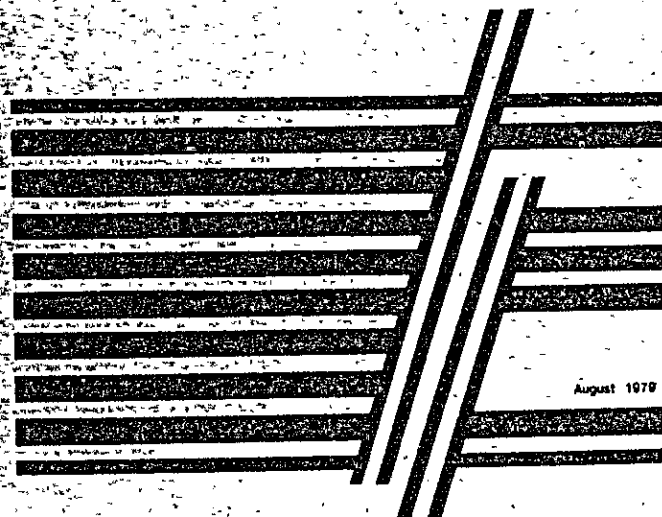
Fig. 2-3 INTERNATIONAL AND DOMESTIC AIR PASSENGERS

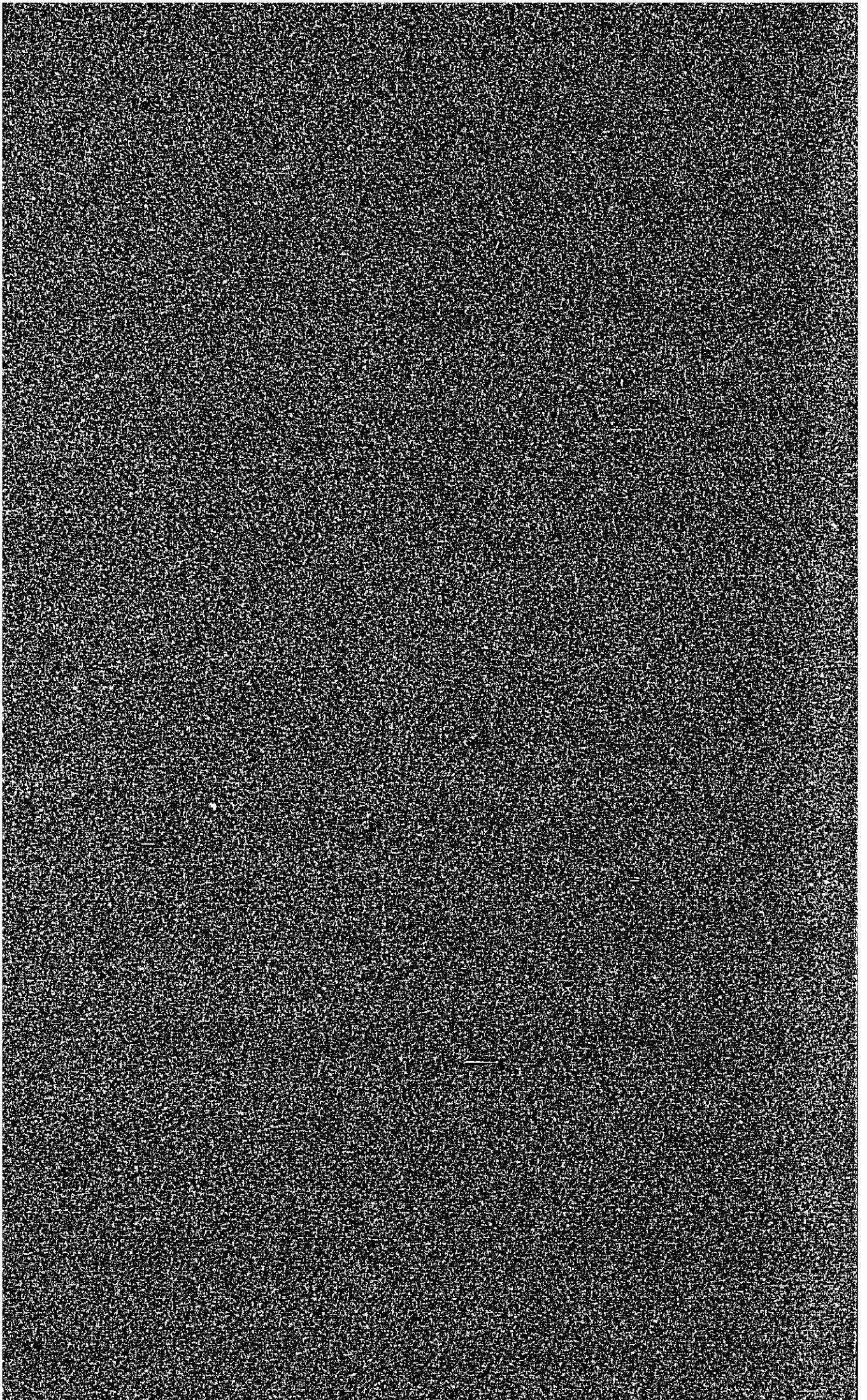


CHAPTER 3

COMMUTER SERVICE BY RAILROAD TRANSPORT

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Chapter 3 RAILROAD COMMUTER SERVICES

3.1 General

The operating length of the State Railway of Thailand (SRT) is 3,765 km with 592 stations; the average distance of adjoining stations is 6.40 km.

The railway network is composed of such main lines as the Southern Line to Malaysia and Singapore, the Northern Line to Chiang Mai located near the Burma border, the Northeastern Line to Nong Khai at the border of Laos and Ubon Ratchathani located at the border of Cambodia and the Eastern Line to Aranyaprathet located at the border with Cambodia. All lines radiate from Bangkok.

The railway system is as shown in Fig. 3-1.

3.1.1 Organization of State Railways

The Railway organization in Thailand was founded as one of departments of the Thai Government in 1890. The first line between Bangkok and Nakhon Ratchasima, which is a part of the existing Northeastern Line, was inaugurated in 1892. By the State Railway of Thailand Act issued in 1951, it became an autonomous organization called the State Railway of Thailand.

The number of permanent staff of SRT is 29,918 as of September, 1977 and the organization chart and staff number of each department are as shown in Table 3-1.

3.1.2 Financial Status

The finance of SRT was in the red from year 1974 to 1976. The balance has improved since 1975 when revision of passenger and freight fares took place and since 1977 the account has become profitable. Fig. 3-2 shows the operating revenues and operating expenses in 1977.

Recently, many short distance railroad passengers began to use the roads, mostly buses. Because of the improved bus services, the railroad passengers have decreased. However, in the case of commuters, the railroad passengers are increasing because of low fare commuter tickets. Now, SRT is endeavoring to improve services and increase the number of long distance passengers who contribute to the high profitability.

3.1.3 Passenger Traffic

The number of passengers in 1977 increased by 20 per cent compared with that in 1968. During the earlier part of 1972 to 1974, the number of passengers increased by 7 to 10 per cent annually, but since then it has become stagnant. One of the major reasons why passenger numbers does not show a remarkable increase is that short distance passengers have been diverted from railway.

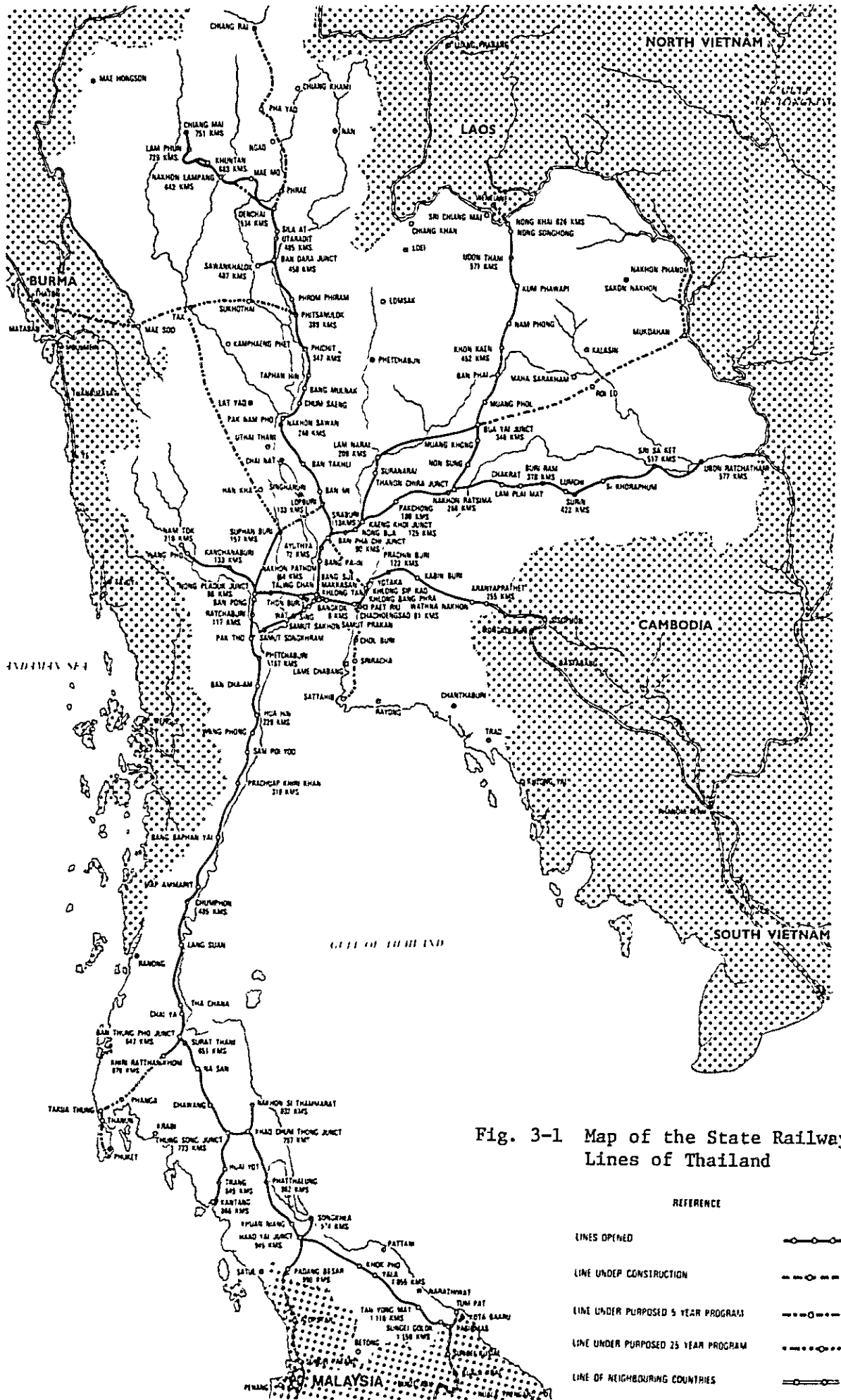
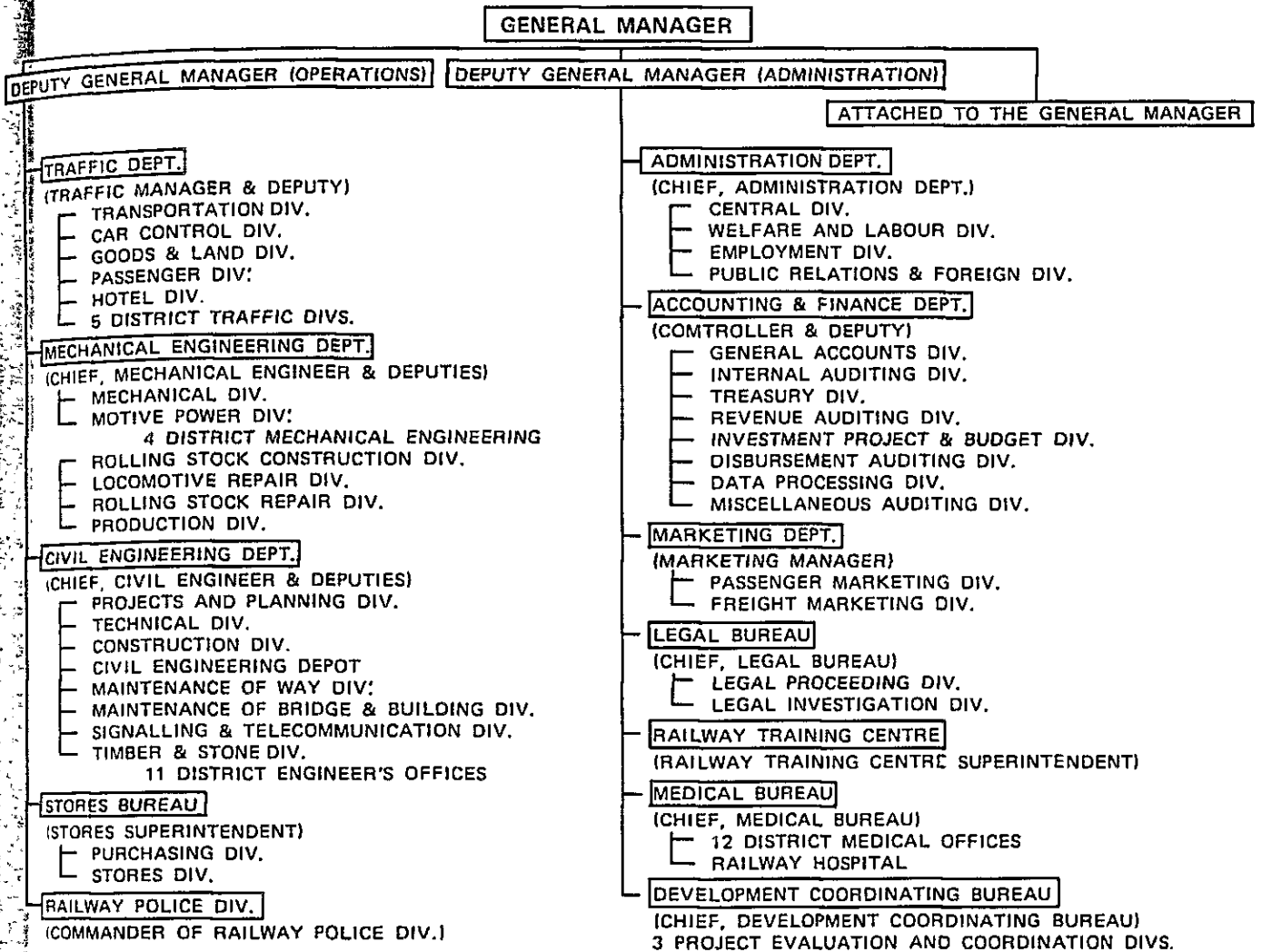


Table 3-1 ORGANIZATION CHART OF STATE RAILWAY OF THAILAND



EMPLOYEES CLASSIFIED BY ORGANIZATION

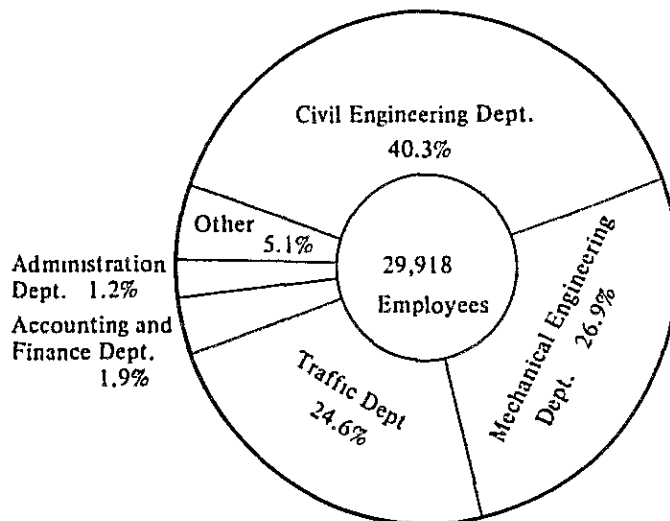
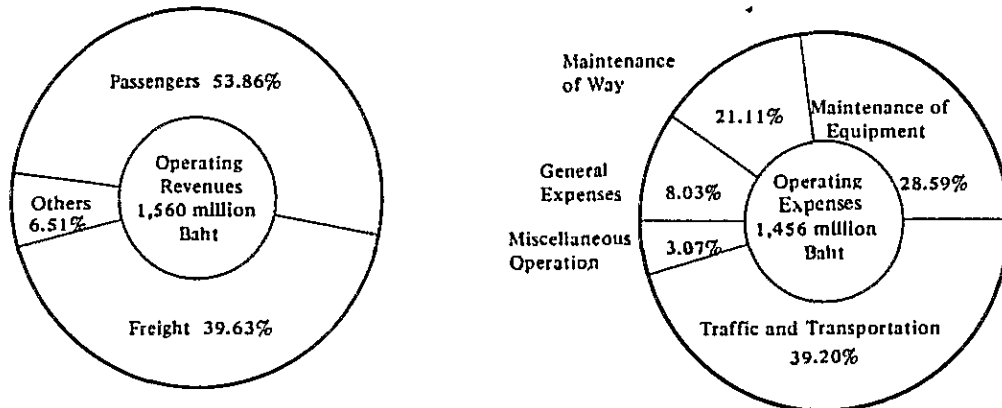


Fig. 3-2 OPERATING REVENUES AND OPERATING EXPENSES (in 1977)



This trend can be seen by the fact that the average traveling length of passengers has increased year by year as shown in Table 3-2.

Table 3-2 NUMBER OF PASSENGERS

Fiscal Year	Number of Passengers ('000)	Passenger -Kms ('000-Km)	Average Distance per Passenger ('000-Km)
1968	48,729 (1.00)	3,884 (1.00)	79.7 (1.00)
1973	55,508 (1.14)	4,694 (1.21)	84.6 (1.06)
1974	61,409 (1.26)	5,376 (1.38)	87.5 (1.10)
1975	61,567 (1.26)	5,640 (1.45)	91.6 (1.15)
1976	55,759 (1.14)	5,352 (1.38)	96.0 (1.20)
1977	57,974 (1.19)	5,649 (1.45)	97.4 (1.22)

() shows the ratio of increase or decrease.

A comparison between 1968 and 1971 of the kind of tickets issued shows that the issued number of oneway tickets was 99%, round trip tickets 161% and commuter's tickets 466%. (See Table 3-3).

The issue of oneway tickets did not show any increase. However, the return tickets and especially issuing of commuter's tickets increased remarkably; both tickets applied reduced fares.

Table 3-3 NUMBER OF SOLD TICKETS ('000)

Fiscal Year	One-way	Return	Commuter	Total
1968	41,412 (1.00)	5,578 (1.00)	1,739 (1.00)	48,729 (1.00)
1973	44,714 (1.08)	1,178 (1.29)	3,615 (2.08)	55,507 (1.14)
1974	48,344 (1.17)	8,471 (1.52)	4,594 (2.64)	61,409 (1.26)
1975	46,956 (1.13)	8,650 (1.55)	5,961 (3.43)	61,567 (1.26)
1976	40,218 (0.97)	8,470 (1.52)	7,071 (4.07)	55,759 (1.14)
1977	40,876 (0.99)	9,001 (1.61)	8,097 (4.66)	57,974 (1.19)

() shows the ratio of increase or decrease from 1968.

The number of passengers who travelled for less than 101km form 79% of the total (Refer to Table 3-4). The average traveling distance for all passengers is 97.40km and this distance is quite competitive with the long-haul bus network. Therefore, the reduced fare should be applied to the short distance passengers, and improvement of the speed of existing lines, modernization of traffic system, etc. for long distance passengers are under way.

Table 3-4 NUMBER OF PASSENGERS BY DISTANCE (1977)

Distance (kms)	Passengers ('000)	Passenger-kms (million)
1 - 100	45,658.2 (79%)	1,239.5 (22%)
101 - 200	4,667.1 (8)	642.6 (11)
201 - 300	1,846.9 (3)	453.1 (8)
301 - 400	1,701.7 (3)	602.0 (11)
401 - 500	1,027.3 (2)	461.1 (8)
501 - 600	1,054.8 (2)	582.2 (10)
601 -	2,017.6 (3)	1,668.5 (30)
Total	57,973.6 (100%)	5,649.0 (100%)

3.1.4 Freight Traffic

Though freight tonnage in 1977 increased by 18% from that in 1976, freight tonnage fluctuation was rather small since 1968, as shown in Table 3-5.

Recently, carload handling has increased but less-than-carload handling has decreased. This fact would probably explain that less-than-carload consignees have changed the transport mode of their small cargoes to the road system.

Table 3-5 GOODS TRANSPORTED ('000 ton/year)

Fiscal Year	Carload	Less-Than-Carload	Total
1968	4,952 (1.00)	510 (1.00)	5,462 (1.00)
1973	4,702 (0.95)	318 (0.62)	5,020 (0.92)
1974	4,835 (0.98)	282 (0.55)	5,117 (0.94)
1975	4,818 (0.97)	234 (0.46)	5,052 (0.92)
1976	5,156 (1.04)	195 (0.38)	5,351 (0.98)
1977	6,142 (1.24)	168 (0.32)	6,310 (1.16)

() shows the ratio of increase or decrease from 1968.

Approximately 60% of the origins and destinations of the carload is Central Region and 20% is the Northern Region. This is influenced by the high density of the railway network connecting the Central Region with Northern and Northeastern Lines. Approximately 10% of the rail freight traffic is from or to the Southern Region. port distance is long, railway becomes a major traffic mode.

For the handling of tonnage by item, shown in Table 3-6, the yearly increase of petroleum products and cement is remarkable. Tonnage of these two items is about 55% of the total traffic.

Table 3-6 FREIGHT TONNAGE BY MAIN COMMODITIES

	Fiscal Year 1976			Fiscal Year 1977		
	Tonnage ('000ton)	Percentage (%)	Average Haul Per ton (Kms)	Tonnage ('000ton)	Percentage (%)	Average Haul Per ton (Kms)
Petroleum Products	942	25.8	468	1,111	24.0	470
Rice Products	470	12.9	797	569	12.3	754
Cement	1,026	28.1	203	1,456	31.5	224
Lumber, Logs & Poles	316	8.7	583	369	8.0	588
Maize	190	5.2	831	192	4.1	819
Clinker & Marl	447	12.3	117	551	11.9	107
Fluorspar	45	1.2	753	94	2.0	733
Gypsum	94	2.6	222	153	3.3	253
Rubber	63	1.7	437	80	1.7	387
Fertilizer	37	1.0	508	42	1.0	502
Jute & Kenaf	19	0.5	457	11	0.2	465

3.1.5 Financial Plans

(1) Investment Plan 1977 - 1981

An investment program was prepared and incorporated in The Fourth National Economic and Social Development Plan. The estimated investment cost was Baht 1,733,818,000 and major goals were to be as follows:

- a) Improvement of antiquated facilities and additions
 - . Replacement of old rails with heavier ones
 - . Manufacturing and laying of concrete sleepers
 - . Replacement of wooden bridges with concrete bridges
 - . Replacement of antiquated steel bridges with new ones
 - . Extension and modernization of Makkasan Workshop
 - . Extension of car sheds
- b) Improvement of Train Operation Efficiency
 - . Dieselization
 - . Production of passenger coaches and freight wagons
 - . Improvement of signal and telecommunication systems
 - . Extension and construction of siding

(2) Improvement of Financial Status

Due to increase of operating and maintenance costs, the finance of SRT was in the red from 1974 to 1976; in 1977, a profit status returned.

In order to cope with such a circumstance, reduction of maintenance manpower together with the introduction of mechanization and the abandoning of non-profitable lines have been considered. The non-profitable lines have been investigated under cooperation with the World Bank and it has been suggested to the Ministry of Communication abandon 9 lines within Thailand.

However, the abandoning of those 9 lines is not preferable to the people who are presently utilizing them and also to the national economy of Thailand; therefore, it was approved to abolish the following 3 lines.

- a) Ban Dara Junction - Sawan Khalok (29.023 km)
- b) Hat Yai Junction - Songkhla (29.605 km)
- c) Wong Wian Yai - Maeklong (65.000 km)

However, the abandonment of the other 6 lines are now under consideration by NESDB.

3.2 Current Traffic Situation of Investigated Area

As the population of the Bangkok Metropolitan Area is rapidly increasing, construction of the housing and industrial complexes in the suburban districts are in progress. In the coming years, development of suburban areas will continue. In such a circumstance, the improvement of the mass transit networks connecting the city center with suburban districts are urgently required.

The existing Thai railway system was aimed at the traffic among major cities; therefore, it does not have any efficient facilities for inter-city traffic. The increasing rate of suburban population is a social need that strongly calls for the improved inter-city function of the railway.

In this report, the current status of the passenger traffic in stations around Bangkok was analyzed in order to study the demands of passengers and the possibility of using railways as a suburban traffic means.

The analysis was limited to the major cities located within 130km from Bangkok along the trunk lines. The analyzed sections for each line are as shown in Fig. 3-3 and listed below.

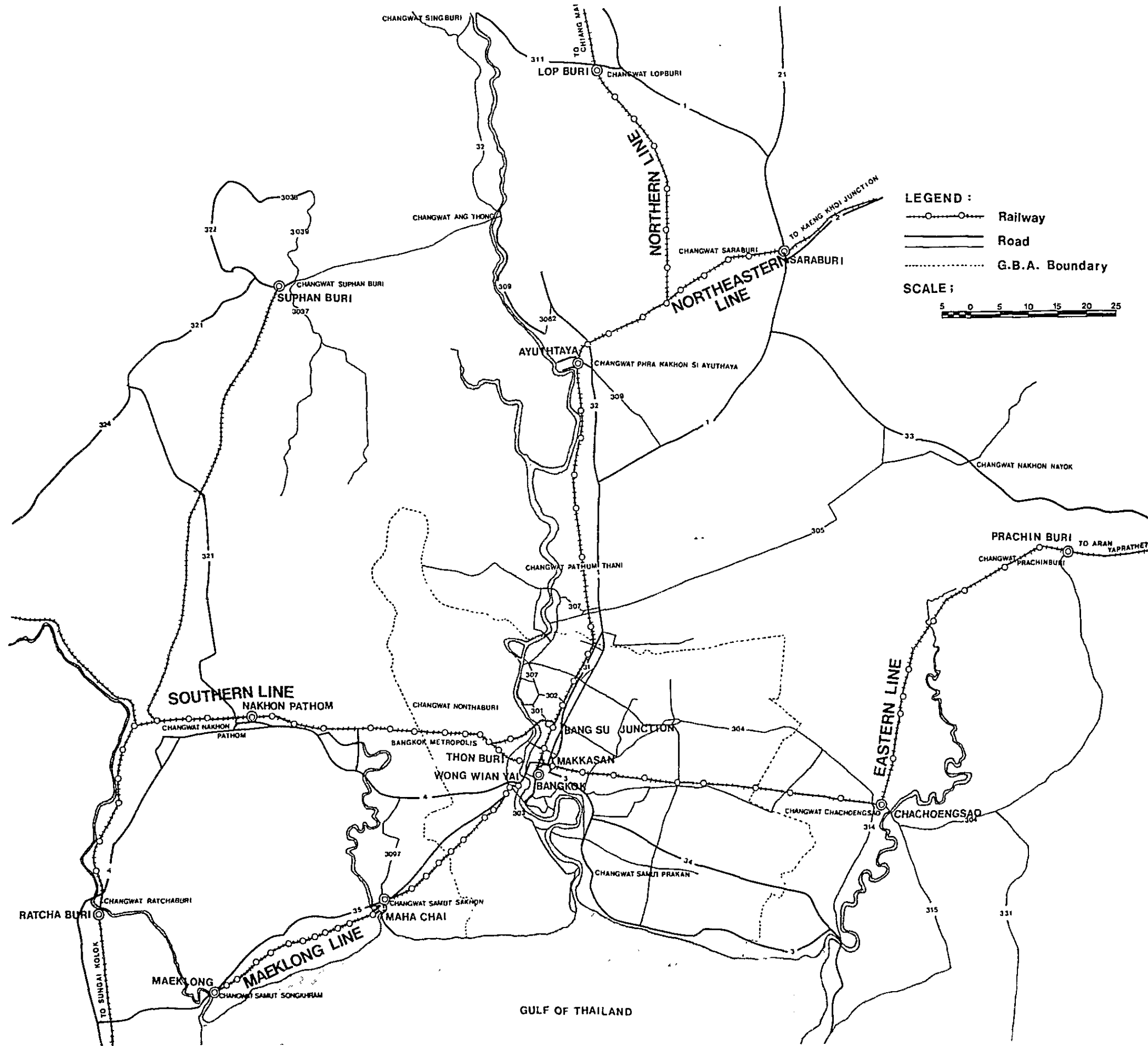
THE STUDY AREA

Line	Route	Length
Southern Line	Bangkok, Thonburi---Ratchaburi	(117 km)
Northern Line	Bangkok---Ban Pachi Junction---Lopburi	(133 km)
Northeastern Line	Bangkok---Ban Pachi Junction---Saraburi	(113 km)
Eastern Line	Bangkok---Prachinburi	(122 km)
Mae Kong Line	Wong Wian Yai---Maha Chai---Mae Klong	(65 km)
Total		(550 km)

3.2.1 Passenger Traffic

The route length of the railway in this area is 500km which corresponds to 15% of the 3,765km total length of the State Railways. The section between Bangkok and Ban Pachi Junction, about 90km, has double track. As Bangkok is located at the center of these lines, passengers in the Bangkok area are relatively many compared with other segments. About 30% of passengers of the State Railway is concentrated in the study area. About 50% of the commuter ticket holders utilize lines in the study area as shown in the following Table 3-7.

Fig. 3-3 INVESTIGATION AREA FOR COMMUTER SERVICE



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Table 3-7 COMPARISON OF RAILWAY PASSENGERS

Unit: Thousand Passengers

	Total Number of Passengers	Commuter's Ticket Holders
Whole Kingdom	57,974	8,097
Investigated Area	16,640 (28.70)	3,966 (48.98)

The yearly trend of passengers in the study area is as shown in Table 3-8. The normal fare passengers are decreasing since 1975 and probably a part of such passengers have been diverted from railroad to bus. Commuter ticket holders, however, are increasing every year due to the economical fare from the special reduction system which is applied to this kind of ticket.

Table 3-8 NUMBER OF PASSENGERS IN THE STUDY AREA

<u>Fiscal Year</u>	<u>1968</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
Non- Commuters	13,379 (1.00)	15,313 (1.14)	15,937 (1.19)	15,198 (1.13)	14,965 (1.12)	12,674 (0.95)
Commuters	850 (1.00)	1,590 (1.87)	2,056 (2.42)	2,849 (3.35)	3,473 (4.00)	3,966 (4.67)
Total:	14,229 (1.00)	16,903 (1.19)	17,993 (1.26)	18,047 (1.27)	18,438 (1.30)	16,640 (1.17)

() shows the ratio of increase or decrease from 1968.

(1) Fluctuation of Passenger Traffic

a) Seasonal Fluctuation

The passengers in March and April, the sightseeing season, increased to 110% of the average number of passenger for ordinary trains and 130-140% for the rapid and express trains. The trains are also very crowded on weekends. The passengers in September in the rainy season decreased to 90% for ordinary trains and 80% for rapid and express trains.

b) Hourly Fluctuation

The hourly number of passenger in Bangkok and Thonburi were investigated all day long on December 21, 1978. As all of the passengers did not go out through the platform gate, count of the passengers at the gate was impossible. Therefore, the passengers riding on the trains were counted at the sections between Bangkok and Samsen, Bangkok and Makkasan and Thonburi and Bang Ramat. The results were classified by hour.

The hourly fluctuation of passenger number calculated is as shown in Figs. 3-4 & 3-5. As the operating number of trains is not so great, passengers arriving on one train may have affected the amount of fluctuation, but the general tendency can be seen and is mentioned below.

The rush-hour in Bangkok is from 7 to 8 o'clock in the morning and includes 23.90% of the daily passengers. In this morning rush period, the arriving trains were all ordinary trains, and no rapid and express trains operated. The evening rush-hours are from 4 to 7 pm, but as there are some long distance rapid and express trains operating between 6 and 7 pm, the actual rush-hours will be taken from 5 to 6 pm.

In case of Thonburi, the morning rush-hour is from 6 to 8 am. As no direct train connecting the Southern Line with Bangkok directly is operated in this period, passengers must cross the Maenam by ferry service to the city center. For this reason, it was assumed that the Thonburi rush-hour comes earlier than the Bangkok one. About 53% of the total daily passengers are concentrated in the Thonburi morning rush-hour.

(2) Origin-Destination Table and Passing Passengers in Each Section

The origin-destination tables used in analysis include one way, round trip and commuter tickets holders based on the actual number of these tickets issued from October, 1976 to September, 1977. The stations in the tables are those in the investigated area, but the number of passengers coming from or going to the stations located outside the investigated area are included. Therefore, in cases of Bangkok, Thonburi and Samsen which serve long distance passengers, passengers are assessed by the number of tickets sold and by counting of passengers in the long distance train.

The attached origin-destination tables in Tables 3-9 through 3-12 are for the following railway sections.

Line	Route	Length
Southern Line	Bangkok, Thonburi --- Nakhon Pathom	(64km)
Northern Line & Northeastern Line	Bangkok --- Ayuthaya	(72km)
Eastern Line	Bangkok --- Chachoengsao	(61km)
Maekhlong Line	Wong Wian Yai --- Maha Chai	(31km)
Total		(228km)

Fig. 3-4 NUMBER OF PASSENGERS PER TIME PERIOD AT THE BANGKOK STATION

Departure						Time	Arrival						
40	30	20	10 (%)	Passengers	No. of Trains		No. of Trains	Passengers	(%)	10	20	30	40
				9	1	4.00~ 5.00	5	2,078					
				93	1	5.00~ 6.00	3	1,986					
				684	4	6.00~ 7.00	4	801					
				213	1	7.00~ 8.00	5	2,732					
				670	3	8.00~ 9.00	2	845					
				373	3	9.00~10.00	0	0					
				129	1	10.00~11.00	6	563					
				283	2	11.00~12.00	2	230					
				748	2	12.00~13.00	1	147					
				321	3	13.00~14.00	1	97					
				459	2	14.00~15.00	2	160					
				737	2	15.00~16.00	2	287					
				1,648	4	16.00~17.00	3	598					
				1,808	3	17.00~18.00	3	623					
				1,373	4	18.00~19.00	2	245					
				198	1	19.00~20.00	2	65					
				381	2	20.00~21.00	0	0					
				402	2	21.00~22.00	0	0					
				149	1	22.00~23.00	0	0					
				10,678	42	Total	43	11,457					

Fig. 3-5 NUMBER OF PASSENGERS PER TIME PERIOD AT THE THONBURI STATION

Departure						Time	Arrival						
40	30	20	10 (%)	Passengers	No. of Trains		No. of Trains	Passengers	(%)	10	20	30	40
				15	1	5.00~ 6.00	0	0					
				32	1	6.00~ 7.00	1	750					
				0	0	7.00~ 8.00	1	815					
				418	2	8.00~ 9.00	0	0					
				0	0	9.00~10.00	1	419					
				432	1	10.00~11.00	2	289					
				0	0	11.00~12.00	0	0					
				191	1	12.00~13.00	0	0					
				128	1	13.00~14.00	1	85					
				104	1	14.00~15.00	0	0					
				0	0	15.00~16.00	1	33					
				514	1	16.00~17.00	3	518					
				420	1	17.00~18.00	0	0					
				0	0	18.00~19.00	1	28					
				597	1	19.00~20.00	0	0					
				2,851	11	Total	11	2,937					

Table 3-9 PASSENGER FLOW TABLE OF SOUTHERN LINE

[Person/Day in 1977]

Total		2	4	0	6	48	201	415	630	182	162	679	141	11	63	565	3,554	6,663
6,540	Bangkok Stn.	2	4	0	0	2	1	0	15	2	0	24	2	0	0	22	2,252	2,326
8	Samsen Stn.	0	0	0	0	0	0	0	4	0	0	10	1	0	1	5	70	91
21	Bang Su Junction	0	0	0	0	1	1	0	5	1	0	12	2	0	0	8	31	61
0	Thonburi Stn.	0	0	6	44	185	378	525	147	131	411	43	2	49	79	937	2,937	
5	Bang Ramat Stn.	5	0	1	11	1	16	10	1	0	1	1	1	0	1	2	0	44
64	Taling Chan Junction	5	5	3	3	5	5	25	2	1	3	1	0	1	5	2	2	48
243	Ban Chlumphli Stn.	7	3	7	16	232	7	22	2	1	5	4	1	1	15	6	73	
407	Sala Thammason Stn.	16	3	15	19	611	19	20	23	26	24	3	2	7	2	0	25	3
720	Salaya Stn.	19	20	23	26	611	19	20	23	26	24	14	85	26	2	98	12	263
188	Wat Suwan Stn.	1	1	2	4	155	1	1	2	4	23	13	41	10	1	56	1	123
158	Khlong Maha Sawat Stn.	1	1	1	2	127	1	1	1	2	13	13	80	17	3	72	1	175
716	Wat Ngiu Rai Stn.	2	2	6	8	428	2	2	6	8	82	43	32	1	4	144	21	202
151	Nakhon Chaisri Stn.	1	1	4	3	42	1	1	4	3	26	12	20	37	1	31	3	36
11	Tha Chaleap Stn.	1	0	1	0	1	0	3	2	1	1	1	1	1	0	1	0	1
66	Ton Samrong Stn.	0	0	1	1	50	1	0	1	1	2	1	5	2	1	2	0	2
555	Nakhon Pathom Stn.	2	4	14	26	81	2	4	14	26	91	55	70	139	32	1	3	215
3,227	Other Stn.s	0	2	7	6	696	0	2	7	6	13	4	2	14	4	1	1	241
6,540	Total	55	37	74	76	2,854	55	37	74	76	252	129	192	197	39	4	4	241

Table 3-10 PASSENGER FLOW TABLE OF NORTHERN & NORTHEASTERN LINE

[Person/Day in 1977]

Total		215	362	297	391	148	258	598	230	240	135	76	293	118	1,343	8,855	13,559
13,040	Bangkok Stn.	215	338	207	309	105	155	273	58	24	14	13	96	19	418	5,912	8,156
219	Samsen Stn.		24	16	25	23	24	130	38	26	12	16	32	21	99	430	916
377	Bang Su Junction			74	56	18	78	180	32	52	20	13	64	17	219	293	1,116
30	Lat Yao Stn.				1	1	0	1	0	0	0	0	0	0	0	0	3
507	Bang Khen Stn.					1	1	10	11	13	4	3	4	3	57	35	142
97	Thung Song Hong Stn.						0	0	1	0	0	0	1	0	0	0	2
237	Lak Si Stn.							4	9	8	6	3	7	1	27	31	96
740	Don Muang Stn.								81	76	49	19	32	18	113	244	632
204	Khlong Rangsit Stn.									41	25	6	4	1	8	22	107
256	Chiang Rak Stn.										5	1	3	3	6	6	24
133	Chiang Rak Noi Stn.											2	7	1	10	5	25
70	Klong Phutsa Stn.												43	0	18	3	64
329	Bang Pa-In Stn.													34	323	52	409
112	Ban Pho Stn.														45	13	58
1,523	Ayuthaya Stn.															1,809	1,809
8,206	Other Stn.s																13,559
13,040	Total																

Table 3-11 PASSENGER FLOW TABLE OF EASTERN LINE

(Passenger/Day in 1977)

Total		54	125	103	81	140	584	253	214	125	677	360	2,716
2,826	Bangkok Stn.	54	103	11	15	34	266	45	64	15	107	265	979
49	Makkasan Stn.	22	72	39	91	222	72	55	79	80	40	772	
124	Khlong Tan Stn.	20	20	20	13	81	36	51	18	34	34	307	
95	Hua Mak Stn.	7	7	7	1	1	1	6	1	3	1	21	
71	Ban Thap Chang Stn.	1	1	1	1	1	1	2	1	1	0	19	
114	Lat Krabang Stn.	1	1	1	1	1	1	3	2	1	3	1	11
568	Hua Takhe Stn.	1	1	92	5	95	29	4	45	5	178		
251	Khlong Luang Phaeng Stn.	2	3	28	5	3	1	1	1	2	51	4	62
224	Preng Stn.	7	3	28	5	3	1	1	4	173	8	185	
126	Khlong Bang Phra Stn.	0	1	3	2	4	177	180	2	182			
701	Chachoengsao Stn.	3	2	48	53	168	177	177	177	177			
503	Other Stn.	1	2	3	4	9	6	-	Other Stn.	Other Stn.			2,716
2,826	Total	21	23	174	64	181	183	-	-	-	-	-	

Table 3-12 PASSENGER FLOW TABLE OF MAEKLONG LINE

(Person/Day in 1977)

Total		32	0	2	7	3	22	26	15	5	9	903	10	1034
1670	Wong Wian Yai Stn.	32	0	1	6	2	12	9	10	1	3	533	10	619
424	Talat Phlu Stn.	0	0	1	1	1	3	7	1	1	3	60	0	78
0	Khlong Ton Sai Stn.			0	0	0	0	0	0	0	0	0	0	0
49	34	15	0	Wat Sai Stn.	0	0	1	0	2	0	0	33	0	36
68	54	14	0	Wat Sing Stn.	0	0	6	9	1	2	2	16	0	36
96	64	32	0	Bang Bon Stn.	0	0	0	1	0	1	1	1	0	4
131	92	32	0	1	6	0	Rang Pho Stn.	0	0	0	0	8	0	8
96	54	32	0	0	9	1	Phrom Daem Stn.	1	1	0	0	41	0	42
63	51	8	0	2	1	0	Bang Num Chut Stn.	0	0	0	0	13	0	13
12	6	3	0	0	2	1	0	Khok Khwai Stn.	0	0	0	23	0	23
44	30	11	0	0	2	1	0	Ban Khom Stn.	175	0	0	175	0	175
667	528	119	0	4	3	0	1	3	1	8	Maha Chai Stn.	0	0	0
20	12	3	0	0	0	0	0	0	0	5	Other Stn.	1034	0	1034
1670	1349	269	0	7	23	3	3	1	8	5	Total	Total	5	

The number of short term passengers travelling between adjoining stations in the above sections are as shown in Fig. 3-6.

(3) Commuting Zone

The average travelling distance of the commuter ticket holders is about 27.10 km based on those using Bangkok and Thonburi, 22.10 km for the Southern Line, 27.40 km for the Northern and Northeastern Lines, 34.40 km for the Eastern Line and 25.70 km for the Mae Klong Line.

The stations where there are a large proportion of commuters are classified by Lines below:

a) Southern Line:

Sala Thammasop (14.05 km from Thonburi) and Salaya (19.05 km from Thonburi). About 40% of the commuters along this line are from these two stations.

b) Northern and Northeastern Line:

Bang Khen (13.00 km), Lak Si (17.57 km) and Don Muang (22.21 km) are mainly for workers. Ayuthaya (71.01 km) is a destination of many students.

c) Eastern Line:

Hua Ta Khe (30.90 km) As the Phra Chom Khao University is located close to this station, many students use it.

d) Mae Khlong Line:

As no big towns are located in the middle, two terminal stations including Wong Wian Yai and Maha Chai are used heavily by the commuters.

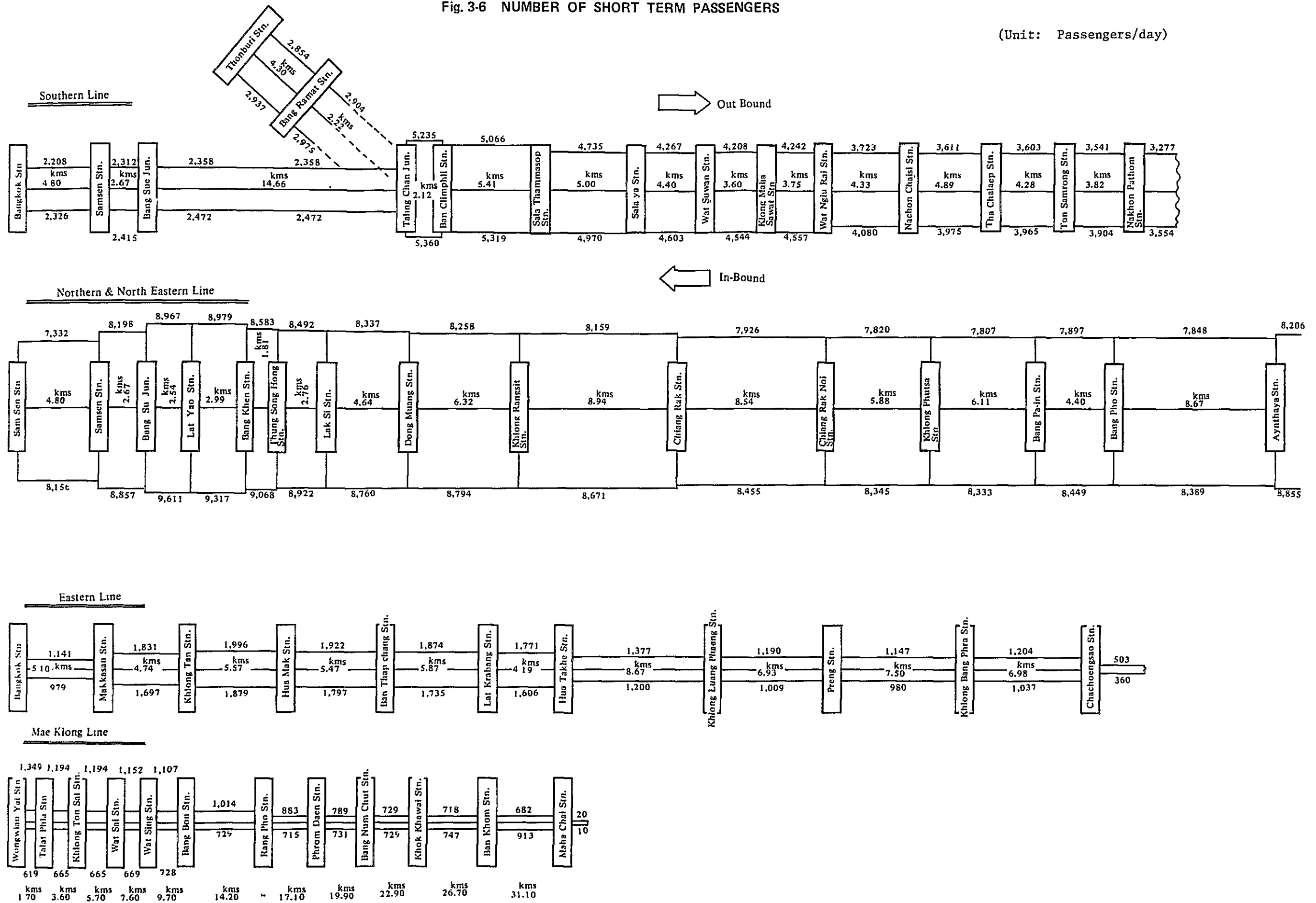
Number of commuting passengers by distance and line is as shown in Fig. 3-7.

(4) Freight Traffic

In the investigated area, the Carload traffic is increasing and less-than-carload traffic is decreasing, reflecting general tendency in Thailand. The yearly trend of freight traffic in this area is as shown in Table 3-13.

Fig. 3-6 NUMBER OF SHORT TERM PASSENGERS

(Unit: Passengers/day)



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Fig. 3-7 NUMBER OF COMMUTING PASSENGERS
BY DISTANCE

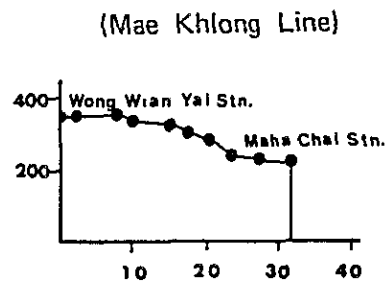
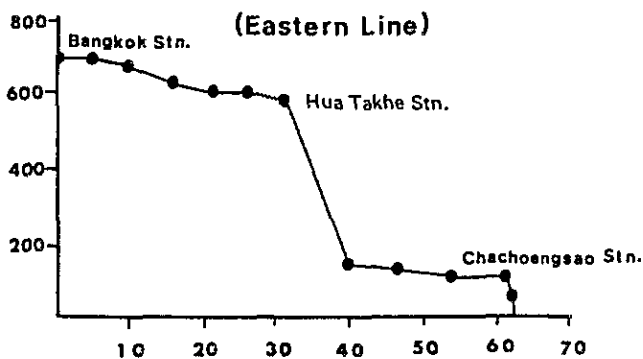
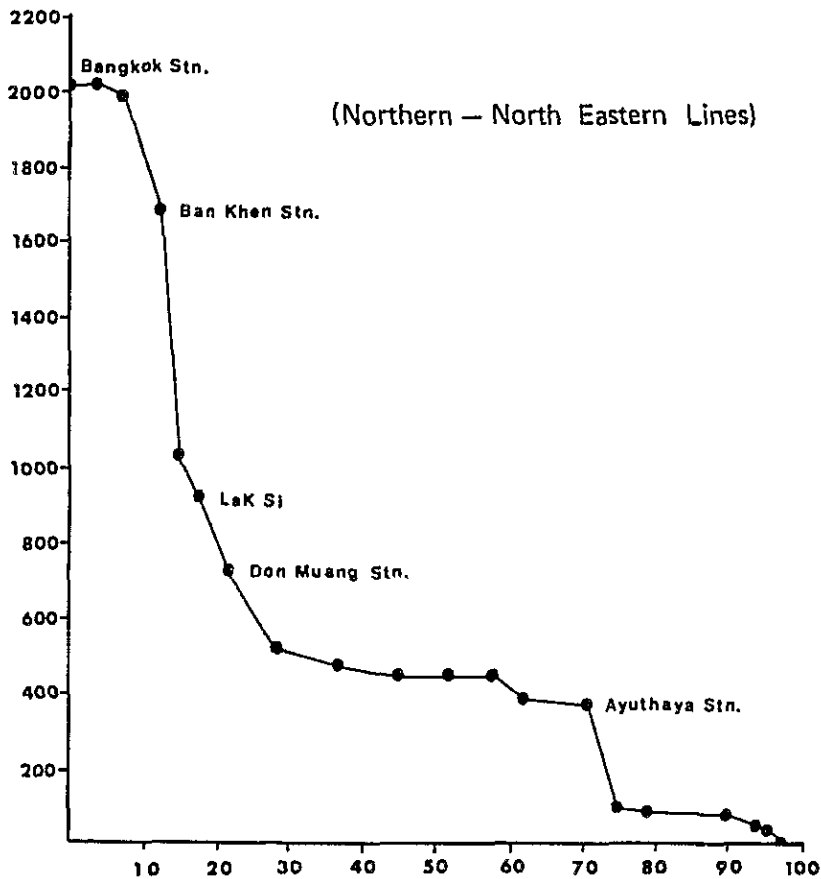
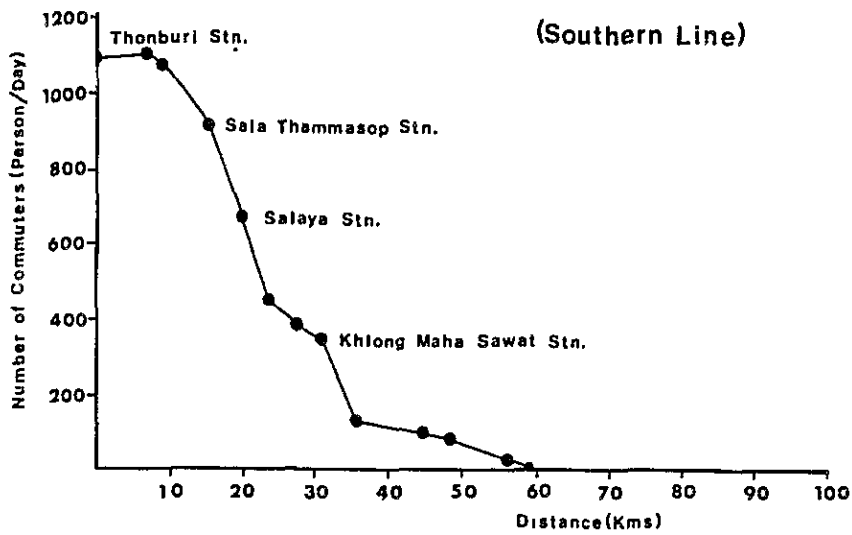


Table 3-13 FREIGHT TONNAGE IN THE COMMUTER SERVICE AREA

		('000 ton/year)			
<u>Railway Line</u>	<u>Item</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
Port Line	Carload	1,539	1,195	1,296	1,310
(Mae Nam	Less-Than-Carload	-	-	-	-
Bang Chak)	Total	1,539	1,195	1,296	1,310
Southern Line	Carload	122	188	203	258
(Thonburi -	Less-Than-Carload	30	42	29	22
Nakhon Pathom)	Total	152	230	232	280
North & N-	Carload	16	22	14	9
Eastern Line	Less-Than-Carload	11	11	11	10
(Bangkok -	Total	27	33	25	19
Ayuthaya)					
Eastern Line	Carload	0	3	1	1
(Bangkok -	Less-Than-Carload	6	5	5	4
Chachoengsao)	Total	6	8	6	5

As the freight train operation does not affect the passenger traffic in the morning rush-hour, future traffic volume is not studied in this report.

3.2.2 General Standard of Railway Line

(1) Gauge

In the inauguration stage, the railway was constructed with 1.435 meter gauge. It was modified into 1.000 meter track when the Southern Line connected with Malaysian and Burmese railways. Now every line is standardized to be of 1 meter track.

(2) Construction and Rolling Stock Gauges

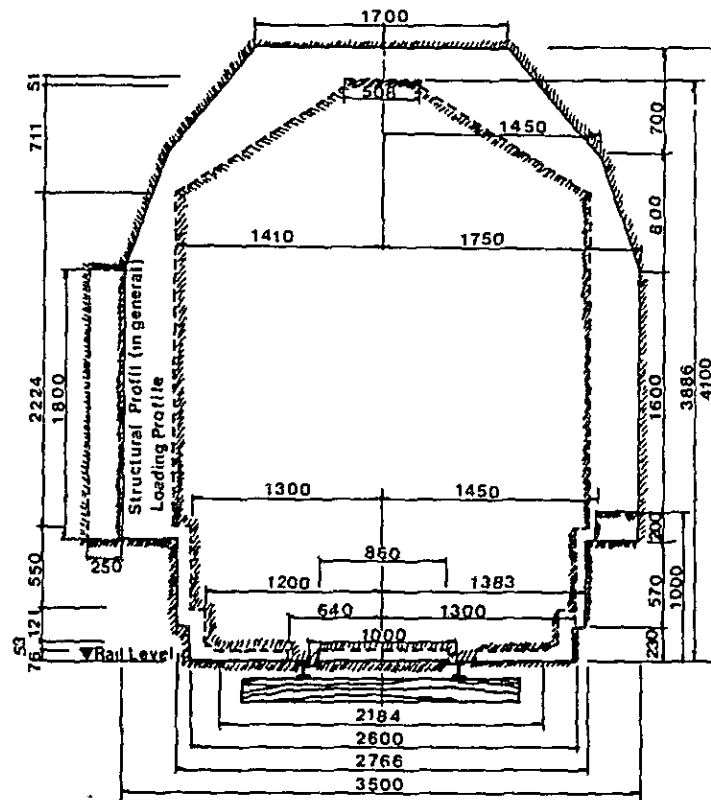
These gauges are as shown in Fig. 3-8.

(3) Track Structure

The track standard classified by kinds of line are as shown in Table 3-14.

The typical cross sections of cutting and embankment are as shown in Fig. 3-9.

Fig. 3-8 TRACK CLEARANCE & CAR CLEARANCE



Center-to-Center Distance of Double Track

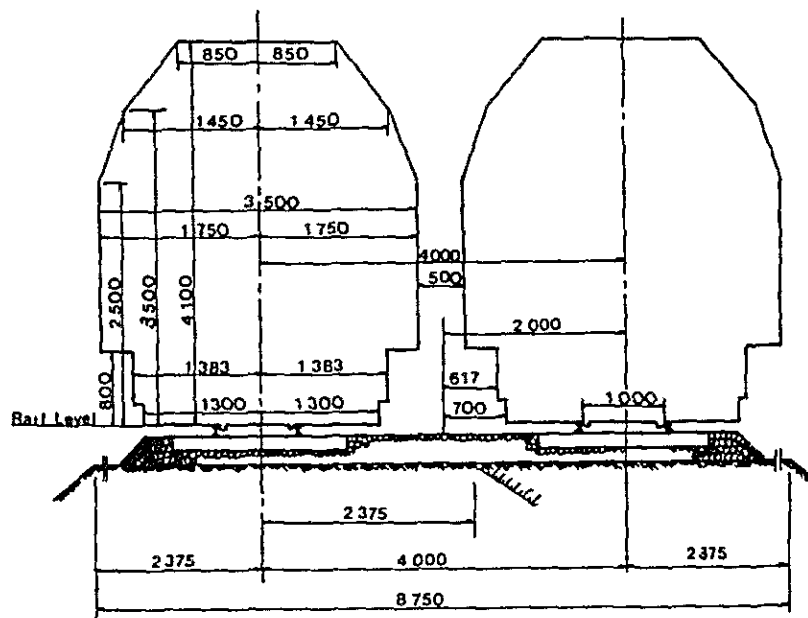
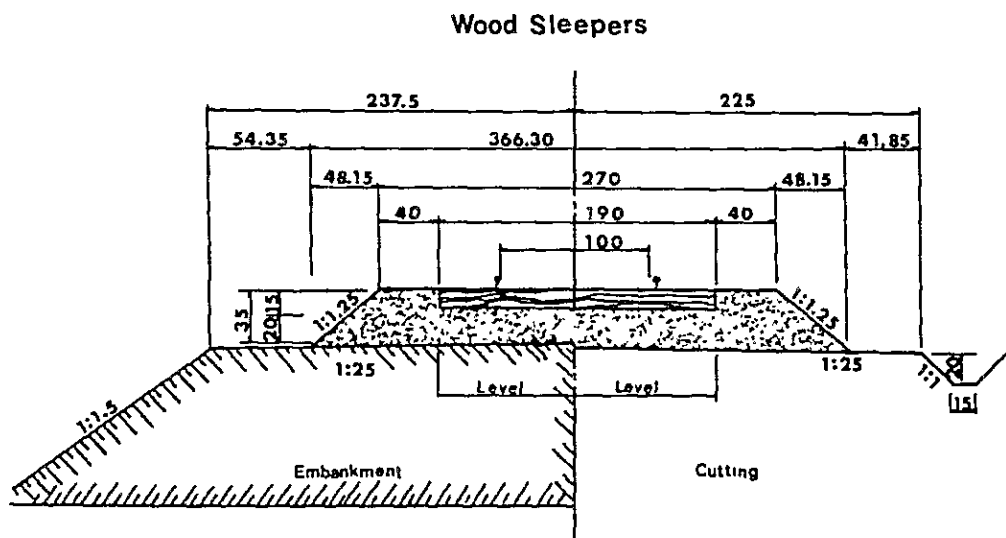
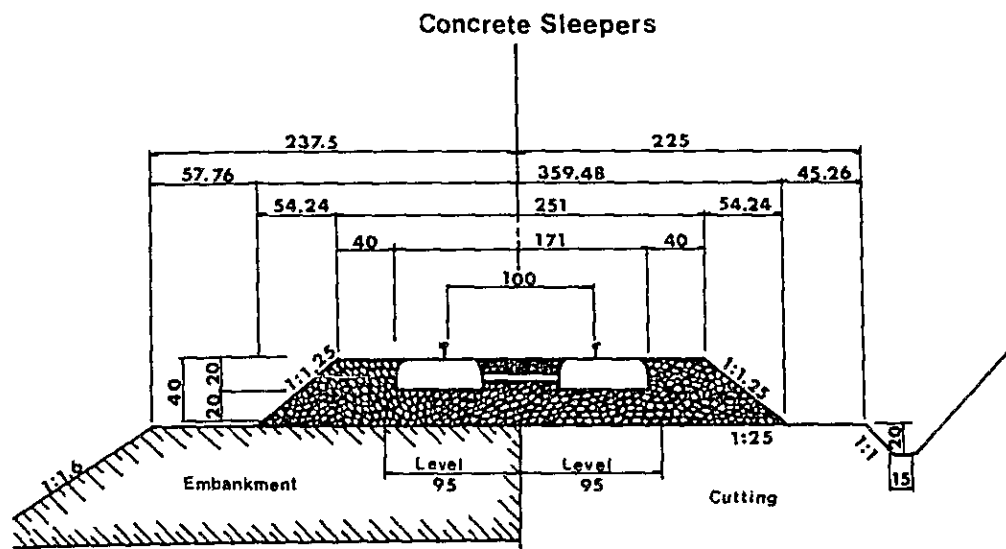


Table 3 - 14 TRACK STRUCTURE

Class of track	Weight of rail	Type of fastening	Sleeper		Min. depth of ballast below sleeper	Maximum train speed allowed
			Type	Spacing		
1.	not less than 80 lb/yd. and long welded.	Elastic fastenings	Non-treated hardwood, creosote-treated softwood, or concrete	65 cm	20 cm	100 km/hr
2.	70 - 80 lb/yd (or reconditioned 80 lb/yd) and long welded.	Elastic fastenings or a combination of dog spikes and elastic fastenings	Non-treated hardwood, creosote-treated softwood or concrete	65 - 67 cm	20 cm	90 km/hr
3.	Reconditioned 60 - 80 lb/yd either standard rail length, or short welded.	Dog spikes, or a combination of dog spikes and elastic fastenings	Creosote-treated softwood, 2nd grade non-treated hardwood, or reconditioned hardwood	70 cm	15 cm	70 km/hr
4.	Reconditioned 50 - 60 lb/yd, either standard rail length, or short welded.	Dog spikes	Creosote-treated softwood, 2nd grade hardwood, or reconditioned hardwood	70 cm	15 cm	30 km/hr

Fig. 3-9 STANDARD TRACK STRUCTURE



DIMENSION IN CM

The track structures in the investigation area are based on standard track structures and are classified as shown in Table 3-15.

Table 3-15 CLASSIFICATION OF TRACK STRUCTURE

Name of Line	Present Max. Speed (km/h)	Rail (lb/yd)	Rail Length (m)	Class of Track	Max. Train Speed allowed (km/h)
<u>Southern Line</u>					
Bangkok-Taling Chan J.	80	70	144	1	100
Thon Buri - Taling Chan J.	80	80	144	1	100
Taling Chan J.- Ratchaburi	80	80	144	1	100
<u>Northern & Northeastern Line</u>					
Bangkok-Ayuthaya	80	70	46	2	90
Ayuthaya-Bang Phachi	80	70	46	2	90
Bang Phachi-Lopburi	80	70	144	2	90
Bang Phachi-Saraburi	80	80	144	1	100
<u>Eastern Line</u>					
Bangkok-Chachoengsao	80	70	144	2	90
Chachoengsao-Prachinburi	70	60	144	3	70
<u>Mae Klong Line</u>					
Wong Wian Yai-Maha Chai	-	60	12	4	30

Note: Rail length is considered in the investment program 1977-1981.

3.2.3 Station and Yard

The locations of stations in Bangkok area are shown in Fig. 3-3. The important stations for passenger traffic and passenger train operation are Bangkok and Thonburi.

(1) Bangkok Station

The track alignment of Bangkok Station is shown in Fig. 3-10.

a) Number of trains from/to Bangkok Station

Table 3-16, 17 show the number of trains from/to Bangkok Station. Total number of arrival trains is thirty-nine

Table 3-16 TIME SCHEDULE OF TRAIN

(Arrive Bangkok Station)

To Bangkok Station						
Coach	Departure Time	From (Origin)	Arrival Time	Platform No.	To Bangkok	
P.T	92	19.10	Phitsanulok	4.00	4	Daily
P.T	66	22.00	Nakhon Ratchasima	4.15	3	"
R	42	13.25	Chum Thang Thung Song	4.30	5	"
P.T	88	18.10	Si La Art	4.45	4	"
R	40	18.20	Ubon Ratcha Thani	4.55	3	"
R	48	12.30	Nakhon Si Thammarat	5.10	3	"
R	30	18.30	Nong Khai	5.15	4	"
R	38	15.00	Chiang Mai	5.25	3	"
E	2	20.00	Ubon Ratcha Thani	6.00	1	"
E	4	19.10	Nong Khai	6.00	1	"
E	8	17.20	Chiang Mai	6.30	4	"
E	12	7.50	Butterworth	6.45	1	T, Th, Sat
E	12/16	8.30	Su-ngai-kolok	6.45	1	S, M, W, F
D.R	222	5.15	Ban Pachi	7.10	5	Daily
D.R.	202	6.05	Paet Riu	7.25	6	"
D.R	166	6.10	Ayuthaya	7.35	5	"
D.R	224	5.15	Lop Buri	7.50	6	"
D.R	210	5.25	Kaeng Khoi	7.50	6	"
R	44	13.30	Hat Yai	8.20	1	"
D.R	228	6.10	Lop Buri	8.55	5	"
D.R	106	5.50	Ban Ta Kli	10.00	5	"
P.T	254	5.40	Kabin Buri	10.05	6	"
D.R	164	7.55	Lop Buri	10.25	5	"
D.R	208	8.10	Kaeng Khoi	10.25	5	"
D.R.	118	5.40	Pran Buri	10.50	5	"
P.T	252	5.35	Aranyaprathet	11.35	5	"
P.T	226	5.30	Ta Phan Hin	11.40	5	"
P.T	62	6.00	Nakhon Ratchasima	12.00	4	"
P.T	90	5.30	Phitsanulok	13.55	5	"
D.R	212	11.50	Kaeng Khoi	14.10	5	"
D.R	232	12.25	Ratchaburi	14.50	5	"
P.T	94	7.25	Phitsanulok	15.25	4	"
D.R	234	12.30	Phetchaburi	15.45	5	"
D.R	204	13.20	Kabin Buri	16.30	5	"
D.R	220	14.00	Lop Buri	16.45	5	"
R	34	6.10	Nong Khai	16.55	4	"
R	32	6.45	Ubon Ratcha Thani	17.05	3	"
D.R	160	13.00	Nakhon Sawan	17.25	2	"
R	36	8.50	Den Chai	17.40	4	"
D.R	110	13.15	Aranyaprathet	18.15	3	"
P.T	64	13.30	Nakhon Ratchasima	18.40	4	"
EX.D	236	14.30	Saiyoke Noi Waterfall	19.30	4	Sat, Sun
D.R	214	16.10	Pak Chong	19.50	5	Daily
D.R	162	17.25	Lop Buri	19.50	5	"

Remarks:

E = Express Train
EX.D = Extra Diesel Railcars
P.T = Passenger Train

R = Rapid Train
D.R = Diesel Railcars
M.T = Mixed Train

Table 3-17 TIME SCHEDULE OF TRAIN

(Depart. Bangkok Station)

From Bangkok Station						
Coach	Plat Form No.	Departure Time	To (Destination)	Arrival Time	From Bangkok	
D.R	163	10	4.40	Lop Buri	7.25	Daily
D.R	207	10	5.50	Kaeng Khoi	8.05	"
D.R	109	6	6.00	Arunyaprathet	11.00	"
R	33	8	6.10	Nong Khai	17.10	"
EX.D	235	5	6.15	Saiyoke Noi Water fall	11.30	Sat & Sun
P.T	87	9	6.30	Si La Art	16.30	Daily
R	31	7	6.50	Ubon Ratcha Thani	17.05	"
P.T	61	10	7.20	Nakhon Ratchasima and Muak Lek	13.05	"
D.R	203	6	8.00	Kabin Buri	11.10	"
D.R	159	5	8.10	Nakhon Sawan	12.45	"
D.R	233	8	8.30	Phetchaburi	11.45	"
D.R	211	6	9.00	Kaeng Khoi	11.15	"
P.T	89	9	9.30	Phitsanulok	17.50	"
D.R	231	7	9.40	Ratchaburi	12.05	"
D.R	219	7	10.40	Lop Buri	13.25	"
D.R	161	7	11.45	Lop Buri	14.40	"
P.T	251	6	11.55	Aranyaprathet	17.55	"
R	43	10	12.10	Hat Yai	6.35	"
D.R	213	8	12.25	Pak Chong	15.55	"
P.T	225	7	13.00	Ta Phan Hin	19.10	"
P.T	253	8	13.35	Kabinburi	17.35	"
D.R	117	7	13.40	Pran Buri	18.45	"
D.R	105	7	14.20	Ban Ta Kli	18.45	"
R	37	9	15.00	Chiang Mai	5.20	"
P.T	63	6	15.30	Nakhon Ratchasima	20.40	"
D.R	223	6	16.05	Lop Buri	18.45	"
E	11	10	16.10	Butterworth	16.30	M,W,S
E	11/15	10	16.10	Su-ngai-Kolok	14.30	S,T,Th,F
D.R	227	6	16.30	Lop Buri	19.00	Daily
D.R	209	6	16.45	Kaeng Khoi	19.10	"
D.R	221	5	17.20	Ban Pachi	19.05	"
D.R	201	6	17.25	Paet Riu	18.50	"
R	47	7	17.30	Nakhon Si Thammarat	9:35	"
E	7	9	18.00	Chiang Mai	7.30	"
P.T	91	10	18.10	Phitsanulok	2.20	"
R	29	7	18.30	Nong Khai	5.30	"
R	39	8	18.50	Ubon Ratcha Thani	5.00	"
R	41	10	19.50	Chum Thang Thung Song	10.40	"
P.T	93	6	20.00	Phitsanulok	4.20	"
E	1	9	20.30	Ubon Ratcha Thani	6.35	"
E	3	9	20.30	Nong Khai	7.20	"
R	35	5	21.15	Den Chai	6.10	"
P.T	65	6	22.00	Nakhon Ratchasima	4.30	"

Remarks:

E = Express Train
EX.D = Extra Diesel Railcars
P.T = Passenger Train
R = Rapid Train
D.R = Diesel Railcars
M.T = Mixed Train

while that of departure trains is forty-one. Six local trains arrive at the station in rush hours from 7 to 9 A.M., while five local trains depart in rush hours from 4 to 6 P.M.

b) Track Alignment

The track alignment is shown in Fig. 3-10. There are passenger carriage yard, diesel railcar shed and passenger carriage shed in this station yard. They occupy the large space of the station yard, therefore adequate track alignment is obstructed. The number of departure and arrival tracks are as follows:

Arrival track	:	four tracks
Arrival and departure track	:	two tracks
Departure track	:	five tracks

One of the problems for increasing commuter trains is that only two tracks can be used to receive and despatch trains directly.

(2) Thonburi Station

a) Table 3-18 shows the details of the 10 trains from/to Thonburi. Only one local train arrives at the station and departs in rush hours from 4 to 6 P.M.

b) Track alignment

The track alignment is shown in Fig. 3-11. There are eight platform tracks for passengers in this station, but nowadays only two tracks are used.

(3) Typical Way Station

Fig. 3-12 shows the location of typical way station on a single track section. It has one main track and one or two sidings. Most way stations have such track alignment.

Fig. 3-10 BANGKOK STATION

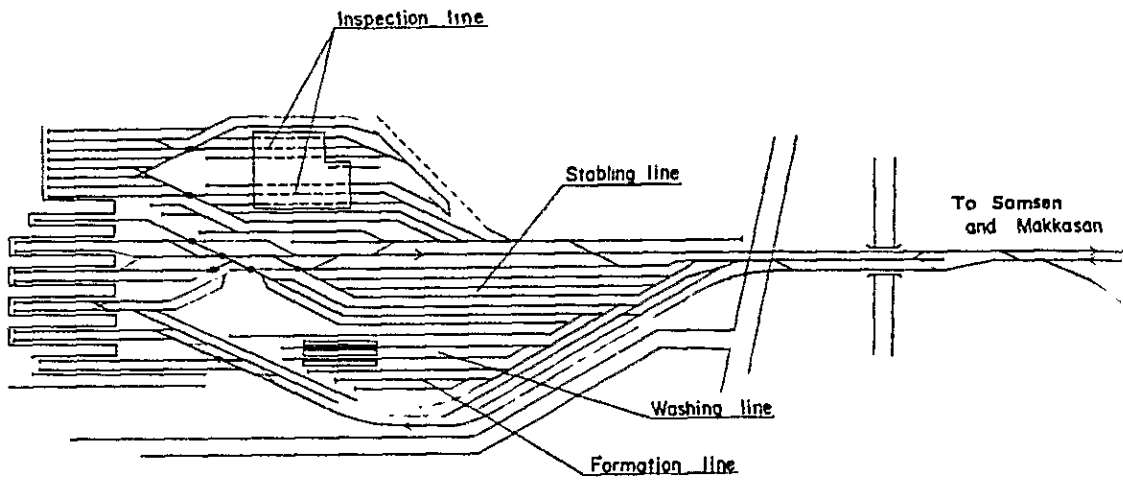


Fig. 3-11 THONBURI STATION

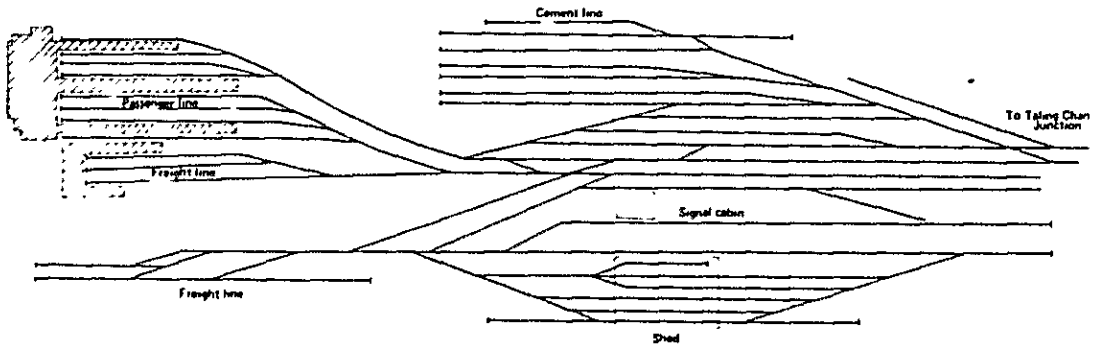


Table 3-18 TIME SCHEDULE OF TRAIN
(Arriving and Departing Thonburi Station)

From Thonburi Station

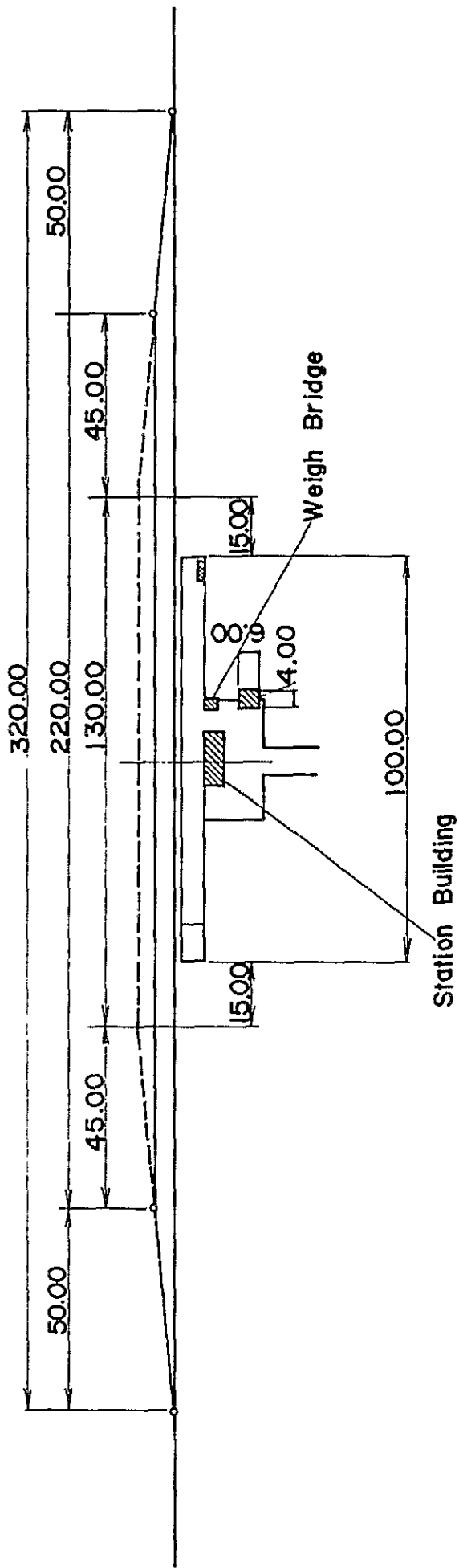
Coach	Plat Form No.	Departure Time	To (Destination)	Arrival Time	From Bangkok
M.T	355	7	5.00 Prachuap Khiri Khan	15.50	Daily
M.T.	349	5	6.35 Saiyoke Noi Waterfall	13.45	"
D.R	169	5	8.00 Chumphon	17.05	"
D.R	171	5	8.00 Saiyoke Noi Waterfall	12.20	"
D.R	177	5	10.35 Nakhon Pathom	11.40	"
M.T	345	5	12.40 Suphan Buri	16.45	"
P.T	179	5	13.20 Nakhon Pathom	14.35	"
D.R	197	5	14.00 Saiyoke Noi Waterfall	18.35	"
P.T	175	5	16.16 Ban Pong	17.45	"
D.R	173	5	17.45 Ratchaburi	20.05	"
R	45	5	19.05 Su-ngai-Kolok	17.35	"

To Thonburi Station

Coach	Departure Time	From (Origin)	Arrival Time	Plat Form No.	To Bangkok
P.T	176	4.35 Ban Pong	6.35	4	Daily
D.R	174	5.30 Ratchaburi	7.35	4	"
R	46	10.40 Su-ngai-Kolok	9.15	4	"
M.T	346	6.15 Su-Phurn Buri	10.05	4	"
D.R	198	6.30 Saiyoko - Noi Waterfall	10.55	4	"
P.T	178	11.55 Nakhon Pathom	13.05	4	"
M.T	356	5.45 Prachuap Khiri Khan	15.20	2	"
P.T	180	14.50 Nakhon Pathom	16.00	4	"
D.R	170	6.50 Chum phon	16.15	4	"
D.R	172	12.35 Saiyoke - Noi Waterfall	16.55	4	"
M.T	350	11.10 Saiyoke - Noi Waterfall	18.45	2	"

Remarks: E = Express Train R = Rapid Train
EX.D = Extra Diesel Railcars D.R = Diesel Rail ars
P.T = Passenger Train M.T = Mixed Train

Fig. 3-12 TYPICAL WAY STATION YARD



3.2.4 Train Operation and Rolling Stock

(1) Train Operation System

a) Passenger Trains and Mixed Trains:

i) Northern line, Northeastern line and Eastern line:

Most of the trains are operated from/to Bangkok Station. A few trains are operated in other sections.

ii) Southern line:

All Express trains, most rapid trains and half the number of carriages in local trains are operated from/to Bangkok Station. A rapid train and half the number of carriages in local trains are operated from/to Thonburi Station.

iii) Mae Klong line:

All trains are operated between Wong Wain Yai and Maha Chai (Samut Sakhon).

b) Freight Train:

Most of the freight trains on the Northern, Northeastern, Eastern and Southern lines are operated from/to Bang Su Yard. A few trains on southern line are operated from/to Thonburi Station. Besides those trains, local trains are operated between Bang Su and Thonburi and between Bang Su and Bangkok river port.

(2) Kind of Passenger Trains

There are two kinds of passenger trains as follows:

a) Carriage Train Hauled by Diesel Locomotives:

Express trains, rapid trains and some of local trains are carriage trains hauled by diesel locomotives. The number of carriages hauled in those trains is seven to eighteen.

b) Diesel railcar train:

Some local trains are diesel railcar trains. One set of diesel railcars consists of one power car and one trailing car. The number of diesel railcars composing one train is typically four or six. Some of trains are composed of two or ten railcars. Table AP3-1-1 and AP3-1-2 shows the number of carriages or diesel railcars composing each train from/to Bangkok Station and Thonburi Station.

(3) Train Operation Interval

A minimum train operation interval is five minutes in existing operation. However such a minimum interval occurs only about four times a day. Even in rush hour, most of the intervals are ten minutes or more. Therefore it is considered that there is time for operating more trains.

(4) Running Time and Schedule Speed

The running time and the schedule speed of existing ordinary trains and diesel railcar trains are shown in Table 3-19:

Table 3-19 RUNNING TIME AND SCHEDULE SPEED

Section	Running Time		Schedule Speed	
	O.T.	D.R.	O.T.	D.R.
Bangkok - Ayuthaya	1hr 30min	1hr 24min	47.3km/hr	49.5km/hr
Bangkok - Lopburi	2 51	2 40	46.6	49.8
Bangkok - Chachaeng Sao	1 14	1 11	49.4	51.5
Thonburi - Nakhon Pathom	1 01	1 01	47.3	47.3
Wong Wain Yai - Maha Chai	- -	0 48	-	38.9

O.T.: Ordinary train

O.R.: Diesel railcar train

(5) Train Diagram

The current train diagrams in Bangkok area are shown in Fig. AP3-1 ~ AP3-6 from which the following information can be mentioned:

- i) The train density is the highest on the double track section between Bangkok and Ban Phachi Junction. However, it is supposed to be able to be increased.
- ii) Although the number of trains on the Eastern line is very small, the line has enough track capacity to increase many trains in this time.
- iii) On the Mae Khlong line, one train operated every hour in the daytime and some trains are added only in rush hours.

(6) Train Crew

The train crews of each train consist of a driver and an assistant driver together with a few guards in the carriages or cars. The drivers and assistant drivers of locomotives belong to the Bang Su Loco Shed or the Thonburi Loco Shed while those of diesel railcars belong to the Bangkok Diesel Railcar Shed in the Bangkok area.

(7) Rolling Stock and Depot

a) Locomotives:

The number of locomotives by type and by depot in overall SRT system is shown in Table 3-20. The locomotives used in Bangkok area mostly belong to the Bang Su Loco Shed. They are mainly 1,200 HP diesel locomotives. The Bang Su Loco Shed is the biggest locomotive shed in the SRT system.

b) Passenger Carriages:

The number of passenger carriages by type is shown in Tables 3-20, 3-21. Passenger carriages do not belong to a fixed depot, and those used in the Bangkok area are maintained at the depot in Bangkok Station.

The current problem of this depot is as follows:

- i) The stabling lines are too short to keep the carriages. Sometimes the carriages have to be kept on the platform track for a long time because of shortage of stabling lines.
- ii) Also the inspection and repair lines are too short to maintain the existing carriages.

Passenger carriage trains hauled by locomotive are not operated on the Mae Khlong line.

c) Diesel Railcar:

The number of diesel railcars by type is shown in Table 3-20. All diesel railcars in the Bangkok area belong to the Bangkok Diesel railcar depot, while those on the Mae Khlong line belong to the Maha Chai depot. The current problem at the Bangkok diesel railcar depot is same as that at the Bangkok passenger carriage depot.

Table 3-20 DISTRIBUTION OF DIESEL LOCOMOTIVES AND DIESEL RAIL CARS: TYPES AND BY DEPOTS AS OF OCT. 1st, 1978

TYPE	DEPOT											TOTAL ON THE BOOKS	IN SERVICE (ON OCT. 1st, '78)	
	BANG SU	THONBURI	NAKHON RATCHASIMA	PAK NAM PHO	UTTRADIT	LAMPANG	CHUMPHON	THUNG SONG JC.	HAT YAI	BANGKOK (HUALAMPONG)	MAE KHLONG			MAKASAN
<u>DIESEL HYDRAULIC LOCOMOTIVE</u>														
HUNSLET (240 HP)	2									1		2	5	3
KRUSS MUFFEI (440 HP)		2						1				2	5	1
HENSCHEL (1200 HP)	8	5	8						4	2			27	22
GRUPP (1500 HP)	19				8				3				30	20
<u>DIESEL ELECTRIC LOCOMOTIVE</u>														
DAVENPORT (500 HP)	10		5	1	4	1	1	4	2	2			30	25
DAVENPORT (1000 HP)	9		5		1								15	11
HITACHI (950 HP)		12						7	8				27	17
GE (1320 HP)	47	1			2								50	41
ALSTHOM (2250 HP)	54												54	46
SULZER											3			2
TOTAL DIESEL LOCOMOTIVES	149	20	28	1	15	1	1	12	17	5	3	4	243	188
<u>DIESEL RAILCARS</u>														
TOKYU (STAINLESS)										4				
TOKYU														
HITACHI										38				
TAIKOKU											6			
NIIGATA											2			

Table 3-21 PASSENGER CARRIAGES AS OF OCT. 1st, 1978

Royal Carriages	3
Bogie Radio Communication Van	1
Bogie Power Van	1
Bogie Special Van	6
Bogie Pay Car	4
Bogie Reserved Saloon	6
Bogie Inspection Car	1
Bogie Air-Conditioned Reserved Saloon	2
Bogie Restaurant Car	18
Bogie Buffet Second Class Carriage	6
Bogie Buffet Third Class Carriage	86
Bogie Second Class Carriage	65
Bogie Third Class Carriage	525
Bogie Air-Conditioned Second Class Carriage	13
Bogie All Class Carriage	1
Bogie Van and Second	5
Bogie Second Class Day and Night Coach	86
Bogie First Class Day and Night Coach	14
Bogie Air-Conditioned First Class Day and Night Coach	13
Bogie Postal Van	12
Bogie Full Van	41
Bogie Third Class and Van	67
Bogie Second and Third Class Carriage	32
Bogie First and Second Class Carriage	22
TOTAL	<u>1,030</u>

3.2.5 Signalling and Telecommunication

(1) Signalling

a) Block system

The block system adopted on the lines in Bangkok area is as follows:

Northern Line and Northeastern Lines

Bangkok - Bang Su	:	Tokenless block system on double line
Bang Su - Ban Pha Chi Jn.	:	Tokenless block system on double line
Ban Pha Chi Jn. - Lop Buri	:	Tokenless block system on single line
Ban Pha Chi Jn. - Sara Buri	:	Tokenless block system on single line

Southern Line

Thon Buri - Ratcha Buri	:	Tokenless block system on single line
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Bang Su - Taling Chan Jn. : Tokenless block system
on single line

Eastern Line

Bangkok - Makkasan : Tokenless block system
on single line

Makkasan - Prachin Buri : Token block system

Mae Khlong Line

Wang Wain Yai - Maha Chai : Ticket system

b) Signalling Facility and Interlocking

Facilities and interlocking devices installed on above mentioned line are as follows:

Northern Line and Northeastern Lines

Bangkok - Bang Su : Color light signal with
all relay interlocking

Bang Su - Ban Pha Chi Jn. : Color light signal with
mechanical interlocking

Ban Pha Chi Jn. - Lop Buri : Semaphor with mechanical
interlocking

Ban Pha Chi Jn. - Sara Buri : Semaphor with mechanical
interlocking

Southern Line

Ban Su - Taling Chan Jn. : Color light signal with
all relay interlocking
Semaphor with Mechanical
interlocking

Thonburi - Ratcha Buri : Semaphor with mechanical
interlocking

Eastern Line

Bangkok - Makkasan : Color light signal with
electro-mechanical
interlocking

Makkasan - Prachin Buri : Hand signal and semi-
interlocking

Mae Khlong Line

Wong Wain Yai - Maha Chai : Hand Signal

(2) Telecommunication

The current telecommunication system in Bangkok area is as follows:

Telephone system	:	Magneto telephone circuit and carrier telephone circuit are installed.
Train dispatcher telephone	:	Selective train control call telephone circuits are installed.
Telegraph and teleprinter	:	Morse's telegraph circuits are generally installed and teleprinter circuits are installed in the main station.

3.2.6 Makkasan Workshop

Heavy repair and inspection of rolling stock is carried out at the workshop located at Makkasan. Makkasan workshop is the largest central repair shop of SRT. There are four divisions in the workshop. Those are the rolling stock repair division, the rolling stock construction division and the production division. The number of working staff in those divisions are 923, 1,066, 362 and 807 respectively. The total number of staff including administration staff is 3,433.

The present output of repairing per month at Makkasan workshop are as follows:

Diesel locomotives	:	25 - 30 unit
Diesel railcars	:	1 "
Passenger carriages	:	25 - 30 "
Wagons (in terms of 4-wheels)	:	140 - 150 "

The present number of days required for repairing one unit are as follows:

Diesel locomotive	:	20 days
Diesel railcar	:	20 "
Passenger carriage	:	13 "
Wagon	:	1.5 "

Not only repair and inspection, but also construction of rolling stock is carried out in Makkasan workshop. Statistics of rolling stock construction as completed up to June 1st 1977 is shown in Table AP3-2.

3.2.7 Fare

The fares of SRT for freight and passenger were revised in the respective years of 1952, 1955 and 1975. However, since the balance in the fiscal year of 1974 was in the red due to increased cost of payroll and other items, a revision of the fare was inevitable. The revision of the fare was made in 1975 which resulted in a raise of 14% of passenger fare and 22% for the freight fare. Tables of old and new passenger fare are shown below for comparison.

Old Fare (Satang/km)

	<u>1st Class</u>	<u>2nd Class</u>	<u>3rd Class</u>
1 - 250 km	40	20	10
251 - 500	36	18	9
Over 501	32	16	8

New Fare (Satang/km)

	<u>1st Class</u>	<u>2nd Class</u>	<u>3rd Class</u>
1 - 100 km	45	26	15
101 - 200	41	23	12
201 - 300	38	20	10
Over 301	36	18	9

The kind of tickets available are One-Way, Round-Trip and Commuter. Reduced fare has been applied to the Round-Trip and Commuter tickets. Also, in competitive sectors with Bus Transport, special reduced fare has been applied to only Round-Trip tickets.

As the long-haul bus transport network has been well developed in the area where the investigation was made this time, special reduced fare was applied to all the Round-Trip tickets. A comparison table of the fare for significant sectors is as follows:

(Unit: Baht)

Sector	<u>Railway Fare</u>		<u>Bus Fare</u>
	One Way	Round Trip*	One Way
Thonburi - Nakhon Pathom	7.50	11.00	7.00
- Ratchaburi	12.50	19.00	10.00
Bangkok - Ayuthaya	11.00	16.00	10.00
- Lopburi	19.50	30.00	19.00
- Saraburi	17.00	25.00	15.00
Bangkok - Chachoengsao	9.50	14.00	9.00
- Prachinburi	18.00	30.00	17.00

* The applicable sectors are only limited to those competitive with bus transport.

The discount system for the passengers holding commuters tickets is as follows:

Students	20%
Workers & Others	40%

