

# APPENDICES

## APPENDIX CHAPTER 2

Existing Transport System and  
Traffic Survey

## APPENDIX CHAPTER 3

Commuter Service by Railroad  
Transport

## APPENDIX CHAPTER 4

Land Use

## APPENDIX CHAPTER 5

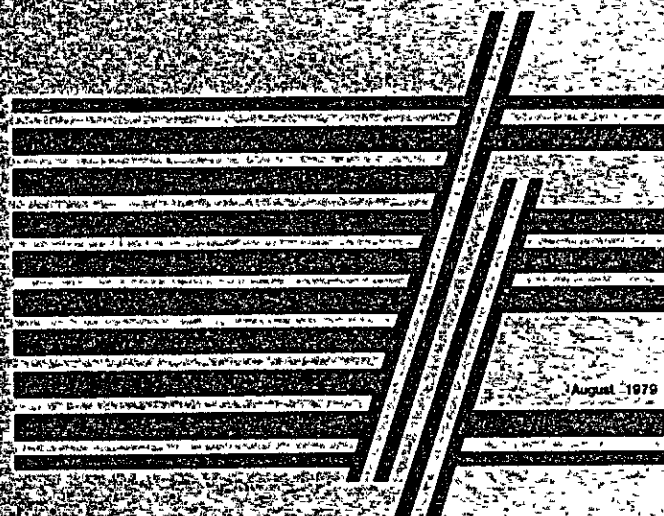
Transportation Planning and  
Forecast of Future Traffic Demand

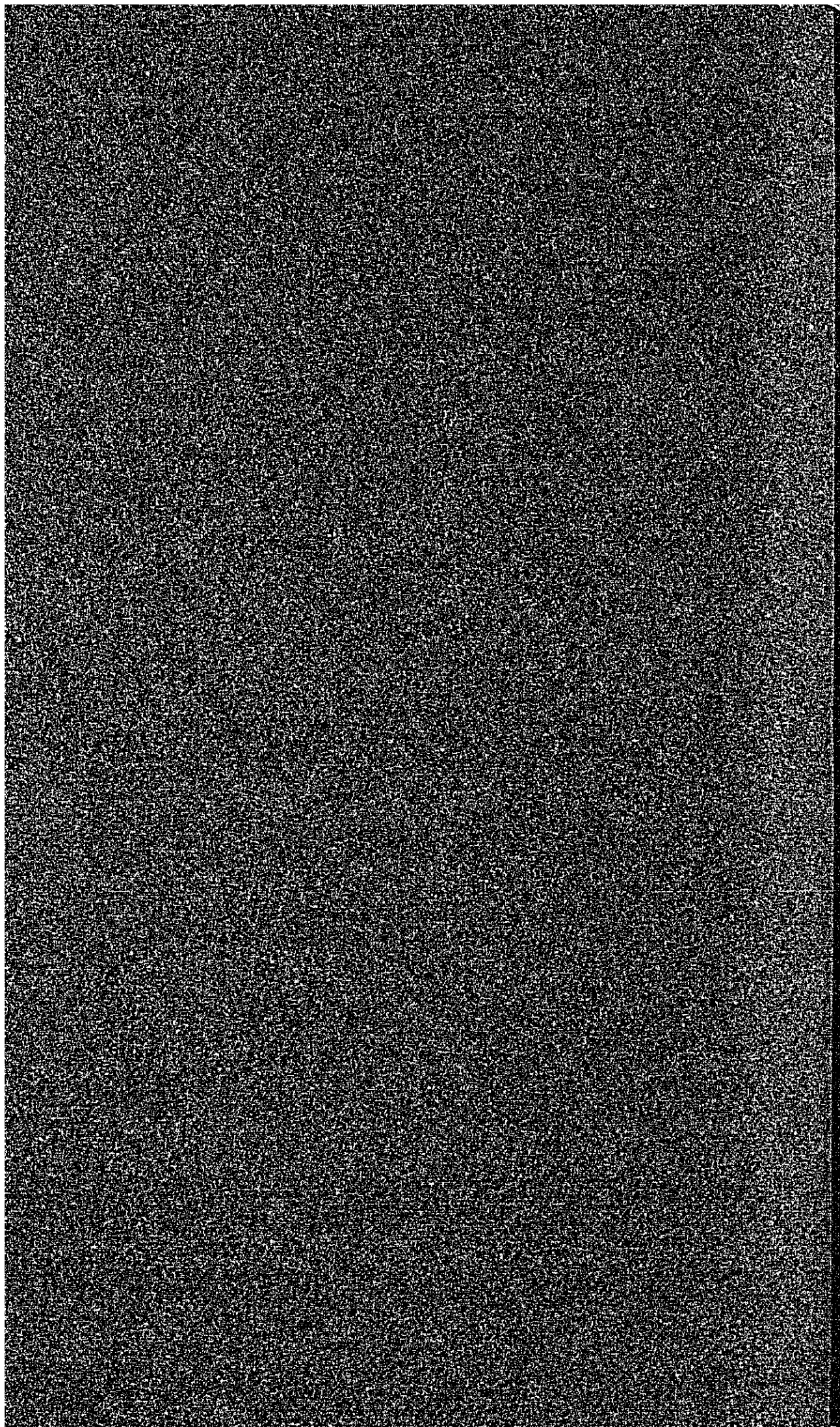
## APPENDIX CHAPTER 6

Transportation Facilities Planning

## APPENDIX CHAPTER 8

Economic and Financial Evaluation





## APPENDICES LIST OF TABLES AND FIGURES

### Chapter 2 EXISTING TRANSPORT SYSTEM AND TRAFFIC SURVEY

Table	AP 2-1	Average Daily Traffic by Vehicle Type and Year	AP 2-1
	AP 2-2	Commercial Vehicles Registered in Central Region by Changwat	AP 2-8
Fig.	AP 2-1	Traffic Count Stations set up by Department of Highways	AP 2-7

### Chapter 3 RAILROAD COMMUTER SERVICES

Table	AP 3-1-1	Number of Coaches Composing Each Train	AP 3-1
	AP 3-1-2	Number of Coaches Composing Each Train	AP 3-2
	AP 3-2	Statistics of Rolling Stock Construction as Completed up to June, 1977	AP 3-3
Fig.	AP 3-1	Northern & Northeastern Lines	AP 3-4
	AP 3-2	Northern Line	AP 3-5
	AP 3-3	Northeastern Line	AP 3-6
	AP 3-4	Eastern Line	AP 3-7
	AP 3-5	Southern Line	AP 3-8
	AP 3-6	Maekhlong Line	AP 3-9

### Chapter 4 LANDUSE

Table	AP 4-1	Official System of Romanization of Thai Place Names	AP 4-1
	AP 4-2	Transformation of Other Project Zones to BSTP Zones	AP 4-2

### Chapter 5 TRANSPORTATION PLANNING AND FORECASTS OF FUTURE TRAFFIC DEMAND

Table	AP 5-1	Malaysian Tourists visiting Thailand	AP 5-2
	AP 5-2	Foreign Tourists Arriving at Bangkok Airport	AP 5-2
	AP 5-3	International Air Passengers to and from BKK Airport	AP 5-3
	AP 5-4	Domestic Air Passenger	AP 5-4
	AP 5-5	Air Passengers to and from BKK Airport	AP 5-4
	AP 5-6	Forecast of International Tourist Arrivals	AP 5-5
	AP 5-7	Thai Air Passengers Embarking from Thailand	AP 5-6
	AP 5-8	Forecast of Future Thai Passengers in International Airport	AP 5-7
	AP 5-9	Thai Airline Operations for Domestic Transport	AP 5-8
	AP 5-10	Forecast of Future Domestic Air Passengers to and from Bangkok Airport	AP 5-9
	AP 5-11	Summary of Future Air Passengers to and from Bangkok Airport	AP 5-9
	AP 5-12	Forecast of Future Transit Passengers	AP 5-10

Table AP 5-13	Forecast of Future Passenger Traffic and Aircraft Flights at Bangkok Airport	AP 5-12
AP 5-14	Average Hourly Flights, 1978	AP 5-14
AP 5-15	Person-trips Generated and Attracted at Bangkok Airport in 1977	AP 5-16
AP 5-16	Person-trips Generated and Attracted at Bangkok Airport in 1990	AP 5-17
AP 5-17	Person-trips Generated and Attracted at New International Airport in 2000	AP 5-18
AP 5-18	Person-trips Generated and Attracted at Bangkok Airport in 2000	AP 5-18
AP 5-19	Estimated Regression Equations and Commercial Vehicles by Changwat in 2000	AP 5-19
Fig. AP 5-1	Proposed Transportation Facilities	AP 5-20
AP 5-2	Estimated Traffic Volume on the Suburban MTS, Case 2	AP 5-15
AP 5-3	Estimated Traffic Volume on the Suburban MTS, Case 5	AP 5-16
AP 5-4	Estimated Traffic Volume on the Suburban MTS, Case 14	AP 5-17
AP 5-5	Estimated Traffic Volume on the Suburban MTS, Case 5'	AP 5-18
AP 5-6	Estimated Traffic Volume on the Road Network, Case 5'	AP 5-19

## Chapter 6 TRANSPORTATION FACILITIES PLANNING

Table AP 6-1	Breakdown of Investment Costs for Different Transports Modes	AP 6-1
AP 6-2	Breakdown of the Operation & Maintenance Costs for Different Transports Mode	AP 6-2

## Chapter 8 ECONOMIC AND FINANCIAL EVALUATION

Table AP 8-1	Expected Time Values for Passenger Car by Speed	AP 8-3
AP 8-2	Expected Time Values for Bus by Speed	AP 8-3
AP 8-3	Time Values in 1978 by Herbert Mohring's Method	AP 8-4
AP 8-4	Comparison of Time Values in 1978 by Different Methods	AP 8-4
AP 8-5	Economic Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 1; Case 2)	AP 8-5
AP 8-6	Economic Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 2; Case 2)	AP 8-6
AP 8-7	Economic Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 3; Case 2)	AP 8-7
AP 8-8	Economic Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 1; Case 14)	AP 8-8
AP 8-9	Economic Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 2; Case 14)	AP 8-9

AP 8-10	Economic Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 3; Case 14)	AP 8-10
AP 8-11	Financial Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 1; Case 2)	AP 8-11
AP 8-12	Financial Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 2; Case 2)	AP 8-12
Table AP 8-13	Financial Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 3; Case 2)	AP 8-13
8-14	Financial Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 1; Case 14)	AP 8-14
8-15	Financial Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 2; Case 14)	AP 8-15
8-16	Financial Construction Costs for Each Section of Suburban MTS by Year in 1978 Prices (Alternative 3; Case 14)	AP 8-16
8-17	Economic Construction Costs for Each Section of SRT by Year in 1978 Prices (Alternative 1, 2, 3; Case 2)	AP 8-17
8-18	Economic Construction Costs for Each Section of SRT by Year in 1978 Prices (Alternative 1, 2, 3; Case 14)	AP 8-17
8-19	Financial Construction Costs for Each Section of SRT by Year in 1978 Prices (Alternative 1, 2, 3; Case 2)	AP 8-18
8-20	Financial Construction Costs for Each Section of SRT by Year in 1978 Prices (Alternative 1, 2, 3; Case 14)	AP 8-18



**APPENDIX  
CHAPTER 2**

**EXISTING TRANSPORT SYSTEM  
AND TRAFFIC SURVEY**





Table AP 2-1 AVERAGE DAILY TRAFFIC BY VEHICLE TYPE AND YEAR

No. Km.	Route No.	Control Section	Terminal	Year	Average Daily Traffic by Type								Total	Increasing Ratio 1972 = 100	% Bus & Truck
					Car & Taxi	Light Bus	Heavy Bus	Light Trucks	Heavy Trucks	Trucks Over 2 Axles					
1 (24,684)	1	01	Bangkok	1972	5,761	727	2,287	805	941	437	10,958	100	33		
				1973	7,734	1,334	2,658	929	1,049	854	14,558	133	31		
				1974	6,536	1,059	1,587	1,525	697	361	11,764	107	22		
				1975	9,229	1,875	2,299	1,344	1,258	508	16,513	151	25		
				1976	7,414	2,290	2,482	1,721	1,628	881	16,417	150	30		
				1977	7,780	1,554	2,229	1,063	1,071	959	14,656	134	29		
				1972	6,053	334	1,213	2,513	2,049	1,137	13,299	100	33		
2 (35,000)	02	Don Muang	1973	8,602	378	1,565	3,504	2,934	1,887	18,870	142	34			
			1974	7,607	363	1,416	3,702	2,632	2,971	18,691	141	34			
			1975	7,698	1,927	1,792	1,863	2,029	2,831	18,140	136	37			
			1976	8,983	2,405	2,178	2,299	2,440	3,180	21,485	162	36			
			1977	10,805	3,147	2,610	2,412	2,789	4,715	26,478	199	38			
			1972	14,664	1,750	2,758	2,271	3,119	15	24,575	100	24			
			1973	13,379	1,775	1,946	3,477	3,158	51	24,786	101	21			
61 (16,680)	3	02	Bangkok	1974	17,196	995	2,856	3,349	3,857	1,535	28,788	117	29		
				1975	15,316	1,615	2,334	3,172	3,350	1,737	27,524	112	27		
				1976	17,324	2,875	3,038	5,035	4,485	2,305	35,063	143	28		
				1977	14,902	1,593	2,257	2,581	2,749	1,581	25,663	104	26		
				1972	13,593	1,709	1,754	2,136	2,661	261	22,114	100	21		
				1973	14,702	2,193	2,018	2,151	2,899	365	24,328	110	22		
				1974	13,881	2,595	2,021	2,344	2,825	1,364	25,030	113	25		
62 (20,200) 1976 (20,000)	02	02	Bangkok	1975	15,232	3,124	2,144	3,433	3,295	1,478	28,706	130	24		
				1976	13,788	4,111	2,075	4,064	3,824	1,860	29,725	134	26		
				1977	3,354	2,891	302	1,371	866	383	9,167	41	17		
				1972	480	442	117	264	145	986	2,434	100	51		
				1973	597	550	95	375	146	1,311	3,074	126	50		
				1974	473	478	276	234	214	738	2,413	99	51		
				1975	596	575	108	538	915	22	2,754	113	38		
63 (74,650)	03		Bangpakong	1976	543	568	105	572	823	22	2,635	108	36		
				1977	601	635	98	625	1,158	12	3,129	129	41		

No. Km.	Route No.	Control Section	Terminal	Year	Average Daily Traffic by Type										Increasing Ratio 1972 = 100	% Bus & Truck
					Car & Taxi	Light Bus	Heavy Bus	Light Trucks	Heavy Trucks	Trucks Over 2 Axles	Total					
75 (16,000)	4	01	Bangkok	1972	16,663	2,896	3,006	2,986	2,718	396	28,665	100	21			
				1973	16,968	2,391	2,510	2,506	2,883	82	27,340	95	20			
				1974	-	-	-	-	-	-	-	-	-	-	-	
				1975	-	-	-	-	-	-	-	-	-	-	-	
76 (41,500)	4	0201	Bangkok	1972	6,167	836	972	1,328	1,465	2,110	12,878	100	35			
				1973	6,316	961	1,094	1,340	1,440	1,309	12,460	97	31			
				1974	6,481	880	1,156	1,170	1,559	2,947	1,4193	110	40			
				1975	7,162	866	1,174	1,162	1,907	3,241	15,512	120	41			
159 (20,700)	31	01	Lat Phrao	1972	---	DATA	NOT AVAILABLE	---	---	---	28,604	100	-			
				1973	21,961	320	1,732	2,264	2,697	3,188	32,162	112	24			
				1974	23,109	272	2,032	2,330	2,812	2,575	33,130	116	22			
				1975	23,503	341	2,044	2,834	3,138	3,272	35,112	123	24			
167 (20,900)	34	01	Bang Na	1972	5,834	593	856	975	1,085	41	9,384	100	21			
				1973	5,942	621	931	922	96	193	9,573	130	22			
				1974	4,384	768	948	841	966	807	8,714	93	31			
				1975	4,585	618	849	874	989	1,173	9,048	96	33			
168 (20,900)	35	01	Thonburi	1972	---	DATA	NOT AVAILABLE	---	---	---	---	---	-			
				1973	---	DATA	NOT AVAILABLE	---	---	---	---	---	---	-		
				1974	3,052	289	341	598	690	492	5,462	-	28			
				1975	3,717	337	493	791	886	645	6,869	-	29			
			Pak Tho	1976	3,407	461	490	856	734	638	6,602	-	28			
				1977	2,731	421	602	982	998	1,029	6,753	-	39			

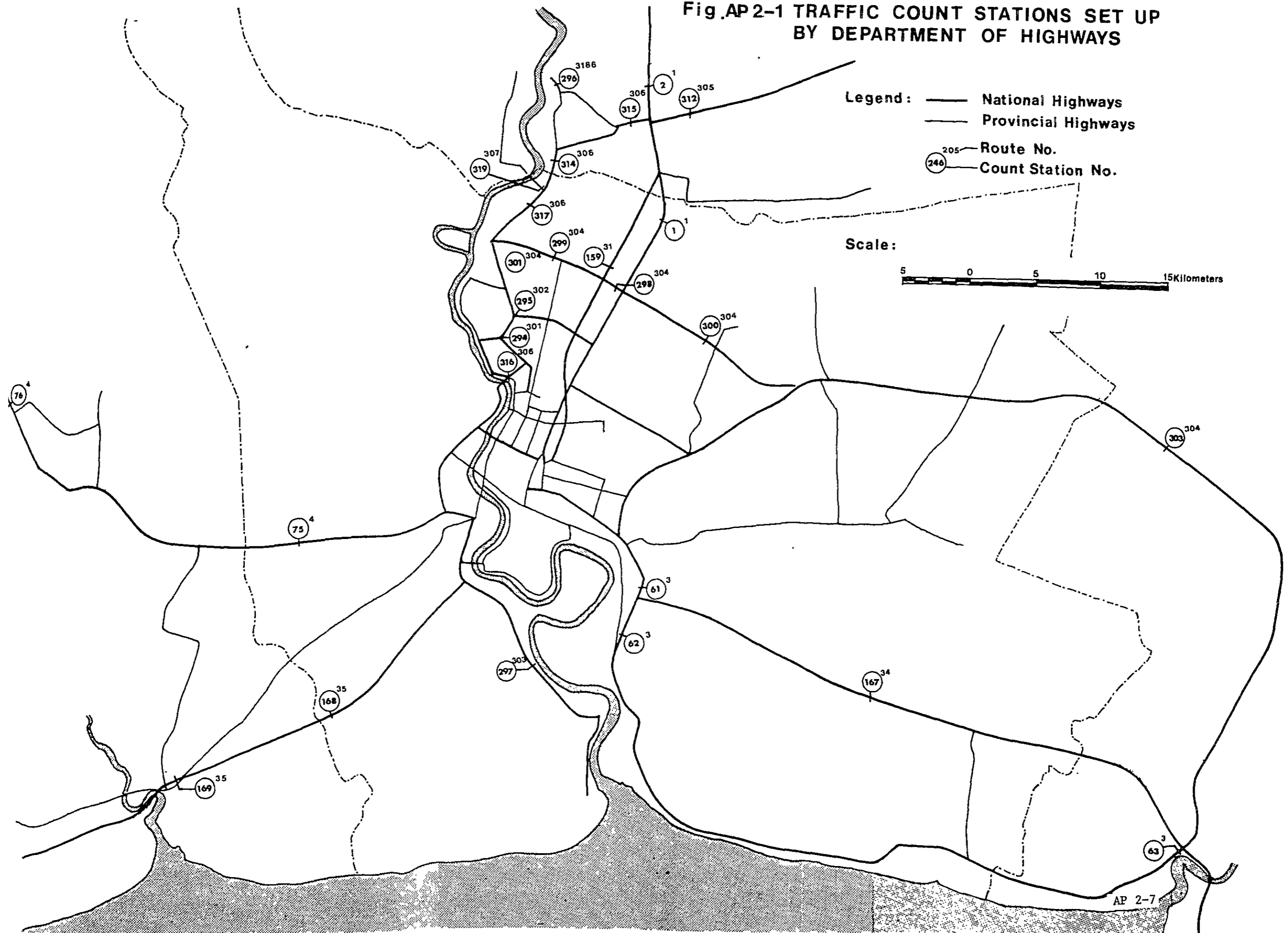
No. Km.	Route No.	Control Section	Terminal	Year	Car & Taxi	Light Bus	Heavy Bus	Light Trucks	Heavy Trucks	Trucks Over 2 Axles	Total	Increasing Ratio 1972 = 100	% Bus & Truck		
169 (30,700)	35	01	Thonburi	1972	-	-	-	-	-	-	-	-	-		
				1973	--	DATA NOT AVAILABLE	333	539	---	398	3,439	-	-		
				1974	2,100	194	425	791	641	586	5,193	-	-		
				1975	2,358	392	634	980	750	726	7,067	-	-		
				1976	3,374	575	505	1,182	983	903	6,756	-	-		
				1977	2,725	458	945	1,849	753	94	9,896	100	18		
				1972	5,430	825	976	2,119	1,721	119	17,433	176	16		
294 (5,175)	301	01	Bangkok	1973	12,022	476	1,795	2,043	2,648	775	19,388	196	27		
				1974	11,495	632	911	2,125	1,952	366	16,748	169	19		
				1975	10,880	514	785	1,660	1,757	343	16,309	165	18		
				1976	10,654	1,110	854	2,588	1,673	691	16,458	166	20		
				1977	9,182	1,470	346	1,370	1,073	184	14,109	100	12		
				1972	10,276	860	375	1,883	2,712	153	15,856	112	20		
				1973	10,009	724	1,079	890	3,020	334	16,138	114	27		
295 1973 (2,340) (6,340)	302	01	Bangkok	1974	9,932	883	526	2,027	2,532	248	14,954	106	22		
				1975	8,903	898	519	1,604	1,407	162	12,028	85	17		
				1976	7,297	1,039	341	1,176	815	287	13,558	96	11		
				1977	10,035	904	1,957	1,465	1,958	52	12,830	100	31		
				1972	10,276	860	375	1,883	2,712	153	15,856	112	20		
				1973	10,009	724	1,079	890	3,020	334	16,138	114	27		
				1974	9,932	883	526	2,027	2,532	248	14,954	106	22		
296 (5,500)	303	01	Dao Khanong	1975	8,903	898	519	1,604	1,407	162	12,028	85	17		
				1976	7,297	1,039	341	1,176	815	287	13,558	96	11		
				1977	10,035	904	1,957	1,465	1,958	52	12,830	100	31		
				1972	7,210	188	3,795	3,262	4,072	64	12,111	94	65		
				1973	9,681	237	-	-	-	-	-	-	-		
				1974	-	-	-	-	-	-	-	-	-		
				1975	-	-	-	-	-	-	-	-	-		
297 (14,000)	01	01	Pom Phra Chun	1976	-	DATA NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	
				1977	--	-	-	-	-	-	-	-	-	-	-
				1972	7,441	282	1,613	1,716	1,881	752	13,685	100	31		
				1973	8,880	388	520	1,821	1,611	132	13,352	98	17		
				1974	11,654	672	471	1,721	1,583	533	16,634	122	16		
				1975	11,956	1,012	467	1,815	1,503	866	17,359	127	17		
				1976	12,864	2,309	168	2,149	1,609	1,064	20,163	147	14		
1977	15,233	3,217	401	3,381	1,872	1,747	25,851	189	16						

No. Km.	Route No.	Control Section	Terminal	Year	Average Daily Traffic by Type										Increasing Ratio 1972 = 100	% Bus & Truck
					Car & Taxi	Light Bus	Heavy Bus	Light Trucks	Heavy Trucks	Trucks Over 2 Axles	Total					
298 (0.05)	304	01	Pak Kret	1972	4,513	476	472	599	625	60	6,745	100	17			
				1973	5,666	1,181	545	750	1,124	209	9,475	140	20			
				1974	5,782	832	726	579	895	284	9,098	135	21			
				1975	-	-	-	-	-	-	-	-	-	-		
				1976	2,595	397	254	635	745	193	4,819	71	-			
1977	3,430	627	413	637	1,052	185	6,344	94	26							
299 ( 6,000)		01	Pak Kret	1972	1,960	417	297	367	1,168	132	4,341	100	37			
				1973	2,072	532	227	494	1,670	202	5,197	120	40			
				1974	1,851	413	207	307	1,114	199	4,091	94	37			
				1975	2,576	366	230	612	729	172	4,685	108	24			
				1976	3,699	558	376	637	692	404	6,366	147	23			
1977	3,430	629	413	637	1,052	185	6,344	146	26							
300 ( 8,000)		01	Lak Si	1972	1,798	92	237	397	514	75	3,113	100	27			
				1973	4,149	520	524	726	1,599	674	8,192	263	34			
				1974	3,896	550	652	760	1,191	458	7,507	241	31			
				1975	3,887	696	699	883	1,057	526	7,748	249	29			
				1976	3,252	563	531	680	1,041	270	6,339	204	29			
1977	3,918	1,000	834	837	1,188	729	8,506	273	32							
301 (10,750)		01	Si Rapsuk	1972	1,267	427	282	227	595	36	2,834	100	32			
				1973	1,438	873	475	358	804	83	4,031	142	34			
				1974	2,209	1,301	793	706	646	26	5,681	200	26			
				1975	2,616	446	259	590	816	208	4,935	174	26			
				1976	2,986	1,215	662	803	707	88	6,461	228	23			
1977	-	CATA NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	-	-	-	-	-							
302 (46,000)				1972	933	229	192	215	190	442	2,201	-	38			
				1973	-	-	-	-	-	-	-	-	-			
				1974	-	-	-	-	-	-	-	-	-			
				1975	-	DATA	NOT AVAILABLE	NOT AVAILABLE	-	-	-	-	-			
				1976	-	-	-	-	-	-	-	-	-			
1977	-	-	-	-	-	-	-	-	-							

No. Km.	Route No.	Control Section	Terminal	Year	Average Daily Traffic by Type								Increasing Ratio 1972 = 100	% Bus & Truck
					Car & Taxi	Light Bus	Heavy Bus	Light Trucks	Heavy Trucks	Trucks Over 2 Axles	Total			
302 (46,000)		02	Lak Si	1972	1,267	427	282	227	595	36	2,834	100	32	
				1973	1,438	873	475	358	804	83	4,031	142	34	
				1974	2,209	1,301	793	706	646	26	5,681	200	26	
				1975	2,116	446	253	590	816	208	4,935	174	26	
				1976	2,986	1,215	662	803	707	88	6,461	228	23	
				1977	-	DATA NOT AVAILABLE	-	-	-	-	-	-	-	-
303 (47,000)		02	Minburi	1972	501	94	130	122	105	165	1,121	100	36	
				1973	819	69	130	200	71	252	1,541	137	29	
				1974	773	62	125	183	109	172	1,424	127	29	
				1975	963	90	138	187	136	191	1,705	152	27	
				1976	1,109	124	136	235	219	68	1,891	169	22	
				1977	1,374	173	165	279	199	245	2,435	217	25	
304 (51,000)	304	02	Lak Si	1972	396	78	63	78	88	134	837	-	34	
				1973	-	-	-	-	-	-	-	-	-	
				1974	-	-	-	-	-	-	-	-	-	
				1975	-	DATA NOT AVAILABLE	-	-	-	-	-	-	-	
				1976	-	-	-	-	-	-	-	-	-	
				1977	-	-	-	-	-	-	-	-	-	
312 ( 4,500)	305	01	Rangsit	1972	1,859	201	207	294	284	129	2,974	100	21	
				1973	1,933	279	218	329	190	83	3,032	102	16	
				1974	1,595	563	214	327	201	108	3,008	101	17	
				1975	1,695	848	218	623	236	133	3,753	126	17	
				1976	1,847	1,033	226	828	298	160	4,392	148	16	
				1977	1,909	1,042	256	793	304	187	4,491	151	17	
314 ( 0.050)	306	02	Bang Phum	1972	-	-	-	-	-	-	-	-	-	
				1973	-	-	-	-	-	-	-	-	-	
				1974	2,165	352	454	284	1,086	714	5,055	-	45	
				1975	-	-	-	-	-	-	-	-	-	
				1976	-	DATA NOT AVAILABLE	-	-	-	-	-	-	-	
				1977	-	-	-	-	-	-	-	-	-	

No. Km.	Route No.	Control Section	Terminal	Year	Average Daily Traffic By Type										Increasing Ratio 1972 = 100	% Bus & Truck
					Car & Taxi	Light Bus	Heavy Bus	Light Trucks	Heavy Trucks	Trucks Over 2 Axles	Total					
315 ( 7,464)	306		Bang Phum	1972	1,427	215	306	264	1,346	803	4,351	100	56			
				1973	2,215	282	338	313	1,288	815	5,251	121	46			
				1974	2,240	335	416	224	627	508	4,350	100	36			
				1975	2,240	363	435	340	648	441	4,467	103	34			
				1976	2,591	827	981	849	738	664	6,650	153	36			
				1977	2,097	1,029	1,007	731	765	860	149	41				
316 ( 2,715)		02	Phra Ram VI	1972	6,461	851	1,982	946	774	86	11,100	100	26			
				1973	7,742	1,008	2,514	1,110	854	156	13,384	121	26			
				1974	5,975	759	1,181	1,330	566	117	9,928	89	19			
				1975	4,921	999	1,304	1,042	674	15	8,955	81	22			
				1976	6,516	1,251	1,054	1,175	568	46	10,610	96	16			
				1977	9,083	1,536	1,897	1,042	661	194	130	19				
317 (17,005)		02	Phra Ram VI	1972	2,930	565	478	762	1,426	423	6,584	100	35			
				1973	3,568	556	485	801	1,725	397	7,532	114	35			
				1974	3,270	576	717	574	1,820	483	7,440	113	41			
				1975	3,452	445	450	936	2,121	467	7,891	120	39			
				1976	3,843	570	444	918	2,192	480	8,447	128	37			
				1977	5,125	682	522	1,484	2,326	1,157	172	35				
319 (0.5)	307	01	Tiwanon	1972	2,186	46	278	378	600	179	3,667	100	29			
				1973	2,661	10	284	609	568	176	4,308	117	24			
				1974	2,608	133	380	329	854	318	4,622	126	34			
				1975	2,136	127	301	865	1,090	232	4,751	130	35			
				1976	2,420	161	310	993	1,300	354	5,538	151	35			
				1977	2,966	367	272	951	1,051	314	161	28				

Fig. AP 2-1 TRAFFIC COUNT STATIONS SET UP BY DEPARTMENT OF HIGHWAYS



Handwritten text, possibly a signature or date, located at the bottom center of the page.



Table AP 2-2 COMMERCIAL VEHICLES REGISTERED IN CENTRAL REGION BY CHANGWAT

Changwat, Central Region	1970	1971	1972	1973	1974	1975	1976	1977
Bangkok	33,020	43,675	43,260	46,189	48,216	43,199	61,474	68,579
Nonthaburi	849	772	1,179	1,305	1,447	1,758	1,909	(2,044)
Samut Prakan	840	950	816	1,516	1,912	2,194	2,457	(2,631)
Pathum Thani	200	236	269	352	471	610	718	(810)
Nakhon Pathom	4,349	4,757	5,440	6,482	8,338	9,913	12,725	(14,244)
Ratchaburi	2,518	2,689	3,178	3,508	3,848	4,364	4,856	(5,676)
Phetchaburi	1,891	2,640	2,538	3,036	3,674	4,362	5,044	(5,842)
Singburi	423	438	540	542	267	1,031	1,402	(1,383)
Kanchanaburi	3,510	3,584	3,853	3,963	7,233	8,289	7,773	(10,109)
Chonburi	12,253	13,215	14,269	15,579	24,277	24,858	30,583	(35,253)
Chanthaburi	2,331	2,733	3,340	3,297	4,453	4,835	5,379	(6,406)
Chai Nat	693	763	663	725	777	980	1,126	(1,199)
Prachuap Khiri Khan	806	1,125	1,070	1,245	1,650	1,870	2,205	(2,578)
Chachoengsao	658	783	948	1,152	1,423	1,695	2,092	(2,444)
Samut Sakhon	572	655	663	759	1,073	1,011	1,051	(1,284)
Samut Songkhram	124	112	147	209	328	397	660	(663)
Lopburi	1,727	2,129	2,207	2,506	3,311	4,057	4,331	(5,203)
Suphanburi	1,944	2,579	2,738	3,181	3,618	4,540	5,862	(6,451)
Phra Nakhon Si Ayuthaya	1,019	1,135	1,298	1,458	1,751	1,813	2,008	(2,445)
Ang Thong	288	244	298	330	611	729	805	(951)
Nakhon Nayok	526	410	696	729	501	638	863	(853)
Trat	530	614	659	867	1,113	1,261	1,487	(1,764)
Saraburi	4,064	4,277	2,764	3,576	4,460	5,428	6,176	(6,479)
Prachinburi	642	736	840	921	1,127	1,324	1,579	(1,837)
Rayong	3,302	2,863	3,173	4,146	4,759	5,394	6,360	(7,227)

Source: Vehicle Registration Division, Police Department  
 Note : Figures in parentheses show the estimation by the Team



**APPENDIX  
CHAPTER 3**

**COMMUTER SERVICE  
BY RAILROAD TRANSPORT**



Table AP3-1-1 NUMBER OF COACHES COMPOSING EACH TRAIN

Departing Bangkok Station						Arriving Bangkok Station					
Train Number	Business Coaches	Dining Coaches	Sleeping Coaches	Passenger Coaches	Total Coaches	Train Number	Business Coaches	Dining Coaches	Sleeping Coaches	Passenger Coaches	Total Coaches
DRC 163	--	-	-	10	10	ORD 92	1	1	-	10	12
DRC 207	-	-	-	2	2	ORD 66	1	-	-	6	7
DRC 109	-	-	-	4	4	RAD 42	1	1	2	9	13
RAP 33	1	1	-	9	11	ORD 88	1	1	-	7	9
ORD 87	1	1	-	7	9	RAP 40	1	1	-	16	18
RAP 31	1	1	-	12	14	RAP 48	1	2	2	13	18
ORD 61	1	1	-	7	9	RAP 30	1	1	-	11	13
DRC 203	-	-	-	6	6	RAP 38	1	1	1	15	18
DRC 159	-	-	-	6	6	EXP 2	1	1	4	5	11
DRC 233	-	-	-	2	2	EXP 4	2	1	4	3	10
DRC 211	-	-	-	4	4	EXP 8	2	1	8	3	14
ORD 89	1	1	-	10	12	EXP 12/16	2	2	12	2	18
DRC 231	-	-	-	2	2	DRC 222	-	-	-	8	8
DRC 219	-	-	-	4	4	DRC 202	-	-	-	6	6
DRC 161	-	-	-	4	4	DRC 166	-	-	-	6	6
ORD 251	1	1	-	4	6	DRC 224	-	-	-	4	4
RAP 43	1	2	2	13	18	DRC 210	-	-	-	4	4
DRC 213	-	-	-	4	4	RAP 44	1	2	2	13	18
ORD 225	1	1	-	5	7	DRC 228	-	-	-	4	4
ORD 253	1	1	-	4	6	DRC 106	-	-	-	6	6
DRC 117	-	-	-	4	4	ORD 254	1	1	-	4	6
ORC 105	-	-	-	6	6	DRC 164	-	-	-	4	4
EXP 19	1	1	3	6	11	DRC 208	-	-	-	2	2
RAP 37	1	1	-	15	17	EXP 20	1	1	3	6	11
ORD 63	1	1	-	8	10	ORC 118	-	-	-	4	4
DRC 223	-	-	-	4	4	ORD 252	1	1	-	4	6
EXP 11/15	2	2	12	2	18	ORD 226	1	1	-	5	7
DRC 227	-	-	-	4	4	ORD 62	1	1	-	8	10
DRC 209	-	-	-	6	6	ORD 90	1	1	-	10	12
DRC 221	-	-	-	6	6	DRC 212	-	-	-	6	6
DRC 201	-	-	-	6	6	DRC 232	-	-	-	2	2
RAP 47	1	2	2	13	18	ORD 94	1	1	-	10	12
EXP 7	2	1	8	3	14	DRC 234	-	-	-	2	2
ORD 91	1	1	-	10	12	DRC 204	-	-	-	6	6
RAP 29	1	1	-	8	10	DRC 220	-	-	-	4	4
RAP 39	1	1	-	13	15	RAP 34	1	1	-	6	8
RAP 41	1	1	2	9	13	RAP 32	1	1	-	9	11
ORD 93	1	1	-	10	12	DRC 160	-	-	-	6	6
EXP 1	1	1	4	5	11	RAP 36	1	1	-	11	13
EXP 3	2	1	4	3	10	DRC 110	-	-	-	4	4
RAP 35	1	1	1	11	14	ORD 64	1	1	-	7	9
ORD 65	1	-	-	6	7	DRC 214	-	-	-	2	2
						DRC 162	-	-	-	4	4
<b>Total</b>	<b>27</b>	<b>26</b>	<b>38</b>	<b>277</b>	<b>368</b>	<b>Total</b>	<b>27</b>	<b>26</b>	<b>38</b>	<b>277</b>	<b>368</b>

Note: DRC = Diesel Railcar  
ORD = Ordinary Train  
RAP = Rapid Train  
EXP = Express Train  
MIX = Mix Train

Table AP3-1-2 NUMBER OF COACHES COMPOSING EACH TRAIN

Departing Thonburi Station					
MIX 355	1	-	-	1	2
MIX 349	1	-	-	1	2
DRC 169	-	-	-	4	4
DRC 171	-	-	-	2	2
ORD 177	2	-	-	4	6
MIX 345	1	-	-	2	3
ORD 179	-	-	-	4	4
DRC 197	-	-	-	2	2
ORD 175	3	-	-	6	9
DRC 173	-	-	-	6	6
RAP 45	3	2	1	10	16
	11	2	1	42	56
Arriving Thonburi Station					
ORD 176	3	-	-	6	9
DRC 174	-	-	-	6	6
RAP 46	3	2	1	10	16
MIX 346	1	-	-	2	3
DRC 198	-	-	-	2	2
ORD 178	2	-	-	4	6
MIX 356	1	-	-	1	2
ORD 180	-	-	-	4	4
DRC 170	-	-	-	4	4
DRC 172	-	-	-	2	2
MIX 350	1	-	-	1	2
	11	2	1	42	56

Note: DRC = Diesel Railcar  
 ORD = Ordinary Train  
 RAP = Rapid Train  
 EXP = Express Train  
 MIX = Mix Train

Table AP3-2 STATISTICS OF ROLLING STOCK CONSTRUCTION AS COMPLETED  
UP TO JUNE, 1977

a) Underframe and Running Gear.	Put in Service :	496 units
b) Bogie Flat Wagon.	" :	199 "
c) Bogie Low-Sided Wagon.	" :	144 "
d) Bogie High-Sided Wagon.	" :	24 "
e) Bogie Covered Goods Wagon.	" :	363 "
f) 4-Wheel Brake Van.	" :	70 "
g) Bogie Third Class Carriage.	" :	246 "
h) Bogie Full Van.	" :	9 "
i) Bogie Buffet Third Class Carriage.	" :	37 "
j) Bogie Second & Third Class Van.	" :	22 "
k) Bogie Third Class Van.	" :	20 "
l) Bogie Second Class Day & Night Coach.	" :	<u>31</u> "
Total		<u>1,657</u> units.

Fig. AP 3-1 NORTHERN & NORTHEASTERN LINE

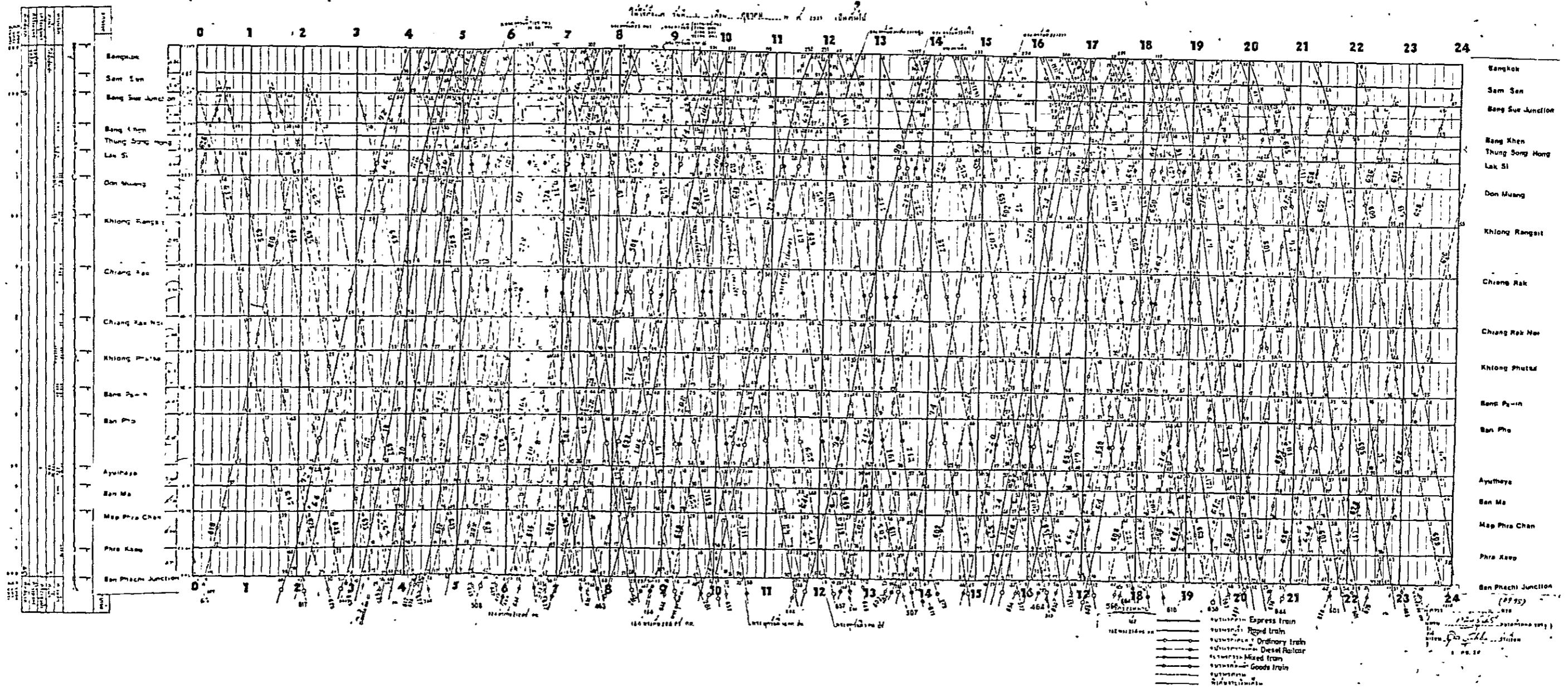




Fig. AP 3-2 NORTHERN LINE

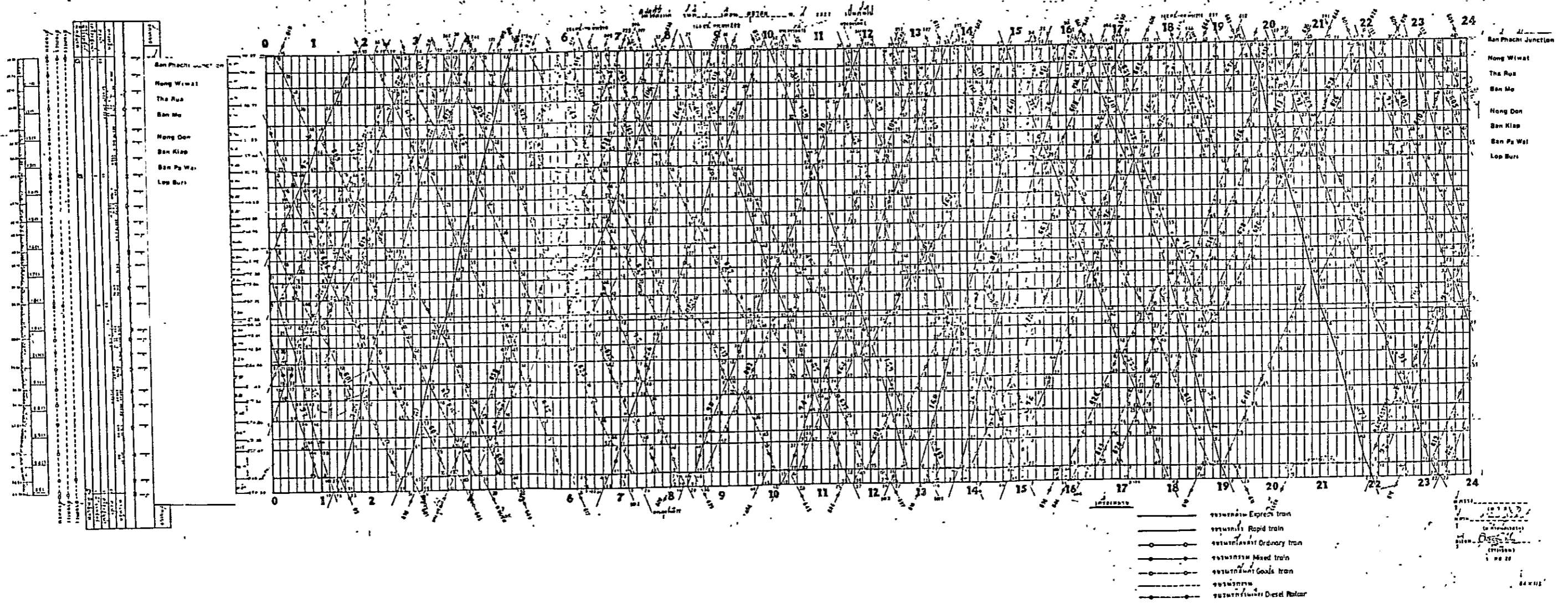


Fig. AP 3-3 NORTHEASTERN. LINE

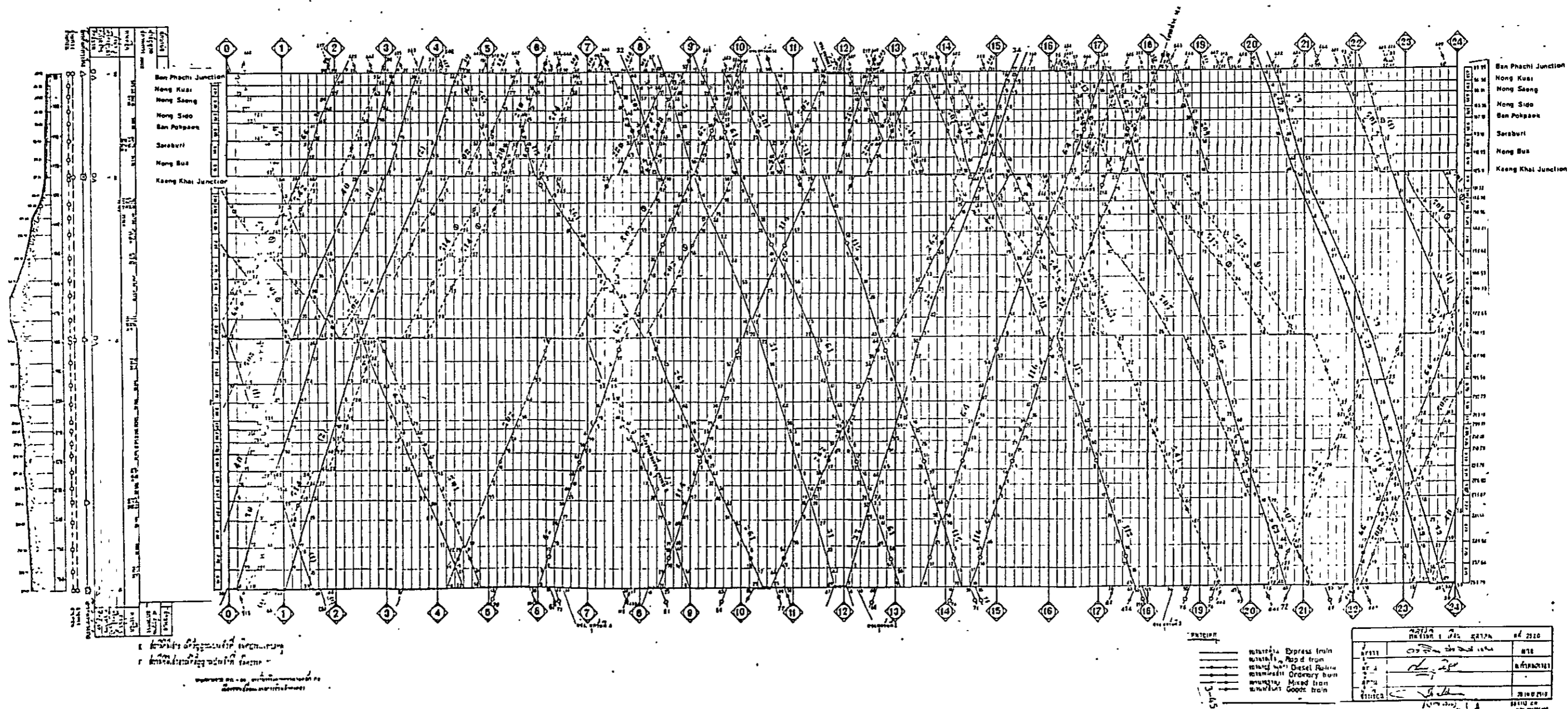


Fig. AP 3-4 EASTERN LINE

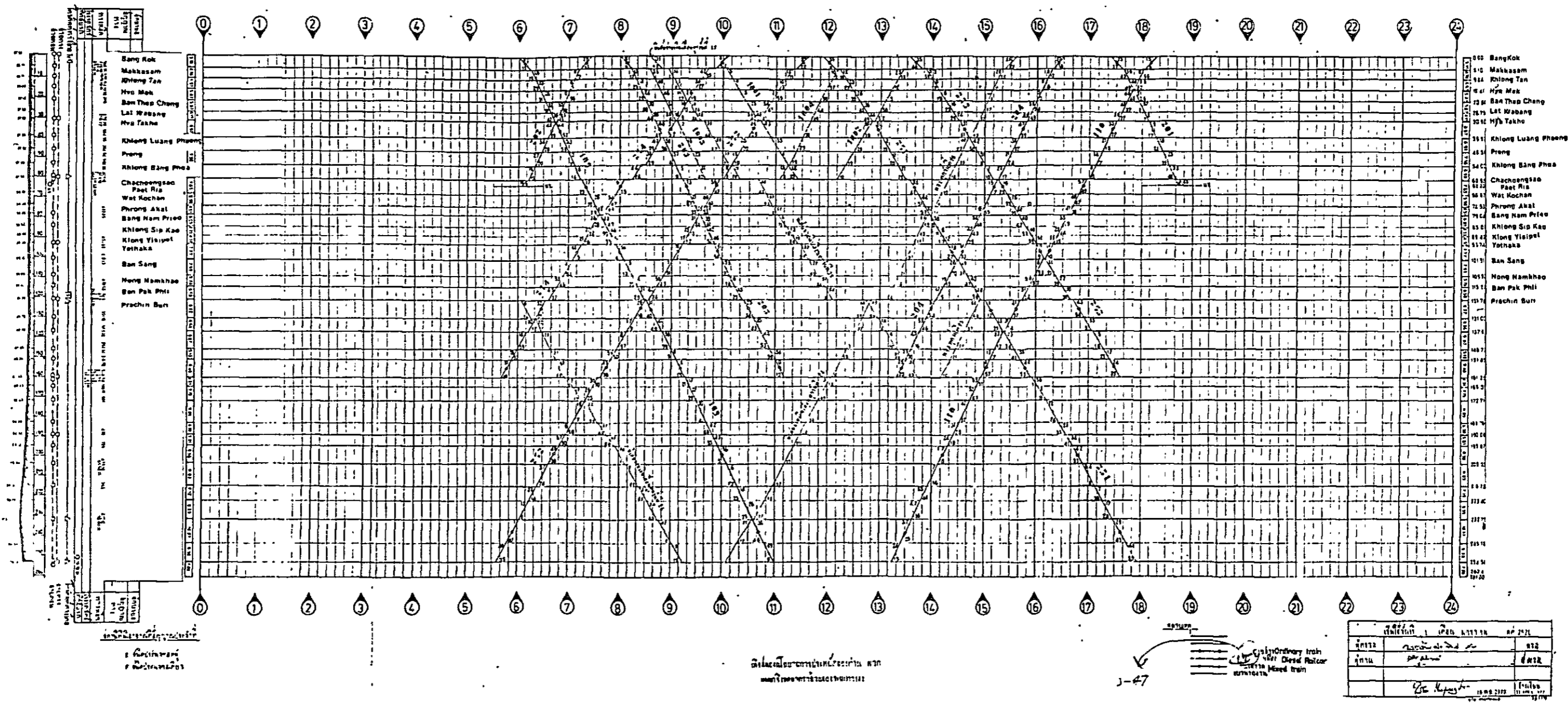


Fig. AP 3-5 SOUTHERN LINE

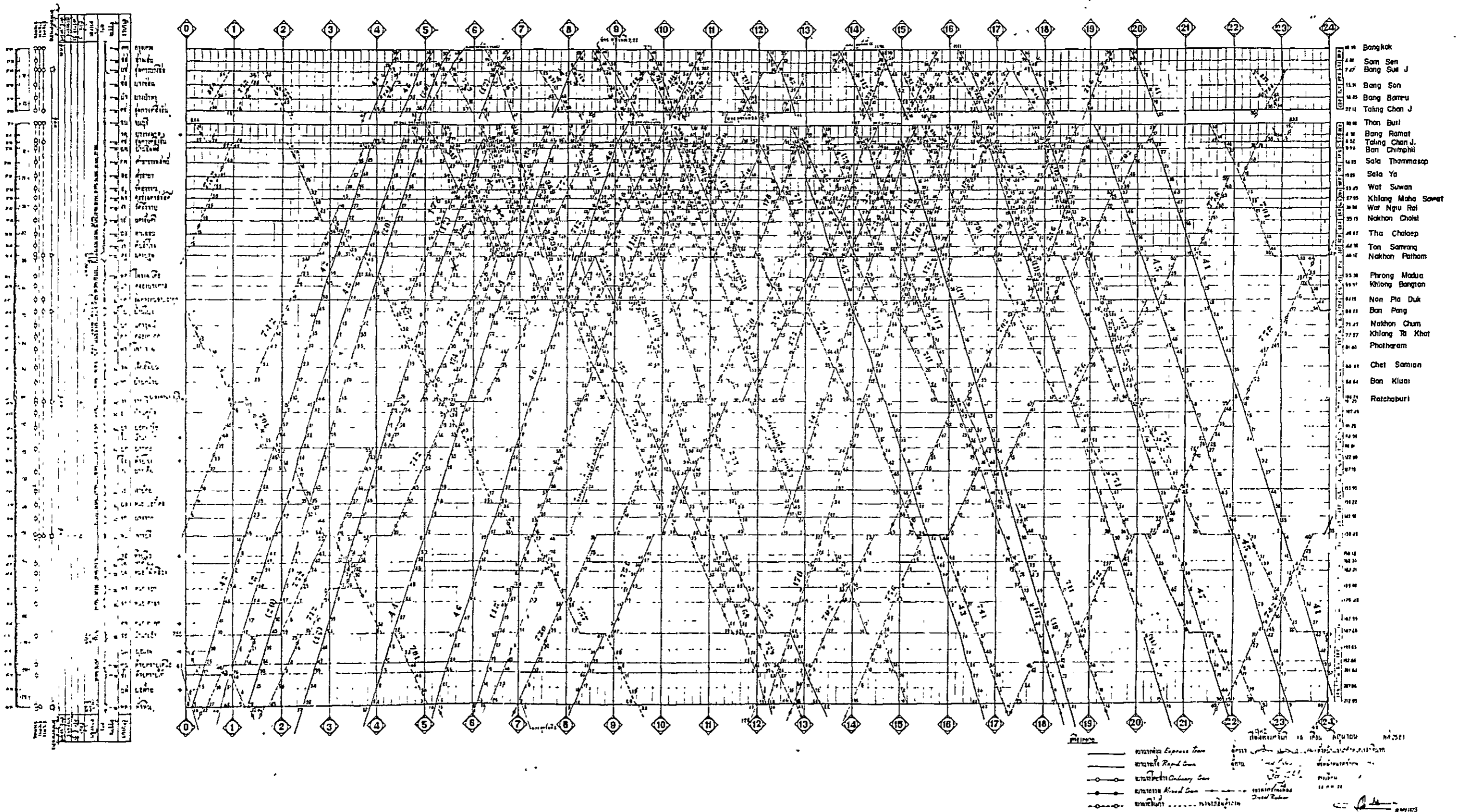
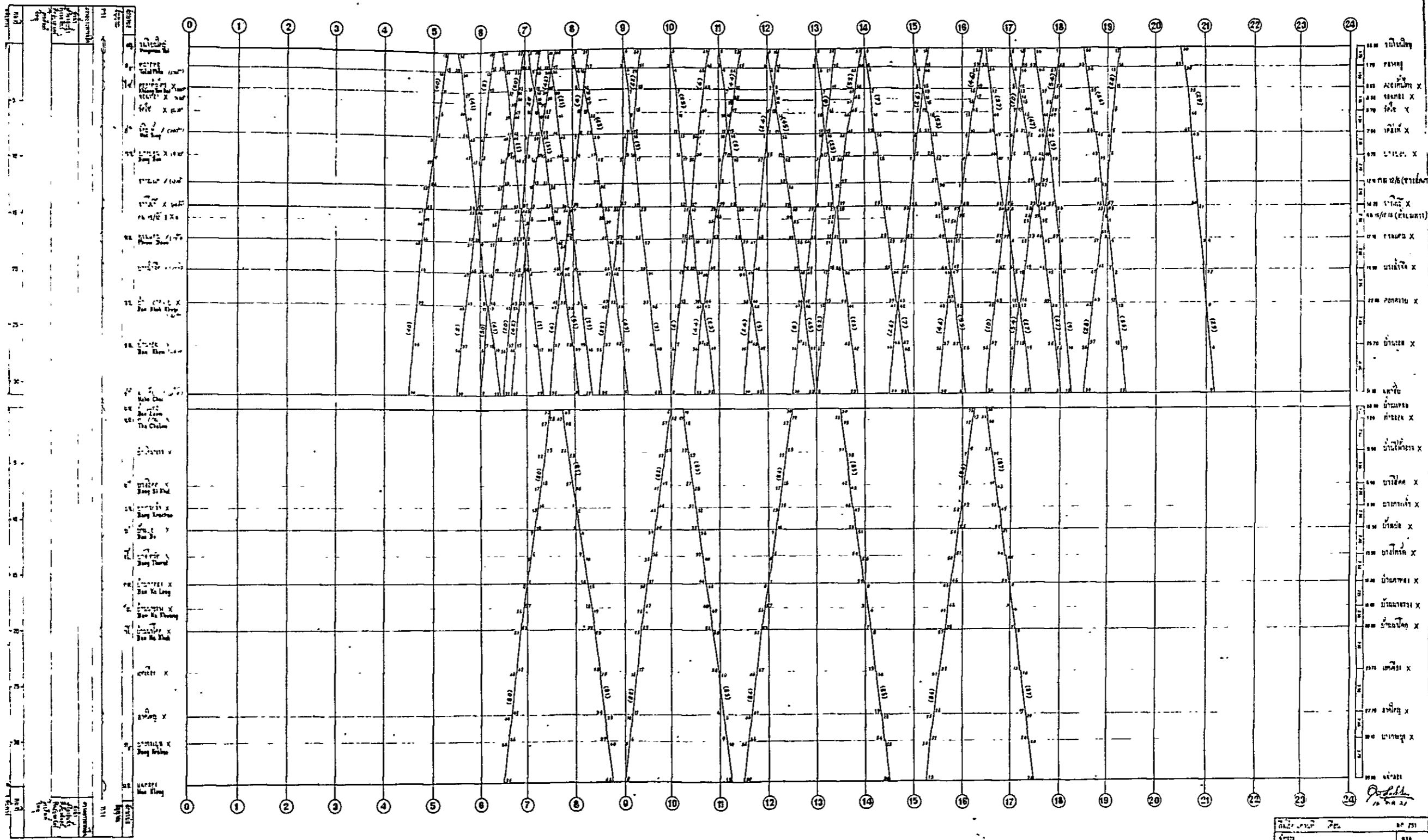


Fig. AP 3-6 MAE KLONG LINE



DATE	BY
NO.	REV.
DESCRIPTION	REVISION



**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		Romanization
	Initial	Final			
บ	B	p	Xɔ̌, Xɛ̌, X̌		a
จ, ฉ, ช, ฉ	Ch	t	ɛ̌X, ɛ̌Xɛ̌		ae
ด, ต	D	t	ɛ̌Xɔ̌		aeo
ฟ, ฟ	F	-	X̌, X̌, X̌, X̌, X̌, X̌		ai
ห, ฮ	H	-	X̌		am
ก	K	k	ɛ̌Xɔ̌, Xɔ̌		ao
ข, ค, ก	KH <sup>2</sup>	k	ɛ̌X, ɛ̌Xɛ̌, ɛ̌X̌		e
น, ญ	L	n	ɛ̌Xɔ̌, ɛ̌X̌		eo
ง, ฦ	Lu	-	X̌, X̌		i
ม	M	m	ɛ̌X̌, ɛ̌X̌		ia
ณ, น	N	n	ɛ̌X̌		ieo
ว	Ng	ng	X̌		iu
ป	P	p	X̌, X̌, ɛ̌X̌, X̌		o
ผ, พ, ภ	PH <sup>2</sup>	p	X̌, X̌, ɛ̌X̌, ɛ̌X̌		oe
ร	R	n	ɛ̌X̌		oei
ฤ, ฦ	Ri, Ru	-	X̌, X̌		oi
ศ, ส, ซ, ฦ	S	t	X̌, X̌, X̌, X̌, X̌		u
ฏ, ท	T	t	X̌, ɛ̌X̌, X̌		ua
ถ, ฒ, ฑ, ฒ, ฦ	TH <sup>2</sup>	t	X̌, ɛ̌X̌		uai
ด	W	vowel	X̌		ui
ย	Y	vowel	Special vowels	Without final	With final
ญ	Y	n			
อ	-	vowel	omitted letter understood		a
			อ		an
			อ		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".

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

BSTP <sup>1)</sup> ZONE	MTS ZONE <sup>2)</sup>	OMTP ZONE <sup>3)</sup>	OBRR ZONE <sup>4)</sup>
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	MTS 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, 270~272	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

- to be cont'd -

BSTP ZONE	MTS ZONE	OMTP 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 <sup>1]</sup>	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- <sup>1]</sup> 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 <sup>2]</sup>	1,766	1,896	1,990	1,934	2,090
(b) Non-tourists	39	28	139	263	(258)
(2) Thai passengers <sup>3]</sup>	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 <sup>1]</sup> 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:  $Y = 1.346 X - 152,801$  ( $r=0.993$ )

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	7.5%
1971	216	
1972	239	
1973	272	
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 PASSENGERS 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 previously 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 reconnaissance. 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 flights	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 calculated 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 <sup>1]</sup>	
(1) International air traffic:	2,683 thousand passengers per year
Departing (Attracted)	$2,683 \div 2 \div 365 \times 0.053 = 0.195$ (x 1000 pass./hr.)
Arriving (Generated)	$2,683 \div 2 \div 365 \times 0.016 = 0.059$ (x 1000 pass./hr.)
(2) Domestic air traffic:	209 thousand passengers per year
Departing (Attracted)	$209 \div 2 \div 365 \times 0.164 = 0.047$ (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)	$2,090 \div 2 \div 365 \times 0.016 \times 0.5 = 0.023$ (x1000 persons/hr.)
PS (Attracted)	$2,090 \div 2 \div 365 \times 0.053 \times 0.5 = 0.076$ (x1000 persons/hr.)

(P.T.O.)

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

Other air passengers:	593 thousand passengers per year
PW (Generated)	$593 \div 2 \div 365 \times 0.016 \times 1.0 = 0.013$ (x 1000 persons/hr.)
PS (Attracted)	$593 \div 2 \div 365 \times 0.053 \times 1.0 = 0.043$ (x 1000 persons/hr.)
(2) Domestic air traffic	209 thousand passengers per year
PW (Generated)	None
PS (Attracted)	$209 \div 2 \div 365 \times 0.164 \times 0.5 = 0.023$ (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<sup>1]</sup> 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 Com- mercial Vehicles in 2000	Adjusted Com- mercial 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
GBA without M. BKK	Total of the above Control Total (Frame)	4,675	16,221	35,306
		4,675	35,306	35,306
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
Sirguburi	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 GBA	Total of the above Control Total (Frame)	121,101	348,586	623,991
		121,101	623,991	623,991

Fig. AP 5-1

PROPOSED TRANSPORTATION FACILITIES



TRUCK TERMINALS



OUTER RING ROAD & FIRST STAGE EXPRESSWAYS



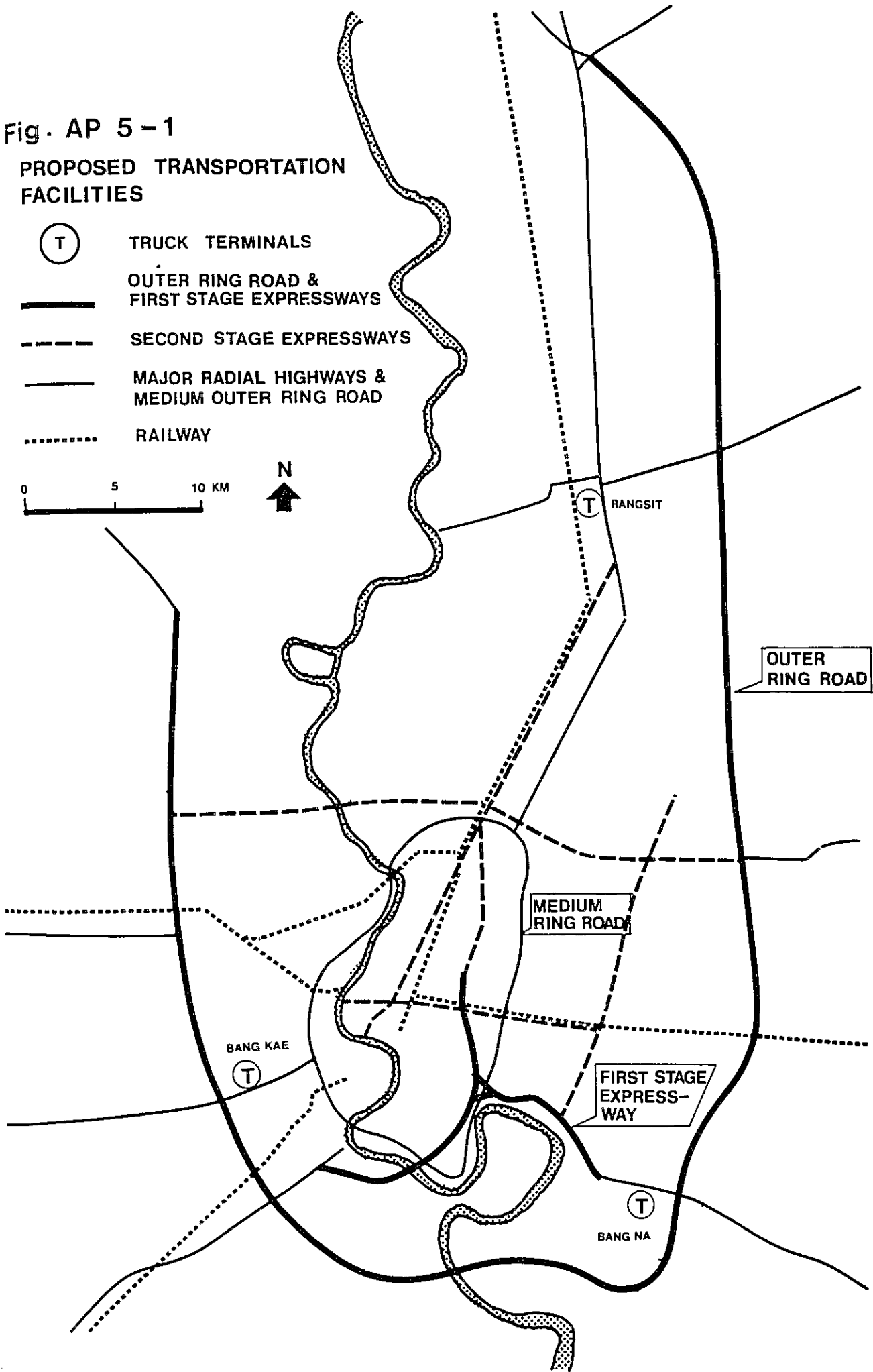
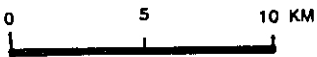
SECOND STAGE EXPRESSWAYS



MAJOR RADIAL HIGHWAYS & MEDIUM OUTER RING ROAD



RAILWAY

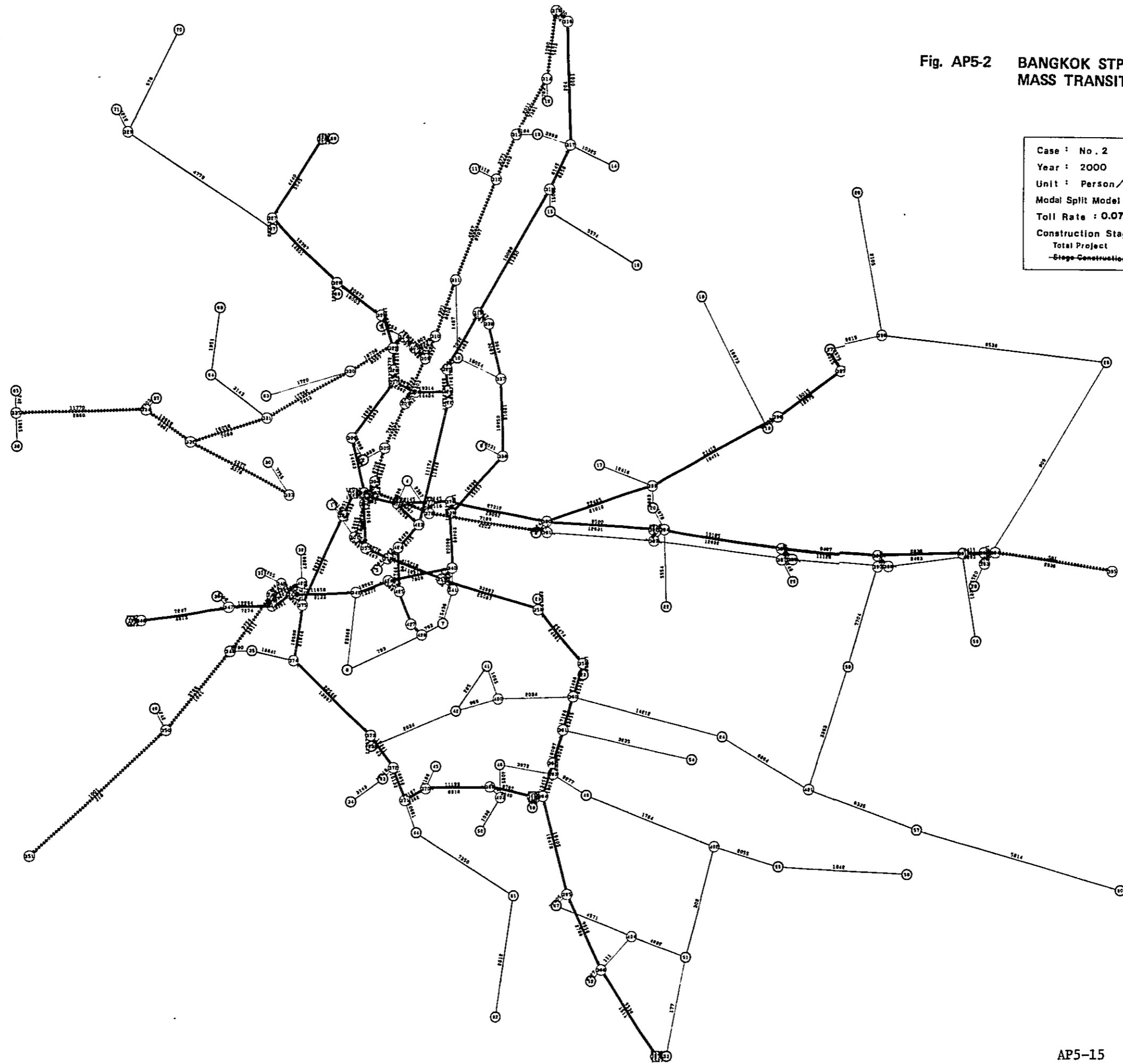




AP5-6 Estimated Traffic Volume on the Transportation  
Network in Typical Alternative Cases, 2000

- Fig. AP5-2      Case 2      Toll Rate: 0.078 Baht/km  
Whole sections of suburban MTS were constructed
- Fig. AP5-3      Case 5      Toll Rate: 0.078 Baht/km  
Whole sections of suburban MTS were not constructed
- Fig. AP5-4      Case 14      Toll Rate: 0.296 Baht/km  
Whole section of suburban MTS were constructed
- Fig. AP5-5      Case 5'      Toll Rate: 0.296 Baht/km  
Whole section of suburban MTS were not constructed
- Fig. AP5-6      Assigned Traffic Volume on the future planning road  
network in the Case 5'.

Fig. AP5-2 BANGKOK STP ESTIMATED TRAFFIC MASS TRANSIT SYSTEM NETWORK



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-No-



Fig. AP5-3 BANGKOK STP ESTIMATED TRAFFIC MASS TRANSIT SYSTEM NETWORK

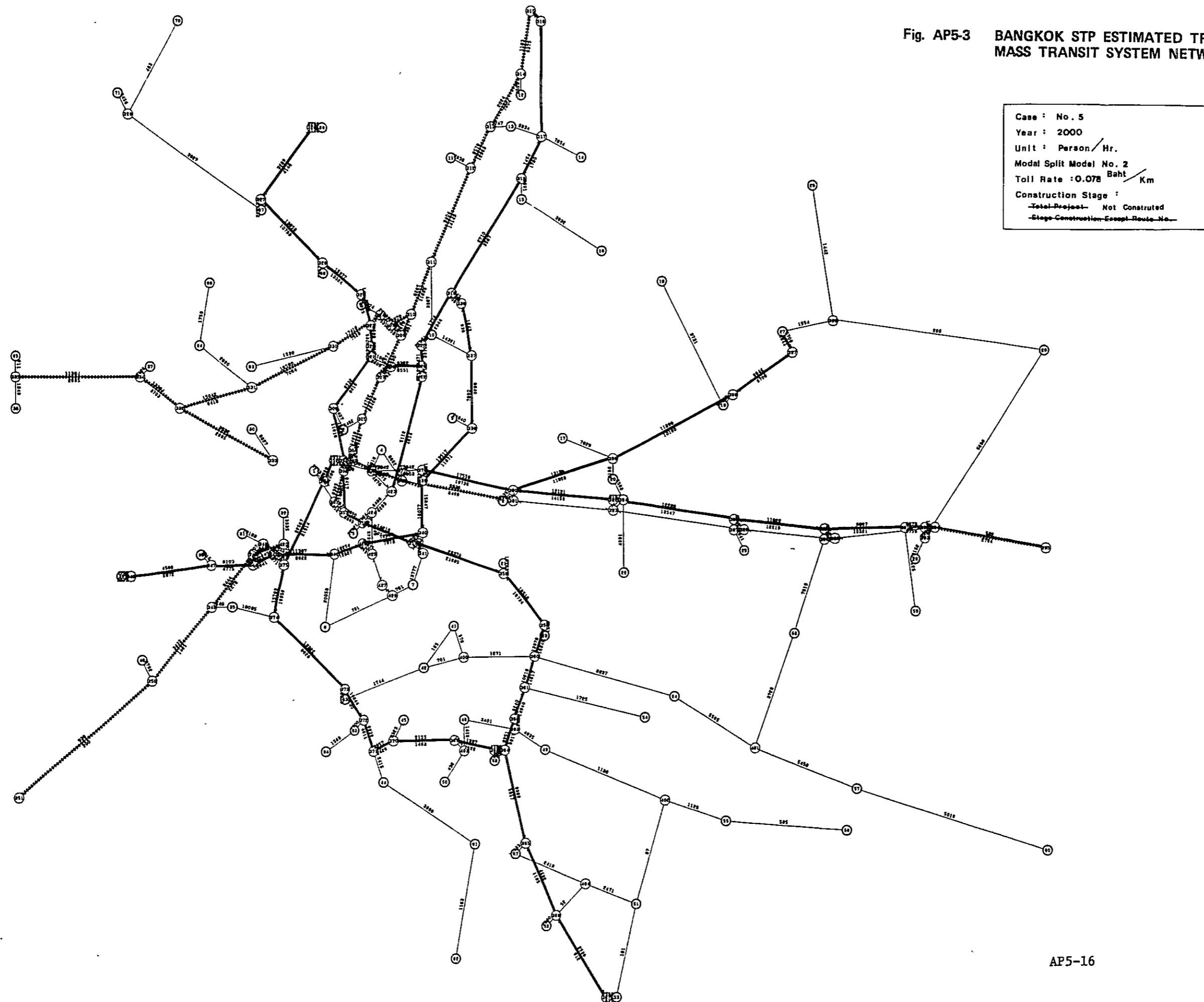
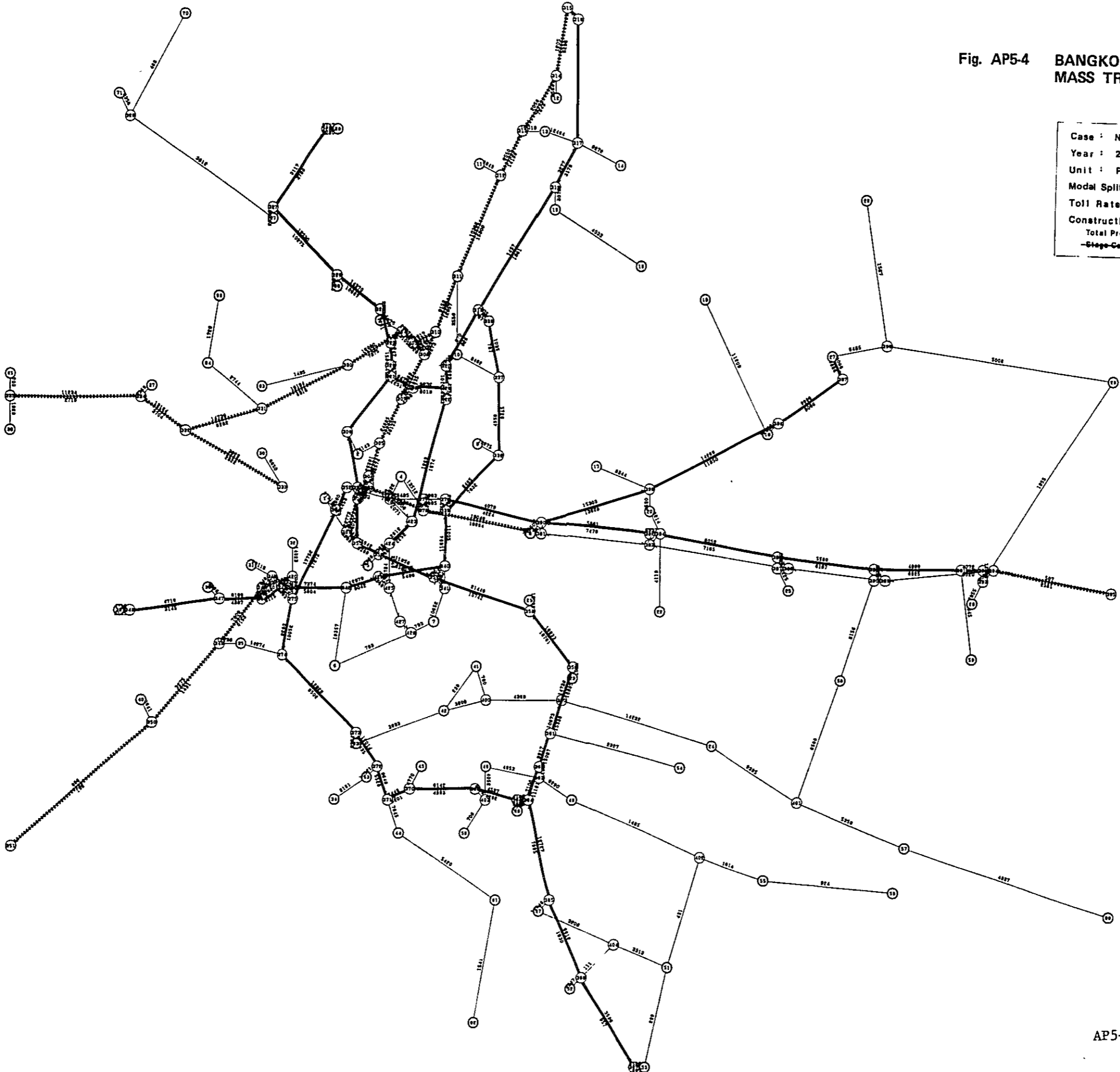
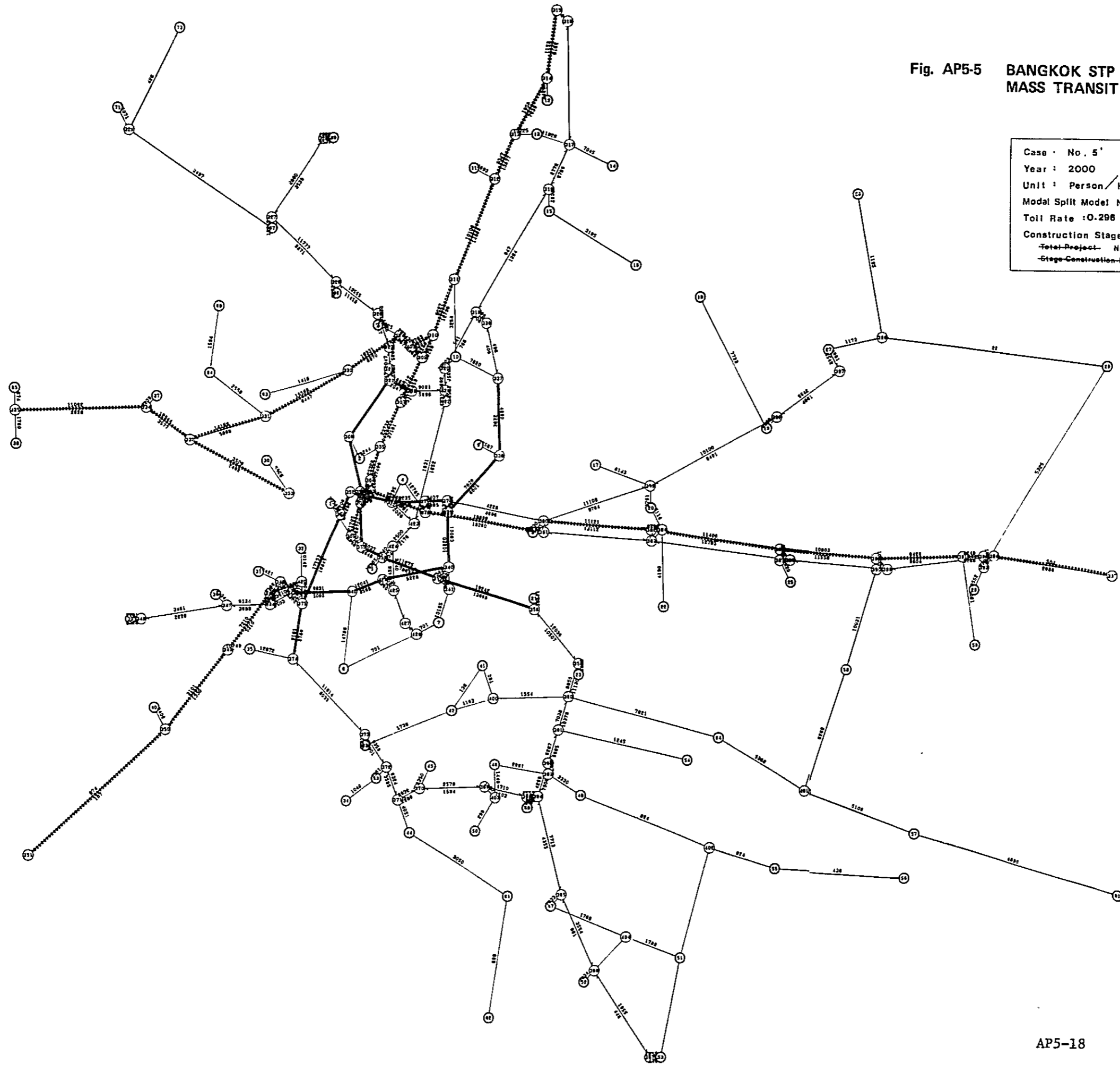


Fig. AP5-4 BANGKOK STP ESTIMATED TRAFFIC MASS TRANSIT SYSTEM NETWORK



Case : No. 14  
 Year : 2000  
 Unit : Person / Hr.  
 Modal Split Model No. 2  
 Toll Rate : 0.296 Baht / Km  
 Construction Stage :  
 Total Project  
 - Stage Construction Except Route No. -

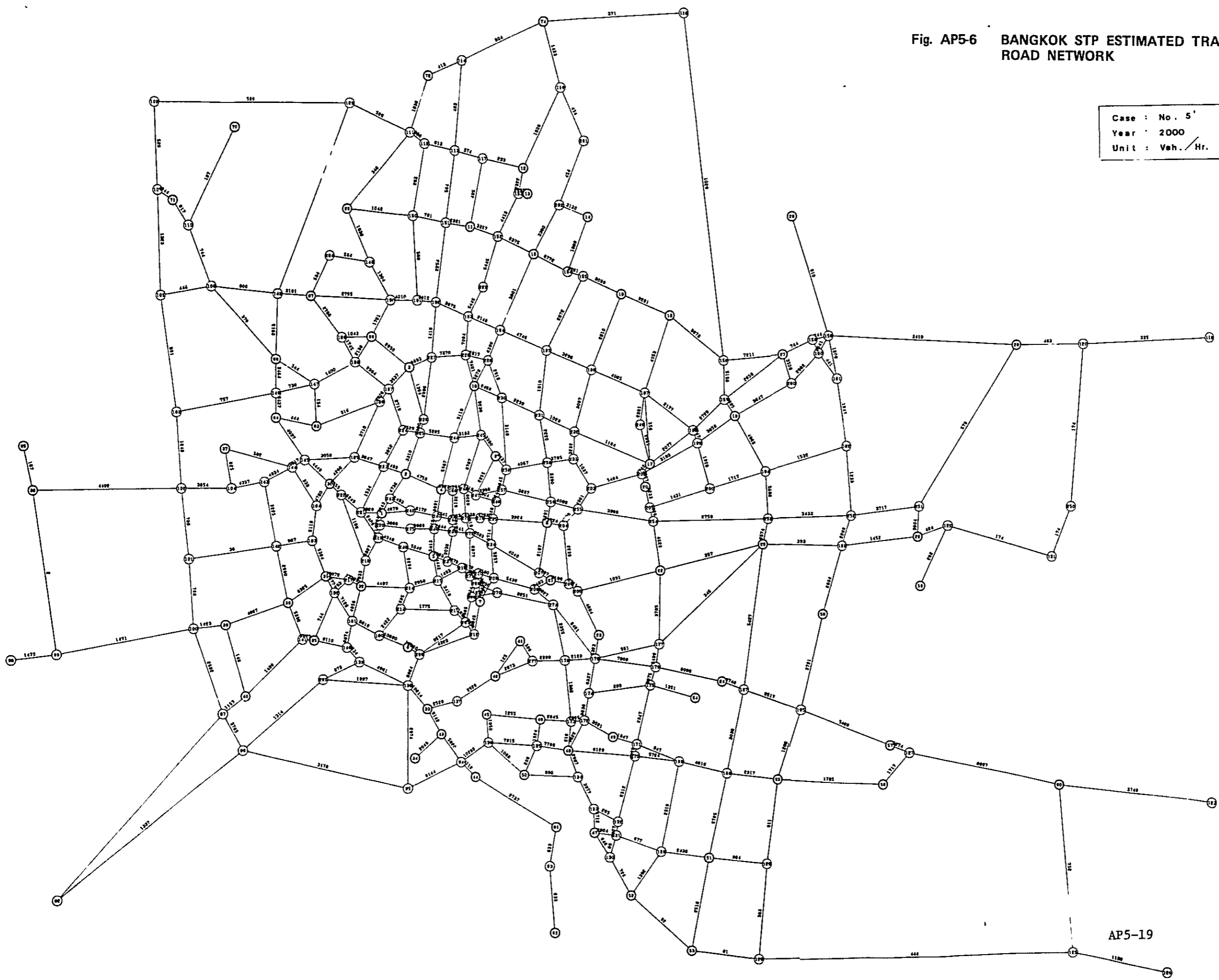
Fig. AP5-5 BANGKOK STP ESTIMATED TRAFFIC MASS TRANSIT SYSTEM NETWORK



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.

Fig. AP5-6 BANGKOK STP ESTIMATED TRAFFIC VOLUME ROAD NETWORK

Case : No. 5'  
Year : 2000  
Unit : Veh./Hr.





**APPENDIX  
CHAPTER 6**

**TRANSPORTATION FACILITIES  
PLANNING**



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

(Unit : 10<sup>6</sup> 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 : 10<sup>6</sup> 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	The Consumption	Maintenance for Structure Permanent Way	Materials & Supplies for Maintenance of Sign. & Tele. System	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	1.7	174.3
Light Rail (2)	51.1	13.0	1.4	3.4	"	0.9	108.0	13.2	-	"	"	1.6	1.8	235.9
Light Rail (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
Heavy Rail (2)	38.1	14.8	1.4	3.4	"	0.7	109.0	13.0	-	"	"	1.4	1.4	226.8
Heavy Rail (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
Monorail (2)	37.7	18.0	1.5	3.4	"	0.7	162.0	16.2	14.3	"	"	1.9	1.3	315.0
Monorail (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
New Guideway (2)	39.4	7.7	1.3	3.4	"	0.4	25.9	3.9	-	"	"	1.1	1.5	128.7
New Guideway (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 attributes 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 verify 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

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

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  
 $\bar{Z}$  = 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 difference 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:

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

therefore,

$$\text{Time value/vehicle} \quad P = S^2 \cdot \frac{\alpha F}{\alpha S} = S^2 \cdot \alpha \cdot \frac{\alpha F'}{\alpha S}$$

where:  $F'$  = direct operating costs and  $\alpha = F/F'$

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 consumption 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

distribution 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 <sup>2</sup>	(2) Economic Cost of the fuel (B/cc)	(3) dG/dS	(4) $\alpha$	(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 <sup>2</sup>	(2) Economic Cost of the fuel (B/cc)	(3) dG/dS	(4) $\alpha$	(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	24.0 Baht
	Per vehicle hour	42.0 Baht
Public Transport	Per passenger hour	18.9 Baht
	Per vehicle hour	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	182.90	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

Table AP8-7 ECONOMIC 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					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	B2	C1	C2	D1	D2	E1	E2	F	Total
1983					346.64							346.64
84					1,166.18		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

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	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									1,456.70
91			418.12					1,217.78				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

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

Alternatives 1, 2, 3

Case 2

[Tariff of MTS : 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	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

[Tariff of MTS : 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	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 MTS : 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 MTS: 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



JICA