APPENDICES TO CHAPTER 8

APPENDIX TABLE 8-1 LIST OF CONTROL POINTS

Code No.	Description
101	Royal Palace
102	Sa Patum Palace
103	Suan Pakard Palace
201	Makok Temple
202	Xavier Church
203	Ta Phan Temple
204	Fatima Church
205	Chang Saeng Temple
206	Patum Wanaram Temple
207	Holy Redeemer Church
208	Dis Hong Saram Temple
209	Mai Chong Rom Temple
210	Pha Sri Temple
211	Mosque
212	Klong Ton Mosque
213	Church
214	Samien Naree Temple
215	Phaya Young Temple
216	Chumni Hattakarn Temple
217	Sa Bue Temple
218	Daung Kae Temple
219	Maha Puttaram Temple
220	Kaew Jam Fah Temple
221	Christ Church
222	Muang Kae Temple
223	Suan Plu Temple
224	Sutti Wararam Temple
225	Don Temple
226	Chinese Cemetery
227	Pok Burma Temple
228	St. Louis Church
229	Christ Church
230	Chinese Christ Cemetery
231	Mosque
232	Sri Uma Thavee Mosque
233	Christ Church
234	Mosque
235	Lum Satta Tum Temple
236	Cemetery
237	Chinese Cemetery
238	Sai Temple
239	Reevaul Mosque
240	Pai Nguen Temple
241	Bang Klo Temple
242	Yannawa Temple
243	Bangkok Church
244	Wattana Wittaya Church
245	Victory Monument
301	Metropolitan Water Works Authority (Filter Section)
302	Office of Children Welfare
303	Ministry of Foreign Affairs
304	Department of Highway
305	Police Fire Brigade Division
306	Ministry of Industry
307	Government Pharmaceutical Organization
308	Office of University Affairs
309	Asoke-Din Daeng Electricity Power, Sub Station
310	Asoke-Din Daeng Telephone, Sub Station
311	Department of Livestock Development

Code No.	Description
312	Express Transportation Organization
313	Bangkok Mass Transit Authority
314	State Railway of Thailand
315	Industrial Estate Authority of Thailand
316	Embassy, Great Britain
317	Embassy, Switzerland
318	Chid Lom Electricity, Sub Station
319	Telephone Orgnanization of Thailand
320	Embassy, Netherland
321	Embassy, Vietnam
322	Embassy, USA
323	Makasan Electricity Power, Sub Station
324	Development of Fishery Industry
325	Embassy, India
326	Embassy, Japan
327	Embassy, Napal
328	Klong Ton Electricity, Sub Station
329	Government Lottery Bureau of Thailand (Printing House)
330	Klong Ton Railway Station
331	Hua Mak Railway Station
332	Embassy, Indonesia
333	Thai Red Cross Council
334	Bang Kuang Correction
335	State Railway of Thailand
336	Metropolitan Water Works Authority (Pumping Station)
337	Treasury Department (Mint Division)
338	Office of the National Environment Board
339	Ministry of Finance
340	National Women Council

Code No.	Description
341	National Energy Administration
342	State Railway of Thailand
343	State Railway of Thailand (Printing House)
344	Electricity Power, Sub Station
345	Bang Rak City Hall
346	Bang Rak Police Station
347	Revenue Department
348	Communication Authority of Thailand
349	Yannawa Police Station
350	Fish Marketing Organization
351	Embassy, Laos
352	Embassy, Burma
353	Embassy, USSR
354	Alien Registration and Taxation Division
355	Embassy, Singapore
356	USA Information Centre
357	Electric Sub Station
358	Embassy, Spain
359	Saudi Arabia Royal Embassy, and Canadian Embassy
360	Embassy, Brazil
361	Embassy, Austria
362	Embassy, Israel
363	Embassy, Egypt
364	Embassy, Cambodia
365	Embassy, Pakistan
366	Residence of Japanese Ambassador
367	Residence of Italian Ambassador
368	Residence of Egyptian Ambassador
401	Army Area
402	Phayathai Police Station
403	Police Department

Code No.	Description
404	Commissioner's Office of the Provincial Police
405	Police Fire Brigade Division
406	Military Area
501	King Mongkut Hospital
502	Nerve Hospital
503	Rama Hospital
504	Monks Hospital
505	Rajvithee Hospital
506	Decha Hospital
507	Phayathai Hospital
508	Makkasan Hospital
509	Phetchaburi Hospital
510	Smittiwiet Hospital
511	Promp Mitr Hospital
512	Camilian Hospital
513	Bangkok General Hospital
514	Phetchawiet Hospital
515	Chulalongkorn Hospital
516	Jong Jitr Hospital
517	St. Joseph Hospital
518	Lerd Sin Hospital
519	St. Louis Hospital
520	Bang Rak Hospital
521	Mahea Sak Hospital
522	Bangkok Christian Hospital
523	Bumrungrad Medical Center
601	Mahidol University
602	Blind School
603	Amnuay Silpa School
604	Phayathai School
605	Santiraj Bumrung School
606	Dusit Commercial School
607	Piboon Wattana School
608	Fatima School

Code No.	Description
609	Patumwan Technical College
610	Chulalongkorn University
611	Uthen Thawai Technical College
612	Traim Udom Suksa School
613	Sri Ayuthaya School
614	Kittikun School
615	Indrachai Technical College
616	Deficiency School
617	AUA
618	Don Bosco School
619	St. Dominic School
620	International School
621	Srinakharin Wiroj University (Prasarn Mitr Campus)
622	Kanta Butr School
623	Chalerm Sart School
624	Charnwit Pittayarai School
625	Jam Jan Wittayarai School
626	Doi Wittaya School
627	Klong Ton Mosk School
628	Kasem Pittaya School
629	Sai Thip Pittaya School
630	Phadung Sit Pittaya School
631	Raevadee School
632	Samsen Kindergarten School
633	Samsen Vittayarai School
634	Business Administration College
635	Chaophaya Commercial School
636	Satree Pratuang Wit School
637	Phaya Young School
638	Sritabut Bumrung School
639	Daung Kae School
640	School
641	Maha Puttaram School

Code No.	Description	Code No.	Description
642	Kaew Jam Fah School	701	Tiara Hotel
643	Krung Thep Pittaya School	702	Thai-Japanese Stadium
644	School	703	Century Theatre
645	Silom Commercial School	704	E M I Theatre
646	Yok Min Suksa School	705	Athen Theatre
647	Assumption School	706	Hollywood Theatre
648	Satja Wittaya Wchool	707	President Theatre
649	Wat Suti Wararam School	708	Asia Hotel
650	Institute of Technology and Vocational Education (Satree Phanakorn Tai Campus)	709	McKenna Theatre
		710	National Stadium
		711	Siam Centre
651	Satree Sri Suriyothai School	712	Siam Square
		713	Siam Intercontinental Hotel
652	Kosol Wittaya School	714	Panthip Plaza
653	Nipat Wittaya School	715	First Hotel
654	Assumption Commercial School	716	Florida Hotel
655	Kindergarten School	717	Metro Theatre
656	Krungthep Christain School	718	Paramount Theatre
657	Padung Darunee School	719	New Amarin Hotel
658	Sathorn Wittaya School	720	O A Shopping Centre
659	Chinese Christain School	721	Chawala Turkish Bath
660	Sawang Wittaya School	722	Chao Phraya 1 Turkish Bath
661	Chaun Chern Kindergarten School	723	Chao Phraya 2 Turkish Bath
		724	Indra Hotel
662	Satja Tham School	725	Sports Club (Turf)
663	Tri Ratana Suksa School	726	Royal Sports Turf Club
664	Kanok Technical School	727	Stella Theatre
665	Panit School	728	Star Theatre
666	Chan Wetch Suksa School	729	Indra Clothing Market
667	Kitti Commercial School	730	Petch Rama Theatre
668	Benjawan Suksa School	731	DaDa Theatre
669	Udom Wetch Kindergarten School	732	Polly Theatre
		733	Hilton International Hotel
670	Pramae Maree School	734	Ploenchit Arcade
671	Yana Wetch School	735	Central Plaza
672	Wat Pai Nguen School	736	President Hotel
673	Wattana Wittaya Academy		

Code No.	Description	Code No.	Description
737	Erawan Hotel	771	Trocade Hotel
738	Rajaprasong Shopping Centre	772	Peninsula Hotel
739	Imperial Hotel	773	Victory Hotel
740	Oscar Theatre	774	Princess Hotel
741	NaNa Hotel	775	New Fuji Hotel
742	Rajah Hotel	776	Ramada Hotel
743	Ambassador Hotel	777	Daily News
744	Manhattan Hotel'	778	Jim Thompson's
745	Chawala Hotel	779	Star Hotel
746	Golf Course	780	Reno Hotel
747	Bang Sue Supermarket	781	Opera Hotel
748	Siam Cement Factory	782	Heaven Hotel
749	Bang Sue Market	783	Picnic Hotel
750	Olympic Theatre	784	Amarin Hotel
751	Coliseum Theatre	785	Atlanta Hotel
752	Bangkok Centre Hotel	786	Golden Palace Hotel
753	British Club	787	Fortuna Hotel
754	Manorah Hotel	788	Federal Hotel
755	Royal Orchid Hotel	789	Prince Hotel
756	Oriental Hotel	790	Astar Hotel
757	Bang Rak Market	791	Nakorn Petch Hotel
758	New Hotel (Under construction)	792	Crown Bowl
759	Bangkok Dock	793	East Hotel
760	Warner Theatre	794	Asoke Bowl
761	Hyatt Rama Hotel	795	Siam Hotel
762	Siam Theatre	796	Metro Hotel
763	Thavee Phol Theatre	797	World Hotel
764	Chan Theatre	798	Star Bowl
765	Bangkok Palace Hotel	799	Morakot Hotel
766	Narai Hotel	800	Marketing Organization of Farmers
767	Sri Sathorn Theatre	901	Police Flat
768	Century Hotel	902	Din Daeng Flat
769	Bangkok Rama Theatre	903	Premruthai Housing Complex
770	Grace Hotel		

Code No.	Description
904	Chawala Housing Complex
905	Seree Housing Complex
906	Seree Housing Complex
907	Seree Housing Complex
908	Seree Housing Complex
909	Seree Housing Complex
910	Police Flat
911	Military Flat
912	Military Flat
913	Lottery Flat
914	National Housing Authority Flat
915	Police Flat

APPENDICES TO CHAPTER 9

APPENDIX 9.1 COMPARATIVE STUDY FOR GEOMETRIC DESIGN PHILOSOPHY

A comparative study was made to select one of the two philosophies mentioned in subsection 9.3.2 of the Text. Different types of design speeds and road widths which basically affect construction cost were chosen to compare the costs, considering design standards of the First Stage Expressway System, Road Structure Ordinance (Japan), Metropolitan Expressway Public Corporation (Japan) and Intra Urban Tollway (Jakarta) as shown in Appendix Table 9–1.

Six alternative cases as shown in Appendix Fig. 9–1 were studied based on the combination of design speeds (60 and 80 km/h) of expressways, design speeds (40 and 50 km/h) of interchange[1]) between expressways, and the cross-sectional composition of expressways by types[2]). The result of the comparison is shown in Appendix Fig. 9–2.

The result of the above discussion indicates that these design speeds for the expressway and interchange made about 0.8 and 0.9 percent difference in the construction costs, respectively, and that the types of expressway widths make 6 percent difference. Based on the above mentioned factors, the following is found among others:

- Design speeds of throughways and interchanges do not introduce big differences into their construction costs;
- Wider lane width is preferable since massive traffic volume is expected on the proposed metropolitan expressways;
- Homogeneity with the First Stage Expressway System is necessary even if their characters are different; and
- Percentage of heavy vehicles of the Second Stage Expressway System is relatively lower than that of the First Stage Expressway System.

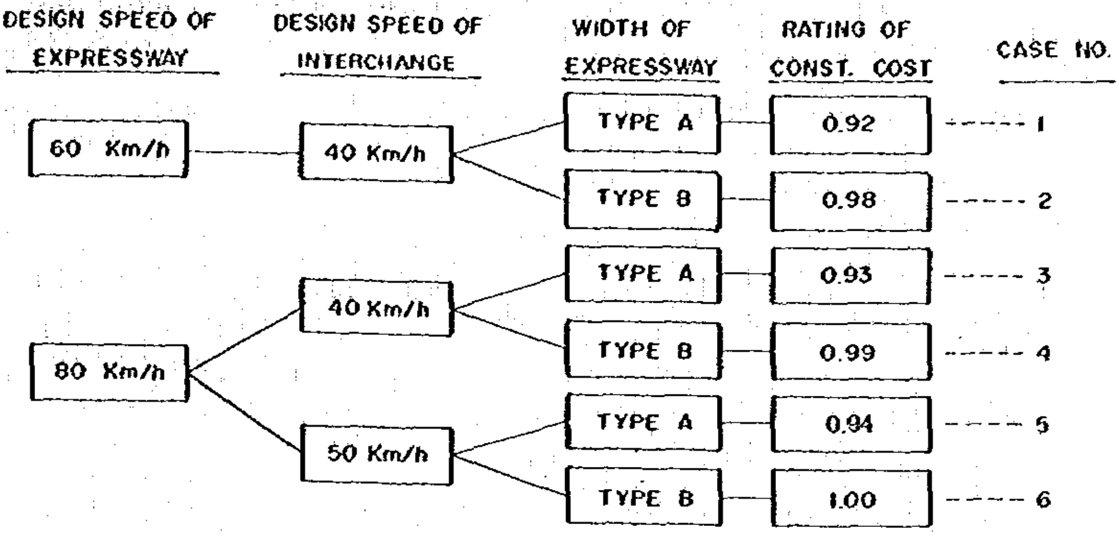
Notes: 1) Interchange does not include on-off ramps connecting with arterial roads.

2) Type A : lane width of 3.25 meters and outer shoulder width of 1.50 meters
Type B : lane width of 3.50 meters and outer shoulder width of 2.00 meters

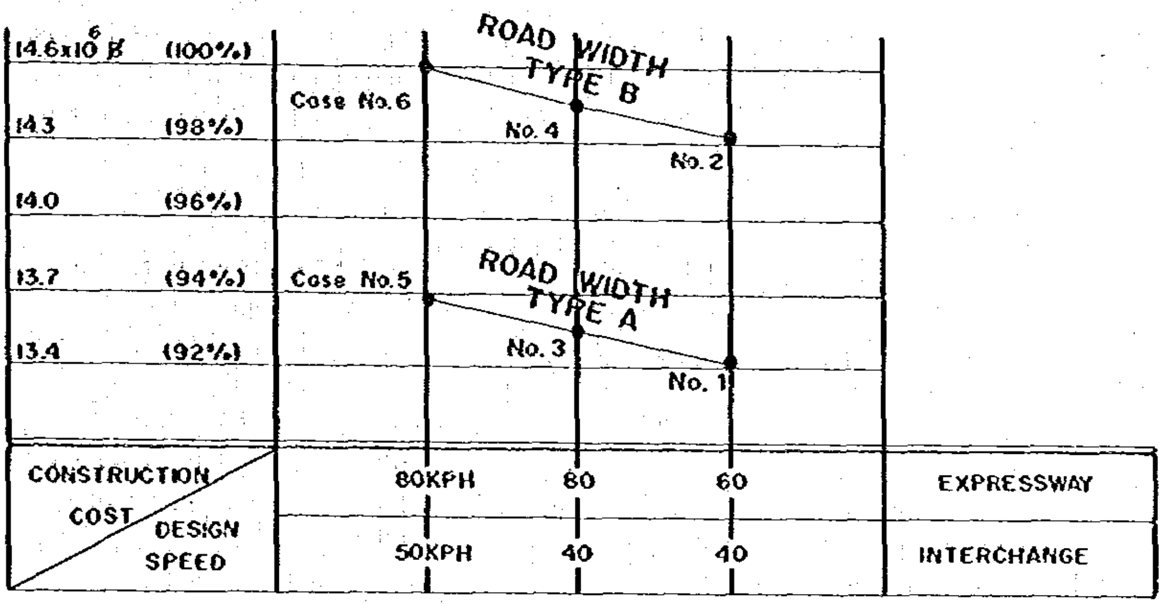
APPENDIX TABLE 9-1 DESIGN STANDARDS FOR URBAN EXPRESSWAYS IN BANGKOK, TOKYO AND JAKARTA

	First Stage Expressway (Bangkok)	Metropolitan Expressway (Tokyo)	Intra Urban Tollway (Jakarta)	Road Structure Ordinance (Japan)
Design Speed :		(Inner Ring)		
Expressway	80 km/hr	60	80	60-80
Interchange	50			
Lane Width	3.50 m	3.25	3.60	3.25-3.50
Outer Shoulder Width	2.00 m	1.25	1.75-2.00	1.25-1.25
Inner Strip	0.33 m	0.50	0.50	0.50-0.50
Median	2.00 m	2.00	2.00-5.00	1.75-2.25
Crossfall (On Tangent)	2.50 %	1.50	2.00	1.50-1.50
Minimum Radii (Horizontal)		120	230	120-230
Maximum Gradient	5.00 %	5.00 (Max.length 500m)	6.00	5.00-4.00
Stopping Sight Distance		75.00	115.00	75.0-110.0

APPENDIX FIG. 9.1 RELATIONSHIP BETWEEN DESIGN STANDARDS AND CONSTRUCTION COSTS



APPENDIX FIG. 9.2 COMPARATIVE STUDY OF DESIGN STANDARDS AND CONSTRUCTION COSTS



NOTES : TYPE A : LANE WIDTH OF 3.25 METERS AND OUTER SHOULDER WIDTH OF 1.50 METERS.

TYPE B : LANE WIDTH OF 3.50 METERS AND OUTER SHOULDER WIDTH OF 2.00 METERS.

APP. FIG. 9-1	RELATIONSHIP BETWEEN DESIGN STANDARD AND CONSTRUCTION COSTS
APP. FIG. 9-2	COMPARATIVE STUDY OF DESIGN STANDARD AND CONSTRUCTION COSTS

THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK

APPENDIX 9.2 BASIC, POSSIBLE AND DESIGN CAPACITIES

Basic capacity, possible capacity and service level were discussed in this appendix to get hourly design capacity of the Expressway.

(1) Basic Capacity

This is defined as the maximum volume per hour able to pass the section of one lane or one carriageway under ideal conditions of road and traffic flow.

The ideal condition is only accomplished providing the following conditions are met:

- Not less than 3.5 m lane width;
- Not less than 1.75 m lateral clearance;
- Good geometrical standard;
- Only passenger cars running; and
- No speed limit.

2,500 veh/hour is recommended in the Japanese standard and this is based on data surveyed at many sites on existing roads in Japan.

(2) Possible Capacity

Actual road and traffic conditions are different from the ideal conditions. The basic capacity is adjusted using several factors which affect the capacity in order to meet the expected actual road conditions. The factors affecting basic capacity are summarized as follows:

a) Lane Width

In the Japanese standard the minimum lane width for mixed traffic so as not to affect the traffic capacity, is designated to be 3.5 m.

The coefficients of the effect of lane width are shown as follows:

Lane Width (m)	Coefficients
3.50	1.00
3.25	0.94
3.00	0.85
2.75	0.77

b) Lateral Clearance

The lateral clearance is the dstance between the edge of lane and obstacles such as retaining wall, electric pole, guardrail, etc.

These obstacles affect the traffic capacity if they are put within 1.75 m from the edge of the lane. The coefficients of the effect of lateral clearance are as shown below in the case of a multilane road.

Lateral Clearance	1.75 m	1.50 m	1.25 m	1.00 m	0.75 m	0.50 m	0
Insufficient clearance only on one side	1.00	1.00	0.99	0.98	0.97	0.95	0.90
Insufficient clearance on both sides	1.00	0.99	0.98	0.97	0.94	0.90	0.81

c) Truck and Buses

Heavy vehicles such as trucks and buses reduce basic traffic capacity not only by the body size but also by the reduced power to weight ratio. This results in lower vehicle speeds especially on steep and long slopes.

The effect of heavy vehicles on the traffic capacity is evaluated by converting one heavy vehicle to the equivalent number of passenger cars (sedan) which give the same influence to the capacity.

Coefficients to affect the traffic capacity due to the influence of heavy vehicles are calculated by applying the following formula:

$$C = \frac{100}{100 - P + E \times P}$$

C : Coefficient to affect traffic capacity by mixing heavy vehicle

P : Heavy vehicle mixing ratio (%)

E : Sedan equivalent of heavy vehicle

d) Degree of Development along the Roadside

On a road on which no interference is expected from outside the road, for example an access-controlled expressway, the running speed of vehicles is affected only by internal factors such as traffic volume and horizontal and vertical alignment.

On the other hand, the running speed of a non-access-controlled road such as an Arterial Street is affected by merging vehicles from access streets and pedestrians crossing the road. This results in a reduction of the traffic capacity of a non-access-controlled road.

The coefficient is evaluated depending on the density of houses, buildings or factories along the corridor. No adjustment is necessary for those sections of street on which there is no interference for reasons such as difference in level, pedestrian barriers, etc. Also no adjustment is necessary on the inner lanes of a multi-lane highway, as the outer lanes act as a barrier.

Degree of Development along Roadside	Coefficient
Not developed	1.0 – 0.9
Partially developed	0.9 – 0.8
Fully developed	0.8 – 0.7

e) Other Considerations

Effects from lack of overtaking sight distance and mixture of motorcycles should also be considered. However, the former only affects the capacity of 2-lane, 2-way roads and the latter is considered in the assessment of traffic assignment by converting motorcycles to sedans by applying the sedan equivalent of a motorcycle. These factors are therefore ignored in the capacity calculations.

The factor discussed in (3)-(a) to (3)-(d), are used to convert the Basic Capacity into a Possible Capacity.

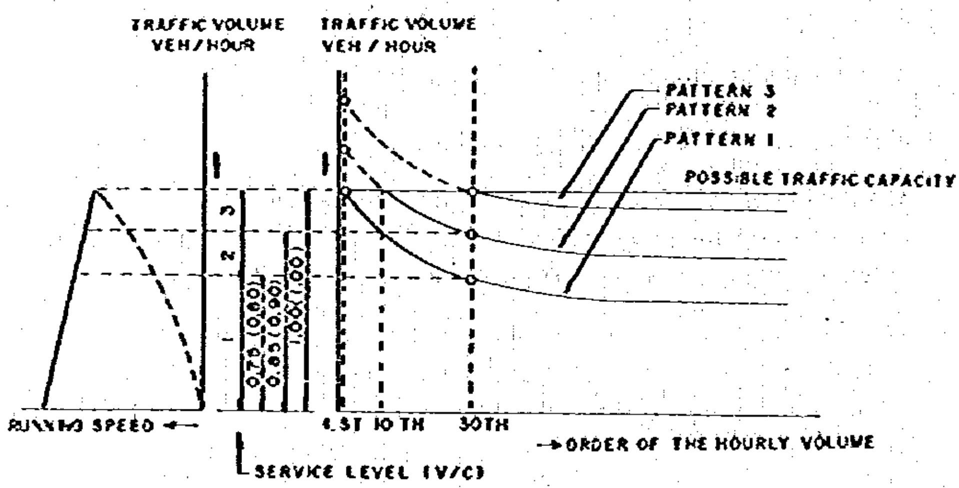
(3) Design Capacity (per hour)

Service level is expressed by the ratio of the traffic volume (V) and the Possible Capacity (C) – V/C. In an urban area the service level is designated as below:

Service level – 1	V/C = 0.80
Service level–2	V/C = 0.90
Service level–3	V/C = 1.00

The design traffic capacity is calculated by multiplying V/C of required service level to the possible traffic capacity.

The Fig. 9–3 shows the relationship between service level and peak hour traffic volume. Summary of the basic criteria on the traffic condition in each service level are as follows:



APPENDIX FIG. 9–3 SERVICE LEVEL AND PEAK HOUR TRAFFIC VOLUME

Service Level–1: At the target year of design, the annual maximum peak hour traffic volume is less than the possible capacity per hour. Vehicles in the 30th highest annual hourly volume can keep stable flow at certain speeds, but selection of speed is restricted.

Service Level–2: At the target year of design, 10th highest annual hourly traffic volume reaches possible capacity and this sometimes causes serious traffic jams during these peak ten hours. Vehicles in the 30th highest annual hourly traffic volume are unable to keep uniform speeds and the speed changes at random.

Service Level–3: At the target year of design, the 30th highest annual hourly traffic volume exceeds possible capacity and this causes serious traffic jams during these peak 30 hours. Vehicle in the flow of the 30th highest annual hourly traffic volume is always forced to change speed and sometimes is forced to stop.

Even if service level-3 is adopted, it is theoretically possible to say that during only 30 hours in 1 year (8,760 hours) does the traffic volume exceed possible capacity.

However, from the nature of traffic flow, it should be considered that a serious traffic jam might remain for longer than theoretically indicated.

By multiplying the Possible Capacity by the appropriate V/C ratio, which depends on service level, it is possible to derive the Design Capacity on hourly basis.

APPENDIX TABLE 9–2 CONSTRUCTION COSTS OF OVER-CROSSING AND UNDERCROSSING SCHEMES

Overpassing Scheme Sta. 1+720 – 2+580

Construction Item	Cost (Million Baht)
Phahol Yothin Crossing Section (L = 120 m)	39.08
Viaducts Section (L = 370 x 2 m)	176.78
Ramp Section	94.45
Miscellaneous	15.51
Sub-Total	325.82
Contingencies	32.58
Engineering Cost	17.92
TOTAL COST	376.32 [1]

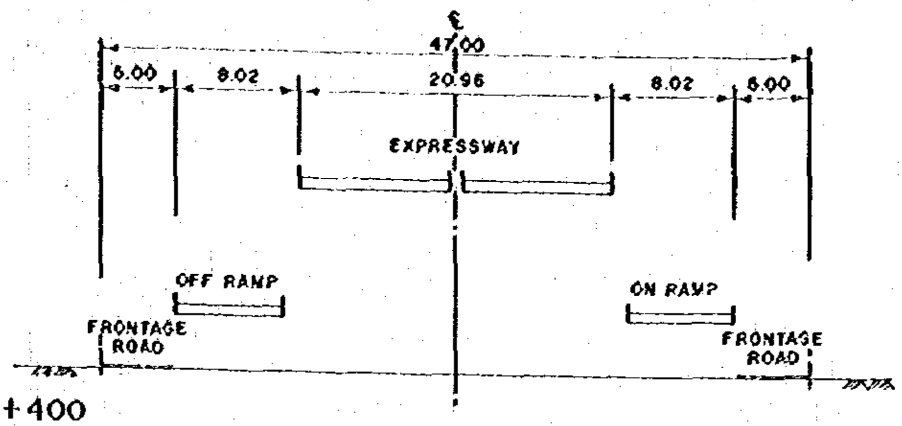
Underpassing Scheme Sta. 1+720 – Sta. 2+580

Construction Item	Cost (Million Baht)
Tunnel Section (L = 320 m)	336.00 [2]
Approach Section (L = 200 x 2 m)	83.52
Embankment Section (L = 70 x 2 m)	14.98
Over-Bridge	13.36
Drainage Facilities	5.90
Ramp Section	46.55
Miscellaneous	25.02
Sub-Total	525.33
Contingencies	52.53
Engineering Cost	28.89
TOTAL COST	606.75 [1]

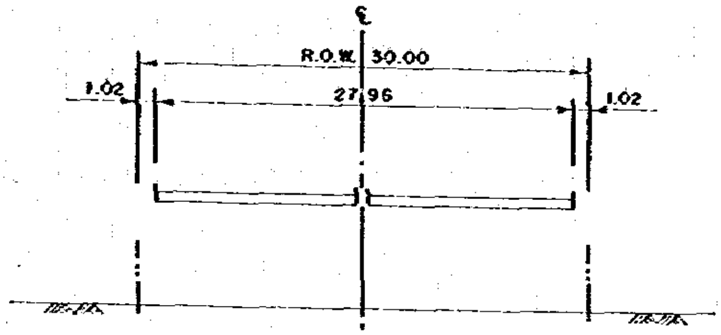
Notes: 1) Excluding land acquisition and compensation
2) Estimate based on the cast-in-situ wall construction method

APPENDIX TABLE 9-3 CONSTRUCTION COSTS OF VIADUCT AND EMBANKMENT SCHEME

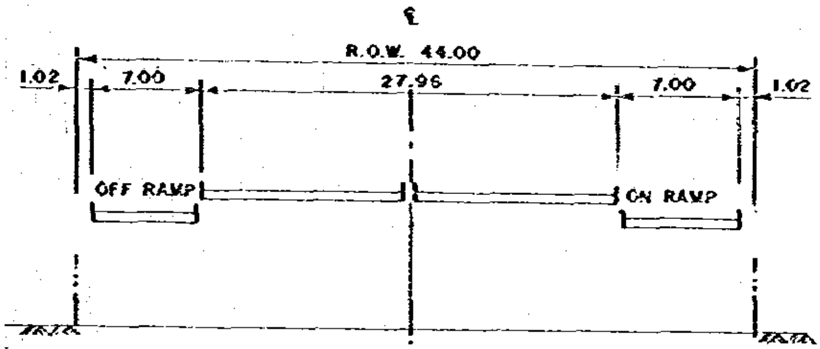
Embankment Scheme Sta. 7+500 – 8+450 of East Route	
Embankment and Drainage Cost	22×10^6
Pavement Cost	16×10^6
Sand Drain and Pre-loading Cost	96×10^6
	134×10^6 Baht
Viaduct Scheme Sta. 7+500 – 8+450 of East Route	
Viaduct (24,377 m^3)	238×10^6 Baht



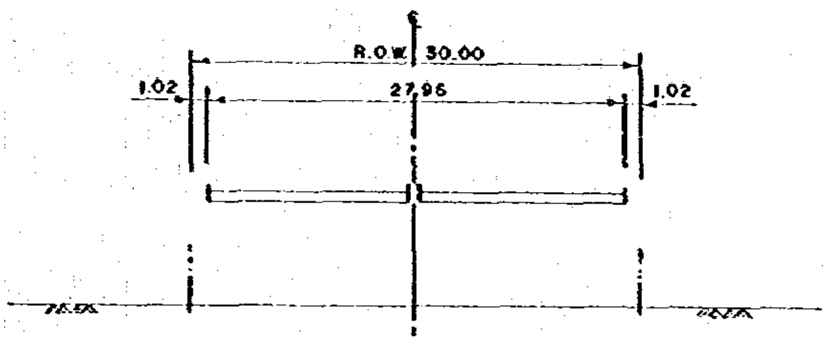
NS④, STA. 4+400



NS③, STA. 4+400



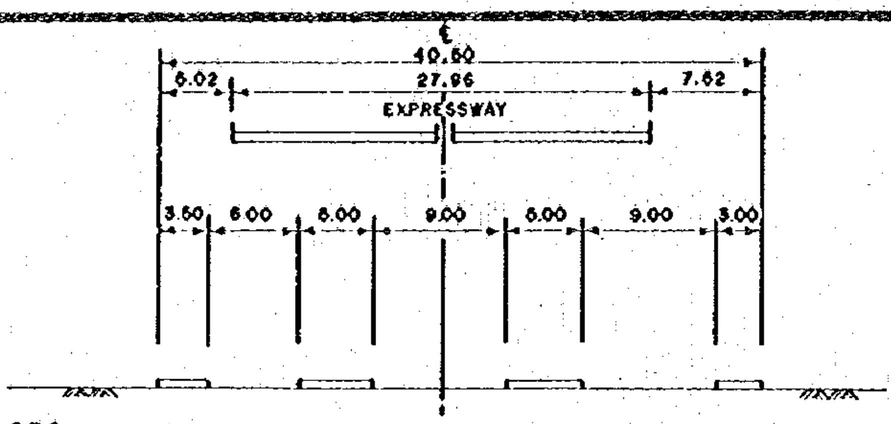
NS②, STA. 3+100



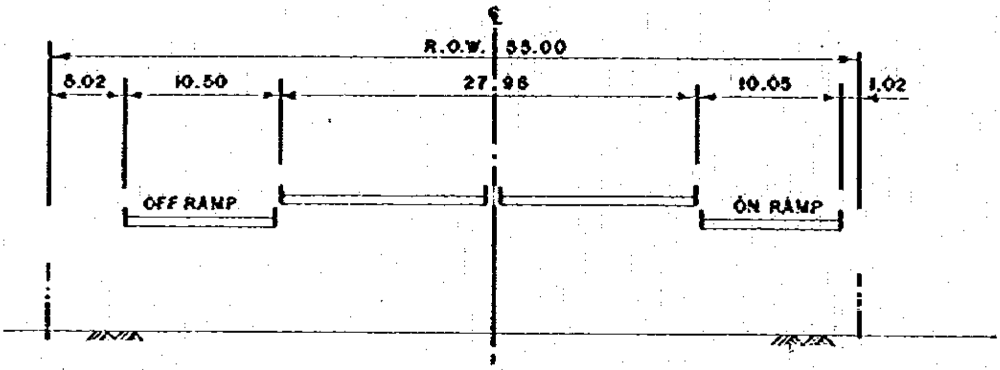
NS①, STA. 1+500

APPENDIX FIG. 9-4 (1)	CROSS SECTION WITH R.O.W. (N.S. ROUTE)

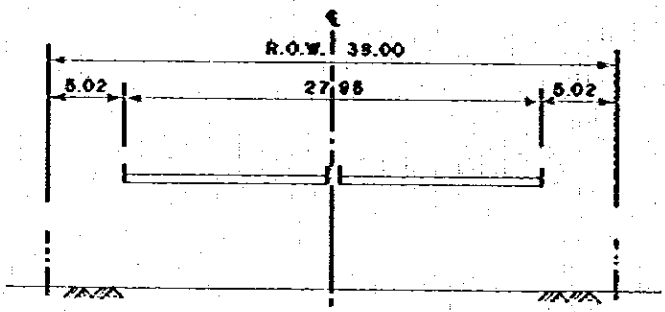
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK



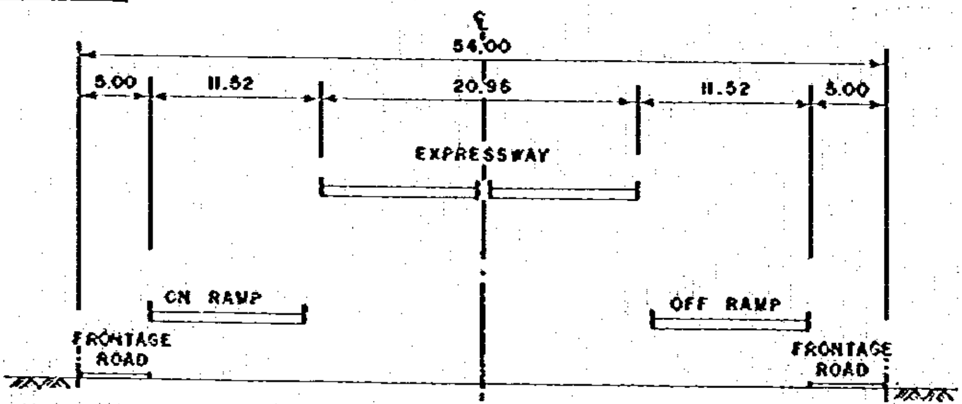
NS ⑧ , STA. 6 + 650



NS ⑦ , STA. 6 + 300



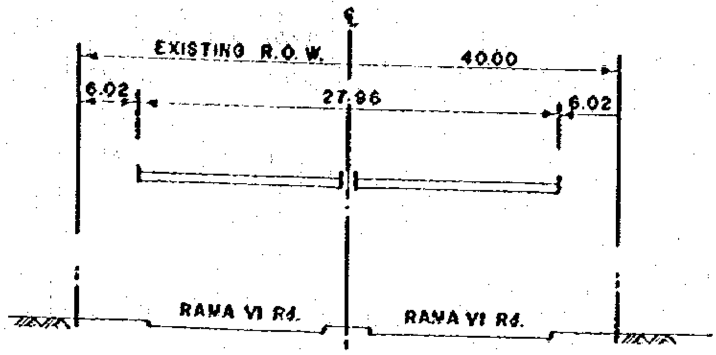
NS ⑥ , STA. 5 + 500



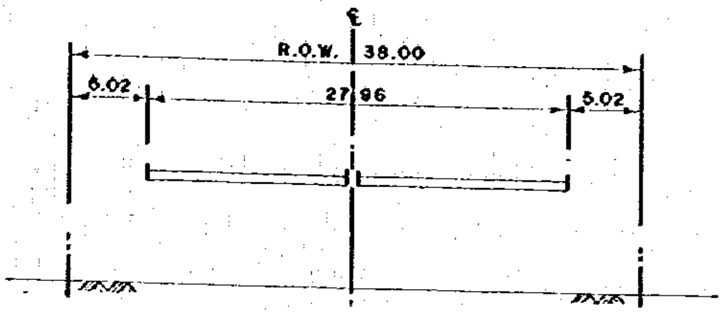
NS ⑤ , STA. 4 + 800

APPENDIX FIG. 9 – 4 (2)	CROSS SECTION WITH R.O.W. (N.S. ROUTE)

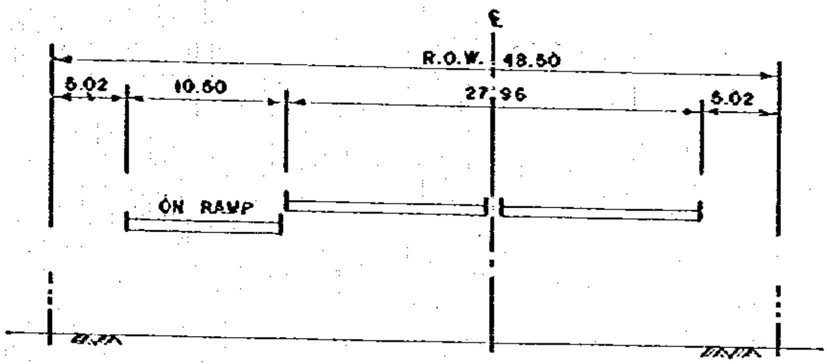
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK



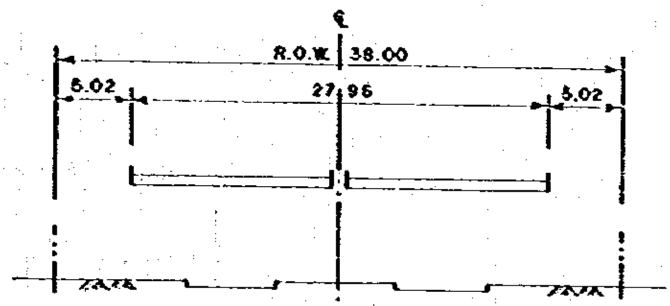
NS ⑫ , STA. 10 + 000



NS ⑪ , STA. 8 + 050



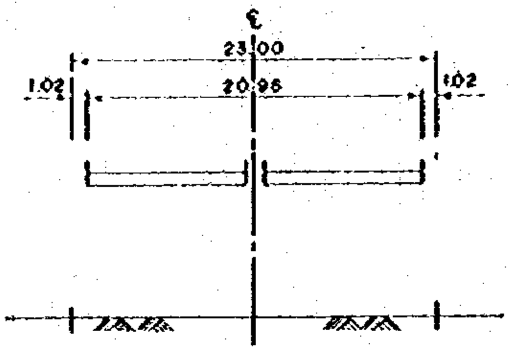
NS ⑩ , STA. 7 + 650



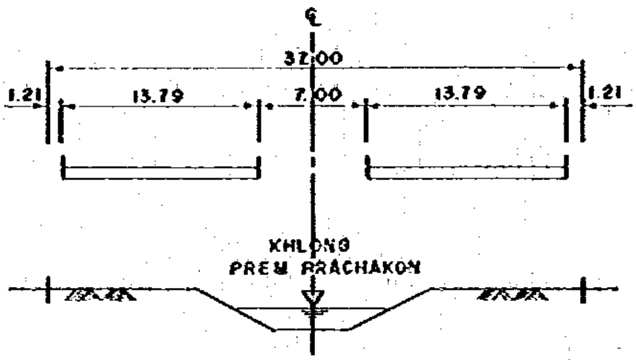
NS ⑨ , STA. 7 + 000

APPENDIX FIG. 9-4(3)	CROSS SECTION WITH R.O.W. (N.S. ROUTE)

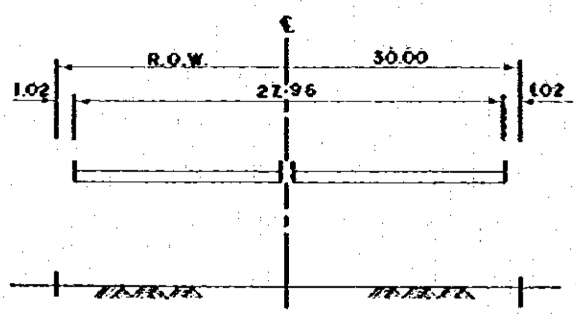
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK



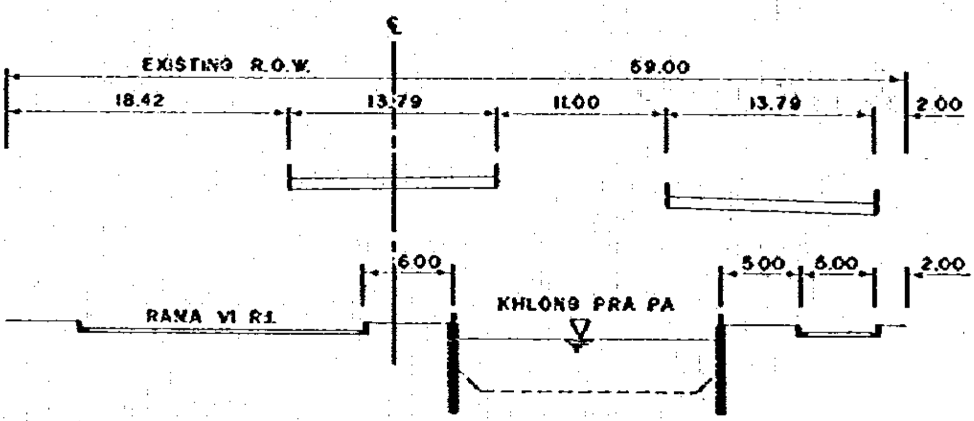
NS ⑯ STA. 19+000



NS ⑮ STA. 17+600



NS ⑭ STA. 15+000

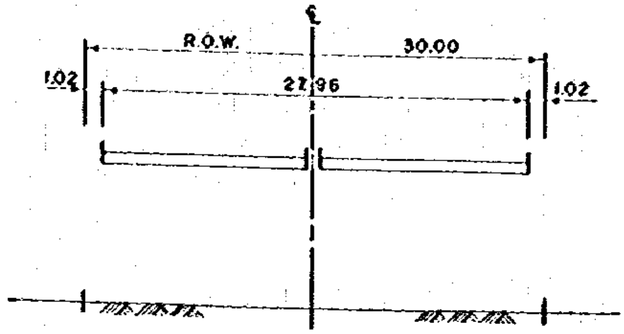


NS ⑬ STA. 11+600

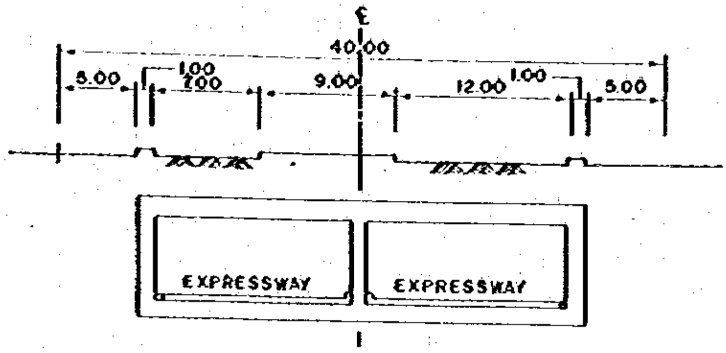
APPENDIX
FIG. 9-4 (4)

CROSS SECTION WITH R.O.W.
(N.S. ROUTE)

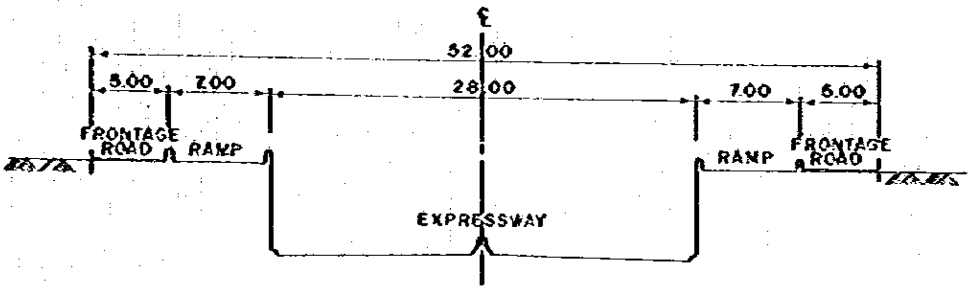
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK



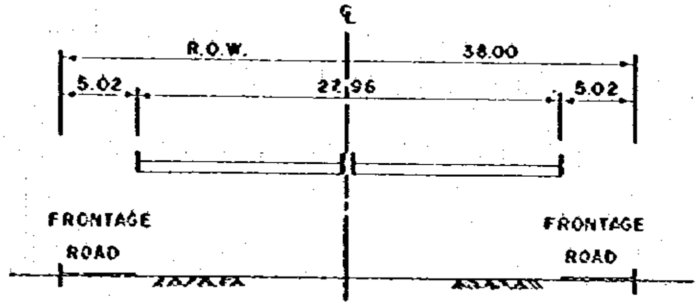
E ④, STA. 3+000 AND STA. 4+500



E ③, STA. 2+200



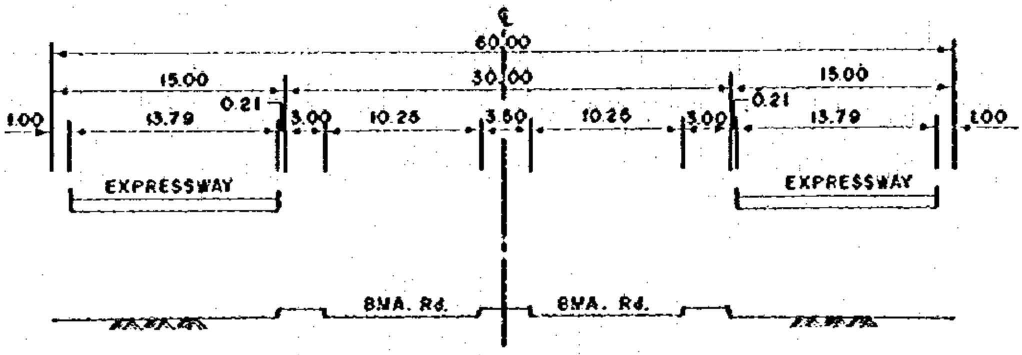
E ②, STA. 2+000



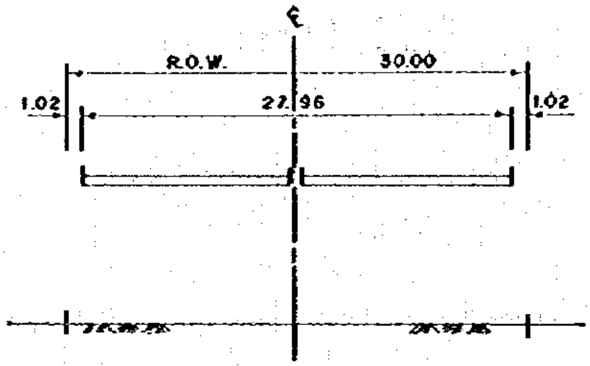
E ①, STA. 1+550

APPENDIX FIG. 9-4(5)	CROSS SECTION WITH R.O.W. (E ROUTE)

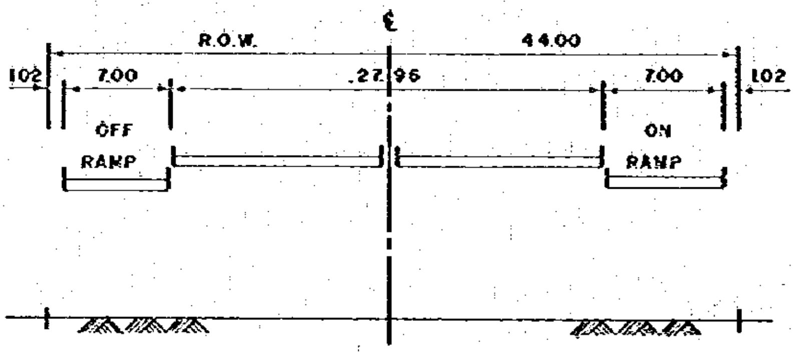
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK



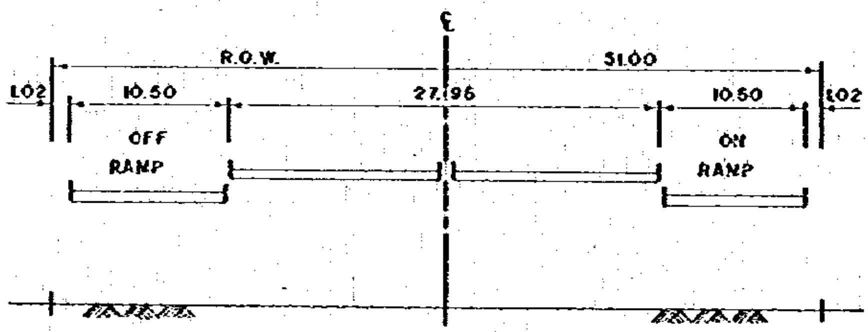
E – ⑧ STA. 8 + 000



E – ⑦ STA. 6 + 400



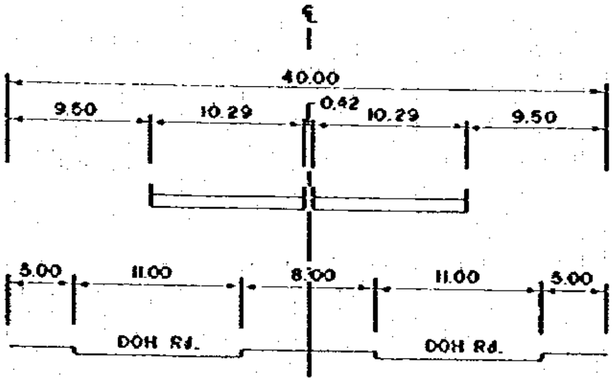
E – ⑥ STA. 5 + 850



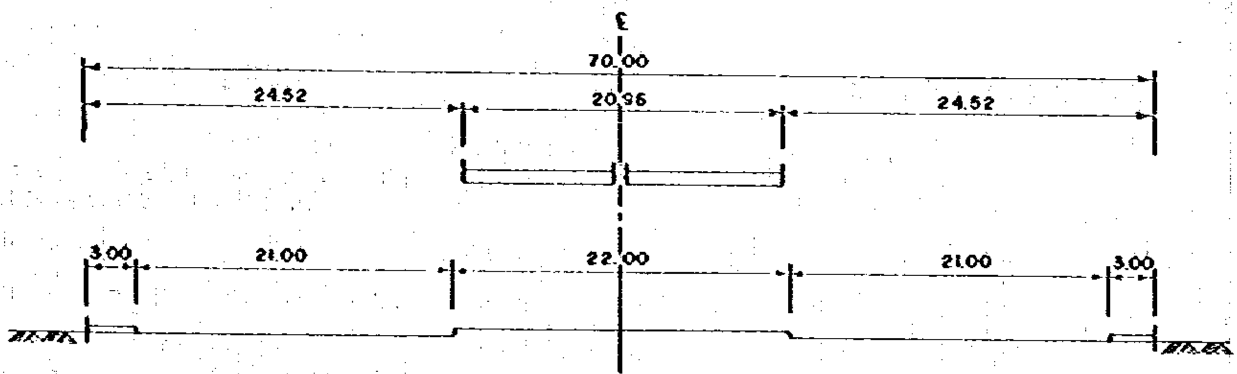
E – ⑤ STA. 5 + 200

APPENDIX FIG. 9–4 (6)	CROSS SECTION WITH R.O.W. (E ROUTE)

THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK



E - ⑩ STA. 11 + 000



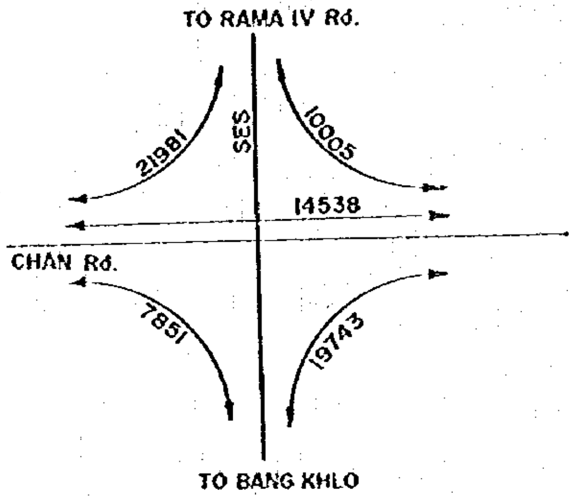
E - ⑨ STA. 9 +900

APPENDIX FIG. 9-4(7)	CROSS SECTION WITH R.O.W. (E ROUTE)

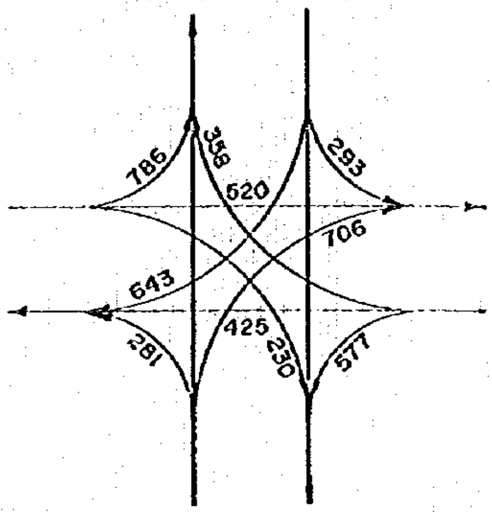
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK

NODE NO. 747 YEAR : 2000

NAME OF INTERSECTION : SES (N - S) x CHAN ROAD



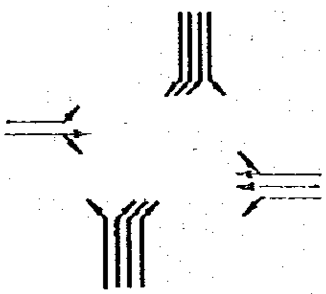
VEH / DAY



VEH / HOUR

TRAFFIC PHASE (VEH/H)		TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	786 / 520 / 230	VL = 868, VT = 574, VR = 254 } 1696	1 x 1800, 1 x 2000 } 3800	0.446 *	0.53	77 + 2
2	358 / 425 / 577	VR = 395, VT = 469, VL = 637 } 1501	1 x 1800, 2 x 2000 } 5800	0.250 *	0.30	43 + 2
3	643 / 1293	VR = 710, (VL = 323) } 710	3 x 1800 } 5400	0.131		
	281 / 706	(VL = 310), VR = 779 } 779	3 x 1800 } 5400	0.144 *	0.17	24 + 2
			TOTAL	0.840	1.00	150

LANE ARRANGEMENT



1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE : 2000 VEH (PCU) / GREEN HOUR
   TURNING LANE : 1800 VEH (PCU) / GREEN HOUR
2. PEAK FACTOR : 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES : 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME : 55.0 %

APPENDIX FIG. 9 - 5 (I)

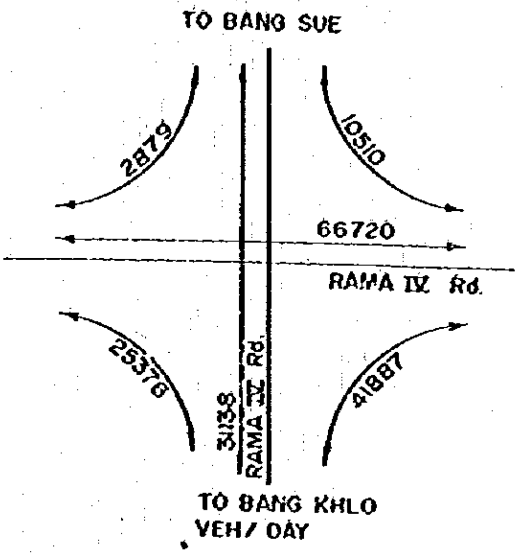
TRAFFIC ANALYSIS OF INTERSECTION (I)

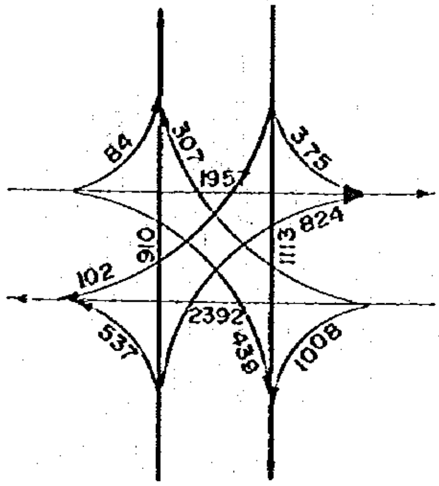
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK

NODE NO. 736

YEAR : 2000

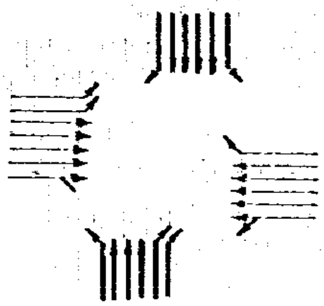
NAME OF INTERSECTION : SES (N-S) x RAMA IV ROAD x RAMA VI ROAD





TRAFFIC PHASE (VEH/H)		TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	84, 1957, 439	VL= 92, VT= 2160, VR= 484 } 2736	2x18000, 5x2000 } 13600	0.20	0.20	28 + 2
2	307, 2392, 1008	VR=338, VT=2160, VL=1112 } 4090	5x2000, 1x1800 } 11800	0.34	0.34	49 + 2
3	102, 113, 375	VR=113, VT=1228 } 1341, (VL=414)	1x1800, 3x2000 } 7800	0.17	0.17	24 + 2
4	537, 910, 824	(VL=592), VT=1228, VR= 909 } 2137	2x2000, 2x1800 } 7600	0.28	0.29	41 + 2
			TOTAL	0.99	1.00	150

LANE ARRANGEMENT



1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE = 2000 VEH(PCU)/GREEN HOUR
   TURNING LANE = 1800 VEH(PCU)/GREEN HOUR
2. PEAK FACTOR = 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES = 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME = 55.0 %

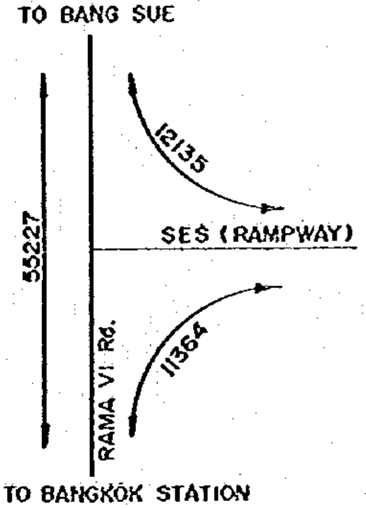
APPENDIX FIG. 9-5(2)

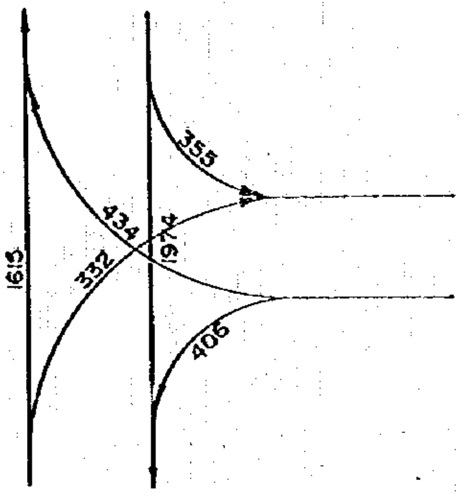
TRAFFIC ANALYSIS OF INTERSECTION(2)

THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK

NODE NO. 770 YEAR : 2000

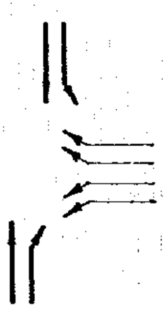
NAME OF INTERSECTION : SES (N - S) x RAMA IV ROAD





TRAFFIC PHASE (VEH/H)		TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	355, 1974, 1615	VT = 1783 VT = 2179 } 2571 VL = 392 }	2x2000 = 4000 2x2000 } 5800 1x1800 }	0.446* 0.443	0.57	66 + 2
2	332	VR = 367	1x1800 = 1800	0.204*	0.26	29 + 2
3	434, 406	VR = 479 } 927 VL = 448 }	4x1800 = 7200	0.129*	0.17	15 + 2
4						
			TOTAL	0.77	1.00	120

LANE ARRANGEMENT



1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE = 2000 VEH (PCU)/GREEN HOUR
   TURNING LANE = 1800 VEH (PCU)/GREEN HOUR
2. PEAK FACTOR = 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES = 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME = 55.0 %

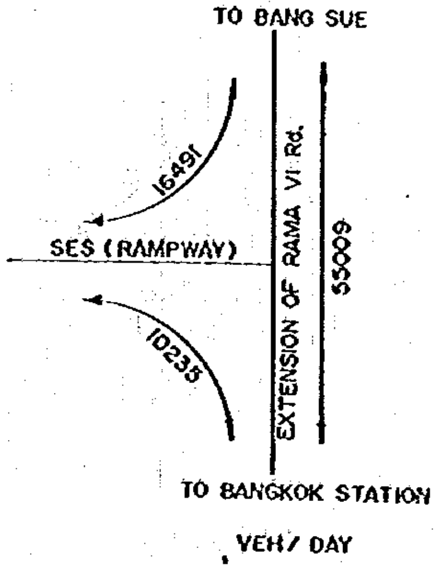
APPENDIX FIG. 9 - 5(3)

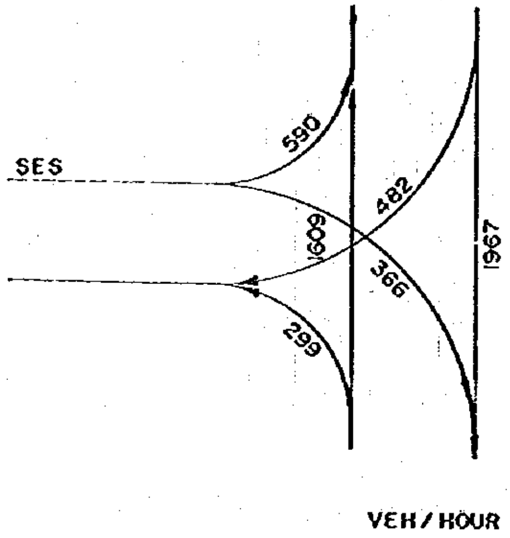
TRAFFIC ANALYSIS OF INTERSECTION(3)

THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK

NODE NO. 770 YEAR : 2000

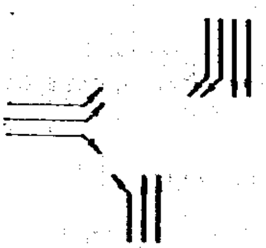
NAME OF INTERSECTION : SES (N-S) x EXTENSION OF RAMA VI ROAD





TRAFFIC PHASE (VEH/H)		TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	299, 1609, 1967	VL = 330, VT = 1776, VT = 2172 } 2106	1 x 1800, 2 x 2000, 2 x 2000 } 5800	0.363 0.543	0.61	71 + 2
2	482	VR = 532	2 x 1800 = 3600	0.148	0.17	19 + 2
3	590, 366	VL = 651, VR = 404 } 1055	2 x 1800, 1 x 1800 } 5400	0.195	0.22	24 + 2
4						
			TOTAL	0.886	1.00	120

LANE ARRANGEMENT



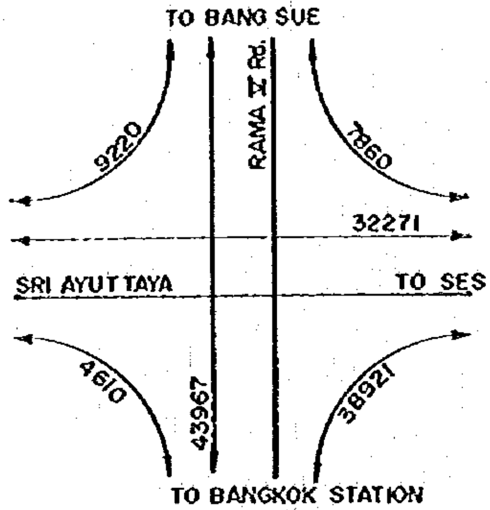
1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE = 2000 VEH(PCU)/GREEN HOUR
   TURNING LANE = 1800 VEH(PCU)/GREEN HOUR
2. PEAK FACTOR = 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES = 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME = 55.0 %

APPENDIX FIG. 9-5(4)	TRAFFIC ANALYSIS OF INTERSECTION (4)

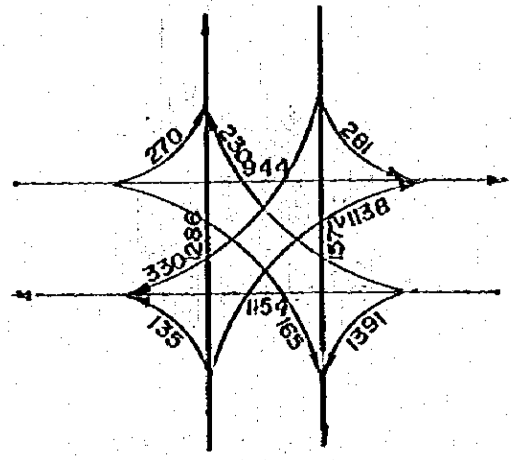
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK

NODE NO. 734 YEAR : 2000

NAME OF INTERSECTION : SES(N-S) x RAMA V ROAD x SRI AYUTTAYA ROAD



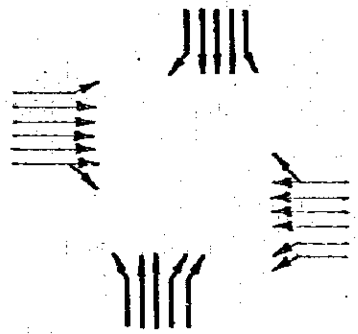
VEH/ DAY



VEH/HOUR

TRAFFIC PHASE (VEH/H)		TRAFFIC VOLUME V(PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	270 / 944 / 165	VL=298, VT=1042, VR=182 } 1522	1x1800, 5x2000 } 11800	0.12	0.12	16 + 2
2	230 / 1154 / 1391	VR=254, VT=1274, VL=1536 } 3064	4x2000, 2x1800 } 11600	0.26	0.27	39 + 2
3	330 / 1572 / 281	VR=364, VT=1735, (VL=310) } 2099	1x1800, 3x2000 } 7800	0.26	0.26	37 + 2
4	135 / 1286 / 1138	(VL=149), VT=1735, VR=1256 } 2676	2x2000, 2x1800 } 7600	0.35	0.35	50 + 2
			TOTAL	0.99	1.00	150

LANE ARRANGEMENT



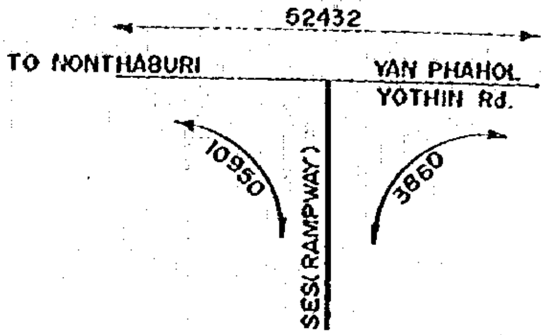
1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE = 2000 VEH(PCU)/GREEN HOUR
   TURNING LANE = 1800 VEH(PCU)/GREEN HOUR
2. PEAK FACTOR = 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES = 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME = 55.0 %

APPENDIX FIG. 9-5(5)

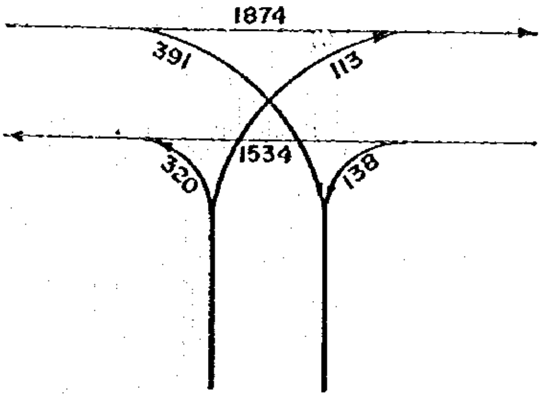
TRAFFIC ANALYSIS OF INTERSECTION(5)

NODE NO. 711 YEAR : 2000

NAME OF INTERSECTION : SES (N-S) x YAN PHAHOL YOTHIN ROAD



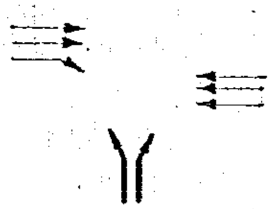
VEH/DAY



VEH/HOUR

TRAFFIC PHASE (VEH/H)		TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	1874 → ; 1534, 138 ←	VT = 2069 VT = 1694, VL = 152 } 1846	2x2000 = 4000 2x2000, 1x1800 } 5800	0.517* 0.318	0.58	68 + 2
2	391 ↘	VR = 432	1x1800 = 1800	0.240*	0.27	30 + 2
3	320, 113	VL = 353, VR = 125 } 478	2x1800 = 3600	0.133*	0.15	16 + 2
4						
		TOTAL		0.890	1.00	120

LANE ARRANGEMENT



1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE = 2000 VEH (PCU)/GREEN HOUR
   TURNING LANE = 1800 VEH (PCU)/GREEN HOUR
2. PEAK FACTOR = 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES = 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME = 55.0 %

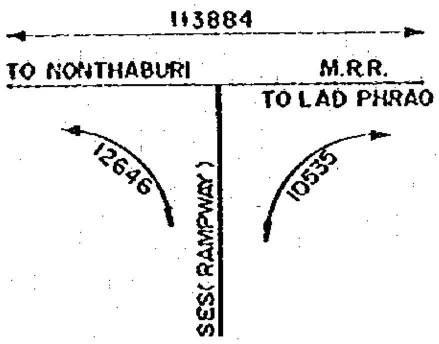
APPENDIX FIG. 9-5 (6)

TRAFFIC ANALYSIS OF INTERSECTION (6)

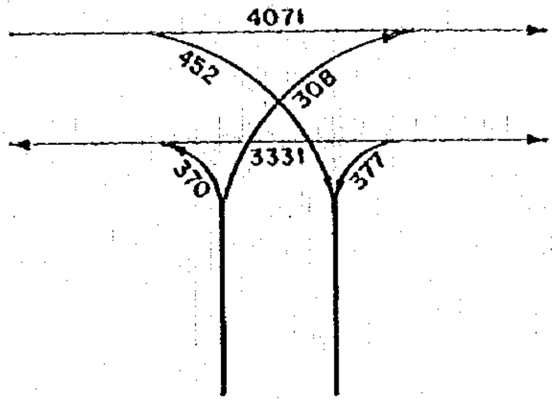
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK

NODE NO. 709 YEAR : 2000

NAME OF INTERSECTION : SES(N-S) x MIDDLE RING ROAD



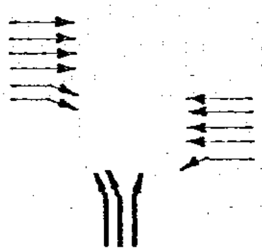
VEH/DAY



VEH/HOUR

TRAFFIC PHASE (VEH/H)		TRAFFIC VOLUME V(PCU/H)	POSSIBLE CAPACITY Cp(PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	4071, 3331, 377	VT=4494 VT=3677, VL=416 } 4093	4x2000 = 8000 4x2000, 1x1800 } 9800	0.562 * 0.418	0.66	78 + 2
2	452	VR=	2x1800 = 3600	0.139 *	0.17	18 + 2
3	370, 308	VL= 408, VR= 340 } 748	3x1800 } 5400	0.139 *	0.17	18 + 2
4						
			TOTAL	0.840	1.00	120

LANE ARRANGEMENT



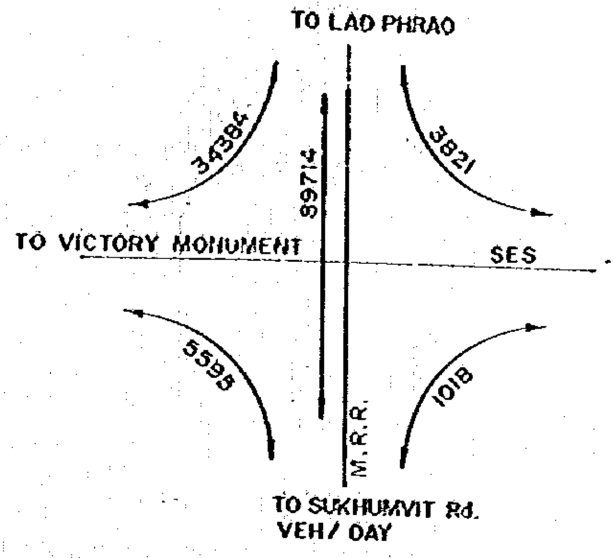
1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE = 2000 VEH(PCU)/GREEN HOUR
   TURNING LANE = 1800 VEH(PCU)/GREEN HOUR
2. PEAK FACTOR = 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES = 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME = 55.0 %

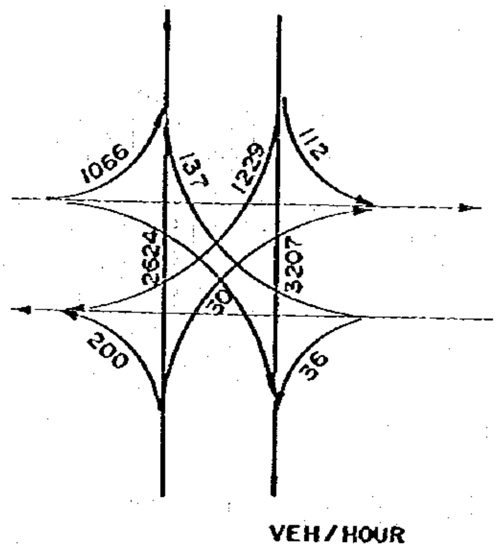
APPENDIX FIG. 9-5(7) TRAFFIC ANALYSIS OF INTERSECTION(7)

NODE NO. 717

YEAR : 2000

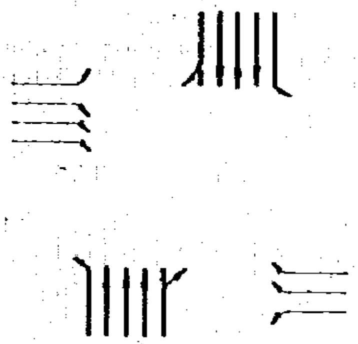
NAME OF INTERSECTION : SES(E) x MIDDLE RING ROAD





TRAFFIC PHASE (VEH/H)		TRAFFIC VOLUME V (PCU/H)		POSSIBLE CAPACITY Cp (PCU/H)		INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	1229 , 112 , 3207	VR = 1357 VT = 3541 VL = 124	5022	1 x 1800 4 x 2000	9800	0.512*	0.58	82 2
2	2624 , 200 , 30	VL = 221 VT = 2897 VR = 33	3151	1 x 1800 4 x 2000	9800	0.322*	0.37	50 2
3	1006 , 164	(VL = 111) VR = 181	181	3 x 1800	5400	0.034		
	137 , 36	VR = 151 (VL = 40)	151	2 x 1800	3600	0.042*	0 05	12 2
				TOTAL		0.876	1.00	150

LANE ARRANGEMENT



1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE = 2000 VEH (PCU) / GREEN HOUR
   TURNING LANE = 1800 VEH (PCU) / GREEN HOUR
2. PEAK FACTOR = 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES = 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME = 55.0 %

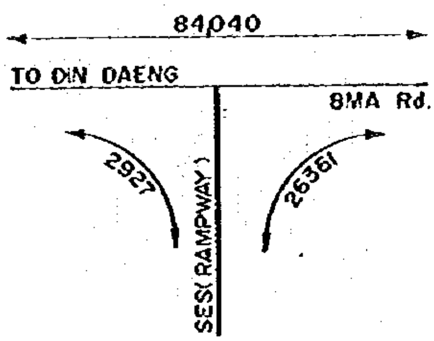
APPENDIX FIG. 9 - 5(8)

TRAFFIC ANALYSIS OF INTERSECTION (8)

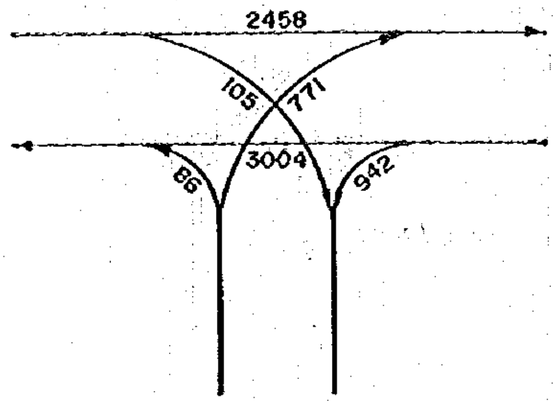
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK

NODE NO. 718 YEAR : 2000

NAME OF INTERSECTION : SES (E) x BMA ROAD ALONG THE NORTHEN BANK OF SAM SEN CANEL



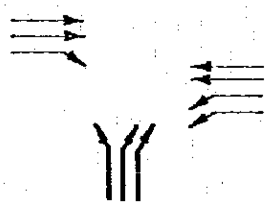
VEH / DAY



VEH / HOUR

TRAFFIC PHASE (VEH/H)		TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	2458 →, 3004 ←, 942 ↙	VT = 2714 VT = 3316 } 4356 VT = 1040	2x2000 = 4000 2x2000 } 7600 2x1800	0.679* 0.573	0.74	81 + 2
2	105 ↘	VR = 116	1x1800 = 1800	0.06*	0.07	12 + 2
3	86, 771	VL = 95 } 946 VR = 851	3x1800 = 5400	0.175*	0.19	21 + 2
4						
			TOTAL	0.914	1.00	120

LANE ARRANGEMENT



1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE = 2000 VEH (PCU) / GREEN HOUR
   TURNING LANE = 1800 VEH (PCU) / GREEN HOUR
2. PEAK FACTOR = 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES = 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME = 55.0 %

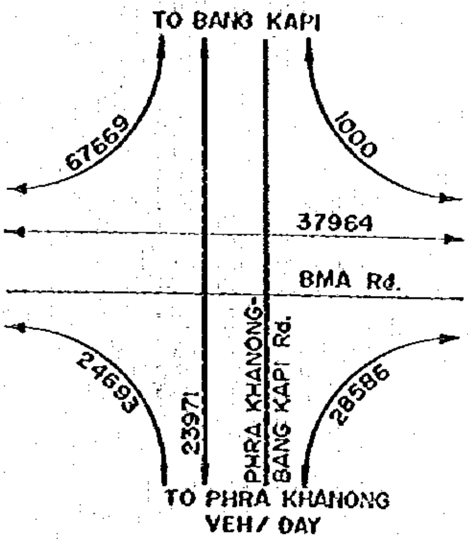
APPENDIX FIG. 9 - 5(9)

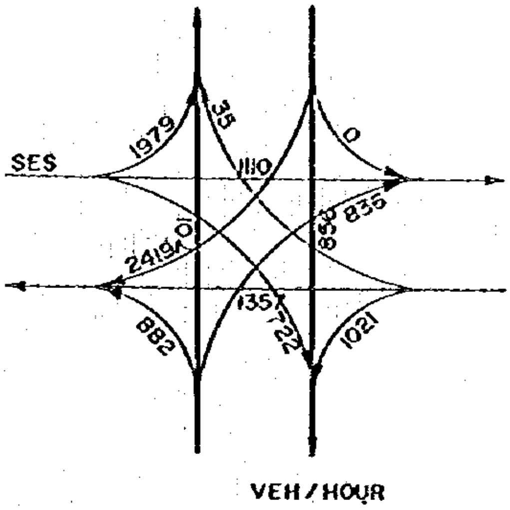
TRAFFIC ANALYSIS OF INTERSECTION(9)

THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK

NODE NO. 721 YEAR : 2000

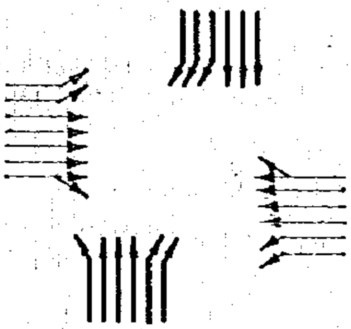
NAME OF INTERSECTION : SES (E) x PHRA KHANONG - BANG KAPI ROAD
BMA ROAD





TRAFFIC PHASE (VEH/H)		TRAFFIC VOLUME V (PCU/H)		POSSIBLE CAPACITY Cp (PCU/H)		INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	1979, 1110, 722	VL = 2184 VT = 1225 VR = 797	4206	2 x 1800 5 x 2000	13600	0.30	0.30	43+2
2	35, 1357, 1021	VR = 38 VT = 1498 VL = 1127	2663	4 x 2000 2 x 1800	11600	0.22	0.22	31+2
3	2419, 856, 0	VR = 2670 VT = 945	3615	3 x 1800 3 x 2000	11400	0.31	0.31	44+2
4	882, 701, 836	(VL = 973) VT = 773 VR = 922	1695	3 x 2000 2 x 1800	9600	0.17	0.17	24+2
				TOTAL		1.00	1.00	150

LANE ARRANGEMENT



1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE = 2000 VEH (PCU)/GREEN HOUR
   TURNING LANE = 1800 VEH (PCU)/GREEN HOUR
2. PEAK FACTOR = 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES = 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME = 55.0 %

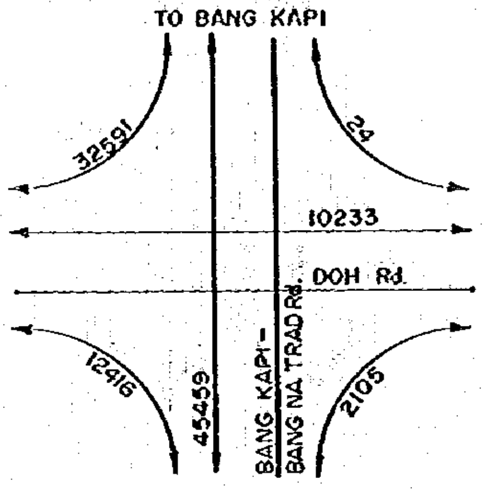
APPENDIX FIG. 9 - 5(10)

TRAFFIC ANALYSIS OF INTERSECTION (10)

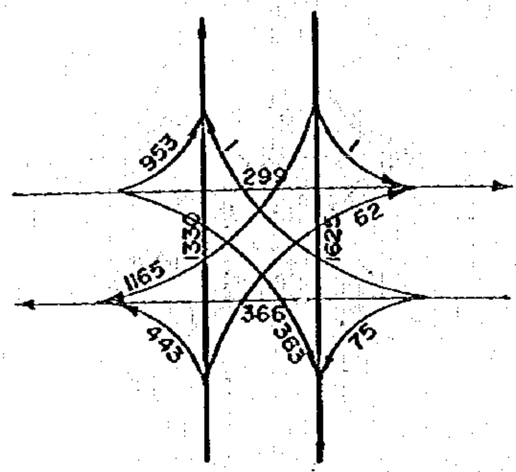
THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK

NODE NO. 722 YEAR : 2000

NAME OF INTERSECTION: SES (E) x BANG KAPI – BANG NA TRAD ROAD
DOH ROAD



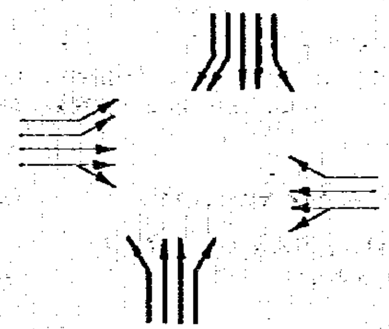
VEH / DAY



VEH / HOUR

	TRAFFIC PHASE (VEH/H)	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED Y	PHASE TIME (SEC.)
1	953, 299, 363	VL = 1052, VT = 330, VR = 401 } 1783	2x1800, 2x2000 } 7600	0.235	0.24	34 + 2
2	1, 366, 75	VR = 1, VT = 404, VL = 83 } 488	2x2000, 1x1800 } 5800	0.084	0.08	12 + 2
3	1165, 1625, 1	VR = 1286, VT = 1794, (VL = 1) } 3080	2x1800, 2x2000 } 7600	0.405	0.41	57 + 2
4	433, 1330, 62	(VL = 478), VT = 1468, VR = 68 } 1536	2x2000, 1x1800 } 5800	0.265	0.27	39 + 2
			TOTAL	0.989	1.00	150

LANE ARRANGEMENT



1. TRAFFIC CAPACITY PER LANE
   THROUGH LANE = 2000 VEH (PCU) / GREEN HOUR
   TURNING LANE = 1800 VEH (PCU) / GREEN HOUR
2. PEAK FACTOR = 6.5 %
3. PERCENTAGE OF HEAVY VEHICLES = 13.0 %
4. DIRECTIONAL DISTRIBUTION OF FUTURE DESIGN HOURLY VOLUME = 55.0 %

APPENDIX
FIG. 9 – 5(II)

TRAFFIC ANALYSIS OF INTERSECTION (II)

THE SECOND STAGE EXPRESSWAY SYSTEM IN THE GREATER BANGKOK