

3.1.4 Method for Implementation and Evaluation

Attention should be paid to the following points in carrying out a finalized measure to tackle traffic problems:

- A. Consistency with other road improvement plans should be confirmed;
- B. Sufficient arrangements and coordination with road users, residents of roadside areas and related administrative office, should be made in advance by eliciting their opinions;
- C. If the plan is designed to come into effect only after it is fully completed, care should be taken not to implement any of its component measures individually and out of order;
- D. The plan should preferably be put into action on a full scale after carrying it out under experimental works.

Even after the plan is put into action, the survey of the locations covered should be continued in order to monitor whether the expected results are achieved or not.

(1) Consolidation of Information up to the Time of Enforcement

The evaluation of an accident prevention plan requires the consolidation of information at each step mentioned in the above, such as: the type of plan; trouble points covered; time of enforcement; executing organization; cost; condition when accidents occurred prior to the enforcement of the plan; contents of problems; reasons for selecting the plan; and the results of its preliminary evaluation.

(2) Implementation of Before-and-After Study

Traffic streams are examined by direct site observation, before and after the implementation of the countermeasures, to see how the situation has changed. This can be facilitated by the use of video cameras. The study may reveal underlying problems with the plan. In order to evaluate the effectiveness of the plan, on the basis of the before-and-after study, the study should cover a significant time period and a large enough accident number, so as to be statistically significant.

The time difference between the before studies and the after studies should be at least a year, to take into

account variations in climate and traffic conditions. The time period required for the adaptation of the new measure is not taken into account.

(3) Indicators and Methods of Evaluation

Evaluation indicators include: absolute number of accidents; accident rate; degree of loss and damage; accident costs; and cost-effectiveness ratio. Whether these indicators are to be examined and recorded for all accidents, or whether the pattern of accidents are only considered, depends on the problems identified. The evaluation of measures or plans is made on the differences, or the ratios of these indicators, or both.

If there is a large difference between the conditions to be compared, there arises the need for standardizing the conditions. Furthermore, if the number of accidents is very small, this figure may not be representative of the accident occurrence, and this sometimes renders it impossible to make accurate evaluations of the changes in the current situation (including the accident occurrence situation) brought about by the execution of a new traffic safety plan. For the purpose of accuracy, therefore, it is necessary to minimize the influence of variation by taking as long a period as possible, and collecting as large a sample as possible for the study. To verify the significance of the sample size, statistical tests should be conducted.

The results obtained at this stage serve as valuable data for working out subsequent accident prevention plans. They should therefore be compiled and stored carefully in the most accessible way possible.

3.2 SELECTION OF STUDY SECTIONS

For the purpose of selecting study sections, a number of proposed sections, which met the following conditions, were screened:

- A. Sections whose inclusion in the Study Area was strongly desired by road administrators, users and neighbouring inhabitants;
- B. Sections considered highly susceptible to accidents from the analysis of various data, including traffic accident data;
- C. Sections considered needy of improvement for better traffic operation using on-site data.

The final selection of the study sections was made after consultation with the DOH. The proposed sections all met the above conditions. Proposed sections in the following categories were then excluded:

- A. Sections whose traffic characteristics and road conditions were similar to other proposed sections and whose traffic safety/control measures were already covered;
- B. Sections with complicated traffic problems requiring a comprehensive traffic management plan based on the DOH policies;
- C. Sections where road and traffic conditions will be changed drastically by the new road improvement programmes to be implemented shortly afterwards.

The Study Sections selected are shown in Table 3.3 and Figure 3.3

Of a total of 59 selected Study Sections, 24 required intersection improvements, 6 required improvements to the general road sections, and 29 needed improvements to provide greater safety for pedestrians.

Table 3.3 List of Study Sections (1)

No.	Route Number	Control Number	Name of Location	KP Start - End (Length)
1.	1	100	Saphan Mai Market	19+000-21+500 (2.5)
2.	1	100	Phumiphol Adulyadet Hospital	23+000
3.	1	100	Ko Mo 25	25+500
4.	1	100	Sorakan Rithiron School	26+000
5.	1	100	ANNEX	26+200
6.	1	100	Chun Sin	26+600
7.	1 (3312)	100	Thupa Temee Stadium	27+600
8.	1	100	Si Mum Muang Market	28+000-29+000 (1.0)
9.	1 (3214)	201	Khlong Luang	40+454
10.	1	201	Ent. AIT	41+500
11.	1	201	Nawanakorn	46+200
12.	3	200	Crocodile Farm	29+000
13.	3	200	Bang Poo	29+250-51+150 (21.9)
14.	4 (3091) (3414)	100	Oam Noi	24+950
15.	4	203	Sanamchan Palace	58+580
16.	34	100	Prapha Montri School	1+500
17.	34	100	Nuan Thong School	2+300-500
18.	302 (1)	100	Kaset Sat	0+000
19.	302 (306)	100	Khae Rai	6+333
20.	302	200	Ratanathibet	6+333-10+800 (4.5)
21.	302	200	Wat Saima	13+400

Table 3.3 List of Study Sections (2)

No.	Route Number	Control Number	Name of Location	KP Start - End (Length)
22.	303 (3104)	100	Prapadaeng	11+198
23.	304	101	Ent.Army	4+800
24.	304 (BMA)	101	Khlong Prapa	4+800-5+600 (0.8)
25.	304	102	Ram Indra Post Office	0+000-0+200 (0.2)
26.	304	102	Army Golf Club	1+000-1+200 (0.2)
27.	304	102	Ram Indra Center	2+000
28.	304	102	Km.4 Market	4+000
29.	304	102	Air Police	4+800
30.	304	102	Mai Ya Lap	5+200
31.	304	102	Wacharaphon	5+600
32.	304	102	Noppharat Ratchathani Hospital	11+900-12+000 (0.1)
33.	306	102	Sattri Nontaburi School	1+500
34.	306	102	Pongsawat Commercial School	3+270
35.	306	102	Wat Lanna Boon	5+500
36.	306	103	Pinprapakom	7+700
37.	306	103	Suang Og Hospital	8+210
38.	306	103	Thai Farmer Bank	9+100
39.	306	103	Tansamrit Pattana	9+538
40.	306	103	Samak Kee	11+251
41.	306	103	Amphan Paisan School	16+300-16+500 (0.2)
42.	306	103	Ha Yaek Pakket	13+450
43.	307 (3035) (3111)	100	Pathum Wilai	10+813

Table 3.3 List of Study Sections (3)

No.	Route Number	Control Number	Name of Location	KP Start - End (Length)
44.	325	200	Damnoen Saduak	33+705-38+215 (4.5)
45.	338	100	Pra Pin Village	2+200
46.	338	200	Suan Pak	2+952-5+900 (3.0)
47.	338	200	Buddha Monthon Sai 7	28+609.5
48.	340 (BMA)	100	Bang Waek	3+725
49.	340 (3242)	100	Ekka Chai	29+300
50.	340	201	Wat Si Boon Rueng	10+500
51.	3119 (BMA)	100	Minburi	0+450
52.	3119 (BMA)	100	Onn Nuch - R.3119	11+003
53.	3202	100	Indra Luk Market	3+000-4+000 (1.0)
54.	3202	100	Nuan Chan	5+300-5+500 (0.2)
55.	3256 (BMA)	100	Onn Nuch - R.3256	11+719
56.	3278	100	Wat Phichai	1+100
57.	3278	100	Bangchan Industrial Estate	7+800
58.	3278	100	Government House	1+039
59.	3278	100	Saha Khon Kan Keha	3+744
Total Number of Study Sections 59				

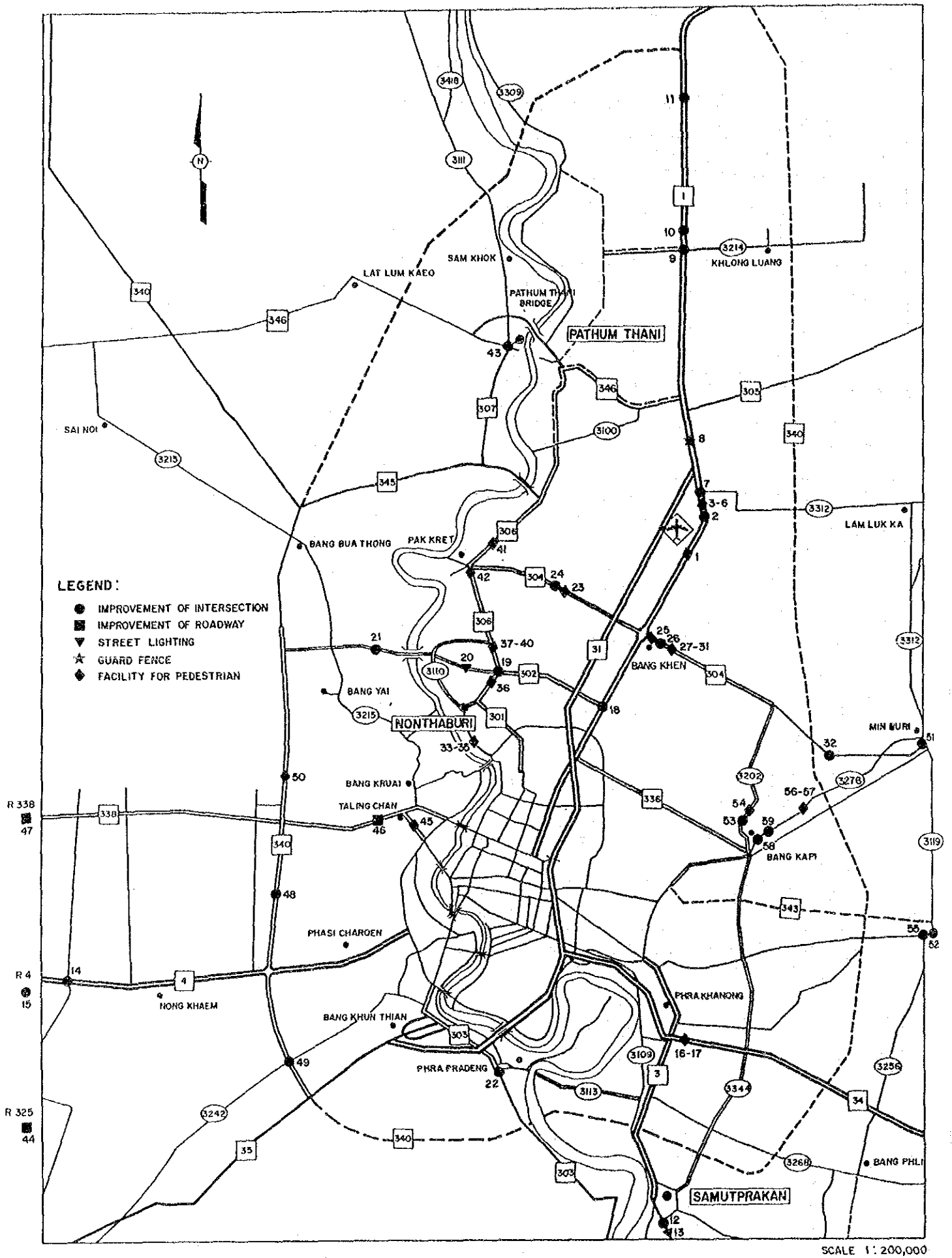


Figure 3.3 LOCATION OF STUDY SECTIONS

3.3 TRAFFIC DATA ANALYSIS

3.3.1 Analysis of Traffic and Accident Data

Traffic accident analyses at each Study Section were carried out based on 1988 traffic accident data. It is impossible to analyze the accident data of 1987 and 1989, because the 1987 data of many of the Study Sections were lost and the 1989 data were incomplete.

For the collection, calculation and tabulation of these data, the sphere of influence of the trouble point was set for each Study Section on the basis of changes in road conditions. A distance of one to two kilometers in both directions was established.

(1) Accident Conditions

Table 3.4 shows the traffic volume, number of accidents, accident casualties, accident rate, etc., for each Study Section where traffic accidents occurred in 1988. This table reveals the following facts about conditions when accidents occurred:

- A. The death and injury accident rate (DIAR) in the entire Study Area was 35.2 casualties/100 mil. vehicle kilometers. Study Sections where the casualty rate was especially higher than this average are S-16 (R34), S-17 (R34), S-29 (R304), S-30 (R304), S-31 (R304), S-39 (R306), S-49 (R340) and S-51 (R3119);
- B. The average accident rate for the entire Study Area was 72.2 cases/100 mil. vehicle kilometers. Study Sections where the accident rate was especially higher than the average are S-1 (R1), S-16 (R34), S-17 (R34), S-18 (R302), S-25 (R304), S-27 (R304), S-29 (R304), S-30 (R304), S-31 (R304), and S-49 (R340). Thus, it can be seen that sections having high accident rates are included in R1, R34, R304 and R340.

(2) Accident Features by Type

Table 3.5 shows a summary of a tabulation of accidents by type that occurred on individual Study Sections. The table reveals the following features of the different accident types:

- A. Pedestrian-vehicle collisions totalled 141 cases in the entire Study Area (12.2% of all accidents). Sections where the frequency of this type of collision is relatively high are S-1, S-16 and S-17;

- B. Vehicle-vehicle collisions include many side, passing and rear-end collisions. There were 208 cases of side-swiping accident for the entire Study Area (18.0% of all accidents), and they occurred most frequently on sections S-1, S-6, S-16, S-17, S-25, S-27, and S-46. Rear-end collisions totaled 341 cases for the entire Study Area (29.4% of all accidents), and their frequency was high on sections S-1, S-16, S-17, S-25, S-27, S-28 and S-47;
- C. Single-vehicle accidents, caused by a vehicle hitting a fixed object, totaled 46 cases for the entire Study Area (4.0% of all accidents), and their frequency is relatively high on sections S-46 and S-47.

Table 3.4 Accident Condition on Each Section (1988) (1)

*NEXT CONTROL SECTION'S ADT
#:1990 ADT DATA

STUDY SECTION NO.	ROUTE NO.	CONTROL SECTION NO.	K.P.-K.P.	LENGTH (KM)	TRAFFIC VOLUME		NUMBER OF ACCIDENTS (CASES)	CASUALTIES			ACCIDENT RATE					REMARKS
					ADT (PCU/DAY)	VEHICLE KILOMETER		DEATH (CASES)	INJURY (CASES)	DEATH AND INJURY (CASES)	ACCIDENT DENSITY (CASES/KM)	ALL ACCIDENTS (CASES/100 MIL. VEH. KM.)	DEATH (CASUAL-TIES/100 MIL. VEH. KM.)	INJURY (CASUAL-TIES/100 MIL. VEH. KM.)	DEATH AND INJURY (CASUL-TIES/100 MIL. VEH. KM.)	
1	1	100	20+500 - 21+500	1.000	46,341	46,341	67	2	17	19	67.0	396.1	11.8	100.5	112.3	32.1
2	1	100	22+500 - 23+500	1.000	36,589	36,589	22	0	1	1	22.0	164.7	0.0	7.5	7.5	32.1
3	1	100	25+000 - 26+000	1.000	36,589	36,589	18	0	4	4	18.0	134.8	0.0	30.0	30.0	32.1
4	1	100	25+500 - 26+500	1.000	36,589	36,589	29	2	4	6	29.0	217.1	15.0	30.0	44.9	32.1
5	1	100	25+500 - 26+500	1.000	36,589	36,589	29	2	4	6	29.0	217.1	15.0	30.0	44.9	32.1
6	1	100	26+000 - 27+000	1.000	36,589	36,589	31	2	6	8	31.0	232.1	15.0	44.9	59.9	32.1
7	1	100	27+000 - 28+000	1.000	36,589	36,589	17	1	2	3	17.0	127.3	7.5	15.0	22.5	32.1
7	3312	101	0+000 - 0+500	0.500	3,221	1,611	0	0	0	0	0.0	0.0	0.0	0.0	0.0	17.5
8	1	100	28+000 - 29+000	1.000	36,589	36,589	6	1	4	5	6.0	44.9	7.5	30.0	37.4	32.1
9	1	201	39+500 - 41+000	1.500	79,604	119,406	12	5	7	12	8.0	27.5	11.5	16.1	27.5	20.9
9	3214	102	0+000 - 0+500	0.500	9,303	4,652	0	0	0	0	0.0	0.0	0.0	0.0	0.0	34.1
10	1	201	41+000 - 42+000	1.000	79,604	79,604	4	0	4	4	4.0	13.8	0.0	13.8	13.8	20.9
11	1	201	45+500 - 46+500	1.000	79,604	79,604	12	3	10	13	12.0	41.3	10.3	34.4	44.7	20.9
12	3	200	28+500 - 29+500	1.000	87,827	87,827	6	2	16	18	6.0	18.7	6.2	49.9	56.2	14.5
13	3	200	29+250 - 51+150	21.900	87,827	1,923,411	18	12	26	38	0.8	2.6	1.7	3.7	5.4	14.5
14	4	100	24+500 - 24+967	0.467	47,813	22,329	3	3	1	4	6.4	36.8	36.8	12.3	49.1	36.7
14	4	201	24+967 - 25+500	0.533	59,013	31,454	7	2	6	8	13.1	61.0	17.4	52.3	69.7	29.7
14	3091	100	0+000 - 0+500	0.500	11,904	5,952	1	0	1	1	2.0	46.0	0.0	46.0	46.0	144.9
14	3414	100	0+000 - 0+500	0.500	6,164	3,082	1	0	0	0	2.0	88.9	0.0	0.0	0.0	28.9
15	4	203	57+500 - 59+500	2.000	37,445	74,890	9	5	6	11	4.5	32.9	18.3	22.0	40.2	28.8
16	34	100	1+000 - 2+000	1.000	45,246	45,246	134	3	48	51	134.0	811.4	18.2	290.6	308.8	40.7
17	34	100	2+000 - 3+000	1.000	45,246	45,246	104	4	49	53	104.0	629.7	24.3	296.7	320.9	40.7
18	302	100	0+000 - 0+500	0.500	53,294	26,647	71	1	7	8	142.0	730.0	10.3	72.0	82.3	45.5
19	302	100	6+000 - 7+000	1.000	53,294	53,294	0	0	0	0	0.0	0.0	0.0	0.0	0.0	45.5
19	306	103	7+000 - 8+000	1.000	24,370	24,370	5	2	5	7	5.0	56.2	22.5	56.2	78.7	44.6
20	302	200	6+333 - 10+800	4.467	18,306	81,773	2	0	0	0	0.4	6.7	0.0	0.0	0.0	10.8

Table 3.4 Accident Condition on Each Section (1988) (2)

*:NEXT CONTROL SECTION'S ADT
#:1990 ADT DATA

STUDY SECTION NO.	ROUTE NO.	CONTROL SECTION NO.	K.P.-K.P.	LENGTH (KM)	TRAFFIC VOLUME		NUMBER OF ACCIDENTS (CASES)	CASUALTIES			ACCIDENT RATE					REMARKS	
					ADT (PCU/DAY)	VEHICLE KILOMETER		DEATH (CASES)	INJURY (CASES)	DEATH AND INJURY (CASES)	ACCIDENT DENSITY (CASES/KM)	ALL ACCIDENTS (CASES/100 MIL. VEH. KM.)	DEATH (CASUAL-TIES/100 MIL. VEH. KM.)	INJURY (CASUAL-TIES/100 MIL. VEH. KM.)	DEATH AND INJURY (CASUL-TIES/100 MIL. VEH. KM.)		ACCIDENT RATE OF CONTROL SECTION (CASUL-TIES/100 MIL. VEH. KM.)
21	302	200	13+000 - 14+000	1.000	18,306	18,306	5	1	1	2	5.0	74.8	15.0	15.0	29.9	10.8	
22	303	100	10+500 - 11+500	1.000	32,511	32,511	12	9	13	13	12.0	101.1	75.8	33.7	109.6	48.2	
22	3104	100	0+000 - 0+500	0.500	35,254	17,627	1	0	1	1	2.0	15.5	0.0	15.5	15.5	17.5	
23	304	101	4+000 - 6+000	2.000	62,574	125,148	8	1	0	1	4.0	17.5	2.2	0.0	2.2	16.7	
24	304	101	4+000 - 6+000	2.000	62,574	125,148	8	1	0	1	4.0	17.5	2.2	0.0	2.2	16.7	
25	304	102	0+000 - 0+500	0.500	44,507	22,254	47	0	9	9	94.0	578.6	0.0	110.8	110.8	64.6	
26	304	102	0+500 - 1+500	1.000	44,507	44,507	36	0	10	10	36.0	221.6	0.0	61.6	61.6	64.6	
27	304	102	2+000 - 2+500	0.500	44,507	22,254	59	0	9	9	118.0	726.4	0.0	110.8	110.8	64.6	
28	304	102	3+500 - 4+500	1.000	44,507	44,507	42	2	12	14	42.0	258.5	12.3	73.9	86.2	64.6	
29	304	102	4+500 - 5+000	0.500	44,507	22,254	27	0	10	10	54.0	332.4	0.0	123.1	123.1	64.6	
30	304	102	5+000 - 5+500	0.500	44,507	22,254	24	0	11	11	48.0	295.5	0.0	135.4	135.4	64.6	
31	304	102	5+500 - 6+000	0.500	44,507	22,254	31	1	14	15	62.0	381.7	12.3	184.7	172.4	64.6	
32	304	102	11+500 - 12+500	1.000	44,507	44,507	13	0	6	6	13.0	80.0	0.0	36.9	36.9	64.6	
33	306	102	1+000 - 2+000	1.000	21,292	21,292	6	0	8	8	6.0	77.2	0.0	102.9	102.9	75.1	
34	306	102	3+000 - 4+000	1.000	21,292	21,292	4	1	3	4	4.0	51.5	12.9	38.6	51.5	75.1	
35	306	102	5+000 - 6+000	1.000	21,292	21,292	5	1	7	8	5.0	64.3	12.9	90.1	102.9	75.1	
36	306	103	7+000 - 8+000	1.000	24,370	24,370	5	2	5	7	5.0	56.2	22.5	56.2	78.7	44.6	
37	306	103	8+000 - 9+000	1.000	24,370	24,370	1	0	2	2	1.0	11.2	0.0	22.5	22.5	44.6	
38	306	103	8+500 - 9+500	1.000	24,370	24,370	7	6	3	9	7.0	78.7	67.5	33.7	101.2	44.6	
39	306	103	9+000 - 10+000	1.000	24,370	24,370	10	13	3	16	10.0	112.4	146.1	33.7	179.9	44.6	
40	306	103	11+000 - 12+000	1.000	24,370	24,370	5	2	7	9	5.0	56.2	22.5	78.7	101.2	44.6	
41	306	103	16+000 - 17+000	1.000	24,370	24,370	2	2	1	3	2.0	22.5	22.5	11.2	33.7	44.6	
42	306	103	13+000 - 14+000	1.000	24,370	24,370	0	0	0	0	0.0	0.0	0.0	0.0	0.0	44.6	
43	307	100	13+000 - 14+500	1.500	21,547	32,321	9	8	5	13	6.0	76.3	67.8	42.4	110.2	20.0	
43	3035	100	0+500 - 2+000	1.500	6,377	9,566	2	0	2	2	1.3	57.3	0.0	57.3	57.3	25.1	

Table 3.4 Accident Condition on Each Section (1988) (3)

*: NEXT CONTROL SECTION'S ADT
#: 1990 ADT DATA

STUDY SECTION NO.	ROUTE NO.	CONTROL SECTION NO.	K.P.-K.P.	LENGTH (KM)	TRAFFIC VOLUME		NUMBER OF ACCIDENTS (CASES)	CASUALTIES			ACCIDENT RATE					REMARKS					
					ADT (PCU/DAY)	VEHICLE KILOMETER		DEATH (CASES)	INJURY (CASES)	DEATH AND INJURY (CASES)	ALL ACCIDENTS (CASES/100 MIL. VEH. KM.)	DEATH (CASUAL-TIES/100 MIL. VEH. KM.)	INJURY (CASUAL-TIES/100 MIL. VEH. KM.)	DEATH AND INJURY (CASUAL-TIES/100 MIL. VEH. KM.)	ACCIDENT RATE OF CONTROL SECTION (CASUAL-TIES/100 MIL. VEH. KM.)						
43	3111	100	0+000 - 0+500	0.500	9,290	4,645	2	1	0	1	4.0	118.0	59.0	0.0	59.0	236.2					
44	325	200	40+500 - 42+725	2.225	8,251	18,358	7	2	6	8	3.1	104.5	29.8	89.5	119.4	41.1					
45	338	100	2+000 - 3+000	1.000	30,225	30,225	16	1	6	7	16.0	145.0	9.1	54.4	63.5	38.1	*				
46	338	200	2+500 - 6+000	3.500	30,225	105,788	81	2	40	42	23.1	209.8	5.2	103.6	108.8	48.5					
47	338	200	28+000 - 29+000	1.000	30,225	30,225	7	0	5	5	7.0	63.5	0.0	45.3	45.3	48.5					
48	340	100	3+000 - 4+000	1.000	41,408	41,408	0	0	0	0	0.0	0.0	0.0	0.0	0.0	2.1	*				
49	340	100	29+000 - 30+000	1.000	41,408	41,408	0	0	0	0	0.0	0.0	0.0	0.0	0.0	2.1	*				
49	3242	100	18+500 - 20+000	1.500	12,923	19,385	25	1	17	18	16.7	353.3	14.1	240.3	254.4	64.1					
50	340	201	10+000 - 11+000	1.000	41,408	41,408	0	0	0	0	0.0	0.0	0.0	0.0	0.0	4.4					
51	3119	100	0+000 - 1+000	1.000	11,093	11,093	7	1	7	8	7.0	172.9	24.7	172.9	197.6	60.6					
52	3119	100	10+500 - 11+500	1.000	11,093	11,093	7	3	2	5	7.0	172.9	74.1	49.4	123.5	60.6					
53	3202	100	3+000 - 4+000	1.000	51,112	51,112	0	0	0	0	0.0	0.0	0.0	0.0	0.0	25.8					
54	3202	100	5+000 - 6+000	1.000	51,112	51,112	9	0	2	2	9.0	48.2	0.0	10.7	10.7	23.8					
55	3256	100	11+000 - 12+000	1.000	11,831	11,831	2	0	1	1	2.0	46.3	0.0	23.2	23.2	20.0					
56	3278	100	0+500 - 1+500	1.000	14,445	14,445	3	0	0	0	3.0	56.9	0.0	0.0	0.0	58.6	#				
57	3278	100	6+500 - 8+500	2.000	14,445	28,890	6	1	1	2	3.0	56.9	9.5	9.5	19.0	58.6	#				
58	3278	100	0+500 - 1+500	1.000	14,445	14,445	3	0	0	0	3.0	56.9	0.0	0.0	0.0	58.6	#				
59	3278	100	3+000 - 4+000	1.000	14,445	14,445	6	0	3	3	6.0	113.8	0.0	56.9	56.9	58.6	#				
							SUM	1,158	451	568	-	-	-	-	-	-	-	-			
							AVERAGE	17	7	8	12.1	72.2	7.1	28.1	35.2						

Table 3.5 Number of Accidents by Accident Type (1988) (1)

NO.	ROUTE NO.	CONTROL SECTION NO.	NUMBER OF ACCIDENTS BY TYPE OF ACCIDENT (CASES)														SUM
			HIT PEDES-TRIANS	HIT BICYCLE	HIT DURING PASSING	HIT OPPOSED VEHICLE	REAR END COLLI-SION	HEAD ON COLLI-SION	HIT AT INTER-SECTION	SIDE COLLI-SION	IMPROPER TURNING	LOST OF CONTROL	HIT FIXED OBJECT	HIT TRAIN	OTHERS		
1	1	100	16	0	12	1	29	0	2	2	0	0	0	0	0	3	67
2	1	100	1	0	4	6	3	0	2	0	0	0	0	0	5	22	
3	1	100	1	0	5	1	2	0	0	1	1	1	0	0	6	18	
4	1	100	2	0	7	4	3	0	0	1	1	1	0	0	9	29	
5	1	100	2	0	7	4	3	0	0	1	1	1	0	0	9	29	
6	1	100	3	0	10	6	3	0	0	1	1	0	0	0	6	31	
7	1	100	0	0	3	4	5	0	0	1	0	0	2	0	2	17	
7	331	101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8	1	100	0	0	0	0	3	0	1	0	1	0	0	0	1	6	
9	1	201	3	0	0	0	2	0	2	0	1	1	3	0	0	12	
9	321	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10	1	201	0	0	0	0	0	1	0	0	2	0	0	0	1	4	
11	1	201	1	0	0	0	5	0	2	0	3	0	0	0	1	12	
12	3	200	2	1	1	1	1	0	0	0	0	0	0	0	0	6	
13	3	200	3	2	2	1	3	5	0	0	0	1	0	0	1	18	
14	4	100	1	0	0	0	2	0	0	0	0	0	0	0	0	3	
14	4	201	4	0	0	0	1	0	0	0	0	1	0	0	1	7	
14	309	100	0	0	0	0	0	0	1	0	0	0	0	0	0	1	
14	341	100	0	0	0	0	0	0	0	0	0	0	1	0	0	1	
15	4	203	1	0	0	0	3	0	0	0	2	0	1	0	2	9	
16	34	100	20	1	28	6	45	0	0	4	23	2	3	0	2	134	
17	34	100	23	1	18	9	29	1	0	2	14	2	3	0	2	104	
18	302	100	2	1	8	13	16	0	9	3	13	0	0	0	6	71	
19	302	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
19	306	103	1	0	0	0	2	0	0	0	0	0	0	0	2	5	
20	302	200	1	0	0	0	0	0	0	0	0	0	1	0	0	2	

Table 3.5 Number of Accidents by Accident Type (1988) (2)

NO.	ROUTE NO.	CONTROL SECTION NO.	NUMBER OF ACCIDENTS BY TYPE OF ACCIDENT (CASES)														SUM	
			HIT PEDES-TRIANS	HIT BICYCLE	HIT DURING PASSING	HIT OPPOSED VEHICLE	REAR END COLLISION	HEAD ON COLLISION	HIT AT INTERSECTION	SIDE COLLISION	IMPROPER TURNING	LOST OF CONTROL	HIT FIXED OBJECT	HIT TRAIN	OTHERS			
21	302	200	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
22	303	100	4	0	3	0	1	0	2	0	0	0	0	0	2	0	0	12
22	310	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
23	304	101	0	0	1	0	4	0	0	0	0	0	0	0	1	0	1	8
24	304	101	0	0	1	0	4	0	0	0	0	0	0	0	1	0	1	8
25	304	102	1	1	14	1	20	0	1	1	0	0	0	0	0	0	8	47
26	304	102	1	0	7	1	14	1	2	0	0	0	0	0	0	0	6	36
27	304	102	3	0	10	2	25	0	6	1	0	0	0	0	1	0	6	59
28	304	102	4	1	6	3	20	0	2	1	0	0	0	0	2	0	1	42
29	304	102	4	1	7	0	12	0	0	0	0	0	0	0	1	2	0	27
30	304	102	3	1	8	0	11	0	0	0	0	0	0	0	1	0	0	24
31	304	102	4	0	6	1	14	0	0	0	0	0	0	0	2	0	3	31
32	304	102	2	0	4	3	1	0	0	0	0	0	0	0	0	0	3	13
33	306	102	0	2	0	0	1	0	1	0	0	0	0	0	1	0	1	6
34	306	102	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	4
35	306	102	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	4
36	306	103	2	0	0	0	2	0	0	0	0	0	0	0	0	0	2	6
37	306	103	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
38	306	103	1	0	2	0	0	0	0	0	0	0	0	0	0	0	4	7
39	306	103	2	1	2	0	0	0	0	1	0	0	0	0	0	0	4	10
40	306	103	0	0	0	0	3	1	0	1	0	0	0	0	0	0	0	5
41	306	103	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
42	306	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	307	100	2	1	1	2	2	0	1	0	0	0	0	0	0	0	0	9
43	303	100	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
43	311	100	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2

Table 3.5 Number of Accidents by Accident Type (1988) (3)

NO.	ROUTE NO.	CONTROL SECTION NO.	NUMBER OF ACCIDENTS BY TYPE OF ACCIDENT (CASES)													SUM	
			HIT PEDES-TRIANS	HIT BICYCLE	HIT DURING PASSING	HIT OPPOSED VEHICLE	REAR END COLLI-SION	HEAD ON COLLI-SION	HIT AT INTER-SECTION	SIDE COLLI-SION	IMPROPER TURNING	LOST OF CONTROL	HIT FIXED OBJECT	HIT TRAIN	OTHERS		
44	325	200	1	0	0	3	2	0	0	0	1	0	0	0	0	0	7
45	338	100	1	1	4	0	6	0	0	0	0	0	2	1	0	1	16
46	338	200	9	0	16	0	27	0	4	2	2	4	2	7	0	10	81
47	338	200	0	0	0	0	0	0	0	0	0	0	0	7	0	0	7
48	340	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	340	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	324	100	1	1	4	1	5	0	10	0	0	1	1	0	0	1	25
50	340	201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	311	100	1	0	1	0	2	0	3	0	0	0	0	0	0	0	7
52	311	100	0	0	0	1	0	0	2	0	0	1	0	0	3	0	7
53	320	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	320	100	2	0	2	1	1	0	0	0	0	0	1	1	0	1	9
55	325	100	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2
56	327	100	0	0	0	0	0	0	0	0	0	1	0	0	2	2	3
57	327	100	1	0	2	0	1	0	0	0	0	0	0	1	0	1	6
58	327	100	0	0	0	0	0	0	0	0	0	1	0	0	2	2	3
59	327	100	2	0	0	0	0	0	0	0	0	0	0	0	4	4	6
			141	16	208	76	341	12	55	25	90	24	46	3	121	1,158	

3.3.2 Supplemental Traffic Survey

The traffic surveys were carried out by the Study Team in order to obtain data on the traffic control and safety measures at selected Study Sections.

The traffic surveys are divided into: a vehicle count survey at intersections; a vehicle count survey at roadsides; and a road crossing pedestrian count survey.

The locations of the traffic surveys are summarized in Table 3.6

Table 3.6 Supplemental Traffic Survey Location

Item	Survey Locations
Vehicle Count Survey at Intersections	2, 7, 9, 10, 11, 12, 14, 15, 18, 19, 21, 22, 23, 24, 26, 32, 43, 51, 52, 53, 55, 58, 59
Vehicle Count Survey at Roadsides	3, 4, 5, 6, 33, 35, 42, 44, 45, 50
Crossing Pedestrian Count Survey	1, 2, 3, 4, 5, 6, 23, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 45, 50, 54, 56, 57, 59

Traffic volume was counted manually for a period of 13 hours from 6 a.m. to 7 p.m. The classification of the vehicle type was divided into 3 categories, as shown in Appendix 3.1. Other traffic surveys, such as a queue length survey and a signal indications survey, were also conducted in order to grasp the existing traffic conditions at selected locations.

3.4 FORMULATION OF MEASURES

3.4.1 Procedure

The selected countermeasures were examined on the basis of the technical guidelines and the engineering specifications in the TOPR Study. In particular, they were examined according to the flow chart shown in Figure 3.4.

As seen in Figure 3.4, the examination consists of the following procedures.

A. Problem Identification

The existing road and traffic conditions, the major traffic problems, and the possible countermeasures, in each of the 59 Study Sections are summarized in section 3.4.2.

B. Selection of Countermeasures

The proposed measures are reviewed and examined for the final selection for each Study Section in section 3.4.3.

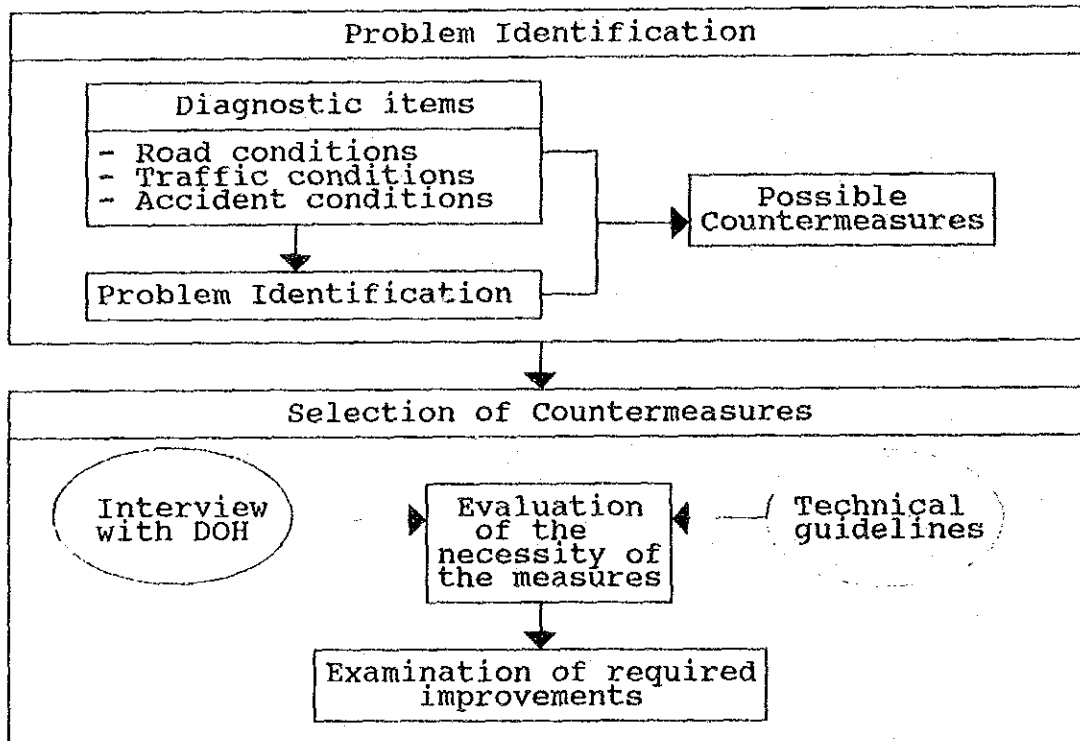


Figure 3.4 FLOW CHART FOR EXAMINING COUNTERMEASURES

3.4.2 Problem Identification

The following is a summary of: the existing road and traffic conditions; the major traffic problems; and the possible countermeasures, in each of the 59 Study Sections. This summary is a result of traffic data analysis and site investigations. The traffic data analysis for each Study Section was based on traffic accident data for 1988.

For details of the road traffic conditions, the traffic data analysis, and problem identification, a diagnostic sheet for each Study Section has been prepared and is attached in Appendix 3.2.

Study Section S-1: Saphan Mai Market (R1)

In this site there are two problem locations: one is the R1 and soi Son Thai intersection (19.8 Kp); the other is the road section in front of Sapan Mai Market (20.3 Kp - 21.8 Kp).

(1) Existing Conditions

a) Road Conditions

R1 is a straight four-lane section with a wide median (4-5 m) and wide shoulders (4 m). There are many service facilities along the section, such as a department store and supermarkets located in front of Sapan Mai market.

b) Traffic Conditions

R1 is a primary highway and has large traffic volumes. The flow of traffic at the intersection on 19.8 Kp is impeded by cars taking U-turns and by the large amount of traffic entering R1 from soi Son Thai in the morning and evening peak hours. There are many pedestrians crossing R1 from shops on both sides of the road in the section between 20.3 Kp and 21.8 Kp.

c) Accident Conditions

Rear-end collisions are the most frequent (29 cases, which represents 43% of all accident types), followed by pedestrian accidents (16 cases, 24% of total), and overtaking accidents (12 cases, 18% of total). Most accidents are caused by speeding. The accident rate is as high as 112.3 casualties/100 mil. vehicle kilometers.

(2) Major Problems

Traffic volume exceeded the capacity of the stop-controlled intersection and there is much confusion caused by U-turning vehicles at 19.8 Kp. Therefore, smoothness of traffic flow, between 19.0 Kp and 21.5 Kp, is not possible. The pedestrian crossing, in front of Sapan Mai Market, is very dangerous.

(3) Possible Countermeasures

In order to secure traffic smoothness, the installation of pre-timed signals with coordinated signal controls in control segment 19.8 Kp to 21.8 Kp, is suggested.

The following measures for pedestrians are proposed:

Alternative-1: installation of a pedestrian overpass;

Alternative-2: installation of pedestrian signals to be coordinated with the traffic signals.

Study Section S-2: Phumiphol Adulyadet Hospital (R1)

(1) Existing Conditions

a) Road Conditions

This is a small T-shaped intersection on R1 and a feeder road leading to Phumiphol Adulyadet Hospital. The R1 section is a straight four-lane section with a wide median (4.5 m).

b) Traffic Conditions

Traffic conditions are the same as at S-1 and traffic signals are situated approximately 100 m to the south.

c) Accident Conditions

Collisions with cars running in the opposite direction are the most frequent (6 cases, 27% of all accident types). These accidents are most probably caused by U-turning and right-turning vehicles.

(2) Major Problems

Confusion is caused by vehicles entering, existing and taking U-turns in front of the hospital.

(3) Possible Countermeasures

The installation of a pre-timed signal, set to offset simultaneous with nearby signals, is suggested.

Study Sections S-3: Ko Mo 25 (R1) to S-6: Chun Sin (R1)

(1) Existing Conditions

a) Road Conditions

The R1 section here is a straight four-lane section with a wide median (4 m). These locations are T-intersections between R1 and several sois.

b) Traffic Conditions

Traffic Conditions are the same as at S-1 and S-2.

c) Accident Conditions

Each location recorded between one and three pedestrian accidents.

(2) Major Problems

The pedestrian crossings are in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-7: Thupa Temee Stadium (R1/R3312)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R1 and R3312. R1 has a right-turn lane going north to R3312 and a left-turn lane going south to R3312. R3312 is a two-lane road and intersects R1 at its curved section. There is a bus-stop and a pedestrian crossing in this section.

b) Traffic Conditions

R1 is a primary highway with heavy traffic volumes.

R3312 has a traffic volume of about 6,300 vehicles/day and its heavy vehicle rate (RHV) is as high as 35.1%. Right-turns from R3312 are prohibited .

c) Accident Conditions

Rear-end collisions are the most frequent (5 cases, 29% of the total), followed by head-on collisions (4 cases, 24% of the total).

(2) Major Problems

Traffic volumes exceed the capacity of the stop-controlled intersection.

(3) Possible Countermeasures

The installation of pre-timed signals to be coordinated with the signals at 27 Kp, is suggested.

Study Section S-8: Si Mum Muang Market (R1)

(1) Existing Conditions

a) Road Conditions

This is a highway section which comes after the end of the R1 and R31 mergings. It has frontage roads which are divided by depressed separators. The R1 section here is a straight section with six lanes on the highway and two lanes on the frontage road on both sides.

b) Traffic Conditions

R1 is a primary highway having heavy traffic and the heavy vehicle rate is 38%.

c) Accident Conditions

The frequency of accidents is not very high (6 cases recorded). The most frequent type of accident is rear-end collisions (3 cases).

(2) Major Problems

Cars drop into the depressed median.

(3) Possible Countermeasures

The installation of a guard fence is suggested.

Study Section S-9: Khlong Luang (R1/R3214)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R1 and R3214. The R1 section is a straight four-lane section with a wide median. R3214 is a narrow road (widening planned) on the western side of R1, but it has two lanes on the eastern side of R1.

b) Traffic Conditions

It is impossible to go straight or make a right-turn from R3214 to R1 because its median opening is blocked-up. Traffic from R3214 wanting to go straight or to turn right must first make a left-turn and then a U-turn in the median opening.

c) Accident Conditions

The number of accidents is not very large, but 5 cases (42% of all accidents) of vehicles running off the road have been recorded.

(2) Major Problems

Traffic from R3214, going straight or turning right, is inconvenienced because of the closed median.

It is difficult to make U-turns at the near median opening due to the heavy traffic volume travelling at speed.

(3) Possible Countermeasures

Installation of signals, channelization of U-turn traffic and the installation of U-turn signals are suggested.

Study Section S-10: Ent. AIT (R1)

(1) Existing Conditions

a) Road Conditions

This is a small intersection of R1, an important primary highway, and a minor road leading to the Asian Institute of Technology (AIT) and Thammasart University. The road has been partially widened from the standard four lanes to ten lanes. R1 has a right-turn lane and an acceleration lane for right-turning cars.

b) Traffic Conditions

R1 has high traffic volumes, a high proportion of heavy vehicles, and a very high traffic running speed. The median has no open section for approximately 1.7 km on the Bangkok-side, including the intersection with R3214. Right-turning traffic from R1 to the crossroad has to make a U-turn here. Most of the U-turn traffic is made up of small cars.

c) Accident Conditions

There were no accidents recorded on this section.

(2) Major Problems

R1 has many lanes with very high running speeds. It is difficult and dangerous for cars from the minor road to make right-turns or U-turns. Some of the U-turn traffic is accommodated in the median shoulder (w is 2.0 m), but some cars are unable to get into the shoulder. This often gives rise to a conflict with the through-traffic, disturbing its steady and smooth flow.

(3) Possible Countermeasures

The reduction of the lane numbers to match ordinary lane numbers and the provision of the U-turn facility are suggested.

Study Section S-11: Nawanakorn (R1)

(1) Existing Conditions

a) Road Conditions

This is a T-intersection of R1 and a feeder road for the Nowanakorn Estate. The R1 section here is a straight four-lane section with a wide median (9 m). Two lanes are provided at the entrance and exit of the estate, and there is an access road leading south to the estate.

b) Traffic Conditions

R1 is a primary highway having heavy traffic. The volume of entering and exiting traffic increases in the morning and evening peak hours.

c) Accident Conditions

Accidents are mostly caused by speeding. Rear-end collisions are the most frequent (5 cases, 42% of all accident types), followed by collisions caused by improper turning (3 cases, 25% of total).

(2) Major Problems

Users from the industrial estate are inconvenienced by the lack of signals.

(3) Possible Countermeasures

The installation of signals is suggested.

Study Section S-12: Crocodile Farm (R3)

(1) Existing Conditions

a) Road Conditions

This is a T-intersection of R3 and a feeder road to a crocodile farm. The R3 section is a straight four-lane section with a wide median. The feeder road is a two-lane road. There is a right-turn lane going south from R3 to the farm.

b) Traffic Conditions

R3 is a primary highway which runs south-east. It has large traffic volumes and a high proportion of heavy vehicles (RHV is 39%).

c) Accident Conditions

Speeding is the main cause of accidents.

(2) Major Problems

Traffic volume of the stop-controlled intersection is almost saturated.

(3) Possible Countermeasures

The installation of pre-timed signals or semi-actuated traffic signals is suggested.

Study Section S-13: Bang Poo (R3)

(1) Existing Conditions

a) Road Conditions

This is a section of R3 and has four lanes and a wide center strip (5.5 m) as far as Kp 40 + 000, after which the number of lanes is reduced to two.

b) Traffic Conditions

R3 is a primary highway which runs south-east. It has large traffic volumes and a high proportion of heavy vehicles (RHV is 39%).

c) Accident Conditions

Speeding is the cause of most of the accidents (14 cases, 78% of the total), especially at night-time when ten of the cases were recorded.

Of all the accident types, head-on collisions are the most frequent (5 cases, 36% of the total), followed by read-end collisions and pedestrian accidents (3 cases, 21% of the total). Ten cases of accidents involving vehicles and motorcycles were recorded.

(2) Major Problems

The number of night-time accidents is higher than on other sections, especially the number of accidents involving motorcycles.

(3) Possible Countermeasures

The installation of continuous lighting between 29.5 Kp and 37 Kp is suggested, because there are many residential areas and market facilities on this section.

Study Section S-14: Oam Noi (R4/R3091/R3414)

(1) Existing Conditions

a) Road Conditions

This location is the staggered intersection of R4, R3091 and R3414. There is a distance of about 100m between the two intersection legs of R3091 and R3414. An improvement plan has already been prepared by the DOH for this section.

b) Traffic Conditions

R4 is a primary highway which runs to the west. It has a large traffic volume and a high proportion of heavy vehicles (RHV is 47%). The vehicles from R3414 to R3091 have a very short length of road in which to weave through the traffic on R4 to turn right at the intersection of R3091 and R4.

c) Accident Conditions

The accident frequency is low.

(2) Major Problems

An examination of traffic signal controls is needed, so as to make a signal control plan along with intersection improvements.

(3) Possible Countermeasures

Signal phasing was examined based on the improvement plan prepared by the DOH.

Study Section S-15: Sanamchan Palace (R4)

(1) Existing Conditions

a) Road Conditions

This is an intersection of Route 4 and one of its feeder roads. This R4 section is a straight four-lane section with a wide median. The northern crossroad is a paved two-lane road and the southern crossroad is an unpaved two-lane road.

b) Traffic Conditions

R4 is a southbound primary highway with heavy traffic volumes and a high proportion of heavy vehicles.

The northern crossroad leads to a town and many cars make right- and left-turns in this direction. It is prohibited to go straight or to make right-turns from the northern crossroad. Right-turning vehicles are required to make a left-turn first and then a U-turn in the median opening.

c) Accident Conditions

Accidents occur mainly in the intersection and in the median opening. Of all the accident types, rear-end collisions are the most frequent, followed by accidents caused by improper turning. It should be noted that night-time accidents account for 60% of all accidents (this includes many fatalities).

(2) Major Problems

Owing to the heavy traffic volume and the high traffic speeds of R4, crossing from the minor road and turning right from R4 are dangerous.

In the median opening, the shoulder is used to accommodate cars decelerating and waiting to make right-turns. However, since the shoulder is not well-paved and the lane width is narrow, the cars there often cause the through-traffic to brake suddenly or to change lanes. This is considered to be one of the major causes of rear-end collisions.

(3) Possible Countermeasures

The installation of traffic signals at the intersection, or the installation of U-turn traffic signals at the median opening and channelization, are suggested.

Study Sections S-16: Prapha Montri School (R34) , S-17:
Nuan Thong School (R34)

(1) Existing Conditions

a) Road Conditions

This is an uninterrupted flow section of R34 with a school access road. R34 is an eight-lane highway with a wide median and a two-lane frontage road divided by a separator on both sides. It has a total width of 96m.

b) Traffic Conditions

R34 is a primary highway which runs south-east. It has a large traffic volume and a high proportion of heavy vehicles (RHV is 34%). It conforms to high-level design standards and allows cars to travel at high speeds.

c) Accident Conditions

The accident frequency is very high. Rear-end collisions are the most frequent, followed by pedestrian accidents.

(2) Major Problems

The pedestrian crossings are in a dangerous condition.

(3) Possible Countermeasures

The installation of pedestrian overpasses are suggested.

Study Sections S-18: Kaset Sat (R302/R1)

(1) Existing Conditions

a) Road Conditions

This is the T-shaped signalized intersection between R302 and R1 (Phahon Yothin Road). The area along the road is commercialized, except for Kaset Sat University on the north-west corner. Plans to widen the R302 from four lanes to eight lanes have been prepared by the DOH.

b) Traffic Conditions

Heavy traffic volume traverses R302 and R1 all day. Right- and left-turning traffic is also heavy, with vehicles predominantly turning right from R302 toward Lat Phrao.

c) Accident Conditions

The number of accidents that occurred at the intersection on R302 was 11 cases with collisions between vehicles being the most common. Of these accidents there were no injuries or fatalities recorded. There were no accidents recorded on R1.

(2) Major Problems

This intersection has been over-saturated due to the high volumes of traffic entering the intersection. The capacity of the lanes is reduced because of inadequate channelization of traffic.

(3) Possible Countermeasures

The widening of R302, channelization on R1 and an improvement of traffic signal phasing are suggested.

Study Section S-19: Khae Rai (R302/R306)

(1) Existing Conditions

a) Road Conditions

This is a signalized intersection of two four-lane roads. R302 has a 40 m. wide right-of-way to be used for future widening to an eight-lane road. R306 also has a right-of-way, but it is narrow and has a minimum width of 14 m on one side.

b) Traffic Conditions

Traffic is heavy on both R302 and R306. It is especially heavy in the south-north direction (R306) and in the north-east and south-east directions. The peak hour heavy vehicle rate is 10 to 15%, which is lower than the levels on primary highways. The motorcycle rate is also high.

c) Accident Conditions

The number of accidents that occurred at the intersection was 10 cases.

(2) Major Problems

The large amount of entering traffic is causing over-saturation.

(3) Possible Countermeasures

The construction of a grade separation, based on the widening plan of R302, is suggested.

Study Section S-20: Ratanathibet (R302)

(1) Existing Conditions

a) Road Conditions

This is an uninterrupted flow section of R302. It is a straight four-lane section with a wide median (4 m).

b) Traffic Conditions

The intersection has average daily traffic (ADT) volumes of 20,000 vehicles and its RHV is 34%.

c) Accident Conditions

Eight night-time accidents were recorded, accounting for 62% of the total accidents.

(2) Major Problems

The number of accidents occurring at night is high in comparison with other sections. This is most likely due to poor lighting at this intersection.

(3) Possible Countermeasures

The installation of continuous lighting is suggested.

Study Section S-21: Wat Saima (R302)

(1) Existing Conditions

a) Road Conditions

This is a skewed intersection of R302 and a soi. This R302 section is a straight four-lane section with a wide median (9 m).

b) Traffic Conditions

The ADT of R302 is 20,000 vehicles and its RHV is 34%. Traffic is often disorganized within the intersection because of its skewdness.

c) Accident Conditions

Nearly all accidents are caused by improper turning (4 out of 5 cases). Three of the accidents involved motorcycles.

(2) Major Problems

Traffic volume exceeds the capacity of the stop-controlled intersection and traffic flow is confused by vehicles making U-turns.

(3) Possible Countermeasures

The installation of signals, or channelization to providing a U-turn lane, are suggested.

Study Section S-22: Prapadaeng (R303/R3104)

(1) Existing Conditions

a) Road Conditions

This is a signalized T-intersection. R303 is a four-lane road with a median. R3104 is connected to R3113 across the Chaophraya river by a ferry service. Widening works to four lanes are now in progress.

b) Traffic Conditions

Peak hour traffic on R303 is heavy at 4400 passenger car units per hour (PCU/hr). Right-turning traffic volumes from R303 and left-turning traffic volumes from R3104 are both high.

c) Accident Conditions

The accident rate is twice as high as that for the entire control section. Many of the accidents are caused by motorcycles.

(2) Major Problems

Through-traffic is interrupted at the approaches of the intersections, causing a decline in traffic capacity and a risk of accidents due to abrupt lane changes.

(3) Possible Countermeasures

The improvement of signal phasing after the widening of R3104 to four lanes, the extension of the storage lane length for right-turns on R303 and the repair of the shoulder, are suggested.

Study Section S-23: Ent. Army (R304)

(1) Existing Conditions

a) Road Conditions

This is an intersection of R304 and a feeder road to army facilities. This R304 section is a straight four-lane section with a wide median (6 m).

b) Traffic Conditions

R304 is a primary highway which runs from east to west and has a large traffic volume. Its RHV is 16%.

c) Accident Conditions

Half of all accidents are rear-end collisions.

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-24: Khlong Prapa (R304/BMA)

(1) Existing Conditions

a) Road Conditions

This is an intersection of R304 and the BMA road. At present, the median is closed. Right-turning traffic makes a U-turn in the median opening. R304 is a four-lane road with a wide median. The BMA road is a two-lane road, but widening plans to four lanes have been prepared by the BMA.

b) Traffic Conditions

R304 has a very large traffic volume, with heavy east-bound morning peak-hour traffic, and equally heavy west-bound traffic in the evening peak-hours. Entering traffic from the BMA road exceeds 800 PCU/hr. in peak-hours. Of this entering traffic, traffic turning right and making U-turns at the median opening, amounts to 344 PCU/hr.

c) Accident Conditions

Rear-end collisions are a major portion of all accidents.

(2) Major Problems

It is dangerous and difficult to make U-turns at the median opening because of the heavy traffic on R304. The situation causes U-turn traffic to clog-up and overflow into the through-lane, thus impeding the flow of the through-traffic.

(3) Possible Countermeasures

The following measures are suggested in order to solve the above problems:

Alternative-A : signalization of the intersection with the BMA road (widening of the BMA road and R304 will be required);

Alternative-B : traffic signals at the median openings on both sides in order to handle U-turn vehicles, without improving the intersection with the BMA road.

Study Section S-25: Ram Indra Post Office (R304)

(1) Existing Conditions

a) Road Conditions

This is an uninterrupted flow section of R304. It has five lanes and a wide median (11 m).

b) Traffic Conditions

R304 is a primary highway which runs from east to west. It has a large traffic volume and its RHV is 35%. The traffic speed on R304 is high.

c) Accident Conditions

Many accidents are caused by speeding (41 cases, 87% of all accidents) and rear-end collisions are the most common of all accidents.

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-26: Army Golf Club (R304)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R304 and a feeder road to an army golf club. This R304 section is a straight four-lane section with a wide median opening. Traffic signals have been installed but are not operational.

b) Traffic Conditions

R304 is a primary highway which runs from east to west and which has a heavy traffic volume (RHV is 35%). The traffic speed on R304 is high, with a large amount of traffic making U-turns from the west.

c) Accident Conditions

Many accidents are caused by speeding (21 cases, 58% of all accidents). Rear-end collisions are the most common of all accidents.

(2) Major Problems

The pedestrian crossing is in a dangerous condition and the vehicles which are entering and exiting from the army golf club are confused when turning.

(3) Possible Countermeasures

The installation of a pedestrian overpass and the operation of signal controls are suggested.

Study Section S-27: Ram Indra Center (R304) to S-31: Wacharaphon (R304)

(1) Existing Conditions

a) Road Conditions

These are the intersections of R304 and several sois. The R304 section is a straight four-lane section with a wide median (12 m).

b) Traffic Conditions

R304 is a primary highway which runs from east to west and which has a large traffic volume (RHV is 35%). The traffic speed on R304 is high.

c) Accident Conditions

Many accidents are caused by speeding and rear-end collisions are the most common of all accidents.

(2) Major Problems

The pedestrian crossings are in a dangerous condition.

(3) Possible Countermeasures

The installation of pedestrian overpasses is suggested.

Study Section S-32: Noppharat Ratchathani Hospital (R304)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R304 and a feeder road to a hospital. The R304 section is a straight four-lane section with a wide median (10 m). Approximately 60 m to the east of this intersection there is a T-intersection where R304 meets a road leading to Siam Park. A U-turn lane for eastbound traffic is provided.

b) Traffic Conditions

R304 is a primary highway which runs from east to west and which has a large traffic volume (RHV is 35%). The traffic speed on R304 is high.

c) Accident Conditions

Accidents are mostly caused by speeding. Accidents caused by overtaking cars are frequent (4 cases, 31% of the total), followed by head-on collisions (3 cases, 23% of the total).

(2) Major Problems

Vehicles entering and exiting the hospital are confused.

(3) Possible Countermeasures

The installation of synchronized signals is suggested.

Study Sections S-33: Sattri Nontaburi School (R306) to S35: Wat Lanna Boon (R306)

(1) Existing Conditions

a) Road Conditions

These are the uninterrupted flow section of R306, with three schools facing its roadway. It is an undivided four-lane road section.

b) Traffic Conditions

R306 is a primary highway having a high traffic volume (RHV is 27%).

c) Accident Conditions

The accident frequency in this section is low (only 6 cases were recorded in the whole of the section including these locations).

(2) Major Problems

The pedestrian crossings are in a dangerous condition.

(3) Possible Countermeasures

The installation of pedestrian overpasses is suggested.

Study Section S-36: Pinprapakom (R306)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R306 and a soi. The R306 section is an undivided four-lane section. R306 has left-turn lanes for traffic entering and existing from the soi.

b) Traffic Conditions

R306 is a primary highway with a high traffic volume (RHV is 31%).

c) Accident Conditions

The accident frequency is low (only 6 cases recorded) of which 4 were caused by speeding.

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-37: Suang Og Hospital (R306)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R306 and a feeder road leading to a hospital. The R306 section is an undivided four-lane road section.

b) Traffic Conditions

R306 is a primary highway with a high traffic volume (RHV is 31%).

c) Accident Conditions

The accident frequency is low (only 1 case recorded).

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-38: Thai Farmer Bank (R306)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R306 and a soi. The R306 section is a four-lane section with no median.

b) Traffic Conditions

R306 is a primary highway with a high traffic volume (RHV is 31%).

c) Accident Conditions

The accident frequency is low (only 7 cases recorded), of which 4 were caused by speeding.

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-39: Tansamrit Pattana (R306)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R306 and a soi. The R306 section is a four-lane section with no median. R306 has an extra lane serving the soi.

b) Traffic Conditions

R306 is a primary highway with a high traffic volume (RHV is 31%).

c) Accident Conditions

There were four accidents due to speeding, and three due to traffic running off the road.

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-40: Samak Kee (R306)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R306 and a soi. The R306

section is a four-lane section with no median. Traffic signals have been installed but are not operational.

b) Traffic Conditions

R306 is a primary highway with a high traffic volume (RHV is 31%).

c) Accident Conditions

The accident frequency is low (only 5 cases recorded), of which three involved vehicles running off the road.

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-41: Amphan Paisan School (R306)

(1) Existing Conditions

a) Road Conditions

This is the uninterrupted flow section of R306, with a school facing its roadway. It has a narrow median and a median opening. Pedestrian push-button signals have been installed.

b) Traffic Conditions

R306 is a primary highway with a high traffic volume (RHV is 31%).

c) Accident Conditions

The accident frequency is low (2 cases).

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-42: Ha Yaek Pakket (R306)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R306 and a feeder road to a school. The R306 section is a four-lane section with a median. Pedestrian push-button signals have been installed.

b) Traffic Conditions

R306 is a primary highway with a high traffic volume (RHV is 31%).

c) Accident Conditions

No accidents have been recorded.

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-43: Pathum Wilai (R307/R3035/R3111)

(1) Existing Conditions

a) Road Conditions

This is a stop-controlled intersection between two two-lane roads in a built-up area in Pathum Thani. Both roads have left-turn lanes, except R3111. R3111, which is connected to R307 at this intersection, has a bridge section on the approach to the intersection.

b) Traffic Conditions

R307 carries slightly more traffic than the other routes. Left- and right-turns occupy a higher percentage of the traffic volume on each approach without there being a left-turn toward R3111 and right-turn from R3111. There is little hourly variation of traffic volume entering the intersection. A high heavy-vehicle composition is observed especially in the south-west and north-south directions.

c) Accident Conditions

Rear-end collisions and collisions with opposed vehicles occurred most frequently. Accidents involving motorcycles were also common.

(2) Major Problems

Traffic volume exceeds the capacity of the stop-controlled intersection. There is no clear prioritization of traffic flow because of the similarity in traffic volumes and in the configurations of the roads.

(3) Possible Countermeasures

Signalization of the intersection and the provision of right-turn lanes, except on R3111, are suggested.

Study Section S-44: Damnoen Saduak (R325)

(1) Existing Conditions

a) Road Conditions

R325 is a two-lane road with a 2.5 m width of soft shoulders. A sharp curvature section is included in the Study Section. The shoulder is reduced to 0.5 m on the bridge and the carriageway width has been narrowed by soil from the shoulder.

b) Traffic Conditions

Traffic volume is not heavy in any one direction but flows evenly. The percentage of motorcycles is very high and it makes up more than 50% of the traffic volume during the peak-hours for both directions.

c) Accident Conditions

Almost all accidents involved motorcycles which resulted in fatalities. The types of accidents causing fatalities are: collisions with opposed vehicles and rear-end collisions.

(2) Major Problems

The mixture of motorcycle and ordinary vehicular traffic is dangerous and interrupts the smooth flow of the traffic. All motorcycles run on the carriageway and avoid the soft shoulder and they also operate at lower speeds than ordinary vehicles.

(3) Possible Countermeasures

The installation of a motorcycle lane and the improvement of the curvature section are suggested.

Study Section S-45: Pra Pin Village (R338)

(1) Existing Conditions

a) Road Conditions

This is an uninterrupted flow section of R338, with department stores, bus terminals and other service facilities on both sides. Pedestrians cannot cross the street at present because the median is fenced.

b) Traffic Conditions

R338 is a primary highway which runs from east to west. It has a high traffic volume and a RHV of 35%.

c) Accident Conditions

Speeding is the cause of many accidents (11 cases, 69% of all accidents). However, none of the accidents involved pedestrians, since they are prevented from crossing the road.

(2) Major Problems

There is no pedestrian crossing facility between 1.1 kp and 3.3 kp on Route 338.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-46: Suan Pak (R338)

(1) Existing Conditions

a) Road Conditions

This is an uninterrupted flow section of R338. It has a two-lane frontage road divided by a separator on both sides. Ramps connect the main carriageway and the frontage roads.

b) Traffic Conditions

R338 is a primary highway which runs from east to west, and merges with R4 in the west. It has a high traffic volume and a RHV of 35%.

c) Accident Conditions

The accident frequency is high (81 cases). Speeding is the cause of most of the accidents. Rear-end collisions are the most frequent (27 cases, 33% of all accident types), followed by accidents caused by overtaking cars (16 cases, 20% of the total types).

(2) Major Problems

There is much conflict in the merging section between the ramps and the frontage road.

(3) Possible Countermeasures

Extension of the merging section is suggested.

Study Section S-47: Buddha Monthon Sai 7 (R338)

(1) Existing Conditions

a) Road Conditions

This is an interchange of R338. The R338 section is a straight four-lane section. R338 has two-way two-lane frontage roads on both sides, the minor road is connected through these frontage roads.

b) Traffic Conditions

R338 is a primary highway which runs from east to west. It has a high traffic volume and a RHV of 35%, and it merges with R4 in the west. The interchange is in a suburban areas and it meets high-level design standards, and consequently cars are able to travel at speed.

c) Accident Conditions

The accident frequency is low (7 cases). Most accidents are caused by speeding (4 cases). Vehicles hitting fixed objects is the next most common all types of accidents.

(2) Major Problems

There is much conflict at the entrances and exits of the frontage road.

(3) Possible Countermeasures

Channelization is suggested.

Study Section S-48: Bang Waek (R340/BMA)

(1) Existing Conditions

a) Road Conditions

This is an at-grade intersection in the suburbs. R340 is a road made up of part of the Outer Ring Road, and only its western section is presently in service. It is designed to high design standards. All arterial highway intersections are grade separated, with the exception of this one.

b) Traffic Conditions

Since R340 is partly in service, its traffic volume is smaller than those of other arterial highways (2400 PCU/peak hour). The BMA road has a peak-hour traffic volume of approximately 600 cars, and also has a considerably large amount of traffic turning right. Traffic speed is high on R340.

c) Accident Conditions

No traffic accident statistics were available.

(2) Major Problems

Traffic volume at the intersection, especially traffic turning right, is too large to regulate by stop-control measures. Right-turning traffic is not channelized on the highway or on the crossroad. Consequently, all traffic, excluding through-traffic and left-turning vehicles on R340 and left-turning vehicles from the crossroad, is accommodated in the center of the intersection. This causes confusion and hinders the smooth flow of turning traffic and through-traffic. The intersection traffic in other sections of R340 is regulated by grade separation. Consequently, drivers tend to underestimate the danger involved in crossing this intersection.

(3) Possible Countermeasures

The installation of pre-timed signals and advance warning signs is suggested for the short-term and the creation of a grade separation for the long-term.

Study Section S-49: Ekka Chai (R340/R3242)

(1) Existing Conditions

a) Road Conditions

This is the interchange of R340 and R3242. R340 is a straight four-lane section. R3242 is a straight two-way two-lane section which overpasses R340 and is connected to it by diamond-shaped ramps. Right-turn vehicles have to make a detour through the U-turn way under R340.

b) Traffic Conditions

Traffic volume is not very large at present (ADT is 24,000 vehicles, RHV is 25%), but it is expected to increase after the completion of the entire ring road. The roads satisfy high-level design standards and allow cars to travel at speed. R3242 runs south-east from Bangkok and serves it, to a certain extent, as a bypass. Although it is a two-lane road, it has a large traffic volume, partly as a result of the ongoing widening work on R35.

c) Accident Conditions

Speeding is the main cause of accidents on R3242 (21 cases). Collisions at the intersection were the most common type of accident (10 cases were recorded).

(2) Major Problems

Drivers make illegal U-turns at the nose of the ramp on R3242.

(3) Possible Countermeasures

The installation of guide signs (diagrammatic-type) is suggested.

Study Section S-50: Wat Si Boon Ruenq (R340)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R340 and a soi. A school, a Sunday market, etc. are found beyond the soi.

b) Traffic Conditions

R340 satisfies high-level design standards and allows cars to travel at speed.

c) Accident Conditions

No accidents have been recorded.

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-51: Minburi (R3119/BMA)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R3119 and the BMA road. R3119 is a suburban two-lane road that narrows north of this intersection.

b) Traffic Conditions

Although it is a two-lane road, it has a relatively high traffic volume (ADT is 24,140 vehicles, RHV is 36%). Most of the traffic flows on the BMA road and the southern-end of R3119.

c) Accident Conditions

The accident frequency is low (7 cases). Speeding is the main cause of accidents (5 cases).

(2) Major Problems

Traffic volume is beyond the capacity of the stop-controlled intersection.

(3) Possible Countermeasures

The installation of a pre-timed signal is suggested.

Study Section S-52: Onn Nuch - R.3119 (R3119/BMA)

(1) Existing Conditions

a) Road Conditions

R3119 and R3256 are connected indirectly via the BMA road. This connection forms a T-intersection. R3119 and the BMA road are two-lane roads with wide shoulders.

b) Traffic Conditions

The traffic flows predominantly between R3119 and R3256. The entering traffic is subject to little hourly variation and shows a steady flow in the daytime. The proportion of heavy vehicles is high in the daytime, exceeding 35% of the total volume.

c) Accident Conditions

Failure to yield to right-of-way by heavy vehicles is a main cause of traffic accidents.

(2) Major Problems

Traffic volume is beyond the limits of the stop-control intersection. Traffic confusion is aggravated by the improper channelization of the traffic on the BMA road.

(3) Possible Countermeasures

Signalization and channelization to provide left-turn and right-turn lanes are suggested.

Study Section S-53: Indra Luk Market (R3202)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R3202 and a soi. R3202 is a straight four-lane section with a wide median (3.5 m). The median opening at this intersection is closed.

b) Traffic Conditions

R3202 has a high traffic volume (ADT is 41,727 vehicles, RHV is 14.5%).

c) Accident Conditions

No accidents have been recorded.

(2) Major Problems

Users from the soi are inconvenienced by the closed median which prevents them from crossing the intersection or turning right. Difficulties also exist in U-turning at the nearest median opening because of the heavy traffic volume.

There are many sois intersecting R3202 in the area between the intersection and the median opening. Right-turns from these sois are prevented by the continuous median. As a result, this traffic concentrates in the median opening to turn right.

(3) Possible Countermeasures

The installation of signals, or channelization for U-turns and the installation of U-turn signals, are suggested.

Study Sections S-54: Nuan Chan (R3202)

(1) Existing Conditions

a) Road Conditions

This is an uninterrupted flow section of R320, with supermarkets, factories, etc. lined up on both sides. It is a straight four-lane section with a wide median (3.5 m).

b) Traffic Conditions

R3202 has a high traffic volume (ADT is 41,727 vehicles).

c) Accident Conditions

Speeding is the cause of most accidents (8 cases).

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-55: Onn Nuch - R.3256 (R3256/BMA)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R3256 and the BMA road. Both R3256 and the RMA road sections are straight two-lane sections. Traffic at the intersection is channelized.

b) Traffic Conditions

R3256 is a north-south road running in a suburban area by a connection to the southern end of R3119 (traffic flow data is not available).

c) Accident Conditions

The accident frequency is low (2 cases).

(2) Major Problems

Traffic volume is beyond the capacity of the stop-controlled intersection.

(3) Possible Countermeasures

The installation of a pre-timed signal is suggested.

Study Section S-56: Wat Phichai (R3278)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R3278, a soi and a feeder road leading to a school. R3278 is a straight six-lane section with a wide median (4 m). A right-turn lane is provided on both sides of R3278.

b) Traffic Conditions

R3278 has high traffic volume (ADT is 11,400 vehicles, RHV is 23%).

c) Accident Conditions

The accident frequency is low (3 cases).

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-57: Bangchan Industrial Estate (R3278)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R3278 and a feeder road leading to a factory. R3278 is a straight six-lane section with a wide median (4 m).

b) Traffic Conditions

R3278 has high traffic volumes (ADT is 11,400 vehicles, RHV is 23%).

c) Accident Conditions

The accident frequency is low (only 6 cases recorded). Most of the accidents (83% of the total) were caused by speeding.

(2) Major Problems

The pedestrian crossing is in a dangerous condition.

(3) Possible Countermeasures

The installation of a pedestrian overpass is suggested.

Study Section S-58: Government House (R3278)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R3278 and a road leading to R3202. R3278 is a straight six-lane section.

b) Traffic Conditions

R3278 has high traffic volumes (ADT is 11,400 vehicles, RHV is 23%).

c) Accident Conditions

The accident frequency is low (3 cases only).

(2) Major Problems

Traffic volume is beyond the capacity of the stop-controlled intersection.

(3) Possible Countermeasures

The installation of a pre-timed signal is suggested.

Study Section S-59: Saha Khon Kan Keha (R3278)

(1) Existing Conditions

a) Road Conditions

This is the intersection of R3278 and a feeder road leading to Sahakhon Village. R3278 is a straight four-lane section with a wide median (3.6 m).

b) Traffic Conditions

R3278 has high traffic volumes (ADT is 11,400 vehicles, RHV is 23%).

c) Accident Conditions

The accident frequency is low (6 cases only).

(2) Major Problems

Traffic volume is beyond the capacity of the stop-controlled intersection.

(3) Possible Countermeasures

The installation of a pre-timed signal is suggested.

In Figure 3.5, the possible countermeasures described above are classified into ten categories, with the relevant Study Section number indicated for each measure.

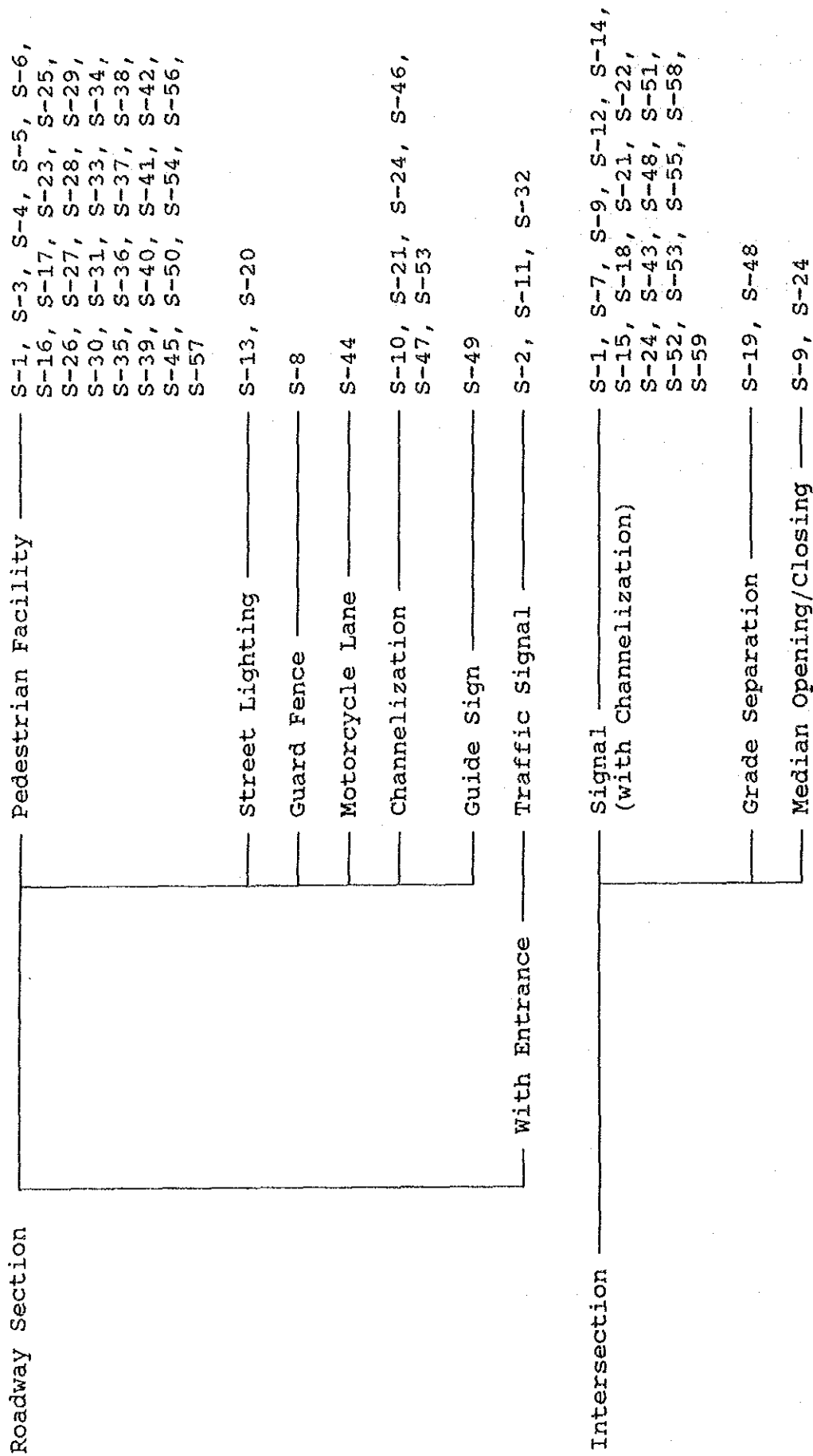
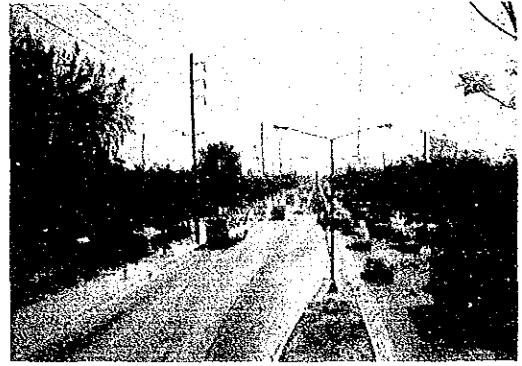
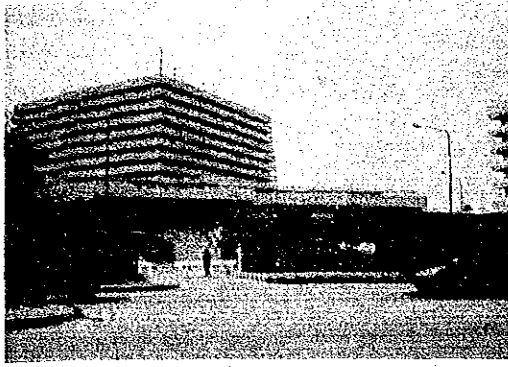
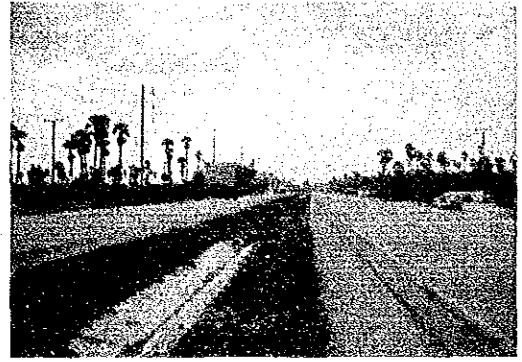
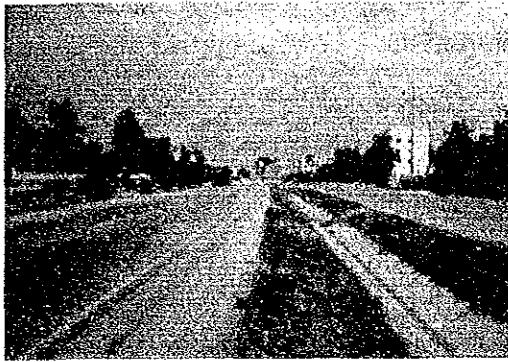


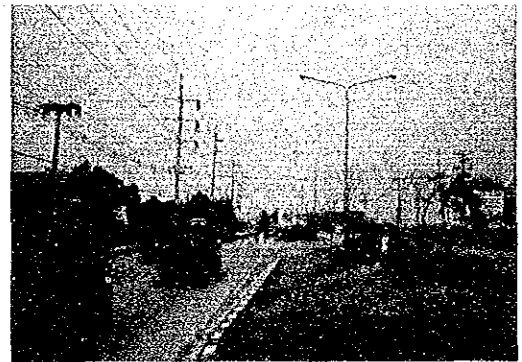
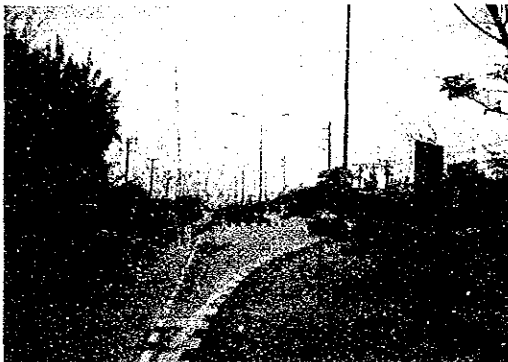
Figure 3.5 CLASSIFICATION OF STUDY SECTION BY ROAD TYPE AND EXPECTED MEASURES



Study Section S-2: Phumiphol Adulyadet Hospital (R1)



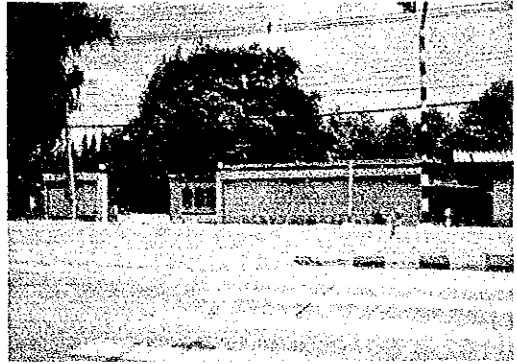
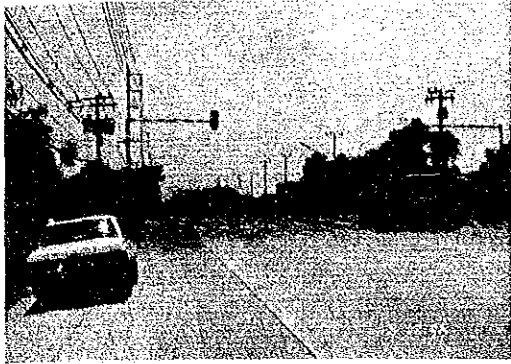
Study Section S-20: Patanatibet (R302)



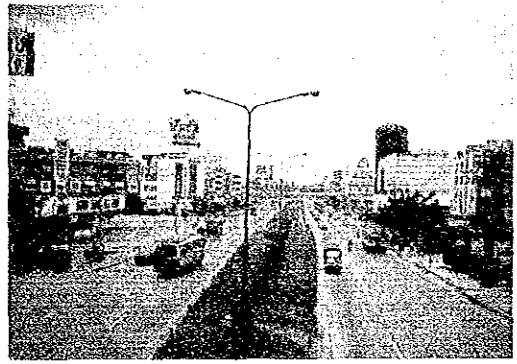
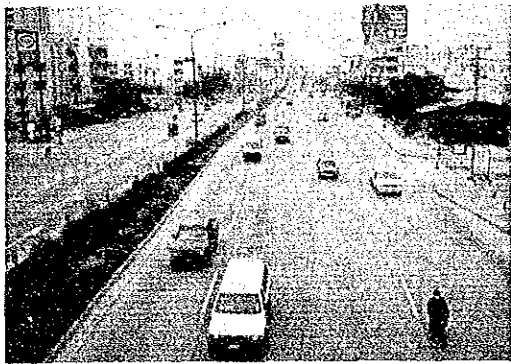
Study Section S-32: Noppharat Ratchathani Hospital (R304)



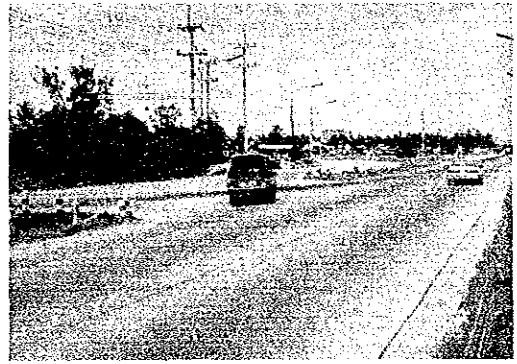
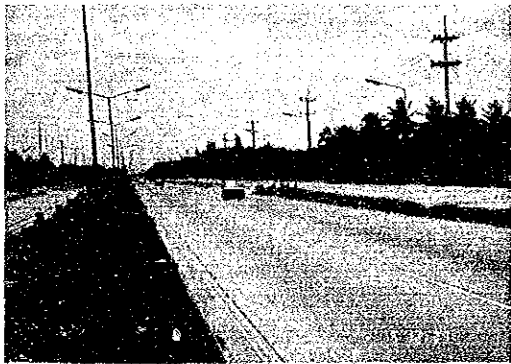
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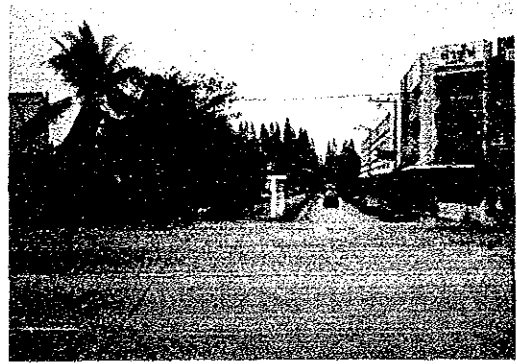
Study Section S-41: Amphan Paisan School (R306)



Study Section S-45: Pra Pin Village (R338)



Study Section S-47: Buddha Monthon Sai 7 (R338)



Study Section S-59: Saha Khon Kan Keha (R3278)

3.4.3 Selection of Countermeasures

The selection of countermeasures was examined on the basis of the technical guidelines and the engineering specifications in the TOPR Study. Especially considering U-turn traffic in the median openings, the installation of U-turn signals was proposed and the necessity of such new signals was evaluated on the basis of the installation standards shown in Figure 3.6. Details of the phase settings in Figure 3.6 are attached in Appendix 3.3.

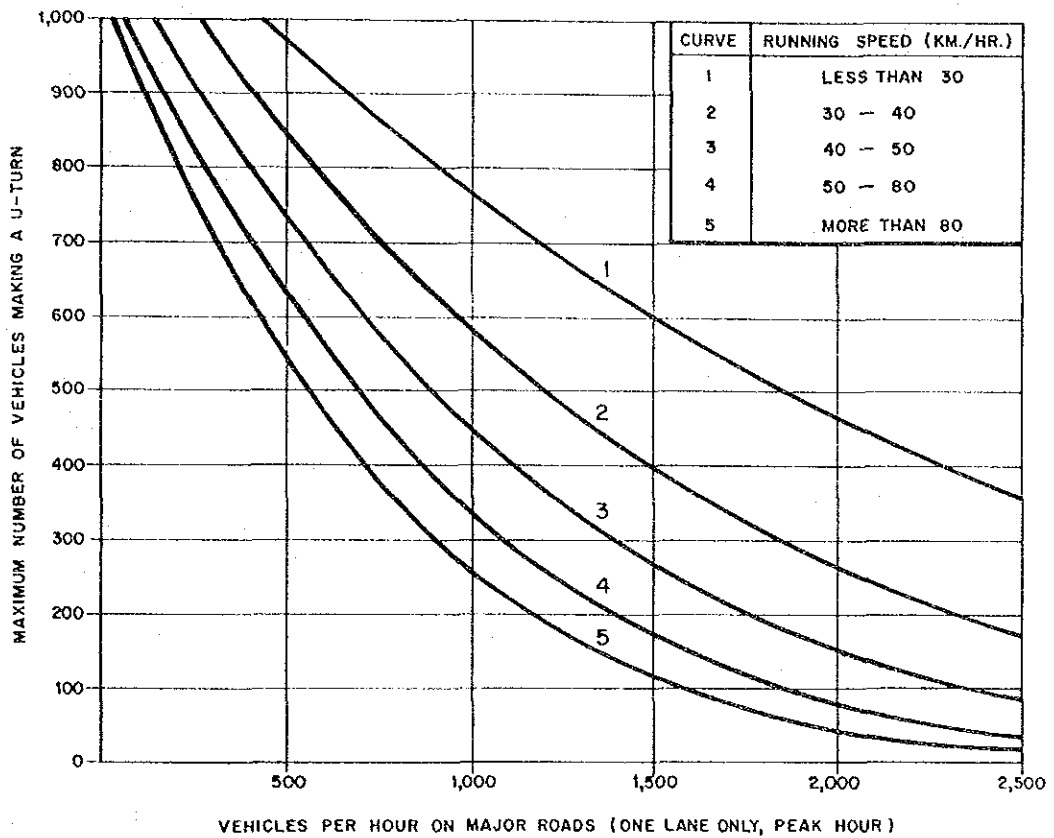


Figure 3.6 MAXIMUM NUMBER OF VEHICLE MAKING A U-TURN

Table 3.7 shows the countermeasures considered effective in resolving traffic operation problems for each Study Section defined in 3.4.2, together with the justification of such countermeasures.

For details of the traffic operation problems, the justifications for the adoption of the measures, and the required improvement plans, a diagnostic sheet for each Study Section has been prepared and is attached in Appendix 3.2.

As seen in the Table 3.7, the proposed countermeasures can be broadly classified as follows:

a) Intersection Improvement

- grade separation;
- installation of traffic signals;
- improvement of intersection configuration;
- channelization of traffic.

b) Improvement of Pedestrian Facilities

- construction of pedestrian overpass;
- installation of pedestrian crossing.

c) Improvement of Night-time Traffic Safety Facilities

- installation of street lighting.

d) Improvement of Roadway Section

- installation of motorcycle lane;
- installation of guard fence;
- installation of guide sign;
- traffic flow channelization in open sections of median strip.

In the following, each proposed countermeasure is described with specific reference to the necessity of its implementation for individual sections/areas, and the factors considered in selecting each measure.

a) Intersection Improvement

In the following, the necessity for each individual measure is determined:

Table 3.7 Basic Conception for Measure (1)

No.	Route No.	Name of Location	Kp. Start-end (Length)	Major Problems	Measures	Results of Examination	
						Necessary	Grounds of Necessity
1.	1	Saphan Mai Market	19+000 - 21+500 (2.5)	<ul style="list-style-type: none"> - Traffic volume exceeds the capacity of stop-controlled intersection. - Confusion from vehicles making U-turn (in 19.8 kp). - Dangerous condition of pedestrian crossing in front of Sapan Mai Market. 	<ul style="list-style-type: none"> - Installation of pre-timed signals. 	Yes	- Satisfies criteria for improvement.
				<ul style="list-style-type: none"> - Decline in smoothness of traffic flow between 19.0 kp and 21.5 kp. 	<ul style="list-style-type: none"> - Alternative 1 Installation of pedestrian overpass. - Alternative 2 Installation of pedestrian signal coordinated with adjacent signals. 	Yes	- Satisfies criteria for improvement.
				<ul style="list-style-type: none"> - Confusion from entering/exiting vehicles and vehicles making U-turns in front of hospital. 	<ul style="list-style-type: none"> - Coordinated signal control in control segment. - Installation of pre-timed signals set to be simultaneously offset with nearby signals (this signal is operated only during hospital opening hours and it is left flashing during closing hours. 	No	- Pedestrian signals coordinated with adjacent signals are not feasible because of the heavy pedestrian volume.
				<ul style="list-style-type: none"> - Dangerous condition of pedestrian crossing. 	<ul style="list-style-type: none"> - Coordinated signal control in control segment. 	Yes	- Satisfies criteria for improvement.
				<ul style="list-style-type: none"> - Dangerous condition of pedestrian crossing. 	<ul style="list-style-type: none"> - Installation of pedestrian overpass. 	Yes	- Satisfies criteria for improvement.
				<ul style="list-style-type: none"> - Dangerous condition of pedestrian crossing. 	<ul style="list-style-type: none"> - Installation of pedestrian overpass. 	Yes	- Satisfies criteria for improvement.
				<ul style="list-style-type: none"> - Dangerous condition of pedestrian crossing. 	<ul style="list-style-type: none"> - Installation of pedestrian overpass. 	Yes	- Satisfies criteria for improvement.
				<ul style="list-style-type: none"> - Traffic volume exceeds the capacity of stop-controlled intersection (R1-R3312). 	<ul style="list-style-type: none"> - Installation of pedestrian overpass. - Installation of pre-timed signals coordinated with signals installed at 27 kp. 	Yes	- Satisfies criteria for improvement.

Table 3.7 Basic Conception for Measure (2)

No.	Route No.	Name of Location	Kp. Start-End (Length)	Major Problems	Results of Examination	
					Measures	Necessary
8.	1	Si Mum Muang Market	28+000 - 29+000 (1.0)	- Cars drop into depressed medium.	- Installation of grade fence.	No - Not warranted. No accidents from cars dropping into depressed medium.
9.	1 (3214)	Khlong Luang	40+454	- Users from R3214 feel inconvenienced when going straight or turning right because of closed median. - Difficulty of making U-turns at the near median opening due to heavy traffic volumes travelling at speed.	- Installation of signals. - Channelization for U-turns. - Installation of U-turn signals.	No - Not warranted enough, No clear need for measure. Yes - Providing U-turn facilities. - Cannot handle U-turn volume without signal.
10.	1	Ent. AIT	41+500	- Difficulty of turning right and making U-turns due to heavy traffic volumes travelling at speed and the partial expanded lanes.	- Reduction of number of lanes to match ordinary lane numbers. - Providing U-turn facilities.	Yes - Although traffic volumes are low, the road conditions warrant the measures.
11.	1	Nawanakorn	46+200	- Users from the industrial estate feel inconvenienced because of the lack of signals.	- Installation of signal.	Yes - Satisfies criteria for improvement.
12.	3	Crocodile Farm	29+000	- Traffic volume is near saturation levels for a stop-controlled intersection (leading to crocodile farm).	- Installation of pre-timed signal. - Installation of semi-actuated traffic signal.	No - Not warranted because of low traffic volume. Yes - Satisfies criteria for improvement (traffic volume from crocodile farm is low).
13.	3	Bang Poo	29+250 - 51+150 (21.9)	- Number of night-time accidents are higher than on other sections (especially the number of vehicles and motorcycle accidents).	- Installation of continuous lighting (kp. 29.5-kp. 37).	Yes - Satisfies criteria for improvement. - There are residential areas and market facilities between 29.5 kp and 37.0 kp. - There are no facilities far from 37.0 kp.
14.	4 (3091) (3414)	Oam Noi	24+950	- To make a signal control plan with intersection improvement.	- Examination of traffic signal control.	Yes - DOK approved.

Table 3.7 Basic Conception for Measure (3)

No.	Route No.	Name of Location	Kp. Start-End (Length)	Major Problems	Results of Examination	
					Measures	Necessary Grounds of Necessity
15.	4	Sanamchan Palace	58+580	<ul style="list-style-type: none"> - Traffic volume exceeds the capacity of the stop-controlled intersection. - Difficult to make U-turns due to the heavy traffic volumes on the major road. 	<ul style="list-style-type: none"> - Installation of traffic signals at the intersection. - Installation of U-turn traffic signals at the median opening - Channelization at the intersection. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement. - Can treat U-turn volume without signal control. - Road conditions warrant the measure.
16.	34	Prapha Montri School	1+500	<ul style="list-style-type: none"> - Dangerous condition of pedestrian crossing. 	<ul style="list-style-type: none"> - Installation of pedestrian overpass. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
17.	34	Nuan Thong School	2+300-500	<ul style="list-style-type: none"> - Dangerous condition of pedestrian crossing. 	<ul style="list-style-type: none"> - Installation of pedestrian overpass. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
18.	302 (1)	Kaset Sat	0+000	<ul style="list-style-type: none"> - Saturated signalized intersection. 	<ul style="list-style-type: none"> - Widening of R302. - Channelization on R1 - Improvement of traffic signal phasing. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
19.	302 (306)	Khae Rai	6+333	<ul style="list-style-type: none"> - Saturated signalized intersection. 	<ul style="list-style-type: none"> - Grade separation based on the widening plan of R302 (R302 will cross over R306). 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
20.	302	Ratanathibet	6+333 - 10+800 (4.5)	<ul style="list-style-type: none"> - Number of night-time accidents are higher than on other sections. 	<ul style="list-style-type: none"> - Installation of continuous lighting. 	<ul style="list-style-type: none"> - It is better that continuous lighting be installed between 6.3 kp and 10.8 kp, since continuous lighting already exists on R3110. - Existing traffic volume is about 19,000 veh./day, continuous lighting should be installed when volume exceeds 25,000 veh./day.
21.	302	Wat Saina	13+400	<ul style="list-style-type: none"> - Traffic volume exceeds the capacity of the stop-controlled intersection. - Confusion from U-turning vehicles. 	<ul style="list-style-type: none"> - Installation of signals. - Channelization to providing a U-turn lane. 	<ul style="list-style-type: none"> - Not warranted because of low traffic volume. - Road conditions warrant the measure.

Table 3.7 Basic Conception for Measure (4)

No.	Route No.	Name of Location	Kp. Start-End (Length)	Major Problems	Results of Examination	
					Measures	Necessary Grounds of Necessity
22.	303 (3104)	Prapadaeng	11+198	- Reduction of road capacity and confusion of traffic owing to parked vehicles, short right-turn lane, bus movement and poor shoulders.	- Improvement of signal phasing after widening of R3104 to 4 lanes. - Prohibition of parking. - Extension of storage lane length for right-turn on R303. - Provision of bus bay.	Yes - Satisfies criteria for improvement.
23.	304	Ent. Army	4+800	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	No - Pedestrian volume is low.
24.	304 (BMA)	Khlong Prapa	4+800 - 5+600 (0.8)	- Difficult to U-turn and weave due to the heavy traffic volumes of through and right-hand turning traffic on R304.	- Alternative A (improving BMA road): Signalization of intersection with the BMA road (widening of BMA road and R304 will be required). - Alternative B (not improving BMA road): Traffic signal at the median openings on both sides in order to handle U-turning vehicles, without improving the intersection with the BMA road.	Yes - Satisfies criteria for improvement.
25.	304	Ram Inthra Post Office	0+000 - 0+200 (0.2)	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
26.	304	Army Golf Club	1+000 - 1+200 (0.2)	- Dangerous condition of pedestrian crossing. - Confusion from entering/exiting vehicles to army golf club.	- Installation of pedestrian overpass. - Operation of signal control (not operated at present).	Yes - Satisfies criteria for improvement. No - Not warranted because of low traffic volumes.
27.	304	Ram Indra Center	2+000	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
28.	304	Km.4 Market	4+000	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
29.	304	Air Police	4+800	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	No - Pedestrian volume is low.

Table 3.7 Basic Conception for Measure (5)

No.	Route No.	Name of Location	Kp. Start-End (Length)	Major Problems	Results of Examination	
					Measures	Necessary/ Grounds of Necessity
30.	304	Mai Ya Lap	5+200	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
31.	304	Wacharaphon	5+600	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
32.	304	Nopparat Ratchathani Hospital	11+900 - 12+000 (0.1)	- Confusion from entering/exiting vehicles in the front of hospital.	- Installation of signals (simultaneous-type).	Yes - Satisfies criteria for improvement.
33.	306	Sattri Nontaburi School	1+500	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
34.	306	Pongsawat Commercial School	3+270	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
35.	306	Wat Lanna Boon	5+500	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	No - Pedestrian volume is low.
36.	306	Pinprapakom	7+700	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
37.	306	Suang Og Hospital	8+210	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
38.	306	Thai Farmer Bank	9+100	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
39.	306	Tansamrit Pattana	9+538	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
40.	306	Samak Ki	11+251	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
41.	306	Amphan Paisan School	16+300 - 16+500 (0.2)	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
42.	306	Ha Yaek Pakket	13+450	- Dangerous condition of pedestrian crossing.	- Installation of pedestrian overpass.	Yes - Satisfies criteria for improvement.
43.	307 (3035) (3111)	Pathum Wilai	10+813	- Traffic volume exceeds the capacity of stop-controlled intersection. - Confusion caused by unclear traffic priority.	- Signalization of intersection. - Provision of right-turn lanes, except on R3111.	Yes - Satisfies criteria for improvement. Yes

Table 3.7 Basic Conception for Measure (6)

No.	Route No.	Name of Location	Kp. Start-End (Length)	Major Problems	Results of Examination	
					Measures	Necessary Grounds of Necessity
44.	325	Damnoen Saduak	33+705 - 38+215 (4.5)	<ul style="list-style-type: none"> - Conflict between ordinary automobiles and motorcycles. - Improper super-elevation and poor pavement markings. 	<ul style="list-style-type: none"> - Installation of motorcycle lane. - Improvement of curvature section. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
45.	338	Pra Pin Village	2+200			
46.	338	Suan Pak	2+952 - 5+900 (3.0)	<ul style="list-style-type: none"> - Conflict in the merging section. 	<ul style="list-style-type: none"> - Extending merging section. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
47.	338	Buddha Monthon Sai 7	28+609.5	<ul style="list-style-type: none"> - Traffic volume is beyond the capacity of stop-controlled intersection. 	<ul style="list-style-type: none"> - Creation of grade separation for the long-term. - Installation of pre-timed signal, and installation of forewarning guide signs for short-term. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
48.	340 (BMA)	Bang Waek	3+725	<ul style="list-style-type: none"> - Drivers make illegal U-turns. 	<ul style="list-style-type: none"> - Installation of guide signs (figure type). 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
49.	340 (3242)	Eakka Chai	29+300	<ul style="list-style-type: none"> - Traffic volume beyond the capacity of stop-controlled intersection. 	<ul style="list-style-type: none"> - Installation of pre-timed signal. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
50.	340	Wat Si Boon Rueng	10+500	<ul style="list-style-type: none"> - Drivers make illegal U-turns. 	<ul style="list-style-type: none"> - Installation of guide signs (figure type). 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
51.	3119 (BMA)	Mimburi	0+450	<ul style="list-style-type: none"> - Traffic volume beyond the capacity of stop-controlled intersection. 	<ul style="list-style-type: none"> - Installation of pre-timed signal. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.

Table 3.7 Basic Conception for Measure (7)

No.	Route No.	Name of Location	Kp. Start-End (Length)	Major Problems	Results of Examination	
					Measures	Necessary Grounds of Necessity
52.	3119 (BMA)	Onn Nuch - 3119	11+003	<ul style="list-style-type: none"> - Priority of R3119 is unclear depending on the T-shaped interchange and this causes confusion. - Traffic volume is beyond the capacity of stop-controlled intersection. 	<ul style="list-style-type: none"> - Signalization. - Channelization to provide left-turn and right-turn lane. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
53.	3202	Indra Luk Market	3+000 - 4+000 (1.0)	<ul style="list-style-type: none"> - Drivers from the soi feel inconvenienced when going straight or turning right because of closed median. - Difficult to U-turn at the near median opening due to the heavy traffic volumes. 	<ul style="list-style-type: none"> - Installation of signal. 	<ul style="list-style-type: none"> - Not warranted enough. No clear need established. - Provides U-turn facility.
54.	3202	Nuan Chan	5+300 - 5+500 (0.2)	<ul style="list-style-type: none"> - Dangerous condition of pedestrian crossing. 	<ul style="list-style-type: none"> - Channelization to handle U-turns. - Installation of U-turn signal. - Installation of pedestrian overpass. 	<ul style="list-style-type: none"> - Cannot treat U-turn volume without signal. - Satisfies criteria for improvement.
55.	3256 (BMA)	Onn Nuch - 3256	11+719	<ul style="list-style-type: none"> - Traffic volume is beyond the capacity of stop-controlled intersection. 	<ul style="list-style-type: none"> - Installation of pre-timed signal. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
56.	3278	Wat Phichai	1+100	<ul style="list-style-type: none"> - Dangerous condition of pedestrian crossing. 	<ul style="list-style-type: none"> - Installation of pedestrian overpass. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
57.	3278	Bangchan Industrial Estate	7+800	<ul style="list-style-type: none"> - Dangerous condition of pedestrian crossing. 	<ul style="list-style-type: none"> - Installation of pedestrian overpass. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
58.	3278	Government House	1+039	<ul style="list-style-type: none"> - Traffic volume is beyond the capacity of stop-controlled intersection. 	<ul style="list-style-type: none"> - Installation of pre-timed signal. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
59.	3278	Saha Khon Kan Keha	3+744	<ul style="list-style-type: none"> - Traffic volume is beyond the capacity of stop-controlled intersection. 	<ul style="list-style-type: none"> - Installation of pre-timed signal. 	<ul style="list-style-type: none"> - Satisfies criteria for improvement.
Total Study Sections 59						

A. Grade Separation

Grade separation is required in the S-19 and S-48 sections. A detailed explanation is omitted here because it is covered in the preliminary design sections described later.

B. Installation of Traffic Signals

Figure 3.7 shows the data for determining the necessity of this countermeasure based on the warrant shown in the technical guidelines. This figure clearly indicates that it is necessary to install traffic signals on all the sites, except on S-1, S-2, S-9, S-12, S-32, and S-53.

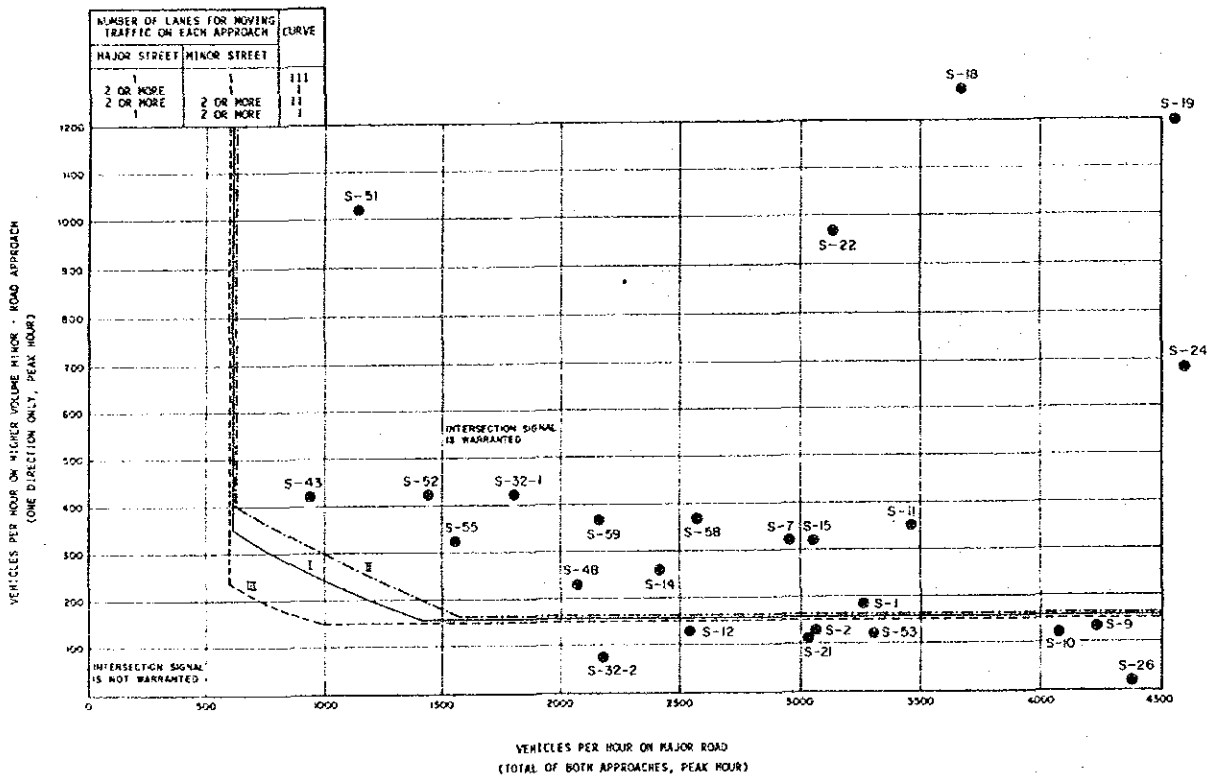


Figure 3.7 NECESSITY OF INSTALLATION TRAFFIC SIGNALS

The following are the standards used to judge the Sites where the necessity of signal installation cannot be clearly determined from the technical guidelines, and where a technical study is required to make a choice from a number of alternatives. If several sites have similar problems, and are judged in a similar way, an explanation is given for the representative site only.

S-1

This section has two areas of concern. One requires a signal installation at the intersection located at 19.8 Kp with coordinated control of the new and existing signals. The other problem requires the evaluation of two pedestrian crossing facility alternatives situated between 20.8 Kp and 21.8 Kp. The first pedestrian crossing alternative proposes the construction of a pedestrian overpass, and the second proposes the installation of pedestrian crossing signals to be coordinated with the adjoining signals so as to minimize the influence on through-traffic flow. The results of the examinations of the two areas of concern are given below.

Signal installation at the intersection located at 19.8 Kp is considered necessary because the present traffic volume fully warrants this, as shown in Figure 3.8. The signal installation is likely to cause a maximum storage length of 120 m and a through-traffic flow delay of approximately 10 secs/vehicle. This delay is based on the traffic stream simulation shown in Appendix 3.4. The coordinated control of the new and adjoining signals is expected to realize an approximate 25% reduction in delay, as compared with the delay caused by the absence of coordinated control.

Regarding the installation of a pedestrian crossing facility, the pedestrian overpass, situated between 20.8 Kp and 21.8 Kp, is considered necessary from an analysis of the present number of pedestrians shown in Figure 3.9. The alternative, which proposes the installation of pedestrian crossing signals coordinated with adjoining signals, is not as feasible as the pedestrian overpass because of the large numbers of pedestrians and the effects of the signal installation on the smooth flow of the vehicle traffic. The construction of a pedestrian overpass is therefore preferable.

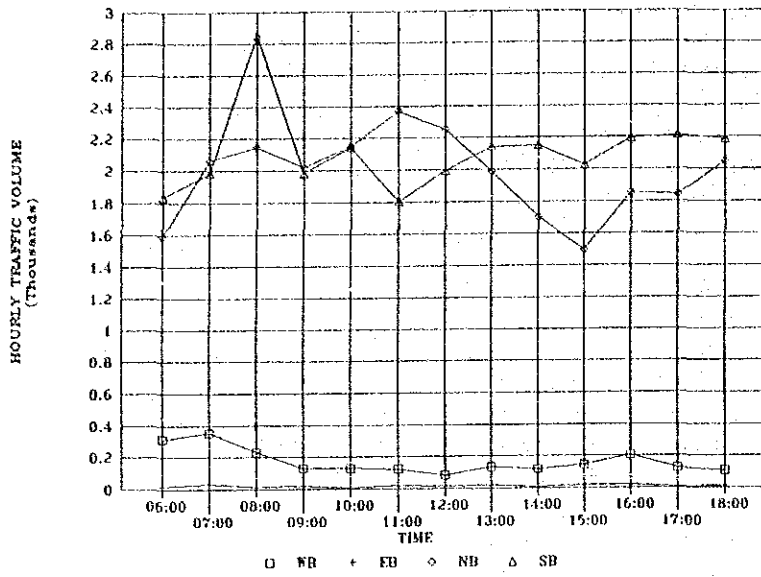


Figure 3.8 TRAFFIC VOLUME IN S-1

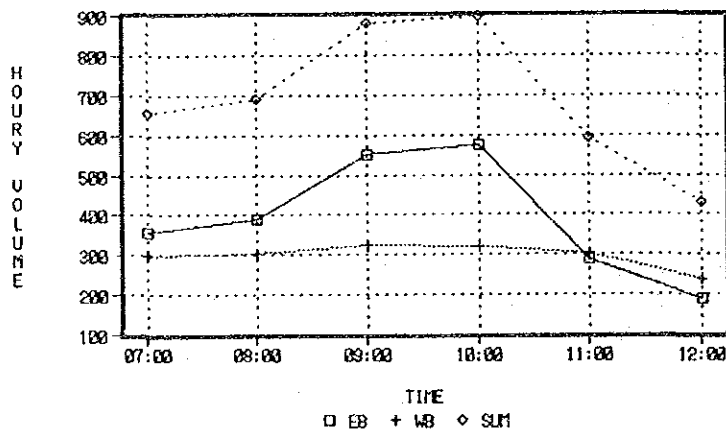


Figure 3.9 PEDESTRIAN VOLUME IN S-1

The problem on S-2 is that there is confusion between entering/exiting vehicles and vehicles making U-turns in front of the hospital. A possible countermeasure to solve this problem is to install traffic signals with coordinated control of the new and existing signals located near this site.

The present traffic volume, shown in Figure 3.10, is not large enough to warrant the installation of traffic signals. However, the installation of traffic signals is likely to be effective because existing signals are situated approximately 100 m to the south of the intersection and the installation of signals, coordinated with the adjoining signals, will not influence the through-traffic flow. In this study, therefore, traffic signals were proposed to be simultaneously offset (see Figure 3.11) with nearby signals.

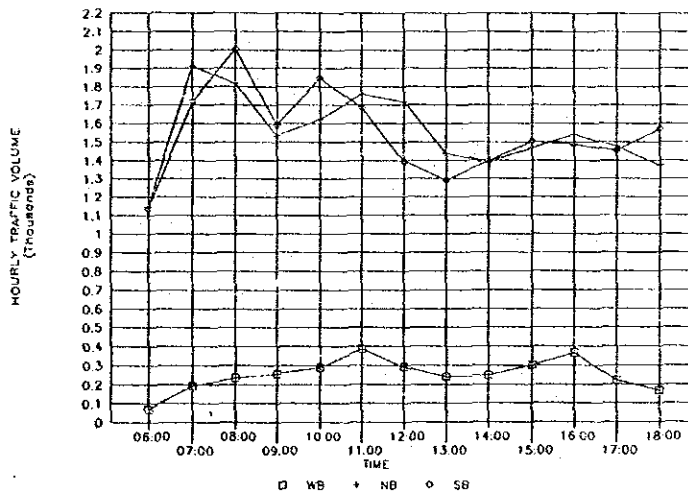
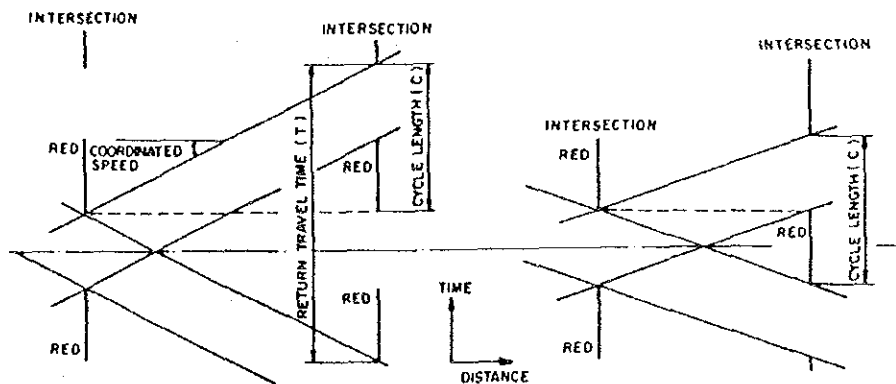


Figure 3.10 TRAFFIC VOLUME IN S-2



(a) Simultaneous Offset (b) Alternate Offset

Figure 3.11 IMPARTIAL OFFSET METHOD

S-32 has similar problems to S-2. This is the intersection of R304 and a feeder road to a hospital approximately 60 m to the west. Signal installation at the intersection of R304 (S-32-1) is considered necessary because the present traffic volume fully warrants this, as shown in Figure 3.12. On the other hand, at the intersection of the hospital (S-32-2) traffic signals are not proposed because the present traffic volume, shown in Figure 3.13, is not large enough.

In this study, simultaneous-type signals were proposed for both sites for the same reasons as for site S-2.

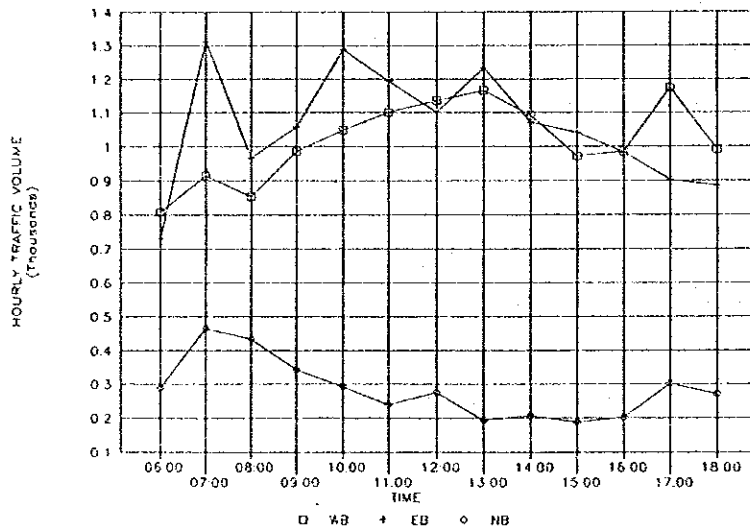


Figure 3.12 TRAFFIC VOLUME IN S-32-1

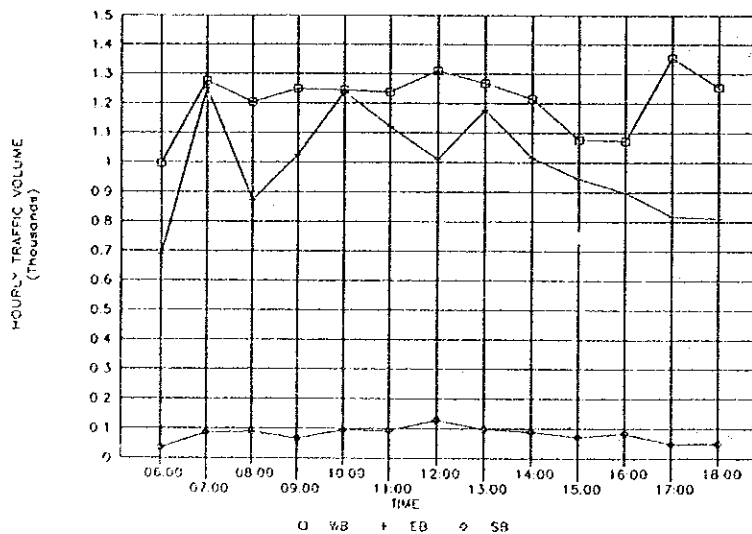


Figure 3.13 TRAFFIC VOLUME IN S-32-2

S-9

The problem at this site is that the median has no opening within the intersection. Consequently, through-traffic or right-turning traffic from the crossing road, are required to make a left-turn first and then a U-turn. Two alternatives can be proposed to solve this problem: one, is to open the median and to install traffic signals; the other, is to leave the intersection as it is and install U-turn signals or a U-turn lane to streamline the traffic in the U-turn zone.

The present traffic volume, shown in Figure 3.14, is large enough to install the traffic signals. In this study, therefore, it was proposed to install U-turn signals and a U-turn lane to streamline the traffic flow in the U-turn zone. The necessity of the U-turn signal installation was judged on the basis of the conditions for U-turn signal installation shown in Figure 3.15. It is expected that the installation of U-turn signals will influence highway traffic by creating a maximum storage length of about 40 m.

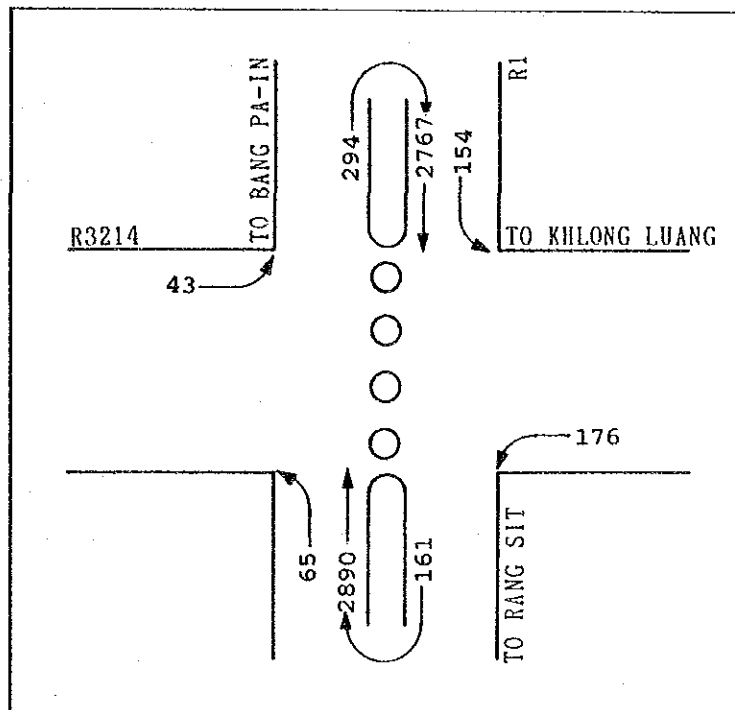


Figure 3.14 TRAFFIC TURNING MOVEMENT IN S-9 (PEAK-HOUR)

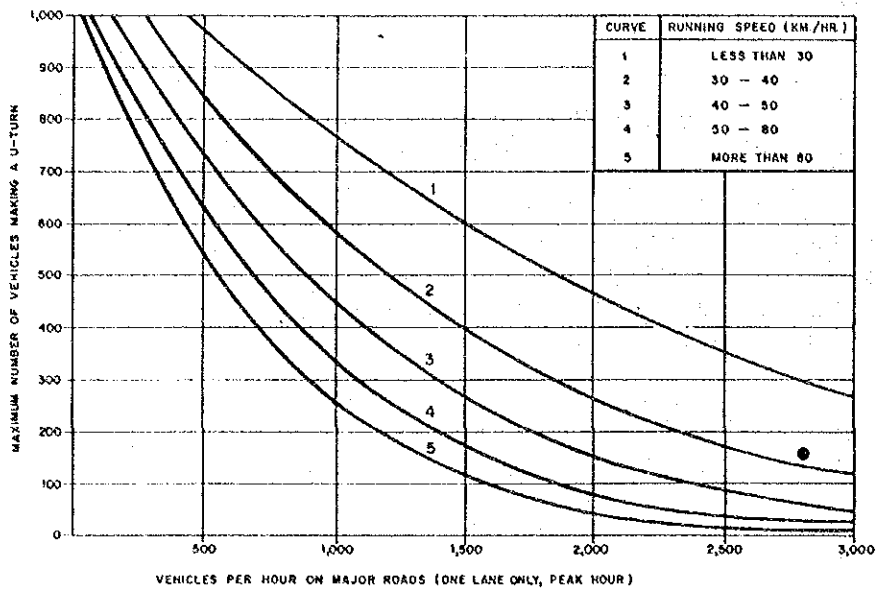


Figure 3.15 NECESSITY JUDGMENT OF U-TURN SIGNAL IN S-9

S-12

The necessity of signal installation should be considered at this site. The present traffic volume, shown in Figure 3.16, indicates that pre-timed signals are not necessary. In this Study, therefore, it was proposed to install semi-actuated traffic signals for two reasons: the necessity of traffic signals cannot be totally precluded for this site, based upon the present traffic volume; and the variation in traffic volume is large.

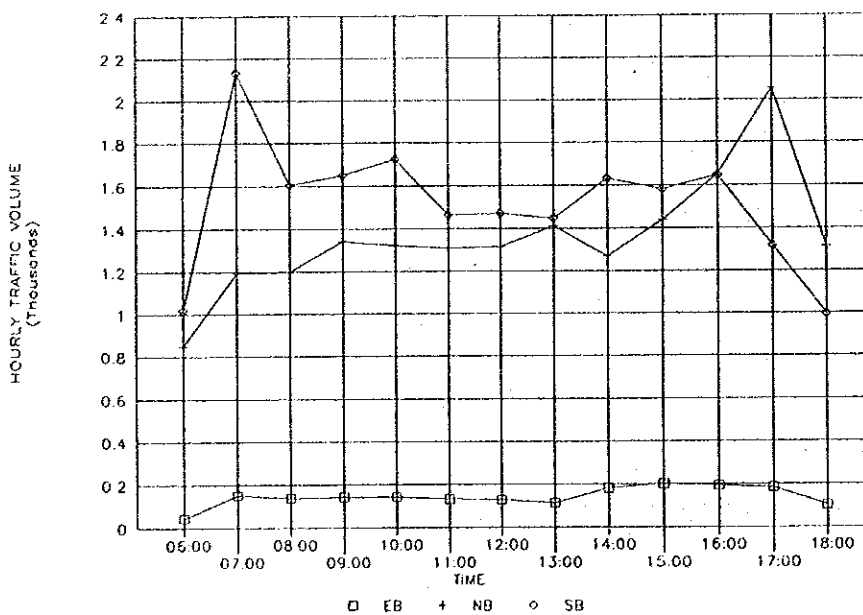


Figure 3.16 TRAFFIC VOLUME IN S-12

The problem at this site is that users from the soi are inconvenienced by the closed median which prevents them from crossing the intersection and turning right. Difficulties also exist in U-turning at the nearest median opening because of the heavy traffic volume.

There are many sois intersecting R3203 in the area between the intersection and the median opening. Right-turns from these sois are prevented by the continuous median. As a result, this traffic concentrates in the median opening to turn right. This is effective if the U-turn traffic is properly regulated. The installation of U-turn facility is also effective in regulating high volumes of traffic emerging from the connecting sois by avoiding signal installation.

The present traffic volume, shown in Figure 3.17 is not large enough to warrant the installation of traffic signals. However, the U-turn traffic cannot be smoothly operated because of the large volume of U-turn traffic in the U-turn zone. In this study, therefore, it was proposed to install U-turn signals and channelization for U-turns, the same as for S-9.

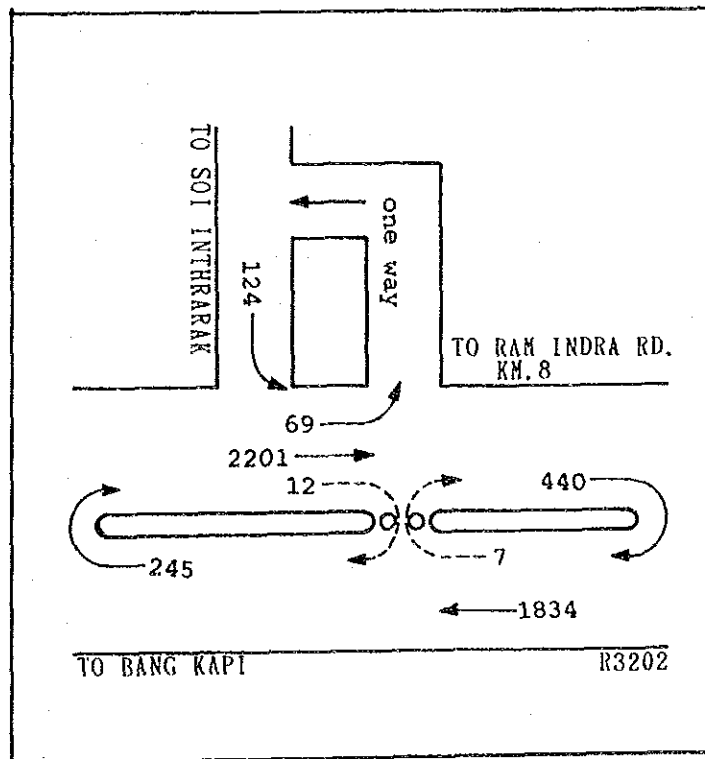


Figure 3.17 TRAFFIC TURNING MOVEMENT IN S-53 (PEAK-HOUR)

Signal installations were also considered for certain problem sections along high-standard highways, such as S-11, S-15 and S-48. In these sites, signal installation created few disruptions to the smooth traffic flow. The signal installations are likely to cause a maximum storage length of 90 m in S-11, 80 m in S-15, and 50 m in S-48.

b) Improvement of Pedestrian Facilities

The construction of a pedestrian overpass is considered necessary except on S-23, S-35. Table 3.8 shows the data used to establish this necessity based on the warrant shown in the technical guidelines.

However, the necessity of the overpass construction at S-45 cannot be clearly determined from the warrant, so the following countermeasure was adopted.

At this site, the median is fenced and therefore prevents, pedestrians from crossing the highway. What is required in this case is to estimate the potential demand of a pedestrian crossing and to judge the necessity of a pedestrian overpass construction on the basis of the estimated number of crossings.

However, owing to the difficulty in estimating the number of crossing pedestrians within the scope of this study, the average spacing between existing pedestrian overpasses was used as a criterion for determining the necessity of pedestrian overpass construction. Table 3.9 shows the average spacing between pedestrian overpasses on major highways in central Bangkok. The table indicates that the pedestrian overpasses are spaced at an average of 500 m in the central business district of Bangkok (1987). Since S-45 is similar to Bangkok's central business district, in that it has many roadside service facilities, it was considered necessary to build pedestrian overpasses at intervals of 500 m.

Table 3.8 Necessity of Installing Pedestrian Overpass

STUDY SECTION NO.	NO. OF PEDESTRIANS OF PEAK-HOUR	HOURLY TRAFFIC VOLUME	FOR SCHOOL CHILDREN OR NOT	WARRANTING COLUMNS OF PEDESTRIAN	NECESSARY	GROUNDS OF NECESSARY
1	1,354	3,331	No	more than 100 persons	Yes	Satisfies criteria for improvement
3	213	2,107	No	more than 100 persons	Yes	Satisfies criteria for improvement
4	100	2,081	Yes	more than 100 persons	Yes	Satisfies criteria for improvement
5	614	2,552	No	more than 100 persons	Yes	Satisfies criteria for improvement
6	559	2,528	No	more than 100 persons	Yes	Satisfies criteria for improvement
16	227	2,511	Yes	more than 100 persons	Yes	Satisfies criteria for improvement
17	295	2,511	Yes	more than 100 persons	Yes	Satisfies criteria for improvement
23	13	4,393	No	more than 100 persons	No	Pedestrian volume is low
25	103	4,218	No	more than 100 persons	Yes	Satisfies criteria for improvement
26	133	4,218	No	more than 100 persons	Yes	Satisfies criteria for improvement
27	213	4,218	No	more than 100 persons	Yes	Satisfies criteria for improvement
28	620	4,218	No	more than 100 persons	Yes	Satisfies criteria for improvement
29	95	4,218	No	more than 100 persons	Yes	Although pedestrian volume is low, running speed of vehicles is very high
30	194	4,218	No	more than 100 persons	Yes	Satisfies criteria for improvement
31	128	3,980	No	more than 100 persons	Yes	Satisfies criteria for improvement
33	1,379	1,414	Yes	more than 100 persons	Yes	Satisfies criteria for improvement
34	764	2,905	Yes	more than 100 persons	Yes	Satisfies criteria for improvement
35	57	2,682	Yes	more than 100 persons	No	Pedestrian volume is low
36	343	4,577	No	more than 100 persons	Yes	Satisfies criteria for improvement
37	425	3,491	No	more than 100 persons	Yes	Satisfies criteria for improvement
38	294	4,306	No	more than 100 persons	Yes	Satisfies criteria for improvement
39	331	4,306	No	more than 100 persons	Yes	Satisfies criteria for improvement
40	845	4,306	No	more than 100 persons	Yes	Satisfies criteria for improvement
41	205	3,020	No	more than 100 persons	Yes	Satisfies criteria for improvement
42	339	4,259	No	more than 100 persons	Yes	Satisfies criteria for improvement
45		5,543	No	more than 100 persons	Yes	Many roadside service facilities
50	226	2,405	No	more than 100 persons	Yes	Satisfies criteria for improvement
54	567	3,368	No	more than 100 persons	Yes	Satisfies criteria for improvement
56	288	896	No	more than 100 persons	Yes	Satisfies criteria for improvement
57	1,516	896	No	more than 100 persons	Yes	Satisfies criteria for improvement

Note: Pedestrians can not cross the highway because of a fence installed on the median in S-45

**Table 3.9 Average Intervals of Pedestrian Overpass
in Central Area of Bangkok**

ROAD SECTION		AVERAGE INTERVALS (M)
SUKHUMVIT ROAD	WITTAYU - ASOKE	430
	ASOKE - EKAMAI	1,060
	EKAMAI - PHRAKHANONG	320
	PHRAKHANONG - BANG NA	700
	AVERAGE	630
RAMA 4 ROAD	HUALUMPONG - SILOM	620
	SILOM - RATCHADAPHISEK	850
	RATCHADAPHISEK - PHRAKHANONG	770
	AVERAGE	750
NEW PHETBURI ROAD	PRATHUNAM - ASOKE	390
	ASOKE - KHLONG TAN	500
	AVERAGE	450
PHAHON YOTHIN ROAD	VICTORY MONUMENT - LAT PHRAO	540
PHAYATHAI ROAD	VICTORY MONUMENT - RAMA 4	460
PHETBURI ROAD	AURUPONG - PHATUNUM	350
SIAYUTTHAYA ROAD	RAMA 6 - RATCHAPHRALOP	340
RAMA 1	RAMA 6 - WITTHAYU	330 *
GRAND AVERAGE		480

c) Improvement of Night-time Traffic Safety

The installation of street lighting in S-13 and S-20 is required to ensure the safety of night-time traffic. The necessity of installing lighting facilities in the following two sections is examined.

S-13

The traffic volume in this section is 25,000 vehicles/day, which is large enough to warrant the installation of lighting facilities. However, S-13 has some sections with no houses or any other kind of building on either side. In this Study, therefore, it was considered necessary to install lighting facilities in S-13, excluding those sections where there were no houses or roadside facilities.

S-20

At present, the daily traffic volume in this section is 19,000 vehicles. This volume is smaller than the standard volume of 25,000 vehicles or more required for lighting installation. However, it was considered necessary to install lighting facilities in this section for the purpose of maintaining the continuity of lighting already installed on the entire highway section up to S-20. It was proposed that the installation be initiated when the traffic volume increases to a level large enough to warrant it.

d) Improvement of Roadway Section

The measures for the improvement of the roadway sections did not require detailed elaboration.

A motorcycle lane was proposed for S-44 because of the high motorcycle composition ratio in this section. A guard fence was deemed unnecessary for S-8 because the depth of the depressed median (0.8 m) was insufficient to warrant the installation of this. The installation of a guide sign was necessary in S-49 because there were no U-turn guide signs at this Section.

CHAPTER 4 PREPARATION OF IMPROVEMENT PLAN

CHAPTER 4 PREPARATION OF IMPROVEMENT PLAN

4.1 OBJECTIVES

The improvement plan for engineering remedial works determines the most effective and applicable traffic control and safety measures to be implemented on road sections experiencing traffic congestion and traffic conflicts.

A study of other improvement plans, and a look at their effectiveness, is useful for the preparation and design of the optimum improvement plan for the remedial works. The sample of improvement plans are also useful guides for the future preparation of improvement plans by the DOH.

In the Study, improvement plans were carried out at the preliminary design level, in order to show some examples of traffic control and safety measures for engineering remedial works.

The basic procedure for the preparation of the improvement plan is shown in Figure 4.1.

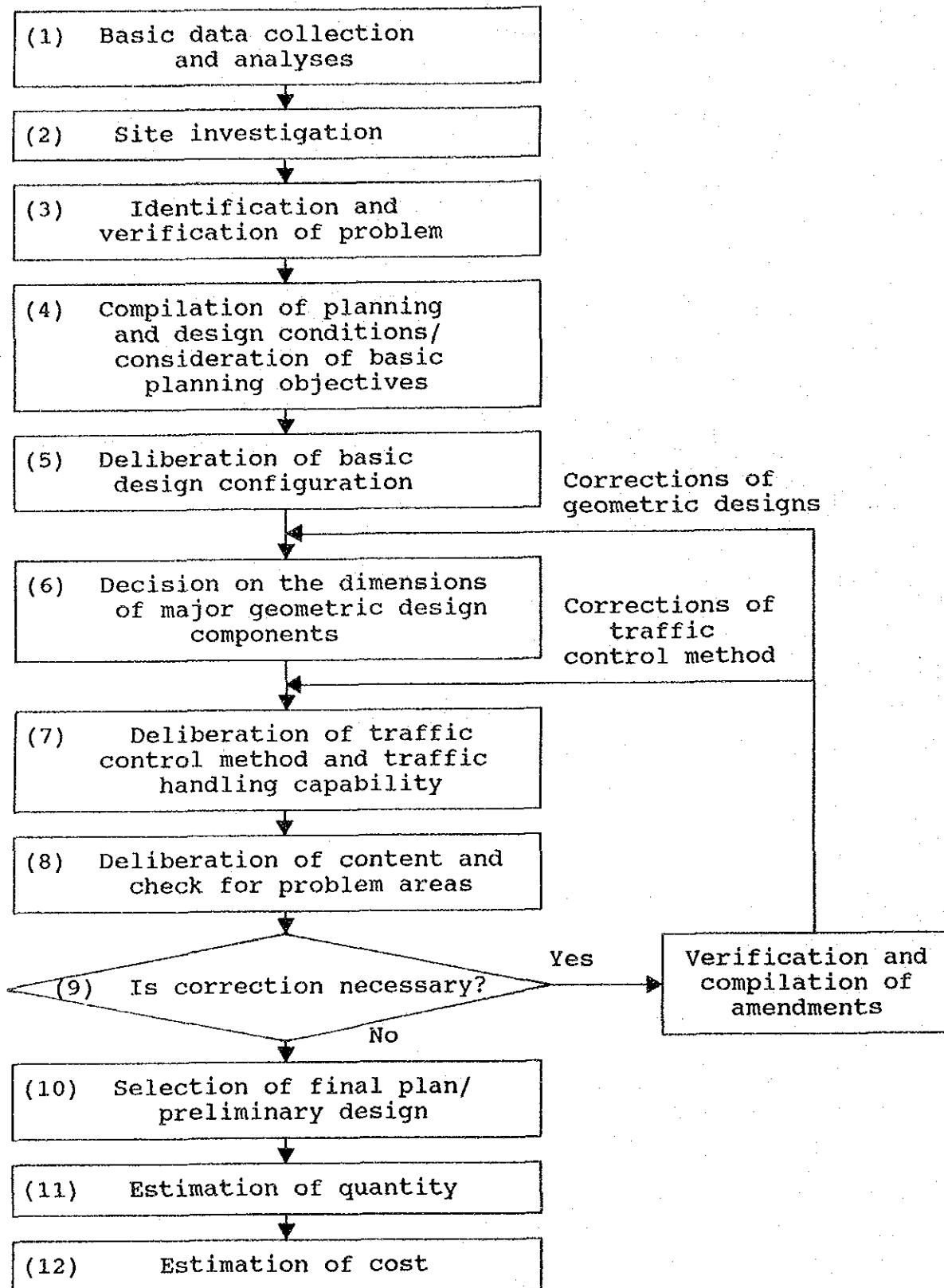


Figure 4.1 BASIC PROCEDURE FOR PRELIMINARY DESIGN