

8.3.7 Effectiveness Evaluation

(1) Evaluation

There are three different calculations attempted in the effectiveness evaluation of the long term plan in this case study, namely; 20 year period evaluation, 10 year period evaluation and the 1st year rate of return, applying all the same evaluation components.

The summary of the calculations' results are as follows and the details are shown in Table 8.7 and 8.8.

Type of Evaluation	Investment Amount			Gross Benefits	Net Benefits	B/C
	Install.	Maint.	Total			
1. 20 Year Period (1985-2004)	961.30	1,610.04	2,571.34	6,657.57	4,086.23	2.59
2. 10 Year Period (1985-1994)	961.30	342.13	1,303.43	2,164.27	860.84	1.66
3. 1st Year Rate of Return	961.30	0.0	961.30	451.73	-509.57	0.47

Regarding evaluation by type of standardized safety measure for 20 year evaluation period, it is revealed that the highest B/C ratio in the roadway is on Type RT-5 at 4.18 with gross net benefits for about 1,980 million Baht, and in the intersection on Type I-4 at 3.08 with the gross net benefits for 290 million Baht. It is also indicated that all of the 6 types of measures for the roadway are more than 2.00 in B/C ratio with average of 2.89, and among 4 types of safety measures for the intersections only one type (I-2) is nearly 1.00 in B/C ratio and the rest of 3 types are above break-even, with highest B/C ratio in Type I-4 at 3.08.

It is also calculated through benefit/cost evaluation that the numbers of persons saved from fatality and injury for the 20 year evaluation period are about 14,000 and 42,000 persons respectively, and for the 10 year period about 4,500 persons would be saved from fatality and 13,600 persons are to be prevented from injury.

With these results, the long term plan for the traffic safety improvement worked out in this case study can be clearly said that the plan can yield quite a high rate of return in monetary terms, and can be justified for implementation.

It is also to be mentioned that there are other methods of evaluation for the safety improvement plan, such as those based on reduction in number of

Table 8.7 Economic Evaluation - 20 year Period (1985 - 2004)
Benefit/Cost Calculation (No. of Casualty Fixed at 1982 Level)

Unit: (2), (3), (4) : No. of persons
(5), (6), (9), (10), (11), (12), (13) : Baht in million

Type of Measure	No. of Section	No. of Casualty	No. of Fatality	No. of Injury	Property Damage	Investment Cost	Progress Rate (%)	Reduction Rate (%)	Economic Benefit				B-C	B/C	
									Fatality	Injury	Property Damage	Total			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
Roadway	RT-1	29,100	7,020	21,080	607.00	528.37	5~100	45	N2,342	7,026	202.34	1,115.71	587.34	2.11	
	RT-2	7,320	1,840	5,480	158.20	135.59	5~100	50	N 622	1,867		296.47	160.88	2.19	
	RT-3	17,200	4,300	12,920	372.00	344.24	5~100	50	N1,595	4,784	53.77	759.69	415.45	2.21	
	RT-4	4,500	1,120	3,380	97.20	83.42	5~100	55	N 458	1,375		218.38	134.95	2.52	
	RT-5	73,600	18,400	55,200	1,589.60	620.91	5~100	40	N5,453	16,358	471.10	2,597.58	1,976.67	4.18	
	RT-6	19,660	4,920	14,740	424.60	282.76	5~100	45	N1,639	4,916	147.47	780.60	497.84	2.76	
Sub Total		150,400	37,600	112,800	3,248.60	1,995.29	5~100	(44)	N12,109	36,326		5,768.43	3,773.14	2.89	
Intersection	I - 1	3,060	760	2,300	66.00	132.62	5~100	50	N 283	850	24.48	134.99	2.37	1.02	
	I - 2	2,600	660	1,940	56.20	117.07	5~100	50	N 241	722	20.80	114.70	-2.37	0.98	
	I - 3	4,700	1,180	3,520	101.60	186.43	5~100	50	N 435	1,301	37.60	208.52	22.09	1.12	
	I - 4	16,280	4,080	12,200	351.60	139.93	5~100	30	N 905	2,714	78.15	430.93	251.00	3.08	
	Sub Total		26,640	6,680	19,960	575.40	576.05	5~100	(38)	N1,864	5,587	161.03	889.14	313.09	1.54
	Total		177,040	44,280	132,760	3,824.00	2,571.34	5~100	(43)	N4,192.99	1,257.39	1,207.19	6,657.57	4,085.23	2.59

Source : JICA Team

Remarks: 1. No. of casualties is fixed at 1982 level for 1985~2004

2. Composition of fatality and injury is 25:75

3. Unit Value

- fatality = 0.30 million Baht

- injury = 0.03 "

- property damage = 0.0216 "

4. Progress rate of implementation in %

1985 86 87 88 89 90 91 92 93 94 95-2004

5.00 11.50 19.50 29.00 40.00 51.33 63.00 75.00 87.33 100.00 100.00

Table 8.8 Economic Evaluation - 10 Year Period (1985 - 1994)
Benefit/Cost Calculation (No. of Casualty Fixed at 1982 Level)

Unit: (2), (3), (4) : No. of persons
(5), (6), (9), (10), (11), (12), (13) : Baht in million

Type of Measure	No. of Section	No. of Casualty	No. of Fatality	No. of Injury	Property Damage	Investment Cost	Progress Rate(%)	Reduction Rate(%)	Economic Benefits			B-C	B/C		
									Fatality	Injury	Property Damage				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
Roadway	RT-1	98	14,050	3,510	10,540	303.50	303.14	5~100	45	N 761 V 228.40	2,284 68.52	65.78	362.70	59.56	1.20
	RC-2	17	3,660	920	2,740	79.10	65.68	5~100	50	N 202 V 60.69	607 18.21	17.48	96.38	30.70	1.47
	RT-3	63	8,610	2,150	6,460	186.00	196.75	5~100	50	N 518 V 155.52	1,555 46.65	44.79	246.96	50.21	1.26
	RC-4	11	2,250	560	1,690	48.60	39.60	5~100	55	N 149 V 44.70	447 13.41	12.87	70.98	31.38	1.79
	RT-5	382	36,800	9,200	27,600	794.80	296.72	5~100	40	N1,773 V 531.75	5,318 159.53	153.15	844.43	547.71	2.85
	RC-6	68	9,830	2,460	7,370	212.30	130.23	5~100	45	N 533 V 159.80	1,598 47.94	46.02	253.76	123.53	1.95
Sub Total	635	75,200	18,800	56,400	1,624.30	1,032.12	5~100	(44)	N3,936 V1,180.86	11,809 354.26	340.09	2,875.21	843.09	1.82	
Intersection	I - 1	25	1,530	380	1,150	33.00	69.91	5~100	50	N 92 V 27.64	276 8.29	7.96	43.89	-26.02	0.63
	I - 2	24	1,300	330	970	28.10	59.41	5~100	50	N 78 V 23.48	235 7.04	6.76	37.28	-22.13	0.63
	I - 3	42	2,350	590	1,760	50.80	90.02	5~100	50	N 143 V 42.90	422 12.69	12.23	67.80	-22.22	0.75
	I - 4	147	8,140	2,040	6,100	175.80	51.97	5~100	30	N 294 V 88.22	882 26.46	25.41	140.09	88.12	2.70
	Sub Total	238	13,320	3,340	9,980	287.70	271.31	5~100	(38)	N 607 V 182.22	1,815 54.48	52.36	289.06	17.75	1.07
	Total	877	88,520	22,140	66,380	1,912.00	1,303.43	5~100	(43)	N4,543 V1,363.08	13,624 408.74	392.45	2,164.27	860.84	1.66

Source : JICA Team

Remarks: 1) No. of casualties is fixed at 1982 level for 1985~94

2) Composition of fatality and injury is 25:75

3) Unit values

- fatality = 0.30 million Baht

- injury = 0.03 "

- property damage=0.0216 "

4) Progress rate of implementation in %

1985 86 87 88 89 90 91 92 93 94

5.00 11.50 19.50 29.00 40.00 51.33 63.00 75.00 87.33 100.00

accident, reduction rate/unit cost as discussed in para. 8.2.4(1). However, it is generally agreed that the evaluation of the safety improvement plan based on B/C together with B - C is one of the most suitable methods as attempted in the case study.

(2) Cross-Examination of Financial Scale

For cross-examination of the investment amount to be required for implementation of the long term plan, an analysis is attempted with the data base obtained from NESDB, MOC and DOH on the budgetary frame of the safety improvement from the macroscopic approach on the scale of national budget, allocations to the Ministry of Communications (MOC), and Department of Highways (DOH) which is within the jurisdiction of MOC and responsible for the highway traffic safety, and on the composition of the budget allocations within DOH.

The reviews on the past trend of above factors reveal that the annual growth rate of the national budget ranges between 6.2 to 27 percents for the past 20 years with an average of about 10 percents, and during the past 5 years the share of MOC budget against the national budget ranges 5.4 to 7.7 percent, that of DOH to MOC ranges 82.3 to 87.2 percent and the budget allocated for maintenance purpose within DOH accounts for 25.2 to 23.2 percent of the total DOH budget.

With above analysis taken into consideration, the budgetary frame for the 10 year period (1985 - 1994) corresponding to the period for the long term plan is attempted with following assumptions;

- 1) Annual compound growth rate of national budget (NBT): 10%
- 2) Share of MOC budget against NBT: 6%
- 3) Share of DOH budget against MOC budget:
Gradually decrease from 82 percent in 1985 to 70 percent in 1993 and onward.
- 4) Share of DOH's maintenance budget against DOH's total budget: Gradually increase from 22 percent in 1985 to 25 percent in 1988 and onward.
- 5) Share of budget allocation for safety improvement among DOH maintenance budget
Gradually increase from 1.14 percent in 1982 to 4 percent in 1989 and onward.

There are two cases attempted for estimation of the budgetary frame for the traffic improvement in DOH for the period 1985 - 94; Case A with 0.8% of DOH budget and Case B with 1.14% in 1982 of DOH maintenance budget and this share is increased gradually to 4% in 1989 and onward, the results of which are as follow.

Property Budgetary Frame for Safety Improvement

	(Unit: ¥ in million)
1. Investment Amount for the Long Term Plan	1,303.43
2. Case A (0.8% of DOH budget)	1,333.00
3. Case B (1.14 - 4.00% of DOH maintenance)	1,350.00

It can be said that the investment amount required for the long term plan may be adequate with this analysis. When such analysis is made for Japan, the share of budget for road traffic safety improvement during 1981 -85 accounts for about 5.5% of the total budget for roads.

The estimated yearly allocation of the budget frame for the highway traffic safety improvement is shown in Table 8.9, together with the projection of national budget, MOC budget, DOH budget and its maintenance budget for the period from 1985 to 1994.

Table 8.9 Estimation of Budgetary Frame

(Unit: Baht in million)

	NAT'L Budget	MOC Budget	DOH Budget	DOH Maintenance	Safety Improvement							
					Case A	Case B	Cost Estimation					
	①	②	③	④	⑤	⑥	⑦					
1980			7,960	811								
81			8,885	1,045								
82	161,000	9,660	9,063	1,504	17.2							
83	177,000	10,620	8,934	1,720	22.9							
84	192,000		10,239	2,114								
				%	%	%	%	%	%	%	%	
85	213,000	12,780	10,670	82.0	2,240	22	92	0.8	43.7	1.95	49.2	2.2
86	234,300	14,060	11,530	80.5	2,540	23	100	0.8	59.4	2.34	65.3	2.6
87	257,700	15,460	12,450	79.0	2,860	24	108	0.8	79.8	2.79	82.0	2.9
88	283,500	17,010	13,440	77.5	3,230	25	116	0.8	107.9	3.34	109.0	3.4
89	311,800	18,710	14,500	76.0	3,630	25	125	0.8	145.2	4.00	129.9	3.6
Sub Total	1,300,300	78,020	62,590	76.7	14,500	23.9	541	0.8	436.0	3.00	435.4	3.0
90	343,000	20,589	15,640	74.5	3,910	25	135	0.8	156.4	4.00	139.2	3.6
91	377,300	22,640	16,870	73.0	4,220	25	145	0.8	168.8	4.00	158.7	3.8
92	415,000	24,900	18,180	71.5	4,550	25	157	0.8	182.0	4.00	175.5	3.9
93	456,600	27,400	19,590	70.0	4,900	25	169	0.8	196.0	4.00	186.6	3.8
94	502,200	30,130	21,090	70.0	5,270	25	186	0.8	210.8	4.00	208.1	4.0
Sub Total	2,094,100	125,650	91,370	71.6	22,850	25	792	0.8	914.0	4.00	868.1	0.8
Total	3,394,400	203,670	153,960	74.3	37,350	24.6	1,333	0.8	1,350.0	3.61	1,303.5	3.8

Source : JICA Team estimation

Basic data by NESDB, MOC, & DOH

Remarks : 1. Assumptions

- 1) Growth rate of National budget : 10% per annum
- 2) MOC Budget : 6% of National budget
- 3) DOH Budget : Share against MOC budget is reduced from 82.0% in 1985 to 70% in 1993 and onward
- 4) DOH Maintenance Budget : Share against DOH Budget is increased from 22% in 1985 to 25% in 1988 and onward

2. Safety Improvement Budget

- 1) Case A : 0.8% of DOH Budget
- 2) Case B : Based on 1.14% of DOH Maintenance Budget in 1982, and is increased up to 4% in 1989.
- 3) Cost Estimation : for long term plan (1985 - 1994)

8.3.8 Summary of Long Term Plan

(1) Amount of Investment and Remedy Works

The total amount of the investment needed in the long term plan of the case study has been estimated at approximately 1,300 million baht at 1985 year's price, consisting of 960 million baht for installation/construction and 340 million baht for replacement and maintenance. This estimation was made on condition that the remedy works in the long term plan are to be implemented over the period of 10 years as shown in Table 8.4. The expenditure for replacement and maintenance also covers the same period of 10 years.

The major safety devices for the remedy works in the plan are shown in the following Table 8.10.

Table 8.10 Major Safety Devices for the Remedy Works

Safety Device	Unit	Amount of Remedy Works	Cost of Installation/Construction (Million Baht)
Marking	m	702,720	198.7
Traffic Sign	set	11,970	24.8
Guardfence	m	115,500	104.0
Lighting	piece	3,030	84.6
Traffic Signal	piece	363	50.7
Sidewalk	m	21,830	220.4
Pedestrian Overpass	set	97	126.9
Others	-	-	117.2
Total			961.3

(2) Target of Long Term Plan

The long term plan is assumed to be implemented in 10 years between 1985 and 1994. When the plan has been fully realized, the expected number of casualties saved due to the safety improvement is about 3,800 annually which can be estimated at approximately 26% against the casualties on all DOH roads*, provided the present number of casualties on DOH roads will remain unchanged in future, if no remedy works would be undertaken.

* 3,800 casualties to be saved is about 43% to the present number of casualty on the hazardous road locations in the long term plan.

8.4 Information for Preparation of Medium Term Plan

8.4.1 Medium Term Plan

The implementation of a long term plan which requires a large amount of investment is generally phased in accordance with available financial resources. This leads to the necessity of preparation of implementation plans with a relatively short plan period, e.g. 5-year plan (This is referred to as "medium term plan" hereinafter).

In a medium term plan to be established within the framework of the long term plan, the selection of priority road locations and/or safety measures should be made taking into account effectiveness analyses from economical and engineering viewpoint and the national policy on traffic safety if any.

8.4.2 Determination of Priority

As mentioned above, there are two approaches to prepare a medium term plan on a priority basis, i.e., priority road locations and priority safety measures. The latter is to determine priority on each of safety device. However, as traffic safety improvement is generally attained through the application of a combination of safety devices, it is a difficult task to determine priority safety measures by device only. Therefore, discussed in the following sub-sections, is a concept for the determination of priority road locations.

(1) Cost-Effectiveness

To select priority road locations from a long term plan by means of cost-effectiveness (see para. 8.3.6), the adoption of net benefits or B/C ratios by the classified road type is practical in case where there is a large number of road locations to be remedied in a long term plan. In this method, the road locations which fall in a certain classified road type of which net benefit or B/C ratio is higher than others, will be given a high priority and incorporated in a medium term plan. The disadvantage with this method, however, appears when the number of accident and/or casualty varies to a considerable degree among the road locations in a certain category of road type, because the less effective locations may be given a high priority owing to the high effectiveness of other locations in the same category.

When the number of the hazardous road locations in a long term plan is relatively small as is the case with the case study in this report, it may be possible to estimate the net benefits or B/C ratios for all road locations regardless of road types. Then, the determination of priority road locations is made according to their effectiveness in terms of net benefits or B/C ratios.

(2) Accident Number

The cost-effectiveness method as discussed above is a reasonable approach to determine priority among a number of hazardous road locations. This method based on economical analyses may not necessarily agree to the judgement of concerned engineers as well as the sentiment of the public, because the road locations where many accidents occurred may not be given a high priority if their cost effectiveness is low. Therefore, it is also important to give due considerations to accident number. This accident number method is self-explaining, that is, to give a high priority to the road locations with a high frequency of accident.

(3) Policy

The above two methods are to determine priority objectively among a number of hazardous road locations. If there is a policy like a national target to meet social needs such as a particular care for pedestrians or transportation poors, e.g. school children, disabled persons, a medium term plan should be worked out so as to fulfill the target.

8.4.3 Formation of Medium Term Plan

There are various methods to determine priority on hazardous road locations in a long term plan. Although each of the methods in the preceding paragraph is practical and reasonable, a final determination of priority road locations to be remedied in a medium term plan should be made comprehensively by the concerned authorities applying these methods.

To formulate a medium term plan, besides the determination of priority road locations, financial aspects also should be reviewed thoroughly. Though, the more investment is made in the early stage of implementation period, the more return can be expected, this principle can't be always adopted to the preparation of a medium

term plan which is a sort of action plan and should be realistic, where available financial resource are limited. Therefore, a medium term plan should be finalized taking into account the engineering, economical and financial aspects.

Furthermore, in a medium term plan, the locations to be remedied should be reviewed, and detailed field investigations and surveys on them also should be conducted. Then, an individual safety plan for each hazardous location should be worked out, instead of the macroscopic approach as being the case with the long term plan.

Appendices

Case-Study Roads

Area	Location	Route Number	Length of Road (km)
Rural Area	Bangkok-Saraburi	1	90.2
	Sam Yak Krachab -Kanchana Buri	323	53.0
	Min Buri -Chachoengsao	304	41.0
	Ban Pa-In -Ang Thong	32	50.9
Urban Area	Bangkok	301	1.6
		302	6.4
		306	17.3
		3113	6.4
	Chiang Mai	11	10.7
		1141	7.4
	Nakhon Ratchasima	2	7.7
205		6.8	

Length of National and Provincial Highways in 1983

(Kilometres)

Region	National Highways			Provincial Highways			National and Provincial Highways					
	Paved	Gravel	Under-Construction	Total	Paved	Gravel	Under-Construction	Total	Paved	Gravel	Under-Construction	Total
Northern	3,305	19	96	3,420	3,724	799	4,675	9,148	7,029	818	4,771	12,618
Northeastern	4,586	43	131	4,760	3,424	1,903	2,334	7,661	8,010	1,946	2,465	12,421
Central	4,177	22	209	4,408	3,210	1,543	2,136	6,889	7,387	1,565	2,345	11,297
Southern	2,912	8	75	2,995	2,678	795	1,730	5,203	5,590	803	1,805	8,198
Thailand	14,980	92	511	15,583	13,036	5,040	10,875	28,951	28,016	5,132	11,386	44,534

Source : Department of Highways

Rural Road Network in 1981

(Kilometres)	
Agencies	Length
Department of Public Works (PWD)	2,277
The Accelerated Rural Development Program (ARD)	11,490
The Mobile Development Units (MDU)	1,176
Royal Irrigation Department (RID)	3,770
Office of Agricultural Land Reform (LRD)	332
Self - Help Land Settlement (SLD)	1,130
Changwat Administrative Organization (CAO), Other	85,825
Total	106,000

Source : Study of Rural Roads, July 1981. DOH

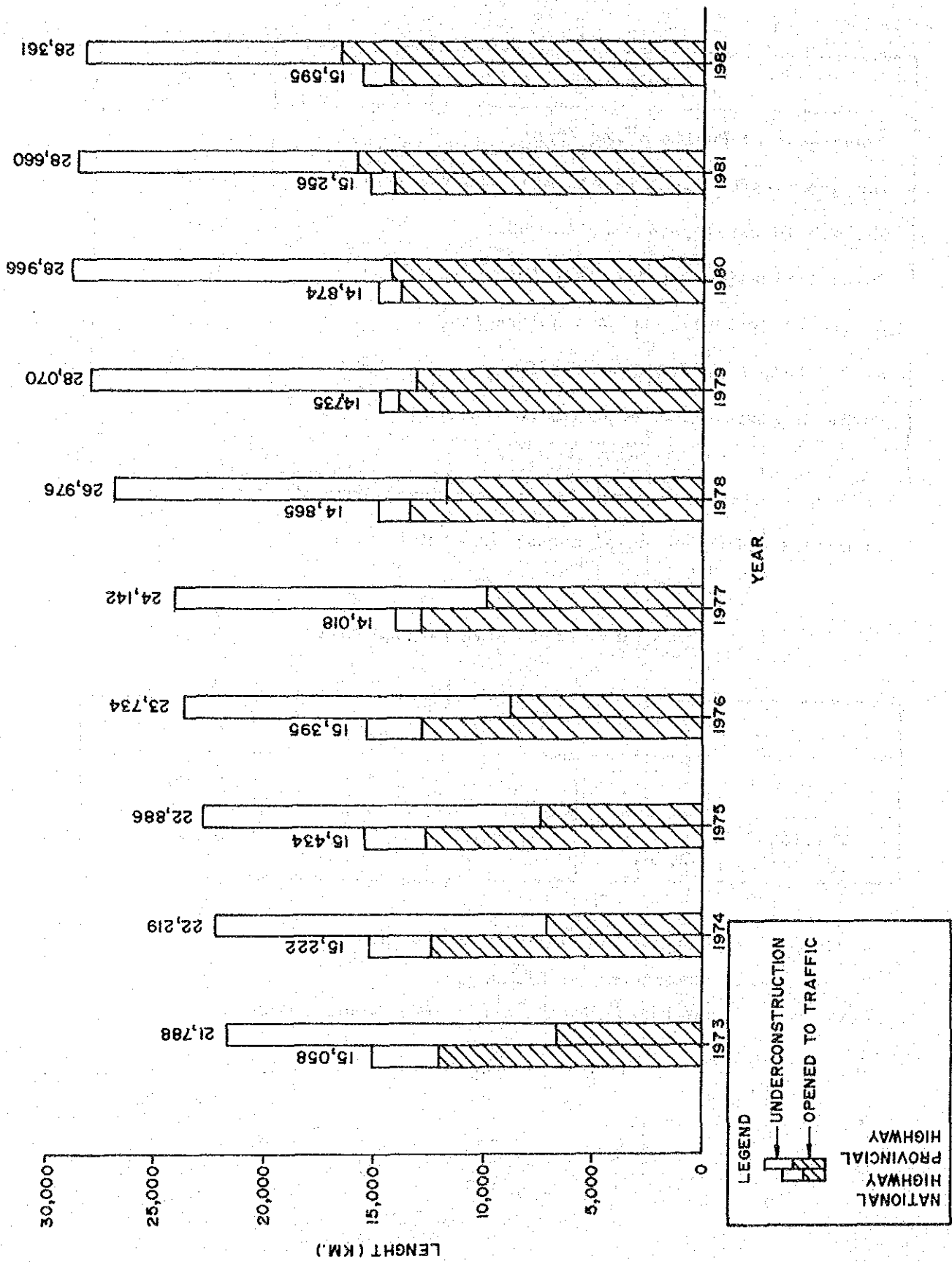
Length of Municipality Roads (latest figure) (Km)

	Paved	Unpaved	Total
Bangkok ¹⁾			3,975*
Thailand ²⁾ (excluding Bangkok)	2,003	558	2,561

Source : 1) Bangkok Metropolitan Administration

2) Department of Highways

Note : * Including local roads (Soi) about 3,000 Km.



Trend in Length of Highway

Number of Registered Motor Vehicles

(Thailand)

Year	Passenger Car (Inc. Samlor)	Buses	Trucks (Inc. Van)	Motorcycle	Others	Total
1970	228,786	18,715	135,673	337,570	16,780	737,524
1971	242,901	18,302	147,218	363,601	17,722	789,744
1972	250,067	20,153	159,126	376,170	27,846	833,362
1973	258,732	21,572	179,394	405,194	19,135	884,027
1974	308,879	22,650	232,396	458,570	23,277	1,045,772
1975	296,818	22,717	236,057	474,474	24,087	1,054,153
1976	304,587	19,603	285,173	511,546	22,135	1,143,044
1977	339,822	27,515	346,222	647,509	31,347	1,392,415
1978	373,230	27,893	372,168	726,920	37,780	1,537,991
1979	398,034	29,517	399,302	756,392	38,674	1,621,919
1980	421,516	50,818	315,683	906,674	37,965	1,732,656
1981	354,865	170,233	466,463	1,163,981	42,021	2,197,563
1982	397,081 (15.4%)	210,418 (8.2%)	555,128 (21.5%)	1,367,874 (53.1%)	47,612 (1.8%)	2,578,113 (100%)

(Bangkok)

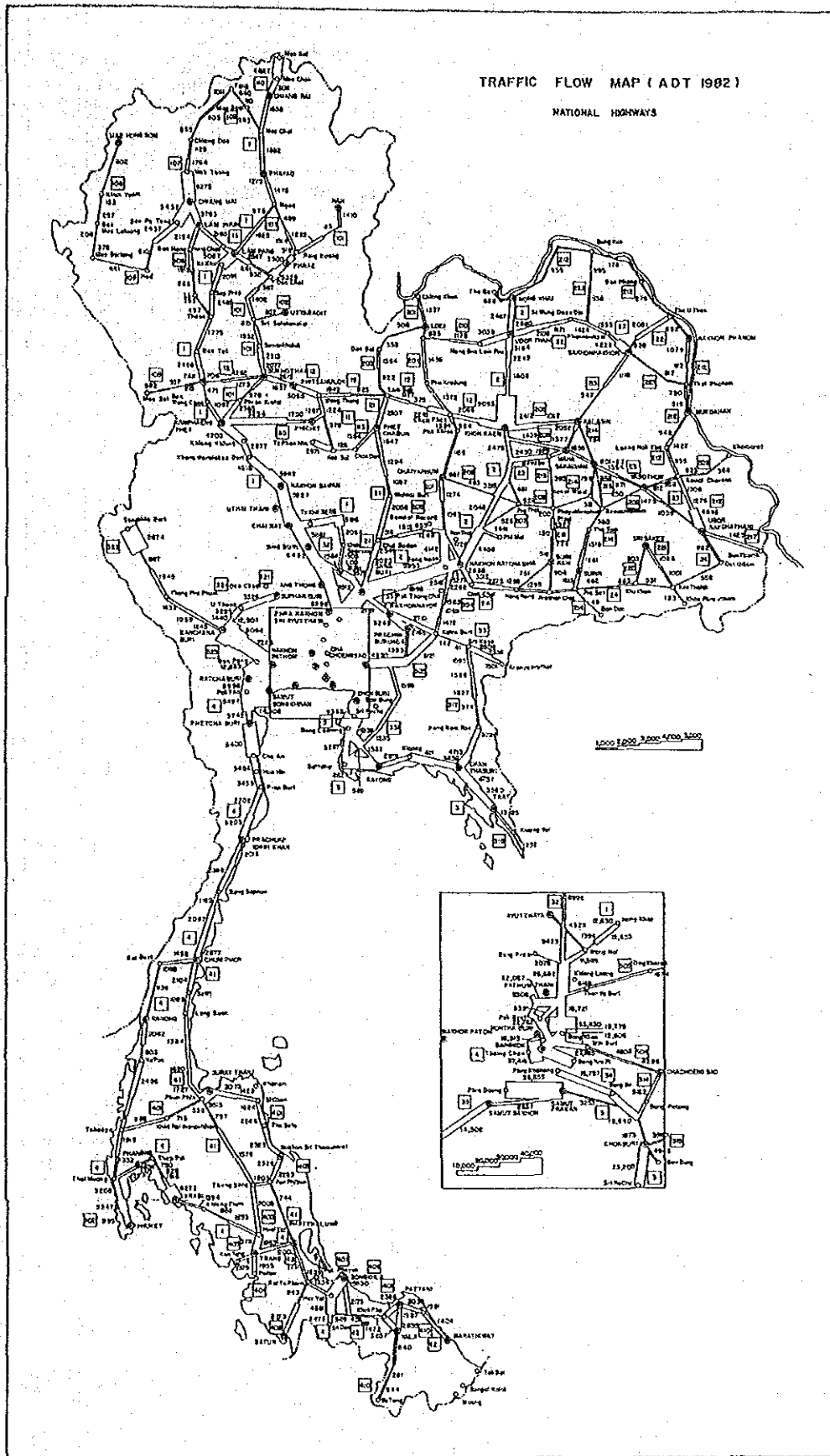
Year	Passenger Car (Inc. Samlor)	Buses	Trucks (Inc. Van)	Motorcycle	Others	Total
1970	178,449	4,793	43,472	69,022	9,274	305,010
1971	188,742	4,936	43,675	73,559	9,668	320,580
1972	189,641	6,250	43,260	72,105	9,317	320,573
1973	190,099	6,401	44,199	72,508	9,196	322,403
1974	237,927	6,312	61,224	73,638	11,211	390,312
1975	221,610	6,938	42,456	86,777	9,849	367,630
1976	228,654	5,420	56,242	94,496	8,544	593,356
1977	249,987	10,050	66,579	121,149	12,620	460,385
1978	271,530	10,892	71,203	129,078	19,613	502,316
1979	293,007	11,884	83,093	136,266	21,272	545,522
1980	320,770	12,940	102,103	161,801	23,079	620,693
1981	277,512	89,892	98,139	289,702	25,445	780,690
1982	290,168 (33.2%)	122,676 (13.6%)	122,268 (13.5%)	338,846 (37.5%)	28,431 (3.2%)	902,389 (100%)

Source : Licenses Division of Police Department, Ministry of Interior.
Department of Land Transport, Ministry of Communications.

Traffic Volume on National Highways
(Average Daily Traffic)

Location	Type of Vehicle	1978	1979	1980	1981	1982
Northern Region Route Number : 1 Control Section: 1500 Station Km : 336+163 Termini : Kamphaeng Phet	Passenger Car	1,613	911	838	859	1,049
	Light Bus and Light Truck	849	1,275	1,126	1,324	1,615
	Heavy Vehicle	1,200	1,273	1,177	1,370	1,539
	Total (Index)	4,869 (100)	3,459 (71)	3,141 (64)	3,553 (73)	4,203 (86)
	Motorcycle	N.A.	615	622	600	916
North Eastern Region Route Number : 2 Control Section: 0502 Station Km : 47+450 Termini : Phimai	Passenger Car	546	530	636	596	664
	Light Bus and Light Truck	806	908	912	1,173	1,381
	Heavy Vehicle	2,244	2,621	2,455	2,890	2,845
	Total (Index)	3,596 (100)	4,059 (113)	4,003 (111)	4,659 (130)	4,890 (136)
	Motorcycle	N.A.	458	339	325	360
Central Region Route Number : 1 Control Section: 0202 Station Km : 35+000 Termini : Rangsit	Passenger Car	9,769	9,727	8,503	9,030	9,625
	Light Bus and Light Truck	5,191	6,822	6,068	6,614	7,479
	Heavy Vehicle	9,514	11,397	10,625	11,358	11,558
	Total (Index)	24,474 (100)	27,946 (114)	25,196 (103)	27,002 (110)	28,662 (117)
	Motorcycle	N.A.	1,110	1,311	1,500	1,681
Southern Region Route Number : 4 Control Section: 1600 Station Km : 465+700 Termini : Siyak	Passenger Car	315	435	386	411	380
	Light Bus and Light Truck	399	503	522	455	847
	Heavy Vehicle	519	489	667	539	860
	Total (Index)	1,233 (100)	1,427 (116)	1,575 (128)	1,405 (114)	2,087 (169)
	Motorcycle	N.A.	378	358	305	517

Traffic Volume on the National Highways (Average Daily Traffic)



Traffic Accidents in Thailand and Bangkok Metropolis

Description		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Number of Accidents	Thailand	9,945	11,464	13,278	13,831	16,583	18,669	23,120	17,742	16,361	16,047
	Bangkok	4,492	5,942	6,721	7,965	10,482	11,680	12,045	11,190	11,802	9,794
Deaths	Bangkok per Thailand	0.68	0.52	0.51	0.58	0.63	0.63	0.52	0.63	0.72	0.61
	Thailand	3,098	2,928	2,503	3,764	2,545	3,952	8,365	4,493	2,760	3,091
Deaths	Bangkok	480	421	350	403	474	534	571	624	631	689
	Bangkok per Thailand	0.15	0.14	0.14	0.11	0.19	0.14	0.07	0.14	0.23	0.22
Casualties	Thailand	13,320	13,150	11,961	13,947	11,851	14,520	30,004	17,885	12,057	12,431
	Bangkok	3,205	3,361	3,401	4,031	5,225	5,378	5,603	5,209	5,441	4,382
Deaths per 100,000 population	Bangkok per Thailand	0.24	0.26	0.28	0.29	0.44	0.37	0.19	0.29	0.45	0.35
	Thailand	8	7	6	9	6	9	18	10	6	6
Deaths per 10,000 vehicle (Excluding motorcycle)	Bangkok	12	10	8	9	10	11	11	12	12	13
	Bangkok per Thailand	1.50	1.43	1.33	1.00	1.67	1.22	0.61	1.20	2.00	2.17
Deaths per 10,000 vehicle (Excluding motorcycle)	Thailand	64	50	43	60	34	49	97	55	27	26
	Bangkok	19	14	13	13	14	14	14	14	13	12
Bangkok per Thailand	0.30	0.22	0.30	0.22	0.41	0.29	0.14	0.25	0.48	0.46	

Source : Research and Planning Division, Police Department

Agencies Related to Road Traffic Safety Administration

Agency	Related Law	Major Activities
Department of Highways (DOH), Ministry of Communications.	Announcement of the Revolutionary Party, No. 295 (Highway Law)	<ol style="list-style-type: none"> 1. Planning, construction and maintenance of all National Highways and Provincial Highways. 2. Planning, installation and maintenance of road safety facilities on National Highways and Provincial Highways. 3. Investigation of traffic accidents which mainly caused damages to DOH properties
Department of Land Transport (DLT), Ministry of Communications.	Transport Act (1979)	<ol style="list-style-type: none"> 1. Registration of commercial buses and trucks (Details are described in 2.5.2(1)) 2. Licensing for commercial vehicle operators and drivers. 3. Issuance of driving license for commercial vehicle. 4. Inspection of commercial vehicles. 5. Road safety education for drivers and conductors related to commercial vehicles. 6. Investigation of traffic accidents caused by commercial vehicles. 7. Law enforcement related to the Transport Act (1979).
Traffic Police Division (TPD), Police Department, Ministry of Interior.	Land Traffic Act (1979) Automobile Act (1979) Transport Act (1979)	<ol style="list-style-type: none"> 1. Maintaining some of traffic signals in Bangkok. 2. Law enforcement related to the Land Traffic Act (1979), Automobile Act (1979) and Transport Act (1979) in Bangkok.
Highway Police Division (HPD), Police Department, Ministry of Interior.	Land Traffic Act (1979) Automobile Act (1979) Transport Act (1979)	<ol style="list-style-type: none"> 1. Investigation of traffic accidents occurred on major Highways outside the municipal area. 2. Law enforcement related to the Land Traffic Act (1979), Automobile Act (1979) and Transport Act (1979) on above mentioned Highways.
Local Police Stations (LPS), Police Department, Ministry of Interior.	Land Traffic Act (1979) Automobile Act (1979) Transport Act (1979)	<ol style="list-style-type: none"> 1. Investigation of traffic accidents occurred on roads other than MPD responsibility. 2. Law enforcement related to the Land Traffic Act (1979), Automobile Act (1979) and Transport Act (1979) on above mentioned roads.
Licenses Division of Police Department (LDPD), Ministry of Interior.	Automobile Act (1979)	<ol style="list-style-type: none"> 1. Registration of vehicles other than DLT responsibility (Details are described in 2.5.2(1)). 2. Inspection of above mentioned classes of vehicles. 3. Issuance of driving license for above mentioned classes of vehicles.
National Safety Council (NSC), Office of Prime Minister.	Act of the National Safety Council	<ol style="list-style-type: none"> 1. Promotion of road safety education for school pupils as well as general public. 2. Collection of traffic accident data from related agencies.
Ministry of Education (MOE)		<ol style="list-style-type: none"> 1. Promotion of road safety education. 2. Supervision of driving schools.

Agency	Related Law	Major Activities
Bangkok Metropolitan Administration (BMA) and Other Municipalities.	Announcement of the Revolutionary Party, No. 295 (Highway Law)	<ol style="list-style-type: none"> 1. Planning, construction and maintenance of municipal roads. 2. Planning, installation and maintenance of road safety facilities on municipal roads.
Office of the Committee for the Management of Road Traffic (OCMRT), Ministry of Interior.		<ol style="list-style-type: none"> 1. Planning of traffic signals and road safety facilities in major municipal areas including Bangkok.

Function of Divisions and Offices in DOH Related to Traffic Safety

Division and Office	Functions
1. Planning Division a. Programming and Highway System Section b. Post-Project Evaluation Section	1. Establish feasibility study programme 2. Construction standardization 3. Conduct road inventory survey 1. Evaluation for benefit of post-project construction
2. Traffic Engineering Office a. Traffic Survey Section b. Traffic Research and Analysis Section c. Traffic Planning Section d. Traffic Design and Standardization Section	1. Conduct survey on traffic volume 1. Analyze data transferred from Traffic Survey Section 2. Analyze traffic accident data from Highway Field Division and HPD 1. Planning for the improvement of hazardous road sections 2. Evaluation of road improvements 1. Standardization of traffic safety devices 2. Supervision for installation of traffic safety devices on existing roads
3. Maintenance Division a. Project and Planning Section b. Evaluation and Standardization Section c. Highway Safety Engineering Section d. Weighing Station and Toll Gate Section	1. Establish short term and long term maintenance programme 1. Evaluation of the maintenance implementation 2. Standardization of maintenance methods 1. Installation of traffic signs and lightings 2. Production of traffic signs 1. Management of weighing stations
4. Design and Location Division a. Highway Design Section b. Highway Survey Section	1. Geometric Design and Pavement Design 2. Design for the installation of lightings and traffic signals 1. Collection of roadside data 2. Preparation of profiles and cross-sections
5. Material & Research Division	1. Traffic Accident Research 2. Cooperated with other agencies for traffic safety campaigns
6. Office of Secretary a. Public Relations Section	1. Announce for accident on highways 2. Announce for flood on highways and construction highway
7. Highway Field Divisions a. Planning Section b. Survey and Design Section c. Traffic Sign Section d. District Offices	1. Collection of relevant data of road conditions 2. Planning of road maintenance 1. Collection of roadside data 2. Geometric Design and Pavement Design 1. Installation and maintenance of traffic signs, traffic signals, lightings and pavement markings 1. Maintenance of roads

Number of Driving Licenses Issued

	1975	1976	1977	1978	1979	1980	1981	1982
Thailand	495,054	561,890	474,855	578,464	1,131,768	354,553	443,888	617,560
Bangkok	223,236	207,160	226,578	230,988	252,999	143,798	162,488	220,188

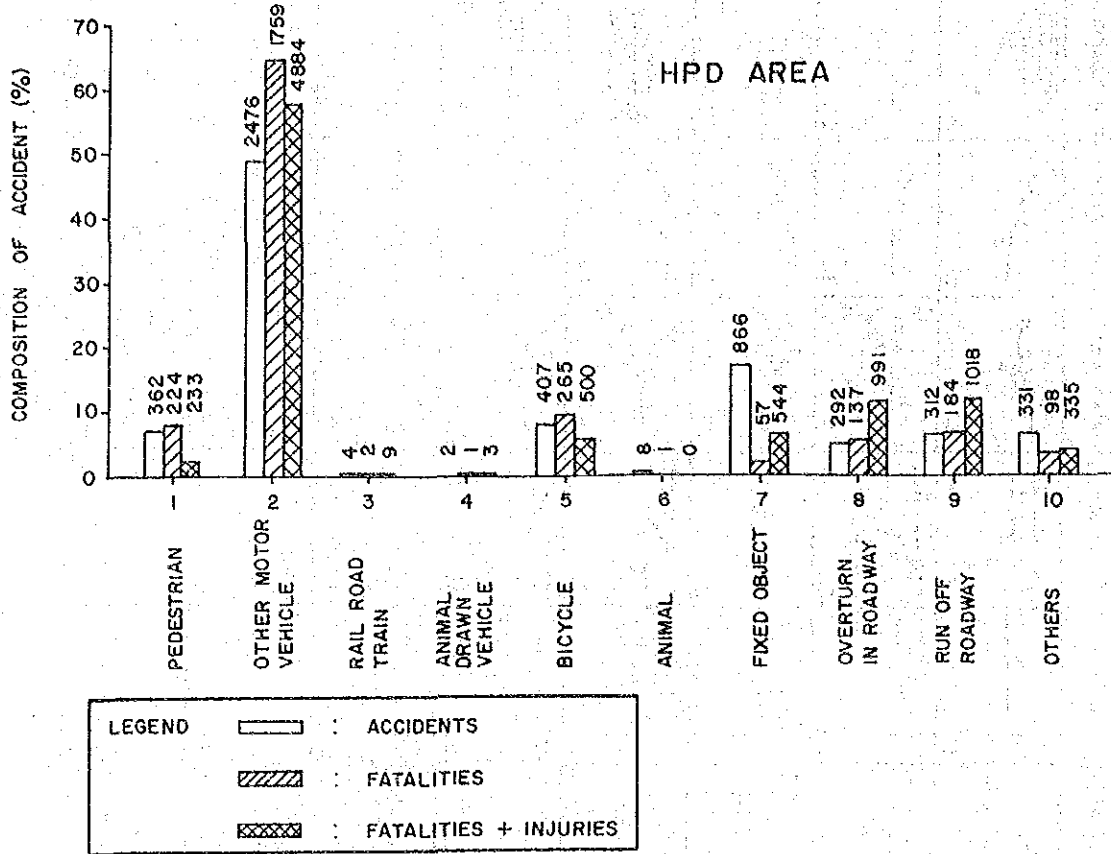
Source : Licenses Division of Police Department

Accident Recording Form of LPs

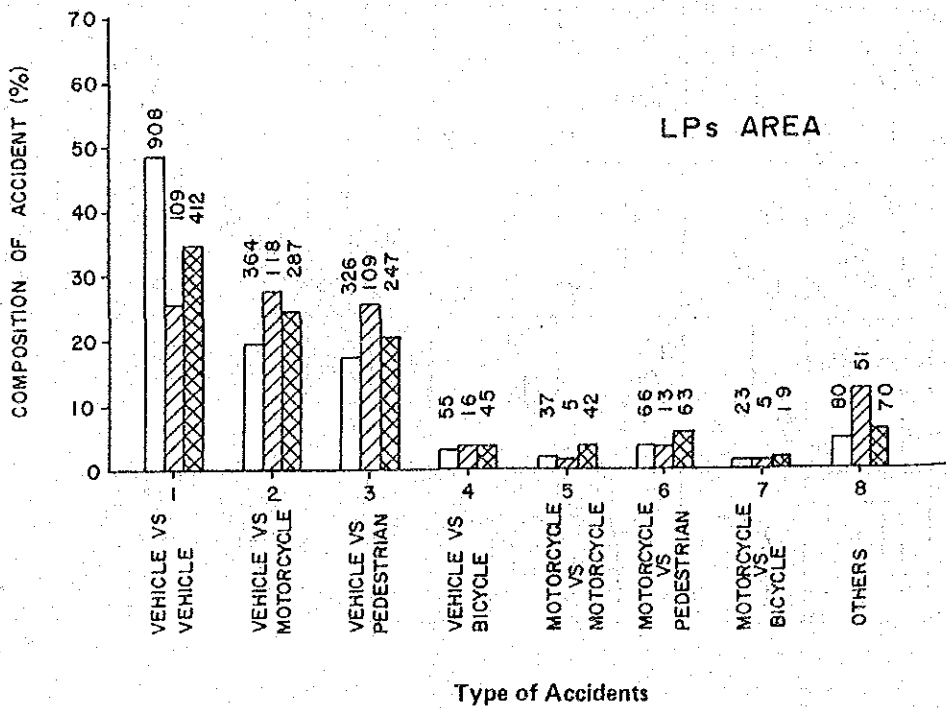
Complaint or Denunciation										
No...../.....				Name of Police Station.....						
To.....				Amphoe.....Changwat.....						
Case No.....										
Type of Case <input type="checkbox"/> Crime <input type="checkbox"/> Adult <input type="checkbox"/> Juvenile <input type="checkbox"/> Act of.....			Case:		Event Occured		Day	Date/Month/Year		Time
					Date of Complaint					
Place	Specific Point of Event	Local Police Station	Alleged Offender			Casualty				
			persons	arrested offender	dead	serious injury	minor injury			
Cause of Action		Armanent		Q'ty	Vehicle			Q'ty		
Action		1. Registered gun 2. illegal gun 3. War arms 4. Explosive material 5. Sharp object 6. Others			Car.....					
					Boat.....					
					Others					
List of Property Damaged		Q'ty	Price	List of Property Returned		Q'ty	Price	Material Evidence		
.....Official No.			Signature of Inquiry Official (.....) Date.....						
For Inquiry Official Only										
Note										
.....Complainant										
.....Offender										
.....Official/Writer										

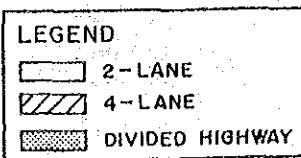
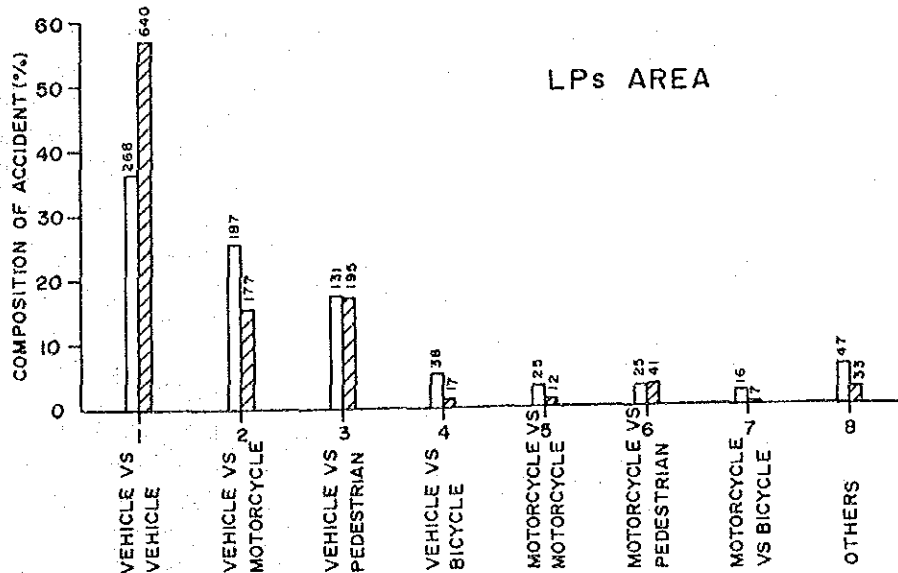
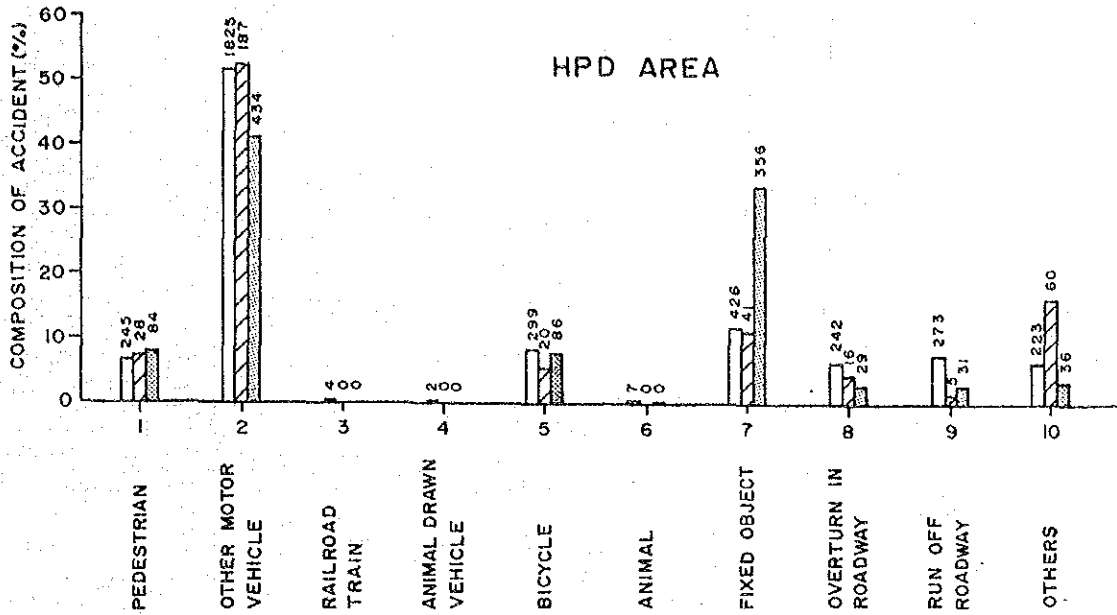
Collision Types and Codes Used by DOH

PEDESTRIAN	PEDAL CYCLIST	INTERSECTION	INTERSECTION	MANOEUVRING	ON PATH	OVERTAKING	CORNERING	OFF PATH	MISCELLANEOUS
01	11	21	31	41	51	61	71	81	91
02	12	22	32	42	52	62	72	82	92
03	13	23	33	43	53	63	73	83	93
04	14	24	34	44	54	64	74	84	94
05	15	25	35	45	55	65	75	85	95
06	16	26	36	46	56	66	76	86	OTHERS
07	17	27	37	47	57	67	77	87	97
08	18	28	38	48	58	68	78	88	98
09	19	29	39	49	59	69	79	89	99



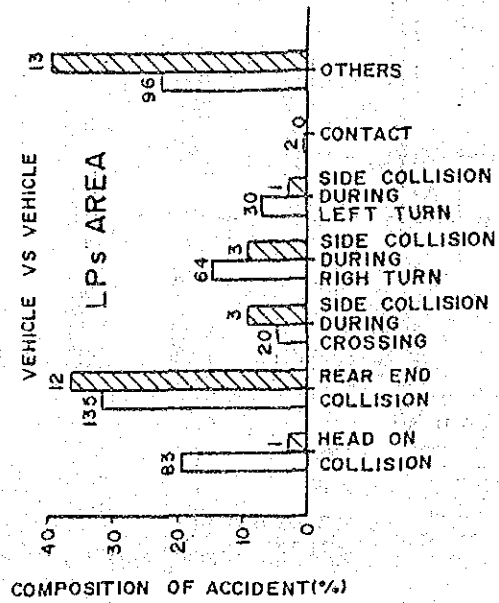
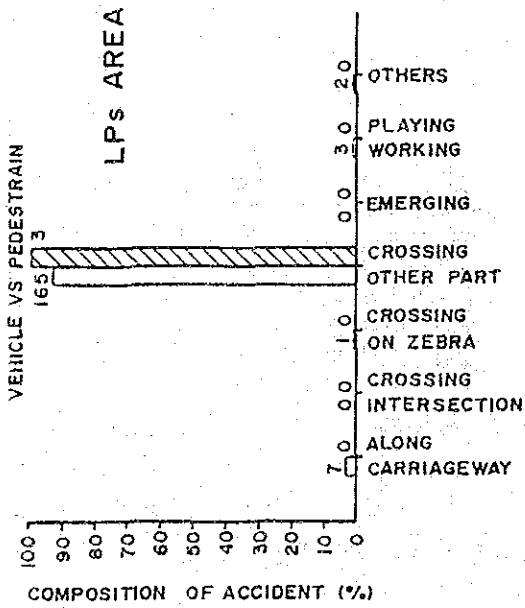
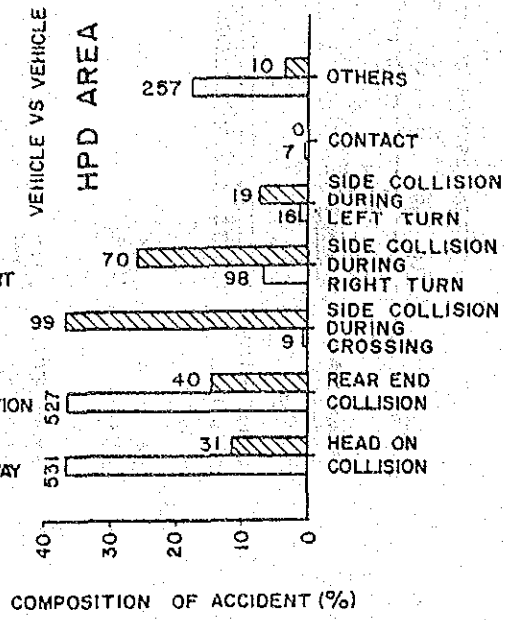
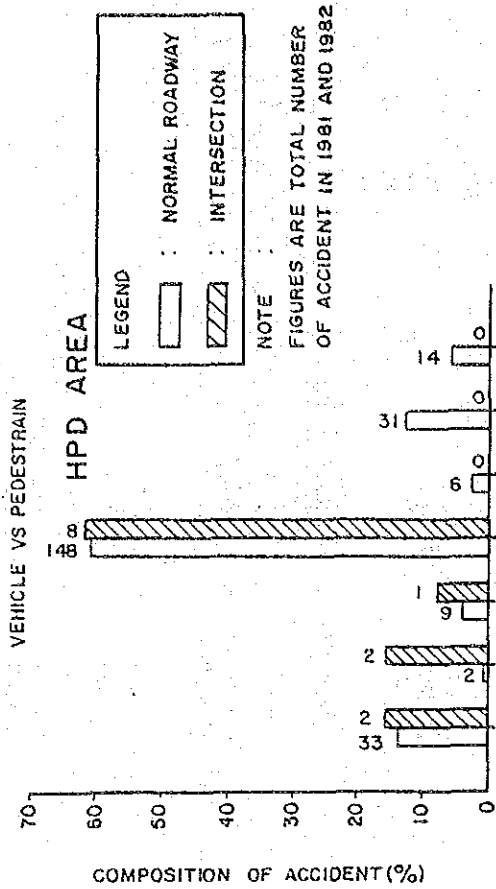
NOTE : FIGURES ARE TOTAL NUMBERS OF 1981 AND 1982



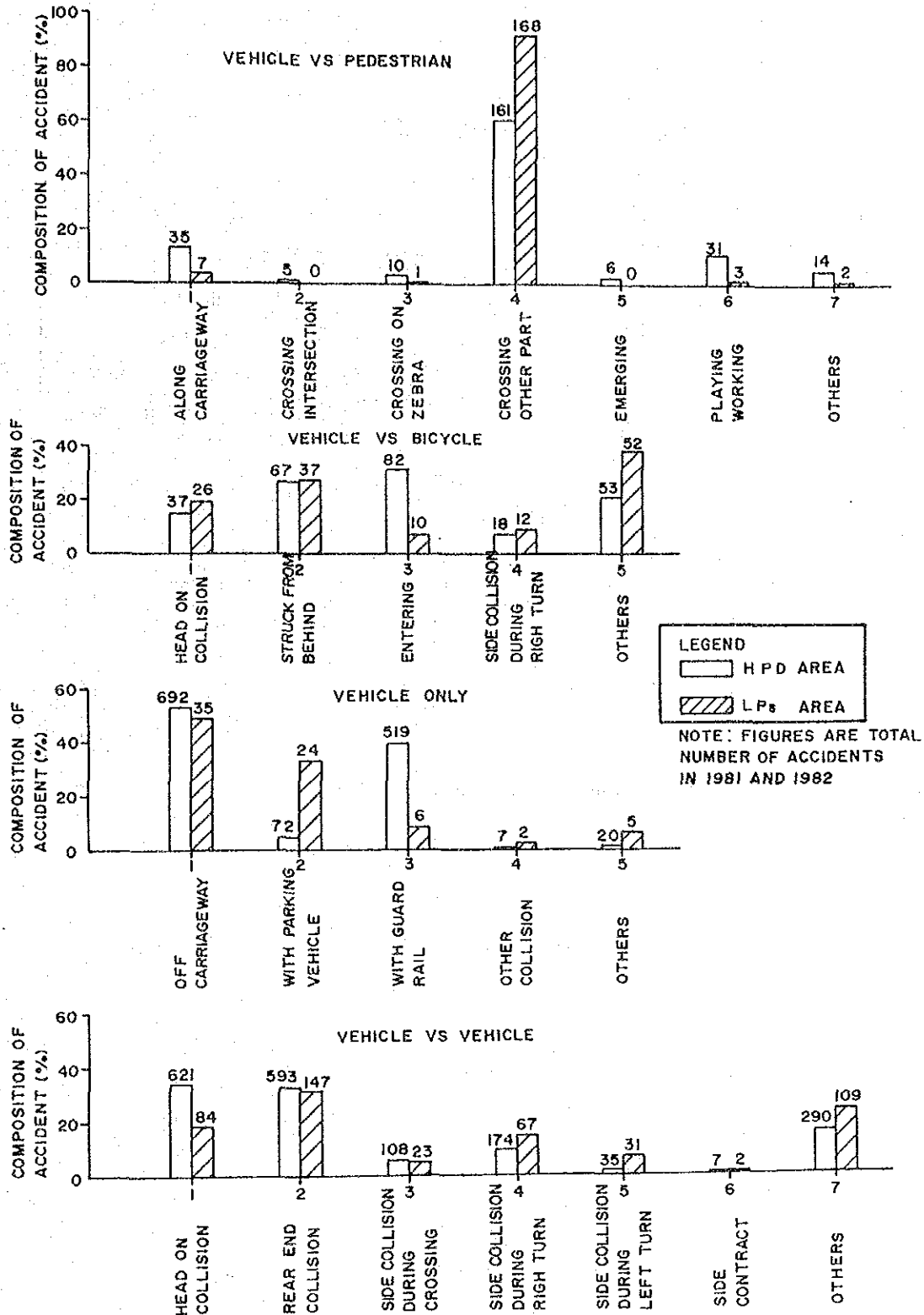


NOTE: FIGURES ARE TOTAL NUMBER OF ACCIDENT IN 1981 AND 1982

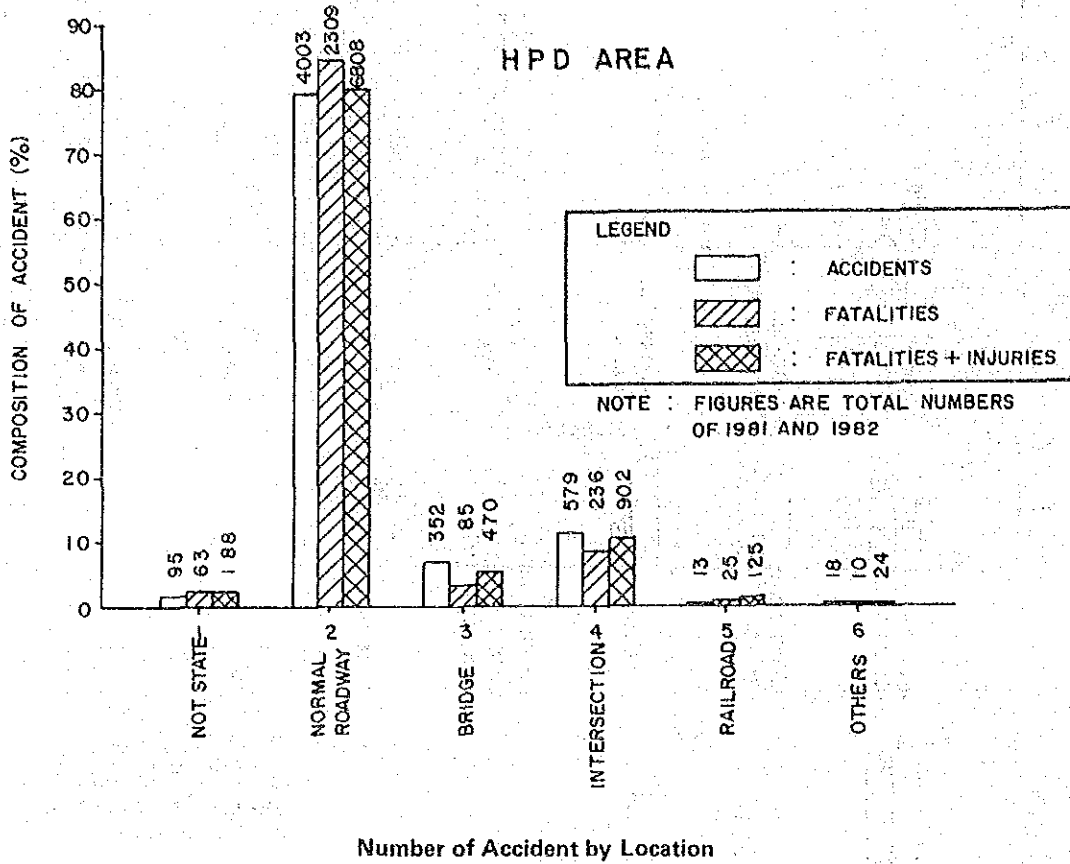
Number of Accidents by Type and Types of Highway

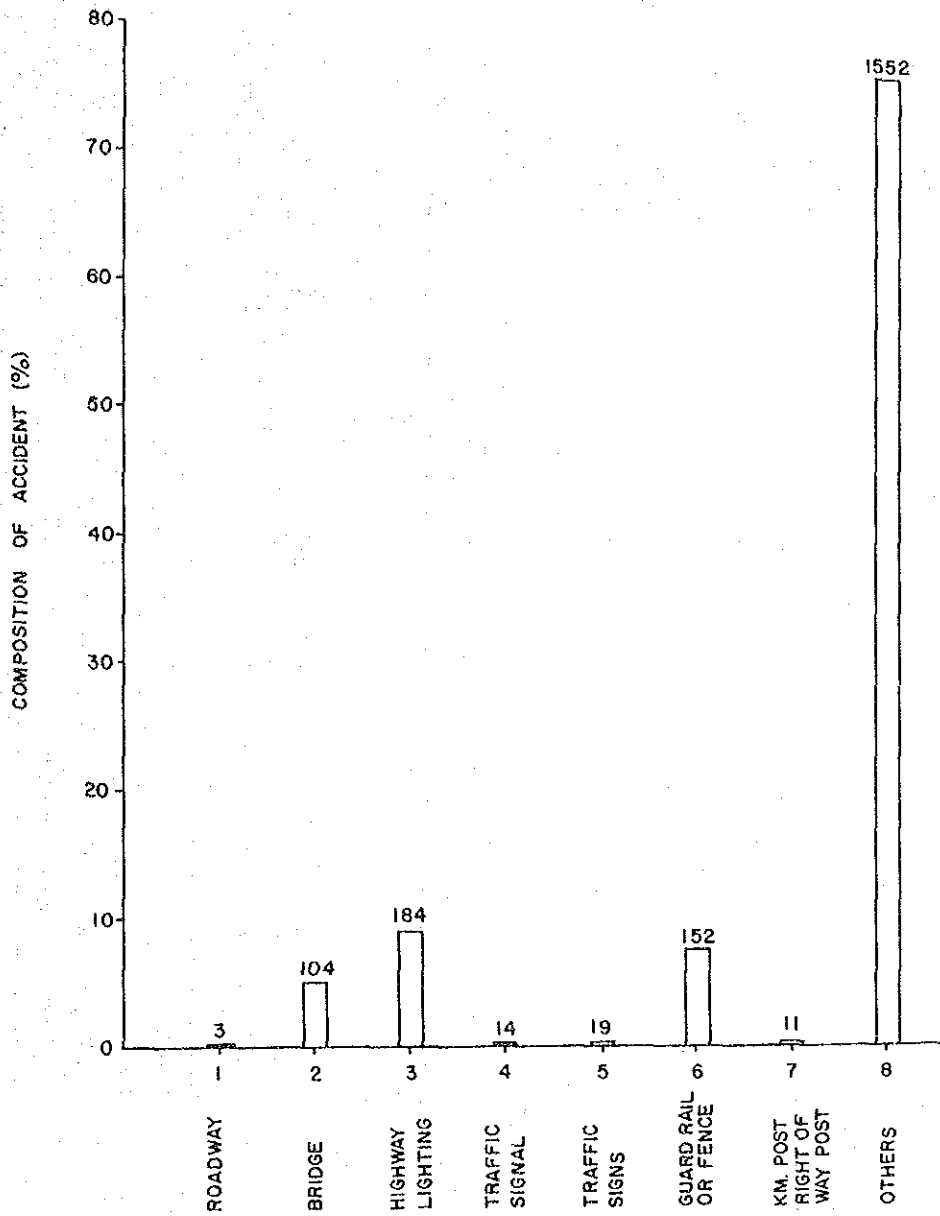


Number of Accidents by Collision Pattern and Location



Number of Accident by Collision Pattern

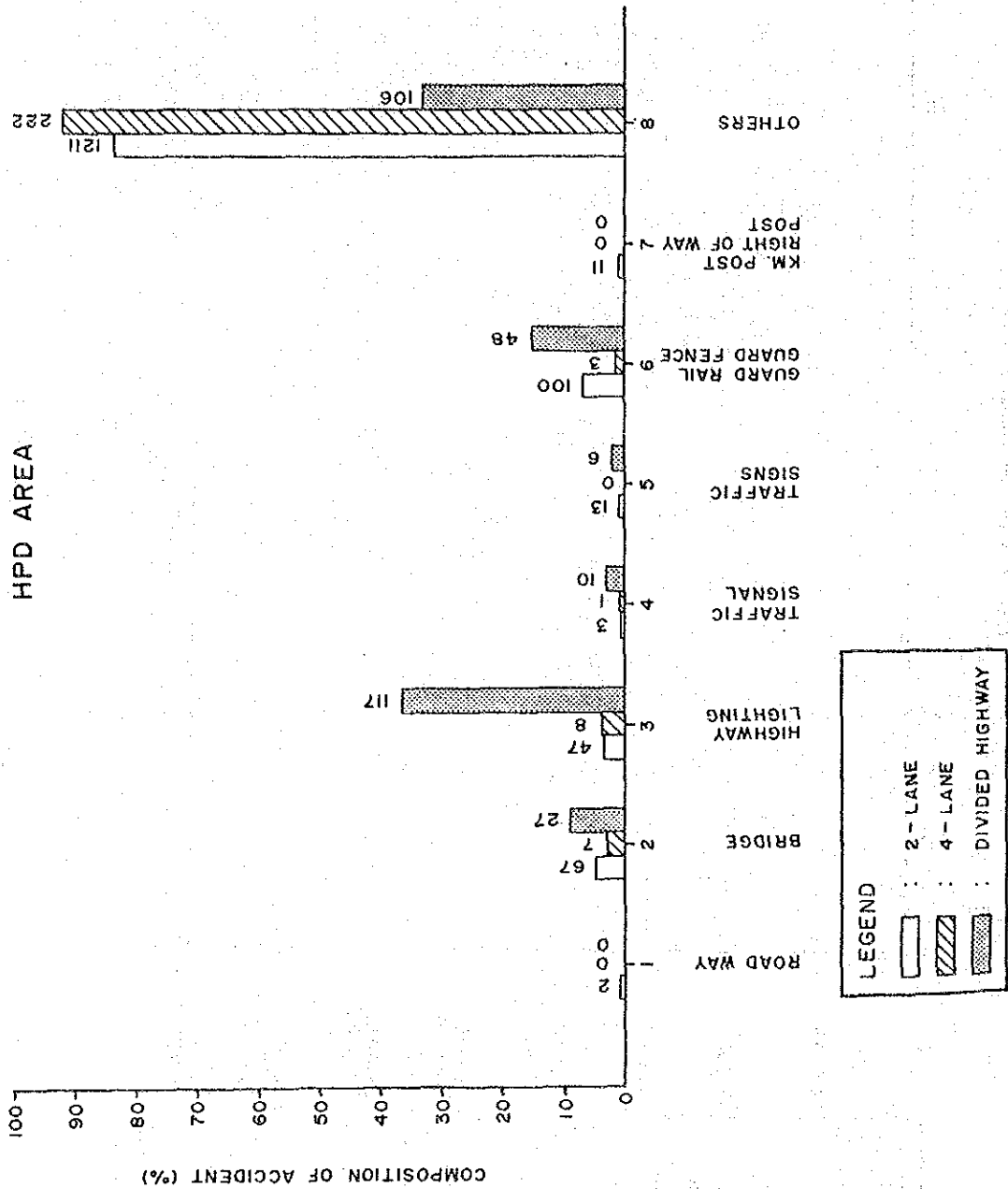




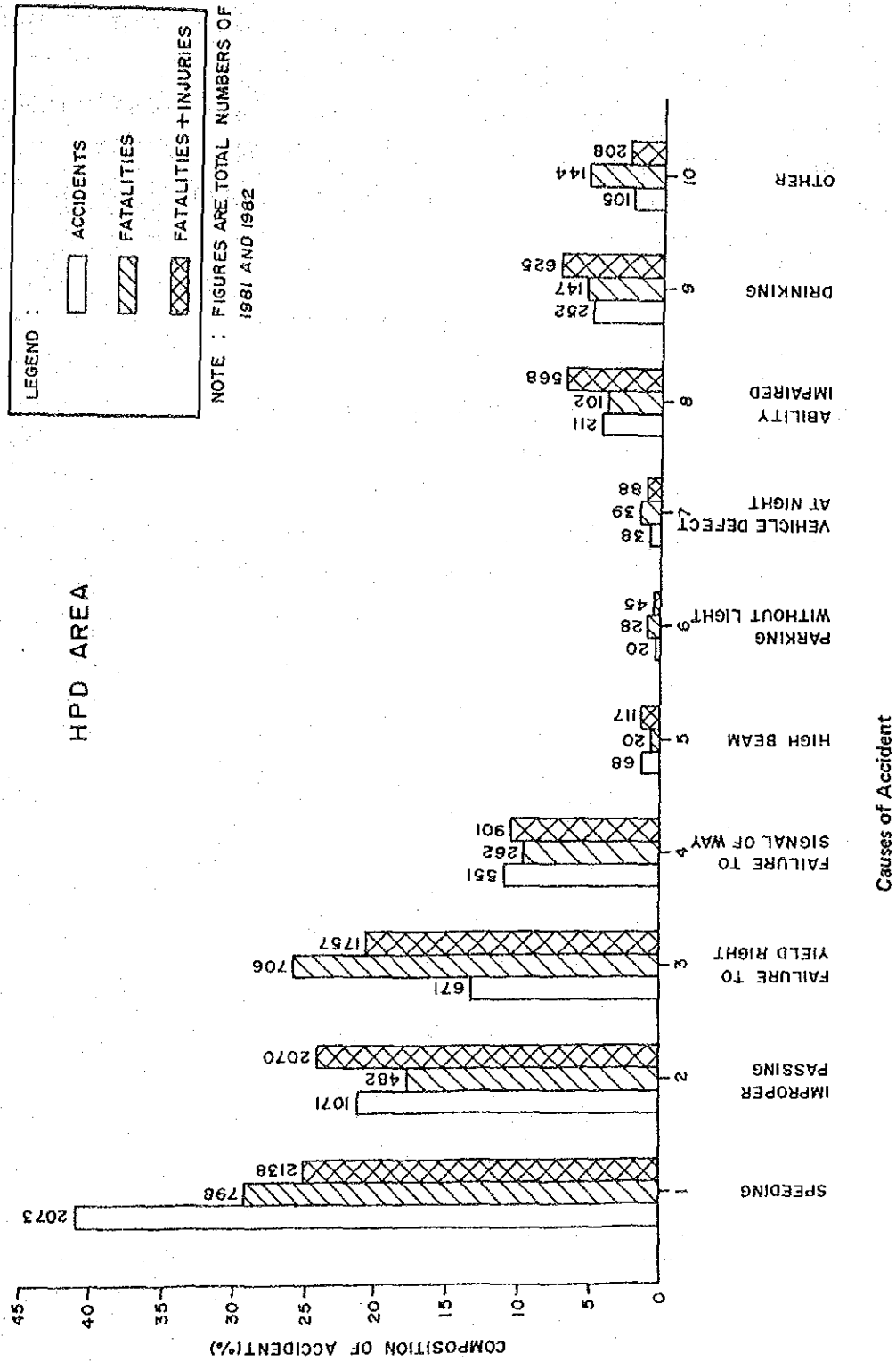
LEGEND
 [] : HPD AREA

NOTE : FIGURES ARE TOTAL NUMBER OF ACCIDENT IN 1981 AND 1982

Number of Accident by DOH Property



Number of Accident by Property Damage and Types of Highway



Questionnaire to DOH engineer

All district offices (73) of DOH have been requested to fill in the following questionnaires (I and II) which were prepared to obtain the firsthand information on traffic safety from the engineers who are acquainted with roads conditions through their day-to-day maintenance and administration, as well as through contacts with the people in the communities in the vicinity of roads.

The items in the questionnaire cover mainly two subjects.

Roadway ... hazardous locations and their road conditions
proposed countermeasures at the locations

Major intersection

... shape and degree of hazards
proposed countermeasures

(I) Survey on Hazardous Road Sections

This survey is to list up road sections which have been found hazardous by the concerned district engineers. In this survey, the road sections are road segments between intersections (the definition of intersection in the Intersection Survey, is applied to this survey).

(1) Data No.

To give numbers in numerical order (1, 2,).

(2) Route No.

Route No. of the hazardous section. (Ex. 302)

(3) Location

The location of the hazardous section shall be indicated by Kilopost on DOH road (Ex. 30+000~32+210).

(4) Degree of Hazard

To put a circle (0) in an appropriate column. The degree of hazard shall be subjectively decided by the concerned district engineers.

(5) Number of Lane

To mark a circle (0) in an appropriate column. When the number of lane changes in the section, mark a circle (0) in the column corresponding to the representative lane-number over the section.

(6) Alignment

To put a circle (0) in an appropriate column.

Good : constructed to standard.

Poor : other than good.

(7) Abutting Land Use

To put a circle (0) in an appropriate column.

(8) Remark

If possible, to propose traffic safety plan(s) to remedy the existing deficiency(ies).

(II) Intersection Survey

The intersections (inclusive of junctions) to be surveyed are those of which all legs have more than two (paved) lanes of carriageways (or more than 6 m wide paved-road).

(1) Data No.

To give numbers in numerical order (1, 2,).

(2) Road Type

DOH v.s. DOH : The intersection composed of two DOH roads.

DOH v.s. Other : The intersection composed of DOH road and other road.

To write route number of DOH roads in an appropriate column, no indication for roads other than DOH roads.

(3) Location

To write control section number of DOH road. When more than two DOH roads meet at the intersection, the control section on low-numbered DOH road.

The location of the intersection shall be indicated by Kilometer-post on DOH road. (Ex.52+060). When two DOH roads intersect, the kilometer-post on DOH road with low-numbered Route.

(4) Shape

The layout of the intersection shall be marked with a sign as defined as follows;

(+) : Cross-intersection

(0) : Roundabout

(T) : T-intersection

(Y) : Y-Junction

(5) No. of Lane

The number of lanes of carriageways which compose the intersection. When two DOH roads cross, the lane-number of low-numbered Route road shall be put in the "DOH Road" column.

(6) Existing Safety Treatment

To put a circle (0) in the appropriate column.

(7) Degree of Hazard

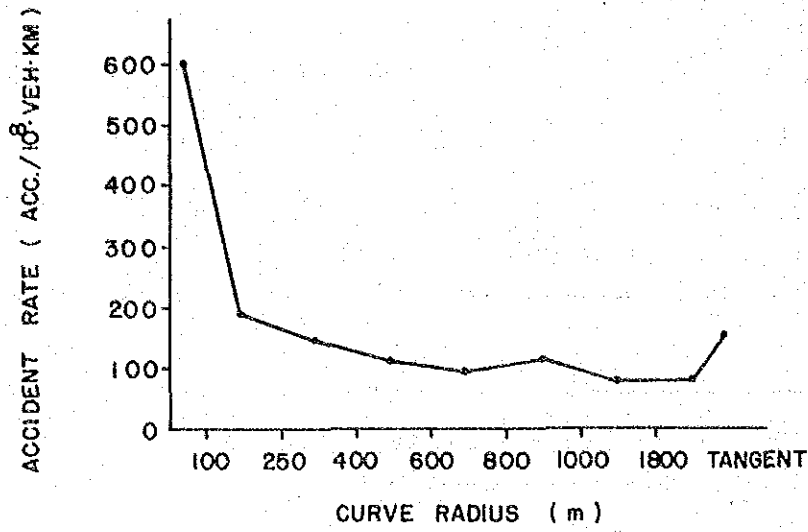
Based on an assessment by the concerned district engineers, to put a circle in the corresponding column.

(8) Remark

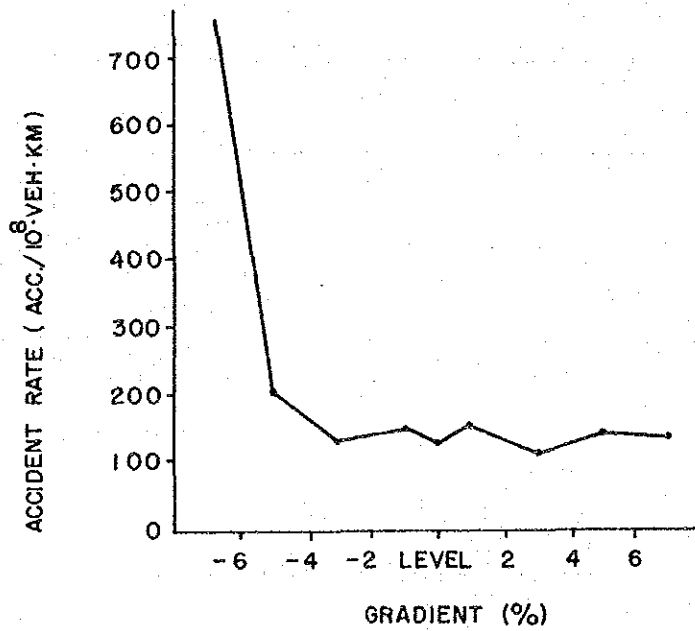
In case of a hazardous intersection, to propose desirable countermeasure(s) to remedy the intersection in terms of traffic safety, if possible.

Intersection Survey

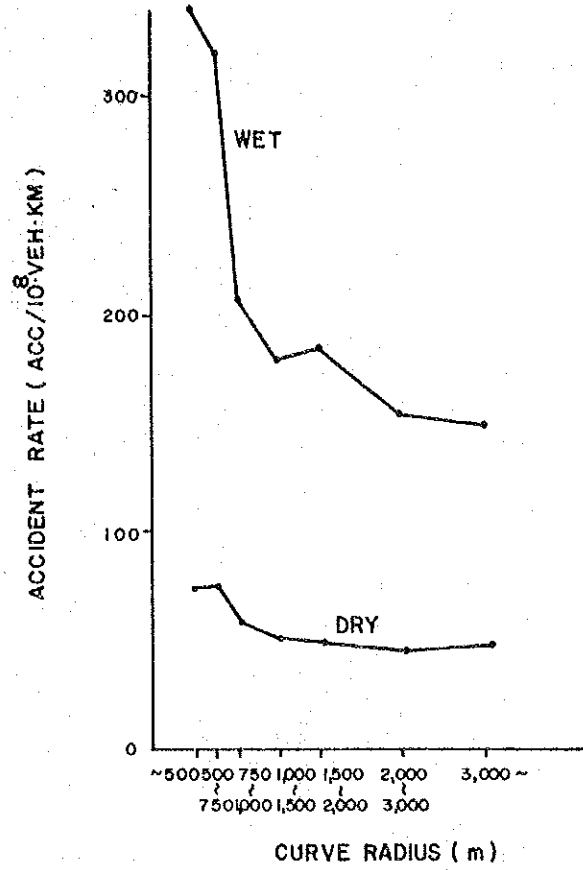
(1) Data No.	(2) Road Type		(3) Location		(4) Shape (+, O, T, Y)	(5) No. of Lane		(6) Existing Safety Treatment				(7) Degree of Hazard			(8) Remark (proposal of safety treatment)
	DOII	v.s. DOII	Control Section	Kilometer Post		DOII	Other Road	Traffic Signal	Channelization	Lighting	None	Very High	High	Other	



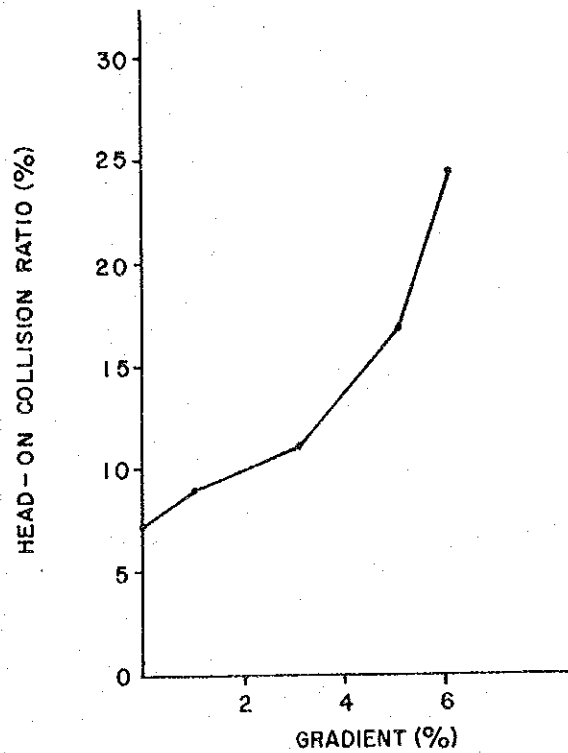
RELATION BETWEEN CURVE RADIUS AND ACCIDENT
(ORDINARY ROAD, JAPAN)



RELATION BETWEEN GRADIENT AND ACCIDENT
(ORDINARY ROAD, JAPAN)



RELATION BETWEEN CURVE RADIUS AND ACCIDENT
(TOMEI EXPRESSWAY, JAPAN)



RELATION BETWEEN GRADIENT AND HEAD-ON COLLISION RATIO
(ORDINARY ROAD, JAPAN)

Existing Condition of Safety Planning Section (I)

Section No.	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10
Location (Kilo Post)	Route 1 19+000-22+000	Route 1 29+500-32+500	Route 1 47+500-51+000	Route 32 52+500-69+500	Route 304 64+500-67+000	Route 323 79+500-80+000	Route 302 1+000-4+000	Route 306 1+200-2+000	Route 306 2+700-3+100	Route 306 13+000-15+000
Length (Km)	3.0	3.0	3.5	17.0	2.5	0.5	3.0	0.8	0.4	2.0
Land Use	Commercial Area	Residential Area	Agricultural Area	Agricultural Area	Residential Area	Residential Area	Commercial Area	Residential Area	Residential Area	Government Institution Utility Facility
Kind of Road Section	Uninterrupted Section	Uninterrupted Section	Uninterrupted Section	Uninterrupted Section	Uninterrupted Section	Channelized Intersection (Right and Left Turning Lane)	Uninterrupted Section	Signalized Intersection	Uninterrupted Section	Uninterrupted Section
Lane	4 Lanes	4 Lanes	4 Lanes	2 Lanes	2 Lanes	4 Lanes	4 Lanes	2 Lanes	4 Lanes	2 Lanes
Division	Mounted up Median	Depressed Median	Mounted up Median	Undivided Road	Undivided Road	Mounted up Median	Undivided Road	Undivided Road	Undivided Road	Undivided Road
Horizontal Alignment	Straight	Straight	Straight	Straight	Straight	Straight	Straight	Straight	SUB-Standard Curve	Straight
Vertical Alignment	Level	Level	Level	Level	Standard Vertical Alignment	Level	Level	Level	Level	Level
Surface	Good (Concrete)	Poor (Asphalt Concrete)	Good (Asphalt Concrete)	Good (Asphalt Concrete)	Poor (Asphalt Concrete)	Good (Asphalt Concrete)	Good	Poor	Poor	Good
Shoulder	Turn-out Lane	Poor (Paved)	Good (Paved)	Good (Unpaved)	Poor (Unpaved)	Good (Paved)	Poor (Unpaved)	Poor (Unpaved)	Poor (Unpaved)	Poor (Unpaved)
Others										
Marking	Insufficient	Insufficient	Insufficient	Good	Insufficient	Good	Insufficient	Insufficient	Insufficient	Insufficient
Lighting	Good	Good	Good	None	Insufficient	Good	Good	- do -	- do -	Good
Sign	Insufficient	Insufficient	Insufficient	Good	Insufficient	Good	Insufficient	A Few	Outstanding Curve Warning Sign	A Few
Guard Rail	-	None	Median	None	Few feet of bridges	None	None	None	Outside	None
Side Walk	Both Side	None	None	Few	None	None	Partially	None	One Side	None
Pedestrian Crossing	A Few	Bridge (1)	None	None	Few	None	A Few	None (Erased)	None (Erased)	Some
Others			Median Open-ning for Un-turning	Bus Bay, Guide Post	Guide Post	Guide Post		Guide Post	Deliretor Road Stud	
Vehicle	Many Heavy Vehicle (245) Many Vehicle (19,000 Ve/day)	Many Heavy Vehicle (202) Many Vehicle (29,000 Ve/day)	Many Heavy Vehicle (230,000/day) Many Heavy Vehicle (40%) High Speed (45%)	Many Heavy Vehicle (40%) High Speed	Low Traffic 70,000 Ve/day	High Speed Turn Vehicle Many Heavy Vehicle (425)	Many Vehicle (17,000 Ve/day)			High Speed
Pedestrian	Many People	Many People	Few	Few	Few	Few	Many People			Many People Crossing
Others							Many Parking Vehicle			

Existing Condition of Safety Planning (II)

Section No.	S 11		S 12	S 13	S 14	S 15	S 16	S 17
	Route 336 (Sol 37) 2+000-5+000	Route 336 (Sol 37) 4+050-4+230						
Location (Kilo Post)	Route 336 (Sol 37) 2+800-3+000	Route 336 (Sol 37) 4+050-4+230	Route 3113 1+800-2+800	Route 11 97+300-97+800	Route 1141 1+000-1+800	Route 2 253+750-254+250	Route 2 254+500-255+000	Route 205 1+300-1+700
Length (Km)	4.0	0.2	1.0	0.5	0.8	0.5	0.5	0.4
Land Use	Commercial Area	Commercial Area	Industrial Area	Residential Area	Agricultural Area	Residential Area	Commercial Area	Agricultural Area
Kind of Road	Uninterrupted Section	Intersection	Uninterrupted Section	Signalized Intersection	Channelized Intersection	Channelized Intersection	Intersection	Uninterrupted Section
Lane	4 Lanes	4 Lanes	4 Lanes	4 Lanes	2 Lanes	2 Lanes	2 Lanes	2 Lanes → 4 Lanes
Division	Mounted up Median	Mounted up Median	Median (Transverse Grooved Concrete)	Undivided Road	Undivided Road	Divided Road	Divided Road	Undivided Road
Horizontal Alignment	Straight	Straight	Straight	Straight	Straight	Straight	Straight	Straight
Vertical Alignment	Level	Level	Level	Level	Level	Level	Level	Level
Surface	Good(Concrete)	Good(Concrete)	Good	Good(Concrete)	Good	Good(Asphalt)	Good(Asphalt)	Good(Asphalt Concrete)
Shoulder	Turn Out Lane	Turn Out Lane	Turn Out Lane	Turn Out Lane	Good (Unpaved)	Good (Unpaved)	Poor (Unpaved)	Poor (Unpaved)
Others								
Marking	Insufficient	Insufficient	Insufficient	Insufficient	Good(Partially erased)	Insufficient	Insufficient	Insufficient
Lighting	Good	Good	Insufficient	Good	Good	Good	Good	None
Sign	Insufficient	Insufficient	Insufficient	A Few	Good	Insufficient	Insufficient	A Few
Guard Rail	None	None	None	None	None	None	None	None
Side Walk	Both Side	Both Side	None	None	None	None	None	None
Pedestrian Crossing	Erased	Erased	A Few	A Few	None	None	Bridge (1)	None
Others	Bus Lane	Flashing Lamp Bus Lane	Bus Lane	Guide Post	Guide Post			
Vehicle	Many Vehicle (28,000ve/day)	Many Vehicle (28,000ve/day)	Many Vehicle (28,000ve/day)	Many Vehicle (28,000ve/day)	High Speed, Low Traffic Volume (3,300ve/day)	Many Samlor	Many Samlor	Low Traffic Volume(1,700 ve/day)
Pedestrian	Many People	Many People	Many People	A Few	A Few	Many People Crossing	Many People Crossing	A Few
Others								

Accident-Pattern Statistics for Safety Planning Section (I)

Section No.	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10
Location (Kilo Post)	Route 1 19-000-22+000	Route 1 29-500-32+500	Route 1 47-500-51+000	Route 32 52-500-62+500	Route 304 64+500-67+000	Route 323 79-500-80+000	Route 302 1+000-4+000	Route 306 1-200-2+000	Route 306 2+700-3+100	Route 306 12+000-15+000
10. Vehicle vs. Pedestrian	44 (30.1)	15 (8.5)	4 (2.0)	2 (2.5)	0 (0.0)	0 (0.0)	35 (13.8)	4 (11.8)	2 (50.0)	23 (67.7)
11. Hit pedestrian walking along carriageway	0	2	0	1	0	0	1	1	0	1
12. Hit pedestrian crossing carriageway at intersection	0	0	0	0	0	0	0	0	0	0
13. Hit pedestrian crossing carriageway at crosswalk	44	10	3	1	0	0	34	3	2	20
14. Hit pedestrian crossing carriageway other than crosswalk	0	0	0	0	0	0	0	0	0	0
15. Hit pedestrian emerging on Carriageway	0	4	1	0	0	0	0	0	0	1
16. Hit pedestrian playing on carriageway	0	0	0	0	0	0	0	0	0	1
17. Others	0	0	0	0	0	0	0	0	0	1
20. Vehicle vs. Bicycle	3 (2.1)	2 (1.1)	2 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.8)	1 (2.9)	0 (0.0)	1 (2.9)
21. Head on collision	1	0	0	0	0	0	0	0	0	0
22. Rear end collision	1	2	2	0	0	0	2	1	0	0
23. Side collision during crossing	1	0	0	0	0	0	0	0	0	1
24. Side collision during right turn	0	0	0	0	0	0	0	0	0	0
25. Side collision during left turn	0	0	0	0	0	0	0	0	0	0
26. Others	0	0	0	0	0	0	0	0	0	0
30. Vehicle only	4 (2.7)	35 (18.5)	63 (32.0)	11 (13.6)	0 (0.0)	1 (25.0)	15 (6.2)	9 (26.5)	0 (0.0)	1 (2.9)
31. Off carriageway	3	4	25	1	0	0	3	3	0	0
32. Collision with parked vehicle.	1	1	0	2	0	0	3	6	0	0
33. Collision with Guard rail	0	29	36	8	0	1	0	0	0	0
34. Collision with electric pole	0	0	0	0	0	0	0	0	0	0
35. Collision with other objects	0	0	0	0	0	0	0	0	0	1
36. Others	0	1	2	0	0	0	0	0	0	0
40. Vehicle vs. Vehicle	94 (64.4)	64 (38.9)	51 (25.9)	37 (45.7)	5 (83.9)	3 (75.5)	204 (79.1)	20 (58.8)	2 (50.0)	9 (26.5)
41. Head on collision	15	9	3	14	2	0	44	5	1	6
42. Rear end collision	29	32	35	16	2	0	77	4	1	0
43. Side collision during crossing	4	4	2	2	0	3	6	2	0	0
44. Side collision during right turn	10	16	8	8	0	0	21	3	0	1
45. Side collision during left turn	10	1	0	0	0	0	18	0	0	0
46. Side contact	3	0	0	0	0	0	1	0	0	0
47. Others	23	2	3	5	1	0	37	6	0	1
50. Unknown	1 (0.7)	72 (38.1)	77 (39.1)	31 (38.3)	1 (16.7)	0 (0.0)	1 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)
Total	146 (100)	189 (100)	197 (100)	81 (100)	6 (100)	4 (100)	258 (100)	34 (100)	4 (100)	34 (100)

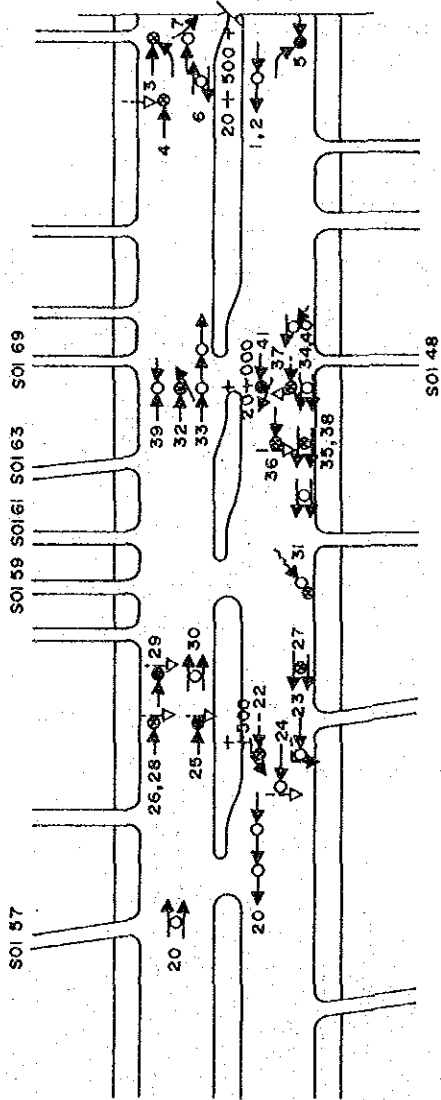
Note : () Composition

Accident-Pattern Statistics for Safety Planning Section (II)

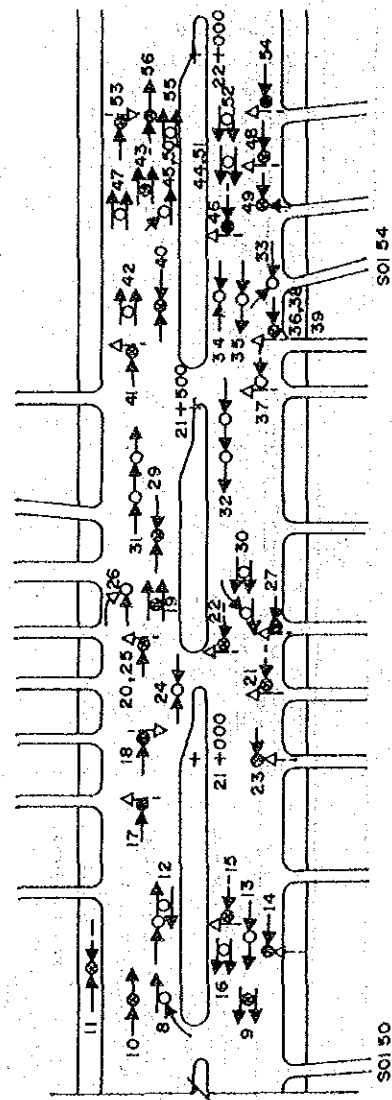
Section No.	S 11				S 12	S 13	S 14	S 15	S 16	S 17
	Route 336 2-000-5-000	Route 336 (Sot. 37) 2-800-3-000	Route 336 (Sot. 53) 4-050-4-250	Route 3113 1-800-2-800						
10. Vehicle vs. Pedestrian	53 (21.7)	8 (27.6)	11 (18.0)	15 (57.7)	1 (6.7)	1 (11.1)	2 (15.4)	1 (100)	0 (0.0)	0 (0.0)
11. Hit pedestrian walking along carriageway	1	0	1	0	0	0	0	0	0	0
12. Hit pedestrian crossing carriageway at intersection	0	0	0	0	0	0	0	0	0	0
13. Hit pedestrian crossing carriage at crosswalk	0	0	0	0	0	0	0	0	0	0
14. Hit pedestrian crossing carriageway other than crosswalk	52	8	10	15	1	1	2	1	0	0
15. Hit pedestrian emerging on the carriageway	0	0	0	0	0	0	0	0	0	0
16. Hit pedestrian playing on carriageway	0	0	0	0	0	0	0	0	0	0
17. Others	0	0	0	0	0	0	0	0	0	0
20. Vehicle vs. Bicycle	6 (2.5)	1 (3.4)	3 (4.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (20.0)	1 (33.3)	0 (0.0)
21. Head on collision	0	0	0	0	0	0	0	0	0	0
22. Rear end collision	0	0	0	0	0	0	0	0	0	0
23. Side collision during crossing	0	0	0	0	0	0	0	0	0	0
24. Side collision during right turn	0	0	0	0	0	0	0	0	0	0
25. Side collision during left turn	0	0	0	0	0	0	0	0	0	0
26. Others	6	1	3	0	0	0	0	2	1	0
30. Vehicle only	15 (6.1)	5 (17.2)	4 (6.6)	1 (3.8)	1 (6.7)	0 (0.0)	2 (15.4)	1 (10.0)	0 (0.0)	0 (0.0)
31. Off carriageway	5	2	2	0	1	0	0	0	0	0
32. Collision with parked vehicle	7	3	1	1	0	0	1	1	0	0
33. Collision with guard rail	3	0	1	0	0	0	1	0	0	0
34. Collision with electric pole	0	0	0	0	0	0	0	0	0	0
35. Collision with other objects	0	0	0	0	0	0	0	0	0	0
36. Others	0	0	0	0	0	0	0	0	0	0
40. Vehicle vs. Vehicle	169 (69.3)	14 (48.3)	42 (70.5)	7 (26.9)	13 (86.7)	8 (88.9)	9 (69.2)	6 (60.0)	2 (66.7)	0 (0.0)
41. Head on collision	4	0	0	2	1	1	1	1	1	0
42. Rear end collision	63	4	25	3	7	3	4	2	0	0
43. Side collision during crossing	14	3	3	0	4	3	1	0	0	0
44. Side collision during right turn	37	3	3	0	1	1	1	0	0	0
45. Side collision during left turn	6	1	1	0	0	0	1	1	0	0
46. Side contact	1	0	0	0	0	0	0	1	1	0
47. Others	44	3	11	2	0	0	1	1	0	0
50. Unknown	1 (0.4)	1 (3.4)	0 (0.0)	3 (11.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	244 (100)	29 (100)	61 (100)	26 (100)	15 (100)	9 (100)	13 (100)	10 (100)	3 (100)	0 (0.0)

Note : () Composition

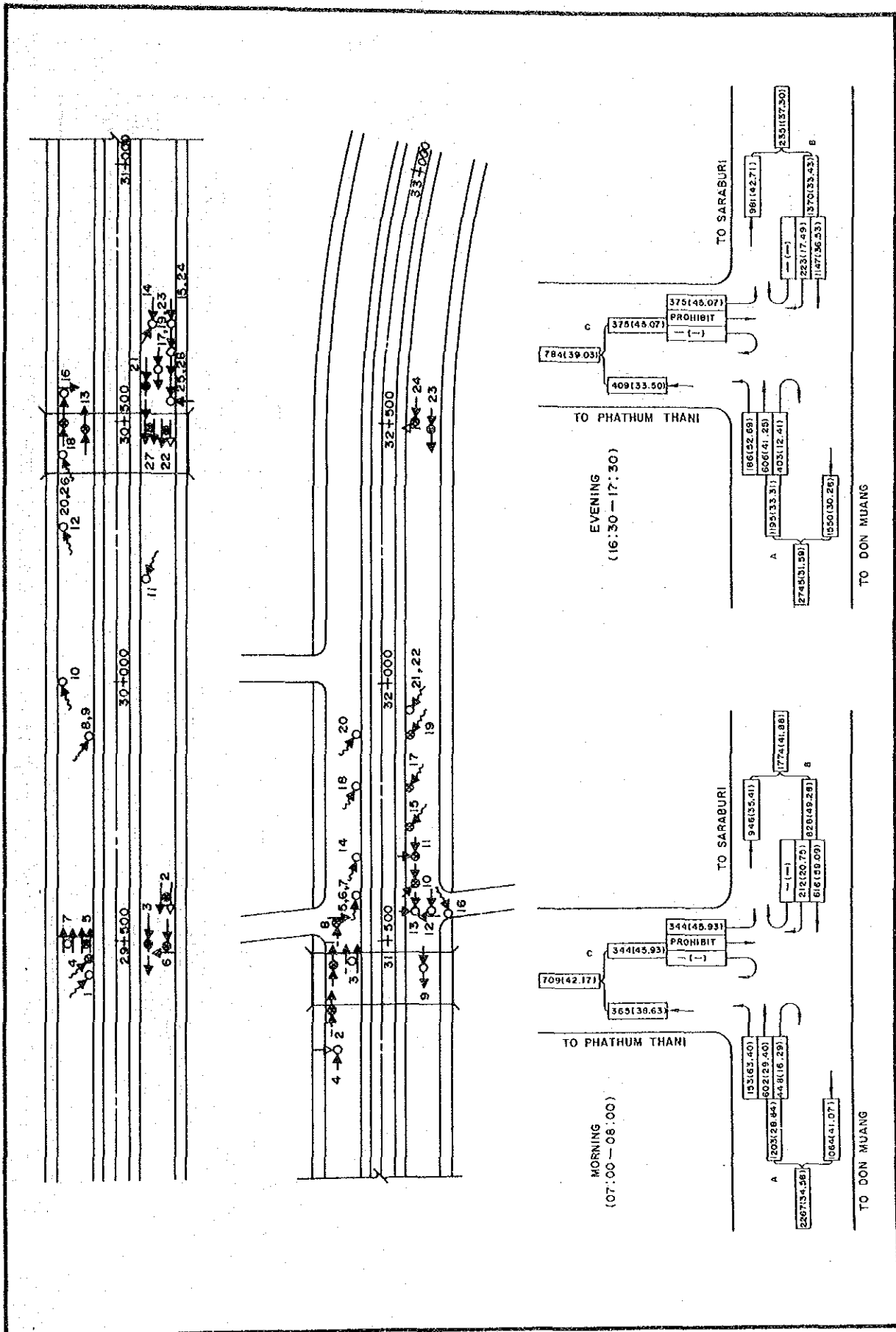
10



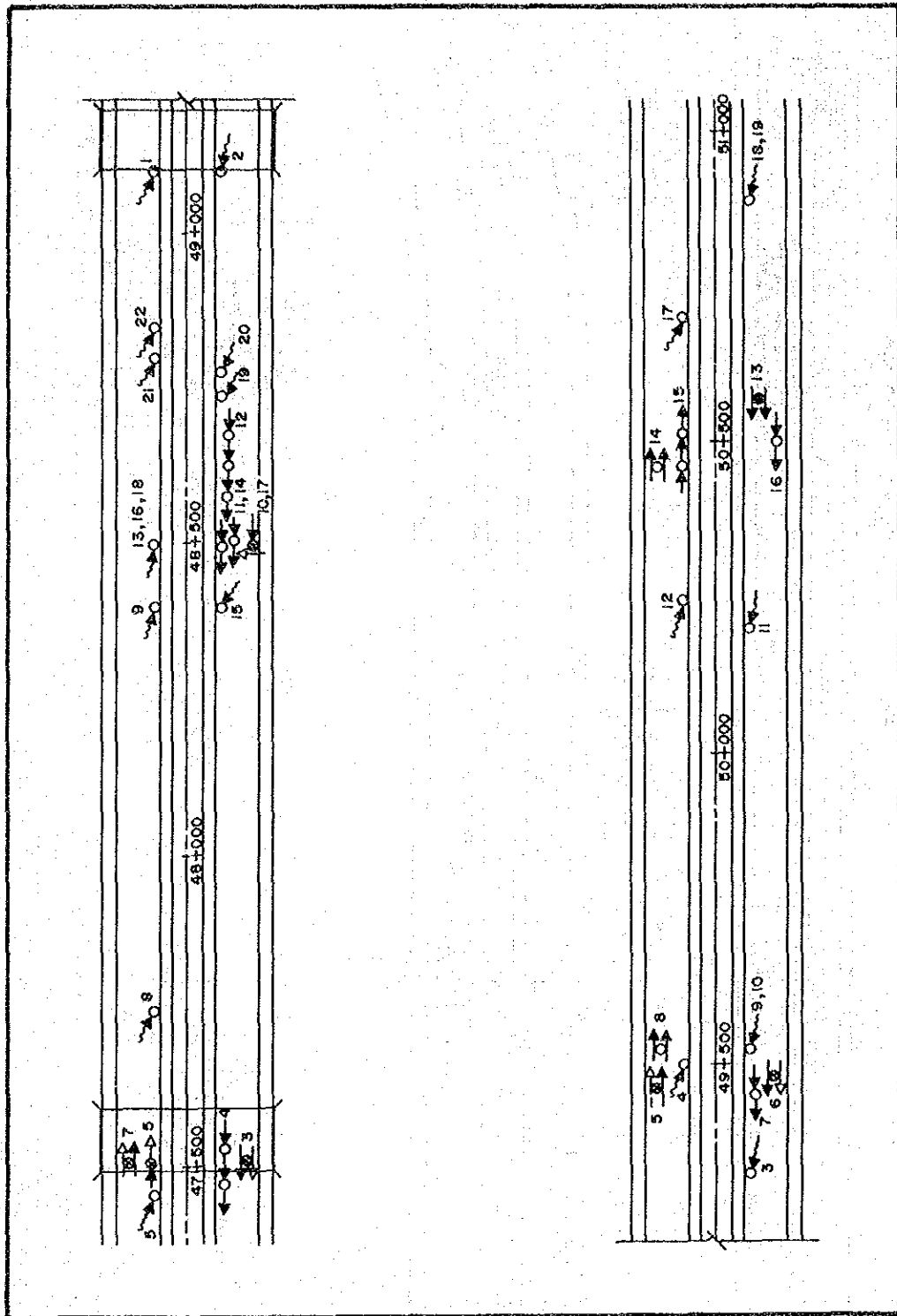
LEGEND	
←	VEHICLE EXCLUDING MOTORCYCLE
←	MOTORCYCLE
←	BICYCLE
←	PEDESTRIAN
←	TRAIN
←	PARKING OR STOPPING VEHICLE
●	ACCIDENT WITH FATALITY
⊗	ACCIDENT WITH INJURY
○	ACCIDENT WITH PROPERTY DAMAGES ONLY
←	LOSING CONTROL
←	OVERTURNING



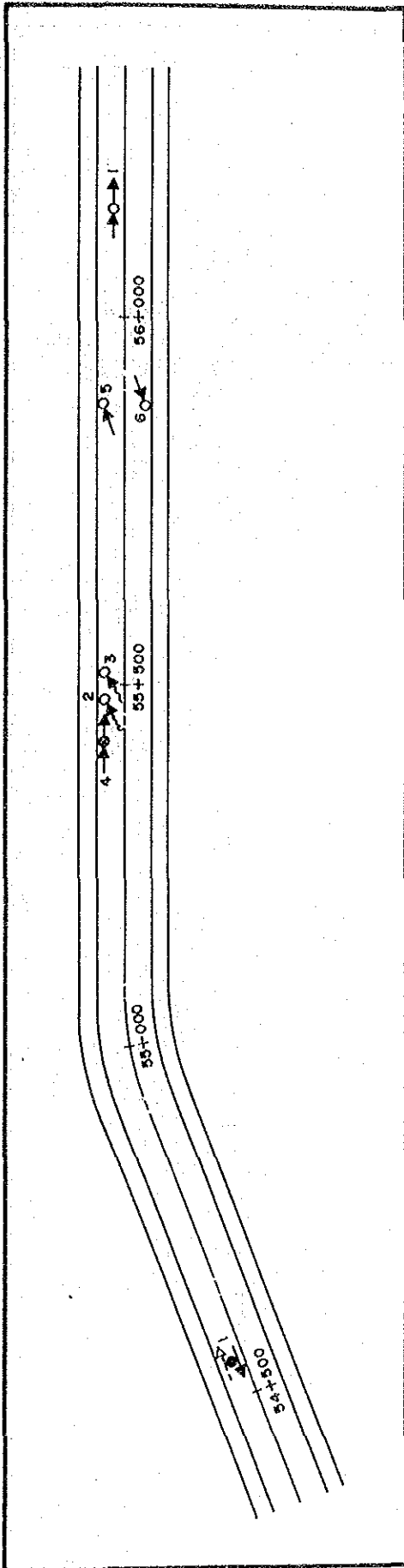
Collision Diagram ((1982) for Section 1 (Route 1, 19+00-22+00)



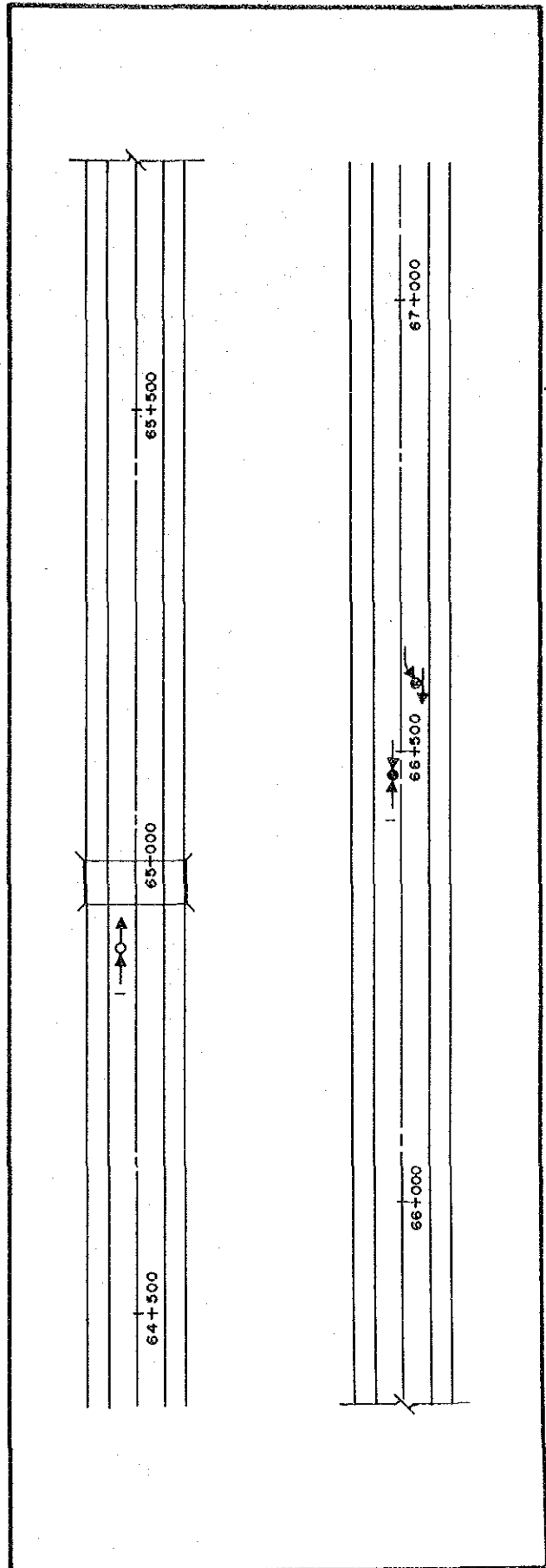
Collision Diagram (1982) and Turning Movement (Peak Hour) for Section 2 (Route 1, 29+500-32+500)



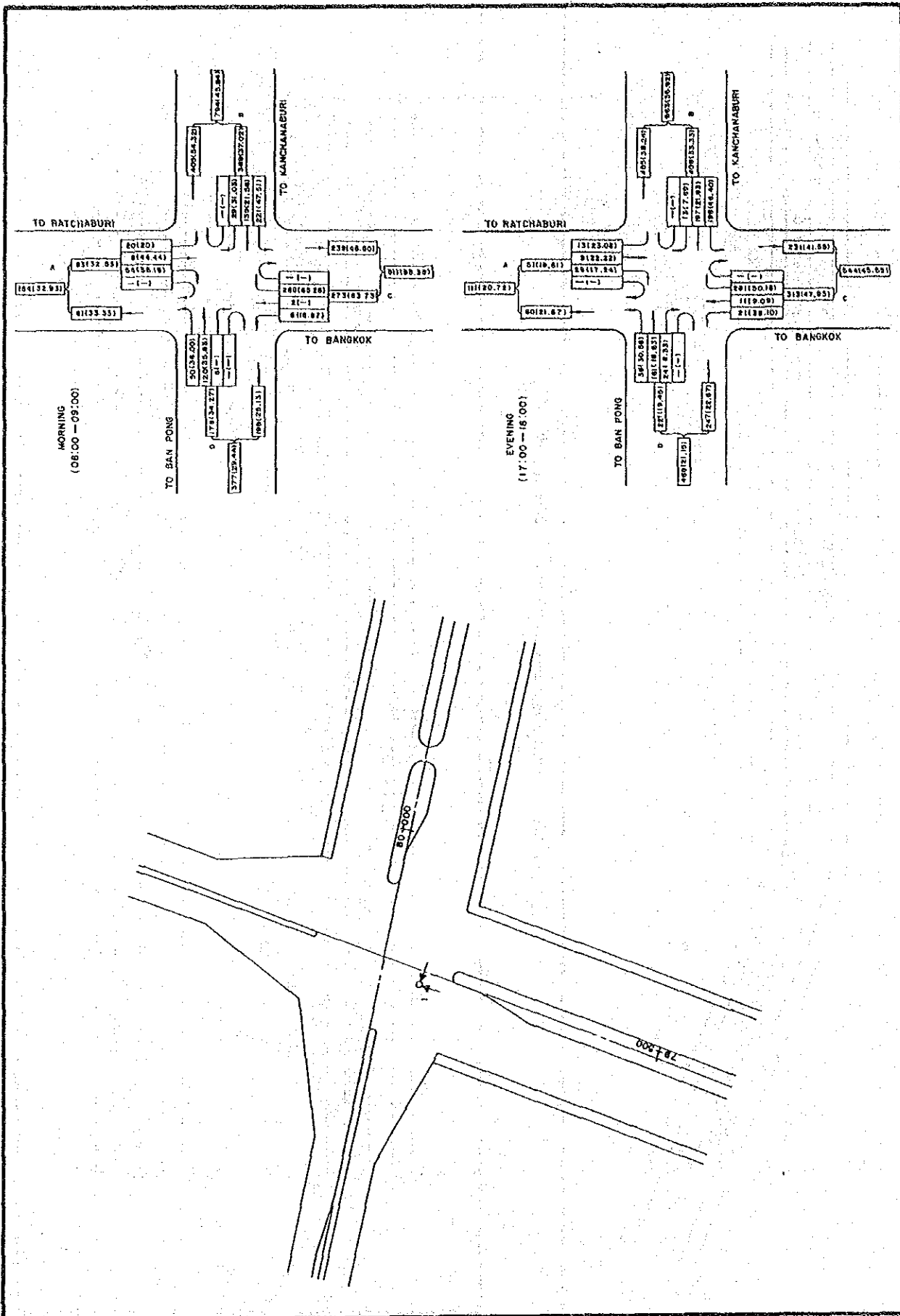
Collision Diagram (1982) for Section 3 (Route 1, 47+500-51+000)



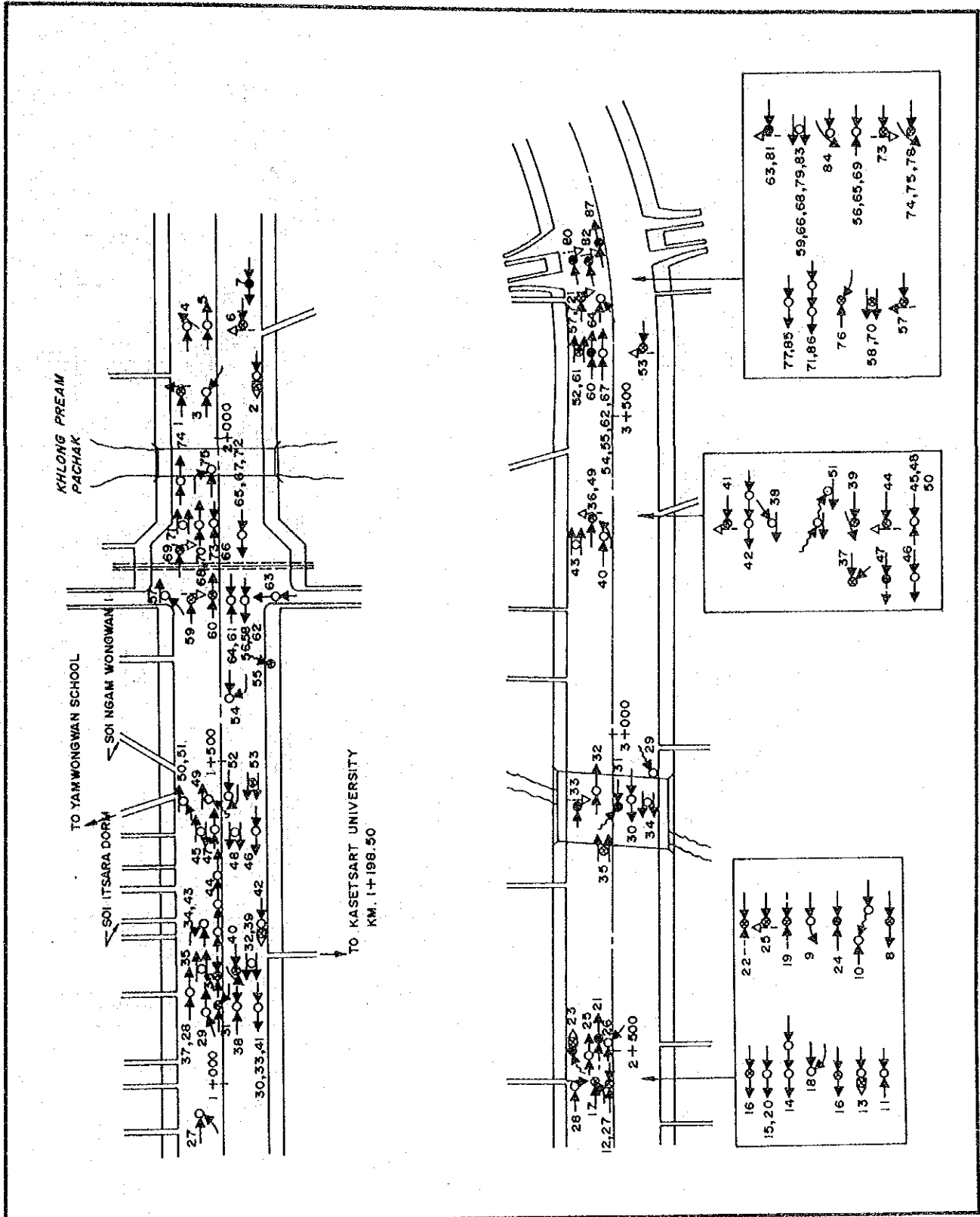
Collision Diagram (1982) for Section 4 (Route 32, 52+500-69+500)



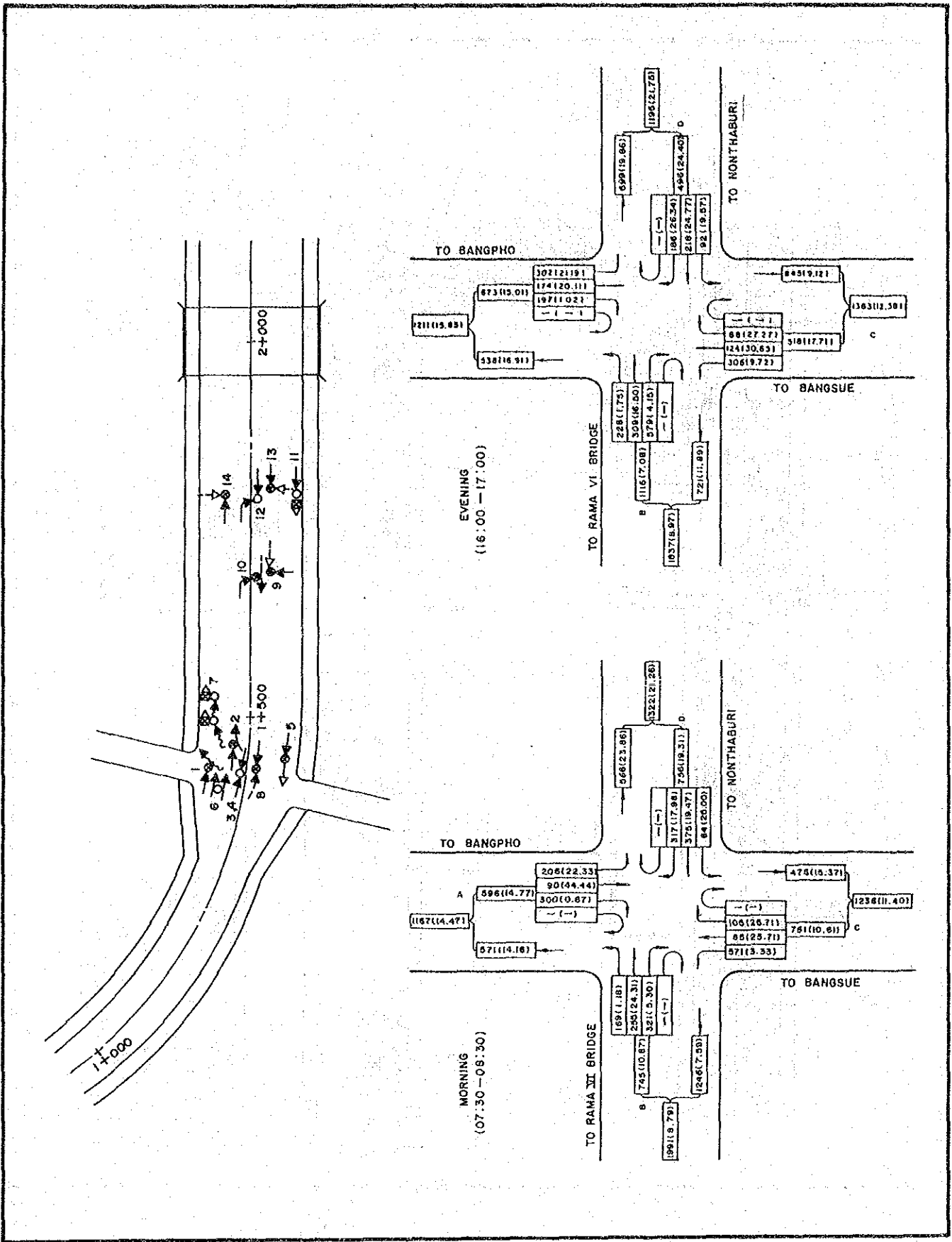
Collision Diagram (1982) for Section 5 (Route 304, 64+500-67+000)



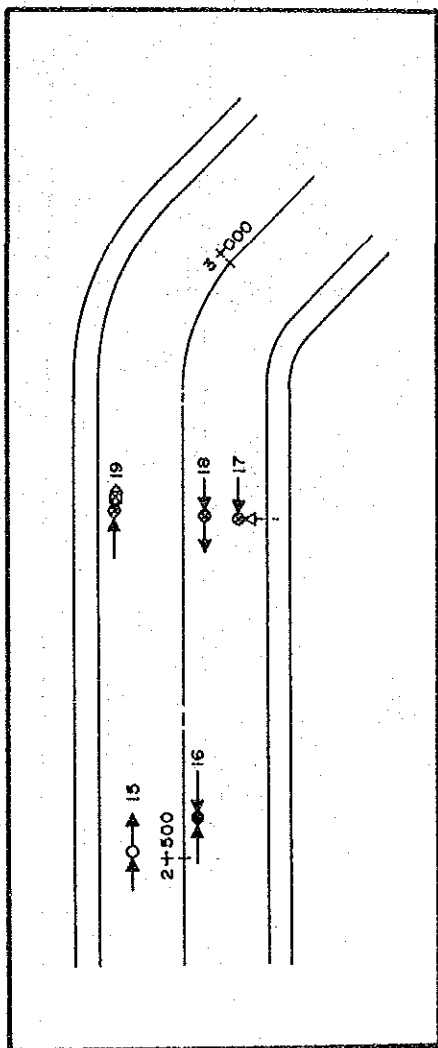
Collision Diagram (1982) and Turning Movement (Peak Hour) for Section 6 (Route 323, 79+500-80+000)



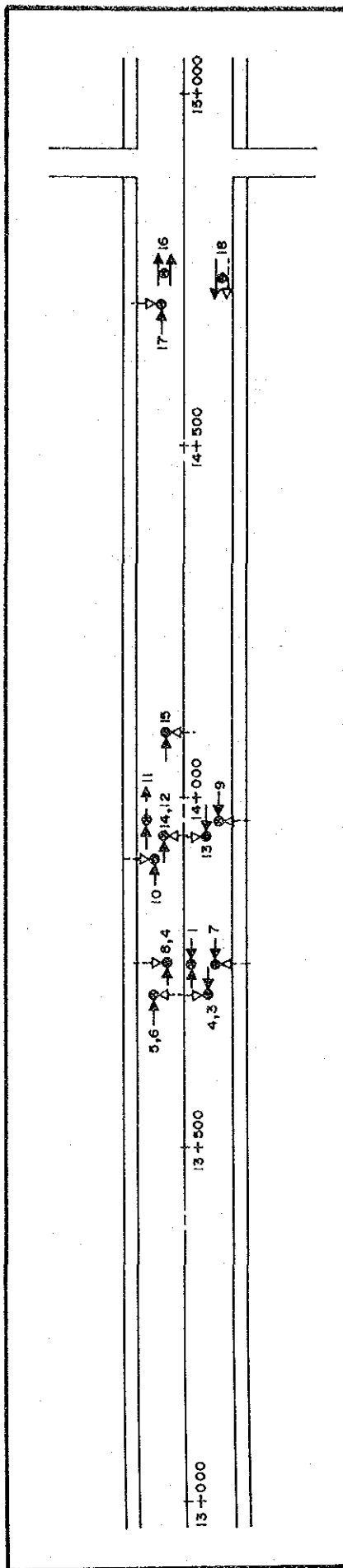
Collision Diagram (1982) for Section 7 (Route 302, 1+000-4+000)



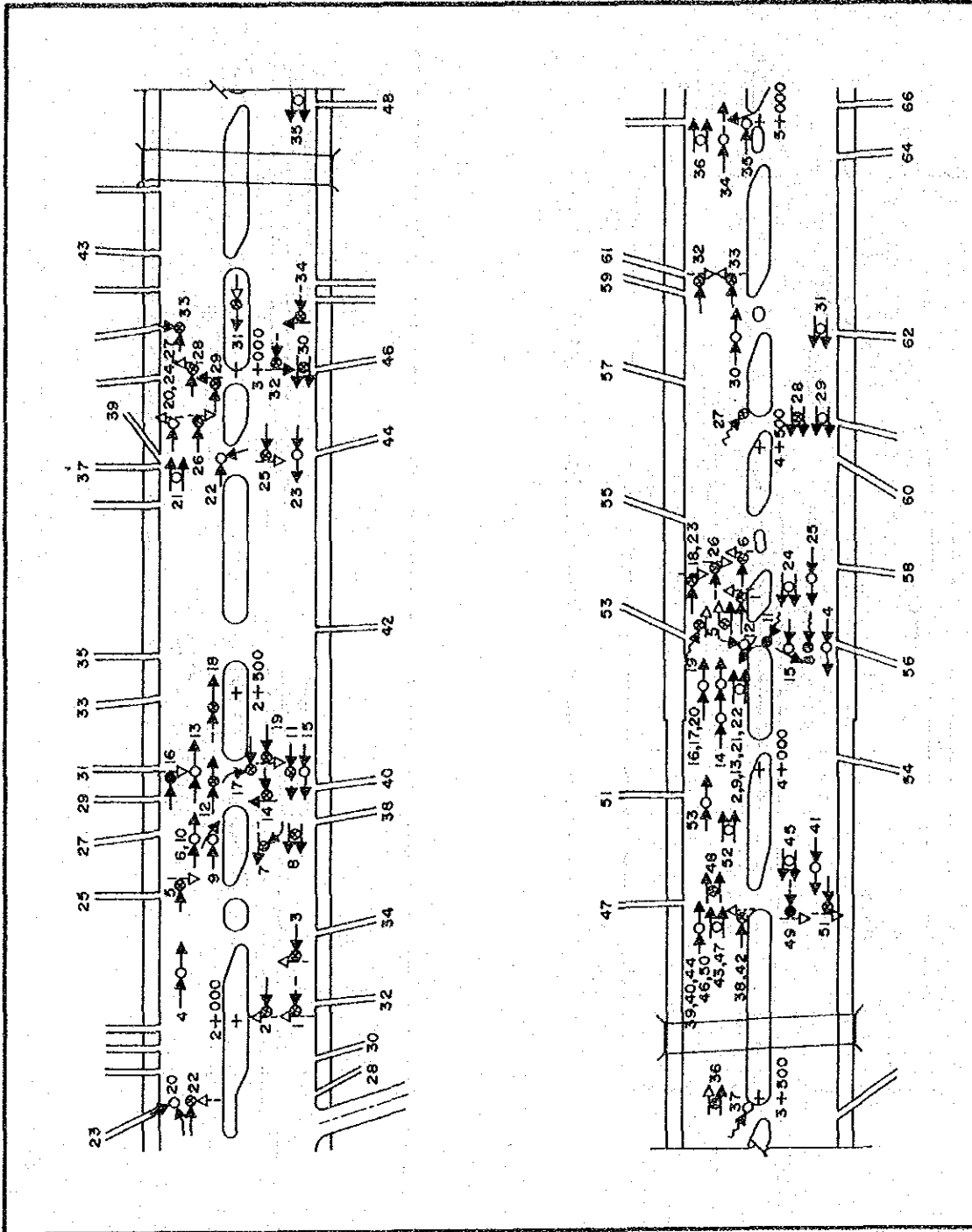
Collision Diagram (1982) and Turning Movement (Peak Hour) for Section 8 (Routes 306, 1+200-2+000)



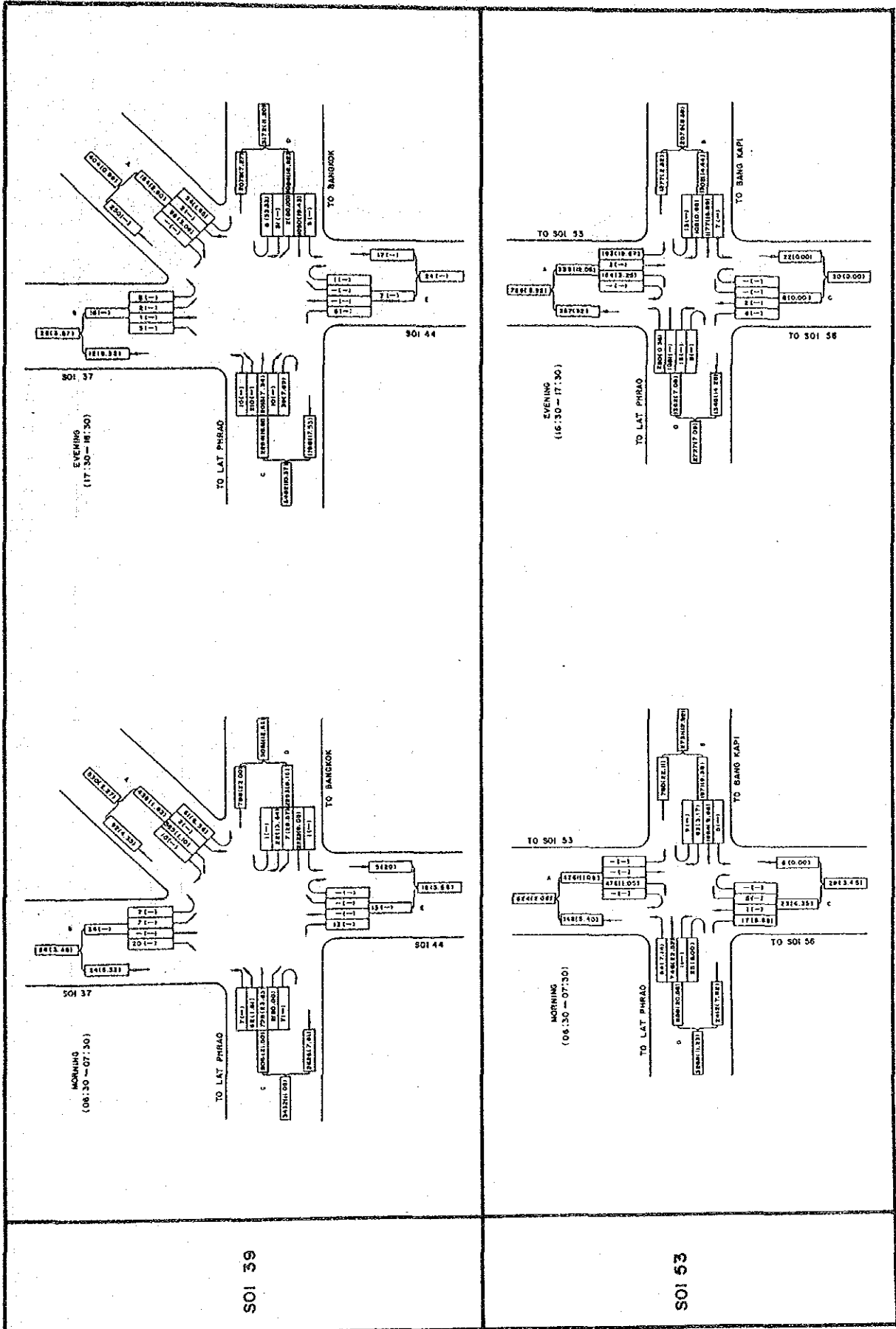
Collision Diagram (1982) for Section 9 (Route 306 2+700-3+100)



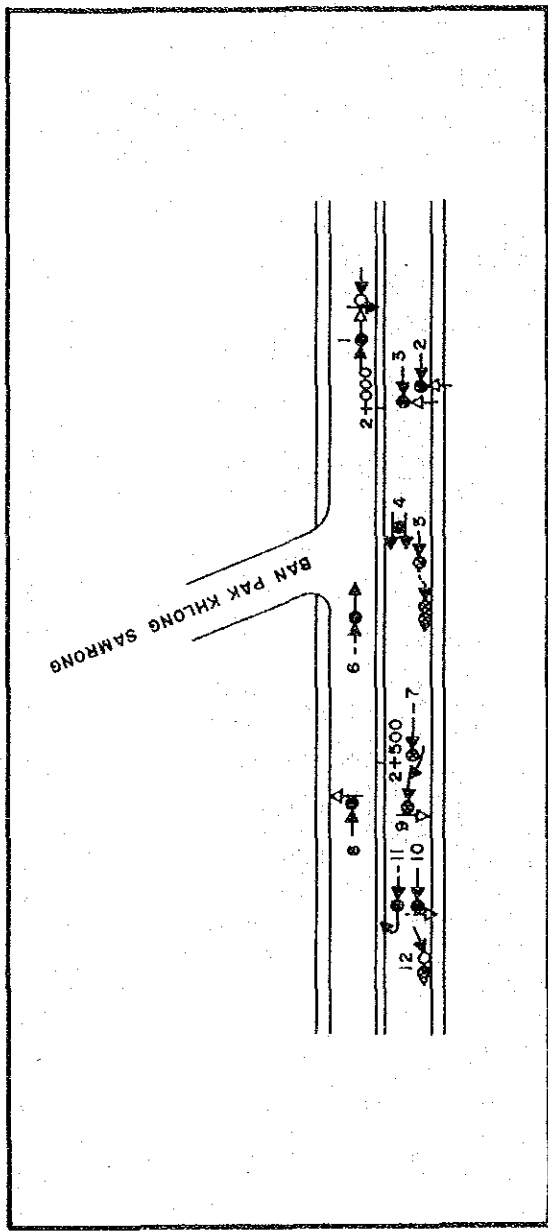
Collision Diagram (1982) for Section 10 (Route 306, 13+000-15+000)



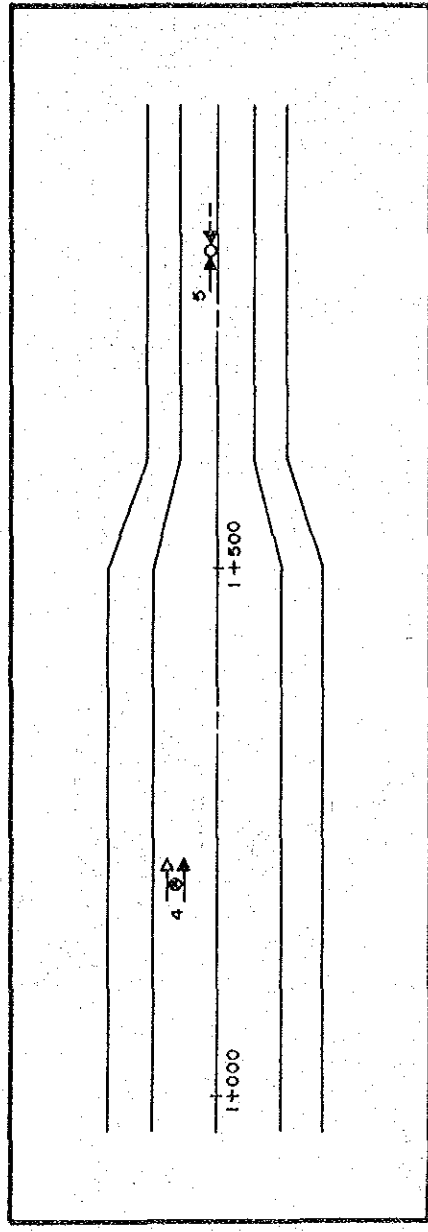
Collision Diagram (1982) for Section 11 (Route 11, 2+000-5+000)



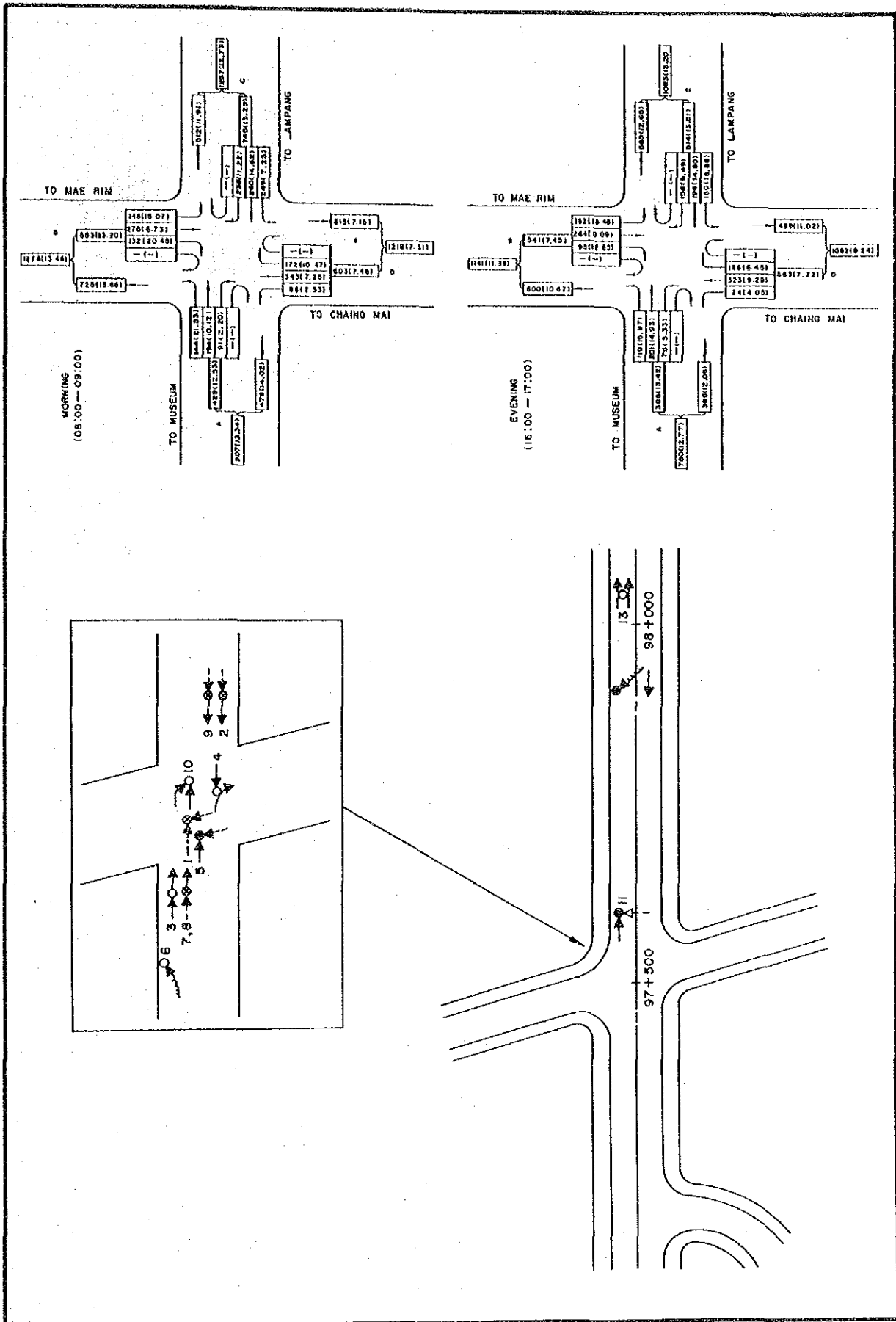
Turning Movement for Section 11 (Soi 39 and Soi 53)



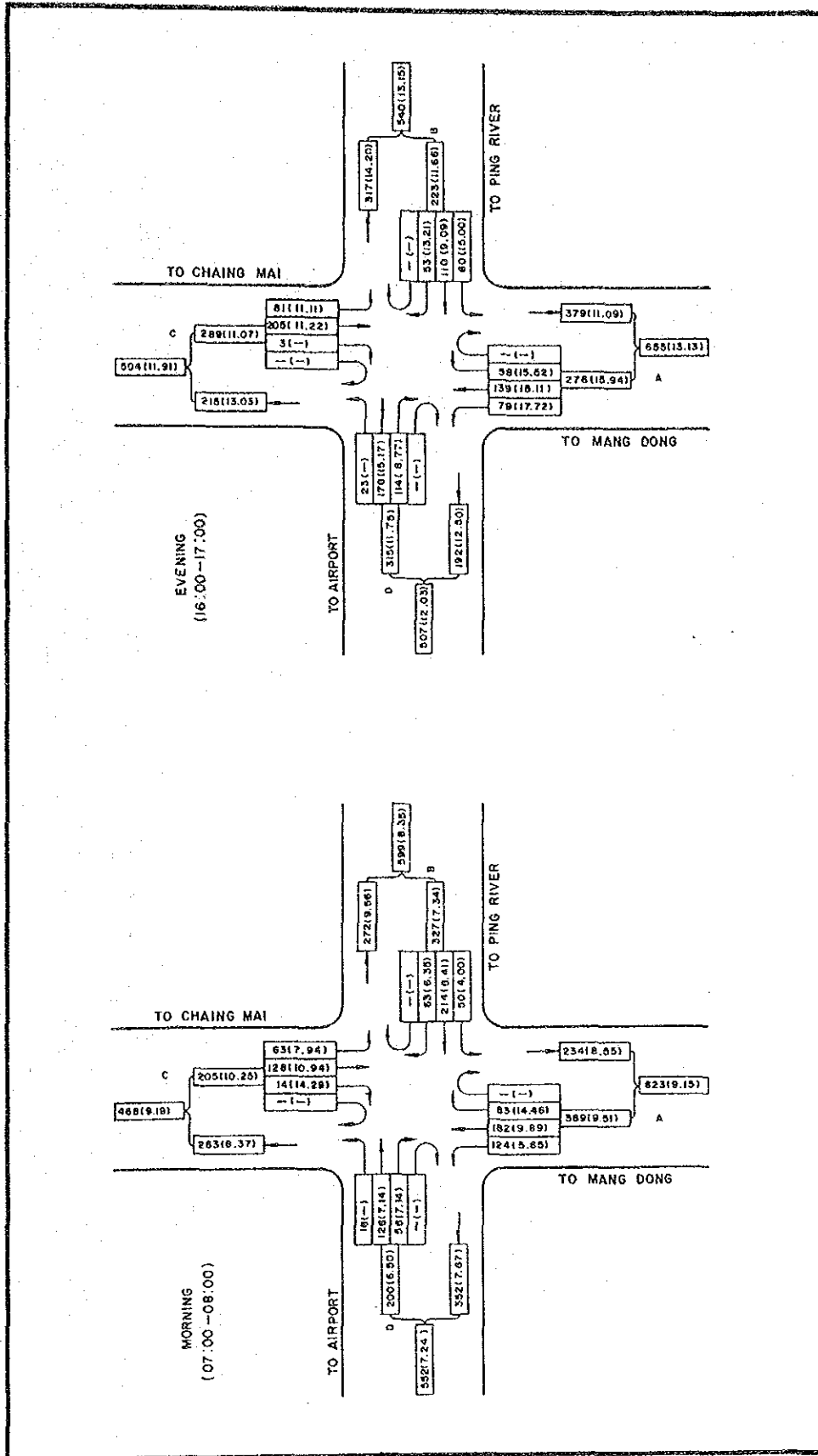
Collision Diagram (1982) for Section 12 (Route 3113, 1+800-2+800)



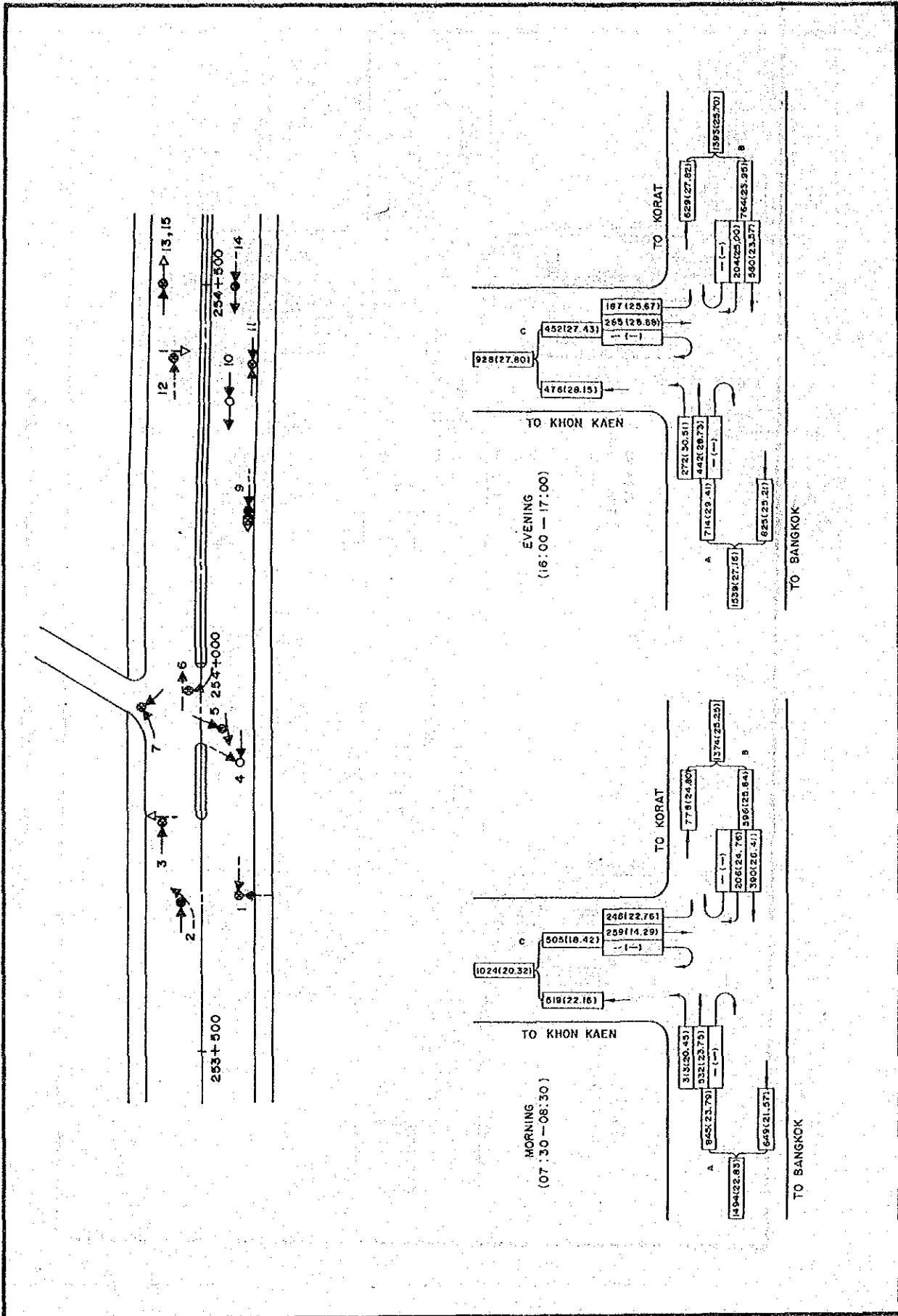
Collision Diagram (1982) for Section 17 (Route 205, 1+300-1+700)



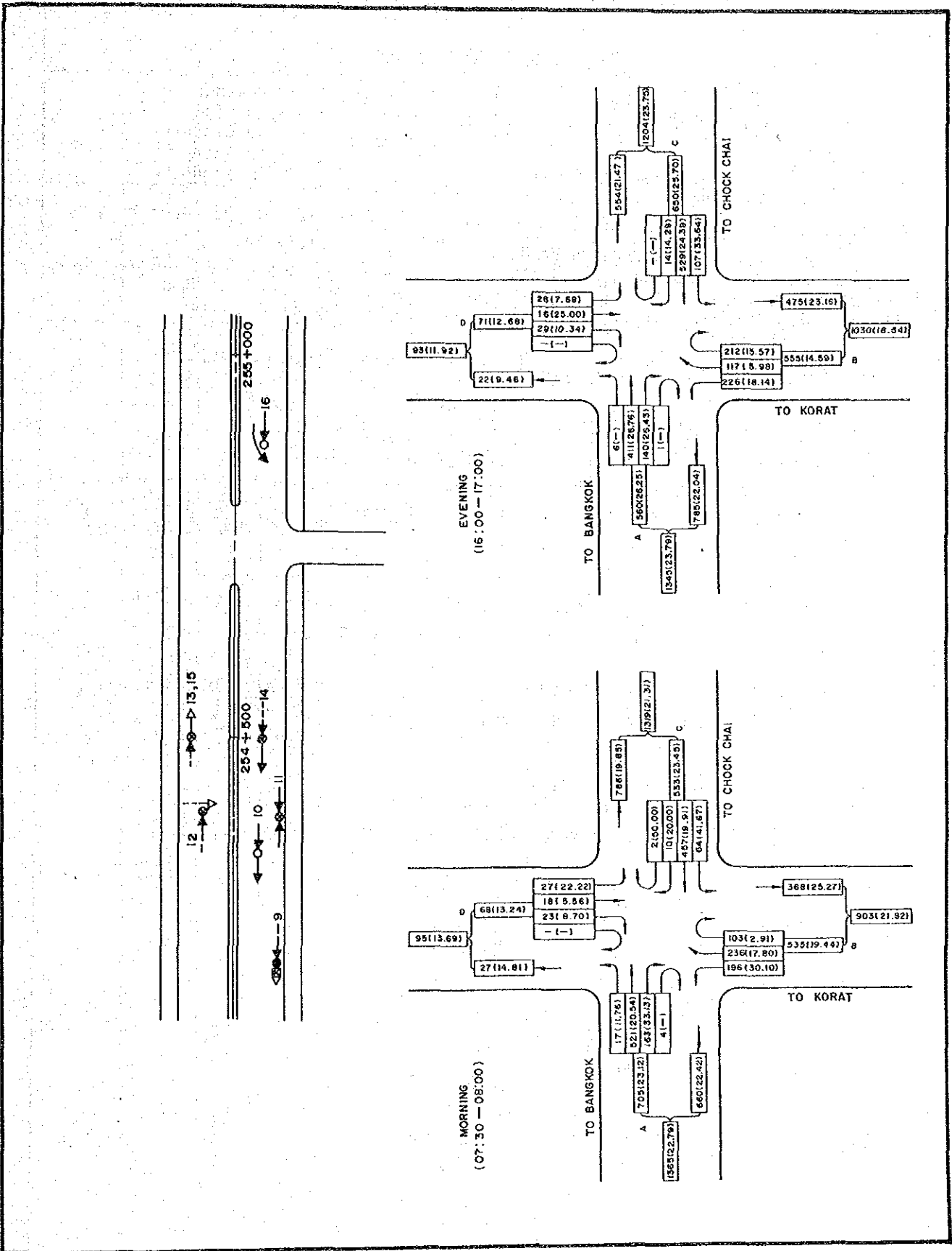
Collision Diagram (1982) and Turning Movement (Peak Hour) for Section 13 (Route 11, 97+300-87+800)



Turning Movement (Peak Hour) for Section 14 (Route 1141, 1+000-1+800)



Collision Diagram (1982) and Turning Movement (Peak Hour) for Section 15 (Route 2, 253+750-254+250)



Collision Diagram (1982) and Turning Movement (Peak Hour) for Section 16 (Route 2, 254+500-255+000)

Result of Traffic Accident Survey (1)

	Route 1 (48-49)		Route 306 (2.9-3.2)		Route 306 (13.5-14)		Route 336 (Sol 39)		Route 336 (Sol 53)		Route 1141 (1-1.45)		Route 1141 (1.45-1.7)	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Number of Accident	5	3	6	3	6	2	13	5	18	11	11	5	7	3
Fatality	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Injury	0	1	7	3	6	0	3	1	2	1	8	3	3	3
Property Damages Only	5	3	0	1	2	2	11	6	18	10	4	2	3	1
Weather Condition	5	3	5	2	5	0	13	4	18	10	7	5	4	2
Police Investigation	0	1	1	1	0	0	6	1	12	1	3	0	1	0
Type of Accident	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Type	4	2	1	2	1	1	13	4	17	11	4	2	6	3
Property Damaged	5	2	5	3	6	2	13	5	18	11	6	4	4	3
Cause of Accident	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Accident Pattern	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Result of Traffic Accident Survey (II)

Number of Traffic Accident by Day (Before Improvement)								
Month	Date	Route 1	Route 306		Route 336		Route 1141	
		48+000 -49+000	2+900 -3+200	13+800 -14+000	Soi 39	Soi 53	1+100 -1+450	1+450 -1+700
December 1983	1	-	-	(1,0,1)	(1,0,0)	-	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	(2,0,2)	-
	4	-	-	-	-	-	-	-
	5	-	-	-	-	(1,0,0)	-	-
	6	-	-	-	-	-	-	(1,0,0)
	7	-	-	-	-	-	-	-
	8	-	-	-	-	(1,0,0)	-	(1,0,1)
	9	-	-	-	-	(1,0,0)	-	(2,0,2)
	10	-	-	(1,0,1)	(1,0,0)	(1,0,0)	-	-
	11	-	-	(1,0,1)	(1,0,0)	(1,0,0)	-	-
	12	-	-	(1,0,2)	-	-	-	-
	13	-	(1,0,1)	-	-	-	-	(2,0,0)
	14	-	-	-	(1,0,2)	-	-	-
	15	-	-	-	-	-	-	-
	16	-	-	-	-	(1,0,0)	-	-
	17	-	-	-	-	-	-	-
	18	-	-	-	-	-	-	-
	19	-	-	-	-	(1,0,0)	(1,0,1)	-
	20	-	-	-	-	-	-	-
	21	-	-	-	-	-	-	-
	22	-	-	(1,0,1)	-	-	(1,0,1)	-
	23	-	-	-	-	-	-	(1,0,0)
	24	-	(1,0,1)	-	-	(1,0,0)	-	-
	25	-	-	-	-	(2,0,0)	(1,0,0)	-
	26	-	-	-	-	-	(1,0,1)	(1,0,0)
	27	-	-	-	-	-	-	(3,0,2)
	28	-	-	-	-	-	(1,0,0)	-
	29	-	(1,0,1)	-	-	-	(1,0,0)	-
	30	-	-	-	-	-	-	-
	31	-	-	-	-	(1,0,1)	-	-
January 1984	1	-	-	-	-	(1,0,0)	-	-
	2	-	-	-	(1,0,0)	-	-	-
	3	-	-	-	-	(1,0,0)	-	-
	4	-	-	-	-	-	-	-
	5	(1,0,0)	-	-	-	-	-	-
	6	(1,0,0)	-	-	-	-	-	-
	7	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-
	9	-	-	-	-	-	-	-
	10	-	-	-	-	-	(1,0,0)	-
	11	-	-	-	-	-	-	-
	12	(1,0,0)	-	-	-	-	-	-
	13	-	-	-	-	-	-	-
	14	-	-	-	(1,0,0)	-	-	-
	15	-	-	-	-	(1,0,0)	-	-
	16	-	(3,0,4)	-	-	-	(1,0,1)	-
	17	-	-	-	-	-	-	-
	18	(1,0,0)	-	-	-	-	-	-
	19	-	-	-	-	-	-	-
	20	-	-	-	-	(1,0,1)	-	-
	21	-	-	-	(1,0,0)	-	-	-
	22	-	-	-	-	-	(1,0,1)	-
	23	-	-	(1,0,0)	-	-	-	-
	24	-	-	-	-	-	-	-
	25	-	-	-	(1,0,0)	-	-	-
	26	-	-	-	-	(1,0,0)	-	-
	27	(1,0,0)	-	-	-	-	-	-
	28	-	-	-	-	(1,0,0)	-	-
	29	-	-	-	-	-	-	-
	30	-	-	-	(1,0,0)	(1,0,0)	-	-
	31	-	-	-	-	-	-	-

Note : (No. of , No. of , No. of)
 (Accident Fatalities Injuries)

Result of Traffic Accident Survey (III)

Number of Traffic Accident by Day (After Improvement)								
Month	Date	Route 1	Route 306		Route 336		Route 1141	
		48+000 -49+000	2+800 -3+200	13+600 -14+000	Soi 39	Soi 53	1+100 -1+450	1+450 -1+700
April 1984	1	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-
	6	-	-	-	-	(1,0,0)	(1,0,0)	-
	7	-	-	-	-	-	-	-
	8	-	(1,0,1)	-	-	-	-	-
	9	(1,0,0)	-	-	-	-	-	-
	10	-	-	-	-	-	-	-
	11	-	(1,0,1)	-	-	-	-	(1,0,1)
	12	-	-	-	-	-	-	-
	13	-	-	-	-	-	(1,0,1)	-
	14	-	-	-	-	-	(1,0,0)	-
	15	-	-	-	-	-	-	-
	16	-	-	(1,0,0)	-	-	(1,0,1)	-
	17	-	-	-	-	-	-	-
	18	-	-	-	-	-	-	-
	19	-	-	-	-	(1,0,0)	(1,0,0)	(1,0,0)
	20	-	-	-	-	-	-	-
	21	-	-	-	-	-	-	-
	22	-	-	-	-	-	-	(1,0,2)
	23	-	-	-	-	-	-	-
	24	-	-	-	-	-	(1,0,0)	-
	25	-	-	-	-	-	-	-
	26	-	-	-	-	-	-	-
	27	-	-	-	-	-	(1,0,1)	-
	28	-	-	-	-	-	(1,0,0)	-
	29	-	-	-	-	-	-	-
	30	-	-	-	-	-	-	-
	31	-	-	-	-	-	-	-
May 1984	1	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
	7	-	-	-	-	-	-	-
	8	-	-	-	-	(1,0,0)	-	-
	9	-	-	-	-	-	-	-
	10	-	-	-	-	-	-	-
	11	-	-	-	-	-	(1,0,1)	-
	12	-	-	-	-	-	(1,0,0)	-
	13	(1,0,0)	-	-	-	-	-	-
	14	-	-	-	-	-	-	-
	15	-	-	-	-	-	-	-
	16	-	-	-	-	(1,0,0)	-	-
	17	-	-	(1,0,0)	-	(1,0,0)	-	-
	18	-	-	-	-	(2,0,1)	-	-
	19	-	-	-	-	-	-	-
	20	-	-	-	-	-	-	-
	21	-	-	-	-	-	-	-
	22	-	-	-	-	-	-	-
	23	(1,0,1)	(1,0,1)	-	-	-	(1,0,1)	-
	24	-	-	-	-	-	-	-
	25	-	-	-	-	-	(1,0,0)	-
	26	-	-	-	-	-	-	-
	27	-	-	-	-	-	-	-
	28	-	-	-	-	-	(1,0,0)	-
	29	-	-	-	-	-	-	-
	30	-	-	-	-	-	(1,0,0)	-
	31	-	-	-	-	-	-	-

Note ; (No.of, No.of , No. of
 Accident Fatalities Injuries)

Survey Items for Traffic Behaviour Survey

Improvement Type	Location (Kilometer Post)	Before-survey		After-survey		Survey Items	
		Date	Hours	Date	Hours	Survey conducted by Video Tape Recorder	Survey conducted by Event Oscillograph
Improvement of Lane Line Marking	Route 1 (48+000-49+000)	25/01/1984 (Wed)	15:00-17:00	21/03/1984 (Wed)	15:00-17:00	Vehicle Movement	Running Speed
Improvement of a Sub-standard Curve by Visual Guidance	Route 306 (2+800-3+200)	07/12/1983 (Wed)	14:00-16:00	14/03/1984 (Wed)	14:00-16:00	Vehicle Movement	Running Speed Approach Speed
		07/02/1984 (Tues)	21:00-23:00	27/03/1984 (Tues)	21:00-23:00	Vehicle Movement (By Observer)	Running Speed Approach Speed
Safeguard of Pedestrian	Route 306 (13+500-14+000)	08/12/1983 (Thur)	16:00-18:00	29/05/1984 (Thur)	16:00-18:00	Vehicle Movement Pedestrian Movement	Running Speed
		29/11/1983 (Tues)	15:00-17:00	20/03/1984 (Tues)	15:00-17:00	Vehicle Movement Pedestrian Movement	Running Speed Head Distance
Improvement of Turning Traffic by Signalization	Route 39	30/11/1983 (Wed)	15:00-17:00	21/03/1984 (Wed)	15:00-17:00	Vehicle Movement Pedestrian Movement	Running Speed Head Distance
	Soi 53						
Intersection Improvement by Channelization	Route 1141 (1+100-1+700)	02/12/1983 (Fri)	14:00-16:00	16/03/1984 (Fri)	14:00-16:00	Vehicle Movement	Running Speed

Result of Traffic Behaviour Survey (I)
(Route 1, Improvement of Lane Line Marking)

	Invasion onto Lane Line	Vehicle Type			Interference to Vehicle on Abutting Lane					Sample Number	Conflicts Number	Reduction Rate
		Heavy Vehicle	Light Vehicle	Total	No. Vehicle	None	Stop	Speed Down	Lane Shift			
Before Improvement	None	187	35	202	\	202	0	0	0	300	92	0.62
	Deeply	6	12	18	6	10	0	2	0			
	Moderately	5	6	11	\	8	0	0	3			
	Slightly	58	11	69	\	69	0	0	0			
After Improvement	None	170	82	252	\	252	0	0	0	300	35	
	Deeply	14	13	27	13	14	0	0	0			
	Moderately	14	0	14	\	14	0	0	0			
	Slightly	7	0	7	\	7	0	0	0			










Result of Traffic Behaviour Survey (II)
(Route 306, Improvement of a Sub-Standard Curve by Visual Guidance)

	Invasion onto Lane Line (or Center Line)	Travelling Lane		Vehicle Type			Interference to Vehicle on Abutting Lane (or Opposite Lane)					Sample Number	Conflicts Number	Reduction Rate
		1st	2nd	Heavy Vehicle	Light Vehicle	Total	No. Vehicle	None	Stop	Speed Down	Lane Shift			
Before Improvement	None	22	136	22	136	158	\	158	0	0	0	300	131	0.59
	Deeply	12	7	0	19	19	11	3	0	0	5			
	Moderately	5	17	0	22	22	\	22	0	0	0			
	Slightly	17	84	22	79	101	\	101	0	0	0			
After Improvement	None	66	160	20	206	226	\	226	0	0	0	300	54	
	Deeply	48	0	7	41	48	20	26	0	1	1			
	Moderately	13	0	1	12	13	\	13	0	0	0			
	Slightly	13	0	0	13	13	\	13	0	0	0			

Result of Traffic Behaviour Survey (III)
(Route 336, Improvement of Turning Traffic by Signalization)

	Vehicle Type	Case of Conflict												Conflicts Number	Total Number of Conflicts	Reduction Rate	
		North			South			East			West						
		Left Turn	Thru	Right Turn	Left Turn	Thru	Right Turn	Left Turn	Thru	Right Turn	Left Turn	Thru	Right Turn				
Route 336 (Sol 39)	Before Improvement	Heavy Vehicle	0	0	0	0	0	0	0	0	1	0	0	0	37	8	0.80
	Light Vehicle	0	1	27	0	0	0	0	0	4	0	0	4				
	Total	0	1	27	0	0	0	0	0	5	0	0	4				
	After Improvement	Heavy Vehicle	0	0	0	0	0	0	0	0	0	0	0	0			
	Light Vehicle	0	0	0	0	0	0	0	0	1	0	3	4				
	Total	0	0	0	0	0	0	0	0	1	0	3	4				
Route 336 (Sol 53)	Before Improvement	Heavy Vehicle	0	0	3	0	0	0	0	0	0	0	0	2	29	68	0.80
	Light Vehicle	0	0	15	0	0	0	0	2	3	0	0	4				
	Total	0	0	18	0	0	0	0	2	3	0	0	6				
	After Improvement	Heavy Vehicle	0	0	0	0	0	0	0	0	0	0	1	0			
	Light Vehicle	0	0	0	0	0	1	0	1	2	1	1	0				
	Total	0	0	0	0	0	1	0	1	2	1	2	0				

Result of Traffic Behaviour Study (IV)
(Route 1141, Intersection Improvement by Channelization)

	Vehicle Type	From Chiang Mai				From Air Port				From Route 1141				Sample Number	Conflicts Number	Reduction Rate
		Free				Free				Free						
Before Improvement	Heavy Vehicle	0	1	3	1	1	0	3	1	3	1	9	0	300	200	0.51
	Light Vehicle	35	16	38	29	45	2	4	19	16	19	38	18			
	Total	35	17	41	30	46	2	7	20	19	20	47	18			
After Improvement	Heavy Vehicle	1	1	1	1	0	0	0	1	4	0	2	1	300	99	
	Light Vehicle	98	7	23	4	27	0	0	10	71	0	43	5			
	Total	99	8	24	5	27	0	0	11	75	0	45	6			

Result of Traffic Behaviour Survey (V)
(Route 306, Safeguard of Pedestrian)

	Crossing Movement (I)	Crossing Location		Number of Pedestrian in Group		Crossing Movement (II)		Interference to Vehicle on Carriageway				Sample Number	Conflicts Number	Reduction Rate
		On Zebra	Other Part	1	2 or more	Stop on Road Side	Stop on Carriageway	None	Stop	Speed Down	Lane Shift			
Before Improvement	Run	72	22	61	33	72	28	50	11	33	0	300	44	0.48
	Walk	189	17	61	145	105	110	11	66	127	2			
After Improvement	Run	115	92	138	69	185	139	184	0	23	0	300	23	
	Walk	90	3	5	88	93	91	14	38	40	1			

Result of Traffic Behaviour Survey (VI)
(Route 336, Safeguard of Pedestrian)

	Crossing Movement (I)	Crossing Location		Number of Pedestrian in Group		Crossing Movement (II)		Interference to Vehicle on Carriageway				Sample Number	Conflicts Number	Total Number of Conflicts	Reduction Rate
		On Zebra	Other Part	1	2 or more	Stop on Road Side	Stop on Carriageway	None	Stop	Speed Down	Lane Shift				
Route 336 (Sol 35)	Before Improvement	Run	109	22	64	67	131	105	97	4	30	0	150	34	
		Walk	19	0	4	15	19	19	0	19	0	0			
	After Improvement	Run	23	12	23	12	33	12	12	20	3	0	150	15	
		Walk	103	12	54	61	5	3	3	106	6	0			
Route 336 (Sol 53)	Before Improvement	Run	0	100	81	19	99	61	80	0	20	0	150	20	54
		Walk	0	50	21	29	52	46	28	0	22	0			
	After Improvement	Run	31	10	16	26	41	16	5	31	5	0	150	10	
		Walk	104	5	73	36	93	57	0	109	0	0			

Result of User Opinion Survey (I)
(for Vehicular Traffic)

Safety Measure		Improvement of Lane Line Marking	Improvement of a Sub-standard Curve by Visual Guidance	Improvement of Turning Traffic by Signalization	Intersection Improvement by Channelization				
Location (Kilometer Post)		Route 1 (48+000-49+000)	Route 306 (2+900-3+200)	Route 336 (2+000-5+000)	Route 1141 (1+000-1+450)				
Number of Sample		240	303	455	106				
Sample Driver	Professional Driver	166 (69%)	177 (58%)	178 (39%)	33 (31%)				
	Others	74 (31%)	126 (42%)	277 (61%)	73 (69%)				
Vehicle Type	Bicycle	0 (0%)	0 (0%)	0 (0%)	14 (13%)				
	Motor-cycle	11 (5%)	52 (17%)	70 (15%)	50 (47%)				
	Light Vehicle	89 (37%)	196 (65%)	363 (80%)	38 (36%)				
	Heavy Vehicle	140 (58%)	55 (18%)	22 (5%)	4 (4%)				
User Opinion		Visibility of Lane Line Marking		Visibility of Curve Section		Visibility of Traffic Signal		Smooth Driving	
		Improve	Not Improve	Improve	Not Improve	Good	Bad	Improve	Not Improve
		235 (98%)	5 (2%)	303 (100%)	0 (0%)	247 (54%)	208 (46%)	76 (72%)	30 (28%)
		Smooth Driving		Smooth Driving		Turning Movement at Intersection			
		Improve	Not Improve	Improve	Not Improve	Improve	Not Improve		
		215 (90%)	25 (10%)	303 (100%)	0 (0%)	332 (73%)	123 (27%)		
		General Evaluation		General Evaluation		Safety Driving			
		Good	Bad	Good	Bad	Improve	Not Improve		
		212 (88%)	28 (12%)	303 (100%)	0 (0%)	154 (34%)	301 (66%)		
						General Evaluation			
Good	Bad								
				261 (57%)	194 (43%)				

Result of User Opinion Survey (II)
(for Pedestrian)

Safety Measures			Safeguard of Pedestrian	Installation of Traffic Signal for Pedestrian		
Location (Kilometer Post)			Route 306 (13+500-14+000)	Route 336 (2+000-5+000)		
Number of Sample			381	560		
Sample Pedestrian	Male	Adult	131 (34%)	186 (33%)		
		Child	96 (25%)	76 (14%)		
	Female	Adult	96 (25%)	211 (38%)		
		Child	58 (16%)	81 (15%)		
User Opinion			Safety of Crossing		Visibility of Pedestrian Signal	
			Improve	Not Improve	Good	Bad
			362 (95%)	19 (5%)	381 (68%)	179 (32%)
					Safety of Crossing	
					Improve	Not Improve
					502 (90%)	58 (10%)
General Evaluation		Good	Bad			
		357 (64%)	203 (36%)			

Number of Sections and Improvement Work Types by DOH

Improvement Type	Number of Sections
1. Overlay	21
2. Patching	35
3. Seal Coat	8
4. Geometric Improvement	30
5. Installation of Guard Rail	5
6. Shoulder Improvement	7
7. Installation of Street Lighting & Traffic Signal	3
8. Installation of Signal	3
9. Installation of Street Lighting	9
10. Installation of Traffic Sign & Guide Post	1
11. Installation of Flashing Light	4
Total	126

Note: The number of sections are for three years from 1979 to 1981.

Accident Reduction Rates by Safety Device (Roading)

Safety Devices	Data A			Data B			Data C			Data D		
	Before	After	Reduction Rate	Before	After	Reduction Rate	Before	After	Reduction Rate	Before	After	Reduction Rate
Traffic Signal for Pedestrian	-	-	-	1,170	587	50	-	-	-	136	85	38
Crosswalk	110	84	24	3,936	2,667	32	2,039	1,277	37	-	-	-
Overpass	70	33	53	-	-	-	439	203	54	137	96	30
Sidewalk	4	1	75	-	-	-	92	51	45	-	-	-
Guardfence	1,337	541	60	-	-	-	5,037	2,976	41	-	-	-
Lighting	1,506	1,333	12	-	-	-	5,837	4,154	29	-	-	-
Curve Mirror	121	41	66	-	-	-	678	215	68	-	-	-
Median Island	4	1	75	-	-	-	3,422	2,765	19	-	-	-
Edge Line	106	78	26	-	-	-	337	242	28	67	38	43
Traffic Sign	-	-	-	2,616	2,278	13	259	113	56	-	-	-
Restriction of Parking	-	-	-	-	-	-	5,696	4,394	23	-	-	-
Restriction of Speed	-	-	-	-	-	-	1,533	1,211	21	-	-	-
Restriction of Overtaking	-	-	-	-	-	-	1,246	935	25	-	-	-

Accident Reduction Rates by Safety Device (Intersection)

Safety Devices	Data A			Data B			Data C			Data D			Data E		
	Before	After	Reduction Rate	Before	After	Reduction Rate	Before	After	Reduction Rate	Before	After	Reduction Rate	Before	After	Reduction Rate
Traffic Signal	473	260	45	6,216	4,290	31	4,612	2,412	48	-	-	-	-	-	-
Lighting	-	-	-	-	-	-	-	-	-	48	30	38*	-	-	-
Channelization	109	57	48	-	-	-	-	-	-	-	-	-	-	-	-
Improvement of Skid Resistance	36	11	69	-	-	-	1,325	565	57	-	-	-	-	-	-
Stop Control	-	-	-	-	-	-	853	343	60	-	-	-	230	65	72

Note ; * Only vehicle vs. pedestrian

Reference;

- M. Koshi "Traffic Accident Reduction Policies by Safety Devices"

Traffic Engineering Vo.15 No.2

Data A 1966, Metropolitan Police Board

Data B 1967, Metropolitan Police Board

Data C 1964, Prime Minister Office

Data D Others

- Japan Traffic Engineering Society "Traffic Accident Reduction Policies on Roadway and Intersection", 1975

Data E 1973, Saitama Prefecture

Material for expanding the number of accidents from
6 Changwats to All Roads in the LPs Area

(Basic Data)

1. Number of casualties of all roads in LPs area by
Police Department (without Bangkok area)

	(A) <u>6 Changwats</u>	(B) <u>Thailand</u>	<u>A/B</u>	
Fatal (persons)	191	1,163	0.16	} 0.20
Injury (persons)	506	2,276	0.22	
No. of Accident	402	2,082	0.20	

(For Information)

2. Number of casualties of HPD area by Highway Police

	(A) <u>6 Changwats</u>	(B) <u>Thailand</u>	<u>A/B</u>	
Fatal (persons)	408	1,652	0.25	} 0.25
Injury (persons)	1,173	4,749	0.25	
No. of Accident	763	3,211	0.24	

3. Population and number of registered vehicle
without Bangkok area

(A) <u>6 Changwats</u>	(B) <u>Thailand</u>	<u>A/B</u>
Population 6,080 (thousands persons)	42,665	0.14
Car 1,047 (hundreds veh.)	4,591	0.23

4. Size of accident data in 6 Changwats

(1) for DOH road on Major Municipality

645 casualties

(2) for all road

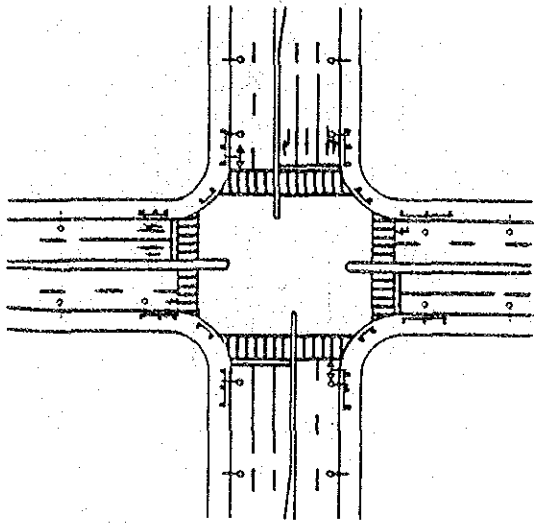
697 casualties

$$(1)/(2) = 0.93$$

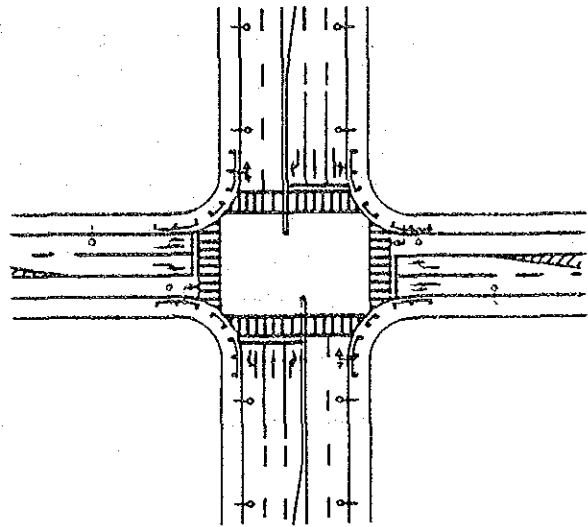
The gathering rate of accidents on DOH roads is more than 93% though the number of casualties (697) includes accidents which occurred in other than DOH roads. The number of accidents in DOH roads on major municipality corrected by the Team are assumed to occupy the majority of accidents in DOH roads.

5. Expanding Factor

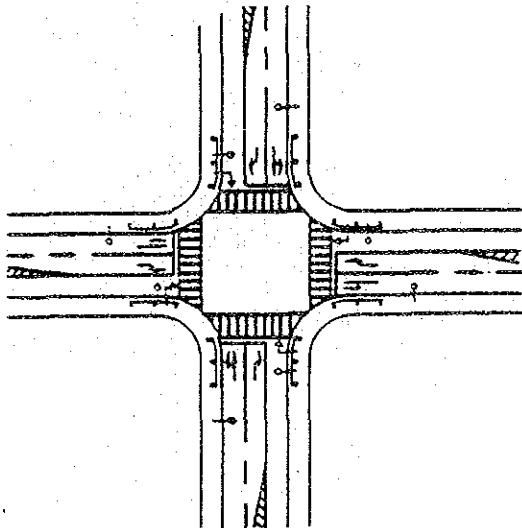
According to above information, the rate of the number of casualties in 6 Changwats to the whole country could be assumed twenty(20) percent. Then, the expanding factor of 5 is set in this study.



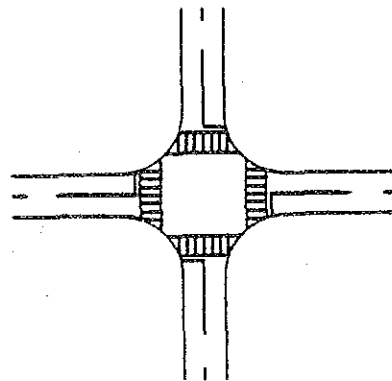
I-1 4 Lanes x 4 Lanes



I-2 4 Lanes x 2 Lanes



I-3 2 Lanes x 2 Lanes
(In Case of High
Traffic Volume)



I-4 2 Lanes x 2 Lanes
(In Case of Low
Traffic Volume)

LEGEND:

- ⊙ : Lighting
- ▬▬▬ : Guardfence
- : Traffic Signal

Schematic Drawings for Intersection

Quantity of Safety Devices by Road Type

Road Type		Roadway						Intersection			
Safety Device	Unit	RT-1	RC-2	RT-3	RC-4	RT-5	RC-6	I-1	I-2	I-3	I-4
Marking	m ²	1,400	1,400	1,400	1,400	765	900	480	570	530	250
Traffic Sign	set	2		2				4	4	4	4
Warning Regulator	set	6	6	6	6	6	6	32	32	28	28
Delineator 1)	P	150/25	200/76	75/12	100/38	75/12	100/38	-	-	-	-
Raised Pavement Marker	P	-	-	160	233	-	233	-	-	-	-
Median	M	-	-	1,000	1,000	-					
Intersection	L							4	2		
Guardfence	M	1,000	1,000	500	500	500	500	120	120	-	-
Crosswalk	M	30	30	30	30	15		95	70	65	50
Lighting	l.m	1,000	1,000	1,000	1,000		500				
Intersection	set							1	1	1	
Traffic Signal	set							1	1		
Medium Scale	set									1	
Right-turn Lane	L							1	1	1	
Sidewalk	M	2,000	2,000	2,000	2,000	2,000	2,000	1,200	1,200	1,200	
Pedestrian Overpass	set	1		1							

Note ; 1) Figure of right side of slash line shows the number of delineator to be attached to the guardfence.

Amount of Safety Devices of Remedy Works

Road Type		Roadway										Intersection				
		RT-1	RC-2	RT-3	RC-4	RT-5	RC-6	Total	I-1	I-2	I-3	I-4	Total			
Safety Device	Unit															
Marking	m ²	137,200	23,800	88,200	15,400	292,230	61,200	618,030	12,000	13,680	22,260	36,750	84,690			
Guide	set	196		126				322	100	96	168	588	952			
Traffic Sign	set	588	102	378	66	2,292	408	3,834	800	768	1,176	4,116	6,860			
Regulator																
Delineator with post	p	14,330	2,110	4,610	680	27,960	4,210	53,900								
Raised Pavement Marker	p			6,048	1,537		15,844	23,429								
Roadway	m			25,200	4,400			29,600								
Intersection	L								100	48 ¹⁾	2)					
Guardfence	m	14,700	17,000	4,725	5,500	28,650	34,000	104,575	3,000	2,880	5,040		10,920			
Crosswalk	m	2,940		1,890		2,865		7,695	2,375	1,680	2,730	7,350	14,135			
Roadway	l.m	14,700	17,000	9,450	11,000		17,000	69,150								
Intersection	set								25	24	42		91			
Traffic Signal	set								25	24			49			
Medium Scale	set										42		42			
Right-turn Lane	L								25	24	42		91			
Sidewalk	m	58,800	10,200	25,200	4,400	76,400	13,600	188,600	9,000	5,760	5,040		19,800			
Pedestrian Overpass	set	59		38				97								

Note; 1),2) The quantity of painted island is transferred to the quantity of marking.

Cost Estimation by Road Type

Unit : Million Baht

Safety Device	Road Type		Roadway										Intersection				Grand Total
	Unit	Unit Cost 1)	RT-1	RC-2	RT-3	RC-4	RT-5	RC-6	Total	I-1	I-2	I-3	I-4	Total			
Marking	m ²	280	38.4	6.7	24.7	4.3	81.8	17.1	173.0	3.4	3.8	6.2	10.3	23.7	196.7		
Guide	set	2,875	0.6		0.4				1.0	0.3	0.3	0.5	1.7	2.8	3.8		
Traffic Sign Regulator	set	1,970	1.2	0.2	0.7	0.1	4.5	0.8	7.5	1.6	1.5	2.3	8.1	13.5	21.0		
Delineator	p	392	5.6	0.8	1.8	0.3	11.0	1.7	21.2						21.2		
Raised Pavement Marker	p	1,160			7.0	1.8		18.4	27.2						27.2		
Median	m	520			13.1	2.3			15.4						15.4		
Intersection	L	58,000								5.8	2.8			8.6	8.6		
Guardfence	m	900	13.2	15.3	4.3	5.0	25.8	30.6	94.2	2.7	2.6	4.5		9.8	104.0		
Crosswalk	m	560	1.6		1.1		1.6		4.3	1.3	0.9	1.5	4.1	7.8	12.1		
Lighting	l.m.	935	13.7	15.9	8.8	10.3		15.9	64.6						64.6		
Intersection	set	0.22M								5.5	5.3	9.2		20.0	20.0		
Traffic Large Scale	set	0.58M								14.5	13.9			28.4	28.4		
Signal Medium Scale	set	0.53M										22.3		22.3	22.3		
Right-turn Lane	L	0.36M								9.0	8.6	15.1		32.7	32.7		
Sidewalk	m	1,058	62.2	10.8	26.7	4.7	80.8	14.3	199.5	9.5	6.1	5.3		20.9	220.4		
Pedestrian Overpass	set	1.68M	99.1		63.8				162.9						162.9		
Total			235.6	49.7	152.4	28.8	205.5	98.8	770.8	53.6	45.8	66.9	24.2	190.5	961.3		
No. of Section			98	17	63	11	382	68	639	25	24	42	147	238			
Total/No. of Section			2.40	2.92	2.42	2.62	0.54	1.57	1.21	2.03	1.80	1.49	0.16	0.76			

Note 1) : The basic data for the unit cost are presented in Appendix 8.5 (2).

Unit Cost for Remedy Works as of 1985 F.Y.

Unit : Baht

Items	Unit	Unit Cost				Remarks	
		Material	Instal- lation ¹⁾	Over- head ²⁾	Total		
Pavement Marking	Ordinary Paint	m ²	28.5	20.0	14.5	63.0	
			60.5	20.0	24.0	104.5	Reflectorized
	Thermoplas- tic paint	m ²	180.0	33.5	64.0	277.5	Reflectorized
Traffic Sign	Guide	set	1,716.0	496.0	663.5	2,875.5	
	Warning	set	1,227.5	389.5	455.0	1,971.5	
	Regulatory	set	1,227.5	289.5	455.0	1,971.5	
Delineator		p	207.0	95.0	90.5	392.5	with Guidepost
Raised Pavement Marker		p	850.0	45.0	268.5	1,163.5	
Guardfence		m	627.0	67.0	208.0	902.0	Auto Guard
Traffic Signal	Large Scale	set				0.58M	
	Medium Scale	set				0.53M	
Pedestrian Bridge		set				1.68M	21.0m length
Pavement	Carriageway	m ²	278.0	20.0	89.5	387.5	
	Shoulder	m ²	65.0	5.5	21.0	91.5	
Embankment		m ³	86.0	11.0	29.0	126.0	
Curb		m	129.0	54.0	55.0	238.0	
Back Fill		m ³	66.0	11.0	23.0	100.0	
Sodding		m ²	4.5	3.5	2.5	10.5	
Raised Bar		m	40.5	5.5	14.0	60.0	
Lighting	Intersection	set				0.22M	8-poles
	Roadway	m				935	30m spacing
Pavement of Sidewalk		m ²	45.0	36.0	24.5	105.5	
Curb Gutter		m	197.0	83.0	84.0	364.0	

1) including labour cost

2) overhead cost is estimated as 30% of direct cost

Conditions of Estimation to Replacement and Maintenance for Safety Devices

Safety Device	Durable Year	Replacement and Maintenance
Marking	3 - years	replace every 3 years
Traffic Sign	7 - years	replace every 7 years
Delineator	do	do
Raised Pavement Marker	do	do
Guardfence	10 - years	2% of installation cost per annum
Crosswalk	1 - year	replace every 1 year
Lighting	10 - years	10% of installation cost per annum
Traffic Signal	10 - years	do
Pedestrian Overpass	50 years	3% of installation cost per annum
Median, Right-turn Lane, Sidewalk	-	-

Accident Reduction Rate by Road Type

Road Type	Roadway						Intersection					
	Divided 4-lanes		Undivided 4-lanes		2-lanes		4-lanes	4-lanes	2-lanes	2-lanes x 2-lanes		
	Tangent	Curve	Tangent	Curve	Tangent	Curve	x 4-lanes	x 2-lanes	High Traf- fic Volume	Low Traf- fic Volume		
	RT-1	RC-2	RT-3	RC-4	RT-5	RC-6	I - 1	I - 2	I - 3	I - 4		
Safety Devices												
Marking	30	30	30	30	30	30	30	30	30	30	30	30
Traffic Sign	15	15	15	15	15	15	15	15	15	15	15	15
Delineator and Raised Pavement Marker	50 (35)	50 (35)	50	50	50 (35)	50	50	50				
Median			20	20								
Guardfence	40	40	40	40	40	40	40	40	40	40	40	40
Crosswalk	30		30		30		30		30	30	30	30
Lighting	30	30	30	30	30	30	30	30	30	30	30	30
Traffic Signal							50	50	50	50	50	50
Right-turn Lane							50	50	50	50	50	50
Sidewalk	45	45	45	45	45	45	45	45	45	45	45	45
Pedestrian Overpass	55		55									
Judgement	45	50	50	55	40	50	50	50	50	50	50	30

Note () ; 35% shown in the parentheses in above table indicate the reduction rate when only delineator is installed on divided 4-lane roadway (tangent and curve sections) and 2-lane roadway (tangent sections) in the macroscopic remedy works plan.

Number of Accident and Casualty Reduced

Road Type		Road Type No.	Number of Casualties	Accident Reduction Rate	Reduction Number of Casualties	Remarks	
Roadway	Divided 4-lanes	RT - 1	1,405	45	632		
		RC - 2	366	50	183		
	Undivided 4-lanes	RT - 3	861	50	431		
		RC - 4	225	55	124		
	2-lanes	Tangent	3,680	40	1,472		
		Curve	983	45	442		
	Sub - Total			7,520	-	3,284	Sub-Total Reduction Rate 0.44
	Intersection	4-lanes x 4-lanes		153	50	77	
		4-lanes x 2-lanes		130	50	65	
		2-lanes xx	High Traf- fic Volume	235	50	118	
			Low Traf- fic Volume	814	30	244	
		Sub - Total			1,332	-	504
Grand Total			8,852	-	3,788	Total Reduction Rate 0.43	



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