Median Accident Study—Long Island, New York

C. E. BILLION and N. C. PARSONS, New York State Department of Public Works

● LONG ISLAND comprises a land area 15 to 20 mi wide extending 125 mi easterly from New York City. The principal east-west traffic movements are limited by the geography of the Island. The highway transport facilities include parkways for passenger cars and State, county and local highway systems for mixed traffic.

Since the early thirties, the demands of high volume urban traffic throughout the Island on the various highway systems has resulted in extensive construction of divided highways incorporating various median designs in an effort to bring about an improvement in safety and comfort to the users.

Divided highways have demonstrated their ability to carry large volumes of traffic efficiently and safely. However, the most modern highway does not prevent all accidents. This results in a continuing demand for improved design and increased safety.

One of the major questions with respect to safety is the proper design of medians to meet various operating conditions. Varying terrain and high cost of right-of-way in urban areas have led to a variety of median designs.

The purpose of this study is to investigate the effect of median design on accident rates for divided urban highways with roadside development.

Three previous studies have been made on this subject. (1) California in 1953 investigated medians on 4-lane rural high-speed highways and also semi-urban highways. For the rural study, intersections, speed zones and sections with roadside development were excluded. For the semi-urban study, restricted speed zones and roadside development were included. (2) Fred W. Hurd, Yale Bureau of Highway Traffic, during the summer of 1954, studied accident experience with traversable medians of different widths on limited-access high-speed highways. (3) California in 1958 studied accident experience on freeways for both the deterring and non-traversable types of median under high volumes.

DESCRIPTION OF STUDY SECTIONS

Detailed records of accidents for the years 1955 through 1959 were collated for 34 sections of State and county highways in Long Island, New York. These sections consisted of 82 mi of urban divided, multilane, free-access (no control of access) highways. Traffic volumes up to 44,000 vehicles per day were represented. In addition, one 4.3-mi section was studied on a 6-lane limited-access expressway carrying more than 85,000 vehicles per day. The 86 mi studied included more than 64 percent of the highway mileage with medians on Long Island, but excluding parkway mileage.

The 35 study sections were representative of 4- and 6-lane highways with concrete and bituminous macadam pavements constructed during the period 1930-1958. The 86 mi studied comprised sections from 0.5 to 9.3 mi in length with an average length of 2.7 mi. Thirteen sections were representative of the grass and flush type median 10 to 54 ft wide; 17 were of the raised grass and curbed type, 6 to 54 ft wide; and 5 were of the raised paved and curbed type, 2 to 8 ft wide. In three of the sections with grass medians, intermittent shrubbery had been planted. Four of the grass median sections were equipped with positive median devices consisting of (a) double steel-beam-type guide rail with steel posts, (b) concrete posts, (c) single-beam-type guide rail with concrete posts, and (d) a 1 on 2 deep ditch slope with concrete post and wooden guide rail at the edge of the median shoulder.

The designs of the various sections included various combinations of left-turn lanes, crossovers, paved, stabilized and compacted median shoulders, highway illumination and other miscellaneous features. There were a total of 650 intersections in the study, and with the exception of 13, all were at grade. The number of intersections per study section varied from 3 to 62 or from 3 to 7 per mile.

PROCEDURE

Median Groupings

The median designs were classified in two general categories by functional type.

Deterring Type.—This type, by an obstruction, discourages deliberate entrance or crossing of the median. The flush and raised grass with intermittent shrubbery, the mountable double curb, and the earth medians with flat cross-slopes are in this group.

Non-Traversable Type.—This type, by a physical obstruction, would prevent crossing from one roadway to another without a reportable accident. Medians with a continuous obstruction (positive median device), those with concrete posts to prevent crossings and earth medians with steep cross-slopes are included in this group. Highways with separate roadways and median greater than 120 ft in width are also generally classified as non-traversable; however, there were none of these in this study.

In the study there was no mileage of the traversable-type medians such as paved medians or an earth median with a flat, smooth, or hard surface.

The deterring types of median were further subdivided for examination into earth, curbed and medians with miscellaneous features. The non-traversable types of median were divided into four sub-groups according to the type of positive median device. Typical study sections for these deterring and non-traversable groups are shown in Figure 1.

A summary of the mileage, number of accidents and related data studied by functional type of median is given in Table 1.

Accident Data Collection

The New York State Department of Public Works receives weekly reports of all accidents from each police department having jurisdiction. (In New York State all accidents of more than $100 property damage are by law reportable. More than 99 percent of reportable accident occurrence is represented by the data.)

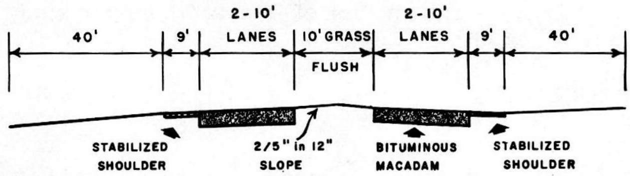
These reports are verified and checked against accident reports from the Motor Vehicle Bureau, and newspaper clippings.

Accident Data.—For the 5-yr period of study there were 1,552 accidents of record which occurred between intersections and 6,628 at the 650 intersections for a total of 8,180 accidents. Each accident was given a consecutive number by study section. Data for each accident were tabulated to indicate hour, day, month, year, location on study section, direction that vehicle involved was traveling, type of accident (27 categories), number injured and killed, kind of locale, the number of travel lanes, marginal friction and dimensions of medians and shoulders. This information was coded and placed on IBM cards for electronic data processing.

The types of accidents between intersections were classified as:

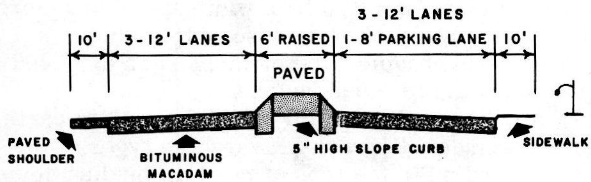
1. Approach.—Cross median collision, right or left turn head-on, collisions and other head-on collisions.
2. Overtaking.—Rear end, sideswipe same direction and opposite direction, right angle collision, collisions with cars turning left or right, skid collision, U-turn and improper right or left turns.
3. Single Vehicle.—Hit post, pole, tree, parked car, bridge abutment or animal, sideswipe median, cross median no collision and car turned over.
4. Pedestrian.
5. Other.—Other personal injury, hit bicycle, accidents caused by road construction.

Individual site data were tabulated for control, identification of traffic and travel, fatal, personal injury and property damage accidents occurring between intersections and for accidents occurring at intersections for night, daytime and total. These tables with EDP tabulations formed the basis for examination of accident data by median groupings.



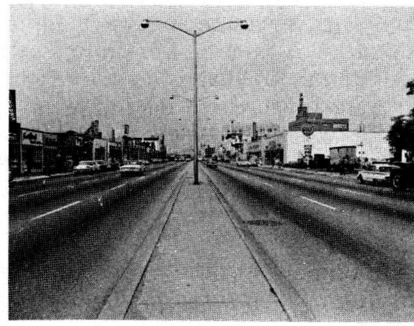
DETERRING MEDIAN

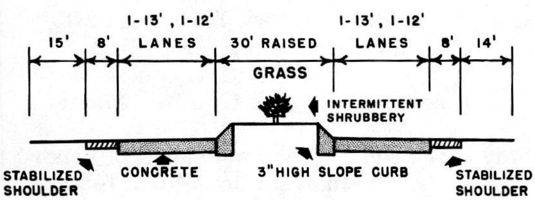
GROUP 1



DETERRING MEDIAN

GROUP 2





DETERRING MEDIAN

GROUP 3

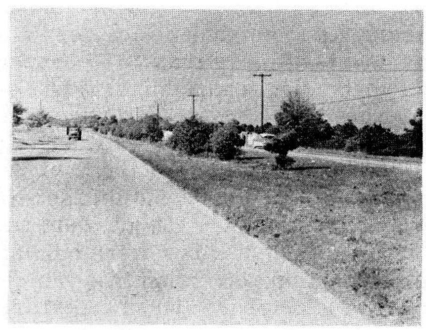
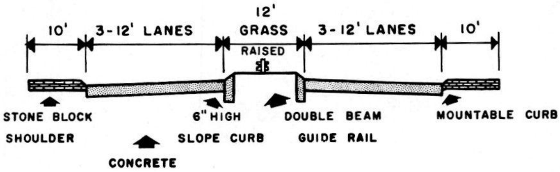
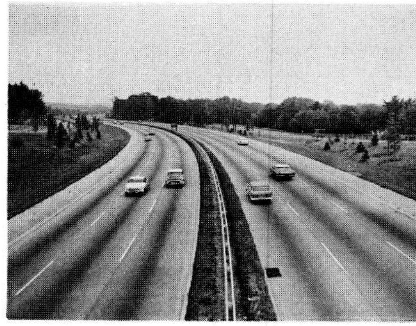


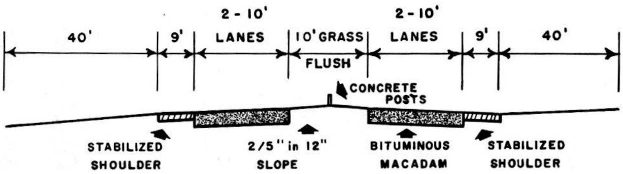
Figure 1. Typical cr

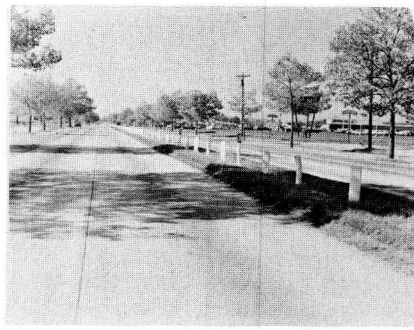




NON TRAVERSABLE MEDIAN

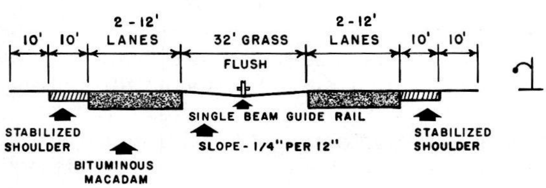
GROUP 1

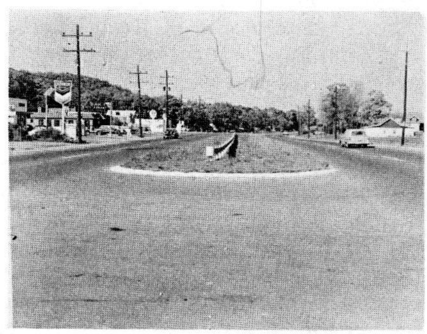




NON TRAVERSABLE MEDIAN

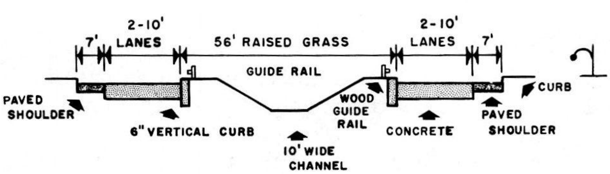
GROUP 2





NON TRAVERSABLE MEDIAN

GROUP 3



NON TRAVERSABLE MEDIAN

GROUP 4

on and view of sites.

TABLE 1

SUMMARY OF MILEAGE AND NUMBER OF ACCIDENTS STUDIED BY FUNCTIONAL TYPE OF MEDIAN

Functional Type of Median	No. of Sections	Total Length (mi)	No of Reported Accidents: Study Period	Between Intersections	At Intersections	Travel MVM for Period of Study
Deterring						
Earth grass or soft surface, slopes 1 on 4 or flatter	10	45.8	1955-60	406	1,325	893 1
Curbed. with standard curbs 6 in or less in height (vertical and mountable)	19	26 3	1955-60	860	4,607	780 7
Miscellaneous Features median with intermittent shrubbery, curbed and flush	2	3 6	1955-60	58	208	87 9
Sub-total	31	75.7		1,324	6,140	1,761 7
Non-Traversable						
Median, 12 ft wide and curbed with double type steel guide railing and steel posts	1	4 3	1959	35	1	127 1
Median, with concrete posts to prevent crossings	1	3 3	1955-60	184	435	132 4
Median, with NYSDPW single-beam-type guide railing and concrete posts	1	2 2	1959	5	9	7 8
Median, with concrete posts and railing and some large trees Deep ditch slope 1 and 2	1	0 7	1958-60	4	43	9.8
Subtotal	4	10 5		228	488	277.1
Total	35	86 2		1,552	6,628	2,038.8

Many variables other than median type and design apparently influence the frequency of accidents between intersections. Among these are the exposure as measured in vehicle-miles of travel, design standards and features of a particular facility, such as crossovers, left-turn lanes, illumination, parking lanes and marginal activity. In addition, there are traffic density, climatic conditions, speed differentials and many others, to say nothing about faulty driver behavior.

Obviously, not all of these variables can be controlled in this type of study. However, based on the mileage of roadway studied, it was considered fair to assume that variables other than traffic volume and width of median were distributed throughout the various median types.

A 4- or 5-yr continuous period of accident data was obtained to provide a reasonably large sample of motor vehicle accidents to compare the influence of the various types of medians. Apropos of the foregoing, an accident occurrence of at least ten in number for the period of study was adopted as a minimum for analysis of accident rates. Rates based on less than 10 occurrences are noted on the ensuing tabulations.

The intersection accidents were excluded in the general analysis of the accident occurrence for the various grouping of medians and are shown separately in some of the analyses where appropriate.

ANALYSIS

Daytime and Nighttime Accident Occurrence

By reason of the fact that this report will be of interest locally, as well as nationally, it appears appropriate to examine the daytime and nighttime frequency of accident occurrence.

It was found that the annual average night traffic volume, for the period of the study, was about 25 percent of the 24-hr traffic volume. This was based on hourly traffic counts from four continuous counter stations strategically located on the State Highway System on Long Island.

Using this index of night travel, the following comparison is made for the median study groups between day and night frequency of all accidents between intersections occurrence.

Median	Rate[a] Day	Night
Deterring		
Earth	33	82
Curbed	85	185
Miscellaneous features	55	91
Subtotal	58	119
Non-Traversable		
With double guide railing	17	59
With concrete posts	119	194
With single guide railing[b]	0	250
With deep ditch[b]	28	74
Subtotal	41	144
Total	48	133

[a]Number of accidents for 100 MVM of travel.
[b]Number of accidents less than 10 for period of study.

The ratio of night to day accident occurrence between intersections averaged 3.5 to 1 for the non-traversable group and 2.0 to 1 for the deterring group of medians. Further analyses of day and night accident rates, including those for intersection accidents, are shown later.

The total accidents data were used as a basis for accident occurrence in the ensuing analyses.

Influence of Traffic Volume on Accident Occurrence

For the over-all safety of a highway, the median types should be investigated for all operating conditions. Hourly traffic volumes are a more accurate indication of the operating conditions and degree of congestion than the annual average daily flow. Because of the obvious difficulties in relating accident rates to hourly flow, the annual average daily traffic volume was used as a basis for comparison of volume groups. It is believed that in a large sample such as this, the study sections within the same daily volume groups will have similar hourly flow patterns, except for the very low volume groups.

Figure 2 shows the average accident rates for the deterring-type median by volume groups. From these data it will be noted that the rate for all accidents increased uniformally from 50 at about 6,000 vehicles per day to more than 150 at 40,000 vehicles per day. The effect of daily traffic volume on injury accident rates was less pronounced although it increased as volume increased. This increase does not appear to be significant.

The volume range for the non-traversable type of median was too small (17-22,000) for determining the effect of volume on accident occurrence.

Influence of Median Width on Accident Occurrence

The all and injury accidents rates by groups of medians with the same width were plotted for the two functional median types in Figure 3. The number of accidents examined for each group of widths is shown in the circles. It was felt that the sample was too small to investigate the effect of the median width for the various median subgroups within each functional type.

Based on an accident occurrence of at least 10 in number as sufficient to permit an analysis of accident rates, the sample size for the non-traversable type was too small to interpret the width relation to accident occurrence.

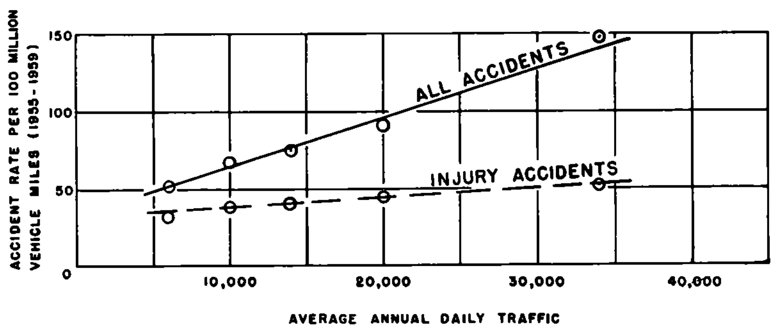


Figure 2. Effect of volume (AADT) on accident occurrence between intersections for multi-lane highways with deterring-type median.

For the deterring-type median there appeared to be no correlation between either the all or the injury accident rates and the width of medians.

As pointed out in the California Study (1), this seems to contradict the hypothesis that, for the same general conditions, the greater the lateral separation the safer the facility. In determining the optimum width of median for safety, consideration should be given to the fact that when a vehicle leaves the roadway, there is a good chance of avoiding a reportable accident if maneuvering space is available. The flush flat slope earth medians provide this space not inherent with the raised and curbed types. For the non-traversable type of median, sufficient space on each side of the positive median device should be provided for emergency stops.

Median widths in excess of 40 ft, however, apparently present an additional hazard. The accident records contain a number of incidence of fatalities and injuries which occurred at night under conditions of low visibility, due to fog or rain. Here, the median widths between 40 to 56 ft appear to have confused the drivers, and they mistakenly entered the opposing lanes of traffic in the belief they were on a two-way highway. This condition demands special signing for safety.

The effect of median width on accident occurrence between intersections was further investigated for the deterring type of median by adjusting the data for the effect of volume.

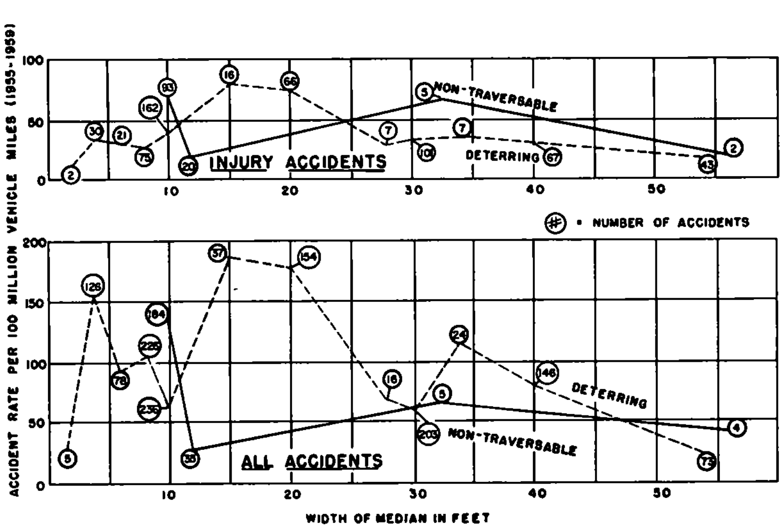


Figure 3. Effect of width of median on accident occurrence between intersections.

This relationship for all and injury accidents is shown in Figure 4. The contribution of increase in traffic volume to the all and injury accident rates was determined for each appropriate study section by the relation, as shown in Figure 2, between accident rates for the AADT of the study section (volume group) and those of the 6,000 vehicles per day group used as a base. These contributions of accident rates were deducted from the total rates and adjusted values for each width of median represented in Figure 4 were depicted.

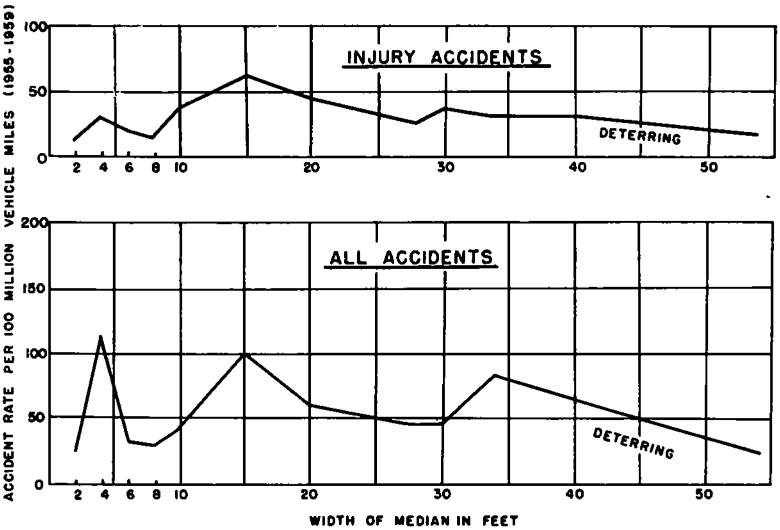


Figure 4. Effect of width of median on accident occurrence between intersections adjusted for effect of volume.

It will be noted that the pattern of this relationship for both all and injury accidents followed those shown in Figure 3 except that the peaks are smaller, but again, no consistent trend was evident. Although a decrease in accidents with increasing median width appeared between widths of 15 and 50 ft, at median widths nearer than 15 ft, however, the injury rate also decreased.

Influence of Median on Type of Accident

To investigate the influence of median type on the safety of a facility in more detail, the accident pattern by type of median for all accidents between intersections was examined. Table 2 gives the accident rates per 100 MVM by type of accident before adjustment for the effect of volume. It is noted that the overtaking type of accident accounted for more than 70 percent of all the accidents for both the deterring and non-traversable types of median. This contribution of overtaking accidents appeared to be consistent in the three sub-groups of the deterring type. For the non-traversable type, the overtaking accidents for the concrete posts accounted for more than 75 percent of the total accidents. (Concrete posts were installed in the median to eliminate indiscriminate crossings in order to gain access to regional shopping areas.)

Figure 5 depicts these data for the three subgroups of the deterring-type median. The white portion of the bars in this figure indicates the contribution of volume to accident rates. Likewise, the difference between the lower and upper numbers in each case indicates the amount of the volume contribution to rate per 100 million vehicle-miles of travel.

TABLE 2

ACCIDENT PATTERN AND RATES BY TYPE OF MEDIAN FOR ALL ACCIDENTS BETWEEN INTERSECTIONS

Type of Median	No All Accidents	Accident Rates Per 100 MVM of Travel					
		Approach	Over Taking	Single Vehicle	Pedestrian	Other	Total
Deterring							
Earth	406	2	32	9	1[a]	2	45
Curbed	860	2	78	22	5	3	110
Miscellaneous features	58	9[a]	44	10	1[a]	1[a]	66
Subtotal	1,324	2	53	15	3	2	75
Non-Traversable							
Double guide rail	35	0[a]	21	7	0[a]	0[a]	28
Concrete posts	184	6[a]	108	19	5[a]	2[a]	139
Single guide rail	5	0[a]	38[a]	26[a]	0[a]	0[a]	64[a]
Guide rail and ditch	4	30	10[a]	0[a]	0[a]	0[a]	41[a]
Subtotal	228	4	62	13	3	1	82
Total	1,552	3	54	15	3	2	76

[a]Number of accidents less than 10 for period of study

The contribution of increase in traffic volume to the all and injury rates (Figs. 5 and 6) for the three sub-groups of the deterring median was determined by use of the same method previously used for adjusting for effect of volume to width of median except that an average volume (AADT) group was used for the study sections in each subgroup and it was assumed that the effect of volume was the same for each type of accident.

Disregarding the effect of volume on accident occurrence, those data showed again that the overtaking accidents predominated, as expected. The approach type of accident appeared to be higher for the median with intermittent shrubbery than for the other types of median which were more or less the same. The rates for the other three types of accident appeared somewhat higher for the curbed median as compared to the others. The total accident occurrence showed the curbed median with the highest contribution, whereas the earth median was lowest.

Table 3 gives the accident pattern and rates by type of median for injury accidents between intersections before adjustment for the effect of volume. Again it was noted that the greatest contribution to the injury accident occurrence was the overtaking type of accident. For the deterring type this contribution is about 62 percent of the total and was more or less the same for each subgroup. For the non-traversable type the overtaking injury type of accident accounted for more than 75 percent of the total frequency and was about the same for each subgroup except the guide rail and ditch which indicated (based on a small number of accidents) that all of the accident occurrence was accounted for by the approach type of accident.

Figure 6 depicts the data in Table 3 for the deterring type of median, adjusted for the effect of volume. Again, it is noted that the overtaking type of injury accident accounted for the highest accident rate averaging about 18 compared to about 3 for the approach, 5 for the single vehicle, and less than 3 for the pedestrian types of accidents. Within the subgroups the curbed median again showed a somewhat higher contribution to overtaking accidents than the other subgroups. In both the approach and single vehicle type of accident, the median with the intermittent shrubbery showed the highest contribution, whereas for the pedestrian type the curbed median frequency was about five times higher than that for the other two subgroups. Again the total accident occurrence showed the earth median with the lowest frequency of occurrence.

Influence of Median on Severity of Accidents

The severity of accidents for the two types of medians is given in Table 4. Using the number of injuries per 100 MVM of travel as an index of severity, it is seen that both the earth and miscellaneous features medians had the smallest contribution to severity (47) in the deterring group. The curbed median was next with a rate of 55. For the non-traversable type the index of severity ranged from 79 for the double guide rail to 108 for the concrete posts. This concrete posts median index was more than twice that for the deterring. It is also higher than the index for any of the other median subgroups.

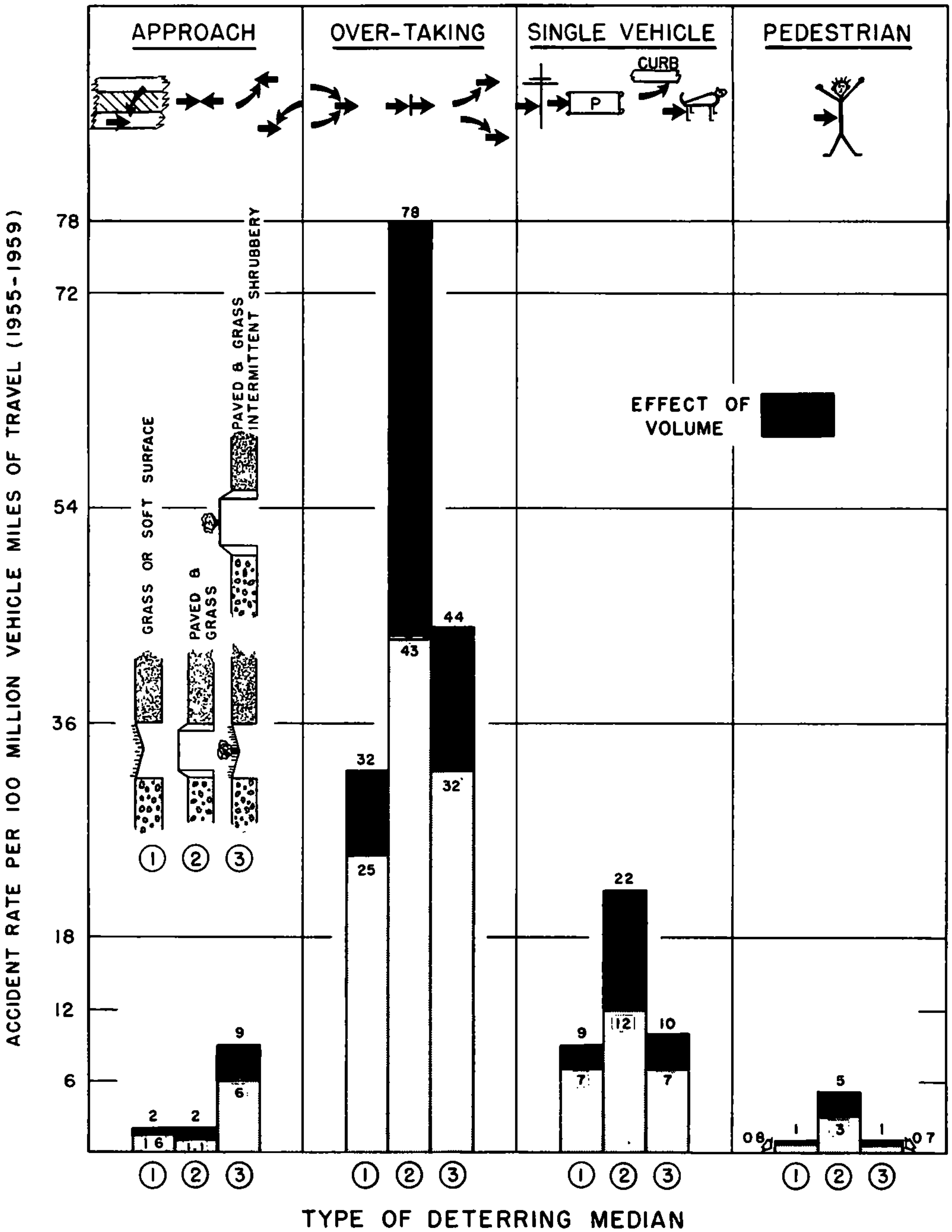


Figure 5. All accident occurrence between intersections on multilane highways with deterring-type median by type of accident.

It is interesting to note that the frequency of the overtaking type of accident for all accidents, subgroup concrete posts (Table 2), and that for injuries for the concrete posts (Table 4) were the same (108). In other words, there was an average of one person injured in each overtaking accident involving the concrete posts positive median. Also, the frequency of total injury accidents (70) from Table 3 for the concrete posts was higher than that for any of the other medians in the non-traversable type.

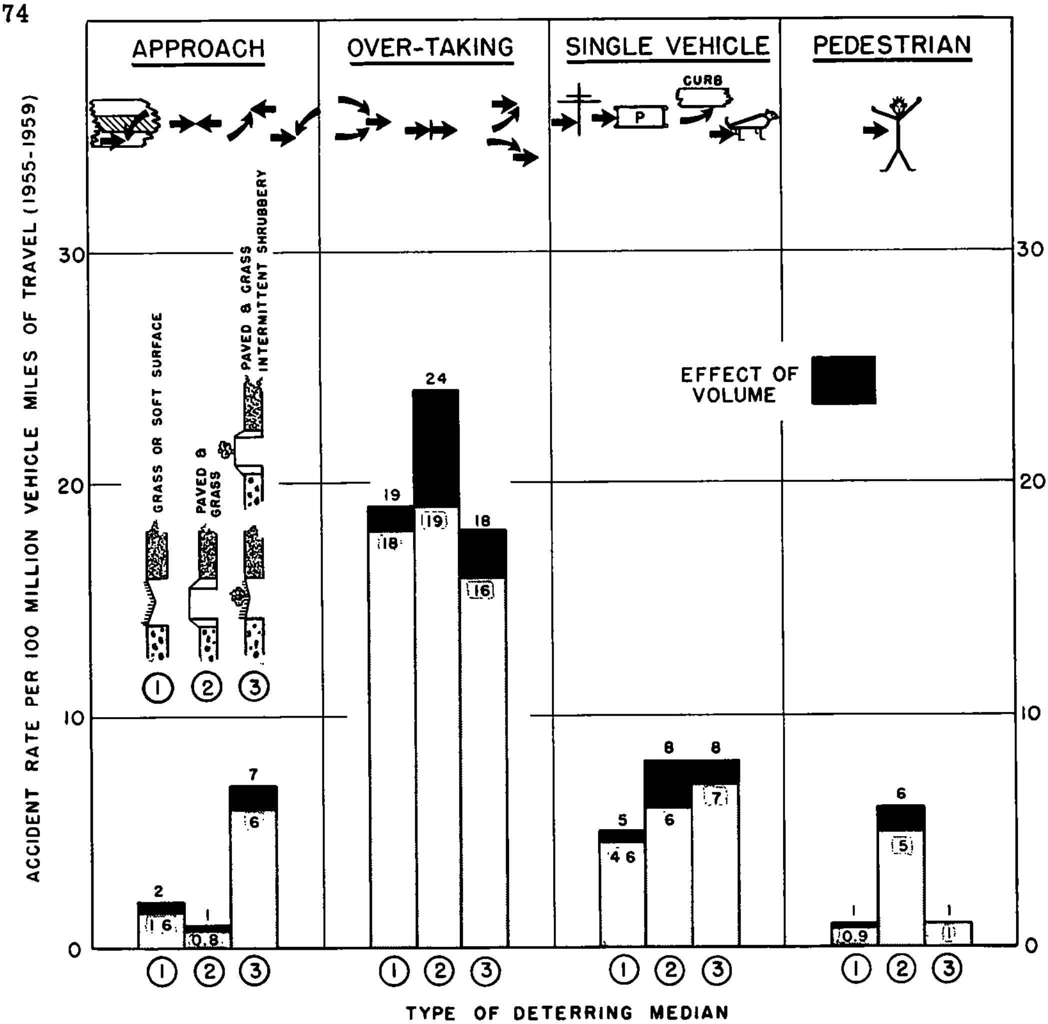


Figure 6. Injury accident occurrence between intersections on multilane highways with deterring-type median by type of accident.

One of the customary yardsticks of accident analysis is the fatality rate per 100 MVM. From Table 4 it will be seen the number of fatalities recorded in this study are too few for meaningful analysis based on the criterion of minimum 10 events. On the other hand, when these fatality rates, of 0.59 based on a 100 percent reporting over a 5-yr period, are compared with the 1959 statewide fatality rates of 4.9, the significance of the divided highway becomes apparent.

It should be remembered that these data are for a volume range from 4,000 to 44,000 vehicles per day and that the effect of volume on injury accident rates for the deterring type can be considered as negligible (Fig. 3). Also, for the non-traversable-type concrete posts the daily volume was about 22,000 and for the double guide rail on the Long Island Expressway it was about 85,000 vehicles. It is perhaps worthy to note that the index of severity for the non-traversable type was about 80 percent (92 vs 51) higher than that for the deterring type.

To further evaluate the operational characteristics of the 10-ft median with and without concrete posts, the following comparison is made. It should be noted that in this comparison all variables are the same with the exception of the concrete posts and the length of the two sections.

Comparison of Accident Rates[a] for the 10-Ft Wide Flush Grass Median With and Without Concrete Posts in the Median for Accidents Between Intersections

Median Type	Length (mi)	Traffic (mvm)[b]	Pers. Injury Accident No.	Rate[b]	Inj.	Rate[b]	Prop. Dam. Accid. No.	Rate[b]	All Accid. No.	Rate[b]
With conc. posts	3.3	132	93	70	142	108	91	68	184	139
W/out conc. posts	7.2	289	143	49	155	54	67	23	210	73

[a]Occurrences per 10^8 vehicle-miles of travel.
[b]Million vehicle-miles.

The all accident rate with concrete posts is about twice that without concrete posts. The property damage frequency of occurrence is about three times higher and the index of severity is double.

Accidents Involving the Median

A breakdown of accidents involving the median is given in Table 5 for the various median types. It would be expected that the deterring-type medians would have the greater cross median accident rate. However, in this study the rate for the non-traversable type

TABLE 3

ACCIDENT PATTERN AND RATES BY TYPE OF MEDIAN FOR INJURY ACCIDENTS BETWEEN INTERSECTIONS

Type of Median	No. All Accidents	Accident Rates Per 100 MVM of Travel: Approach	Overtaking	Single Vehicle	Pedestrian	Other	Total
Deterring							
Earth	250	2	19	5	1	1	28
Curbed	316	1[a]	24	8	6	2	40
Miscellaneous features	31	7[a]	18	8[a]	1[a]	1[a]	35
Subtotal	597	2	21	6	3	2	34
Non-Traversable							
Double guide rail	20	0[a]	12	4[a]	0[a]	0[a]	16
Concrete posts	93	4[a]	55	7	4[a]	1[a]	70
Single guide rail	5	0[a]	38[a]	26[a]	0[a]	0[a]	64[a]
Guide rail and ditch	2	20[a]	0[a]	0[a]	0[a]	0[a]	20[a]
Subtotal	120	3	33	6	2	0.4	43
Total	717	2	23	6	3	1	35

[a]Number of accidents less than 10 for period of study

TABLE 4

FATALITIES AND INJURY RATES BY TYPE OF MEDIAN FOR ACCIDENTS BETWEEN INTERSECTIONS

Type of Median	No. All Accidents: Injury	Fatalities	Accident Rates Per 100 MVM of Travel: Injury Accidents	Injuries	Fatalities
Deterring					
Earth	250	6	28	47	0.67[a]
Curbed	316	3	40	55	0.38[a]
Miscellaneous features	31	1	35	47	1.14[a]
Subtotal	597	10	34	51	0.57
Non-Traversable					
Double guide rail	20	0	16	79	0[a]
Concrete posts	93	2	70	108	1.51[a]
Single guide rail	5	0	64[a]	77[a]	0[a]
Guide rail and ditch	2	0	20[a]	61[a]	0[a]
Subtotal	120	2	43	92	0.72[a]
Total	717	12	35	56	0.59

[a]Number of accidents less than 10 for period of study

was four and less than two for the deterring. Even the frequency of all accidents involving the median was higher (4.7 vs 2.4) for the non-traversable type than the deterring.

TABLE 5

ACCIDENTS INVOLVING THE MEDIAN

Type of Median	MVM	All Cross Median Accidents No	All Cross Median Accidents Rate 100 MVM	All Median Accidents No	All Median Accidents Rate 100 MVM	All Accidents between Intersections No	All Accidents between Intersections Rate 100 MVM	Ratio Median Accidents to Accidents between Intersections	Ratio Cross Median Accidents to All Median Accidents
Deterring									
Earth	893.1	14	1.6	17	1.9	406	45	1 to 24	4 to 5
Curbed	780.7	12	1.5	19	2.4	860	109	1 to 45	3 to 5
Miscellaneous features	87.9	6	6.8	6	6.8	58	64	1 to 10	1 to 1
Subtotal	1,761.7	32[a]	1.8	42	2.4	1,324	75	1 to 32	3 to 4
Non-Traversable									
Double guide rail	127.1	2	1.6	2	1.6	35	28	1 to 17	1 to 1
Concrete posts	132.4	6	4.5	8	6.0	184	138	1 to 23	3 to 4
Single guide rail	7.8	1	12.8	1	12.8	5	64	1 to 5	1 to 1
Guide rail and ditch	9.8	2	20.4	2	20.4	4	41	1 to 2	1 to 1
Subtotal	277.1	11[b]	4.0	13	4.7	228	82	1 to 18	8 to 10
Total	2,038.8	43	2.1	55	2.7	1,652	76	1 to 29	8 to 10

[a]6 of 14, 9 of 12 and 6 of 6 for the 3 groups, respectively, were head-on collisions
[b]All head-on collisions

It is interesting to note the curbed median had the lowest ratio (1 to 45) of median accidents to accidents between intersections, whereas this ratio for the earth median was about twice that of the curbed median. This can be expected because it is well known that many vehicles enter upon the earth median to avoid having a serious accident, whereas the curbed median confines traffic to the pavement lanes and accidents cannot be avoided. This data presents an anomaly wherein the lowest ratio indicates the highest accident occurrence. A comparison of the accident ratio of 45 for the earth median with 109 for the curbed median confirms this.

For the non-traversable type the ratio of median accidents to accidents between intersections was somewhat greater (1 to 18) than that for the deterring type, whereas it appeared that almost all of the median accidents were cross median. It is also to be noted that 21 of the 32 cross median accidents for the deterring type were head-on collisions, whereas for the non-traversable type the 11 cross median accidents for the period of study were all head-on collisions.

Nighttime Accident Rates for Deterring Curbed Medians Lighted vs Unlighted

An attempt was made to evaluated the effect of illumination on night accident rates for the various types of medians. However, the data would only support an analysis for the curbed deterring type of median. These detailed data for six of the curbed median study sections are given in Table 6.

TABLE 6

COMPARISON OF DAYTIME AND NIGHTTIME ACCIDENT RATES FOR ILLUMINATED HIGHWAYS WITH CURBED MEDIANS

Study Section No	Length (mi)	No Inter-sections	Median width (ft)	Length of study (yr)	Travel MVM Day	Travel MVM Night	No Accidents Between Intersections: Day Fatal	Day PI	Day PD	Day Total	Night Fatal	Night PI	Night PD	Night Total	Total Rates Day	Total Rates Night	Accidents at Intersections No Day	No Night	Rates[a] Day	Rates[a] Night
(a) Illuminated																				
8	1.3	7	40	4.5	37.2	12.4	0	1	1	2	0	1	4	5	5	40	74	33	29	38
27	1.1	13	8	5.0	20.5	6.6	0	1	6	7	0	1	5	6	34	91	228	67	84	78
30	0.7	10	6	3.0	8.0	2.6	0	0	0	0	0	0	2	2	0	77	16	8	20	31
Subtotal	3.1	30	–	4.1[b]	66.0	21.6	0	2	7	9	0	2	11	13	14	60	318	108	18	18
(b) Non-Illuminated																				
17	1.2	8	30	5.0	12.3	4.1	0	8	5	13	0	5	0	5	106	122	13	11	13	34
18	1.1	2	4	2.5	12.2	4.1	0	0	0	0	0	0	0	0	0	0	22	7	90	85
26	0.8	12	6	2.0	6.8	2.3	0	3	2	5	0	1	0	1	74	43	7	9	9	33
Subtotal	3.1	22	–	3.3[b]	31.3	10.5	0	11	7	18	0	6	0	6	58	57	42	27	6	12
Total	6.2	52	–	3.6[b]	97.3	32.1	0	13	14	27	0	8	11	19	28	59	358	135	7	8

[a]Rate for travel per 10^8 vehicle-miles in direction of study per intersection
[b]Average

It will be noted that the total number of accidents between intersections for both day and night on the illuminated sections is small but meets the requirement of ten accidents for complete analysis. Also, the nearly four years of experience provides stabilization of the accident occurrence. Likewise, for the non-illuminated sections, the total of six night accidents and the some three years of experience must be weighed in the interpretation.

These data indicate that the total night accident rate for the illuminated sections of curbed deterring medians is about four times that during the day, whereas for the non-illuminated sections the day and night total accident rates are about the same and are of the same frequency as the night rate at the illuminated sections. From this sample it cannot be said that highway lighting reduces accident rates between intersections on multilane highways with curbed medians.

Looking at the data for accidents at intersections, it is apparent that nighttime illumination reduces the accident frequency to that of daylight. This effect is further emphasized by a comparison of the night and day rates at non-illuminated intersections which is in the ratio of 2 to 1.

Other Analyses

It can be seen that the variety of data collected supports the analysis of many other factors than those related to medians. For instance, in Table 7, the accident data has been arranged to show the yearly trend of accident rate between intersections and at intersections. These data show that the rates of occurrence of injury accidents for

TABLE 7

INJURY ACCIDENTS ALL SITES BY YEAR

	Non-Intersectional Total		Intersectional Total		
Year	No.	Rate[a]	No.	Rate[b]	MVM
1955	74	34	340	0.2358	221.8
1956	130	44	455	0.2352	297.6
1957	109	31	543	0.2343	356.5
1958	173	36	723	0.2318	479.9
1959	219	33	773	0.1767	673.0
Total	705	35	2,834	0.2139	2,038.8

[a]Rate per 100 MVM.
[b]Accidents per year per double intersection (both directions on Expressway) per MVM.

accidents between intersections, as well as accidents at intersections, did not vary significantly from year to year.

Table 8 indicates the accident pattern for the period of study by route including the frequency of accidents between intersections and at the intersections. This type of information may be of interest locally for comparative purposes and is an indication of where the need for enforcement and education is most urgent for the system studied.

Other analyses that are applicable from these data—not included in the study—are available to interested agencies from the New York State Department of Public Works.

TABLE 8

ROUTE ACCIDENT PATTERN FOR PERIOD OF STUDY

Route No	Length (mi)	Control Sections	Day and Night	Accidents Between Intersection Per 100 MVM: Fatal No	Fatal Rate	Injury No	Injury Rate	Property No	Property Rate	Total No	Total Rate	Accidents at Intersection: Fatal	Injury	Property Damage	Total	All Accidents: Fatal	Injury	Property Damage	Total	For Period of Study: Average AADT	Total MVM
24-A	5 7	1	Day	0	0	37	43	48	55	85	98	0	195	143	338	0	232	191	423	27,400	87 0
			Night	0	0	26	30	43	49	69	79	0	124	94	218	0	150	137	287		
			Total	0	0	63	73	91	104	154	177	0	319	237	556	0	382	328	710		
25-B	3 2	2, 3	Day	0	0	28	25	33	30	61	55	1	277	243	521	1	305	276	582	18,050	111 7
			Night	1	1	9	8	16	14	26	23	3	149	113	265	4	158	129	291		
			Total	1	1	37	33	49	44	87	78	4	426	356	786	5	463	405	873		
27-West	8 3	4, 5, 6	Day	1	0 3	82	22	182	49	265	71	5	479	1,144	1,628	6	561	1,326	1,893	28,996	371 5
		7, 8, 9	Night	1	0 3	75	20	127	34	203	55	7	318	610	935	8	393	737	1,138		
		10	Total	2	0 6	157	42	309	83	468	126	12	797	1,754	2,563	14	954	2,063	3,031		
27-East	19 0	11, 12	Day	1	0 2	161	25	125	19	287	45	5	470	395	870	6	631	520	1,157	17,018	642 0
		13	Night	4	0 6	115	18	63	10	182	28	7	241	185	433	11	356	248	615		
			Total	5	0 8	276	43	188	29	469	73	12	711	580	1,303	17	987	768	1,772		
107	2 4	14, 15	Day	1	0 2	6	10	11	18	18	29	1	8	13	22	2	14	24	40	14,070	61 2
			Night	0	0	11	18	12	20	23	38	0	5	4	9	0	16	16	32		
			Total	1	0 2	17	28	23	38	41	67	1	13	17	31	2	30	40	72		
109	3 2	16, 17	Day	0	0	20	31	19	30	39	61	0	49	60	109	0	69	79	148	10,270	64 1
			Night	0	0	13	20	5	8	18	28	2	49	44	95	2	62	49	113		
			Total	0	0	33	51	24	38	57	89	2	98	104	204	2	131	128	261		
110	8 1	18, 19, 20, 21,	Day	0	0	13	12	6	5	19	17	0	56	28	84	0	69	34	103	12,520	110 4
		22	Night	2	2	14	13	6	5	22	20	2	37	20	59	4	51	26	81		
			Total	2	2	27	25	12	10	41	37	2	93	48	143	4	120	60	184		
115	1 8	23, 24	Day	0	0	11	13	15	18	26	31	0	66	56	122	0	77	71	148	18,691	82 6
			Night	0	0	6	7	5	6	11	13	0	36	24	60	0	42	29	71		
			Total	0	0	17	20	20	24	37	44	0	102	80	182	0	119	100	219		
Long Island Express-way	4 3	25	Day	0	0	8	6	8	6	16	13	0	1	0	1	0	9	8	17	85,000	127 1
			Night	0	0	12	10	7	6	19	15	0	0	0	0	0	12	7	19		
			Total	0	0	20	16	15	12	35	28	0	1	0	1	0	21	15	36		
CR-1	0 8	26	Day	0	0	3	33	2	22	5	55	0	2	5	7	0	5	7	12	15,600	9 1
			Night	0	0	1	11	0	0	1	11	0	4	5	9	0	5	5	10		
			Total	0	0	4	44	2	22	6	66	0	6	10	16	0	10	12	22		
CR2-1	1 1	27	Day	0	0	1	3	6	19	7	22	0	68	158	226	0	69	164	233	13,067	31 4
			Night	0	0	1	3	5	16	6	19	2	31	34	67	2	32	39	73		
			Total	0	0	2	6	11	35	13	41	2	99	192	293	2	101	203	306		
CR-2	3 8	28, 29	Day	0	0	10	16	25	39	35	54	0	31	118	149	0	41	143	184	15,326	64 5
		30, 31	Night	0	0	12	19	34	53	46	71	0	13	40	53	0	25	74	99		
			Total	0	0	22	35	59	92	81	125	0	44	158	202	0	66	217	283		
CR-76	14 0	32, 33	Day	0	0	17	11	11	7	28	18	0	48	91	139	0	65	102	167	8,455	157 6
			Night	0	0	6	4	20	13	26	16	1	21	38	60	1	27	58	86		
			Total	0	0	23	15	31	20	54	34	1	69	129	199	1	92	160	253		
CR-80	5 2	34	Day	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	2	4,160	39 5
			Night	1	3	0	0	0	0	1	3	2	0	2	4	3	0	2	5		
			Total	1	3	0	0	0	0	1	3	2	0	4	6	3	0	4	7		
CR-85	5 3	35	Day	0	0	0	0	0	0	0	0	2	32	55	89	2	32	55	89	10,225	79 1
			Night	0	0	7	9	1	1	8	10	2	24	28	54	2	31	29	62		
			Total	0	0	7	9	1	1	8	10	4	56	83	143	4	63	84	151		
All																				19,923	2,038 8
Day				3	0 15	397	19 47	491	24 08	891	43 70	14	1,782	2,511	4,307	17	2,179	3,002	5,198		
Night				9	0 44	308	15 11	344	16 87	661	32 42	28	1,052	1,241	2,321	37	1,360	1,585	2,982		
Total	85 1			12	0 59	705	34 58	835	40 95	1,552	76 12	42	2,834	3,752	6,628	54	3,539	4,587	8,180		

SUMMARY OF RESULTS

The results of this investigation of the effect of median design on accident rates for divided urban highways carrying traffic volumes up to 44,000 vehicles per day and having unrestricted roadside access are summarized as follows:

1. There appears to be no correlation between accident rates and width of deterring-type medians between intersections.
2. Accident rates increased linearly with traffic volumes for deterring types of medians between intersections.
3. The overtaking type of accident accounted for more than 70 percent of the accidents between intersections for both deterring and non-traversable types of median. In the deterring-type median, the grass flush median had the lowest rate for all accidents between intersections and the curbed-type median, the highest rate.
4. On highways with deterring curbed medians and without illumination, the night intersection accident rate is twice that of the day rate, whereas on highways with illumination, the night and day rates are the same. On these highways, illumination apparently has no effect in accident rate reduction between intersections.
5. Medians with double beam rails had the lowest all accident and injury accident rates followed by the earth and curbed medians. Medians with concrete posts had the highest accident rates.
6. On highways having the deterring-type median, the curbed median section has nearly 2½ times the accident ratio of the earth median section for all accidents between intersections.

REFERENCES

1. California, Median Accident Study (1958).
2. Telford, E. T., and Israel, R. J., "Median Study." HRB Proc., 32:208-231 (1953).
3. Hurd, F. W., "Accident Experience with Traversable Medians of Different Widths." HRB Bull. 137, 18-26 (1956).
4. The Federal Role in Highway Safety, U. S. Department of Commerce Report to Congress, pp. 57, 74. U. S. Gov't. Printing Office (Feb. 1959).