THE EFFECT OF FREEWAY MEDIANS ON TRAFFIC BEHAVIOR

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Synopsis

This paper presents a portion of the material developed during a series of traffic behavior studies conducted on freeways in Texas. The research was conducted by the Texas Transportation Institute for the Texas Highway Department and was designed to obtain data which would be useful in evaluating freeway median design.

The field studies utilized the Bureau of Public Roads' electronic traffic behavior equipment which permitted the recording of data on volume, speed and vehicle placement for each of several freeway lanes. Studies were made on six different sections of freeways located in Houston, Dallas, and Fort Worth, Texas. Approximately 50,000 observations were analysed.

Statistical analyses were made to determine the effect of various types of median designs on traffic behavior. Vehicle placements were used as a criterion of traffic behavior and the variations in these placements were compared for various median designs.

Studies were also made before and after the erection of a barrier fence on the 4-foot median of the Gulf Freeway in Houston to determine the effect of this fence on traffic behavior. This study utilized data obtained by use of the Bureau of Public Roads' equipment and from motion picture studies conducted by the Texas Transportation Institute.

The analysis of the data indicated that average vehicle placements did not vary greatly, but that different type and width medians had some effect on traffic behavior. The wider medians reduced the effects of opposing flows and high volumes.

Introduction

Numerous types of medians, differing in width and in design, have been used on existing highways in Texas and throughout the country. Although various median studies have been performed in recent years, additional information regarding the effect of freeway median design on traffic behavior was felt to be of value. The purpose of this study was to develop additional knowledge of this type.

Volume, speed, and placement data were recorded as a possible criterion of median effect on traffic behavior. These data were obtained from a number of traffic behavior studies conducted by the Bureau of Public Roads and from motion picture studies performed by personnel of the Texas Transportation Institute.

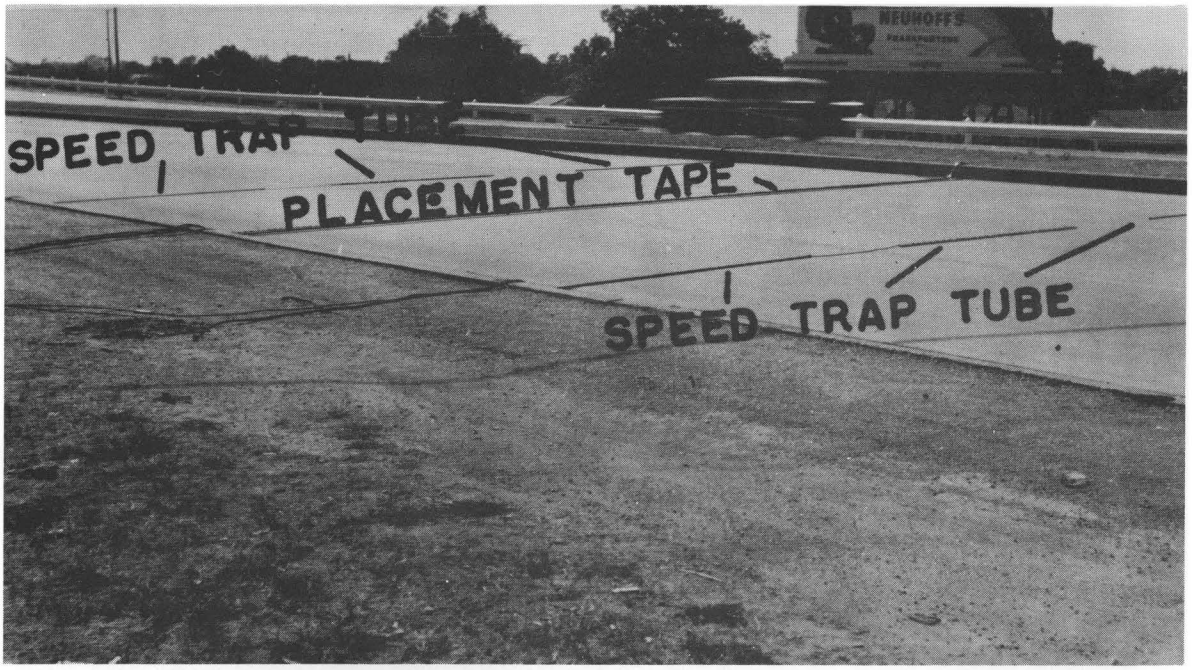
The field studies utilized the Bureau of Public Roads' electronic traffic analyzer equipment. Mr. A. Taragin of the Bureau of Public Roads supervised the installation and operation of the equipment. Personnel of the Bureau of Public Roads and of the Texas Highway Department conducted the surveys.

Segmented placement tubes and air impulse speed tubes were placed across the pavement as shown in Figure 1. These tubes transmitted impulses to the electronic recording equipment housed in a special truck which was concealed from the motorists as shown in Figure 2. A speed meter, decimal timer, and four coding machines capable of handling any four traffic lanes were used to record time of passing, speed and placement data on each vehicle. These data were placed on punch cards and high-speed electronic computers were used in the analyses.

For this study, six different sections of freeways located in or near Houston, Dallas, and Fort Worth, Texas were selected to provide data on various designs of medians presently being used on freeways in Texas. The different types of medians studied (Figures 3 and 4) ranged from a 4-foot concrete median to a 40-foot grassed median.

The studies performed are listed below with a brief description of median type for each study:

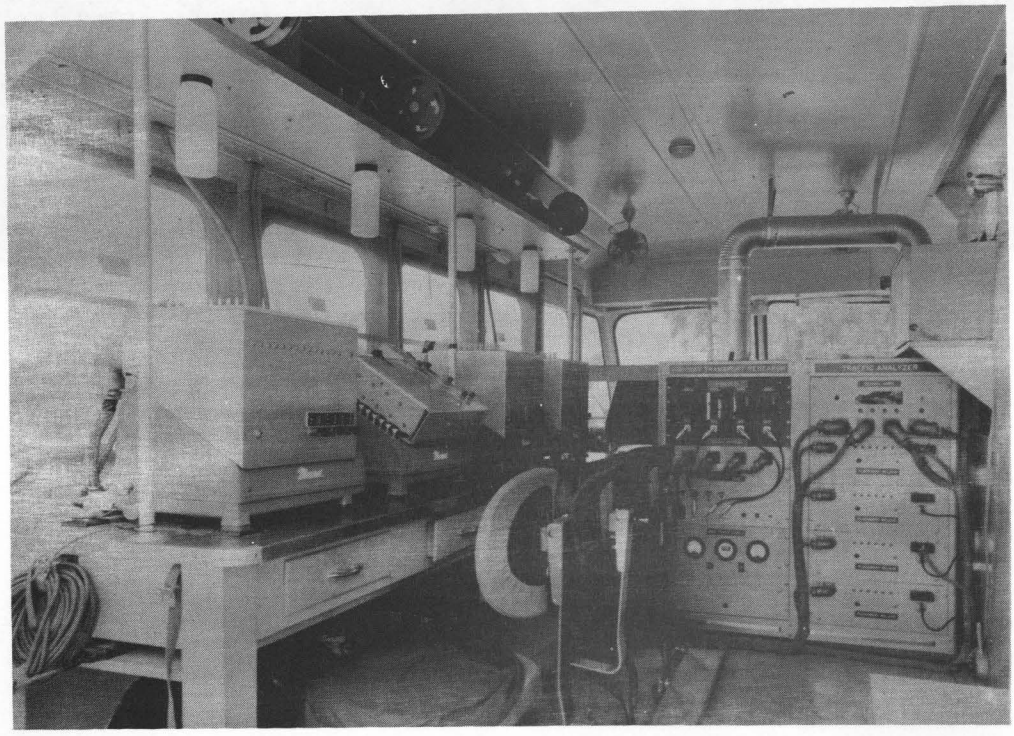
Study	Location	Date		Median Type	Fig. No.
00	Houston - Gulf Freeway	May, 1958	4'	concrete with barrier curb	4A
01	Fort Worth - East West Freeway	July, 1957	12'	asphalt with concrete barrier curb	3A
03	Dallas-Central Expressway	July, 1957	12'	concrete with mountable curb	3B
04	Dallas-Central Expressway	July, 1957	27'	grassed with mountable	3C
05	Dallas - U. S. 80 (Rural)	July, 1957	40'	grassed, no curb	3D
07	Houston - Gulf Freeway	July, 1957	4'	concrete with barrier curb & barrier fence	4B
08	Houston - Eastex Freeway	July, 1957	4'	concrete with concrete barrier	4C



SPEED TRAP TUBES AND PLACEMENT TAPES
BUREAU OF PUBLIC ROADS STUDY

FIGURE 1

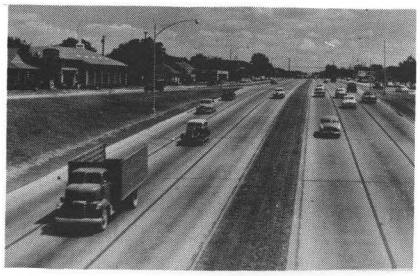
A. MOBILE TRAFFIC ANALYZER



B. INTERIOR OF MOBILE TRAFFIC ANALYZER

FIGURE 2

MEDIAN SECTIONS AND TYPICAL STUDY SITES



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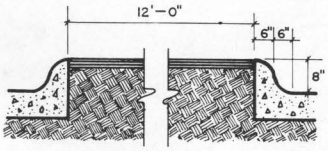
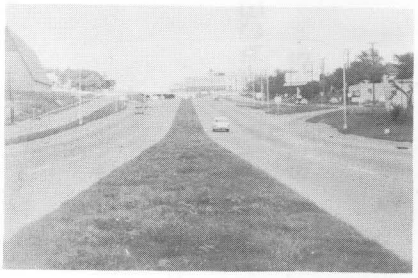


STUDY 04

DALLAS - CENTRAL EXPRESSWAY



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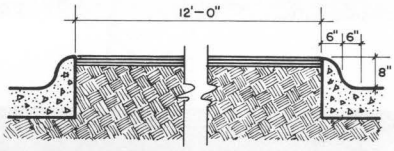
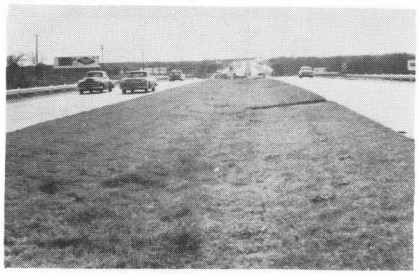


STUDY 01

FORT WORTH - EAST WEST FREEWAY



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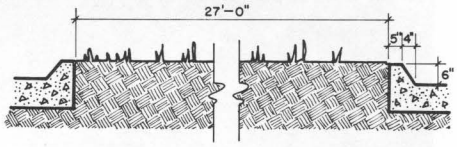
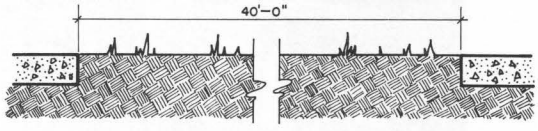


STUDY 03

DALLAS - CENTRAL EXPRESSWAY

D



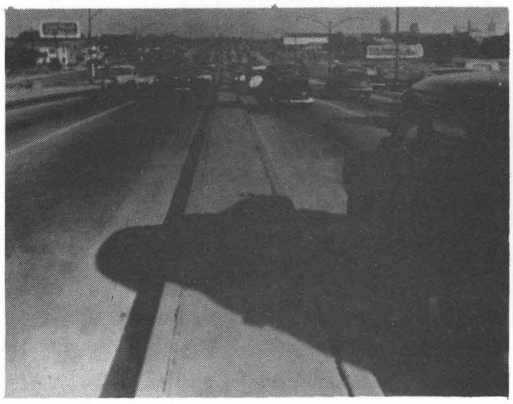
STUDY 05

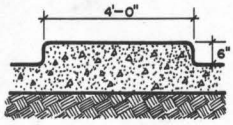
DALLAS - U.S. 80

FIGURE 3

MEDIAN SECTIONS AND TYPICAL STUDY SITES

A

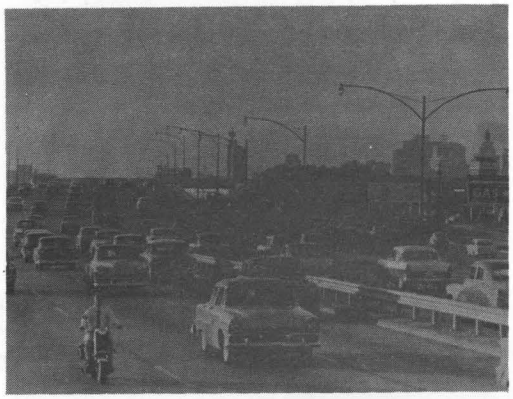


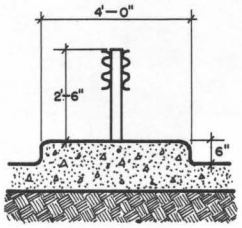


STUDY 00

HOUSTON – GULF FREEWAY

B

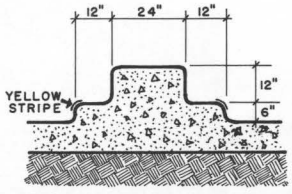




STUDY 07

HOUSTON – GULF FREEWAY

C



STUDY 08

HOUSTON – EASTEX FREEWAY

FIGURE 4

VARIATION IN AVERAGE PLACEMENT
ALL DAYTIME STUDIES

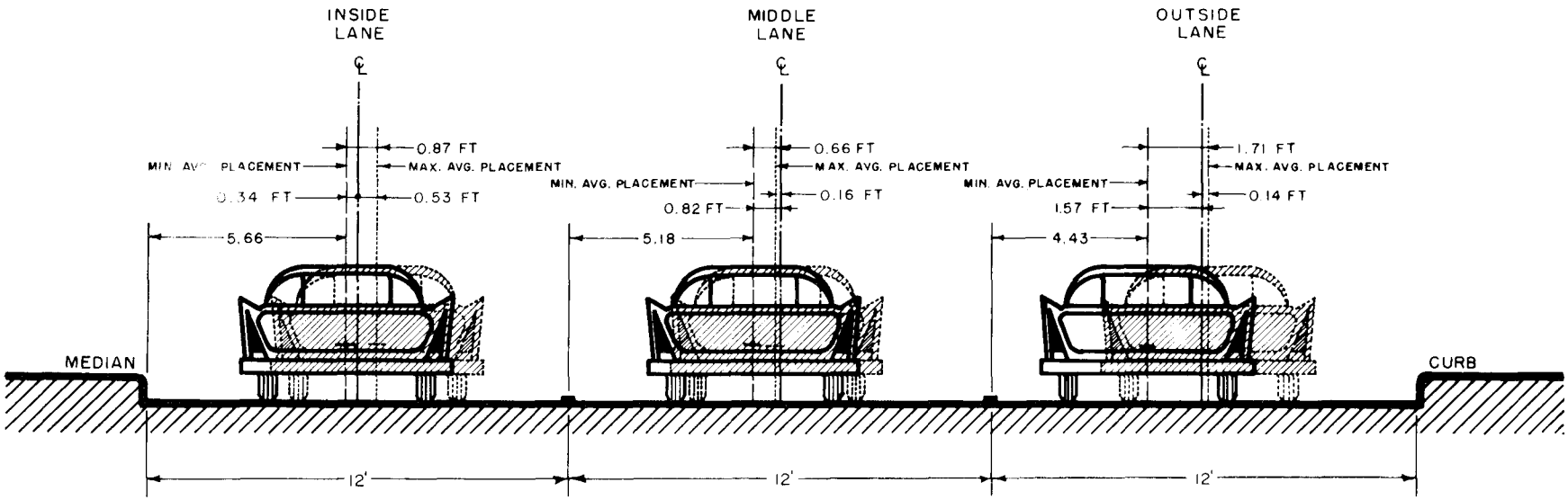


FIGURE 5

VARIATION IN AVERAGE PLACEMENT

ALL NIGHT STUDIES

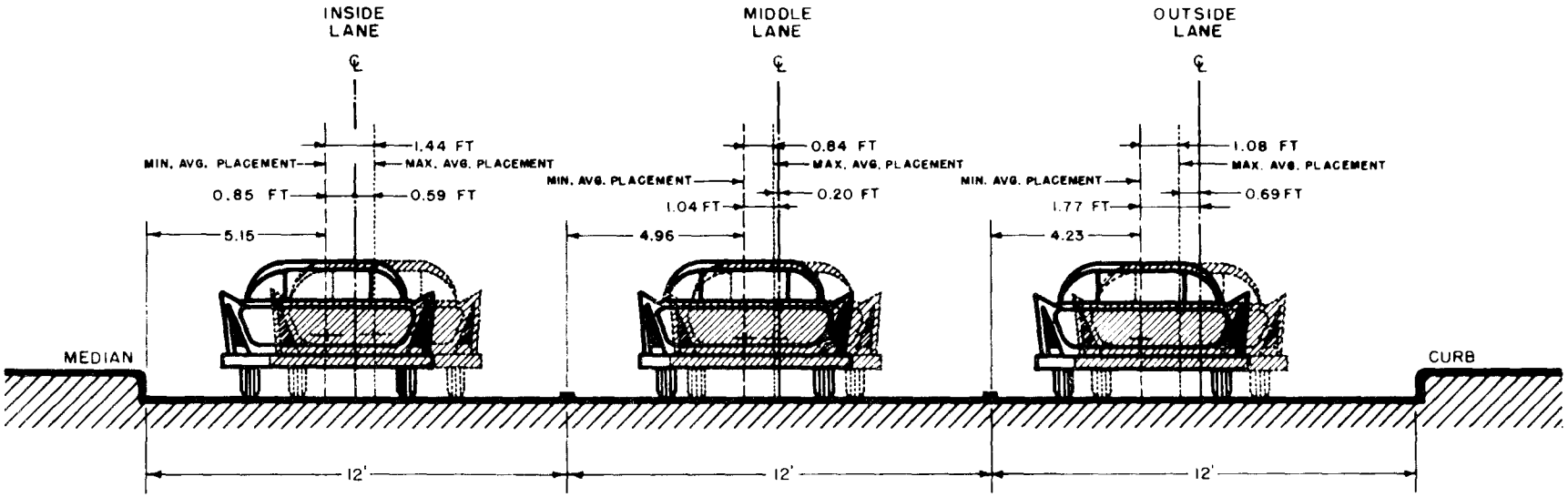


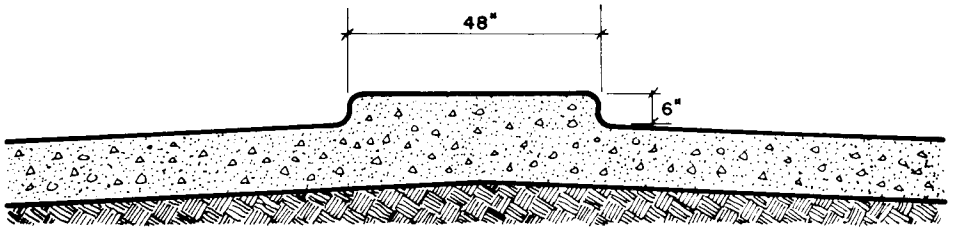
FIGURE 6

AVERAGE VEHICLE PLACEMENTS
ALL B.P.R. STUDIES

	DAY			NIGHT			STUDY NUMBER
	INSIDE LANE	MIDDLE LANE	OUTSIDE LANE	INSIDE LANE	MIDDLE LANE	OUTSIDE LANE	
AVG. PLACEMENT	5.86	5.18	4.87	5.85	4.96	4.23	STUDY 00
NUMBER VEHICLES	5145	6323	3769	1163	2094	1196	4' MEDIAN
AVG. PLACEMENT	6.26	5.66	4.43	6.52	5.80	4.50	STUDY 01
NUMBER VEHICLES	1924	2438	2576	94	688	120	12' MEDIAN
AVG. PLACEMENT	6.00	—	5.23	6.19	—	5.06	STUDY 03
NUMBER VEHICLES	1287	—	1368	152	—	264	27' MEDIAN
AVG. PLACEMENT	5.66	5.38	5.10	5.15	5.35	4.83	STUDY 04
NUMBER VEHICLES	4184	4859	1242	290	793	485	12' MEDIAN
AVG. PLACEMENT	6.19	—	6.14	6.59	—	5.31	STUDY 05
NUMBER VEHICLES	433	—	1142	36	—	221	40' MEDIAN
AVG. PLACEMENT	6.53	5.84	5.38	6.23	5.51	5.05	STUDY 08
NUMBER VEHICLES	676	616	528	98	661	103	4' MEDIAN
PLACEMENT MEASURED FROM LEFT LANE LINE							

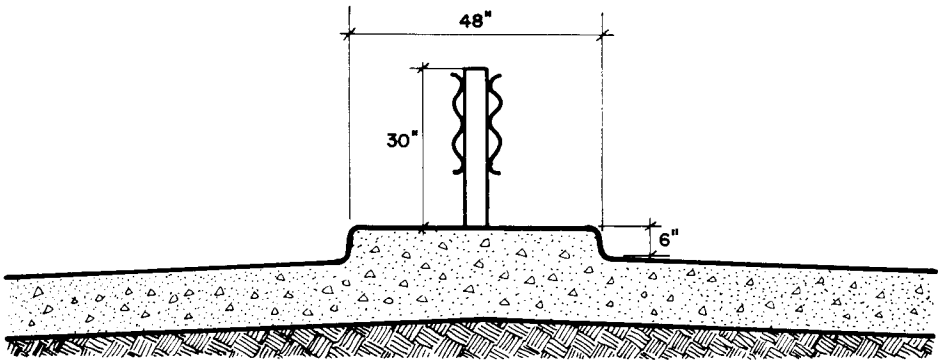
TABLE I

MEDIAN SECTIONS
GULF FREEWAY HOUSTON



SECTION BEFORE CONSTRUCTION OF
BARRIER FENCE

STUDY 00



SECTION AFTER CONSTRUCTION OF
BARRIER FENCE

STUDY 07

FIGURE 7

B.P.R. STUDY SITE

GULF FREEWAY
HOUSTON, TEXAS

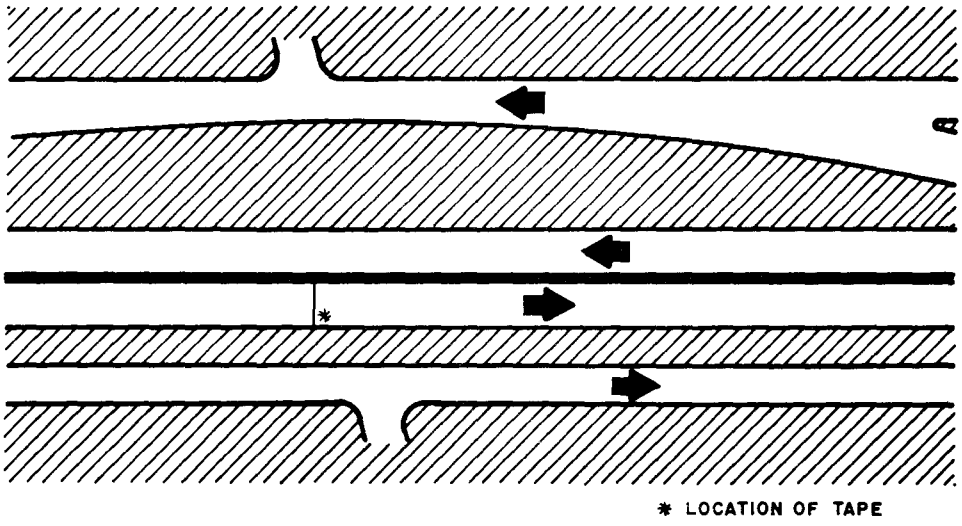


FIGURE 8

MOTION PICTURE STUDY SITE

GULF FREEWAY
HOUSTON, TEXAS

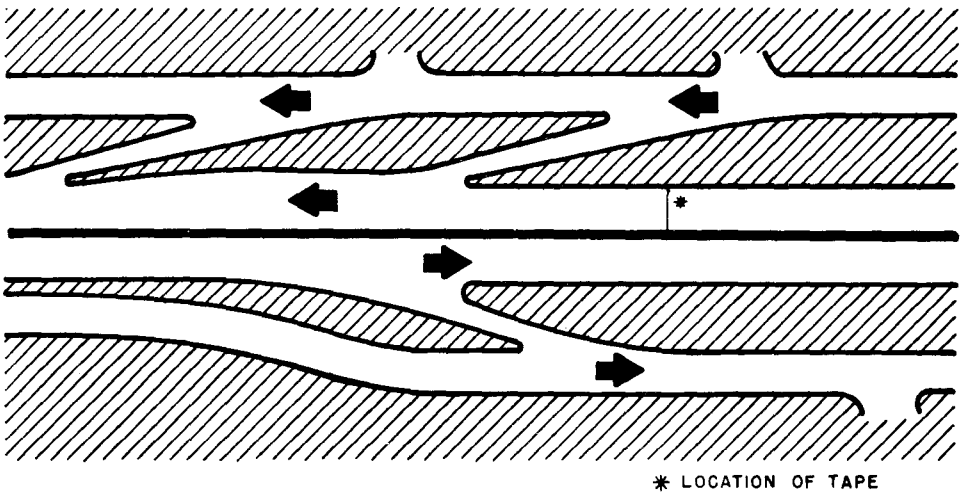


FIGURE 9

The daytime studies were conducted during the period of 7:00 A.M. to 7:00 P.M. and the night studies from 8:00 P.M. to 12:00 P.M. The data on speed, volume, and placement were tabulated by 6-minute periods for each hour.

Data on average vehicle placements for all Bureau of Public Roads studies are shown in Table 1. These data include only passenger vehicles and are subdivided by lane anddday-night tabulations. Placements were measured from the left lane line to the centerline of the vehicles.

The data shown in Table 1 represent a total of 46,968 observations of vehicle placements. The actual number of placement observations were greater than this but some data was involidated by inclement weather and by unusual traffic conditions on the freeways such as accidents, stalled vehicles, etc.

The maximum variations in average placements are shown in Figures 5 and 6. These data indicate that for all of the medians studied there was a relatively small amount of variation in average vehicle placement. The average placements for the inside and middle lanes were close to the centerline of the lane with the maximum difference being 0.85 feet for the inside lane and 0.82 feet for the middle lane during the daytime. The average placements in the outside lane were generally further to the left of the lane centerline and were more variable than the inside and middle placements.

Method of Study

Since the variations in average placements for the different type medians were relatively small, a statistical analysis was performed to study the variance of the data. With this type of analysis, it was possible to determine significant differences among the data and to infer possible conclusions from these differences. Two separate studies were made: a study to determine the effect of a barrier fence on traffic behavior and a general study to determine the effect of various width medians on traffic behavior.

After consideration of the data and the method of analysis it was decided to use only placement and volume data in the analysis. Since vehicle speeds were affected by such factors as volume, speed limits, type of area, enforcement level, etc. the application of speed data to statistical analysis was impractical in these studies. Data on average speeds are presented in Table 2 as an indication of the character of operation on each of the facilities.

Effect of Barrier Fence

During the median studies, a barrier fence as shown in Figure 7.was erected on the 4-foot median of the Gulf Freeway in Houston, Texas. Data taken before (study 00) and after (study 07) erection of this fence were analysed to determine the effect of the barrier fence on traffic behavior and accidents.

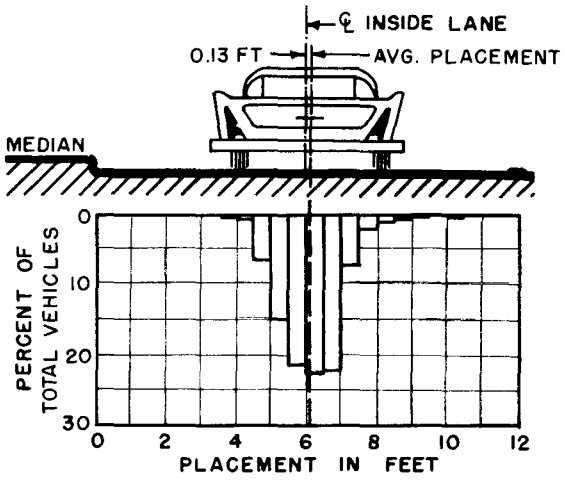
Accident Study

The principal purpose of the barrier fence was to reduce the number of serious accidents resulting from vehicles crossing the median and colliding head-on with traffic in the opposing lanes.

In order to investigate accident experience on the freeway as related to the barrier fence, accident data were collected for periods of two years before and

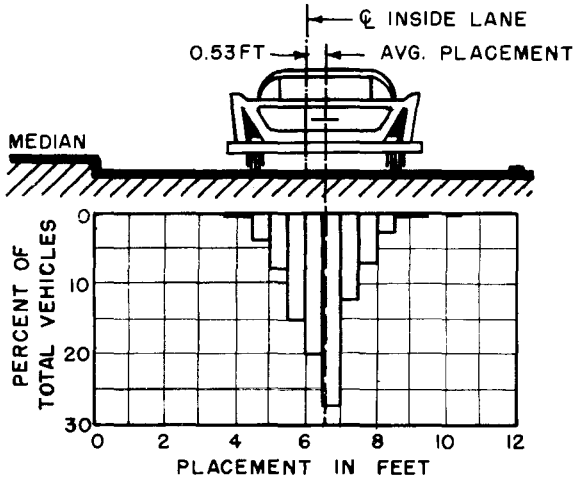
AVERAGE PLACEMENTS IN MEDIAN LANE

GULF FREEWAY



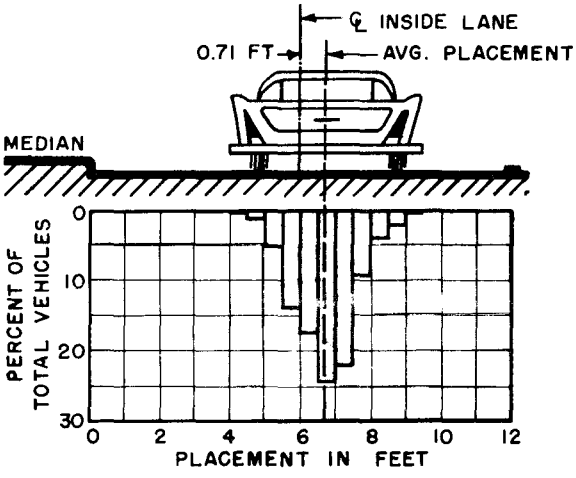
TIME
7:00 TO 8:30 AM

AVG. PLACEMENT FROM MEDIAN TO ℄ OF VEHICLE = 6.13'



TIME
9:00 TO 10:30 AM

AVG. PLACEMENT FROM MEDIAN TO ℄ OF VEHICLE = 6.53'

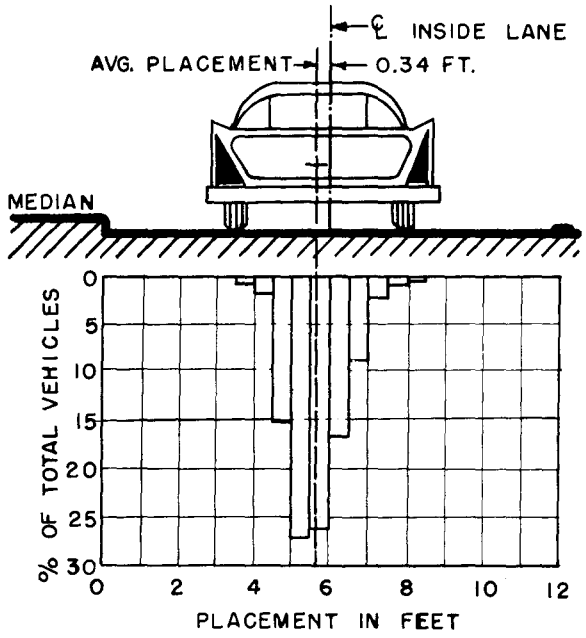


TIME
4:00 TO 5:30 PM

AVG. PLACEMENT FROM MEDIAN TO ℄ OF VEHICLE = 6.71'

FIGURE 10

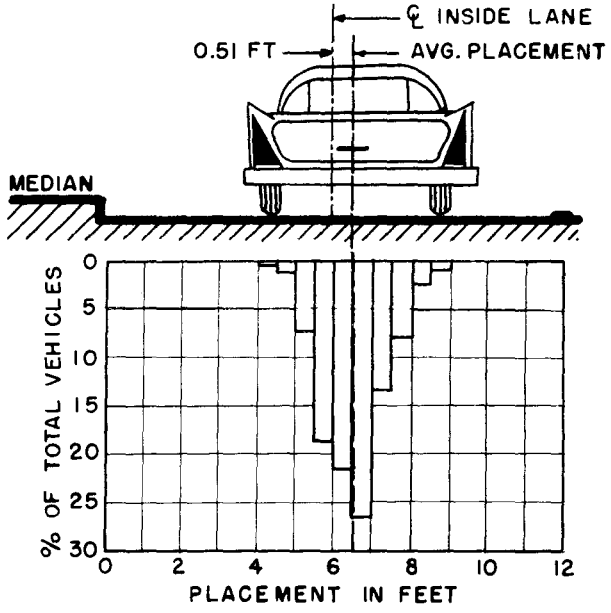
AVERAGE PLACEMENTS IN MEDIAN LANE
BEFORE BARRIER FENCE
GULF FREEWAY



MORNING PEAK
7:15 TO 7:30 AM

AVG. PLACEMENT
FROM MEDIAN TO
℄ OF VEHICLE = 5.66'

VARIANCE = 0.515



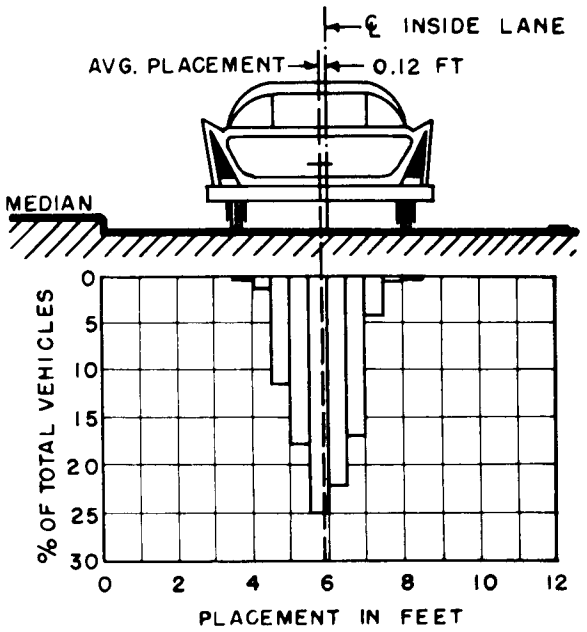
AFTERNOON PEAK
4:3[illegible] TO 4:46 PM

AVG. PLACEMENT
FROM MEDIAN TO
℄ OF VEHICLE = 6.51'

VARIANCE = 0.619

FIGURE 11

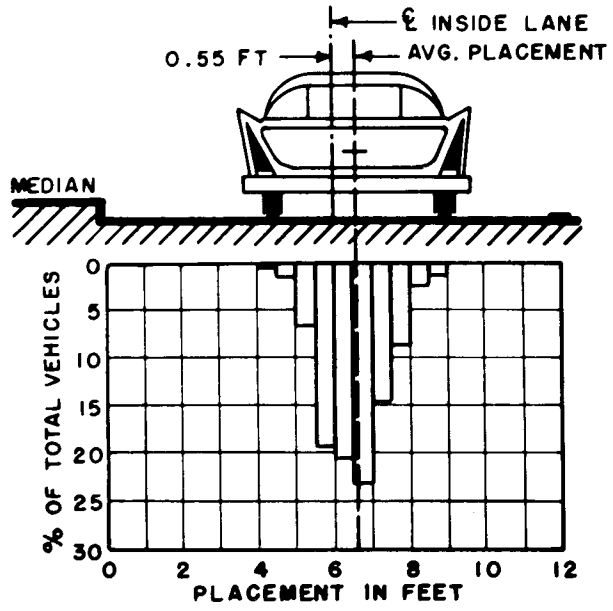
AVERAGE PLACEMENTS IN MEDIAN LANE
AFTER BARRIER FENCE
GULF FREEWAY



MORNING PEAK
7:25 TO 7:40 AM

AVG. PLACEMENT FROM MEDIAN TO ℄ OF VEHICLE = 5.88'

VARIANCE = 0.513



AFTERNOON PEAK
4:31 TO 4:46 PM

AVG. PLACEMENT FROM MEDIAN TO ℄ OF VEHICLE = 6.55'

VARIANCE = 0.700

FIGURE 12

Table 2

AVERAGE SPEEDS
INSIDE LANES - DAYTIME
B.P.R. SURVEYS

	Equivalent Vol. Levels 0 - 600	Equivalent Vol. Levels 600 - 1200	
Avg. Speed	48.8	48.8	Study 00
No. Vehicles	1017	2573	
Avg. Speed	54.4	49.5	Study 01
No. Vehicles	1761	202	
Avg. Speed	56.5	57.1	Study 03
No. Vehicles	1073	121	
Avg. Speed	48.7	47.7	Study 04
No. Vehicles	762	1132	
Avg. Speed	59.2	---	Study 05
No. Vehicles	509	---	
Avg. Speed	48.9	---	Study 08
No. Vehicles	718	---	

two years after the erection of the barrier fence.

The data were tabulated by total freeway accidents (accidents which occurred on the main freeway lanes and not including ramp and frontage road accidents) and by median accidents (accidents which involved the median). This data is shown in Table 3.

The data indicates that while the total accident rate per 100 million vehicle-miles increased (195.94 before to 232.93 after) the rate of the severe accidents decreased slightly (personal injury 26.33 before to 24.34 after and fatal 2.63 before to 2.01 after).

A study of the median accidents indicates that the median accident rate was only slightly reduced from 13.56 before to 11.71 after. The severity of the median accidents, however, appears to have been materially reduced. There were 4 fatal median accidents before compared with none after and 28 personal injury accidents involving the median before compared with 11 during the after period.

Table 3

ACCIDENT DATA GULF FREEWAY HOUSTON, TEXAS

1954 to 1958

A

Main-lane Freeway Accidents

Rate Per 100 Million Vehicle-Miles

	Before	After
Property Damage	166.98	206.58
Personal Injury	26.33	24.34
Fatal	2.63	2.01
All Accidents	195.94	232.93

B

Median Accidents

Number of Accidents

	Before	After
Property Damage	15	34
Personal Injury	28	11
Fatal	4	0
Total	47	45

C

Median Accident Rate

Per 100 Million Vehicle-Miles

	Before	After
All Accidents Involving Median	13.56	11.71

Table 4

ANALYSIS OF VARIANCE
BEFORE-AFTER STUDY OF BARRIER FENCE
B.P.R. SURVEYS

Source	df	Variance	F	df_1	df_2
T*	1	0.2620	4.2532	1	94
Error	94	0.0616			
Total	95				

T* Before (T_1) and After (T_2) without considering volume levels

Source	df	Variance	F	df_1	df_2
V*	2	0.3198	5.4948/	2	93
Error	93	0.0582			
Total	95				

V* Volume levels V_1 (0-600), V_2 (600-1200) without considering before and after conditions.

/ Significance at 95% level of confidence.

Source	df	Variance	F	df_1	df_2
T	1	0.0406	1.5675	1	29
Error	29	0.0259			
Total	30				

T Before and after considering only one level of traffic V_1 (0-600)

Source	df	Variance	F	df_1	df_2
T	1	1.0745	19.8613 ///		
Error	52	.0541			
Total	53				

T Before and after considering only one level of traffic V_2 (600-1200)

/// Significance at 0.999 level of confidence.

Table 5

ANALYSIS OF VARIANCE
BEFORE-AFTER STUDY OF BARRIER FENCE
MOTION PICTURE SURVEYS

Source	df	Variance	F	df_1	df_2
T*	1	0.1380	1.0144	79	1
Error	79	0.1400			
Total	80				

T* = Before and after without considering volume

Source	df	Variance	F	df_1	df_2
V*	2	1.4136	13.1742///		
Error	78	0.1073			
Total	80				

V* = Volume levels V_1 (0-6) V_2 (6-12) and V_3 (12-18) without considering before and after

/// = Significance at 999% level of confidence

Source	df	Variance	F	df_1	df_2
T	1	0.0994	2.1148		
Error	15	0.0470		1	15
Total	16				

T = After and before considering only one level of traffic V_1 (0-600)

Source	df	Variance	F	df_1	df_2
T	1	0.0035	41.5428	33	1
Error	33	0.1454			
Total	34				

T = After and before considering only one level of traffic V_2 (600-1200)

Source	df	Variance	F	df_1	df_2
T	1	0.1450	1.4963	1	27
Error	27	0.0969			
Total	28				

T = Before and after considering V_3

GENERAL MEDIAN STUDY TEST RESULTS

S		1	2	3	4	5	6
	V	V_1 V_2 V_3	V_1	V_1 V_2 V_3	V_1	V_2	V_3
	T	T_1 T_2	T_1 T_2	T_1	T_1	T_1	T_1
STUDY-00 THROUGH STUDY-08	S	+++	+++	+++	+++	+++	++
	V	+++		+++			
	T	NO SIGNIFICANCE	+				
STUDY-00 & STUDY-03	S_1	+++	+++	NO SIGNIFICANCE	NO SIGNIFICANCE	NO SIGNIFICANCE	NO DATA S-03
	V	NO SIGNIFICANCE		++			
	T	NO SIGNIFICANCE	NO SIGNIFICANCE				
STUDY-00 & STUDY-04	S_2	NO SIGNIFICANCE	+++	NO SIGNIFICANCE	++	NO SIGNIFICANCE	++
	V	+++		+++			
	T	NO SIGNIFICANCE	+++				
STUDY-00 & STUDY-05	S_3	++	++	NO SIGNIFICANCE	NO SIGNIFICANCE	NO DATA S-05	NO DATA S-05
	V	NO SIGNIFICANCE		NO SIGNIFICANCE			
	T	NO SIGNIFICANCE	NO SIGNIFICANCE				
STUDY-00 & STUDY-07	S_4	NO SIGNIFICANCE	NO DATA S-07		NO SIGNIFICANCE		NO DATA S-07
	V	+		NO DATA S-07			
	T	NO DATA S-07	NO DATA S-07				
STUDY-03 & STUDY-04	S_5	++	NO SIGNIFICANCE	+	NO SIGNIFICANCE	NO SIGNIFICANCE	NO DATA S-03
	V	+++		+++			
	T	+	NO SIGNIFICANCE				
STUDY-03 & STUDY-05	S_6	+++	NO SIGNIFICANCE	NO SIGNIFICANCE	NO SIGNIFICANCE	NO DATA S-05	NO DATA S-03 & 05
	V	NO SIGNIFICANCE		NO SIGNIFICANCE			
	T	+++	NO SIGNIFICANCE				
STUDY-04 & STUDY-05	S_7	NO SIGNIFICANCE	NO SIGNIFICANCE	NO SIGNIFICANCE	NO SIGNIFICANCE	NO DATA S-05	NO DATA S-05
	V	+		++			
	T	NO SIGNIFICANCE	NO SIGNIFICANCE				

S – STUDY (00, 01, 03, 04, 05, 06, 07, 08)
S_1 – STUDY 00, 03
S_2 – STUDY 00, 04
S_3 – STUDY 00, 05
S_4 – STUDY 00, 07
S_5 – STUDY 03, 04
S_6 – STUDY 03, 05
S_7 – STUDY 04, 05

V – VOLUME OF TRAFFIC
V_1 – 0-600 VPH
V_2 – 600-1200
V_3 – 1200-1800

T – PERIOD
T_1 – DAY
T_2 – NIGHT

\+ – SIGNIFICANT AT 95% LEVEL OF CONFIDENCE

++ – SIGNIFICANT AT 99% LEVEL OF CONFIDENCE

+++ – SIGNIFICANT AT 999% LEVEL OF CONFIDENCE

COLUMN

1 { TEST OF SIGNIFICANCE FOR THE VARIATION IN EACH VARIABLE (STUDY, VOLUME, PERIOD) WITHOUT CONSIDERING THE INFLUENCE OF THE OTHER VARIABLES

2 { TEST OF SIGNIFICANCE FOR THE VARIATION IN STUDY OR PERIOD CONSIDERING ONLY ONE VOLUME LEVEL (V_i) AND WITHOUT CONSIDERING THE INFLUENCE OF THE OTHER VARIABLE

3 { TEST OF THE SIGNIFICANCE FOR THE VARIATION IN STUDY AND VOLUME CONSIDERING ONLY DAYTIME DATA AND WITHOUT CONSIDERING THE INFLUENCE OF THE OTHER VARIABLE

4,5,6 { TEST OF SIGNIFICANCE FOR THE VARIATION IN STUDY CONSIDERING ONLY DAYTIME DATA AND SEPERATE LEVELS OF VOLUME (V_1 V_2 V_3)

TABLE 6

Statistical Analysis

Only the inside or median lane placements were studied in the analysis of the before and after data as these are the most critical with respect to the median and would likely reflect any effect on driver behavior that could be attributed to the median.

Two separate studies were analysed: the Bureau of Public Roads' study taken at the location shown in Figure 8, and the film study conducted at the location shown in Figure 9. The motion picture study was conducted in the vicinity on an entrance ramp while the Bureau of Public Roads' study was conducted on a section with no ramps in the vicinity.

The variables considered in the study were before and after median conditions and traffic volume. Traffic volume was considered at three separate levels - V_1(0-600 vph), V_2(600-1200 vph), and V_3(1200-1800 vph). The data were analysed using an analysis of variance technique with the index F as a test statistic.

For both the Bureau of Public Roads and the motion picture studies, the following tests were made:

1. Test of significance comparing before and after placement data without considering volume levels.

2. Test of significance comparing the three volume levels without considering before and after conditions.

3. Test of significance comparing before and after placement data at each of the three volume levels.

Tabulations of the results from these studies are shown in Tables 4 and 5.

The following results were obtained from the analysis of the Bureau of Public Roads' study:

1. There was no significant difference between the before and after placements when volume was not considered.

2. There was no significant difference between the placements grouped according to the three volume levels V_1(0-600), V_2(600-1200), and V_3(1200-1800).

3. There was no significant difference between before and after placements considering only the first level of traffic (0-600vph).

4. There was a significant difference between before and after placements considering only the second level of traffic (600-1200 vph).

5. The data was not sufficient to compare before and after conditions at the third level of traffic (1200-1800 vph).

The following results were obtained from the analysis of the before and after motion picture studies:

1. There was no significant difference between the before and after placements when volume was not considered.

2. There was a significant difference between the placements grouped according to the three volume levels V_1(0-600), V_2(600-1200) and V_3(1200-1800).

3. There was no signigicant difference between before and after placements at any of the three volume levels.

Conclusions

The results of the studies indicate the following conclusions:

1. The barrier fence was valuable in reducing the severity of accidents involving the median.

2. The barrier fence had no significant effect upon driver behavior as indicated by vehicle placement.

3. On the section where there were no ramps, a significant difference between the before and after placements at the second level of traffic (600-1200 vph) indicated that the barrier fence had some effect on driver behavior as the volume increased.

4. The results of the analysis for the motion picture study indicated that volume had a more pronounced effect in this study than in the Bureau of Public Roads' study. This is probably a result of the entrance ramp conditions and the different time periods during which data were recorded. The motion picture study recorded data during three separate periods - 7:00-8:30 A.M.; 9:30-10:30 A.M.; 4:00-5:30 P.M., while the Bureau of Public Roads' study recorded data from 1:00 P.M. to 7:00 P.M. Thus the motion picture study reflected peak morning and afternoon conditions while the Bureau of Public Roads' study reflected only afternoon conditions.

   The motion picture study indicated that volume conditions on both sides of the median affect vehicle placements. The average placements for the morning peak, offpeak and afternoon peak periods are shown in Figure 10 for the inside lane on the Gulf Freeway. A shift in vehicle placements toward the median during the morning peak and away from the median during the afternoon peak is indicated. The total change in average placement, comparing the morning peak (7:00-8:30 A.M.) with the afternoon peak (4:00-5:30 P.M.), is 0.58 feet. This effect is even more pronounced if peak 15-minute periods (morning and evening) are compared for study 00 (before barrier fence) as shown in Figure 11. Here the total change is 0.89 feet. This difference was slightly less (0.67 feet) after the barrier fence was erected as shown in Figure 12.

Thus it is evident that the opposing flow has a large amount of effect on vehicle placements in this study of a narrow median.

General Median Study

In order to develop knowledge of the effect of various type and width freeway medians on traffic behavior, a specific study was conducted using placement data recorded on freeways with the following median types:

Study	Location	Median Type
00	Houston - Gulf Freeway	4' Concrete with barrier curb
03	Dallas-Central Expressway	12' Concrete with barrier curb
04	Dallas-Central Expressway	27' Grassed with barrier curb
05	Dallas - U. S. 80	40' Grassed, no curb

Statistical Analysis

In order to study the relationship of various type medians a number of comparisons of placement data was made. Since the difference in the average placements was small for the various type medians, the variance of the data was studied to determine any significant differences that occurred.

The data was grouped according to volume levels V_1(0-600 vph), V_2(600-1200 vph) and V_3(1200-1800 vph) and by day-night periods. The tests that were made and the results of these tests are shown in Table 6.

Comparisons of vehicle placements were made for the following medians:

1. Comparison of all medians
2. Comparison of 4-ft. median with 12-ft. median.
3. Comparison of 4-ft. median with 27-ft. median.
4. Comparison of 4-ft. median with 40-ft. median.
5. Comparison of 12-ft. median with 27-ft. median.
6. Comparison of 27-ft. median with 40-ft. median.

In order to obtain the various size median sections for study, it was necessary to study a number of freeway sections. This placed some limitations on the comparisons that could be made since it was impossible to obtain a full range of volume conditions on all of the sections. For example, only one level of traffic (0-600) could be compared for night and day. For this reason some comparisons were impossible.

The results of the comparisons were as follows:

General Results - Including all studies

1. There was a significant difference in placements among the studies.

2. There was a significant difference in placements grouped according to the three volume levels for all studies.

3. There was no significant difference between day and night placements at the first level of traffic (0-600 vph).

4. There was a significant difference in placements at each volume level for all studies.

Study 00 with 04: 4-ft. with 12-ft.

1. There was no significant difference in placements between the studies without considering volume.

2. There was a significant difference in placements grouped according to the three volume levels for both studies.

3. There was no significant difference between day and night placements at the first level of traffic (0-600 vph).

4. There was a significant difference in placements at each volume level for these studies.

Study 00 with 03: 4-ft. with 27-ft.

1. There was a signigicant difference in placements between the studies without considering volume.

2. There was no significant difference in placements grouped according to the three volume levels for both studies.

3. There was no significant difference between day and night placements at the first level of traffic (0-600 vph).

4. There was no significant difference in placements at each volume level for these studies.

Study 00 with 05: 4-ft. with 40-ft.

1. There was a significant difference in placements between the studies without considering volume.

2. There was no significant difference in placements grouped according to the three volume levels for both studies.

3. There was no significant difference between day and night placements at the first level of traffic (0-600).

4. There was not sufficient data to compare all volume levels for these studies.

Study 04 with 03: 12-ft. with 27-ft.

1. There was a significant difference in placement between the studies without considering volume.

2. There was a significant difference in placements grouped according to the three volume levels for both studies.

3. There was no significant difference between day and night placements at the first level of traffic (0-600 vph).

4. There was not sufficient data to compare all volume levels for these studies.

Study 03 with 05: 27-ft. with 40-ft.

1. There was a significant difference in placements between the studies without considering volume.

2. There was no significant difference in placements grouped according to the three volume levels for both studies.

3. There was no significant difference between day and night placements at the first level of traffic (0-600 vph).

4. There was not sufficient data to compare all volume levels for these studies.

Conclusions

The following conclusions were drawn from the results of the various comparisons made in the general study:

1. Although the change in average placements was relatively small for all studies, a study of the variation in the data indicates that median width does significantly affect traffic behavior.

2. The following comparisons were made:

   (a) 4-ft. median with 12-ft. median.
   (b) 4-ft. median with 27-ft. median.
   (c) 4-ft. median with 40-ft. median.
   (d) 12-ft. median with 27-ft. median.

The results of the tests indicate no significant difference in placements for comparison (a) but a significant difference in placements for comparisons (b), (c), and (d). Thus the wide medians (27' and 40') compared with the narrow medians (4' and 12') reflect a significant change in traffic behavior that is not apparent when comparing the narrow medians with each other. This indicates, though all variations in average placement are slight, the narrow medians have a different effect on driver behavior from the wider medians.

3. A study of vehicle placements with regard to volume was made for the following comparisons:

(a) 4-ft. with 12-ft.
(b) 12-ft. with 27-ft.
(c) 4-ft. with 27-ft.
(d) 4-ft. with 40-ft.

The results of these tests indicate that volume had a significant effect on placements for comparisons (a) and (b) but no significant effect for comparisons (c) and (d). This indicates a reduction in the effect of volume on vehicle placement for the wider medians (27-ft., 40-ft.) as compared to the narrow medians (4-ft., 12-ft.). Thus, the wider medians appear desirable to reduce or eliminate the effect of heavy volumes on the driver's behavior.

Summary

The data analysed indicated that variations in vehicle placements on freeways are relatively small. Data on vehicle placements and observations of overall freeway operation indicate that median widths as small as 4-ft. are satisfactory. However, numerous median accidents were observed and the accident data indicated that a barrier fence on the 4-ft. median was very effective in reducing the severity of median accidents. Also, the results of placement data analyses indicated that the barrier fence had no significant effect on driver behavior.

In the general median studies which compared various width medians, it was found that median widths did affect traffic behavior as indicated by vehicle placements. A difference in driver behavior was noted when comparing wide medians with narrow medians and the data indicated that wide medians are valuable in reducing or eliminating the effect of opposing flow and heavy volumes on traffic behavior.

Comparisons of day and night placement data in the volume range of 0-600 vph indicate no significant difference between day and night vehicle placement.

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