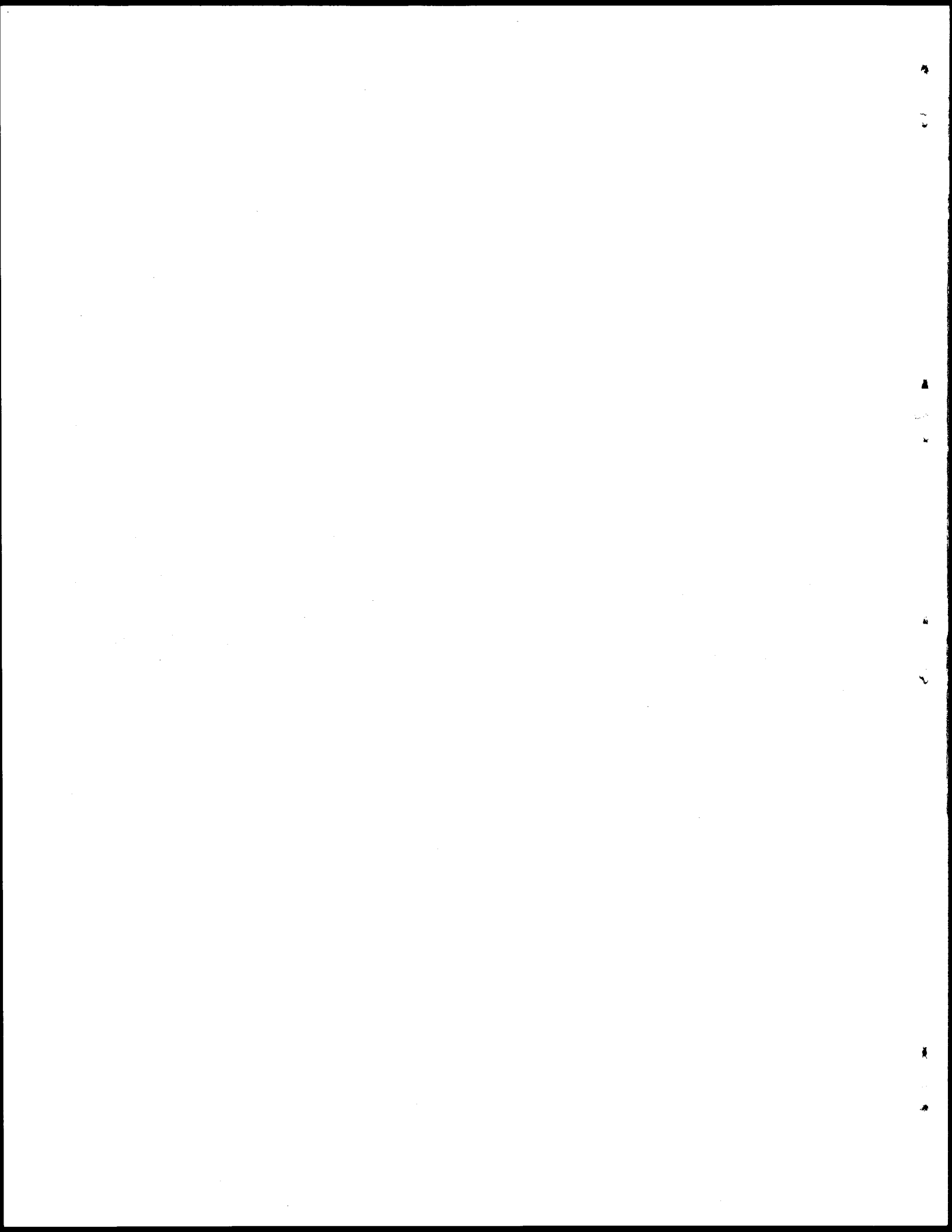


1. Report No.		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle "A Study of Accident Investigation Sites on the Gulf Freeway"				5. Report Date August 1972	
7. Author(s) Mary Ann Pittman Roy C. Loutzenheiser				6. Performing Organization Code	
9. Performing Organization Name and Address Texas Transportation Institute A & M University College Station, Texas 77843				8. Performing Organization Report No. 165-1	
12. Sponsoring Agency Name and Address Texas Highway Department 11th & Brazos Austin, Texas 78701				10. Work Unit No.	
				11. Contract or Grant No. 2-18-72-165	
				13. Type of Report and Period Covered Interim - Sept. 1971- Aug. 1972	
15. Supplementary Notes Research conducted in cooperation with DOT, FHWA.				14. Sponsoring Agency Code	
16. Abstract The degree of freeway congestion and delay caused by an accident depends on the length of time that the accident vehicles block a lane and are visible to other freeway motorists. To reduce the effects of accidents, the investigation by policemen should be made at a location not visible to freeway motorists. This report discusses the use of specially designed accident investigation sites which are located in areas adjacent to the Gulf Freeway in Houston but concealed from freeway motorists. Usage of the sites reduces delay to freeway motorists and frequency of secondary accidents. To improve operation on other freeways, accident investigation sites should be installed.					
17. Key Words Accident Investigation Sites; Freeway Safety; Freeway Delay; Freeway Operation; Accident Prevention; Benefit/Cost Analysis.			18. Distribution Statement		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 71	22. Price



A STUDY OF ACCIDENT INVESTIGATION SITES
ON THE GULF FREEWAY

by

Mary Ann Pittman
Research Associate

and

Roy C. Loutzenheiser
Engineering Research Associate

Research Report Number 165-1

DEVELOPMENT OF URBAN TRAFFIC MANAGEMENT
AND CONTROL SYSTEMS

Research Study Number 2-18-72-165

Sponsored by
The Texas Highway Department
In Cooperation with the
U.S. Department of Transportation
Federal Highway Administration

Texas Transportation Institute
Texas A&M University
College Station, Texas

August 1972

ABSTRACT

The degree of freeway congestion and delay caused by an accident depends on the length of time that the accident vehicles block a lane and are visible to other freeway motorists. To reduce the effects of accidents, the investigation by policemen should be made at a location not visible to freeway motorists. This report discusses the use of specially designed accident investigation sites which are located in areas adjacent to the Gulf Freeway in Houston but concealed from freeway motorists. Usage of the sites reduces delay to freeway motorists and frequency of secondary accidents. To improve operation on other freeways, accident investigation sites should be installed.

Key Words: Accident Investigation Sites; Freeway Safety; Freeway Delay; Freeway Operation; Accident Prevention; Benefit/Cost Analysis.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification or regulation.

SUMMARY

Sixteen accident investigation sites were designated along the Gulf Freeway from Dowling Street to Broadway Street. The purpose of the sites is to provide a place out of view of the freeway motorists where police officers can investigate accidents. Eight of the sites are located on city streets adjacent to the freeway; two are located on city streets under the freeway; one is located off a city street on freeway right-of-way; and the other five are on unused space under freeway structures.

Officers from the Houston Police Department began using the sites on July 12, 1971. Data were collected through supplementary accident report forms that each investigating officer filled out. During the first year of operation, 851 accidents were reported in the study area, and the sites were used for 339 investigations (40 percent usage). In addition, another 176 investigations were conducted at other off-freeway locations (21 percent).

Benefits of the system in terms of delay saved were evaluated for the peak travel periods. Annual savings from usage of the investigation sites and other off-freeway locations amounted to \$203,000. In addition, there was a reduction in secondary accidents during the first year of operation which resulted in a savings of \$25,000. Construction costs were prorated, and the annual cost plus the maintenance costs were estimated at \$8,000. For the first year of operation, the benefit/cost ratio was 28:1.

The criteria for an acceptable accident investigation site are as follows: must be easily accessible, well-marked, concealed from freeway

motorists, located near a high accident area, constructed at low cost, an area of at least 1000 square feet of space, and lighted for nighttime usage.

Implementation

The application of accident investigation sites should be considered for urban freeways with heavy traffic demand. To provide accessibility, the sites should be located within freeway right-of-way and be concealed from freeway motorists. Concealment of the sites could be accomplished by metal or foliage screens. The construction costs of most sites will be economically feasible due to reduction in freeway delay alone. To increase efficiency, an educational program on the use and benefits of the sites should be conducted for the public. This study recommends that accident investigation sites be constructed on all freeways in Houston.

TABLE OF CONTENTS

	Page
INTRODUCTION	1
PILOT STUDY SYSTEM	3
Location of Sites	3
Design of Sites Requiring Construction	11
Study Procedures	15
DATA ANALYSIS	19
Usage of AIS	19
Usage Analysis	20
Comments from Officers	25
Benefit Analysis	27
Reduction in Delay	29
Reduction in Accidents	33
Comparison of Benefits and Costs	35
Evaluation of Individual Sites	37
Modifications for the AIS System	41
Expansion to Other Freeways	42
FINDINGS AND RECOMMENDATIONS	46
General	46
Findings	47
Recommendations	48
REFERENCES	50
APPENDICES	51

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Accident Investigation Sites	5
2	Frequency of Site Usage	20
3	AIS Usage During Peak and Off-Peak Periods	22
4	Monthly Usage Rate of AIS	23
5	Usage Rate of AIS According to Direction of Travel	24
6	Frequency of Reporting and Usage of Sites	26
7	Accident Delay Summary	34
8	Summary of Construction Costs	36
9	Usage Rate of Individual Accident Investigation Sites	39
10	Nighttime Usage Rate of Individual Accident Investigation Sites	40
11	Accident Experience	45

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Study area on the Gulf Freeway.	4
2	Typical layouts of investigation sites.	6
3	ALS direction signs.	8
4	Accident investigation on city street at Site 4.	9
5	Accident investigation site on city street underneath freeway overpass.	10
6	Accident investigation site on unused land underneath freeway overpass.	12
7	Accident vehicles moved under the freeway to Site 12.	12
8	Design of accident investigation site on unused land under a freeway overpass.	13
9	Site 1 on freeway right-of-way off Pease Street.	14
10	Accident investigation sites under freeway overpasses.	16
11	Houston Police Department supplementary freeway accident report form.	18
12	Time- <i>flow</i> relationship for a one-lane blocked, noninjury accident over Telephone Road inbound.	30
13	Time- <i>delay</i> relationship for a one-lane blocked, noninjury accident over Telephone Road inbound.	32
14	Modification of investigation site locations.	43

INTRODUCTION

The movement of vehicles on urban freeways has become an important part of a metropolitan area. Motorists usually find uninterrupted flow and few hazards on a freeway. However, the occurrence of freeway incidents such as accidents or stalled vehicles causes congestion on the freeway and delay to motorists. When such an incident occurs, one or more lanes are blocked resulting in a bottleneck situation and reduction in freeway capacity. Normally, an accident causes more freeway congestion than a stall since it usually involves two or more vehicles. The degree of congestion and delay caused by an accident depends on the length of time that the accident vehicles block a lane and are visible to motorists. Police usually investigate accidents on the freeway shoulder, therefore, extending the time period during which the motorists are distracted by the accident vehicles. If an accident investigation is made at a location not visible to freeway motorists, congestion and delay will be reduced and the traffic flow will return to normal more rapidly.

To continue the development and refinement of traffic control systems for urban areas, the Texas Transportation Institute (TTI) and the Texas Highway Department (THD), in cooperation with the U.S. Department of Transportation, has begun a research project entitled "Development of Urban Traffic Management and Control Systems." One objective of this report is to evaluate a system of accident investigation sites (AIS) located on a section of the Gulf Freeway (Interstate 45 South) in Houston. The

sites are concealed from freeway motorists and are used by the police to make their accident investigations. The accident investigation site study is being carried out in cooperation with the Houston Police Department (HPD) and the City of Houston.

This study is an outgrowth of earlier research of accidents in the moving freeway lanes. In 1963, Wilshire and Keese (1) conducted a study on the effects of traffic accidents on freeway operation and the methods of accident investigation. In their conclusions they stressed the importance of clearing the freeway of all visible signs of the accident as quickly as possible. Lynch and Keese (2) evaluated the average time elapsed between the time of the accident and the time when the damaged vehicles were moved from the roadway. They recommended that studies be conducted to devise procedures for more rapid removal of accident vehicles. In 1969, Goolsby (3) recommended the designation and construction of accident investigation sites on the Gulf Freeway. His study showed that on the average a minor accident occurring during peak periods, affects traffic flow for 41 minutes, and of this time, 24.5 minutes are spent in police investigation. Thus, if the accident investigation is conducted at a site off the freeway, the accident would affect traffic for only 16.5 minutes. Goolsby (4) further determined that a minor accident blocking one lane of a three-lane roadway reduces capacity by 50% even though the number of lanes is only reduced by 33%. Also, if the damaged vehicles are moved to the freeway shoulder, the main-lanes capacity is still reduced by 33% because of the "gapers-block" phenomenon. Thus, to more rapidly restore freeway operations, it is necessary to move the accident vehicles to a location which is out of view of the freeway motorists.

PILOT STUDY SYSTEM

The Gulf Freeway was designed and built in the late 1940's. The divided, six-lane freeway is complemented by an adjacent non-continuous frontage road, and a slip-type design is used for the ramps. The Surveillance and Control Office, used by the Texas Highway Department and the Texas Transportation Institute, started operation in 1967. A closed circuit television system provides surveillance for the six-mile control section of the freeway. Within this section, eight inbound entrance ramps are controlled by signals run by a digital process computer. This study was conducted on the six-mile section of the freeway within the video surveillance system (Figure 1).

Location of Sites

Sixteen accident investigation sites have been designated along the six-mile section of the Gulf Freeway from Dowling Street to Broadway Street. These sites were chosen because of their accessibility from the freeway and concealment from freeway motorists. The location of the sites were grouped into three types: a site on a city street, a site on a city street under the freeway, and a constructed site on unused space within freeway right-of-way. Table 1 presents a summary of the approximate location of each site, and Appendix A contains a map of the locations. Typical layouts of the investigation sites are shown in Figure 2. Site preparation involved the installation of direction signs and "No Parking" signs.

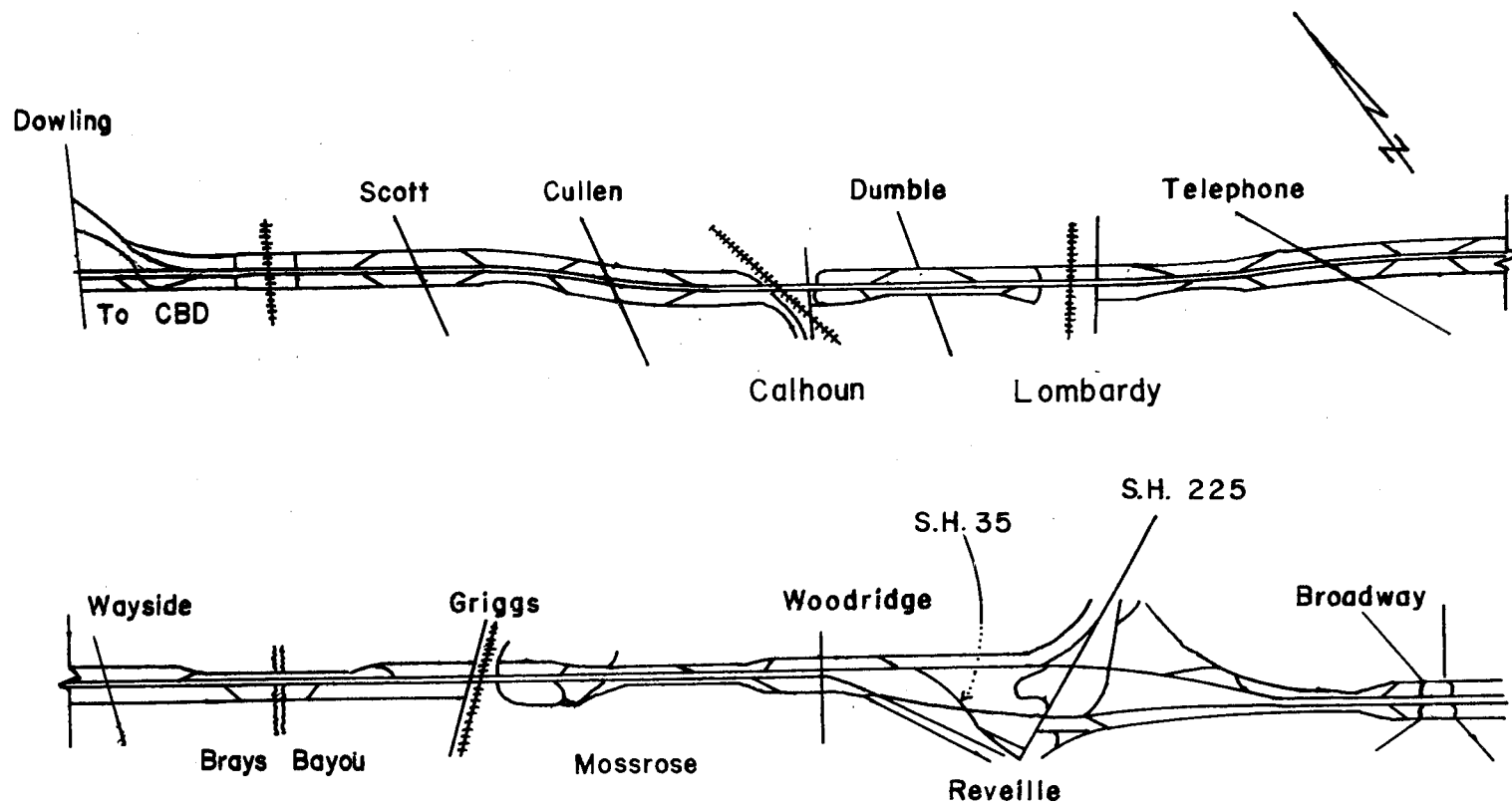


Figure 1. Study area on the Gulf Freeway.

TABLE 1
ACCIDENT INVESTIGATION SITES

<u>Site No.</u>	<u>Location</u>	<u>Direction of Access</u>
1	Pease Street	Northbound
2	Under Freeway at Scott	Northbound & Southbound
3	Under Freeway at Cullen	Northbound & Southbound
4	Sharpe Street	Northbound
5	Under Freeway at Lombardy	Southbound
6	Under Freeway at Tellepsen	Northbound
7	Burwell Street	Southbound
8	Harriet Street	Northbound
9	Oakcliff Street	Southbound
10	Maxwell Street	Northbound
11	Under Freeway at Griggs	Southbound
12	Under Freeway at Myrtle	Northbound & Southbound
13	Under Freeway at Woodridge	Northbound & Southbound
14	Thurrow Street	Southbound
15	Easton Street	Northbound
16	Erie Street	Southbound

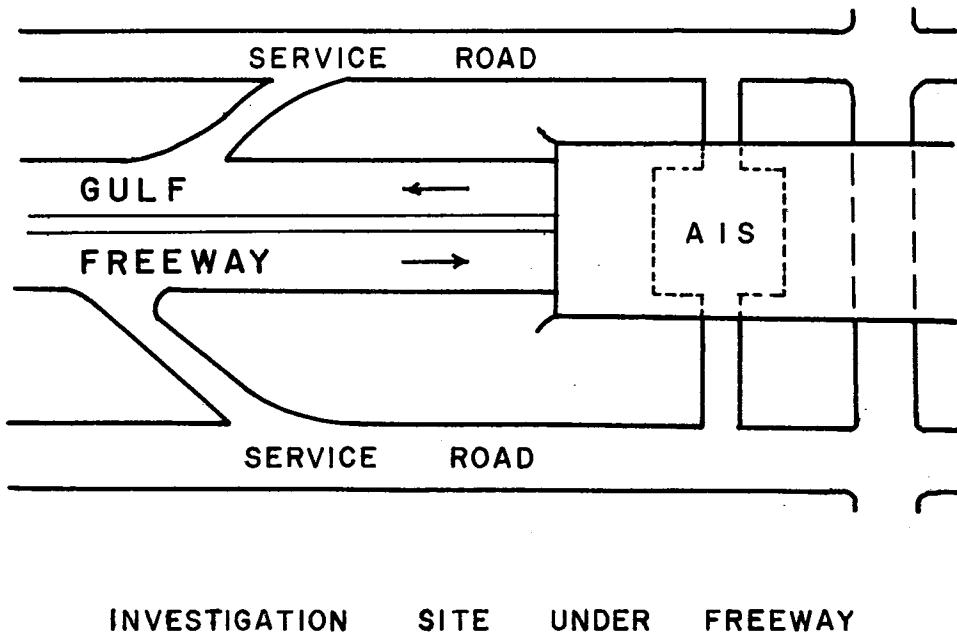
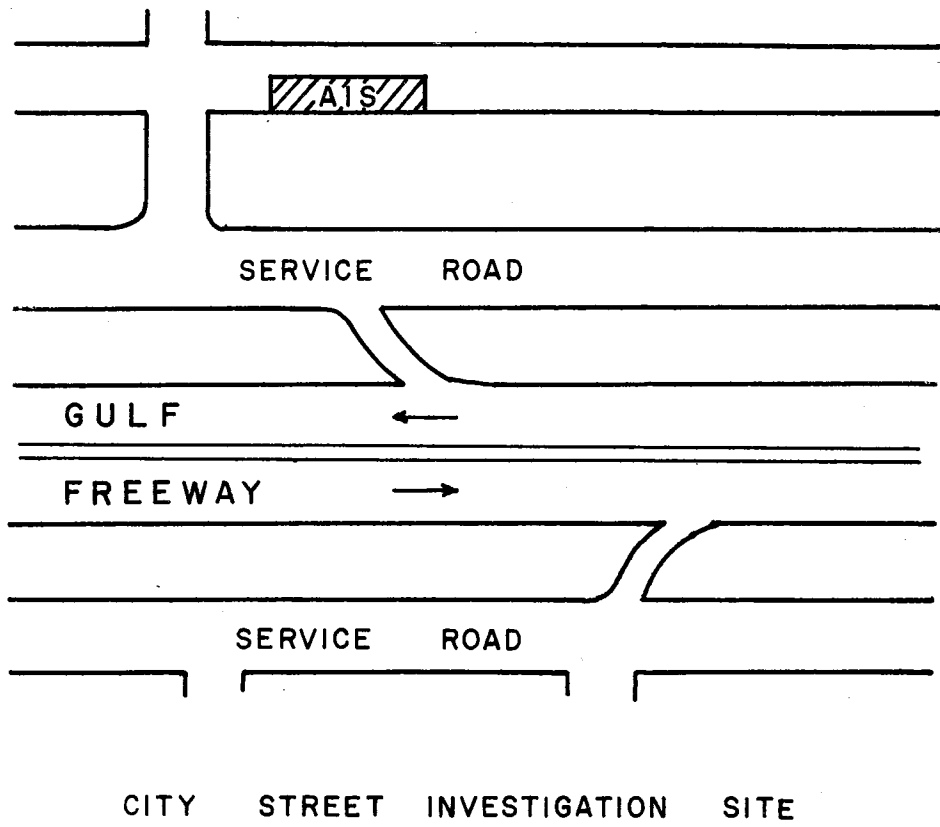


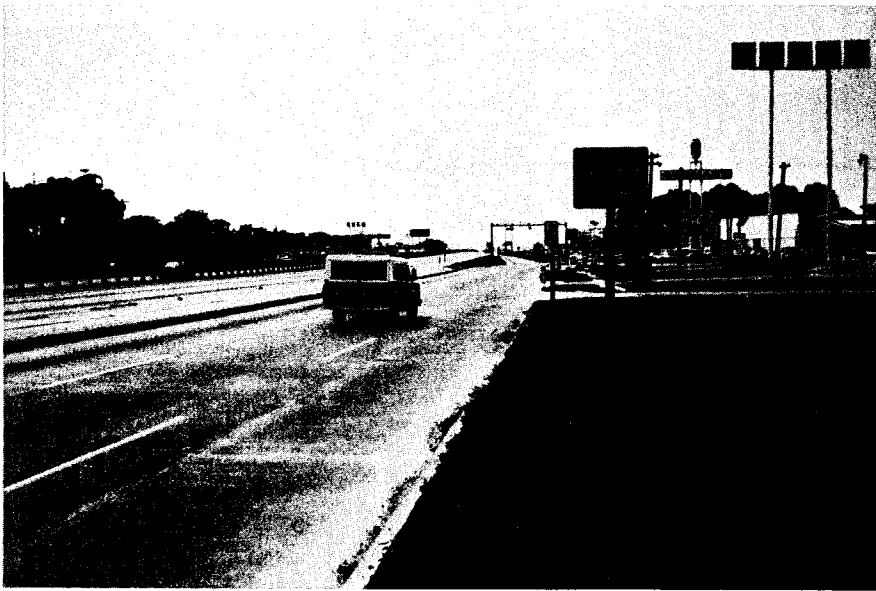
Figure 2. Typical layouts of investigation sites.

Direction signs usually consisted of signs on the service road directing people to the site and a sign designating the location of the site. "No Parking" signs were posted at each site to insure available space for the investigation and accident vehicles. Typical approach signs and signs designating the sites are shown in Figure 3.

Since most sections of the Gulf Freeway are at-grade with the service road and city streets, many locations within the freeway right-of-way would be visible to the motorists. Therefore, eight sites (4, 7, 8, 9, 10, 14, 15, 16) were located on city streets adjacent to the freeway. The criteria for locating these sites were: downstream of an exit ramp, on a city street with light traffic flow, and sufficient parking area for vehicles involved in an accident investigation. The cost for city street sites was \$35 per site for signs. Figure 4 shows an accident investigation being conducted at Site 4.

City streets, underneath one freeway overpass, carry a minimum of traffic flow; therefore, two accident investigation sites (Sites 5 and 6) were located on these streets under the freeway. There is space available under the overpass to construct sites; however, to reduce costs, the streets were selected. The necessary costs were \$35 per site for installation of signs. Figure 5 shows Site 6 on Tellepsen Street.

Of the remaining six sites, five (Sites 2, 3, 11, 12, and 13) were located on unused land under freeway overpasses, and one (Site 1) was lo-



An approach sign to Site 10.



A sign designating Site 2.

Figure 3. AIS direction signs.

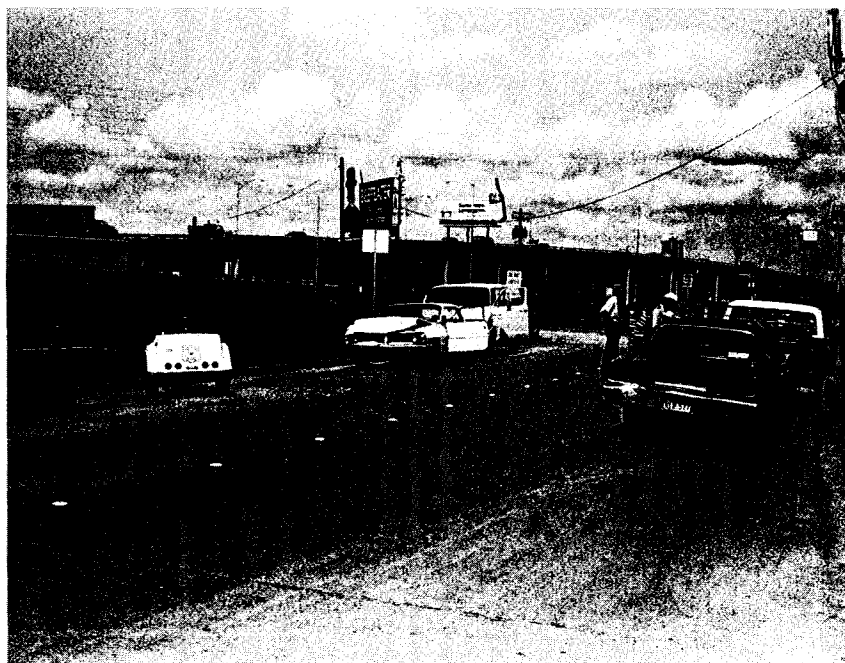
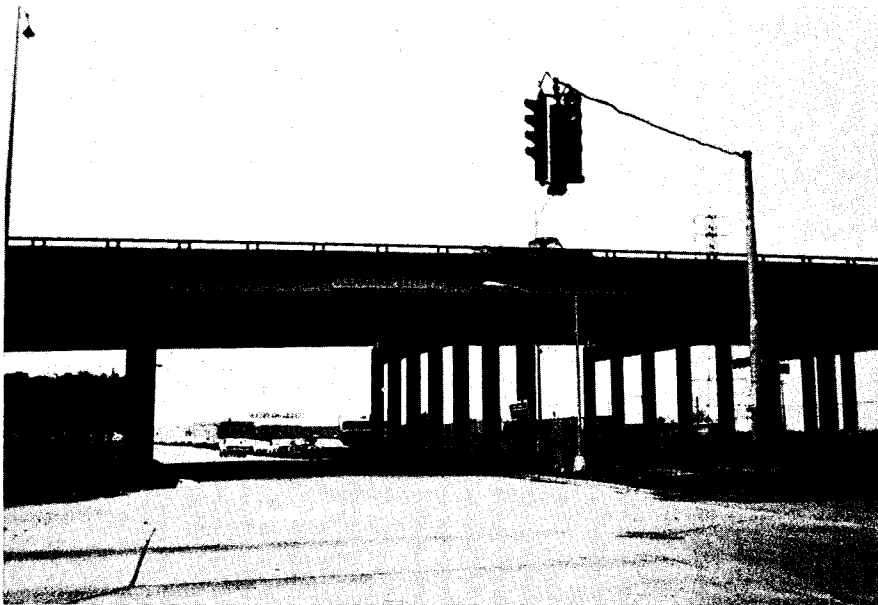


Figure 4. Accident investigation on city street at Site 4.



Site 6 on right side of Tellepsen Street.

Figure 5. Accident investigation site on city street underneath freeway overpass.

cated off a city street within freeway right-of-way. Design of these sites and construction costs are discussed below. Figure 6 is a picture taken from Griggs overpass with Site 12 in the foreground under the overpass, and Figure 7 shows an accident investigation being conducted at Site 12.

Design of Sites Requiring Construction - A typical accident investigation involves five vehicles - one police car, two damaged vehicles, and two wreckers. If it is assumed that each vehicle requires a 10 feet by 20 feet space to park, a typical site should contain at least 1000 square feet of space. The six constructed sites (1, 2, 3, 11, 12, 13) have a surfaced area of 30 feet by 85 feet, or 2550 square feet. The extra area provides space for driving. Figure 8 shows a picture of Site 2 and a diagram of the surfaced area.

Site 1 shown in Figure 9 is unique from all the other sites since it is located in an open area off a city street. The ground, near a pre-existing luminaire, was graded and paved. This construction amounted to approximately \$3,200, and an additional \$35 was spent on signs.

The five sites constructed under the freeway were also graded and paved, and guardrails were placed between the pavement and the bridge supports for protection. To discourage local use of the sites, the access road between the service road and the site did not provide smooth curves for turning into the sites. All of the construction work amounted to about \$3,200 per site. In addition to direction and "No Parking" signs, it was necessary to add two clearance signs. "No Thru Traffic"



Site 12 in foreground of picture.

Figure 6. Accident investigation site on unused land underneath freeway overpass.



Figure 7. Accident vehicles moved under the freeway to Site 12.

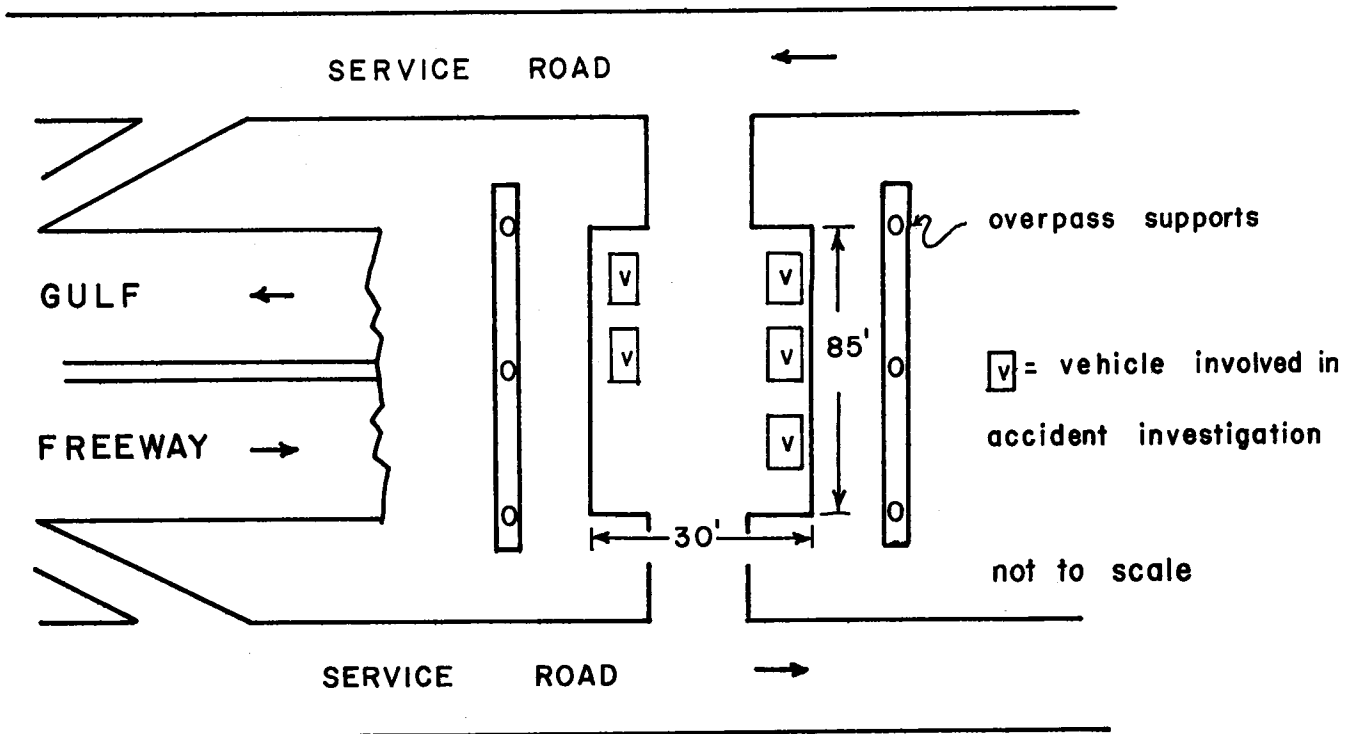


Figure 8. Design of accident investigation site on unused land under a freeway overpass.



Figure 9. Site 1 on freeway right-of-way off Pease Street.

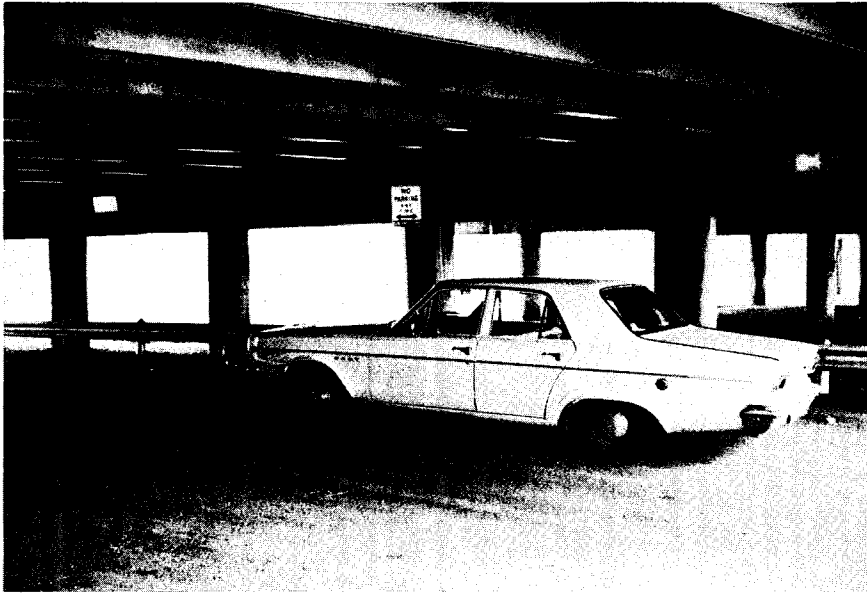
signs were also installed to discourage motorists from using the sites as U-turns. Cost of signing amounted to \$115 per site.

Since existing street lighting did not provide sufficient illumination, additional lighting was mounted under the overpasses. Installation of the lighting increased the construction costs at each site by about \$2,800. Thus, lighting at the five sites amounted to about 45 percent of the total construction costs. Figure 10 shows Site 2 with lighting, guardrail, and a "No Parking" sign. A second picture shows the entrance/exit to Site 11.

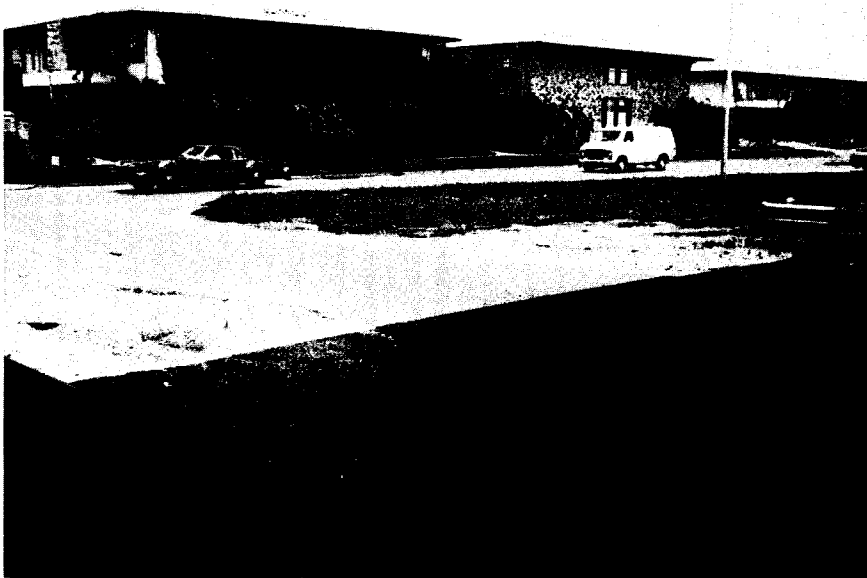
Of the sixteen investigation sites located on the six-mile section of the Gulf Freeway, four sites are accessible from either the inbound or outbound direction, six sites are accessible to inbound traffic only, and six sites are accessible to outbound traffic only. Therefore, a site is located an average of every 0.6 mile for either the inbound or outbound direction. Of the six sites requiring extra construction, four sites are accessible from both directions, while the other two sites are accessible from one direction only.

Study Procedures

Officers of the Houston Police Department began using the sites on July 12, 1971. Prior to this date, booklets identifying the location of the investigation sites were distributed to the police officers. At that time, they were also given supplementary freeway accident report forms to be filled out at each accident by the investigating officer. To provide a basis for the total city, officers investigating accidents on all freeways



Site 2 with lighting, guardrail and "No Parking" sign.



Entrance/exit to Site 11.

Figure 10. Accident investigation sites under freeway overpasses.

in Houston were requested to fill out the forms; therefore, freeway accidents were reported 24 hours per day, 7 days per week. These forms were revised in mid-August after representatives of TTI, THD, and HPD decided that the information provided on the original form was confusing as to location of the accident and location of the investigation. By mid-September, the revised forms were being used by a majority of the officers. Figure 11 shows an example of the revised form. Each investigating officer was requested to include the following information on the forms: date, time, location of accident, location of investigation, why investigation site not used, length of investigation, and officer's name.

1. Date 1-5-72 Time 10:30 AM PM
2. Freeway (name) GULF
3. Location of Accident: _____
_____ Block No. 7200
4. Direction of Traffic:
- Northbound Inbound
- Southbound Outbound
- Eastbound
- Westbound
5. Location of Investigation:
- Shoulder Accident Investigation Site No. 13
(if used)
- Service Road Median
- City Street Other
6. If Investigation Site Not Used, Why Not? _____

7. Type of Accident:
- Major
- Minor
8. How Long Did Investigation Take? 20 Minutes

Signed John Doe
Investigating Officer

Figure 11. Houston Police Department supplementary freeway accident report form.

DATA ANALYSIS

The analysis of the accident investigation sites included four major areas: the usage rate, the benefit/cost ratio, the impact on the operation of the freeway, and evaluation of individual sites. The usage rate was evaluated according to time of day, month, and direction of travel. Estimated delay time saved was used to determine benefits of the system. Other benefits derived from the added safety and convenience of the sites were discussed, but a monetary value was not calculated. In addition to the decrease in time during which capacity was reduced on the freeway, the impact of accident experience before and during the study was analyzed. Analysis of individual sites provided information on modifications to the AIS system.

Usage of AIS

Information from the supplementary freeway accident report forms was analyzed each week, and summaries were sent to THD and HPD. These summary forms are found in Appendix B. The summary sheet included the following: (a) number of police reports received, (b) number of times the investigation sites were used, (c) the percent of time the investigation sites or other off-freeway sites were used, (d) the number of times a service road, city street, or parking lot was used for the investigation, and (e) apparent reasons for not using the sites. The apparent reasons included: (a) non-critical time, (b) major accident, (c) short

investigation, (d) no towing facilities, (e) site inaccessible, (f) other given reasons, or (g) no reason given. The apparent reason for not using a site was taken from the policeman's comments on the police report forms.

Usage Analysis - During the first year of operation, a total of 851 police forms were received. The Police Department closely monitored the accident investigation records to insure that all reported accidents were included in the study. On 61 percent of the forms, the officer indicated that he had used an accident investigation site or some other location off the freeway to conduct the investigation. These off-freeway locations included service roads, city streets, or parking lots. Table 2 summarizes the frequency of the site usage.

TABLE 2
FREQUENCY OF SITE USAGE

	Number	Percent
Police Report Forms Received	851	100
Usage of AIS	339	40
Usage of Other Off-Freeway Locations	176	21
Investigation on Shoulder	336	39

In Table 3, the frequency of usage is compared for the peak and off-peak travel periods. The morning and evening peak period usage rate for the AIS was 45 percent. The usage rate for the daylight off-peak period was 41 percent, and the nighttime usage was 28 percent. One apparent reason for the lower usage rate at night is that the lighter traffic flow does not produce congestion. When investigating an accident during the morning peak-period, the officers preferred using an investigation site over another off-freeway location by a ratio of 3:1. For the afternoon peak period and daylight off-peak, this ratio dropped to 2:1, while the nighttime ratio was a little over 1:1. The overall ratio was approximately 2:1.

The monthly usage rates of the AIS showed a general increasing trend. Except for the first two weeks, the usage rate increased from 27 percent to about 50 percent, as shown in Table 4. The 48 percent usage rate during the first two weeks was probably due to the initial efforts of starting the study. The usage rates of the AIS plus other off-freeway sites show any trend and varied between 53 and 74 percent.

There was no significant difference in the frequency of AIS usage according to direction of travel. Table 5 shows that the investigation sites on the inbound side of the freeway were used 44 percent of the time, and on the outbound side they were used 43 percent. Similar usage was expected since there are ten sites accessible to inbound traffic and ten sites on the outbound side of the freeway. Data prior to October 1971 were not analyzed for direction of travel, because the first supplementary freeway accident report forms did not provide this information.

TABLE 3

AIS USAGE DURING
PEAK AND OFF-PEAK PERIODS

	Peak Periods		Off-Peak Periods	
	Morning	Afternoon	Daylight	Nighttime
Time Period	6 a.m.-9 a.m. (Mon.-Fri.)	3 p.m.-6 p.m. (Mon.-Fri.)	9 a.m.-3 p.m. (Mon.-Fri.) 6 a.m.-6 p.m. (Weekend)	6 p.m.-6 a.m. (Daily)
No. of Accidents	152	186	321	192
No. of Investigations at AIS	75(49%)	78(42%)	132(41%)	54(28%)
No. of Investigations at Other Off-Freeway Locations	23(15%)	39(21%)	70(22%)	44(23%)
Percent of Time AIS and Other Off-Free- way Locations Used	64%	63%	63%	51%

TABLE 4
MONTHLY USAGE RATE OF AIS

	1 9 7 1						1 9 7 2						
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July
No. of Accidents	52	62	65	72	75	72	69	103	70	57	64	69	21
No. of Times AIS Used	25	17	23	22	26	23	27	41	34	28	26	36	10
Percent of Time AIS Used	48%	27%	35%	31%	35%	32%	39%	40%	49%	49%	41%	52%	48%
23 No. of Times Other Off-Freeway Locations Used	10	17	12	21	15	20	12	24	10	14	10	10	1
Percent of Time Other Off-Freeway Location Used	19%	27%	18%	29%	20%	28%	17%	23%	14%	25%	16%	14%	5%
Total Percent of AIS and Off-Freeway Locations Used	67%	54%	53%	60%	55%	60%	56%	63%	63%	74%	57%	66%	53%

TABLE 5

USAGE RATE OF AIS
ACCORDING TO DIRECTION OF TRAVEL

	Direction	
	Inbound	Outbound
No. of Accidents	348	282
No. of Times AIS Used	154	120
Percent of Time AIS Used	44%	43%
No. of Times Other Off-Freeway Locations Used	73	55
Percent of Time Other Off-Freeway Locations Used	21%	20%

A total of 115 officers reported accidents in the study area during the first year of operation. The usage rate for a police accident investigator was obtained by dividing the number of times investigation sites were used by the number of accidents investigated. Table 6 shows the AIS usage rates for the police officers. Twenty-eight officers investigated only one accident, and their usage rate (18 percent) was much lower than that of other accident investigators (41 percent).

Comments from Officers - To obtain first hand opinions on the value of the AIS system, eighteen Houston police officers were interviewed at the Freeway Surveillance Office in June. Each officer had investigated more than ten accidents in the study area during the previous year, and their usage rates varied from 14 to 68 percent. Most of the officers agreed that the AIS system improved traffic operations during an accident investigation. When queried as to the conditions under which they would not move the accident vehicles off the freeway, they cited the following situations: when a fatality or possible fatality has occurred, when a crime has been committed, or when photographs or measurements are needed at the scene. Several of the officers said that they hesitate moving the vehicles when too many cars are involved and when an accident site is some distance away. Since the AIS system is a new concept, one officer stated that sometimes he forgot that the investigation sites are available.

One of the problems encountered by the officers was that they had to explain to the motorists how to get to a site. Also, motorists were not aware that they could move their vehicles off the freeway before the

TABLE 6
 FREQUENCY OF REPORTING AND USAGE OF SITES

1. Officers Reporting Only One Accident			
	No. of Officers		28
	No. of Accidents		28
	No. Moved to Sites	5(18%)	
	No. Not Moved to Sites		23
2. Officers Reporting Two to Ten Accidents			
	No. of Officers		61
	No. of Accidents		254
	No. Moved to Sites	106(42%)	
	No. Not Moved to Sites		148
3. Officers Reporting More Than Ten Accidents			
	No. of Officers		26
	No. of Accidents		563
	No. Moved to Sites	225(40%)	
	No. Not Moved to Sites		338
4. Totals			
	No. of Officers		115
	*No. of Accidents		851
	No. Moved to Sites	339(40%)	
	No. Not Moved to Sites		512

*6 report forms from the HPD were not signed.

police arrived. During the last quarter of the study year, wrecker drivers were instructed by the police department to move noninjury accident vehicles to a site as soon as possible. Several officers pointed out that this procedure caused problems if the wrecker driver failed to report where he had relocated the vehicles. A possible solution to this problem is the expansion of the THD "freeway patrol" who could be authorized to move vehicles from the freeway to an AIS and report pertinent information to the Houston Police Department.

The officers agreed that using a site made their jobs easier because of the more relaxed atmosphere. The sites provided a place concealed from freeway traffic and reduced noise levels. The under-freeway sites provided an added convenience of sheltering police and motorists from inclement weather conditions.

Change or modifications to the AIS system on the Gulf Freeway were suggested by several officers, and these are incorporated in other sections. In general, the theme which the officers related in the interviews was to inform the motorists of the location and purpose of the sites. Most officers preferred using the under-freeway sites because they are more easily accessible. Placing some type of communication system at the sites was suggested by a majority of the officers.

Benefit Analysis

The anticipated benefits of the AIS system were improvement in safety and convenience, reduction in delay time, and reduction of secondary accidents. Benefits derived from the safety and convenience that the investigation sites provide were difficult to evaluate quantitatively. The sequence through which

a minor accident progresses is listed below with the average time for execution of each step:

1. Detection and reporting of accidents to Police Dispatcher (1 minute) - use of television surveillance system shortens this activity.
2. Location, dispatch, and travel to accident scene of police unit (11 minutes).
3. Clearance of accident vehicles from traveled lanes (4 minutes).
4. Investigation of accident by police (25 minutes).

Eliminating the 25 minutes for the actual investigation on the freeway results in only 16 minutes during which traffic flow would be affected. Thus the freeway operation is restored to normal more rapidly, making it possible for emergency vehicles and other such vehicles to reach their destinations more quickly. Analysis of peak-period accident data for the year prior to the installation of the AIS system showed that only 30 percent of the investigations were made off the freeway. During this study year when the AIS system was in use, 45 percent of the peak-period accident investigations were made at an AIS, and an additional 20 percent were made at other off-freeway locations (see Table 3). If an average of thirty peak period accidents occur each month, the accidents would have affected freeway traffic flow for 1005 minutes for the year prior to the installation of the AIS system. During the study year, with a 65 percent removal rate, thirty peak period accidents affected traffic flow for 742 minutes. This amounted to a 26 percent reduction in affected traffic flow during peak periods.

Use of the accident investigation sites also decreases delay to freeway motorists since the "gapers-block" or "rubbernecking" is eliminated after the vehicles are removed from the freeway. Usage of the sites also reduces

the hazards to persons involved in an accident investigation. Other benefits of the accident investigation sites unique to a particular type of accident improve the operation and safety of the freeway.

Reduction in Delay - Usage of the AIS system and other off-freeway locations reduced the number of vehicle-hours of delay significantly. Time-delay graphs were developed to estimate the total hours of delay saved during the first year. Initially, time-flow graphs were used to develop the time-delay relationships.

To provide a conservative estimate, the following assumptions were made: all accidents blocked only one lane, accident vehicles were moved from the freeway lanes in 15 minutes, and no injuries were incurred by occupants of the accident vehicles. The time-flow graph shown in Figure 12 illustrates the effects of such an accident occurring at 7:00 a.m. on the inbound Gulf Freeway at Telephone Road. The demand curve was based on normal operational data, and the reduced volume curves were plotted using the following three-lane flow rates (4): accident vehicles on freeway (2750 VPH), accident vehicles on freeway shoulder (4030 VPH), and service volume during normal peak hour (5560 VPH). The area between the demand and service volume curve is the delay in vehicle-hours that motorists will experience. The 15 minutes of freeway blockage produced a fixed delay of 690 vehicle-hours. Additional delay is a function of the investigation procedure, of which three cases are presented.

In case 1, it was assumed that the accident vehicles were moved to an AIS or another off-freeway location. Thus, no additional delay occurred, and freeway operation was normal by 8:15. For case 2, the investigation was conducted on the freeway shoulder and required 20 minutes. This procedure

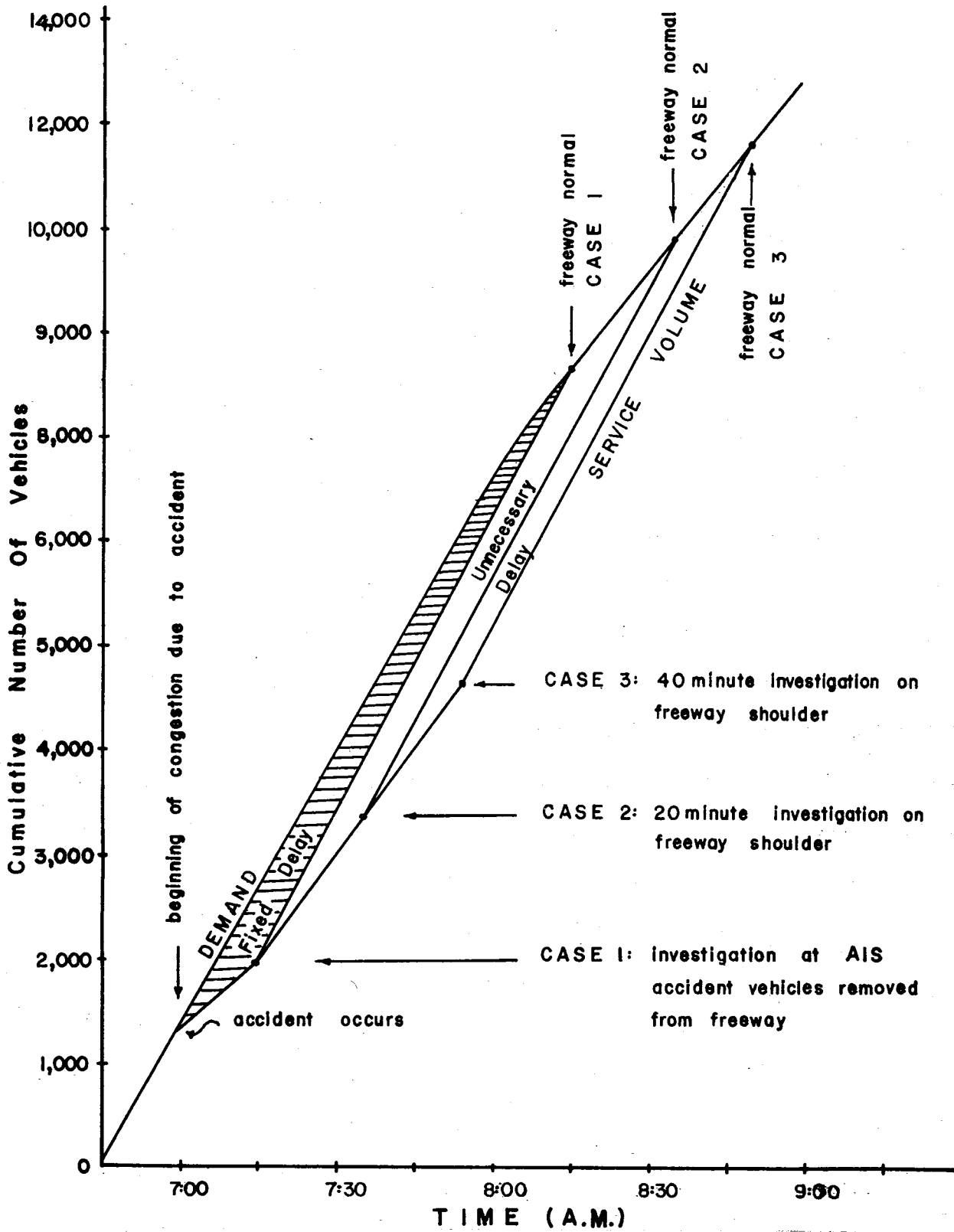


Figure 12. Time-flow relationship for a one-lane blocked, noninjury accident over Telephone Road inbound.

caused a total delay of 1470 vehicle-hours. A 40-minute investigation on the shoulder (case 3) produced 2170 vehicle-hours of delay. Similar graphs were drawn for hypothetical accidents occurring at various times during the day at Woodridge, Griggs, and Dumble. Because of the light flow rates, delay times between 7:00 p.m. and 6:00 a.m. were nearly zero.

Time-delay graphs consisting of three curves of delay versus the time of day were plotted for accidents occurring at Woodridge, Griggs, Telephone and Dumble. Only the 13-hour period from 6:00 a.m. to 7:00 p.m. was summarized on each graph. Figure 13 is the time-delay graph for accidents occurring at the Telephone overpass. For example, if an accident occurred on the inbound freeway over Telephone Road at 7:30 a.m., the amount of delay to freeway motorists would be 460 vehicle-hours if the investigation is conducted off the freeway. If the investigation is conducted on the freeway shoulder and takes 20 minutes, the amount of delay would be 1000 vehicle-hours. Therefore, 540 vehicle-hours of delay are saved due to moving the vehicles off the freeway. Similarly, a 40-minute investigation on the freeway causes 1480 vehicle-hours of delay. The delay saved in this instance would be 1020 vehicle-hours, if the investigation is conducted at a site off the freeway.

There was no significant difference in delay for the three cases during the daylight off-peak periods (9 a.m.-3 p.m.), because traffic demand usually did not exceed the reduced capacity caused by an accident investigation on the shoulder. Thus, for this study, delay time saved was computed for accidents occurring during the peak periods only. From September 13, 1971 to July 9, 1972, the estimated delay time saved due to the 93 uses of

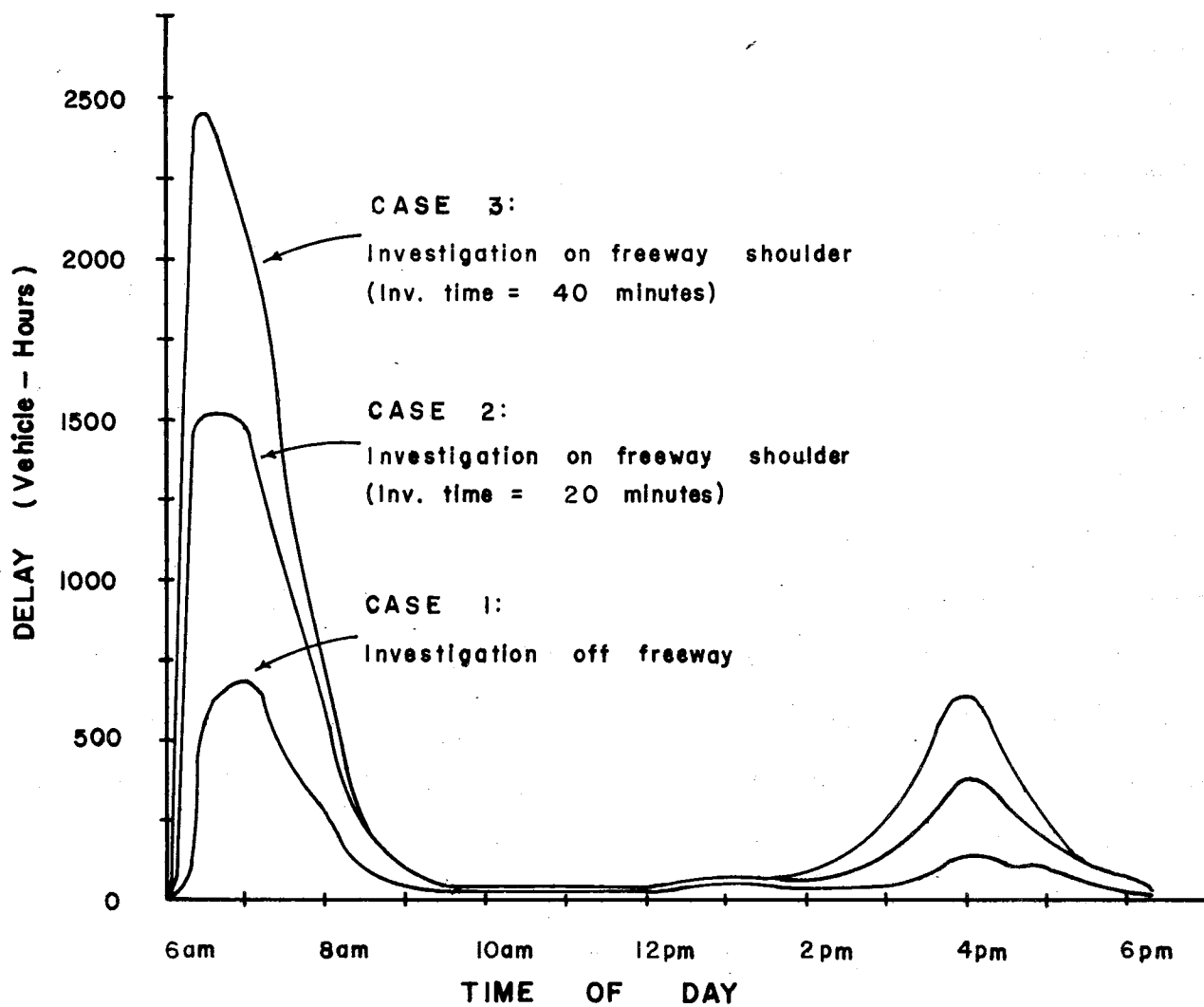


Figure 13. Time-delay relationship for a one-lane blocked, noninjury accident over Telephone Road inbound.

the investigation site was 29,250 vehicle-hours. An additional 8100 vehicle-hours were saved due to investigations conducted at other off-free-way locations. These results are shown in Table 7. Data prior to mid-September were not included in the analysis because the information on the original forms was insufficient for this analysis.

In 1969 an economic study of the Gulf Freeway was conducted using 1967 data. The cost per vehicle-hour of travel was determined to be \$2.92 (5). This value was based on the "conservative" estimate of 1.0 persons per passenger vehicle. Assuming a compounded increase of 5 percent per year for 5 years, and an increase in the vehicle occupancy from the "conservative" estimate of 1.0 persons to a realistic estimate of 1.2 persons per vehicle, the value of one vehicle-hour in 1972 would be \$4.50. By using this updated value, the monetary savings can be calculated. The total delay saved for the 35-week period was 29,580 vehicle-hours, thus resulting in a savings of \$133,000. This represents an annual savings of \$200,000.

Reduction in Accidents - Restoring freeway operations more rapidly also aids in the reduction of secondary accidents that occur as a result of shock waves. Data for the analysis of secondary accidents were obtained from records in the Surveillance Office Television Room during peak periods. During the year prior to the AIS system, 15 out of 212 accidents were classified as secondary; whereas, with the use of the AIS, the secondary accidents decreased to 8 out of 179 accidents. Thus, the total number of peak period accidents decreased by 33, and the number of secondary accidents decreased by 7. Secondary accidents, therefore, represented 21% of the reduction in peak-period accidents.

Using a 24-hour basis, data obtained from the City of Houston showed that 1046 accidents occurred in the study area during the year prior to installation of the AIS system. After installation, there were 851 acci-

TABLE 7

ACCIDENT DELAY SUMMARY

(Sept. 13, 1971 - July 9, 1972)

Time Period	6 a.m.-9 a.m.	3 p.m.-6 p.m.
No. Removed to AIS	49	44
Delay Time Saved Due to Usage of AIS (vehicle-hours)	15,450	13,800
No. Removed to Other Off-Freeway Locations	13	15
Delay Time Saved Due to Usage of Other Off-Freeway Locations (vehicles-hours)	4,760	3,340

dents or a reduction of 195 accidents. If it is assumed that the probability of occurrence of a secondary accident is the same for peak periods and off-peak periods, then about 41 secondary accidents were prevented (that is, 21 percent of 195 accidents).

Burke (6) in 1970 determined accident costs for the three types of accidents listed below. Again, assuming a 5 percent per year compounded increase, the cost per vehicle involved for the following types of accidents in 1972 would be:

1. property damage - \$ 307.00
2. injury - \$1,857.00, and
3. fatality - \$5,380.00.

It was further assumed that all accidents analyzed involved only two cars and that only property damage was incurred. Therefore, the annual savings due to reduction of 41 secondary accidents was approximately \$25,000.

Comparison of Benefits and Costs

Total construction costs, summarized in Table 8, amounted to approximately \$34,500. Maintenance for the AIS system was minor for the first year. Three signs were observed to be damaged, and one light fixture was reported to be broken. Other repairs were probably not reported. No cost figures were available, so a very conservative estimate of \$200 per month was made. An estimate of maintenance costs for the first year is, therefore, \$2,400.

TABLE 8

SUMMARY OF CONSTRUCTION COSTS

Item	Costs
I. Sites Using Existing Facilities (Numbers 4, 5, 6, 7, 8, 9, 10, 14, 15, 16)	
Directional Signs	\$ 350.00
II. Sites Requiring Construction (Numbers 1, 2, 3, 11, 12, 13)	
Surfacing, guardrail, etc.	\$19,308.69
Clearance Signs at five sites	\$ 400.00
Directional Signs	\$ 210.12
Lighting at five sites	<u>\$14,178.61</u>
Total Construction Costs	\$34,447.62

To determine the annual cost of the AIS system, the initial construction costs were multiplied by a uniform series capital-recovery factor which was based on a conservative interest rate of 10 percent for only 10 years. The benefit/cost ratio (B/C) then can be stated as follows:

$$B/C = \frac{AB}{(crf \cdot IC) + AMC}$$

where AB = annual benefits,

crf = uniform series capital recovery factor for

i = 10%, n = 10 years,

IC = initial capital cost,

AMC = annual maintenance cost.

Benefits of the system due to delay saved and reduction in secondary accidents was \$228,000. Thus,

$$\begin{aligned} B/C &= \frac{\$228,000}{(0.163 \times \$34,500) + \$2,400} \\ &= \frac{\$228,000}{\$8,000} \\ &= 28.5 \end{aligned}$$

Evaluation of Individual Sites

An analysis of the usage rate for each site was made. This usage rate was obtained by dividing the number of times a site was used by the number of accidents that occurred near it. The number of times that a site was used was based on information obtained from the supplementary police forms, and the number of accidents that were within moving distance of

a site was determined by subjective analysis. No accident was considered for more than one site, and when there was a question as to which was the nearest site, the accident was omitted from analysis. The results of the analysis are shown in Table 9.

The sites located under the freeway, including the two on city streets, had a combined usage rate of 53 percent, while the usage rate for the sites located on city streets was 35 percent. The rates at individual sites varied from 12 to 64 percent. Of the seven sites which had usage rates greater than 50 percent, only two sites (Sites 9 and 16) are on city streets. These two are the only city street sites immediately downstream of an exit ramp. To reach all other city street sites, motorists must drive further. There is a definite trend to use sites that are located under the freeway or directly adjacent to it. However, Sites 1 and 10, which are furthest from the freeway, had usage rates of 36 and 45 percent, respectively. The sites with the lowest usage rates are Sites 14 (12 percent) and 15 (22 percent). Both of these sites are located near the SH 225 interchange which appears to have affected the usage rate.

An analysis of the nighttime usage of the accident investigation sites was made to determine if the sites were being used at night and if the additional cost for lighting was justified at Sites 2, 3, 11, 12, and 13. Table 10 is a summary of the results. Unfortunately, the number of accidents near each site was too small in most cases to provide a valid analysis. Most sites had a decrease in the usage rate at night. The nighttime usage rate for sites under freeway overpasses, including the two sites on city streets, was 38 percent as compared with 53 percent for 24 hours.

TABLE 9

USAGE RATES OF INDIVIDUAL
ACCIDENT INVESTIGATION SITES

Site	Number of Uses	Number of Accidents Near Site	Usage Rate (%)
1	16	45	36
2*	39	103	38
3*	42	80	53
4	13	42	31
5*	26	56	46
6*	21	33	64
7	10	29	34
8	8	27	29
9	10	18	56
10	10	22	45
11*	23	44	52
12*	41	67	61
13*	55	87	63
14	3	25	12
15	6	27	22
16	16	31	52

*Sites Located under Freeway Overpasses.

TABLE 10
 NIGHTTIME USAGE RATES
 OF INDIVIDUAL ACCIDENT INVESTIGATION SITES
 (6:00 p.m. to 6:00 a.m.)

Site	Number of Uses	Number of Accidents Near Site	Usage Rate (%)	24-Hour Usage Rate (%)
1	3	14	21	36
2*	8	24	33	38
3*	4	11	36	53
4	0	2	0	31
5	1	8	12	46
6	1	3	33	64
7	1	2	50	34
8	2	9	22	29
9	2	7	28	56
10	1	2	50	45
11*	4	10	40	52
12*	3	6	50	61
13*	9	17	53	63
14	1	11	9	12
15	2	14	14	22
16	3	4	75	52

* Sites where lighting was installed.

For the other sites the usage rate decreased from 35 to 23 percent. The five sites, where lighting was installed, had a nighttime usage rate of 41 percent as compared to a 24-hour usage rate of 52 percent.

Modifications for the AIS System

After a year of experience, the AIS system on the Gulf Freeway was shown to be satisfactory, based on design and location of sites. However, with certain modifications it is anticipated that the efficiency of the system can be increased. The modifications should be considered for implementation of other sites. The basic design of the sites on unused freeway right-of-way was sufficient. The use of the site as a U-turn continued to be a minor problem. "No Thru Traffic" signs reduced this problem and should be included in the original design. A low curb at the entrance to the sites could be used to discourage improper use. Location of the entrance/exit of the site directly across from a driveway or street is undesirable.

The initial design of the sites located on city streets has proven workable, but some modifications are needed. Three sites (7, 14, and 15) are located on narrow streets and are not long enough for accident vehicles. If the vehicles involved in the investigation are parked on one side of the street, the site should be at least 100 feet long (five vehicles, each of which are 20 feet long). The street should be at least 30 feet wide to allow traffic to pass the site in both directions during an investigation. A street narrower than 30 feet should have "No Parking" signs on both sides of the street.

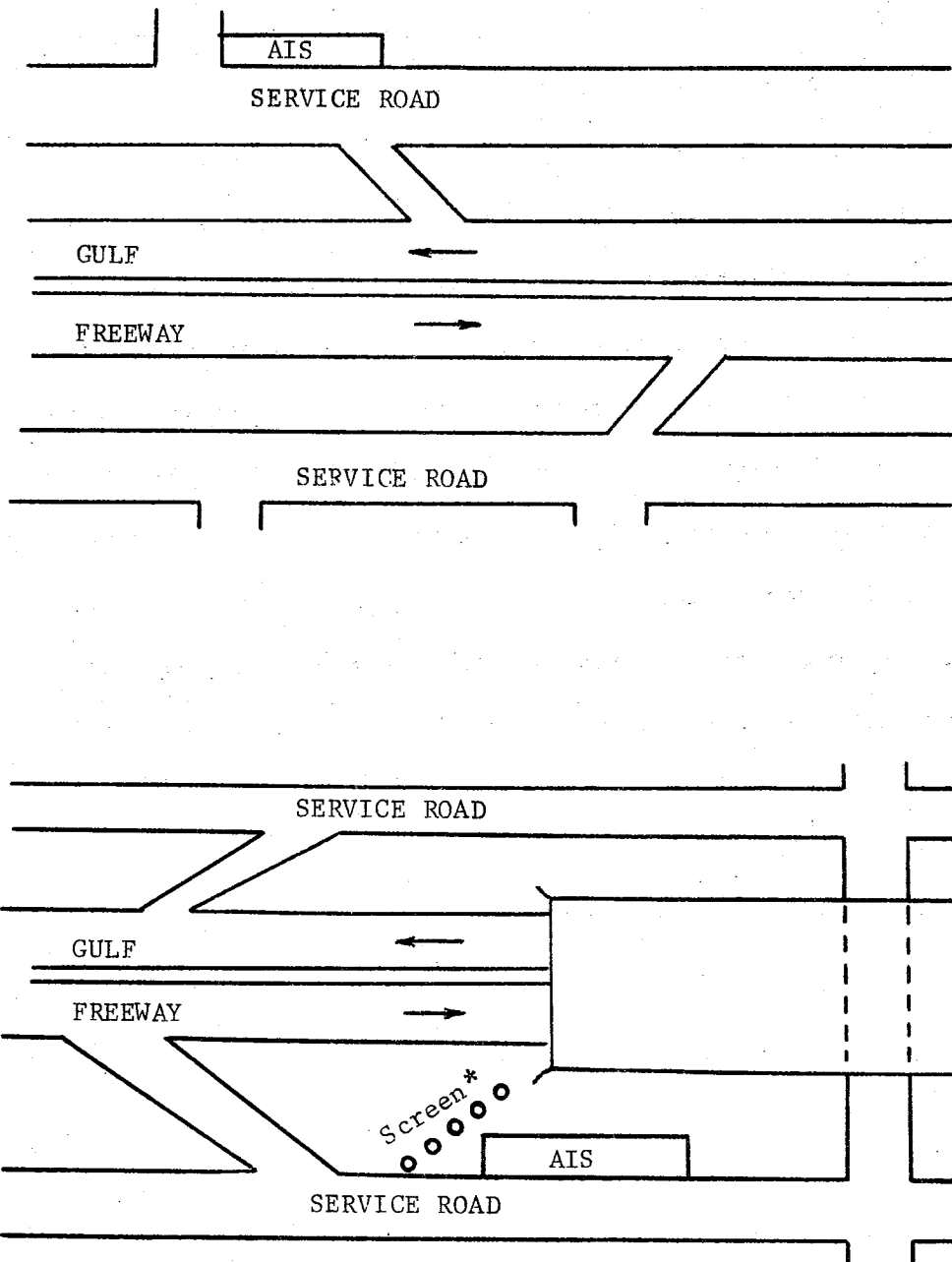
The installation of lights at a site may not be justified based on the added cost if nighttime usage rate is low. The purpose of the lighting should be to illuminate the area and not provide light for completing the investigation forms since officers use flash lights. Therefore, additional lighting should be limited to sites which have a high usage rate and no city lights.

The most used sites were those under the freeway overpasses. Several sites (9, 10, 14, and 16) were located at places with low accident rates and may be unnecessary. However, the cost of installation was low (\$35 a site), and other sites were difficult to reach. Due to freeway construction, the exit ramp leading to Site 15 was permanently closed on May 24. The site is now inaccessible from the freeway, and no replacement site has been proposed.

A site should be located so that it is accessible from the freeway and easy to find. Locating the site so that it is out of view of freeway motorists should take secondary consideration since screens (metal or foliage) could be installed. Where possible, sites should be constructed adjacent to the service road as shown in Figure 14. If modifications of the Gulf Freeway AIS system are made, Sites 7 and 8 should be relocated onto the freeway right-of-way near the service road.

Expansion to Other Freeways

Expansion of the AIS system to other freeways in Houston should be encouraged. Data on accidents were collected from the other freeways in Houston on a 24-hour basis. This was accomplished through the supplementary free-



*Screens should not be placed in a position that blocks the view of 'wrong-way' signing at exit ramps.

Figure 14. Modification of investigation site locations.

way accident report forms that the investigating officers filled out. A limited analysis was made to determine characteristics of accident removal on the other freeways. Table 11 summarizes accident experience and removal on all the Houston freeways. The Gulf Freeway study area had the highest removal rate, 61 percent. The removal rate for the other freeways varied from 24 percent to 41 percent. An AIS system installed on the other freeways should improve the removal rates. In designating the sites, emphasis should be placed on locations with high accident rates. Also to be considered in the city-wide AIS system are low construction costs and easily accessible sites. Representatives of the Houston Police Department, City of Houston - Department of Traffic and Transportation, and the Texas Highway Department, District 12, should be included in the choosing of the sites.

TABLE 11

ACCIDENT EXPERIENCE

Freeway Name	Gulf* I-45 S.	Gulf** I-45 S.	North I-45 N.	Katy I-10 W.	East I-10 E.	Southwest U.S. 59 S.	Eastex U.S. 59 N.	N. Loop I-610 N.	S. Loop I-610 S.	W. Loop I-610 W.
Distance in Miles	6.2	8.1	8.7	12.8	9.8	11.4	8.3	12.7	11.6	8.5
No. of Accidents	851	273	466	369	344	468	519	449	480	525
No. Investigated on Fwy. Shoulder or Median	336	173	301	245	210	298	308	273	320	401
No. Removed To an Off-Freeway Loca- tion	515	100	165	124	134	170	211	176	160	124
Removal Rate	61%	37%	35%	34%	39%	36%	41%	39%	33%	24%

* AIS Study Area

** Other than AIS Study Area

FINDINGS AND RECOMMENDATIONS

General

The usage rate for the Accident Investigation Sites on the Gulf Freeway was 40 percent during the first year of operation. Although this was lower than was anticipated, it is felt that the program has been a success. The AIS system is a new concept for handling accidents, and therefore, it should be expected that through an educational and managerial process, the usage rate will increase. That is to say, as policemen and motorists become more familiar with the purposes and benefits of the AIS, the usage rate will increase.

Findings

1. Of the 851 accidents reported in the study area, 40 percent were investigated at accident investigation sites and 21 percent at other off-freeway locations.
2. Of the 348 accidents that occurred on the inbound side of the Gulf Freeway, 44 percent were moved to an investigation site. On the outbound side, 43 percent of 282 accidents were removed to a designated site.
3. Between the hours of 6:00 - 9:00 a.m. and 3:00 - 6:00 p.m., 93 accidents were investigated at accident investigation sites which resulted in a savings of 29,250 vehicle-hours of delay. During the same period, 28 accidents were investigated at other off-freeway locations which amounted to a savings of 8,100 vehicle-hours of delay. The savings in delay totaled \$203,000 annually.
4. There was a 21 percent reduction in the number of secondary accidents after the AIS system was installed, resulting in a savings of \$25,000.
5. Total construction costs for the system amounted to \$34,500. Maintenance costs for the first year were estimated at \$2,400.
6. For the first year of operation, prorated costs of the system totaled \$8,000, while benefits from delay saved and accident reduction were \$228,000. Thus, the benefit/cost ratio was 28:1.
7. Criteria for an acceptable accident investigation site are:
 - a. easily accessible,
 - b. well-marked,

- c. concealed from freeway motorists,
- d. located near high-accident area,
- e. low construction costs,
- f. contain at least 1000 square feet of space, and
- g. sufficient lighting.

Recommendations

Based on the first year of operation of the AIS system, the following recommendations are made:

1. Because of the success of the first-year program of the AIS system on the Gulf Freeway, the evaluation of this system should be continued for succeeding years so that a long-term operation analysis can be made.
2. Since the investigation sites have proven to be beneficial on the Gulf Freeway, they should be expanded to include other freeways within the State.
3. To complement the expansion, there should be a major effort towards educating the general public as to removal and reporting of accidents and the purpose and location of the AIS. A city-wide AIS system should then work more efficiently since all freeway motorists would be able to use the system. This should reduce some of the problems encountered by the police department in accident investigation.
4. "Freeway Patrol" vehicles should be assigned to the Gulf Freeway to aid motorists in moving their vehicles off the freeway.

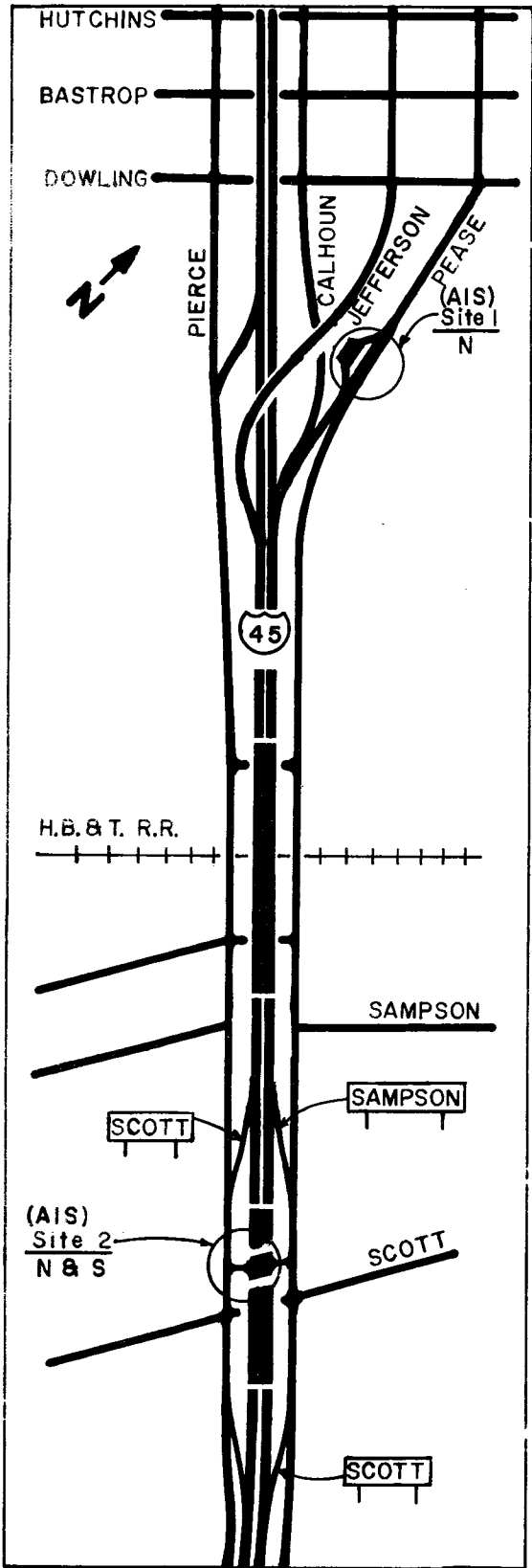
5. Conveniences, such as a public telephone or other communication systems should be added to the existing sites.
6. To assure the effective use of freeway sites and to obtain improved freeway operations after an accident has occurred, an educational program should be developed to inform the City Police Department on the intent and use of the sites. The program should be directed to the individual policeman.

REFERENCES

1. Wilshire, Roy L. and Keese, Charles J., "Effects of Traffic Accidents on Freeway Operation," Texas Transportation Institute, Bulletin No. 22.
2. Lynch, Frank L. and Keese, Charles J., "Restoring Freeway Operation After Traffic Accidents," Texas Transportation Institute, Bulletin No. 28.
3. Goolsby, M. E., "Accident Reporting and Clearance Procedures on the Gulf Freeway," Texas Transportation Institute, Research Report 139-1, 1969.
4. Goolsby, M. E., "Influence of Incidents on Freeway Quality of Service," Highway Research Record 349, 1971, pp. 41-46.
5. McFarland, W. J., Adkins, W. G., and McCasland, W. R., "Evaluation of the Benefits of Traffic Surveillance and Control on the Gulf Freeway," Texas Transportation Institute, Research Report 24-22, 1969.
6. Burke, Dock, "Highway Accident Costs and Rates in Texas," Texas Transportation Institute, Research Report 144-1F, 1970.

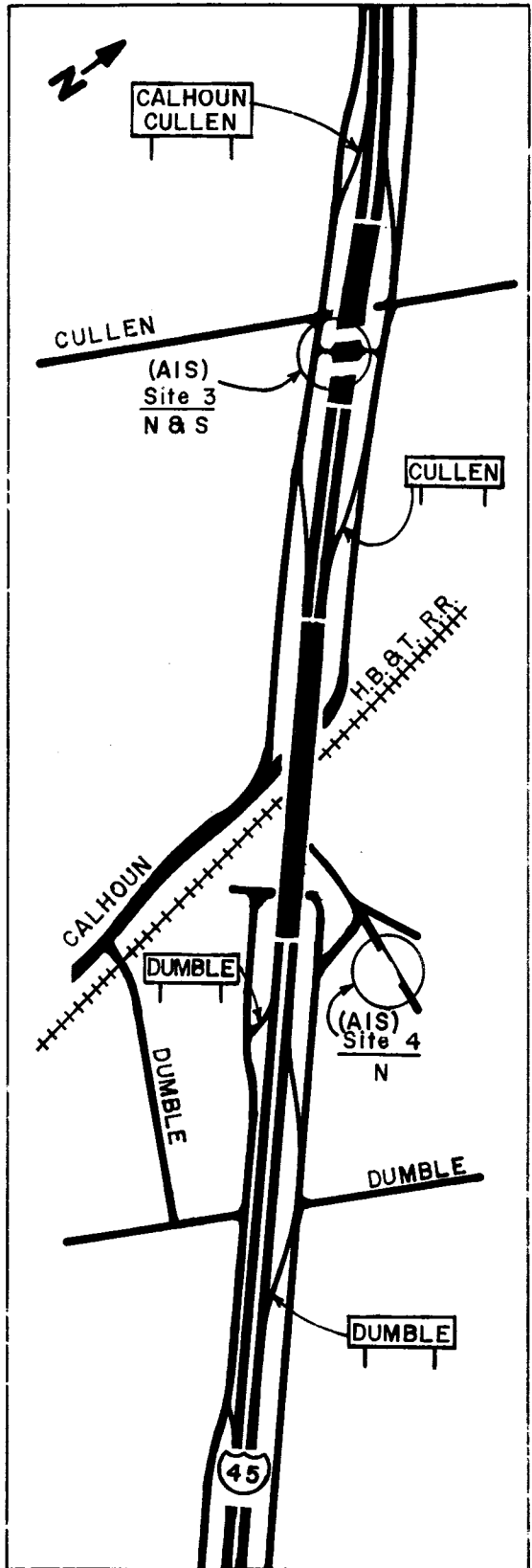
APPENDIX A

Map of Gulf Freeway Study Area
with Locations of AIS System



See Page 2

1

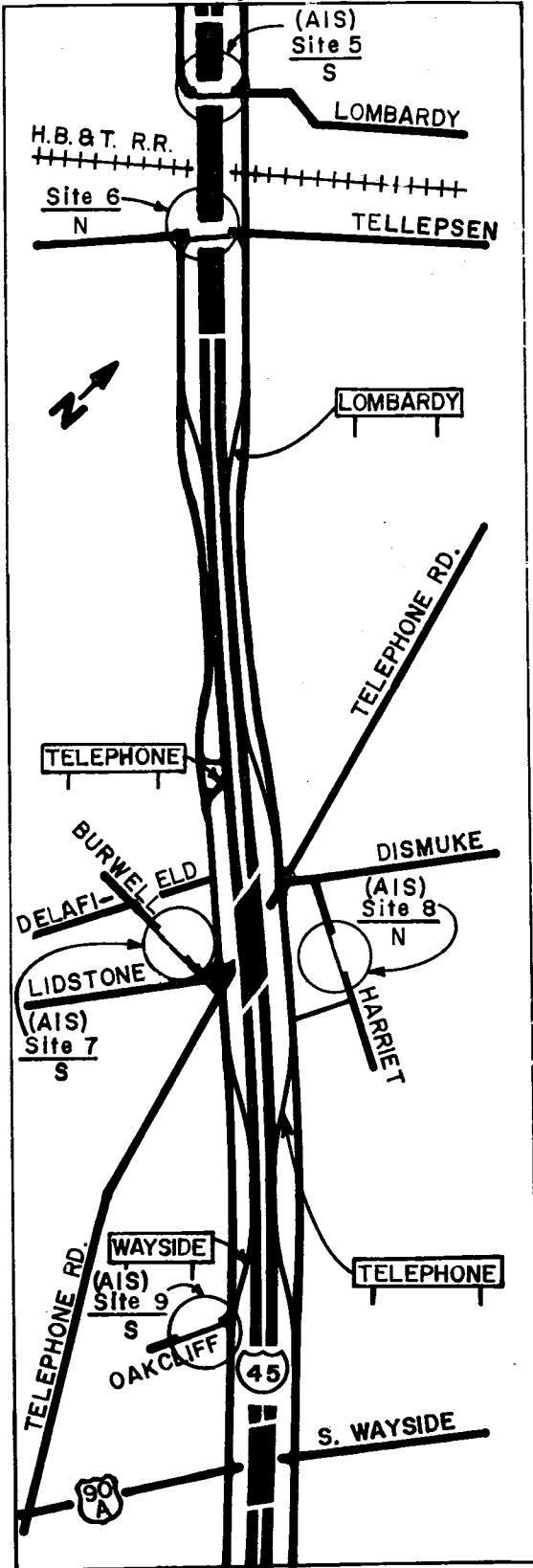


See Page 1

See Page 3

2

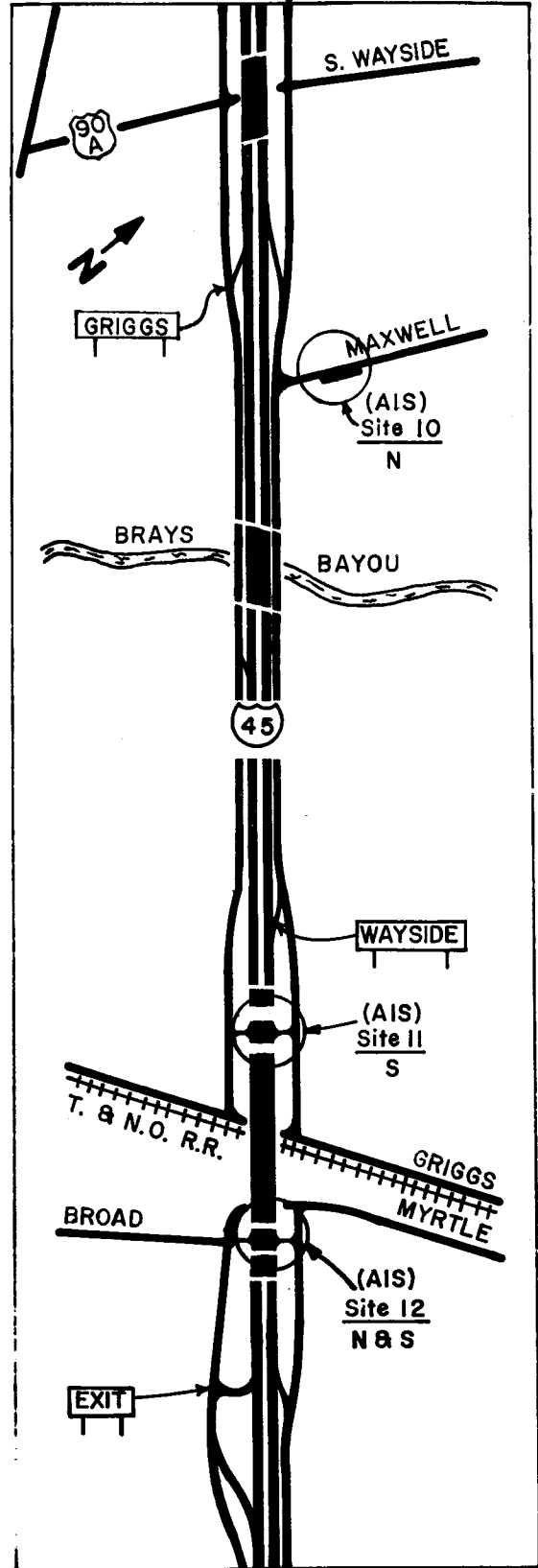
See Page 2



See Page 4.

3

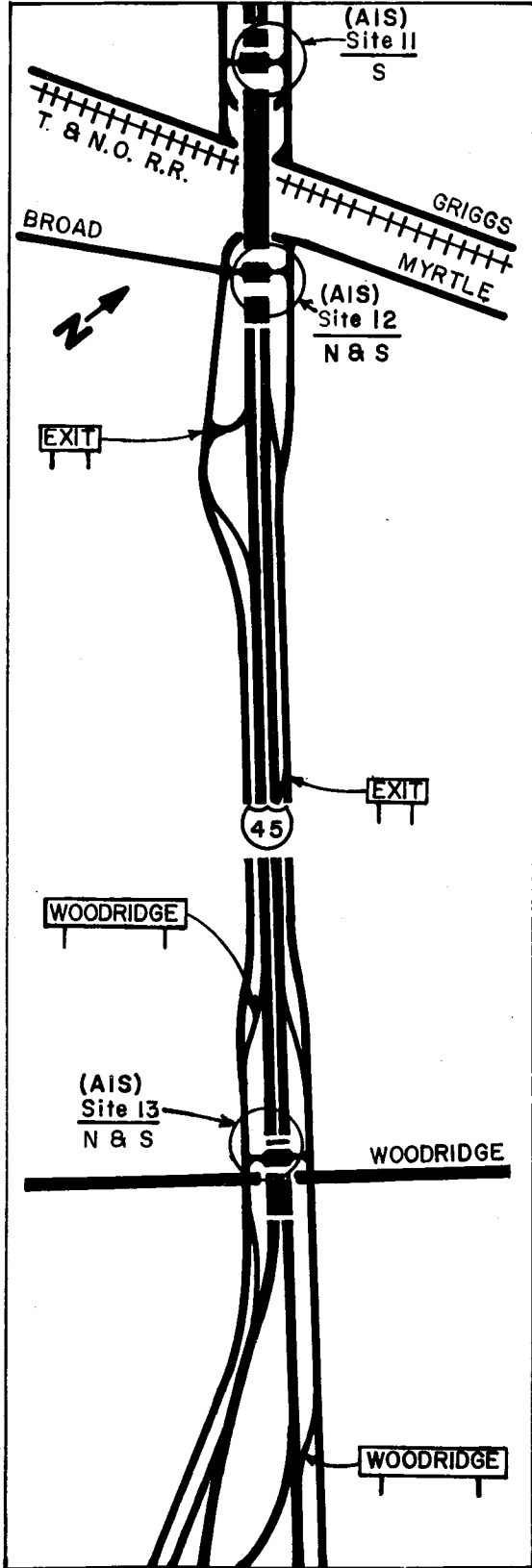
See Page 3



See Page 5

4

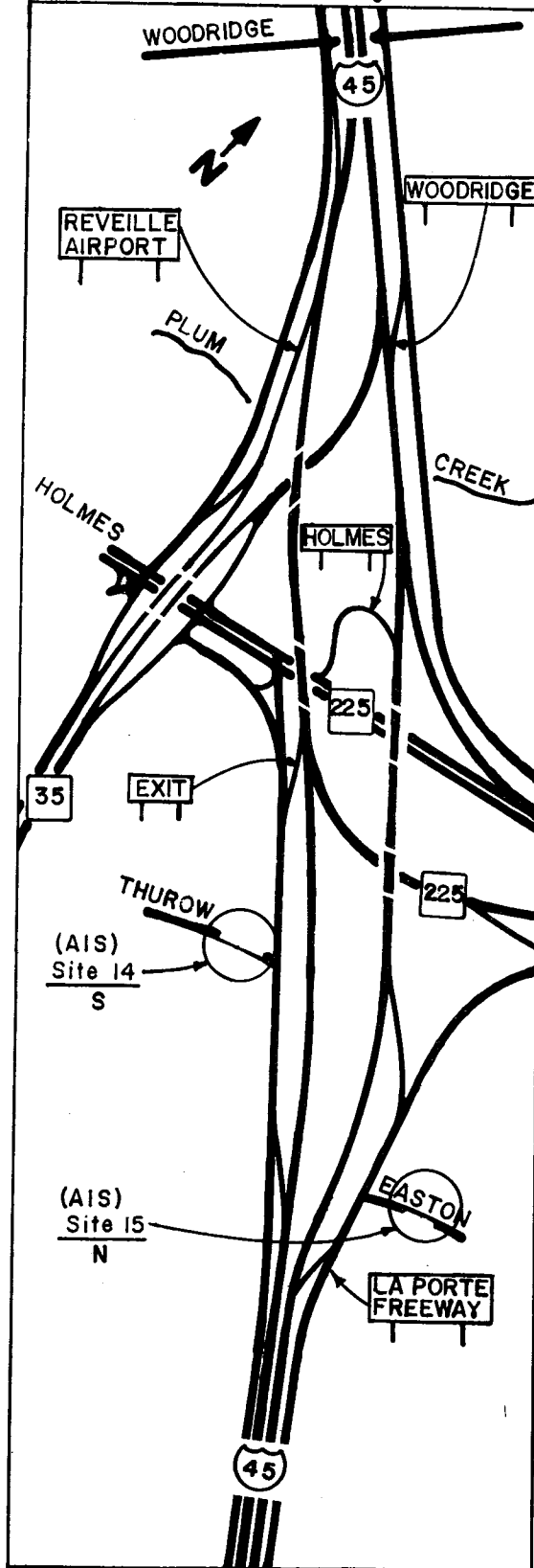
See Page 4



See Page 6

5

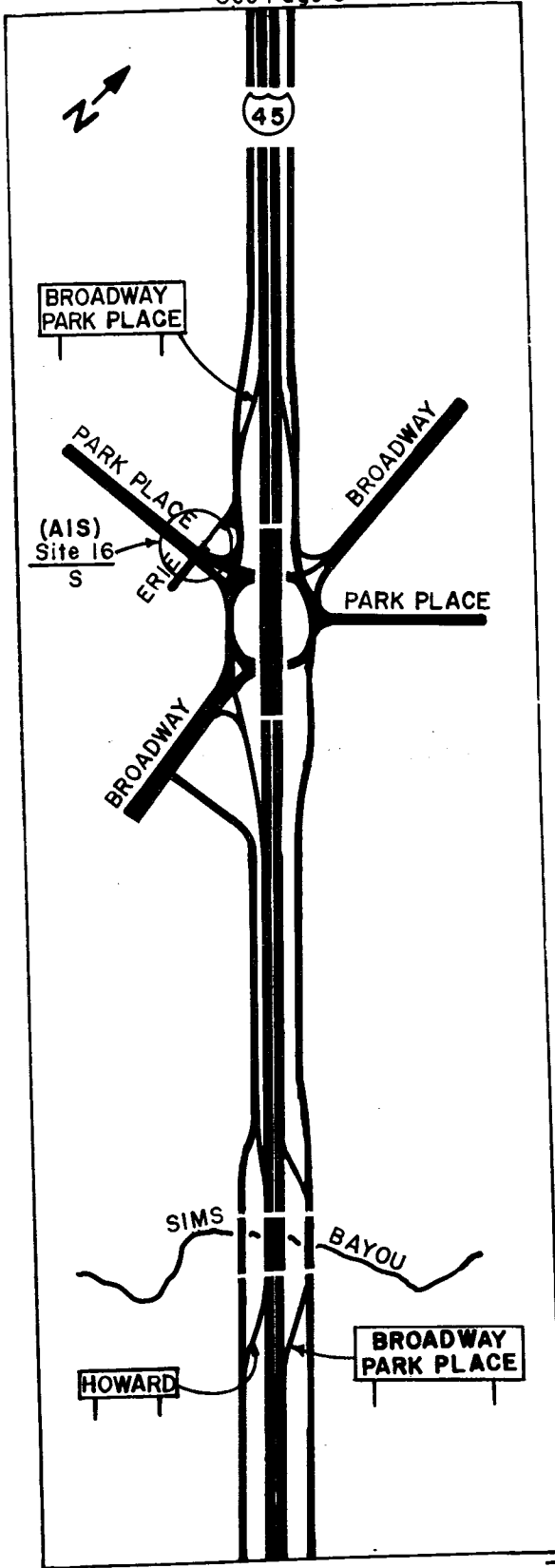
See Page 5



See Page 7

6

See Page 6



7

APPENDIX B

Weekly Summary Sheets and Graphs

ACCIDENT INVESTIGATION SITE (AIS) SUMMARY
GULF FREEWAY (2000 BLOCK - 8200 BLOCK)

WEEK OF STUDY →→→→	7/12- 7/18	7/19- 7/25	7/26- 8/1	8/2- 8/8	8/9- 8/15	8/16- 8/22	8/23- 8/29	8/30- 9/5	9/6- 9/12	9/13- 9/19	9/20- 9/26	9/27- 10/3	10/4- 10/10	total since July 12
1) Number of HPD Supplemental Freeway Accident Report Forms received	16	25	14	12	18	13	15	15	9	13	22	14	12	198
2) Percent of reports in which AIS or off-freeway sites used (as defined in 3 and 4 below)	75%	68%	50%	50%	61%	46%	60%	40%	55%	69%	50%	71%	67%	59%
3) Number of times AIS used	12	11	2	4	4	4	4	5	4	6	5	7	5	73
4) Investigations conducted off the freeway (other than AIS)														
a. Service road (or city street)		4	3	2	6	2	5	1	1	2	3	2	1	32
b. Parking lot		2	2		1					1	3	1	2	12
5. Investigations conducted on freeway or shoulder (apparent reasons for not using off-freeway site or AIS)														
a. Non-critical time*	3	2	4	3	5	2	1	5	1	2	4	1		33
b. No towing available														
c. Major incident		1	1								2	1		5
d. AIS inaccessible								2						2
e. Short investigation		2	1				2		1	1		1		8
f. Other given reason										1		1		2
g. No reason given (investigation during critical time*)	1	3	1	3	2	5	3	2	2		5		4	31

*Non-critical time - weekends, holidays, weekdays (9:00 a.m.-4:00 p.m.; 6:30 p.m.-6:30 a.m.)
 Critical time - weekdays (6:30 a.m.-9:00 a.m.; 4:00 p.m.-6:30 p.m.)

ACCIDENT INVESTIGATION SITE (AIS) SUMMARY
GULF FREEWAY (2000 BLOCK - 8200 BLOCK)

WEEK OF STUDY →→→→	10/11- 10/17	10/18- 10/24	10/25- 10/31	11/1- 11/7	11/8- 11/14	11/15- 11/21	11/22- 11/28	11/29- 12/5	12/6- 12/12	12/13- 12/19	12/20- 12/26	12/27- 1/2	1/3- 1/9	total since July 12
1) Number of HPD Supplemental Freeway Accident Report Forms received	13	23	18	14	20	24	16	24	13	13	7	18	13	414
2) Percent of reports in which AIS or off-freeway sites used (as defined in 3 and 4 below)	54%	65%	44%	57%	30%	62%	69%	75%	54%	38%	71%	56%	54%	58%
3) Number of times AIS used	4	7	3	5	5	9	6	14	4	1	1	4	2	138
4) Investigations conducted off the freeway (other than AIS)														
a. Service road (or city street)	2	6	3	1	1	4	3	3	3	4	3	5	4	74
b. Parking lot	1	2	2	2		2	2	1			1	1	1	27
5. Investigations conducted on freeway or shoulder (apparent reasons for not using off-freeway site or AIS)														
a. Non-critical time*	3	3	2	2	4	3	4	3	1	2	1	4	1	66
b. No towing available			2	2	4			1		2			1	12
c. Major incident	1	1	2		1				1	1			1	13
d. AIS inaccessible		2			1				1					6
e. Short investigation		1		2	1	2				1		1		16
f. Other given reason			1		2	2			1	1	1	1		11
g. No reason given (investigation during critical time*)	2	1	3		1	2	1	2	2	1		2	3	51

*Non-critical time - weekends, holidays, weekdays (9:00 a.m.-4:00 p.m.; 6:30 p.m.-6:30 a.m.)
Critical time - weekdays (6:30 a.m.-9:00 a.m.; 4:00 p.m.-6:30 p.m.)

ACCIDENT INVESTIGATION SITE (AIS) SUMMARY
GULF FREEWAY (2000 BLOCK - 8200 BLOCK)

WEEK OF STUDY →→→	1/10- 1/16	1/17- 1/23	1/24- 1/30	1/31- 2/6	2/7- 2/13	2/14- 2/20	2/21- 2/27	2/28- 3/5	3/6- 3/12	3/13- 3/19	3/20- 3/26	3/27- 4/2	4/3- 4/9	total since July 12
1) Number of HPD Supplemental Freeway Accident Report Forms received	12	34	5	27	25	20	25	24	16	12	18	9	12	653
2) Percent of reports in which AIS or off-freeway sites used (as defined in 3 and 4 below)	58%	50%	100%	56%	76%	60%	65%	79%	50%	58%	61%	44%	75%	59%
3) Number of times AIS used	6	13	5	8	13	8	9	17	7	4	6	4	4	242
4) Investigations conducted off the freeway (other than AIS)														
a. Service road (or city street)		2		7	3	3	4	1		1	1		2	98
b. Parking lot	1	2			3	1	3	1	1	2	4		3	48
5. Investigations conducted on freeway or shoulder (apparent reasons for not using off-freeway site or AIS)														
a. Non-critical time*	2	4		4		2	6	1		1	3	1	1	91
b. No towing available		2		3	3	1	1		1		3	1		27
c. Major incident	2	3		2	1		2	2			1			26
d. AIS inaccessible				2	1	1								10
e. Short investigation		2			1				1					20
f. Other given reason		2				2		2	3	2		2	2	26
g. No reason given (investigation during critical time*)	1	4		1		2			3	2		1		65

*Non-critical time - weekends, holidays, weekdays (9:00 a.m.-4:00 p.m.; 6:30 p.m.-6:30 a.m.)
Critical time - weekdays (6:30 a.m.-9:00 a.m.; 4:00 p.m.-6:30 p.m.)

59

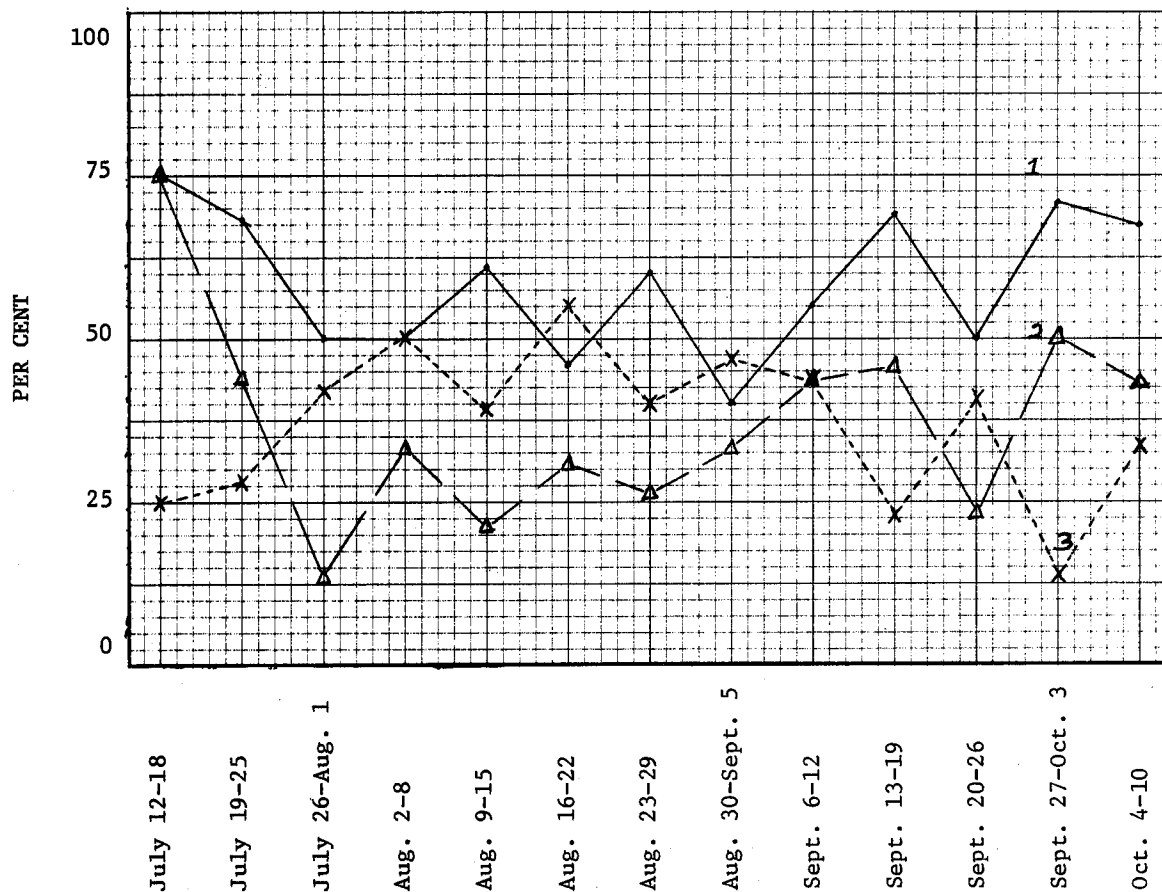
ACCIDENT INVESTIGATION SITE (AIS) SUMMARY
GULF FREEWAY (2000 BLOCK - 8200 BLOCK)

WEEK OF STUDY ---->	4/10- 4/16	4/17- 4/23	4/24- 4/30	5/1- 5/7	5/8- 5/14	5/15- 5/21	5/22- 5/28	5/29- 6/4	6/5- 6/11	6/12- 6/18	6/19- 6/25	6/26- 7/2	7/3- 7/9	total since July 12
1) Number of HPD Supplemental Freeway Accident Report Forms received	12	22	10	14	17	11	17	13	14	19	14	17	18	851
2) Percent of reports in which AIS or off-freeway sites used (as defined in 3 and 4 below)	67%	77%	80%	43%	59%	55%	65%	69%	86%	53%	64%	65%	56%	61%
3) Number of times AIS used	4	13	7	3	9	4	10	4	8	9	7	10	9	339
4) Investigations conducted off the freeway (other than AIS)														
a. Service road (or city street)	3	3		2		1	1	4	2	1	1	1	1	118
b. Parking lot	1	1	1	1	1	1		1	2		1			58
5. Investigations conducted on freeway or shoulder (apparent reasons for not using off-freeway site or AIS)														
a. Non-critical time*	1		1	4	1						1	1	1	101
b. No towing available	1	1			1		1		1	1	1	1	2	37
c. Major incident	1					3		1		1				32
d. AIS inaccessible				2	1				1	1	2	1	1	19
e. Short investigation								1						21
f. Other given reason	1	2	1	1	3	1	4	1		2		3	2	47
g. No reason given (investigation during critical time*)		2		1	1	1	1	1		4	1		2	79

*Non-critical time - weekends, holidays, weekdays (9:00 a.m.-4:00 p.m.; 6:30 p.m.-6:30 a.m.)
 Critical time - weekdays (6:30 a.m.-9:00 a.m.; 4:00 p.m.-6:30 p.m.)

AIS SUMMARY OF POLICE REPORTS

19



1. Per cent of reports in which AIS or off freeway sites used (see 2 on summary site)

2. Per cent of reports in which AIS used (see 3 on summary sheet)

3. Per cent of reports in which no apparent reason given for not clearing freeway (see 5a, 5e and 5g on summary sheet)

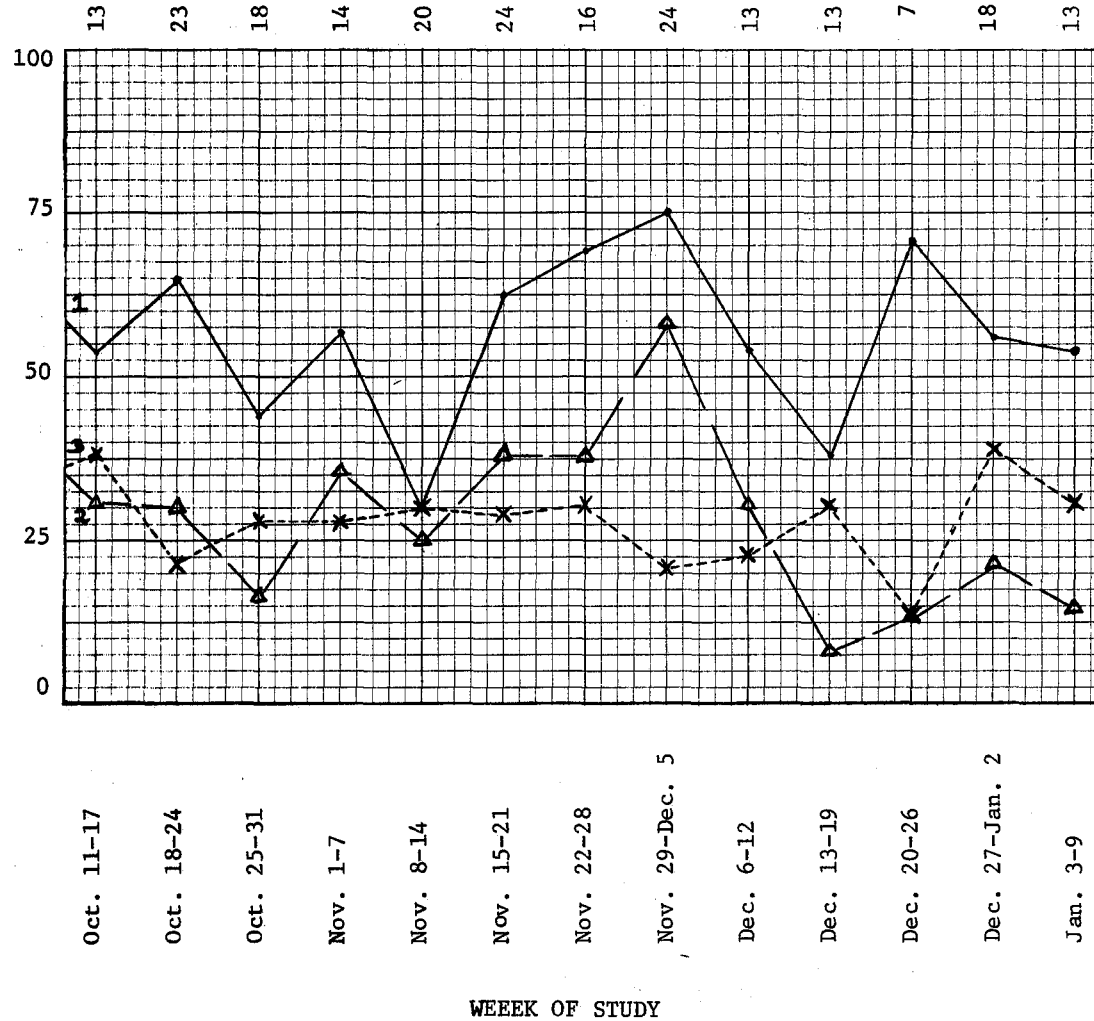
WEEK OF STUDY

AIS SUMMARY OF POLICE REPORTS

No. of Accidents

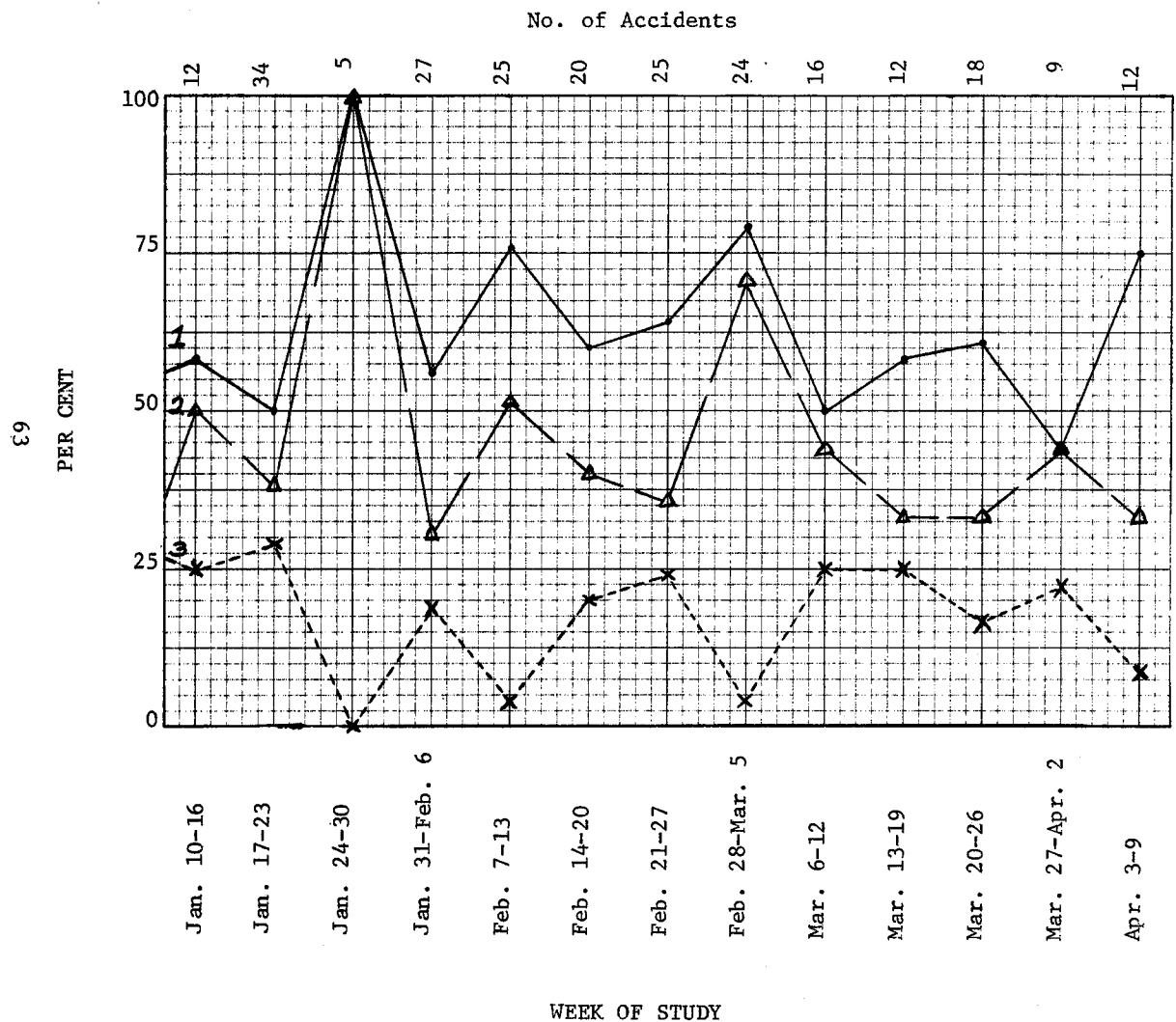
79

PER CENT



1. Per cent of reports in which AIS or off freeway sites used (see 2 on summary site)
2. Per cent of reports in which AIS used (see 3 on summary sheet)
3. Per cent of reports in which no apparent reason given for not clearing freeway (see 5a, 5e and 5g on summary sheet)

AIS SUMMARY OF POLICE REPORTS



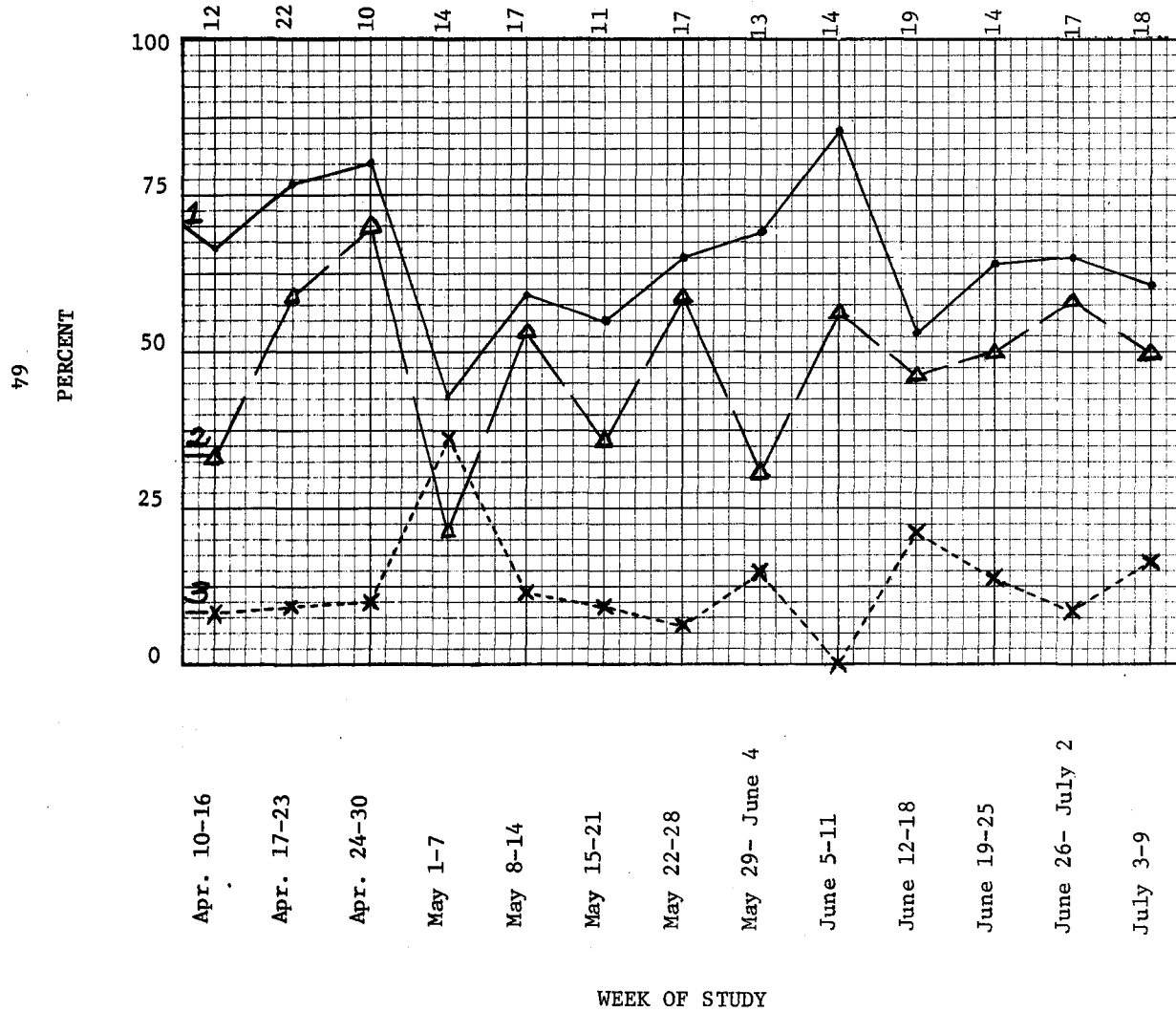
1. Per cent of reports in which AS or off freeway sites used (see 2 on summary site)

2. Per cent of reports in which AS used (see 3 on summary sheet)

3. Per cent of reports in which no apparent reason given for not clearing freeway (see 5a, 5e and 5g on summary sheet)

AIS SUMMARY OF POLICE REPORTS

No. OF ACCIDENTS



1. Percent of reports in which AIS or off freeway sites used (see 2 on summary sheet)
2. Percent of reports in which AIS used (see 3 on summary sheet)
3. Percent of reports in which no apparent reason given for not clearing freeway (see 5a, 5e and 5g on summary sheet)