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16. Abstract <p>This report contains case study analyses of four motorist assistance patrol programs in the State of Texas. In addition, it contains discussions of the four incident response and clearance strategies most often pursued by various agencies within the state: (1) freeway corridor surveillance and control, (2) traffic and incident management teams, (3) fast removal policies, and (4) motorist assistance patrols.</p> <p>Of the four strategies discussed in this report, motorist assistance patrols appear to offer the greatest opportunity for agencies to directly affect the duration of the response and clearance stages of an incident. Many factors go into determining the physical structure and coverage area of a motorist assistance patrol, a great deal of them political. This report provides useful insight into the various political and organizational attributes that need to be considered when developing a motorist assistance program. Regardless of their organizational structure or geographic coverage, motorist assistance patrols provide an effective way to reduce incident response and clearance time and at the same time are a useful tool for improving an agency's public image.</p>					
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**INCIDENT RESPONSE AND CLEARANCE IN THE STATE OF TEXAS:
CASE STUDIES OF FOUR MOTORIST ASSISTANCE PATROLS**

by

Steven D. Wohlschlaeger

Kevin N. Balke

Research Report 1232-15
Research Study 2-18-90/4-1232

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Texas Department of Transportation
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October 1992

METRIC (SI*) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	2.54	centimetres	cm
ft	feet	0.3048	metres	m
yd	yards	0.914	metres	m
mi	miles	1.61	kilometres	km

AREA				
in ²	square inches	645.2	centimetres squared	cm ²
ft ²	square feet	0.0929	metres squared	m ²
yd ²	square yards	0.836	metres squared	m ²
mi ²	square miles	2.59	kilometres squared	km ²
ac	acres	0.395	hectares	ha

MASS (weight)

oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg

VOLUME

fl oz	fluid ounces	29.57	millilitres	mL
gal	gallons	3.785	litres	L
ft ³	cubic feet	0.0328	metres cubed	m ³
yd ³	cubic yards	0.0765	metres cubed	m ³

NOTE: Volumes greater than 1000 L shall be shown in m³.

TEMPERATURE (exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimetres	0.039	inches	in
m	metres	3.28	feet	ft
m	metres	1.09	yards	yd
km	kilometres	0.621	miles	mi

AREA

mm ²	millimetres squared	0.0016	square inches	in ²
m ²	metres squared	10.764	square feet	ft ²
km ²	kilometres squared	0.39	square miles	mi ²
ha	hectares (10 000 m ²)	2.53	acres	ac

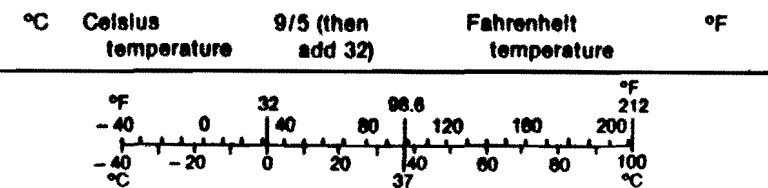
MASS (weight)

g	grams	0.0353	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (1 000 kg)	1.103	short tons	T

VOLUME

mL	millilitres	0.034	fluid ounces	fl oz
L	litres	0.264	gallons	gal
m ³	metres cubed	35.315	cubic feet	ft ³
m ³	metres cubed	1.308	cubic yards	yd ³

TEMPERATURE (exact)



These factors conform to the requirement of FHWA Order 5190.1A.

* SI is the symbol for the International System of Measurements

ABSTRACT

This report contains case study analyses of four motorist assistance patrol programs in the State of Texas. In addition, it contains discussions of the four incident response and clearance strategies most often pursued by various agencies within the state: 1) freeway corridor surveillance and control, 2) traffic and incident management teams, 3) fast removal policies, and 4) motorist assistance patrols.

Of the four strategies discussed in this report, motorist assistance patrols appear to offer the greatest opportunity for agencies to directly affect the duration of the response and clearance stages of an incident. Many factors go into determining the physical structure and coverage area of a motorist assistance patrol, a great deal of them political. This report provides useful insight into the various political and organizational attributes that need to be considered when developing a motorist assistance program. Regardless of their organizational structure or geographic coverage, motorist assistance patrols provide an effective way to reduce incident response and clearance time and at the same time are a useful tool for improving an agency's public image.

EXECUTIVE SUMMARY

Incidents are a major contributor to urban roadway congestion. Estimates indicate that incidents are responsible for somewhere between 40 and 60 percent of all urban delay. In Texas alone, the annual cost of delay due solely to incidents has been estimated at over \$1.25 billion each year. The Texas Department of Transportation (TxDOT) has developed several programs to deal specifically with the response and clearance stages of an incident. Of the four strategies discussed in this report (freeway corridor surveillance and control; traffic and incident management teams; fast vehicle removal policies; and motorist assistance patrols), motorist assistance patrols appear to offer the greatest opportunity for agencies to directly affect the duration of the response and clearance stages of an incident.

This report discusses four motorist assistance patrols in the state of Texas. Of the four motorist assistance patrols, only the programs in Dallas, Fort Worth, and San Antonio are operated solely by TxDOT. The Houston motorist assistance program is funded and operated by a unique combination of public and private interests. Patrol philosophies also vary among the four programs. The Houston, San Antonio, and Fort Worth programs patrol a majority of the freeways in their respective metropolitan areas. Unlike these motorist assistance patrols, the Dallas patrol focuses on improving incident response and clearance times only on the North Central Expressway.

As mentioned previously, Houston's motorist assistance patrol is a cooperative effort between TxDOT, the Houston Automobile Dealers Association, the Harris County Metropolitan Transit Authority, the Harris County Sheriff's Department, and the Houston Cellular Telephone Company. It is the result of a unique partnership agreement which has promoted and improved intergovernmental cooperation. Although cumbersome, the partnership arrangement does provide more opportunities for rapid expansion than a single agency program. In contrast though, the complex administrative and accounting structure of the program may hinder the day-to-day operations of the motorist assistance patrol.

The Dallas motorist assistance patrol is organized and operated by a single agency, but unlike the others, it focuses on only one radial freeway, US-75, the North Central Expressway. By concentrating on only one freeway, patrols can provide more frequent service and exhibit their worth on a smaller, less costly scale. Accompanied by favorable community reactions, this strategy can be used as a springboard for expanding coverage to an entire metropolitan area. Although limiting the coverage area reduces the cost of providing the motorist assistance patrol, congestion is a metropolitan wide problem, and expanded coverage would probably provide a greater benefit to the community as a whole.

Many factors go into determining the physical structure of a motorist assistance patrol. Regardless of their organizational structure or geographic coverage, motorist assistance patrols provide an effective way to reduce incident response and clearance time while improving an agency's public image.

IMPLEMENTATION STATEMENT

This report contains case study analyses of four motorist assistance patrol programs in the State of Texas. In addition, it contains discussions of the four incident response and clearance strategies most often pursued by various agencies within the state: 1) freeway corridor surveillance and control, 2) traffic and incident management teams, 3) fast vehicle removal policies, and 4) motorist assistance patrols. This information will be beneficial to TxDOT District personnel when choosing the incident response and clearance strategies which best fit the District's needs. It will also provide useful insight into the various political and organizational attributes that need to be considered when developing a motorist assistance program.

DISCLAIMER

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

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1. INTRODUCTION

Nationwide, traffic congestion continues to be one of the most pressing domestic problems, particularly along many of the freeway corridors in major urban areas (1). The old solutions of building new roadways or adding more lanes to existing facilities are becoming obsolete as construction costs rise and the prospects of obtaining additional right-of-way decrease. To keep traffic flowing, efforts must be made to utilize existing facilities as efficiently as possible.

In the fifteen years between 1970 and 1985, the total vehicle miles of travel in the United States doubled in urban areas and tripled on urban interstates (2). Congestion is no longer limited to highways near the central business district nor can it be considered only a peak-hour problem. Congestion is quickly becoming a major economic concern as it impedes the flow of local, regional, and interstate freight (3). In 1985, congestion was estimated to have caused more than 1.2 billion hours of delay, wasted 1.3 billion gallons of fuel, and generated more than \$9 billion in excess road user costs for motorists nationwide (4).

Using the FHWA's Highway Performance Monitoring System database and a slightly different analysis methodology, freeway congestion in each of the nation's thirty-seven largest cities in 1989 was estimated to have caused 2 billion hours of delay, at a cost of approximately \$16 billion. Based on these statistics and current trends, it has been estimated that the cost of congestion in each of these cities could be as high as 8 billion vehicle-hours and \$88 billion by 2005. In Houston and Dallas, the yearly cost of congestion, in 1990 dollars, has been estimated at \$2 billion and \$1 billion, respectively (5).

Types of Congestion

There are two types of traffic congestion, recurring and non-recurring. Recurring congestion exhibits a predictable pattern. Although recurring congestion can occur at any time during the day, the morning and evening rush hours are the most common time

periods for this type of congestion. Non-recurring congestion, on the other hand, is random in nature and is the result of various incidents which disrupt the normal flow of traffic. "Incidents include accidents and a vast array of small events - stalls, flats, spills, debris on the road, even highway maintenance work or construction - that divert drivers attention and disrupt the normal flow of traffic (5)." This definition can also be expanded to include pavement failures, landslides, flooding and other environmental or roadway conditions that reduce capacity (6). In short, an incident can be defined as any random act (random because the exact time and location of occurrence cannot be accurately predicted) that adversely affects the capacity of a roadway.

Estimates indicate that incidents are responsible for between 40 and 60 percent of all urban delay (4). According to the FHWA estimates for 1987, incident-related congestion costs the nation 13 billion vehicle-hours of delay at a loss of nearly \$10 billion (5). Texas is not immune to the problems of congestion. The annual cost of delay due solely to incidents in Texas has been estimated to be over \$1 billion, excluding the cost of wasted fuel (estimated to cost Texas motorists an additional \$250 million annually) (7).

Developing strategies to detect, respond to, and clear incidents quickly is one approach for mitigating the impacts of incidents on freeways. Such strategies help alleviate the economic and environmental impacts of incidents, as well as relieve some of the stress and anxiety experienced by motorists driving on congested roadways. These strategies are formally referred to as incident management procedures.

Incident Management

Incident management refers to a coordinated and planned approach to restoring freeway traffic to normal operation after an incident by using available human and mechanical resources (8). "Effective incident management involves a coordinated, cooperative, systematic approach among all the agencies involved to reduce the time it takes to detect and verify that an incident has occurred, coordinate the appropriate response, clear the incident, and manage traffic until normal conditions are restored (6)." The time saved by an incident management program (IMP) depends upon how well the

four stages of an incident (detection, response, clearance, and recovery) are managed (9).

Because many IMP strategies address both incident response and clearance, there will be no attempt to separate these two stages when discussing the various incident management options in this report. Options for responding to and clearing an incident effectively include the use or development of one or more of the following:

- Freeway corridor surveillance and control,
- Traffic and incident management teams,
- Fast vehicle removal policies,
- Motorist assistance patrols,
- Accident investigation sites,
- Peak period motorcycle patrols,
- Tow truck/crane removal contracts,
- Personnel, equipment, and material resource lists,
- Ordinances allowing travel on shoulders around incidents,
- Alternative route planning,
- Public education programs, and
- Training and manuals for incident response personnel demonstrating the proper use of equipment and other resources at an incident site.

All of these procedures have been implemented in some form around the country. However, the incident response and clearance strategies most often pursued by various agencies within the state of Texas include 1) freeway corridor surveillance and control, 2) traffic and incident management teams, 3) fast vehicle removal policies, and 4) motorist assistance patrols.

Motorist assistance patrols are particularly well suited for incident response and clearance. Their primary advantage is that they allow the agencies involved to take on an active role. Where other strategies require the action of other agencies or the public to be effective, motorist assistance patrols allow the supporting agency to physically aid

vehicles involved in an incident. Eighty-six percent of the incidents responded to by the Houston motorist assistance patrol (MAP) were detected by the sheriff's deputies which man the assistance patrol vehicles (10). Not only do the deputies identify incidents, they also stop and offer assistance to stranded and disabled motorists, remove debris from the roadway, call for additional assistance, and provide directions to lost motorists. Motorist assistance patrols are able to reduce the time of all four stages of an incident and thereby have the potential to dramatically decrease total incident duration. The Chicago motorist assistance patrol, for example, has been able to cut the time needed to clear major incidents in half due to the training and equipment they have available (11).

Purpose and Scope of Report

This report is intended to provide insight into the various political and organizational attributes that need to be considered when developing a motorist assistance program. Chapter two discusses the composition and impacts of incidents nationwide. Coupled with an understanding of the costs of congestion as discussed in the introduction, these data demonstrate the need for the development of procedures to effectively respond to and clear incidents. Chapter two also addresses the roles of incident response and clearance in mitigating the impacts of incidents, and examines four of the incident response and clearance strategies pursued by the state of Texas. Chapter three describes the development of motorist assistance patrols in four Texas cities. This case study approach brings to light the political and institutional factors that affect the development, operation, and organization of motorist assistance patrols. Chapter four summarizes the major points of the report and provides recommendations for consideration when implementing motorist assistance patrols.

2. INCIDENT DISTRIBUTION, AND RESPONSE AND CLEARANCE

Incidents encompass any random event that disrupts the normal flow of traffic. The type of incident that occurs (accident, stall, flat, etc.) often affects the magnitude of the impacts both in terms of incident duration and the severity with which it reduces roadway capacity. Developing and implementing effective incident response and clearance procedures can aid in mitigating the adverse impacts of incidents.

This chapter describes the three general categories of incidents (disabled vehicles, accidents, and other incidents) and their impacts on the surrounding travel lanes. It also focuses on the factors affecting the response and clearance stages of an incident and illustrates their contribution to the total duration of a typical incident. This chapter concludes with a discussion of four incident response and clearance strategies most often used by various public and private agencies in Texas.

Incident Distribution

The first step in solving any problem is properly identifying the problem. Once the problem is identified, steps can be taken toward finding the best solution. Determining what incidents occur most frequently can aid in the development of effective strategies to lessen the impacts of those incidents.

Disabled Vehicles

The vast majority of incidents recorded by police and highway departments nationwide (80 percent) are the result of disabled vehicles. This includes cars and trucks that have run out of gas, had a flat tire, or have been abandoned by their drivers (3). Figure 1 illustrates a typical break-down of recorded incidents by type. Nationwide, it has been found that eighty percent of all disabled vehicles end up on the shoulders of the roadway for an average of 15 to 30 minutes (5). The presence of these disabled vehicles on the shoulder during peak periods can slow traffic in the adjacent travel lanes, reducing capacity by up to 26 percent (12) and causing 100 to 200 vehicle-hours of delay to other

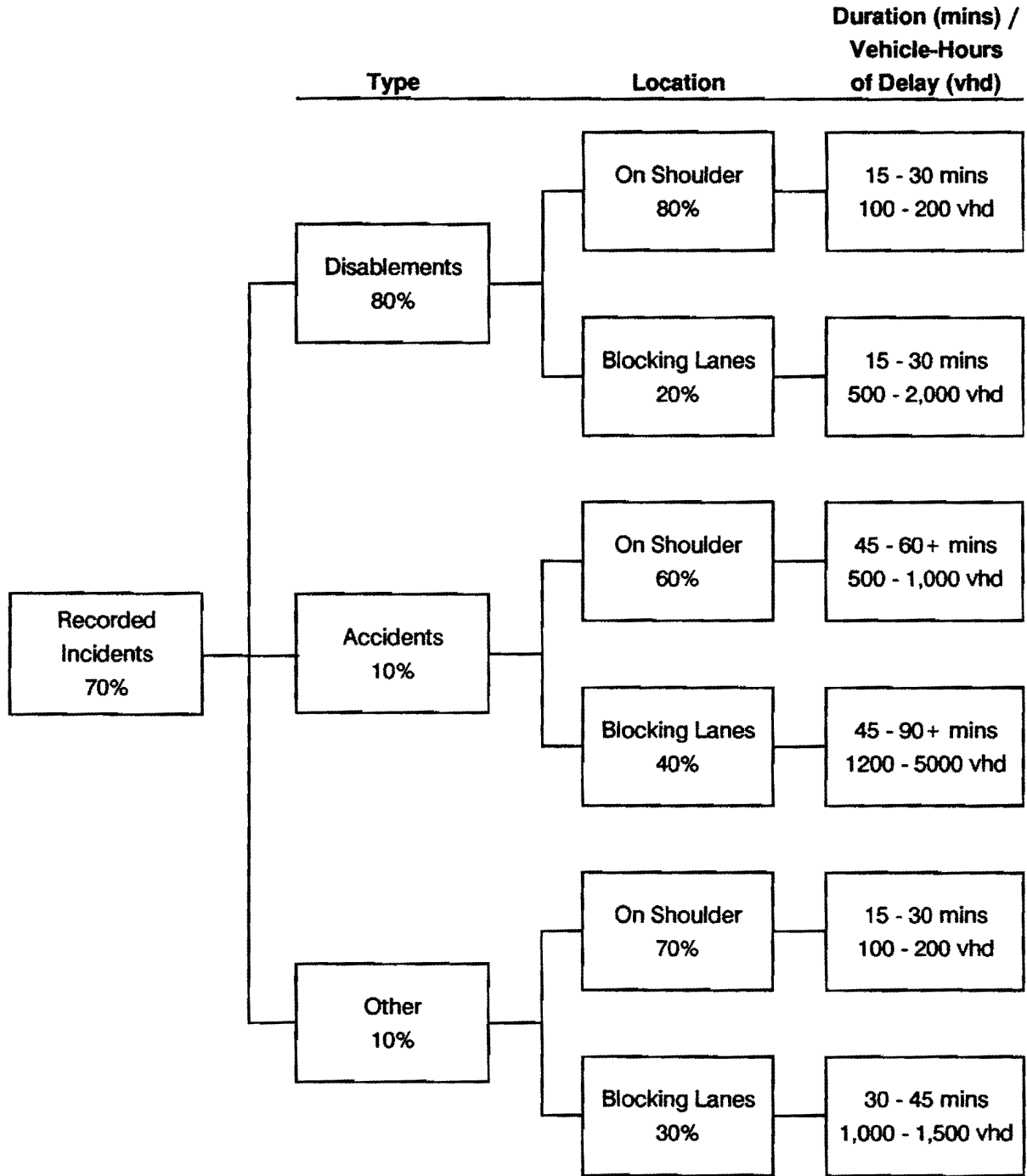


Figure 1. Profile of Recorded Incidents by Type (5)

motorists. The other 20 percent of disabled vehicles can be found blocking one or more of the travel lanes for an average of 15 to 30 minutes per incident (5). Although an incident which blocks one lane on a three lane highway reduces the physical capacity of the roadway by only 33 percent, actual traffic flow can be cut by up to 50 percent. For incidents which block two out of the three lanes, traffic flow can be reduced by up to 80 percent (12). During peak periods, these disabled vehicles can cause between 500 and 2,000 vehicle hours of delay (5). More recent studies performed by the Texas Transportation Institute have found a similar distribution of incidents on the Houston freeways. Of all of the freeway incidents responded to by the Houston MAP, 75 percent involve vehicles on the shoulders while 19 percent are found on the mainlanes. The location of the other 6 percent could not be determined from analyzing the incident report forms (10).

Accidents

Accidents account for only 10 percent of the recorded incidents across the nation (5). In the city of Houston, 9 percent of the incidents responded to by MAP were the result of major or minor accidents (10). Approximately 40 percent of all accidents block one or, occasionally, two lanes of traffic. Each such incident typically lasts for 45 to 90 minutes and causes between 1,200 and 2,500 vehicle-hours of delay (5). Accidents that involve personal injury or fatalities can be especially time consuming.

Between 5 and 15 percent of all accidents can be classified as major. Most of these cause between 2,500 and 5,000 vehicle hours of delay (13). In a few cases, these may last from 10 to 12 hours and cause up to 40,000 vehicle hours of delay (3). Although their contribution to the total number of recorded incidents is small when compared to disabled vehicles, accidents often have very severe impacts on traffic.

Other Incidents

According to national statistics, the remaining 10 percent of incidents that appear in police and highway agency records are attributed to emergency maintenance work, debris on the road, brush fires, wandering pedestrians, stray animals, or other events.

Their impacts are similar to those caused by vehicle disablement, with 70 percent occurring on the shoulder of the roadway and 30 percent blocking one or more lanes of traffic. The 30 percent blocking one or more lanes of traffic typically last from 30 to 45 minutes and cause between 1,000 to 1,500 vehicle-hours of delay per incident under congested conditions (5).

The impact of incidents is not limited to congestion. Secondary accidents and additional vehicle break-downs occur in the stop-and-go traffic created by incidents, increasing the total number of incidents and slowing the return of normal conditions after the initial incident is cleared (6). A study performed by the Minnesota Department of Transportation found that 13 percent of all peak period accidents on a Minneapolis freeway were secondary accidents (14).

Although the discussion in this report focuses primarily on the response and clearance stages of an incident, it is important to recognize the considerable overlap between all four stages of an incident. Although all incidents are eventually cleared, clearance time may be unnecessarily extended and total incident time proportionally increased if an incident is not promptly detected and verified, or if the proper agency does not respond. In a report prepared by the Washington State Transportation Center (15), many of the strategies presented as options for reducing response time are also included in the options for reducing detection time, in addition to being included in those suggested for reducing clearance time.

Incident response and clearance

Response is the activation, coordination, and management of the appropriate personnel and equipment necessary to clear an incident (6). Incident response time can be considered as the sum of three time elements: 1) the time required to determine the appropriate emergency equipment and personnel needed to remove the incident, 2) the time needed to report these needs to the appropriate agencies, and 3) the time required for the emergency vehicles and personnel to travel to the incident site.

Clearance is the safe and timely removal of the incident in order to facilitate restoration of the roadway to its full capacity (6). Incident clearance time is affected by a number of factors including: the severity of the incident, the response provided, the surrounding traffic conditions, and the coordination of response personnel and equipment at the incident site. Typical clearance activities include the following:

- Administering first aid,
- Extracting occupants from damaged vehicles,
- Fire fighting,
- Accident investigation,
- Coroner investigation if necessary,
- Traffic control and diversion,
- Vehicle removal,
- Debris cleanup, and
- Removing temporary signing and traffic control devices (16).

The contributions of the response and clearance stages of an incident to the total incident duration can be seen in Figure 2. Incident response and clearance procedures are implemented by agencies with the intent of reducing the incident duration. This can have a dramatic effect on the congestion (and also total delay) caused by incidents which occur during periods when traffic volumes are at or near capacity. The potential reduction in delay brought about by implementing effective incident response and clearance procedures is shown graphically in Figure 3. The total number of vehicles desiring to use the roadway over the time period is represented by line D_N , the normal traffic demand. Lines C_I and C_N illustrate the capacity of the roadway as a result of the incident and the normal roadway capacity, respectively. The incident begins at time B and continues (without the implementation of effective incident response and clearance strategies) until normal roadway capacity returns at the end of the incident E. If through effective incident response and clearance strategies, an agency is able to reduce the total incident duration to time E', then there would be a related decrease in the time required for the roadway to return to normal operation. This decrease brings about a subsequent delay savings which is represented by the shaded area in Figure 3.

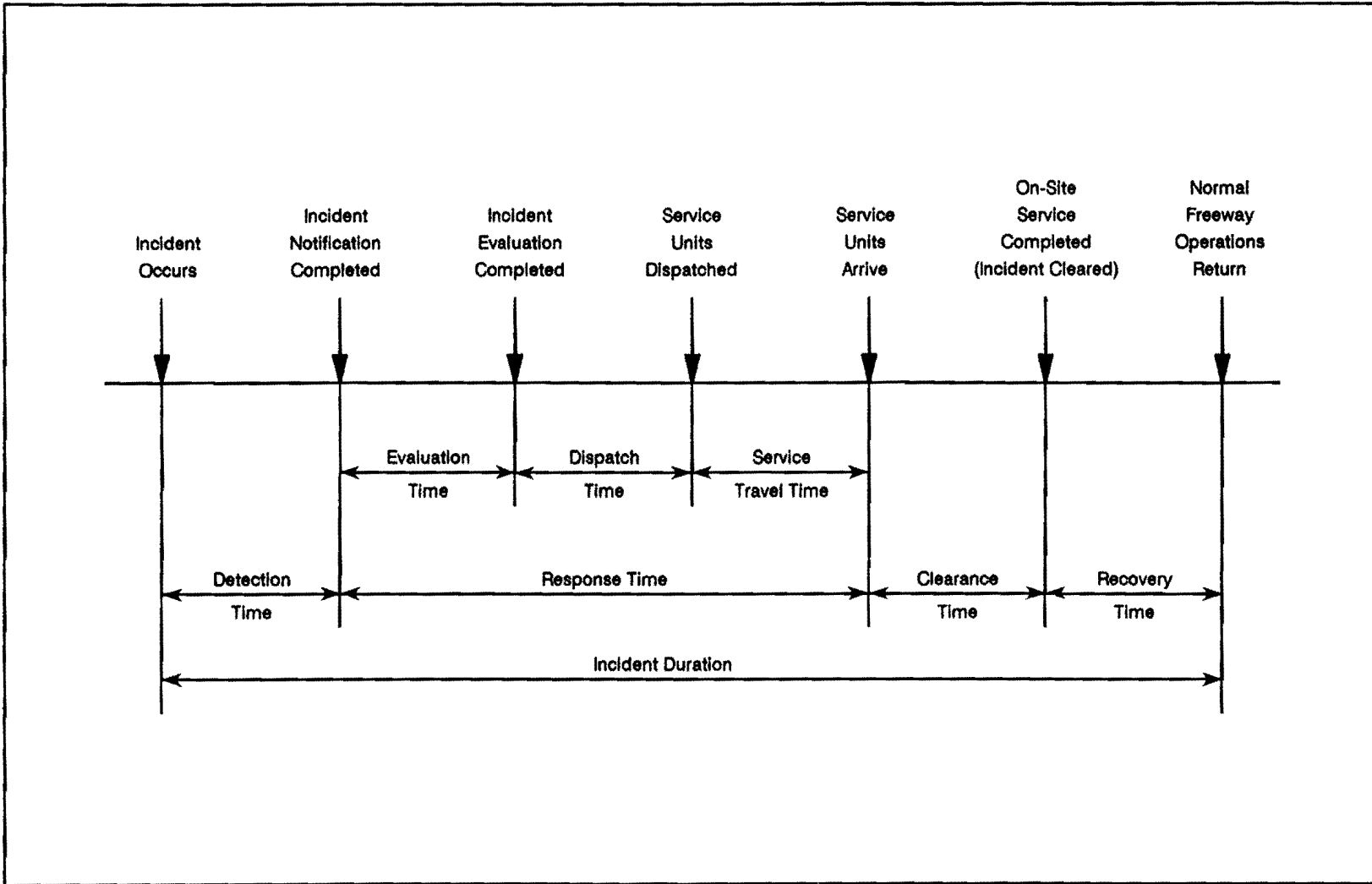


Figure 2. Components of Incident Duration (16)

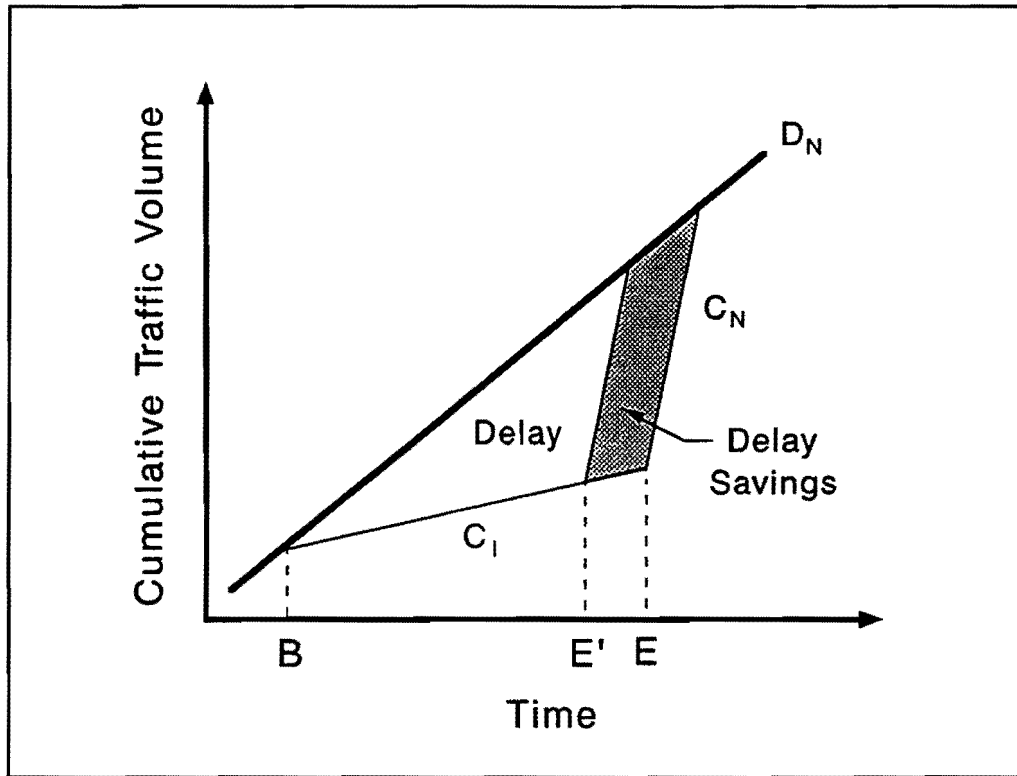


Figure 3. Delay Reduction Due to Reduced Response and Clearance Time (17)

The benefits of effective incident response and clearance procedures are not limited to reducing incident related delay. Adverse impacts can be reduced by implementing incident response and clearance procedures that are focused on the vehicles involved in the incident, on those in the surrounding travel lanes, or both. By introducing the proper procedures, an agency can also reduce the magnitude and severity of adverse impacts such as vehicle emissions and secondary accidents.

Four of the strategies most commonly used by TxDOT Districts to improve incident response and clearance are as follows: (1) freeway corridor surveillance and control systems, (2) traffic and incident management teams, (3) fast vehicle removal policies, and (4) motorist assistance patrols. Each of these procedures, including their typical utilization, is discussed below.

Freeway Corridor Surveillance and Control Systems

Freeway corridor surveillance and control systems focus on managing the traffic in the travel lanes surrounding or adjacent to an incident as well as on detecting and verifying incidents. They are designed and operated to monitor traffic conditions, detect the occurrence of incidents, monitor and report on the status of traffic control hardware, provide information for traffic controls, and operate those controls (18). They are able to reduce response and clearance time by shortening the time it takes to verify that an incident has occurred and to initiate the appropriate response. They also have the potential to reduce the adverse impacts of an incident by providing the ability to discourage the use of the facility upstream of an incident or by directing motorists more efficiently through an incident site. NCHRP Synthesis of Highway Practices 177 (1) and 156 (8) provide detailed discussions as well as more exhaustive lists of references on this subject.

Surveillance and control systems are being developed by TxDOT to manage traffic in a freeway corridor (19, 20). There are many components of the systems being developed. Elements of the control phase of the systems -- ramp meters, changeable message signs (CMS), and lane control signals -- are most pertinent to the response and clearance stages of an incident and are used in conjunction with the surveillance systems to expedite incident response and clearance. Ramp meters can be used to restrict the influx of traffic upstream of an incident. The CMSs could be used to provide advanced notice of an incident and to inform motorists of an alternative route around the incident location. Lane control signals can be used to indicate which lanes are blocked by an incident. This allows motorists to move into an unimpeded lane upstream of an incident, reducing the potential for erratic maneuvers (i.e. hard braking, last minute lane changes, swerving, etc.) and increasing the efficiency of traffic flow past the incident site.

Freeway surveillance and control systems can do much to lessen the impacts of incidents. Closed-circuit television and similar visual setups allow system operators to visually determine the type of response (i.e. police only, police and fire, motorist assistance patrol only, etc.) needed to clear an incident, eliminating the need to use the

motorist assistance patrol for verification. The total duration of an incident can be decreased because 1) less time is spent verifying an incident and initiating a response, and 2) the proper response is dispatched initially. Some of the other related benefits that freeway surveillance and control systems can provide include the following:

- Reduced accidents - the ramp to freeway merging operation is controlled by ramp meters, reducing conflicts and the potential for accidents;
- Reduced delay - motorists can be advised of alternative routes/unimpeded lanes upstream of the incident allowing better traffic flow around and through the incident site, and ramp meters can be used to reduce demand at the incident site;
- Reduced secondary accidents - motorists can be alerted of an upcoming incident, increasing the caution with which they approach the site;
- Increased driver satisfaction - motorists can be notified of upcoming conditions, allowing them to respond to rather than be at the mercy of current conditions;
- Improved public relations - motorists appreciate being informed of roadway conditions;
- Improved incident detection and verification; and
- Reduced police non-enforcement calls - surveillance can be used to identify need for police response (21, 22, 23).

Ramp metering alone has been shown to reduce accidents 24 to 50 percent (23). In 1982, the Illinois Department of Transportation (IDOT) integrated their Traffic Systems Center, Communications Center, Emergency Traffic Patrol, and IDOT management and traffic personnel into an interagency computer terminal network. Results indicate that the combined surveillance and control system has been responsible for a 60 percent reduction in traffic congestion during the peak-periods and an 18 percent reduction in accidents (24). Upon completion, the Fort Worth freeway surveillance and control system is expected to reduce accidents by as much as 30 percent (25).

Traffic and Incident Management Teams

Coordination and cooperation among various state and local agencies are the keys to successful incident response and clearance. Both traffic management teams (TMT) and incident management teams (IMT) are excellent methods to facilitate communication

between the various agencies involved in incident response and clearance. TMTs focus on improving the overall traffic operation and safety along principal arterials and/or urban area corridors (26). IMTs focus on coordinating incident response and clearance efforts in the most effective manner by fostering quality communication between the agencies involved. Both TMTs and IMTs provide excellent forums for discussing, analyzing, and developing (sometimes overnight) solutions to traffic and incident related problems (27).

The TMT and IMT bring together professionals from the various transportation related agencies in an area in order to solve the area's traffic and incident related problems. They aid in the development of mutual respect among members, help members to view problems from another agency's point of view, and more importantly, they help to break down the barriers to effective communication that have been built up as a result of previous disputes between agencies (26). These improvements in communication, cooperation, and coordination can translate into reductions in the time required to respond to and clear incidents.

The first TMT in Texas was officially formed in 1975. By January 1990, a total of twenty-four TMTs were operating in nine of the largest metropolitan areas, as well as other smaller areas of the state (26). This growth alone seems to indicate that TMTs are beneficial.

TMTs are typically composed of transportation and enforcement personnel responsible for the day to day operations of the roadway network in a common area. They are currently being used to coordinate the efforts of various agencies in the following typical areas:

- Work zone traffic control,
- Route improvements,
- Normal Operations,
- Emergency planning, and
- Special event traffic handling (26).

Fast Vehicle Removal Policies

Fast vehicle removal policies insure that disabled, abandoned, or damaged vehicles do not create unnecessary hazards for other motorists. Of the 216,148 non-injury accidents investigated in the State of Texas in 1990, 158,660 were considered minimal damage accidents. Texas Motor Vehicle laws require drivers to move their vehicles off of the freeway when non-injury acts occur and the vehicles can be driven (28). However, a survey showed that 71 percent of Texas drivers are unaware of this law (29). Furthermore, motorists are hesitant to move their vehicles because of the following reasons:

- most believe it is illegal to move their vehicles before police arrive, and
- many motorists believe their insurance policy will be void if they move their vehicles before the police arrive (30).

There are two variations of fast vehicle removal policies. In the first, emphasis is placed on educating the public on the need for them to remove their vehicles from the roadway as soon as possible after they are involved in an incident (24). The "MOVE IT" public awareness campaign initiated by TxDOT is an example of this type of fast removal policy.

The "MOVE IT" campaign, which originated in Dallas, is an effort by TxDOT to inform motorists of Article IV, Section 39 of the Texas Motor Vehicle Laws Uniform Act 1981-82 (28). Simple observance of the law by motorists will lessen the impacts of many incidents on the freeway system. This will result in safer, more efficient roadways for everyone.

In the second variation of fast vehicle removal policy, the public agency takes the initiative in removing disabled, abandoned, or damaged vehicles (24). Recent legislation (Senate Bill 312) strengthened TxDOT's ability to remove disabled, abandoned, or damaged vehicles from the roadway without undue concern of liability (31). The legislation gives TxDOT the authority to remove cargo or personal property from the roadway without owner consent. This legislation also reduced the threat of TxDOT liability

and claims of damages against TxDOT provided that the removal or disposal was not carried out in a reckless or grossly negligent manner. The legislation granted TxDOT the authority to remove cargo or property from the roadway anytime it is impeding traffic flow or is otherwise considered to be endangering public safety.

Both of these developments, the "MOVE IT" campaign and Senate Bill 312, have helped TxDOT provide more expedient incident response and clearance. By quickly removing spilled cargo and/or disabled vehicles from the roadway, incident duration is decreased and the possibility of secondary accidents is diminished. Senate Bill 312 has also decreased incident clearance time by providing a clearer understanding of TxDOT liability and authority for restoring roadways to normal operating conditions after an incident.

Motorist Assistance Patrols

Motorist assistance patrols, or courtesy patrols, offer another tool to combat the impacts of incident related congestion. An individual who is involved in an incident is generally unprepared to immediately cope with even the simplest situation. With the passage of time, presence of darkness, or remoteness of setting, motorists may become fearful and behave in an irrational manner. Abandoning their vehicles in search of aid, these motorists increase the probability that they will sustain personal injury (32). By providing timely, reliable service, motorist assistance patrols can improve motorist safety, decrease incident related congestion, and reduce the occurrence of secondary incidents.

Although most are similar in terms of basic equipment, there are three primary differences found among motorist assistance patrols. First, they vary in terms of the type of incident they are designed to accommodate. Although most are prepared to render basic assistance, some are able to provide specialized equipment for use during incidents involving larger vehicles. Second, they differ in terms of their method of response. That is they are either stationary (usually for spot locations such as tunnels or bridges) or they are roving (1). As might be expected, roving patrols have been found to be more effective for covering a section of freeway or a freeway network (8). Third, motorist

assistance patrols can differ in terms of their sponsoring organization and funding source. Most are operated by enforcement or highway agencies; however, motorist assistance patrols have also been established in some parts of the country by private corporations or citizen groups as a community service and/or public relations promotion (11, 33).

The Chicago Emergency Traffic Patrol (ETP), familiar to motorists as the "Minutemen," provides mobile surveillance and responds to incidents on 718 lane-miles of expressway, 24 hours per day, 7 days per week. They assist more than 100,000 motorists annually by putting out small fires; changing flat tires; towing disabled vehicles off the roadway; providing fuel, water, and air for tires; assisting with minor mechanical problems; and providing small hand tools for motorist use. In addition, Minutemen assist at accident scenes, remove debris from the roadway, establish emergency traffic detours, report state property damage, etc. (34). They also carry radios to request extra equipment or personnel if the response is beyond their capabilities.

Although the direct impacts of the ETP were not reported by McDermott, et al., they did evaluate the IDOT Chicago Freeway Traffic Management (FTM) program as a whole. FTM program elements, which includes the ETP, have reduced peak period traffic congestion up to 60 percent and accidents by up to 18 percent (35). A benefit-cost analysis of IDOT expenditures on the Chicago FTM program was also conducted. It revealed that \$17 in public benefits are generated for every \$1 (1989 dollars) invested by IDOT (5).

Motorist assistance patrols provide both measurable and non-measurable benefits to the motorists they assist, the motorists driving by on the travel lanes, and the agencies they represent. Some of the benefits include the following:

- Reduced incident delay and congestion,
- Reduced secondary accidents,
- Improved motorist safety,
- Improved public relations,

- Reduced non-enforcement activities of law enforcement officers, and
- Reduced debris related accidents, as well as reducing the time maintenance personnel spend picking up debris (11, 32, 33, 36, 37).

A 1973 cost-effectiveness evaluation of freeway courtesy patrols in Houston found a benefit-cost ratio of 2 to 1. Not included in this evaluation were the provision of a feeling of security to motorists and the creation of a favorable public image brought about by implementation of the courtesy patrol (32). A more recent benefit-cost study of the Houston MAP found that \$7 to \$36 in benefits can be gained for each \$1 (1990 dollars) invested in the program by the various agencies. This range was dependent upon the average amount of delay saved that could actually be attributed to MAP (10).

Summary

All four of the incident response and clearance procedures identified can provide positive benefits to the motoring public as well as to the transportation agency. Motorist assistance patrols, freeway corridor surveillance and control systems, management teams offer the most favorable atmospheres for TxDOT influence and oversight. Of the three, freeway corridor surveillance and control systems are by far the most expensive. Fast vehicle removal policies require, and have gained, the support of the state legislature. To be effective though, they also require a concerted effort on behalf of the transportation agencies to educate both motorists and their own employees of the existing legislation. The incident response and clearance strategy pursued depends greatly upon the existing problem. For example, if stranded motorists cause an excessive amount of congestion on the roadway network, development of a motorist assistance patrol should be considered.

Of the four strategies presented, motorist assistance patrols have the ability to most favorably affect roadway operation and reduce congestion. The proper configuration of a motorist assistance patrol depends largely upon the area which it will serve. Therefore, motorist assistance patrols may take on many different forms. To illustrate how different motorist assistance patrols have evolved in the State of Texas, case studies of four motorist assistance programs are presented in the following chapter. They

are intended to provide insight into the political and institutional factors which affect the development, operation, and organization of motorist assistance patrols. The knowledge gained from the study of these four programs will improve the understanding of existing motorist assistance programs and aid in the implementation and operation of future motorist assistance patrols.

3. CASE STUDIES

This chapter provides case study discussions of the motorist assistance patrols in the cities of Houston, Dallas, Fort Worth, and San Antonio. Although TxDOT is involved in all of the programs, the degree of participation varies. The Dallas, Fort Worth, and San Antonio patrols are all run and supported solely by TxDOT. The Houston patrol is operated by a unique combination of public and private agencies. TxDOT's role in the Houston patrol is limited to dispatching and providing administrative and supervisory support.

The first motorist assistance patrol to operate on the freeways of Texas was initiated in San Antonio. The patrols were originally established in order to accommodate the increased tourist traffic brought to the area by the 1968 Hemisfair. It was in operation during the six months of the Hemisfair and was then discontinued. The oldest motorist assistance patrol remaining in operation today was begun in Fort Worth in 1973 (San Antonio did not reinstate their patrol until 1978). Houston also had a motorist assistance patrol in the 1970s, but it was discontinued due to funding shortages. The current Houston and Dallas motorist assistance patrols began operation in 1986 and 1992, respectively.

Houston

Program Development

The Motorist Assistance Patrol (MAP) program in Houston began operating in 1986. It was originally developed by the Houston Automobile Dealers Association (HADA) in conjunction with the Harris County Sheriff's Department. The program began as a public service provided by HADA to the citizens of the greater Houston metropolitan area. The original intent of the program was to provide a quick and easy means of helping motorists whose vehicles became disabled on the freeway during peak traffic periods. The program began operating with two vans and was expanded to three vans a year after the program received widespread recognition and support.

Originally, the program began operating during the peak periods only. Patrols provided a wide range of services including the following:

- Removing stalled or disabled vehicles to the shoulder of the freeway,
- Providing gasoline or water for stranded motorists,
- Changing flat tires,
- Performing minor repairs to vehicles, and
- Summoning towing or emergency assistance for motorists.

In the original program, HADA was responsible for providing and equipping the vans, which were staffed by off-duty Harris County Sheriff's Deputies. Harris County Sheriff's Deputies were provided with the intent of adding credibility to the program through the use of uniformed officers. HADA was responsible for paying the salaries of the Sheriff's deputies. No fees were charged by HADA for providing assistance to stranded motorists. The HADA program was discontinued around 1987 due to a lack of funding.

In 1989, the Harris County Metropolitan Transit Authority (METRO) governing board asked TxDOT and METRO to examine options for reducing peak period congestion in the Houston metropolitan area. METRO and TxDOT used the success of the HADA patrols to illustrate the benefits of providing a full-time, motorist assistance patrol. As a result, HADA, METRO, TxDOT, and the Harris County Sheriff's Department entered into a unique public/private, intergovernmental agreement for expanding the program from three vans to six vans.

Under the agreement, each of these agencies is responsible for funding specific items needed to expand the program. Through the agreement, METRO provides the majority of the funds required to operate the program, which includes funding the salaries of the Harris County Sheriff's Deputies used to staff the vans. TxDOT performs the dispatching functions as well as provides administrative and supervisory support for the patrols. In addition to staffing the vans, the Harris County Sheriff's Department is

responsible for maintaining and fueling the vans. HADA has maintained an active role in the partnership by providing new and replacement vans as the program expands. Figure 4 illustrates the partnership adopted for the current operations of the MAP program. Two years after METRO and TxDOT became involved, the program has been expanded to its current strength of nine vans. The MAP program, as it currently exists, costs close to \$1.3 million annually to staff and operate. The facilities patrolled by the nine vans are shown in Figure 5. These facilities consist of 129 centerline miles of state supported roadways. The MAP program provides coverage of these areas from 6:00 a.m. until 10:00 p.m., for a total of 16 hours each day, and provides some type of assistance to approximately 11,000 motorists each year (38).

The other eight hours of each day are covered solely by District 12 of TxDOT (Houston). District 12 operates a courtesy patrol from 9:30 p.m. to 8:00 a.m. seven days a week, covering about 150 centerline miles of roadway with only one vehicle (two vehicles are available). The courtesy patrol, like the MAP program, will provide assistance to motorists, but only upon visual identification of an incident. (There is no number for motorists to call to request service from the courtesy patrol.) Although the primary functions of the courtesy patrol are minor maintenance, identifying damage to state property, and verifying requests for sanding, they provide assistance to close to 835 motorists per year. The courtesy patrol costs roughly \$131,400 annually to maintain and operate (39).

By and large, the MAP program has been a success both in terms of the number of incidents cleared and in terms of the public's acceptance of the program. Since 1989, MAP personnel have responded to more than 24,000 incidents and assisted more than 32,770 stranded motorists. The program has been estimated to save between 0.6 and 1.3 million vehicle hours of delay annually (10). The program has also received widespread public acceptance and receives approximately 100 appreciation letters annually (38). Because of the success of the program, it also receives widespread political support from city and county elected officials.

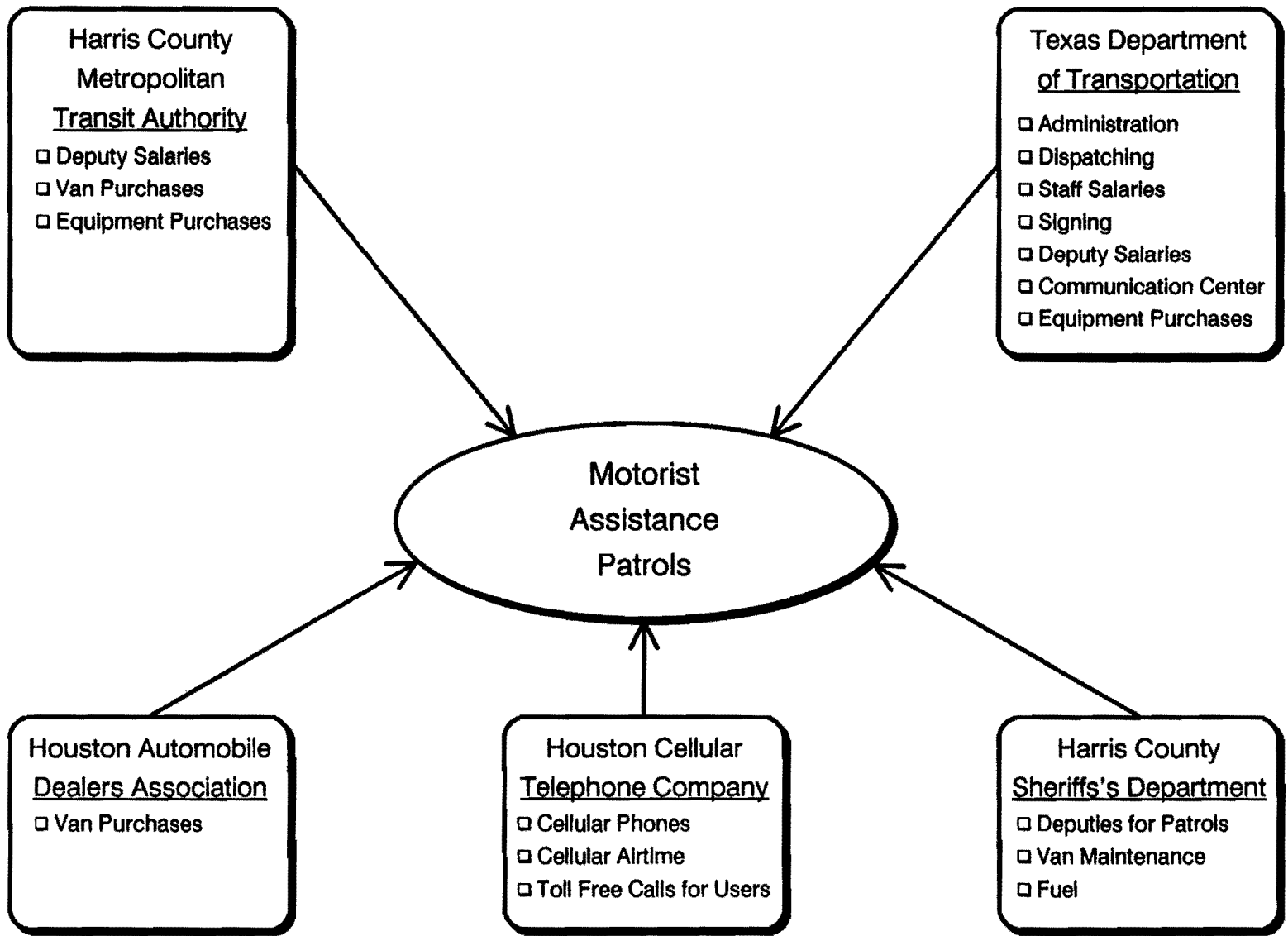


Figure 4. Organizational Structure of Motorist Assistance Patrol: Houston, TX. (38)

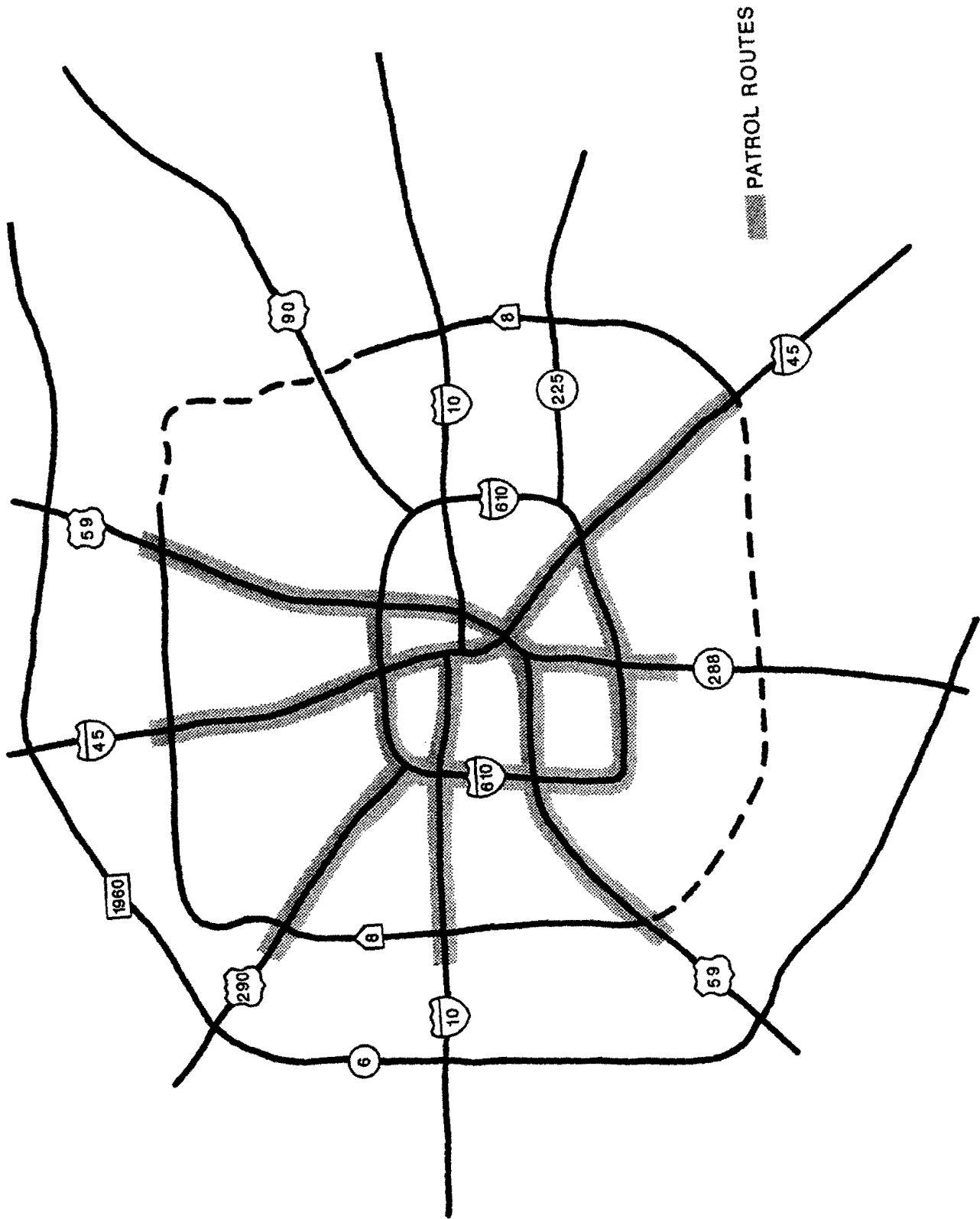


Figure 5. Motorist Assistance Patrol Routes: Houston, TX. (38)

The success of the MAP program has been aided, in part, by extensive public awareness campaigns launched at several strategic points during the development of the program. Media campaigns were launched at the beginning of the program, and every time new vehicles were added to the program. TxDOT, METRO, and HADA also sponsor a public relations booth at the Houston Auto Show each year. At this booth, information is distributed that illustrates the benefits of the MAP program and informs motorists about how the MAP program works. Furthermore, a dedicated emergency line has been established for motorists to report incidents or summon help. This line is provided toll-free for cellular telephone users. In addition to incident information gathered from this dedicated line, TxDOT and TTI, in conjunction with many other public and private entities, have developed a Real-Time Traffic Information System (RTTIS) using probe vehicles equipped with cellular phones (Automatic Vehicle Identification (AVI) and television surveillance will also be used when they become available sometime in 1994). This system allows MAP dispatchers to obtain travel time and incident information in real-time directly from motorists travelling on the freeway system (40).

Future Activities

The MAP program is continuing to grow and expand in Houston. Current plans are to expand the program to a total of fourteen vehicles and to increase the number of roadways covered by the program. However, as the program continues to grow and expand, both METRO and TxDOT foresee that the way the program is currently structured will have to change. The role of each of the agencies in the program is currently being assessed and a revised funding and administrative structure is anticipated in the next few months.

Lessons Learned

While the partnership arrangement promoted and improved intergovernmental cooperation, the particular method of funding the MAP program in Houston has proven to be cumbersome. In the Houston program, each agency is responsible for providing funding for specific portions for operating the program. For example, METRO is responsible for the salaries of the Sheriff's Deputies that staff the patrol vans. The Harris

County Sheriff's Department is responsible for operating and maintaining the vans while TxDOT performs the administrative functions for the program. Essentially, there is one agency that is responsible for paying for the program, one agency that is responsible for operating the program, and one agency that is responsible for administering the program. Each agency has its own accounting and administrative procedures that must be followed. Since there are multiple accounting and administrative bureaucracies associated with the program, modifications or changes to the program often take longer to execute than if only one agency was responsible for funding, operating, and administering the program.

Another important lesson learned through the development of the MAP program in Houston was the importance of publicizing the program. Motorist assistance patrols can be an extremely useful and powerful public relations tool. A motorist assistance patrol allows citizens to see that the transportation agency is directly concerned with helping individual motorists and not just building new freeways or patching potholes. However, the public relations benefits of the program are wasted if most of the public does not know about the program or how to use it. In Houston, the MAP program continues to maintain a high profile. Participating agencies are also looking for opportunities for promoting the program. In the past, they have utilized many different techniques to promote the benefits of the program including promotional campaigns at major special events such as the Houston Auto Show as well as inviting the news media to travel in a MAP vehicle as it patrols the freeway. These efforts have helped the program build strong political and community support which has proven invaluable during efforts to expand the program.

Dallas

Program Development

Unlike the Houston program, the Dallas motorist assistance program is in its infancy. The program began operating on North Central Expressway in Dallas on January 2, 1992 and is currently operating in the corridor Monday through Friday from 6:00 a.m. to 10:00 p.m. The program is currently operating with two 1/2 ton trucks and patrols in

a limited area (18 centerline miles) which includes North Central Expressway (US-75) between IH-635 and the central business district, and IH-635 (LBJ Freeway) from Preston Road to Greenville Avenue (see Figure 6). Each vehicle operates as an independent roving patrol. Even though dispatching services are provided by District 18's Maintenance Division, visual inspection is the primary mode through which incidents are detected.

The Dallas motorist assistance patrol program is operated as part of the District 18 Maintenance Division and is actually considered an extension of the District's ongoing Courtesy Patrol system. The Courtesy Patrols, which are also part of the Maintenance Division, provide assistance to stranded motorists on the freeways in the Dallas area. The Courtesy Patrols operate between the hours of 4:00 p.m. to midnight, Wednesday through Sunday, covering approximately 325 miles of roadway in Dallas and the surrounding areas. Operating two vehicles, they are able to provide assistance to around 6,800 motorists annually at a total cost of about \$42,000 each year (41). Even though the motorist assistance program is an extension of the Courtesy Patrols, there is a fundamental difference in the objectives of the two systems. The primary mission of the Courtesy Patrol is to assist motorists whose vehicles have become disabled. The primary objective of the motorist assistance program, on the other hand, is to facilitate freeway traffic movement through the rapid detection and removal of capacity reducing incidents (42). While the Courtesy Patrol system is intended mainly to be a public relations tool, the motorist assistance patrol program is intended to be a tool to better manage traffic flow and safety in the North Central Expressway corridor.

North Central Expressway was selected as the original corridor to implement the program for a number of reasons. First, North Central Expressway is one of the most heavily travelled freeways in the Dallas Metroplex area. It currently carries approximately 131,000 vehicles per day. In addition, the North Central Expressway also experiences a relatively high number of incidents. Currently, North Central Expressway, between the Central Business District and I-635, experiences an estimated 33 vehicle breakdowns per day. Over 900 accidents a year were also reported on this section of the North Central

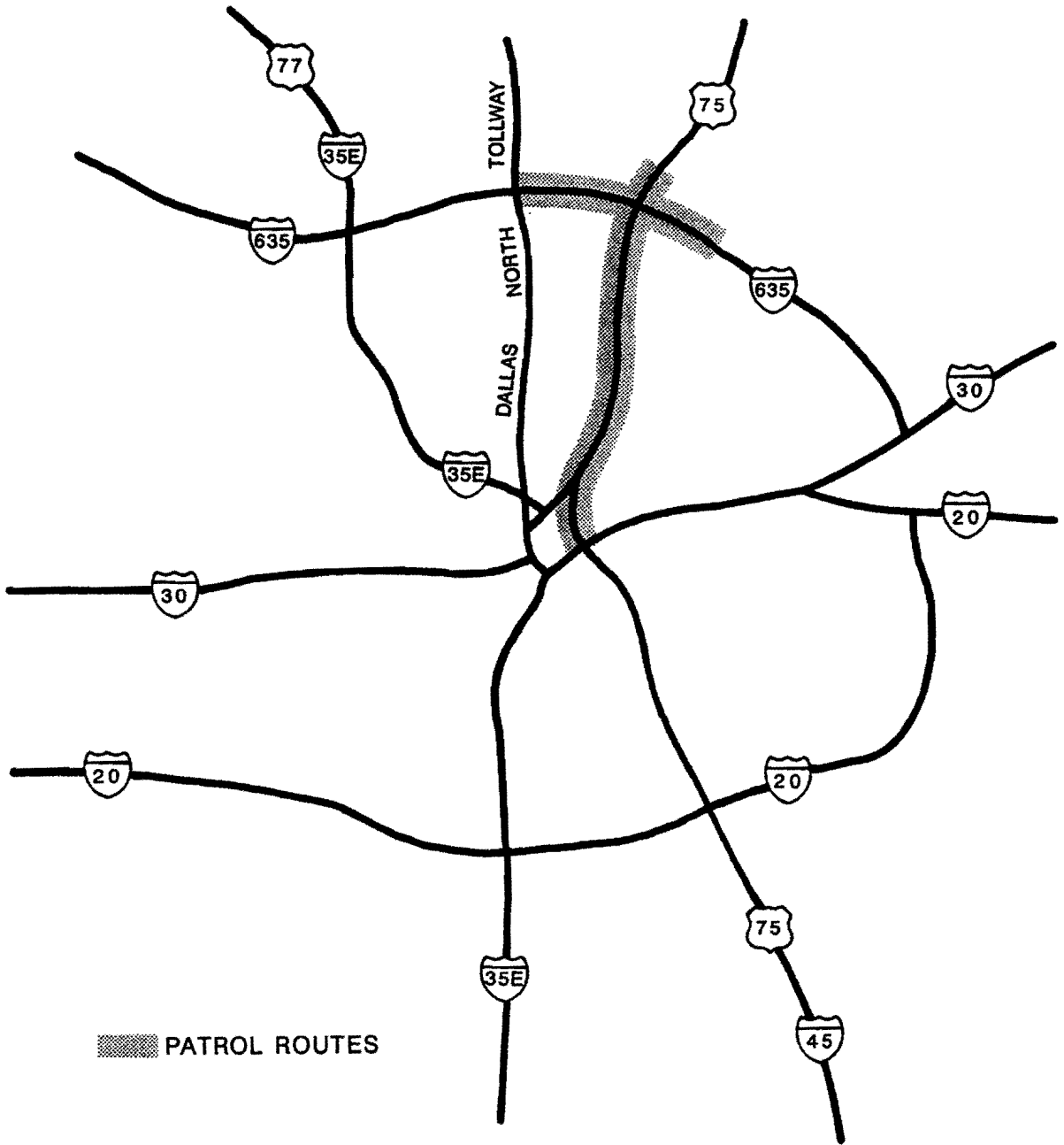


Figure 6. Motorist Assistance Patrol Routes: Dallas, TX. (39)

Expressway (42). The Dallas motorist assistance patrol is able to provide assistance to approximately 3,750 motorists each year at a total annual cost of \$123,000 (41).

Another major reason that this corridor was selected to initiate the motorist assistance patrol in Dallas was the major reconstruction effort currently underway in the corridor. The project, which began in July 1990, is planned to be an eight year, \$600 million project and is anticipated to severely affect traffic operation and capacity in the corridor. Since the current reconstruction plans call for temporary reductions in the number and width of the travel lanes as well as the elimination of the emergency shoulders, the impacts of an incident on traffic flow in the corridor will be more pronounced during the reconstruction project.

Currently, the system is operating with two vehicles. Each vehicle is equipped with the following special equipment:

- Front and rear signs identifying the trucks as patrol vehicles,
- Emergency flashers,
- An arrow board, which is controlled from the inside of the truck, for directing traffic,
- A heavy duty bumper to push stranded or stalled vehicle from the roadway,
- Plug-in battery jumpers,
- Containers for gasoline, water, and compressed air, and
- Storage compartments for tools, flares, cones, rain suits, etc.

In addition, each vehicle is equipped with a TxDOT radio, a Dallas Police radio, and a cellular telephone (42).

Unlike the program in Houston, the motorist assistance program in Dallas is totally funded and supported by the TxDOT. Even though the program performs a traffic management function, District maintenance personnel are used to staff the patrol vehicles and to provide administrative and dispatching support. The organizational structure of the program in Dallas is illustrated in Figure 7. This structure has its advantages and

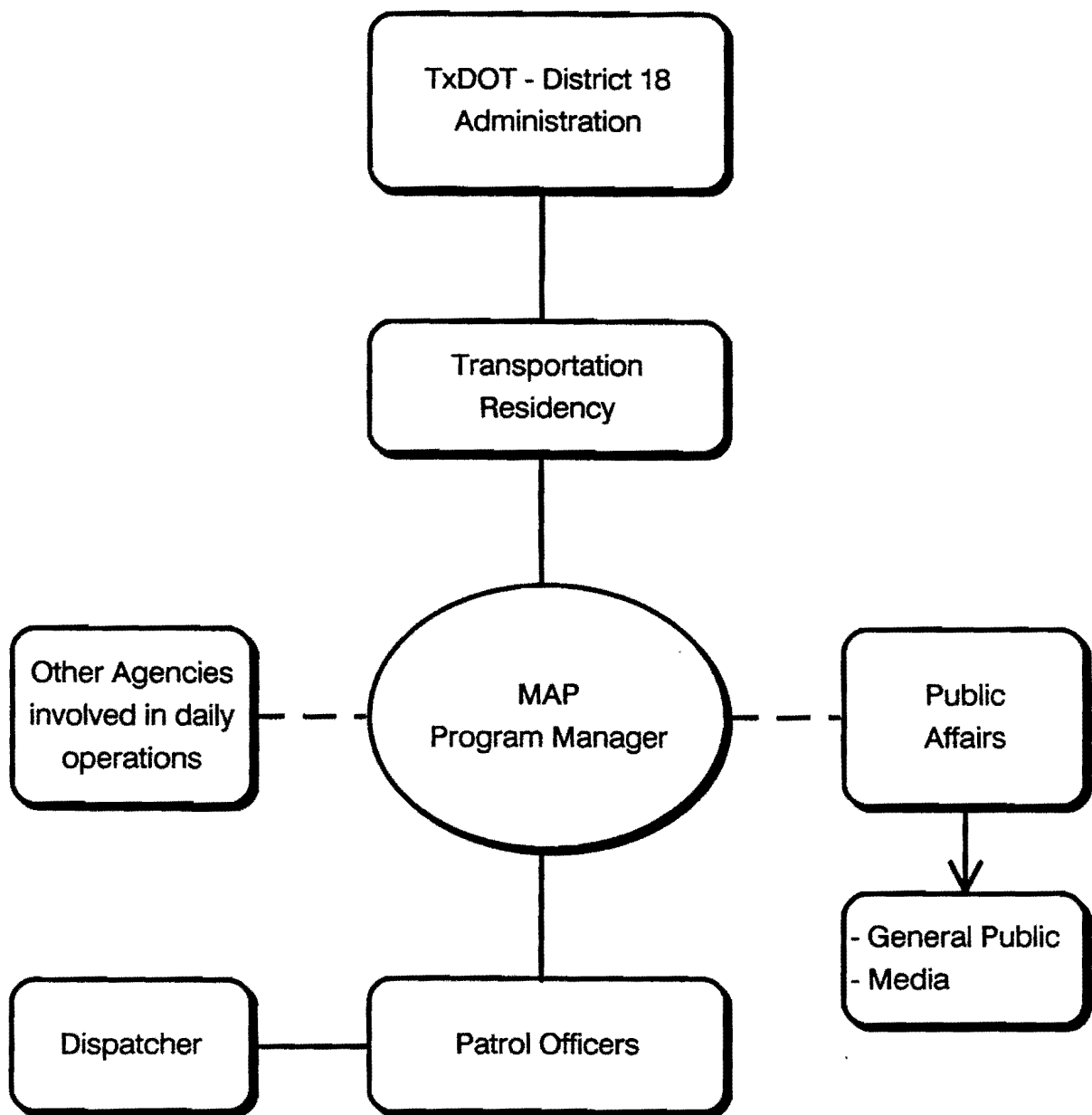


Figure 7. Organizational Structure of Motorist Assistance Patrol: Dallas, TX. (39)

disadvantages over the one used in Houston. The primary advantage of this structure is that all personnel and administrative functions are within one organization. However, by its very nature, this structure does not provide an opportunity to improve intergovernmental cooperation and coordination.

Future Activities

A phased implementation approach has been adopted with the Dallas motorist assistance patrol program. This approach begins with a small scale patrol operating in a heavily congested corridor. The implementation of a small patrol with a minimal amount of investment in capital and personnel, is then used to illustrate the benefits of a larger patrol program. If the program is shown to be cost effective for the North Central Expressway, the program will be expanded to provide coverage on other freeways in the Dallas area as funding permits.

Lessons Learned

One of the biggest lessons learned in the development of the motorist assistance patrols in the Dallas area so far has been the need for intergovernmental and intra-agency cooperation and coordination. Cooperation between all of the agencies involved in the incident management process is essential for ensuring the rapid removal of incidents from the freeway. The development of the motorist assistance patrol program in Dallas has improved the working relationship between the police and the District. As a result of the program, response and clearance time for freeway incidents have dramatically improved. Also, because of the improved relationship between TxDOT and the Dallas Police Department (DPD), DPD has now assigned a police officer whose sole responsibility is to investigate accidents and patrol the North Central Expressway. This is expected to further improve incident response and clearance in the North Central Expressway corridor.

Fort Worth

Program Development

Fort Worth's incident management program began informally in 1971 when the District safety coordinator made an agreement with the local police which allowed TxDOT personnel to physically remove disabled vehicles and their cargo from the freeway travel lanes. This was encouraged by the District engineer after a series of major incidents blocked highways around the city for several days at a time (43). The District's motorist assistance patrol, or Courtesy Patrol as it is called, began formal operations in 1973.

Today, the Courtesy Patrol consists of 16 personnel, including three radio dispatchers. They cover three shifts operating 24 hours a day, seven days a week. They operate two trucks per shift with the exception of the "graveyard" shift (12:00 midnight to 8:00 a.m.), during which they operate only one truck (44). They are also able to maintain three or four spare trucks to use in the event that one of the on-duty trucks breaks down (43). In 1991, the Courtesy Patrol logged about 336,000 miles on their trucks while monitoring the 193 centerline miles that make up their patrol routes. Each patrol truck is equipped with a push-bumper and carries jumper cables, air tanks, water cans, gasoline, tools, traffic cones and flares to assist or remove stalled or disabled vehicles (44). In addition, each vehicle has blue, red, and yellow revolving beacons to enhance their night-time visibility, as well as an arrow board mounted on back. Each patrol vehicle is staffed with two TxDOT employees. Because field experience is valued most, new personnel training is provided on the job. They are required to work their first few shifts with veterans of the Courtesy Patrol (43).

The original mandate of the patrol was to keep the freeways clear and running smoothly. The focus of their efforts was to be toward monitoring collision damage to state property and providing a quick response to incidents that posed an immediate threat to the traveling public, such as objects in the roadway. Soon after its inception; however, emphasis switched to providing assistance to disabled motorists. It is estimated that the Courtesy Patrol provides assistance to an average of 10 motorists per day, or 3,650 motorists annually. In addition, they help local police direct traffic at approximately 730

accident sites per year, focusing their efforts on IH-820 (The Loop) and all of the state-maintained freeways within the Loop (44). They regularly patrol the routes shown in Figure 8 and will also respond to incidents outside this area if called.

In addition to the Courtesy Patrol, District 2 has two safety officers that are dedicated to incident management. The two officers work in cooperation with the local police and fire department to clear overturned trucks, spilled cargo, hazardous materials, and other major incidents that the Courtesy Patrol is not able to handle with its dedicated equipment. Although the Courtesy Patrol provides assistance free of charge, when large loads are involved, the District charges the responsible parties for the cost of cleanup. Surprisingly, they have an 80 percent recovery rate (44). The efforts of the two safety officers have produced an unusual nationwide reputation for innovation in rapidly removing incidents (45).

The Fort Worth Courtesy Patrol is funded entirely from the District operating funds, as are many other programs, and costs around \$400,000 per year to staff and operate. Operation of the Courtesy Patrol is approved one year at a time, and because the Courtesy Patrol has no dedicated source of funding, its future is uncertain (43). The longevity of the program attests to its success, and it is hoped that the Courtesy Patrol will remain a top priority.

The organizational structure of the Fort Worth Courtesy Patrol is similar to that found in Dallas, with all activities being coordinated and delegated by TxDOT. This structure (see Figure 9) allows the District to operate the Courtesy Patrol more efficiently. The Courtesy Patrol was initially housed by the Maintenance Division but has recently moved to the Traffic Operations Division (43). This move appears to be more in line with the current role of the Courtesy Patrol.

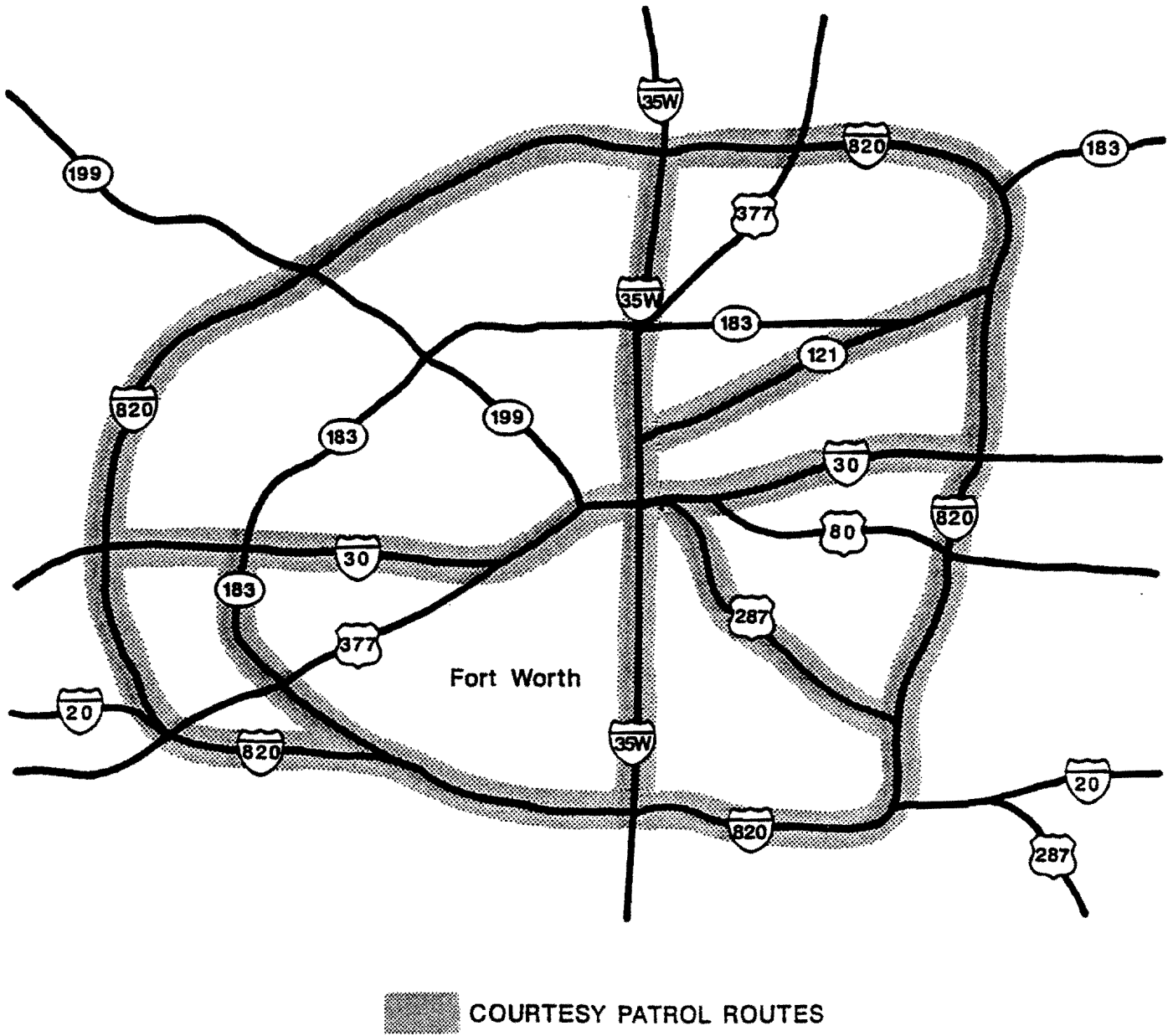


Figure 8. Motorist Assistance Patrol Routes: Fort Worth, TX. (40)

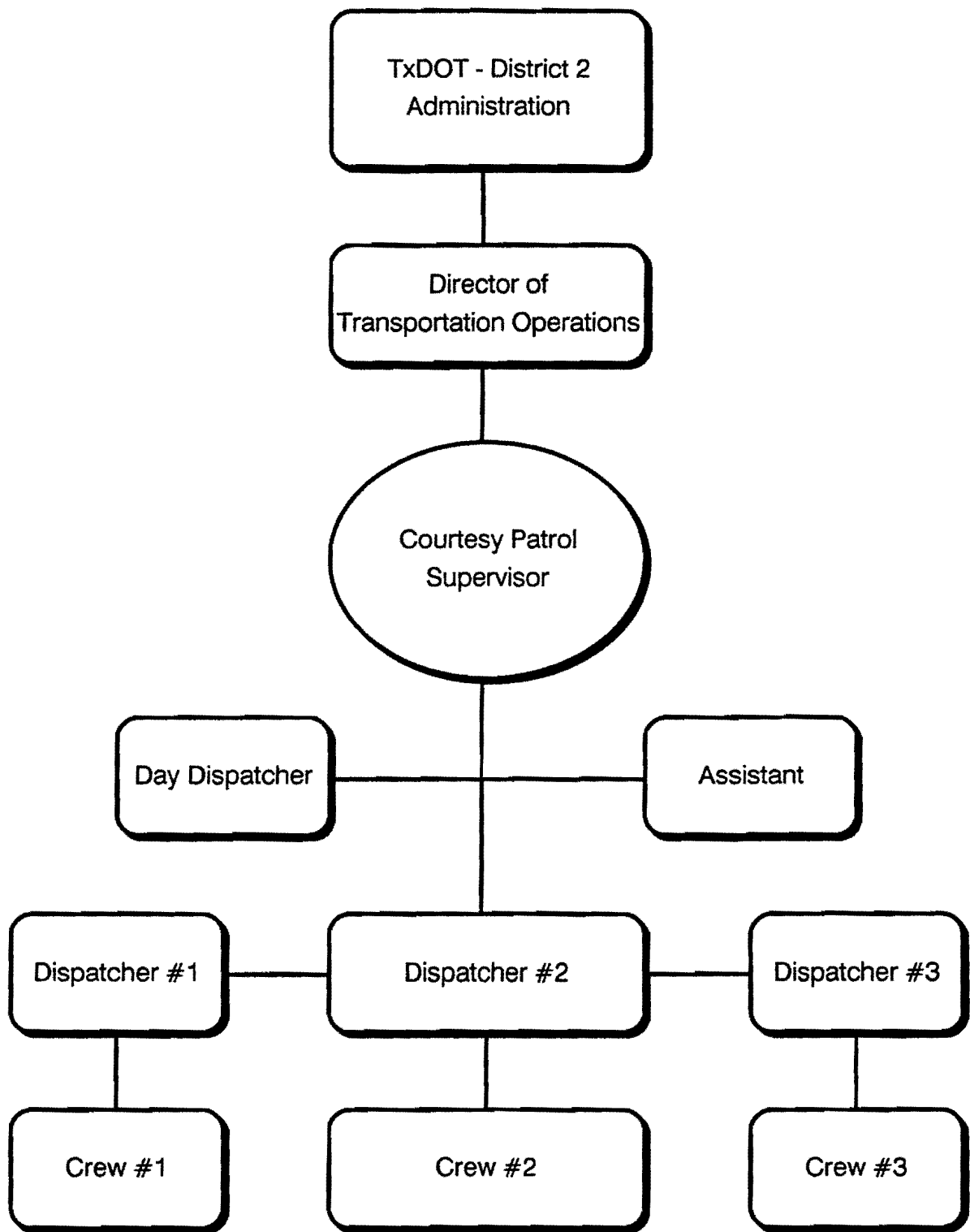


Figure 9. Organizational Structure of Motorist Assistance Patrol: Fort Worth, TX. (40)

Cooperation and coordination between the various government agencies has not been an issue in the development of the Fort Worth program. Key personnel are encouraged to take part in Traffic Management Teams (27). In addition to belonging to TMTs, the current District Safety Officer also teaches classes at the local police academy, improving the cadets understanding of the District's role in incident management. This has helped to facilitate a healthy working relationship between officers and District incident management personnel (43).

Future Activities

District 2 of TxDOT is currently in the process of building a \$52 million advanced traffic management system. Implementation of this plan is being accomplished in stages by the District's Traffic Engineering Section and it is scheduled for completion in 2004. Using closed-circuit television, system operators will be able to gather more complete information about the magnitude and severity of an incident (25). With this information, they will be able to make more informed decisions about the type and nature of the response required to clear an incident. The resulting improvements in incident detection and verification will help the Courtesy Patrol respond more quickly and effectively to incidents. It is hoped that this will provide an opportunity to expand the geographical area covered by the Courtesy Patrol as well as an incentive to purchase additional equipment (43). Future plans envision the purchase of heavy duty trucks with crash attenuators mounted on back, and the purchase of vehicles constructed specifically for, and dedicated to, major incident response and clearance (43).

Lessons Learned

Courtesy Patrol supervisors recognize that looking to TxDOT as the sole source of funding limits the size of the patrol. However, the extra control gained by limiting the number of agencies participating in the operation and dispatching of the patrol vehicles is felt to be beneficial. Although involving other agencies in Courtesy Patrol operation would certainly provide more opportunities for intergovernmental cooperation and coordination, the commitment to participation in TMTs serves this purpose well for TxDOT.

District 2 places a high priority on providing quality service to Fort Worth area motorists. The success of the Courtesy Patrol is a direct result of the support it has received by supervisors and field personnel. For example, although all Courtesy Patrol trucks are equipped with a two-way radio and a citizen's band radio, several operators have invested their own money in cellular phones to provide a more complete service to the public (44).

San Antonio

Program Development

The first Courtesy Patrol began operating on the freeways of San Antonio in 1968. It was begun for the purpose of rendering aid to the larger volume of tourist travel expected in the area during the six months of the 1968 Hemisfair. During this six month period, Courtesy Patrol operators assisted approximately 1300 motorists (46). Although the program was successful, traffic volumes and a constrained budget could not support the Courtesy Patrol at the end of the six months and it was discontinued.

In 1978, under the direction of the District Engineer, the District Traffic Engineer and Maintenance Foreman began what is San Antonio's present day Courtesy Patrol. The Courtesy Patrol was organized by TxDOT, with the cooperation of the San Antonio Police Department (SAPD), to improve freeway operations in the San Antonio area. The patrols are currently staffed, housed, and funded by the Maintenance Division; however, like the Courtesy Patrol in Fort Worth, they will be moved to the Traffic Operations Division sometime during the last quarter of 1992. The organizational structure of the Courtesy patrol can be seen in Figure 10. They operate 24 hours a day on weekends and holidays and from 5:00 p.m. until 8:00 a.m. on normal workdays. Two trucks are sent out on patrol each shift and two are kept in reserve at the garage (47). The Courtesy Patrol puts approximately 320,000 miles on their trucks each year while patrolling the 118 centerline miles of IH-410 and the freeways within its boundaries (see Figure 11).

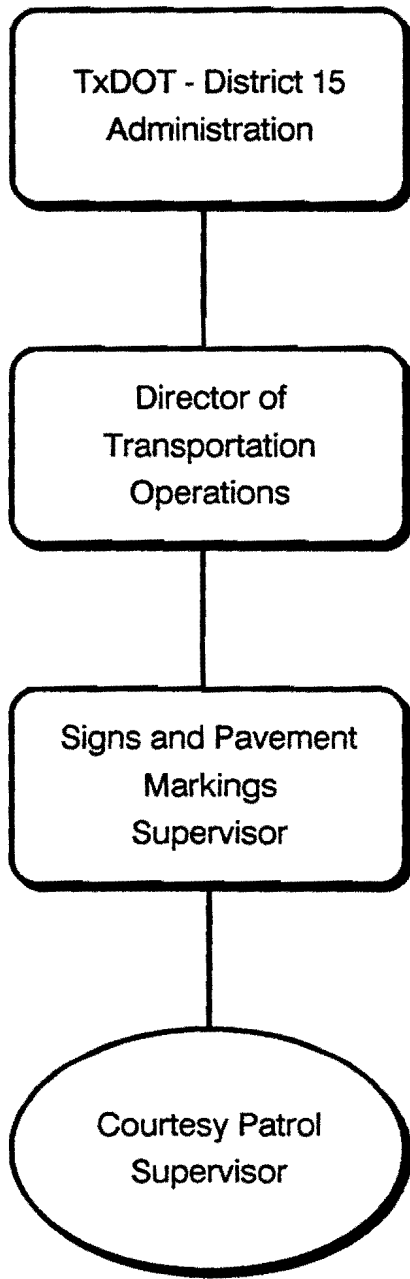


Figure 10. Organizational Structure of Motorist Assistance Patrol: San Antonio, TX. (44)

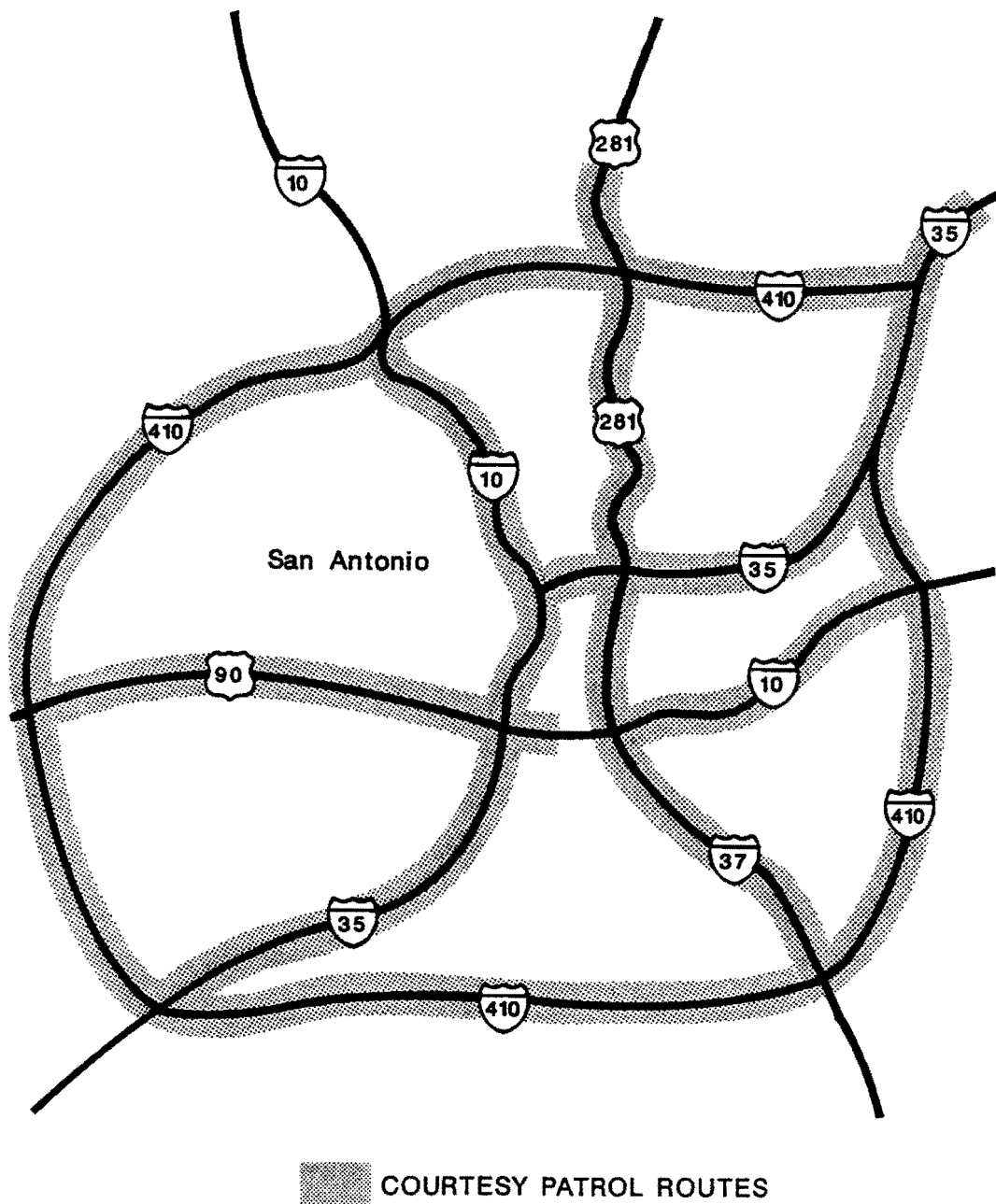


Figure 11. Motorist Assistance Patrol Routes: San Antonio, TX. (44)

The Courtesy Patrol is dedicated to improving the operation of freeways in the San Antonio area. Patrol operators accomplish this by removing hazardous debris from the roadway, rendering aid to stranded motorists, and providing assistance to the SAPD at incident sites (46). If needed, they may also erect portable signs (e.g. portable stop signs at a damaged or malfunctioning traffic signal), or they may set out traffic cones to channel motorists away from some hazard on or near the roadway (47).

Courtesy Patrol trucks are equipped with a multi-channel state radio, a citizens-band radio, a mobile phone, and an eight channel police radio. In addition to all of the radio equipment, they carry fire extinguishers, jumper cables, gasoline, water, bumper and floor jacks, flares, torches, and various hand tools, duct and electrical tape, fuses, wire clamps, and other minor auto supplies. Each truck also has revolving lights, a public-address system, and push bumpers (46). Courtesy Patrol operators also carry keys to all of the District 15 Maintenance yards. This allows them access to the maintenance equipment and supplies during all hours of Courtesy Patrol operation (48).

Although current statistics are not available, a study conducted in 1978 provides some very favorable statistics about the benefits of the San Antonio patrol. In the twelve months from July 1978 through June 1979, the Courtesy Patrol assisted 5,345 stranded motorists, removed the debris of 1,855 incidents, and made 145 minor repairs to signs, signals, and sign lighting. The total savings to the community resulting from Courtesy Patrol activity and due solely to the elimination of secondary accidents was estimated to be more than \$1.6 million (46). This savings (which does not include the savings associated with the reduced delay and resulting road user costs eliminated as a result of the prompt response of the Courtesy Patrol) yielded a benefit/cost ratio of 7 to 1 in 1978, using 1978 dollars. The Courtesy Patrol currently costs District 15 about \$400,000 per year to operate (47).

Future Activities

Courtesy Patrol operations have continued to move forward since 1978. With the increasing population of the San Antonio area and the related increase in licensed drivers,

the Courtesy Patrol has remained busy responding to and clearing incidents off of the San Antonio freeways. They are also keeping abreast of advancements in alternative fuels technology. The Courtesy Patrol is supposed to receive its first two combination compressed natural gas/gasoline burning trucks in 1992 as well as their first extended cab pick ups. The extended cabs will be more conducive to carrying radio equipment and passengers (47).

Similar to District 2 in Fort Worth, District 15 is making plans to build an integrated Traffic Management System beginning sometime in 1992-93. This system will enhance traffic operations, incident management, and motorist information capabilities in the San Antonio area. Construction will be staged with the first section (28 miles of the 190 mile system) scheduled to be let in December 1992 at a cost of \$30 million. This section is expected to be completed sometime in 1994. The entire project is expected to be completed sometime in 2002 at a total cost of \$155 million (48). The proposed improvements should aid in the detection and verification of incidents. It is anticipated that the system will be able to detect an incident within two minutes of its occurrence. Following detection, it is felt that system operators will be able to initiate a response within 30 to 60 seconds using lane control signals and changeable message signs (48). As a result of the enhanced detection and verification, police and Courtesy Patrol response time is also expected to be drastically reduced. This reduced response time will help the Courtesy Patrol provide faster, more efficient service to disabled motorists.

Lessons Learned

No formal attempts have been made by District 15 to educate the public about the Courtesy Patrol; however, it is recognized as a good public relations tool. It has also improved relations with the SAPD by reducing the number of non-enforcement calls (i.e. Calls for which no citation is issued) and debris related incidents to which officers are required to respond. Coordination and cooperation between government agencies is further enhanced by the San Antonio area traffic management team. TMT members include TxDOT, the City of San Antonio, the San Antonio Police Department, and VIA Metropolitan Transit.

The administrators of the San Antonio program, like those of the Dallas and Fort Worth motorist assistance programs, recognize the lack of funding as a limiting factor. Although not recognized as a real problem, there have been instances in the past when personnel resources were reduced as a result of inadequate funding. In addition, there currently are shifts when only one truck is providing assistance for the whole city. Obviously, some motorists do not receive help during these times. In spite of these things, the Courtesy Patrol continues to be a positive public relations item for TxDOT in San Antonio.

4. SUMMARY AND CONCLUSIONS

This report has presented some of the incident response and clearance strategies pursued by the State of Texas. It is prepared to enhance the understanding of the costs of congestion and to provide insight into the development of various incident response and clearance procedures being used in the State of Texas. In addition, the report is intended to provide insight into the political and organizational attributes of various agencies which affect the implementation and operation of motorist assistance programs.

There are many ways to implement effective incident response and clearance strategies. The structure of the chosen program is dependent upon the participating agencies. The most important factors for consideration when developing a program are the coordination and cooperation of all of the agencies involved. Sumner, et. al. (49) stated that "Communication and cooperation are the principle components necessary to ensure a coordinated response to a freeway incident."

Various components of freeway surveillance and control systems have specific applications in incident response and clearance. Used properly, they can reduce the amount of time required to initiate a response to an incident. They can also improve the movement of traffic around an incident. It is recommended that all freeway surveillance and control technologies be explored and discussed thoroughly before any program is implemented. Also, it is recommended that an attempt be made to standardize the use and configuration of motorist information signs, signals, and message formats statewide in order to eliminate driver confusion and error. As with any system based on modern technology, advancements in the state of the art are continually being made. Attempts should be made to make system components compatible with future upgrades and there should be a concerted effort on behalf of those involved to keep informed about new technology. Careful initial planning and an attempt to thoroughly cover all the bases will eliminate the majority of potential problems.

"Once a local problem, incident management is now a metropolitan-scale problem that falls awkwardly between the traditional responsibilities of state highway agencies and local police departments."(3) Coordinating the efforts of several agencies which may be responding to an incident requires that some degree of communication take place before hand. Traffic and Incident Management Teams are excellent tools to ensure that this all important communication and cooperation takes place.

TMTs and IMTs are another way in which incident response and clearance can be handled more efficiently. Determining the responsibilities of various agencies prior to involvement in an incident situation will facilitate a more coordinated response and clearance effort. This will reduce response and clearance times and consequently the congestion and secondary accidents caused as a result of the initial incident. Coordinating all incident management information, equipment, and agencies through a single, responsible agency is also offered as another possible way to increase the efficiency of incident response and clearance efforts.

Fast vehicle removal policies enlist still another procedure to lessen the impacts of incidents. They are focused primarily toward decreasing incident clearance time, but they can also positively affect incident response time. Fast removal policies are able to decrease incident response time by providing responding agencies with more clear cut responsibility for keeping the roadways clear. The authority to remove stalled or disabled vehicles from the roadway reduces response time by allowing responding agencies to do their job without unnecessary threat of legal recourse. Increasing public awareness of fast vehicle removal policies is essential for them to be effective. It is also recommended that a formal attempt be made to ensure that incident response and clearance personnel are aware of current legislation which affects their operation at incident sites.

The final incident response and clearance procedure discussed is also the one with the most potential to directly affect the time required to respond to and clear incidents. Motorist assistance programs can be organized in many different ways, each of which has both positive and negative aspects. Involving more than one agency increases the

base from which resources can be drawn, but it also increases the complexity of the program. Handling administrative differences generally requires more time, and in turn increases the time needed to enact necessary changes.

Although a motorist assistance program which is operated by only one agency is usually more efficient, its ability to expand by purchasing more equipment and hiring more personnel is limited by the availability of funds. The Fort Worth and San Antonio courtesy patrols have budgets that are at the high end of the motorist assistance programs supported by a single agency. They each receive close to \$400,00 per year from their respective Districts (see TABLE 1). These budgets pale in comparison to that of the Houston MAP which is supported by several public and private agencies and has a total annual budget of \$1,300,000. In addition to the obvious limitations of having only one funding source, the single agency motorist assistance programs are also likely to be hampered by continued battles to secure funds each year. Furthermore, single agency programs provide little opportunity to improve interagency cooperation and coordination.

Some suggestions made by TxDOT personnel and others with respect to developing and operating motorist assistance programs include the following:

- Provide a permanent source of dedicated funding for operation;
- Operate the vehicles 24 hours a day, 7 days a week to encourage drivers to stay in their vehicles by assuring them that assistance will be provided within a reasonable amount of time (49);
- Equip the patrol with specific uniforms and distinctively marked vehicles that will reduce the anxiety level of motorists the patrol attempts to help (50);
- Provide full-time staff personnel to foster teamwork and the sharing of ideas;
- Publicize the available services to obtain maximum utilization by disabled motorists; and
- Agree formally upon a policy regarding the use of lights on response vehicles and developing guidelines for the placement of response vehicles at the incident site(49).

TABLE 1. SUMMARY OF MOTORIST ASSISTANCE PATROL CASE STUDIES

	Houston		Dallas		Fort Worth	San Antonio
	MAP	C.P.	MAP	C.P.	C.P.	C.P.
Number of Vehicles	9	2	2	2	5	4
Hours of Operation	6:00 a.m. to 10:00 p.m.	9:30 p.m. to 8:00 a.m.	6:00 a.m. to 10:00 p.m.	4:00 p.m. to Midnight	24 hours per day	5:00 p.m. to 8:00 a.m. *
Centerline Miles	129	150	18	325	193	118
Average Annual Number of Assists	11,000	835 [†]	3744	6800	5000	7300 ^{††}
Annual Cost	\$1,300,000	\$131,540	\$123,000 [‡]	\$142,000 [‡]	\$400,000	\$400,000

* Weekdays only. Courtesy Patrol operates 24 hours per day on weekends and holidays.

† Assists during 1992 fiscal year. Motorist assistance is not primary duty.

†† Assists during 1978/1979 evaluation study.

‡ Cost for employees only.

This is by no means an exhaustive discussion of the issues that need to be considered when establishing incident response and clearance procedures. These suggestions have been offered in the hopes of stimulating the discussions of incident response and clearance personnel. It is hoped that these discussions will help existing or planned motorist assistance programs to run more smoothly; however, nothing can replace the insight of trained personnel with an understanding of their community and the local limitations involved in the day-to-day operations of a program.

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