INCIDENT MANAGEMENT SYSTEM DEMONSTRATION

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16. ABSTRACT

This report assesses the usefulness of the guide *"Framework for Developing Incident Management Systems"* in developing incident management systems for small to medium-sized urban areas. The assessment was conducted on the incident management system in Tacoma, Washington. The research approach consisted of four components: 1) study of the process that produced Tacoma's existing incident management system, 2) inventory and evaluation of Tacoma's existing incident management alternatives, 3) application of the "Framework" to make recommendations for improvement in Tacoma's system, and 4) evaluation of the effectiveness of the "Framework." The findings of this report show that the guide *"Framework for Developing Incident Management Systems"* has some weaknesses, but overall it should be considerably helpful in developing and improving incident management systems.

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Final Report
Research Project T9233, Task 25
Incident Management System Demonstration

INCIDENT MANAGEMENT SYSTEM DEMONSTRATION

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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 Washington State Transportation Commission, Department of Transportation, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

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SUMMARY

Incidents, such as accidents, vehicle breakdowns, spilled loads, or other random events, reduce roadway capacity and are a major cause of highway congestion. Nationally, incidents are responsible for an estimated 60 percent of all vehicle hours lost because of congestion. The magnitude of the incident problem has resulted in a number of research efforts that have sought to design incident management systems. The objective of these management systems has been to mitigate the traffic-congestion impacts of incidents.

Arguably, the most comprehensive research work to date on incident management is presented in the guide "Framework for Developing Incident Management Systems". (1) This study developed a thorough and exhaustive methodology for establishing incident management systems in urban areas. The methodology is based on existing incident management systems. However, the "framework" document has not actually been used as a basis for incident management system development and/or refinement. The objective of the current study was to apply the framework document and to comment on its strengths and weaknesses.

The area chosen for this study was Tacoma, Washington. When the study began, Tacoma already had an incident management system. While it would have been desirable to apply the "Framework" to an urban area with no existing incident management program, much could still be learned by studying the development of the Tacoma system and comparing this development with the idealized development approach contained in the "Framework." Moreover, the "Framework" could be applied to Tacoma's existing incident management system to recommend future system improvements.

The following research approach was undertaken in this study:

1. State and local transportation officials and the Washington State Patrol (WSP) were interviewed to determine (a) the incident management alternatives currently available in Tacoma, and (b) how these incident management alternatives were selected and implemented. This system development information was then compared to the procedures recommended in the guide *"Framework for Developing Incident Management Systems."*

2. All existing incident management alternatives in Tacoma were studied, and their development and effectiveness were critiqued.

3. Given the development of Tacoma's incident management system and the incident management alternatives already in place, the systems approach suggested in the "Framework" was applied to provide recommendations for improving Tacoma's incident management system. This application focused on the 25 miles of Interstate 5 in Pierce County, in and around Tacoma. Figure 1 is a map of this study area.

4. On the basis of the analysis of the development of Tacoma's existing incident management system and the application of the "Framework" for improving the existing system, the "Framework" was critiqued and recommendations for improvement were presented.

The research resulted in mixed findings. The "framework" was found to be quite comprehensive and useful for almost all incident management options considered. However, it was also somewhat idealistic and seemed to understate the political realities of funding and previous experience. Furthermore, evaluation and communication/ training/marketing issues discussed in the framework tended to gloss over many practical limitations. This study does not recommend that wholesale changes be made to the "framework" but that a greater emphasis be placed on political realities and practical limitations.

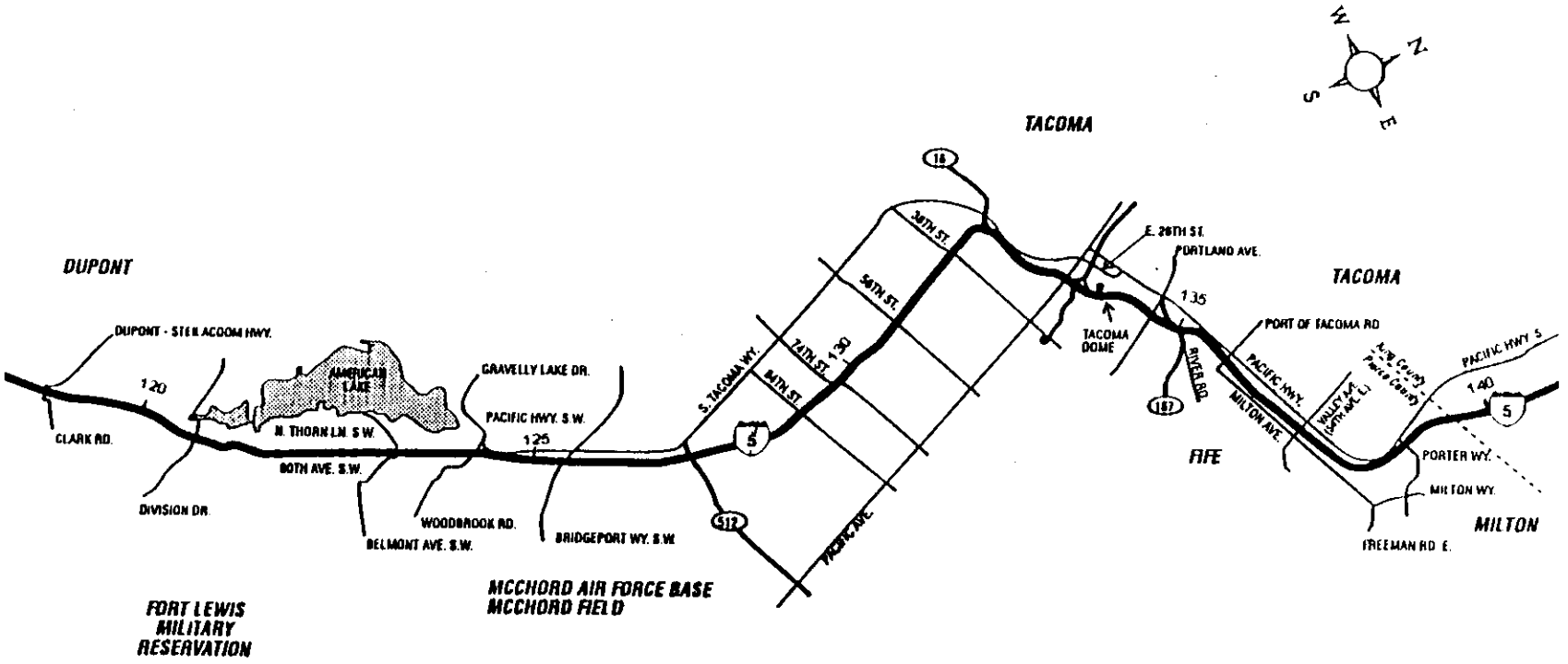

Figure 1. Map of Study Area

CONCLUSIONS AND RECOMMENDATIONS

The assessment of the usefulness of the guide *"Framework for Developing Incident Management Systems,"* produced mixed results. The systems approach recommended in the "Framework" (i.e., problem definition, goals and objectives, alternative development, re-evaluation, system refinement) was not followed when Tacoma's existing incident management system was developed. Moreover, it is not clear that it would have been followed had it been available. The idealized systems approach recommended in the "Framework" seems to overlook important elements that often drive incident management system development. These elements include the following.

1. Funding. In Tacoma, and nationwide, incident management is in its infancy; as a consequence, funding can be sporadic and difficult to plan for. Funding is often the single most important factor in incident management alternative selection.

2. Previous Experience. Incident management experiences in other urban areas often have a strong influence on alternative selection. For example, Seattle's experiences clearly played an important role in the development of Tacoma's incident management system. This is not necessarily bad because it means that incident management alternatives with proven track records are applied. However, caution should be exercised because an alternative's effectiveness may not be entirely transferable from one region to another.

3. Evaluation. The evaluation of an alternative's effectiveness is conducted on an informal basis that focuses on (a) the frequency of the alternative's use, and (b) word-of-mouth opinions from field personnel. Such an

evaluation is reasonably effective, but it makes decision-making based on a rigorous cost-benefit analysis impossible.

4. Communication/Training/Marketing. The finding that a number of Washington State troopers did not contact WSDOT incident response teams when needed suggests a potentially serious awareness problem. While the "Framework" clearly addresses communication and training and, indirectly, marketing, the importance of these may be understated. Specifically, marketing, both to the public and to involved agencies, is extremely important to the success of an incident management system, but it does not seem to be given the attention it deserves in the "Framework."

In light of the above, the systems approach presented in the "Framework" document should place greater emphasis on the effects of funding, the incident program "inertia" that is likely to be encountered (i.e., agency tendencies to apply what has been done elsewhere with little or no analysis), on the fact that the evaluation of alternatives is almost always going to be subjective because of the current lack of rigorous incident-management evaluation techniques, and on possible communication/training/ marketing problems.

The systems approach recommended in the "Framework" can be effectively applied in an idealized setting, as was done in Chapter 4 of this report. However, as mentioned above, the actual implementation and evaluation processes are likely to be governed by funding, previous alternative experiences in other urban areas, and rather subjective evaluations.

The six basic concerns outlined in the framework document (i.e., jurisdiction, geographic constraints, available resources, operational procedures, training and administration) appear to cover all relevant concerns. Tacoma's existing incident management system addressed all of these concerns, and this could go a long way in

explaining the system's success. This study makes no recommendations for changing the six basic concerns outlined in the framework.

Overall, this study showed that the *"Framework for Developing Incident Management Systems"* is a very useful document for (a) conceptually developing a new incident management system, (b) providing guidelines for improving existing incident management system, and (c) studying the development of an existing incident management system. However, individuals applying the "Framework" must be aware of the strong role that funding availability, the tendency to apply incident management alternatives from other areas, and subjective evaluation play. While these factors are alluded to in the "Framework," they are not given the prominent attention they deserve.

Other recommendations relating to the development of incident management programs include the following:

1. The development of the incident management system should occur both in the field and at management levels. The operational needs of the system can best be determined by the incident response personnel in the field, while interagency agreements and funding can best be accomplished at the management level. The development of the system should be the primary duty of the person responsible for its operation and/or implementation so that the program will not be impeded.

2. Agency officials are familiar with the general benefits of having an incident response program but may not be aware of the advantages of the individual options. Copies of the *"Framework for Developing Incident Management Systems"* were given to representatives of the agencies that would be involved in the program so that they could become familiar with the incident management options. Initially, the manuals were not thoroughly reviewed. When follow-up questions were asked a few months

later, the typical response received was, "I haven't had a chance to look at it yet." The "Framework" later proved to be very useful in educating the agencies on the advantages and disadvantages of the incident management options.

3. The questions presented in the step-by-step approach in Section 3 are very useful in developing an incident response program. The questions asked should be in a checklist format. Having this format would allow the results of the questions to later be used in an incident response guide of policies and procedures.

4. Agency officials in small to medium-sized areas should be made more aware of the advantages of having an incident management system and the usefulness of the *"Framework for Developing Incident Management Systems"* in developing such a system. Awareness of these benefits can be achieved through transportation conferences and articles in journals. This awareness should increase the use of the *"Framework for Developing Incident Management Systems."*

INTRODUCTION AND BACKGROUND

INCIDENT MANAGEMENT

Traffic congestion is a problem affecting most urban areas throughout the United States. The management of this congestion is an increasing concern among transportation agencies. Congestion results when traffic demand exceeds the roadway's capacity. Incidents, such as an accident, vehicle breakdown, spilled load, or other random event that reduces the maximum number of vehicles that the roadway can carry, are major causes of highway congestion. Incidents reduce traffic flow directly by requiring that a lane be closed or indirectly by causing motorists to slow down to look at the incident.

Recurrent congestion, which is caused by geometric and operational features that reduce the roadway's capacity, is relatively predictable from day to day. Incident-caused congestion (non-recurrent congestion) is not predictable and constitutes 60 percent of the total vehicle hours lost because of congestion. (2) The options of constructing additional lanes and building more freeways are becoming increasingly more difficult because of environmental and social concerns and escalating construction costs. Therefore, minimizing any reduction in capacity is critical. The costs to motorists caused by such delays can easily exceed $2,000 per minute of incident duration in urban areas. (3)

DOCUMENT DESCRIPTION

The Washington State Department of Transportation (WSDOT) recognizes that congestion caused by incidents is a serious problem and funded a research project to determine the characteristics of these incidents and their traffic impacts. (4) That project, through a traffic simulation of 20 miles of Interstate in Seattle, revealed that incident-induced delays resulted in over $250 million in lost travel time per year. (4)

As a result of that study, WSDOT officials became aware of the urgency of mitigating the impacts of incident-induced congestion in Seattle. The WSDOT, in cooperation with the Washington State Transportation Center (TRAC), developed an effective incident management program (IMP) for Seattle. A product of the development of the IMP was a document entitled *"Framework for Developing Incident Management Systems"* that outlined specific guidelines for creating an incident management system. (1)

The approach suggested in the *"Framework for Developing Incident Management Systems"* is patterned after a classic "systems" approach to program development. The *"Framework for Developing Incident Management Systems"* helps those responsible for IMP development and implementation to identify the following:

- the issues and problems to be resolved,
- alternative ways to solve those problems, and
- the relative merits and disadvantages of the alternatives selected for analysis.

The systems approach to program development breaks the decision making process into six separate tasks:

- define the problem,
- set goals and objectives,
- develop alternatives,
- implement alternatives,
- re-evaluate alternatives, and
- refine the system.

The task of developing a new incident management program or expanding an existing one is simplified with the *"Framework for Developing Incident Management Systems."* The introduction provides background on the incident management process and is an excellent resource for personnel new to the incident management process. The "Systems Approach to Problem Solving," found in Section 1, outlines the steps needed to develop an incident management system. "Major Issues in Selecting Incident Management Alternatives," also found in Section 1, is useful for anyone who is

responsible for the development and implementation of the Incident Management System.

Section II of the manual, "Incident Management Options to Consider for Implementation," includes tables of the five parts of the incident management process (detection, response, clearance, site management, and motorist information) affected by each incident management alternative and the cities across the United States where each of the options are being used. The remainder of the chapter is devoted to the options that can improve detection and verification time, response time, site management, clearance time, and motorist information. Tables of all incident management options, with a brief comment and evaluation of the potential benefits and costs of each, are shown. A table describing the amount of necessary agency involvement is also presented for each option. Each chapter includes a general description of each option; conditions under which it is appropriate; advantages and disadvantages; capital, maintenance and operating costs; special equipment and training required; liability; legislative requirements; public and/or private agency operation; and operating agency and funding responsibility.

"Systems Development Process and References," found in Section III of the manual, discusses ways to design a new incident management system and develop specific incident management measures while addressing many relevant questions regarding jurisdiction, geographic constraints, available resources, operational procedures, training, and administration. A list and comparison of computer models that can be used for traffic simulations is also included.

The last two chapters of the framework may be the most useful in evaluating the different options. The Reference Guide is a comprehensive list of material on general and specific incident response measures. A list of contacts with phone numbers and addresses are categorized by state and by a separate list of contacts within the USDOT.

RESEARCH OBJECTIVES AND APPROACH

This study first looks at how closely Tacoma's existing incident management system followed the systems approach recommended in the document *"Framework for Developing Incident Management Systems."* This is an important comparison because the officials who developed Tacoma's incident management system did not have access to the "Framework." Thus we can assess how close Tacoma's development process was to the "ideal" development process outlined in the "Framework." This assessment points to weaknesses in Tacoma's incident management system development and isolates unrealistic components of the framework.

Next, this study inventories and discusses current incident management options currently used in Tacoma. Comments regarding the effectiveness of these options are made where appropriate. The systems approach presented in the document *"Framework for Developing Incident Management Systems"* is then applied to determine the actions that should be taken to improve Tacoma's incident management system. This is an important step because it demonstrates the application of the systems approach to an existing incident management system.

Finally, this study concludes with a summary of the Tacoma application and recommendations for improving the systems approach detailed in *"Framework for Developing Incident Management Systems."*

PROCEDURES AND DISCUSSION

Tacoma's existing incident management system was developed without the benefit of the document *"Framework for Developing Incident Management Systems."* Therefore, it is important to study how the Tacoma experience differed from that presented in the "Framework" and to determine whether the availability of the "Framework" could have improved the development of Tacoma's incident management system.

This chapter is divided into two sections. The first deals with the systems approach and how it differs from the approach used to develop Tacoma's incident management system. The second section discusses the role that the six basic concerns (jurisdiction, geographic constraints, available resources, operational procedures, training, and administration), discussed in Section 1 of the "Framework," played in the development of Tacoma's incident management system.

SYSTEMS APPROACH AND THE DEVELOPMENT OF TACOMA'S INCIDENT MANAGEMENT SYSTEM

As outlined in the "Framework," the six stages of the systems approach are problem definition, goals and objectives, developing alternatives, implementation, re-evaluation, and system refinement. The following sections discuss how well Tacoma's incident management development process followed the six steps of the systems approach.

Problem Definition

Under ideal conditions, a region wishing to develop an effective incident management system would conduct a study to isolate specific problems and recommend solutions. In reality, such an idealistic process rarely occurs.

Problems are more likely to be defined as a result of political pressure from disgruntled motorists, concern from police patrols and emergency vehicle operators, and suggestions by state and city transportation personnel who are involved in roadway operations.

Tacoma's incident management system was defined largely through the WSDOT, in cooperation with local agencies, and the Washington State Patrol (WSP). Problem definition for Tacoma's system also benefited from ongoing incident management experience in neighboring Seattle.

Goals and Objectives

While Tacoma clearly had goals that one would expect of any incident management system (i.e., reduce non-recurrent congestion by minimizing response time and on-scene time), its specific objectives were limited. This was a result of budget constraints, which often limit the number of objectives that can be considered.

Alternative Development

Alternatives were developed in Tacoma primarily on the basis of Seattle's experiences and the experiences of other areas of the country. The development of alternatives was strongly affected by budgeting and implementability. The alternatives were also influenced by the ones that WSDOT had already selected for Seattle. This is an important point because, although economies of scale may exist, smaller urban areas are likely to adopt alternatives that nearby larger urban areas are using. These alternatives may or may not be the best alternatives for the small urban area.

Re-evaluation

Tacoma's incident management system does not have a rigorous means by which implemented alternatives can be evaluated. This is not surprising because few incident management programs have an effective method for measuring the effectiveness of alternatives. The approach taken in Tacoma for re-evaluation is similar to that practiced in most cities and consists of an informal assessment of (1) the frequency of the incident

management alternative's use, and (2) feedback from incident management personnel. This system seems to be highly effective, qualitatively, although it does not lead to a quantitative assessment of alternatives. As a result, the process produces a list of alternatives that can be considered effective, but the alternatives are difficult to rank in order of effectiveness.

System Refinement

As with re-evaluation, Tacoma's system refinement process is driven by the frequency of the alternative's use and feedback from incident management personnel. This has to be considered the norm of system refinement, nationwide. A more rigorous quantitative method of system refinement seems to be a few years away from implementation in most urban areas.

SIX BASIC CONCERNS AND THE TACOMA INCIDENT MANAGEMENT SYSTEM

As defined in the *"Framework for Developing Incident Management Systems,"* the six basic concerns are jurisdiction, geographic constraints, available resources, operational procedures, training, and administration. By almost any measure, the Tacoma incident management system successfully addressed these six concerns. Although the next chapter will show some problems with these issues related to specific alternatives, the overall system has been quite successful in this regard. This success can be attributed to the WSDOT's careful orchestration.

WSDOT's experience with Seattle's incident management program, although sometimes developed concurrently with Tacoma's, was clearly a positive influence here.

APPLICATION AND IMPLEMENTATION

This section discusses the application of the systems approach described in the *"Framework for Developing Incident Management Systems"* to recommend improvements to Tacoma's existing incident management program. The area of study included 25 miles of Interstate 5 in and around Tacoma (see Figure 1 for study area).

STEP 1: DEFINING THE PROBLEM

Data Analysis

Information regarding incidents is an important part of defining the problem. This information can be broken down into three categories: incident occurrence, incident duration, and traffic impacts.

The incidents that occurred between February and April of 1992 on 25 miles of Interstate 5 (MP 115 to MP 140) in Pierce County were analyzed. Some information regarding vehicle accidents can be obtained from the Washington State Department of Transportation's accident reporting database, Microcars. However, because this information does not include detection, response, or clearance times, it was not used for this study. Therefore, the majority of information regarding such incidents was retrieved from the Washington State Patrol's Computer Aided Dispatch (CAD) system. This system records all communication that occurs between patrol officers and the dispatcher. The data contained in the CAD reports are listed below:

- time of incident,
- time the officer was assigned,
- time the officer arrived at the scene,
- time the officer left the scene,
- type of incident (fire, stalled vehicle, blocking, accident, etc.),
- lanes blocked (if any),
- incident location, and
- others responding to the incident.

The CAD data were difficult to obtain from the WSP. WSP officials are reluctant to let others access their terminals because of the sensitive nature of their work. Once the data were obtained in printed hard copy form (data cannot be obtained in any type of computer ready form), they had to be manually entered into a database program before they could be analyzed.

The data retrieved from the CAD reports to determine incident duration included the amount of time required to detect the incident, the amount of time between the time the incident was first reported and the arrival of a response vehicle at the scene, and the amount of time required to clear the incident after the responding vehicle had arrived.

The average amount of time that elapsed between the time a vehicle became disabled and blocked at least one lane to the time a trooper responded to the scene was just under 10 minutes. This figure appears very impressive, but the response time may have been artificially skewed because many of the blocking incidents were first discovered by the trooper, and therefore the response time was recorded as zero. Also, the time of actual vehicle disablement was estimated by the trooper. In 1989, analysis of WSP CAD data indicated that, on average, a WSP trooper required 15 minutes to reach the scene of an incident on I-5 in Tacoma after the incident had been reported to the WSP. (5)

The analysis also revealed that average response times were lower in the morning and in the evening peak periods. Slightly more than 6 minutes were required to respond to an incident during the morning peak period between 6:00 and 8:00 a.m., and just over 7 minutes were required in the evening peak period between 4:00 and 6:00 p.m. Response times were lower during the peak periods because all troopers are required to be in their assigned areas. In contrast, during off peak hours, day troopers are completing paperwork, attending court hearings, and doing other required activities, leaving fewer troopers to respond quickly to an incident.

The incidents analyzed over the three-month study period included accidents, disabled vehicles, and disabled vehicles blocking at least one lane of traffic. The frequency of these incidents showed a steady increase from the early hours of the morning (2:00 a.m.) to the evening peak period (4:00 p.m. to 6:00 p.m.). The number of incidents versus time of day for all disabled vehicles, disabled vehicles blocking one or more lanes, and for all accidents can be seen in Figure 2, Figure 3, and Figure 4, respectively.

Over the study period, 1,317 vehicles were disabled on the 25 miles of Interstate 5. Approximately 54 percent (711) of all those vehicles were disabled in the southbound direction. 44 percent (582) were traveling northbound, and the remaining 2 percent (24) were off of the freeway system. Of the total 1,317 disabled vehicles, 13 percent (173) were blocking at least one lane of travel and 11 percent required a tow truck.

The majority of the blocking disabled vehicles occurred near the downtown Tacoma area on the three-mile section between the 38th Street ramps (approximately MP 131) and the SR 7/SR 705 ramps (approximately MP 133). This section of freeway had a 1990 average daily traffic (ADT) volume of 142,500. Figure 5 shows the frequency of blocking disabled vehicles by mile post. The total number of accidents on the 25 miles of Interstate 5 in Pierce County during 1990 was 1,767. The 1990 accident rates for the two ramps were 4.3 and 4.1, respectively. This is more than double the statewide accident rate of 1.9. The accident rate is calculated using the following formula:

$$\text{Accident Rate} = \frac{(\text{Number of Accidents}) \times (1\ \text{Million})}{(\text{Section Length}) \times (\text{AADT}) \times (365\ \text{Days})}$$

AADT = Annual Average Daily Traffic

The data showed that Tacoma area incident durations are comparable to those typical in the nation. (1)

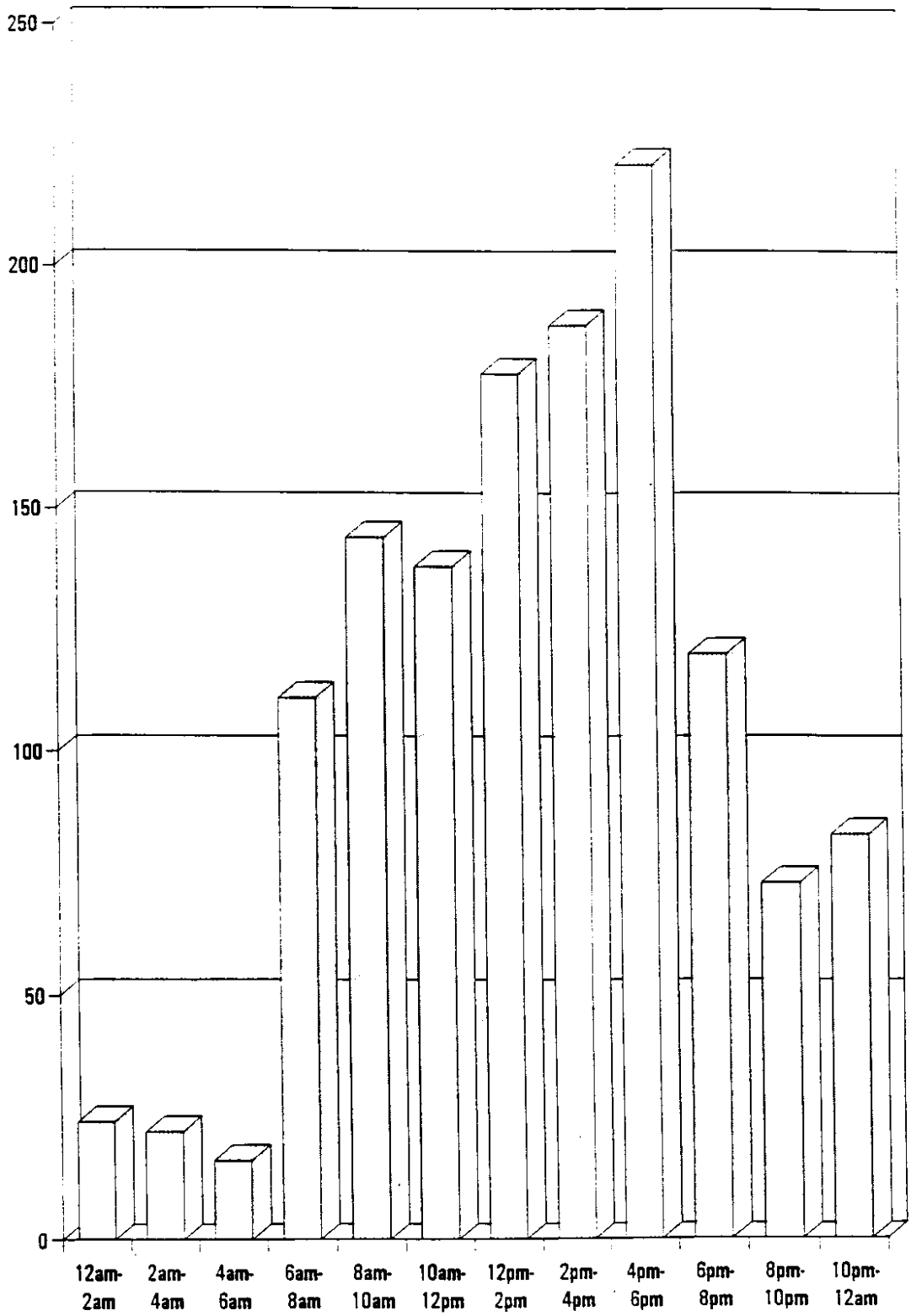

Figure 2. Disabled Vehicles by Time of Day

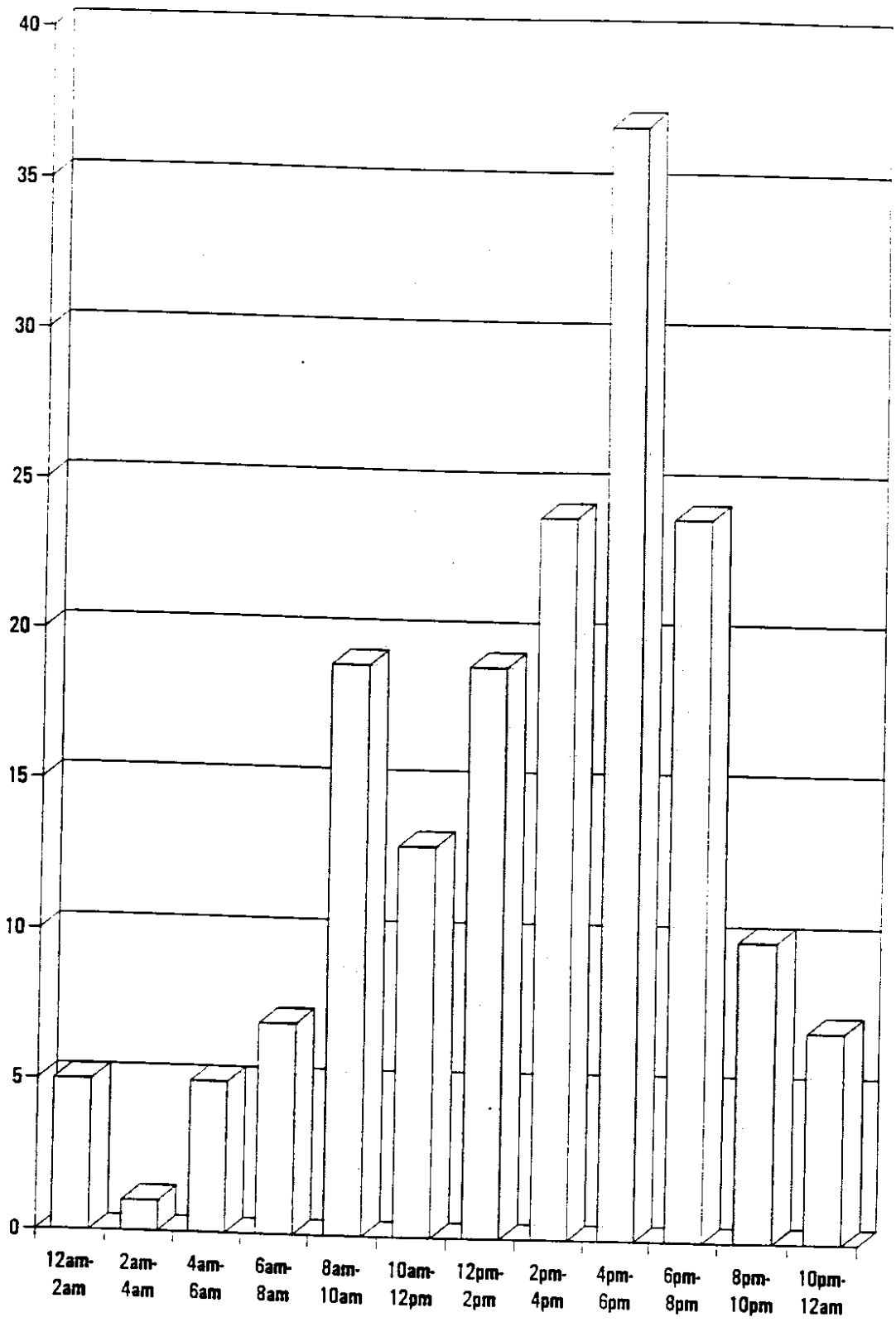

Figure 3. Blocking Disabled Vehicles by Time of Day

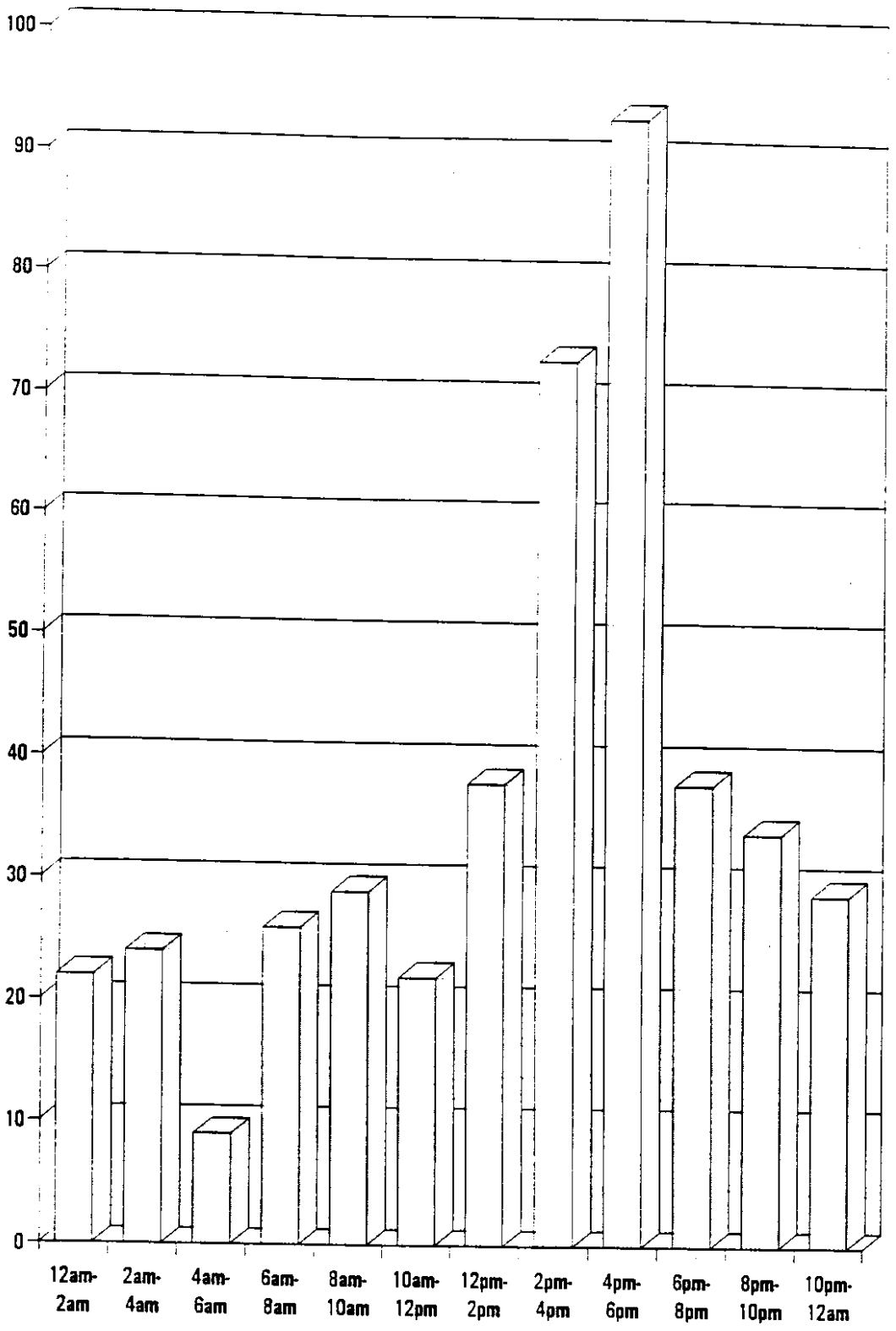

Figure 4. Number of Accidents by Time of Day

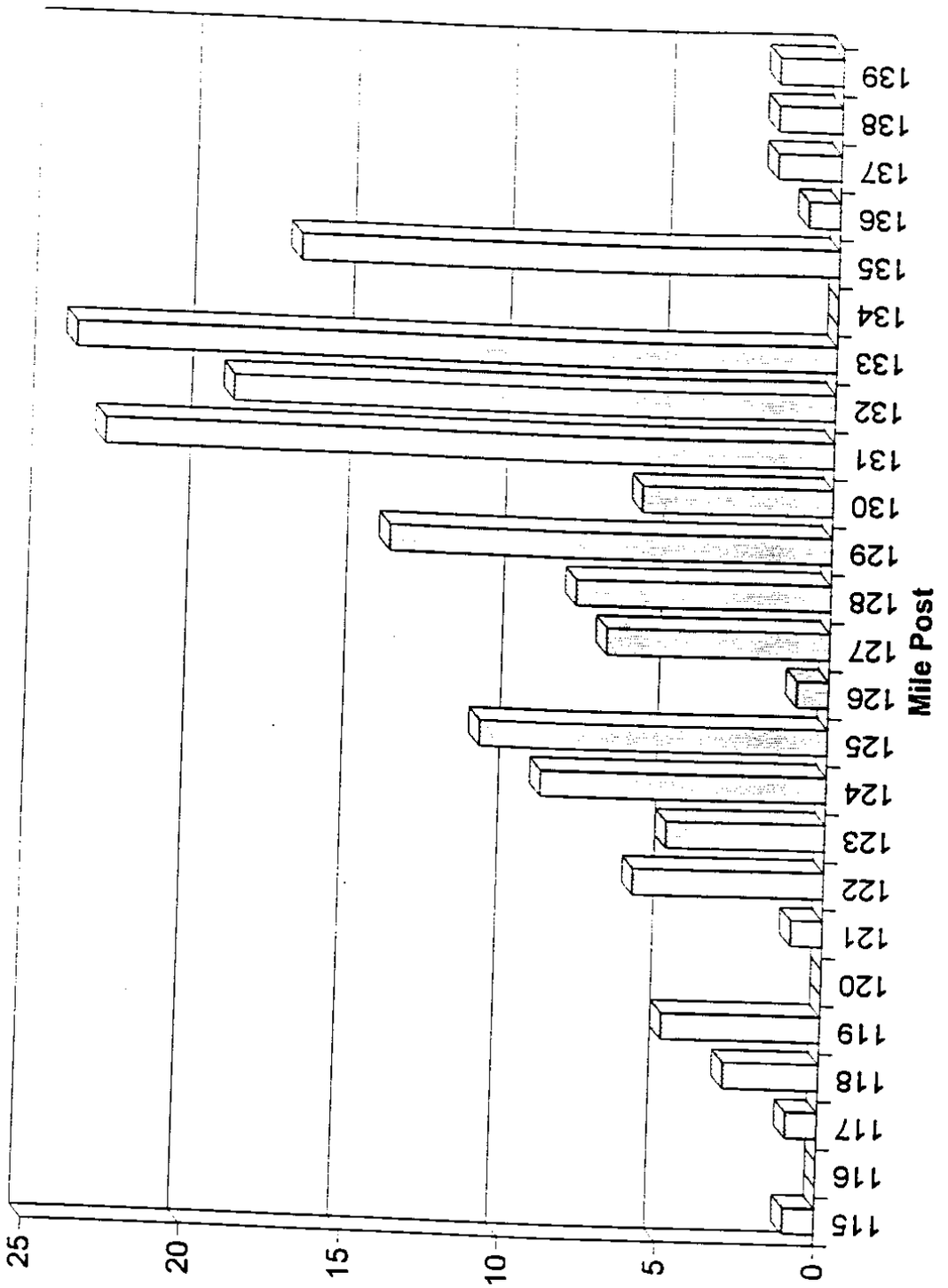

Figure 5. Blocking Disabled Vehicles by Mile Post

Agency Interviews

Regarding current response procedures and management policies and options, responding agency personnel are most concerned about funding, communication within and between agencies, motorist information, and the impacts on traffic.

WSDOT and WSP officials and response personnel felt that the management of large or severe incidents, especially those involving chemical and hazardous materials, can be improved. Since the inception of the District 3 incident response program on March 1, 1991, WSP officials have noticed a continued improvement in the management of severe incidents. This is primarily because the Incident Response Supervisor (IRS) installs the proper traffic control devices, leaving troopers free to manage the scene or perform other critical tasks. The Supervisor can also expediently get WSDOT maintenance equipment and personnel to the scene. Before, troopers had to have their dispatcher call the proper WSDOT officials and request that they send the proper equipment and personnel. Many questions were relayed between the dispatcher, WSDOT officials, and the trooper (e.g., the size of front loader, the number of maintenance technicians). The Supervisor knows who is available to aid in the incident and has the authority to call them to the incident scene. He is also knowledgeable about the type and size of equipment that are needed to clear the roadway.

Incident response personnel from the WSDOT had concerns that not all troopers contacted the WSDOT Incident Response Team when needed. The Incident Response Program is still fairly new to the Tacoma area and, unfortunately, may not occur to the trooper.

The possible lack of awareness among troopers suggests that the incident response program in Tacoma may not have been sufficiently comprehensive in terms of training and communications. The document "*Framework for Developing Incident Management Systems*" carefully addresses training and communication issues and stresses their

importance in sections 2 and 3. It also suggests that the consequences of this lack of awareness could be severe. Under utilization of specific incident management strategies (i.e., the incident response team) could greatly compromise the effectiveness of the entire incident management program.

STEP 2: SETTING GOALS AND OBJECTIVES

The incident management system will meet WSDOT's strategic objective of reducing congestion by

- developing new and using existing transportation system management techniques to mitigate congestion,
- aggressively pursuing multi-jurisdiction partnerships for transportation system improvements, and
- increasing emphasis on safety through operational improvements.

WSDOT officials would like to improve their incident response program in all five incident management system areas in Tacoma. Therefore, options that will reduce the time required to detect an incident, reduce the response time to the scene, improve the management of the incident site, improve the time needed to clear the incident from the roadway, and inform the motorist should be considered.

More specifically, officials have realized that they need a quantifiable measurement system for incident management procedures. Having numerically quantifiable results allows a realistic assessment of the success or failure of the options implemented. Decision makers are more inclined to approve funding for new programs or continue funding for existing programs that are backed by numbers to prove their success.

A key component for a successful, ongoing assessment of an incident response program is having a database of performance measures. Relying on the WSP CAD system reports for an ongoing data analysis is not recommended. As mentioned earlier,

obtaining this information is tedious and time consuming. Not only are the data difficult to obtain, the data must be printed from the CAD system and manually input into a meaningful database program before they can be analyzed.

A database was developed by incident response personnel in Seattle. Information contained in the database includes the time of incident detection, time of response, number of lanes blocked, time required to clear the roadway, materials used, and incidents in which their personnel responded. The Tacoma Supervisor has a copy of this program, but its use is limited because it can not be manipulated into a usable database form. Instead of combining incident information into useful summary forms, it is more like an electronic file cabinet that stores individual incident documents.

At the time this study began, a WSDOT/TRAC study was underway to develop an incident management database. This project will determine the information needed by responding agency personnel and officials to determine the areas that need improvement (detection, response, or clearance). The data will be recorded in the field by incident personnel using lap-top computers. Data will be collected throughout the state and will be in a common format. Officials responsible for incident management programs will be able to efficiently evaluate the success or failure of the programs implemented and discontinue programs found ineffective.

STEP 3: DEVELOPING ALTERNATIVES

After the goals and objectives of the incident management system have been established, specific incident management alternatives should be explored. The *"Framework for Developing Incident Management Systems"* outlines many of the options available in each of the categories of detection, response, site management, clearance, and motorist information. Table 1 gives the areas of impact for incident management alternatives that were included in the *"Framework for Developing Incident Management Systems."* Many of these alternatives have been implemented in the Tacoma urban area.

Table 1. Existing Incident Management Alternatives

Options	Incident Detection	Incident Response	On-Site Management	Incident Clearance	Motorist Info.
Alternative Route Planning		X		X	
Cellular Telephone	X				
Freeway Patrols	X	X		X	
Equipment & Material Resource List		X			
Equipment Storage Sites		X			
Highway Advisory Radio					X
Identification of Fire Hydrants				X	
Improved Interagency Communication		X	X		
Incident Phone Lines	X				
Incident Response Team			X	X	
Personnel Resource List		X			
Policy Requiring Fast Vehicle Removal				X	
Push Bumpers				X	
Surveying Equipment				X	
Variable Message Signs					X

Most of the incident management alternatives presently employed in the Tacoma area were chosen from the successful alternatives implemented in Seattle. An example of this is Tacoma's incident response vehicle, which was modeled after the vehicle used in Seattle. The Incident Response Supervisor's duties were also modeled after Seattle's Maintenance Supervisor's duties. The major difference is that District officials for the Tacoma area chose to use a maintenance supervisor for their lead incident response person, rather than an engineer, as used in Seattle. They felt that a maintenance supervisor would have an easier time coordinating the efforts of the maintenance personnel assigned to assist during an incident.

STEP 4: EVALUATING AND SELECTING ALTERNATIVES (NEW PROGRAMS)

Based on the analysis presented in the final technical report, the following incident response options would benefit the Tacoma area the most:

- traffic management system and control center,
- freeway service patrols,
- incident response manual,
- administrative traffic management teams, and
- incident response database.

The traffic management system (TMS) and control center that is planned for Tacoma will have a positive impact on all areas of the incident response program. Detection time will be reduced by use of electronic loops and video monitoring. Incidents can also be visually verified, and the severity of the incident can be assessed before response personnel and equipment are assigned. Site management will be improved because a single source of information will eliminate duplication of response efforts. Clearance time will be improved by ramp metering that will eliminate excess traffic. The variable message signs (VMS) will inform the motoring public about the cause of delay.

Presently, there are no formal means of incident detection in the Tacoma area. Freeway service patrols, similar to the tow truck service patrols used during the 1990 Goodwill Games, are recommended. The service patrols would improve incident detection and clearance. The use of the service patrols should be reevaluated after completion of the TMS to determine whether continued use would be appropriate.

The multiagency administrative traffic management team is a low cost alternative that would benefit the incident management program by bringing key players from each organization together so that jurisdictional problems and other idiosyncrasies could be worked out. An effort should be made to have team meetings on a scheduled basis; otherwise, the interest and effectiveness of the team might diminish. The team members should include the supervisors of incident response personnel to maximize the exchange of information between upper management and response personnel.

An incident response database is being developed through the joint efforts of the WSDOT and TRAC. This database will allow WSDOT to efficiently evaluate the success or failure of the incident response programs implemented.

In addition to the above options, the following options, which have already been implemented, should be expanded or improved until funding for the new programs is available:

- alternative route planning,
- equipment and material resource list,
- incident response teams,
- personnel resource list, and
- variable message signs.

One problem encountered in selecting incident management alternatives was that the amount of funding available from the responding agencies was not known. Funding is a critical part of developing and implementing an incident management system. Without knowing the amount of funds available, it is hard to select specific options,

especially those that require a substantial investment. For this reason, the recommended new options overlap with the existing options proposed for expansion.

The options that are proposed for expansion require much less funding than those included in the new options. The personnel resource list and equipment and material resource list options are recommended for expansion, but the same information contained in these lists would be included in the incident response manual option. There is a reason for this overlap in recommendations. If funding for the development of the comprehensive response manual is not available, extensive lists of personnel, equipment, and materials can be developed at a nominal cost. Likewise, the variable message signs included in the costly TMS Center option are still recommended even if the TMS is not constructed. A motorist information system such as variable message signs would be very beneficial for incidents and during special events at the Tacoma Dome.

Alternative route planning is being proposed for expansion because these routes have already been determined in Thurston County, but plans for informing the motoring public in the event they are needed have yet to be developed. Signs at key locations are needed to reduce motorist confusion and advocate smooth traffic flow. Expansion of this option has already been planned as funds become available.

Continued support and training for the Incident Response Team is strongly suggested. A staff of maintenance technicians properly trained in incident response procedures can save time and money and improve the safety of other response personnel and the motoring public. The Incident Response Supervisor is the backbone of the entire incident response program. As mentioned previously, this person is responsible for coordinating WSDOT response efforts by requesting the appropriate personnel and equipment, as well as for dealing with other responding agency personnel.

REFERENCES

1. Koehne, J., Mannering, F., and Hallenbeck, M., "Framework for Developing Incident Management Systems," Washington State Department of Transportation, August 1991.

2. Cambridge Systematics, Inc. in association with JHK & Associates, Transmode Consultants, Inc. and Sydec, Inc., "Incident Management," 1990.

3. Garrison, D. and Mannering, F., "Assessing the Traffic Impacts of Freeway Incidents and Driver Information," ITE Journal, August 1990.

4. Mannering, F., Jones, B., Garrison, D., et. al, "Generation and Assessment of Incident Management Strategies," Washington State Department of Transportation, January 1990.

5. Mannering, F., and Hallenbeck, M., "Incident Management Systems Framework: Impact of Service Patrols," Washington State Department of Transportation, March 1991.