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Incident Management Systems Framework

Impacts of Service Patrols

WA-RD 221.1

Final Summary Report
March 1991

Washington State Department of Transportation
Planning, Research and Public Transportation Division

in cooperation with the
United States Department of Transportation
Federal Highway Administration

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16. ABSTRACT

This report documents the impacts of two service patrol demonstrations performed in the Puget Sound metropolitan area during the 1990 Goodwill Games. Service Patrols were provided thanks to the cooperation of the Washington State Department of Transportation, the Washington State Patrol, the Federal Highway Administration, the Washington Tow Truck Operators Association, and the Professional Tow Truck Operators of Pierce County.

As a result of these patrols, substantial decreases in incident duration were measured within the study area during the demonstration. A major portion of this reduction came from the average decrease of over 5 minutes in the response time required to reach an incident that resulted from the use of service patrols. In addition, the service patrols speeded the removal of disabled vehicles from the freeway creating less disruption to the traffic flow on that facility and improved safety through a decrease in the length of time a hazardous condition was allowed to exist on the roadway.

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Final Summary Report

Research Project GC 8719, Task 6
Incident Management Systems Framework

INCIDENT MANAGEMENT SYSTEMS FRAMEWORK

IMPACTS OF SERVICE PATROLS

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U.S. Department of Transportation
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March 1991

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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CONCLUSIONS AND RECOMMENDATIONS

A large number of mitigation efforts were undertaken to reduce the impact of traffic congestion associated with the Goodwill Games in the summer of 1990. One of the most far reaching of these mitigation measures was the operation of special quick response service patrols on the most congested portions of the metropolitan freeway system. This study was commissioned to analyze the impacts of these service patrol tests, and to help determine whether service patrols should be instituted on a regular basis in the metropolitan area.

CONCLUSIONS

The following points are the main conclusions of this study.

- The service patrol efforts provided by the WSDOT, WSP, FHWA and participating tow truck organizations during the Goodwill Games had a significant impact on the response to incidents within the Puget Sound area's metropolitan freeway system.
- Operation of the service patrols reduced the time required to reach an incident location by over 5 minutes.
- Incident duration decreased within all categories of incident response where service patrols operated. The most significant decreases were an average reduction of 15 minutes for incidents involving accidents in Tacoma, and an average reduction of over 6 minutes for incidents involving disabled vehicles in Seattle.
- Similar reductions were not found on the segments of the freeway system that were not part of the service patrol demonstration.
- The increased presence of WSP officers and assistance tow trucks during the demonstration resulted in a 300 percent increase in motorist assists in the Tacoma area during the demonstration.

- Both WSP officers in jeeps and tow truck operators in conventional tow trucks proved successful as service patrol options. Both styles of service patrol had their own advantages and disadvantages.
- Motorists were unanimous in their support for the continued operation of the demonstration.

RECOMMENDATIONS

While this was a short, small scale demonstration of service patrols, some clear directions for the application of these techniques can be given. These recommendations are provided below.

Continued Operation of the Demonstration

It was not possible to compute a valid estimate of the costs and benefits of service patrols from the data available for this study. However, the results of the study did indicate that service patrols can have a substantial impact on the speed and effectiveness with which the state's operating agencies respond to incidents. Further, this assistance will have a significant impact on traffic performance, and the assistance provided by the service patrols is both desired by the motoring public and visible to many motorists.

Thus, the expenditure of funds for service patrols would benefit the state in terms of both improved traffic performance and improved public opinion. The research team recommends that the state fund further service patrol activity if operational funding exists for improving facility performance and safety.

Equipment Selection

Given the advantages and disadvantages of tow trucks and jeeps or small trucks equipped with push bumpers, the project team recommends a service patrol fleet that contains both tow trucks and jeeps. The majority of the service patrol would use the smaller, less expensive vehicles, while the tow trucks would operate on the segments of highway that are mostly seriously impacted by incidents. This would be an extension of

the current WSDOT policy of maintaining tow trucks at either end of the floating bridges during peak periods, plus the addition of service patrol vehicles for other parts of the metropolitan area.

Style of Operation

While both WSP officers and trained tow truck operators worked well for the demonstration, and either would be acceptable for an ongoing program, the research team recommends that special training be employed for persons (either state employees or private contractors) who would perform service patrol work as a regular job.

The research team also recommends that the service patrol be equipped with specific uniforms and distinctively marked vehicles that clearly identify them as "government provided" (i.e., free of charge). This identification would improve the initial working climate for the drivers and reduce the anxiety level (and suspicions) of motorists they attempted to help. These recommendations should be followed regardless of the style of patrol vehicle used and whether the service was actually provided by government employees (WSP or WSDOT) or by private contractors.

INTRODUCTION AND RESEARCH APPROACH

BACKGROUND

The Goodwill Games is a large, international gathering of world class athletes competing in a variety of sporting events. Coincident with the athletic events are a variety of cultural events (plays, concerts, arts exhibits) aimed at broadening the world's understanding of different cultures and traditions.

The 1990 Goodwill Games took place over 15 days, from July 20 through August 5, in the state of Washington. The majority of sporting venues were located within the Seattle-Tacoma metropolitan area. The largest sporting venues included the following:

- Husky Stadium at the University of Washington, which hosted the opening ceremonies and track and field events;
- Cheney Stadium in Tacoma, which hosted the baseball games;
- the Seattle Coliseum and Seattle Center, which hosted the basketball games and the press center; and
- the Tacoma Dome, which hosted gymnastics, figure skating and the final two rounds of ice hockey.

Other sporting and cultural events were scattered throughout Washington's metropolitan regions, including Spokane and the Tri-cities area.

Because of the size of the Games, their unique international flavor, and nationwide media coverage from both the Turner Broadcasting Network and the regular sports press, event planners expected a large influx of tourists to the Seattle metropolitan area, and large crowds attending the events. When local traffic planners combined traffic volumes expected to result from the scheduled sporting and cultural events (many of which were scheduled to start during the early evening rush hours) with the existing

levels of urban traffic, their resulting forecast was for unprecedented levels of traffic congestion, especially near the largest sports venues.

To address these fears, several agencies participated in a large number of traffic mitigation efforts. These agencies included the Seattle Goodwill Games Organizing Committee, the Washington State Department of Transportation (WSDOT), the Washington State Patrol (WSP), the Municipality of Metropolitan Seattle (Metro), the University of Washington (UW), the City of Seattle, and others.

One of the most far reaching of these mitigation measures was the operation of quick response service patrols on the most congested portions of the metropolitan freeway system. These service patrols were provided in two distinct areas and involved two methodologies. In Seattle, the roving service patrols were WSP officers in specially equipped Jeep Cherokees and Nissan Pathfinders. In Tacoma, service patrols were provided by the Washington Tow Truck Operators Association (with support from WSDOT and the Professional Tow Truck Operators of Pierce County) with conventional tow trucks. Part of the funding for both of these efforts was provided by the Federal Highway Administration.

The intent of both types of service patrols was to reduce the delay freeway incidents would cause motorists and improve the safety of the facilities. The service patrols were intended to reduce both the time needed to identify incidents and the time needed to respond and clear those incidents.

This study was commissioned to analyze the impacts of these two service patrol tests and to help determine whether service patrols should be instituted on a regular basis in the metropolitan area.

RESEARCH APPROACH

To compare the performance of the system with and without the service patrols, the project collected data from available traffic monitoring sources before and during the

Goodwill Games. The traffic monitoring data were supplemented with data from several sources. Tow truck operators and WSP service patrol officers filled out incident report forms after each roadside assistance stop. Observers positioned in Tacoma to help detect incidents also submitted data sheets indicating the number and time of incidents they observed. Data were also collected from the WSP's Computer Aided Dispatch (CAD) system, which monitors WSP officer activity. Finally, after making an assist, service patrol drivers in Tacoma gave the motorists they helped a stamped, pre-addressed post card, which requested comments on the service provided. Motorists were asked to fill out and mail the post card to WSDOT as part of the evaluation of the service patrol demonstration. Unfortunately, data collection outside of routine traffic volume and vehicle speed monitoring information was limited by the relatively small size of the project budget.

The majority of the incident data that were useful for evaluating the impacts of the service patrol vehicles came from the WSP CAD system because they were available both before (from 1989) and during the service patrol demonstration. The remaining data were mostly useful for examining the operation of the demonstration. Data from the CAD system included the following:

- the number of incidents reported,
- the time of the incidents,
- the duration of the incidents,
- the nature of the incident (accident, stalled vehicle, fire),
- the number of lanes blocked, if any,
- the location of the incident, and
- who responded to the incident.

Figure 1 shows what the CAD data looked like when they were obtained from the WSP.

This information was converted into a series of standard records and used to compare conditions before and during the Goodwill Games. Statistics were then used to

```
R 8908010339ID                                PRIOR HISTORY INQUIRY                PCADP021

CASE#: 8908010339ID              COMMCEN:  ID          ZONE:  03
CODE: ACC                  SIGNAL: PI                  SOURCE: BILL SCHALLERT 329-3625
COUNTY: 17                   HWY: I 90               LOCATION: WB MI LID        1C SEMI
DISP: R RT                                             INV. OFF. :
 REMARKS:        0805 J214 ADVISES INJURY - AID ADVISED
                 0808 L1 L2 BLOCKED TRAFFIC ADVISORY IN EFFECT WB LID SIGN
                 .      ACTIVATED      IMPOUND INFO TO BE CALLED IN
          OLN:                                  LIC:          LIS:    MORE TEXT:  NO
           CO:  X206          TIME: 0800        OP: X332  CLOSER:  X332  TIME:   0902
     ADV TIME:                UNITS:
     PRM UNIT:  512           ASGN:  0801   ARRVD: 0808      CLEAR:  0902
                UNIT           ASGN ARRV   CLEAR                UNIT  ASGN ARRV CLEAR
     BACKUP1:   J214            0806 0806     0846          BACKUP6:
     BACKUP2:   921             0806 0819     0840          BACKUP7:
     BACKUP3:                                               BACKUP8:
     BACKUP4:                                               BACKUP9:
     BACKUP5:                                               BACKUP10:
TOW:  ID45 STARBUCKS  0822  TOW:                                TOW :
              I = INQUIRY (KEY CASE NO)...(PF5)        S = SYSTEM MASTER MENU.........(PF1)
              2 = FATAL INQUIRY.................(PF6)      R = RETURN TO CALLING PANEL...(PF2)
              F = FORWARD TO TEXT PAGE..(PF8)
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Figure 1. CAD Data Obtained from WSP

determine when measured changes were observed and if those changes could be attributed to the congestion mitigation measures or only to the variable nature of traffic incidents.

STUDY AREA

While the Goodwill Games event venues were scattered throughout the Puget Sound region, as well as some locations in Spokane and the Tri-cities area, the majority of traffic congestion concerns were centered on the larger sports facilities in Seattle and Tacoma. These sports facilities were located next to highways that already exhibited significant routine traffic congestion during peak travel periods. The transportation facilities of most concern were the following:

- SR-520 between I-5 and I-405,
- I-5 through Seattle,

- I-5 approaching the Tacoma Dome, and
- SR-16 approaching Cheney stadium.

A map showing these highways and their relation to the largest Goodwill Games venues is provided as Figure 2.

MITIGATION MEASURES

The service patrols were deployed to provide the maximum benefit possible to traffic using these facilities. Because WSDOT already operates tow truck patrols on the SR-520 floating bridge during the peak hours, the WSP service patrols (which were assigned to Seattle) operated primarily on I-5 unless requested to provide assistance on SR-520 west of the floating bridge. In Tacoma, the tow truck patrols operated both on I-5 and SR-16.

No special effort was made to publicize the service patrols before or during the Goodwill Games. Demonstration planners did worry that distrust of strangers and the cost of traditional towing charges would make stranded motorists reluctant to accept service patrol assistance. They were especially concerned about Tacoma, where the service would be performed by private contractors. In Seattle, on the other hand, patrols would be provided by uniformed police officers

To overcome anticipated motorist resistance, private contractor's tow trucks were equipped with special magnetic signs stating that each vehicle was working for the WSDOT. Drivers were also provided with special white work uniforms and safety vests to help identify them as special service providers. Roving WSDOT personnel were also present in the Tacoma area in standard WSDOT vehicles to oversee the tow truck operation. These personnel could also be used to convince a worried motorist that the service patrol assistance was, indeed, free. The last element of the public relations effort

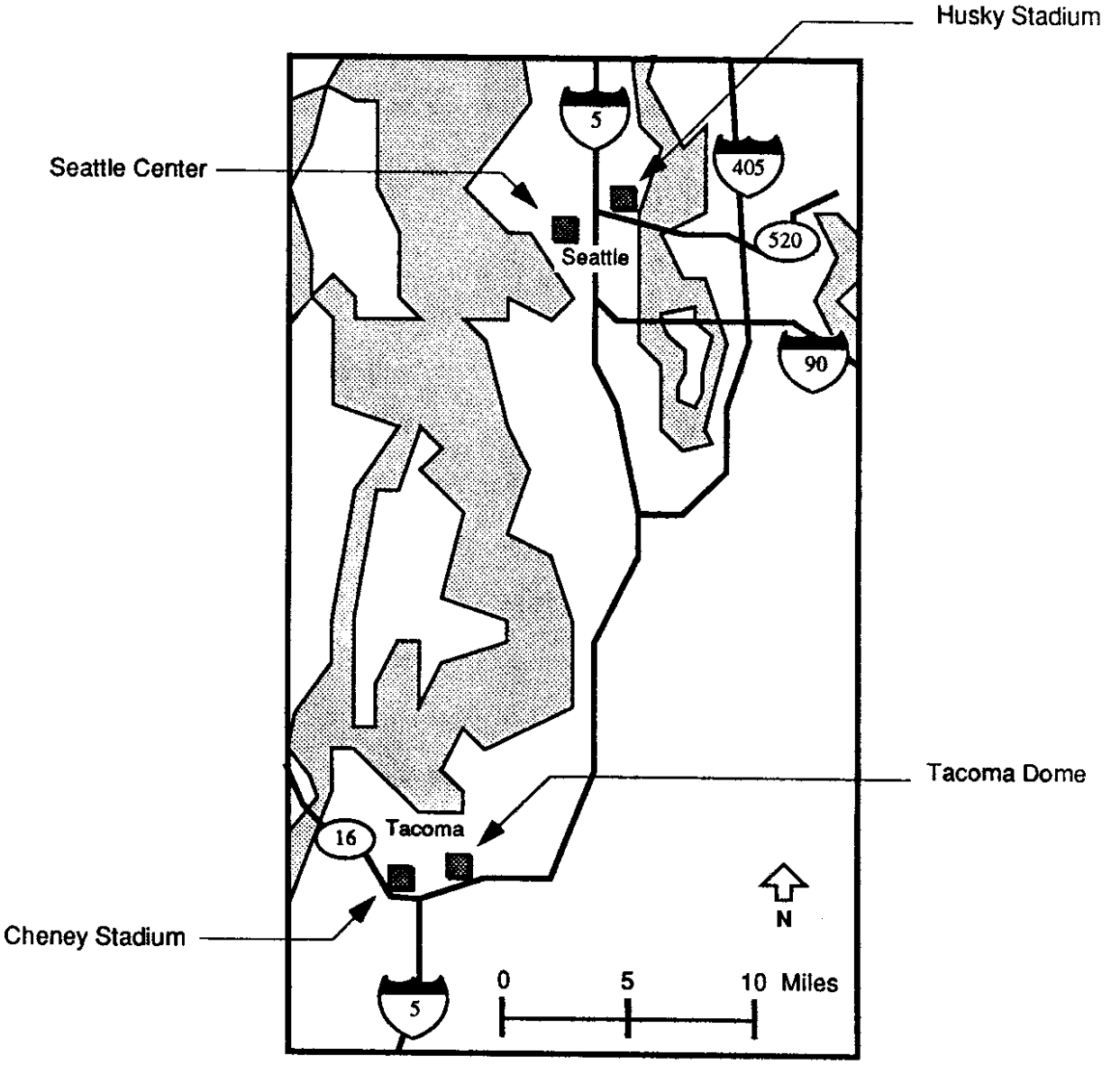

Figure 2. 1990 Goodwill Games Main Venues

was the use of pre-stamped post cards, which asked motorists to comment on the service they received (see Figure 3). These cards were also useful in easing motorists' fears about whether the service was legitimate. A slightly different version of these cards was handed out by WSP service patrol officers.

Details of the two service patrol efforts are given below.

You have been assisted as a courtesy of the Washington State Department of Transportation, the Washington Tow Truck Association, and the Professional Tow Truck Operators of Pierce County. This is a Motorist Assistance Program being evaluated during the 1990 Goodwill Games in order to reduce delays and congestion on area highways. Your comments are welcome.

stamp

FAME Manager
4507 University Way NE, Suite 204
Seattle, WA 98105

Figure 3. Pre-stamped Post Cards

WSP Service Patrols

WSP operated six service patrol vehicles from July 17 to August 5, 1990. The service patrols were supplementary to the normal complement of WSP officers regularly assigned to monitor traffic on the Seattle metropolitan freeway system. The WSP service patrols consisted of four Jeep Cherokees and two Nissan Pathfinders, all of which were equipped with push bumpers and incident response supplies (water cans, cones, vests, sand). Winches were included on some vehicles to assist in moving disabled vehicles.

The WSP service patrol vehicles operated on a fixed time table, regardless of the specific Goodwill Games events scheduled for a given day. Three service patrol vehicles operated between 10:00 a.m. and 6:00 p.m., and the other three vehicles worked from 1:00 p.m. to 9:00 p.m., seven days per week. Thus, six vehicles operated during the p.m. peak period to meet the congestion problems expected because of the concurrent p.m. peak traffic volumes and traffic headed to afternoon and evening Goodwill Games events.

The six vehicles patrolled the portion of the I-5 corridor pictured in Figure 4. Each vehicle was assigned to a particular patrol area. Six response areas were defined to help spread the service patrol vehicles evenly throughout the covered area. Response vehicles were permitted to cross patrol zone boundaries as needed, and during the periods when only three vehicles were in service, each vehicle monitored more than one service zone.

Tow Truck Patrols in Tacoma

The Washington Tow Truck Operators Association operated six tow trucks from July 16th through August 5th as service patrols in the Tacoma area, pictured in Figure 5. The tow truck work shifts were more variable than the WSP shifts in Seattle. Tow truck operations in Tacoma were geared more towards the Goodwill Games event schedule and less towards weekday traffic congestion relief. Because some times at the Tacoma Dome and Cheney Stadium varied by event (i.e., some days events started earlier than others, particularly when different sports took place in the Tacoma Dome), tow truck service

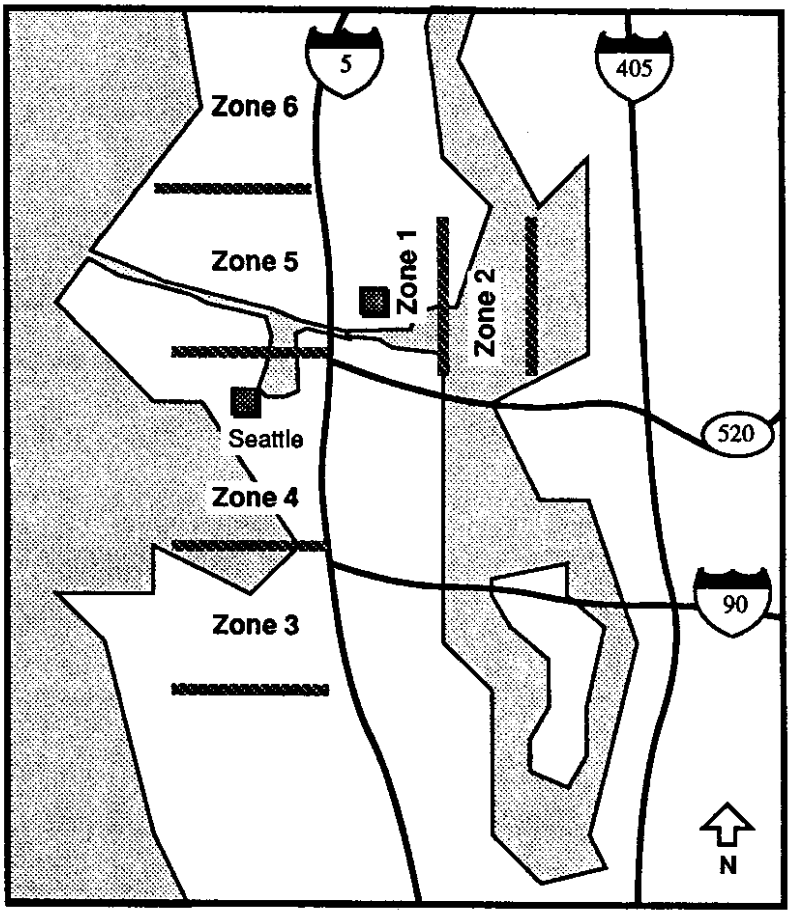

Figure 4. Seattle Service Patrol Area Map

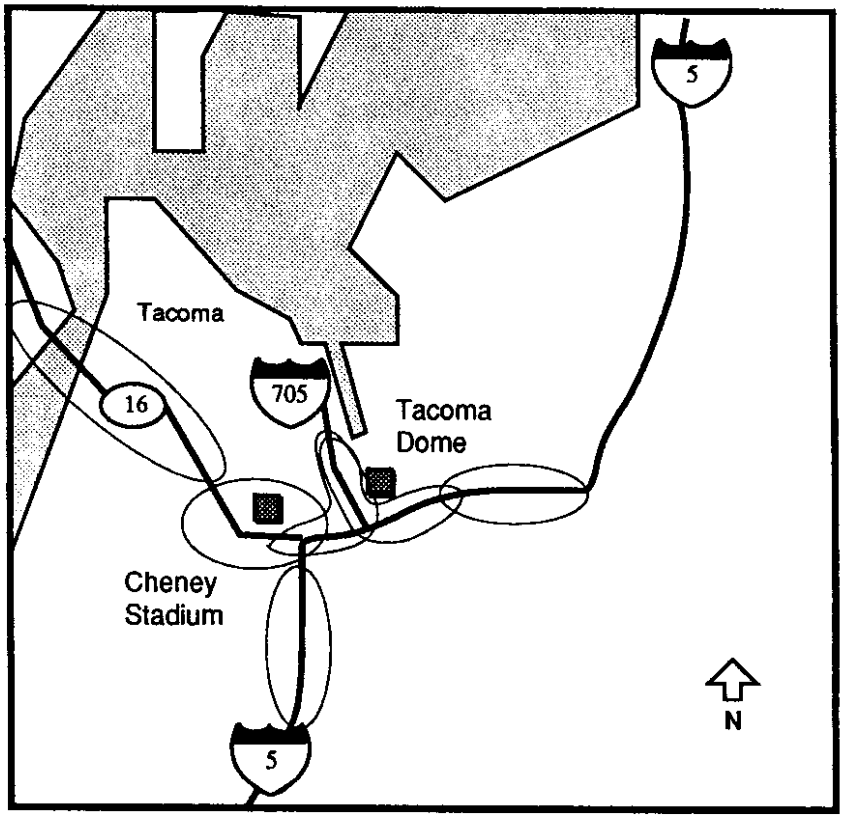

Figure 5. Tacoma Service Patrol Area Map

patrol schedules were adjusted so that the schedules coincided with event traffic in Tacoma, beginning 1.5 hours before the first events started and ending 1.5 hours after the last event started. The Tacoma tow truck shift times are shown in Table 1.

The vehicles used in Tacoma were the conventional tow trucks normally operated by commercial towing firms in the Tacoma area. The vehicles were not modified for this demonstration. During the planning stage, it was decided that certain vehicles could not be accommodated under the free assistance program. Assistance for those vehicles, i.e., exotic sports cars and large trucks, would be provided by the normal tow truck call-out. As it turned out, this type of assistance was not needed during the Games.

Disabled vehicles in Tacoma were towed to one of ten temporary storage sites. These sites are identified in Table 2 and Figure 6. All disabled vehicles that could not be quickly moved from the roadway under their own power were towed under this arrangement. Once at the temporary storage site, vehicle owners were given 30 minutes to repair their vehicle or call a tow company to move it to the destination of their choice because of limited space and potential liability from vandalism. Roving WSDOT personnel provided free cellular telephone assistance for the motorist to call for the secondary tow service. Vehicles not removed from the temporary storage site were impounded.

The tow trucks that provided the free service patrol tow were not allowed to recruit business from their patrol work. That is, the tow truck was not allowed stay at the temporary storage site to provide a second tow (this time for a fee) from the storage site to another location.

In practice, the service patrol tow trucks occasionally removed disabled vehicles directly to a nearby garage or gas station (without charge), and the 30-minute time limit for removing disabled vehicles from the temporary storage sites was flexibly enforced to to allow time for owner repairs or removal and to avoid vehicle impoundments.

TABLE 1
TACOMA TOW TRUCK SERVICE PATROL SCHEDULE

	FR 7/20	SA 7/21	SU 7/22	TH 7/26	FR 7/27	SA 7/28	SU 7/29	MO 7/30	TU 7/31	TH 8/2	FR 8/3	SA 8/4	SU 8/5
Morning													
Area 1		10:00			7:00	7:00	7:00	7:00	7:00			8:30	8:30
		1:00			10:00	10:00	10:00	10:00	10:00			11:30	11:30
Area 2		10:00										8:30	8:30
		1:00										11:30	11:30
Area 3		10:00										8:30	8:30
		1:00										11:30	11:30
Area 4		10:00										8:30	8:30
		1:00										11:30	11:30
Area 5		10:00			7:00	7:00	7:00	7:00	7:00			8:30	8:30
		1:00			10:00	10:00	10:00	10:00	10:00			11:30	11:30
Area 6					7:00	7:00	7:00	7:00	7:00			8:30	8:30
					10:00	10:00	10:00	10:00	10:00			11:30	11:30
Afternoon													
Area 1	3:45		3:00	3:30	3:00	3:00	3:00	3:30	3:30	2:00	4:00	5:30	5:30
	6:45		6:00	6:30	7:00	6:30	6:30	6:30	6:30	5:00	7:00	8:30	8:30
Area 2	3:45		3:00	3:30	3:00	3:00	3:00	3:30	3:30	2:00	4:00	5:30	5:30
	6:45		6:00	6:30	7:00	6:00	6:00	6:30	6:30	5:00	7:00	8:30	8:30
Area 3	3:45		3:00	3:30	3:00	3:00	3:00	3:30	3:30	2:00	4:00	5:30	5:30
	6:45		6:00	6:30	7:00	6:00	6:00	6:30	6:30	5:00	7:00	8:30	8:30
Area 4	3:45		3:00	3:30	3:00	3:00	3:00	3:30	3:30	2:00	4:00	5:30	5:30
	6:45		6:00	6:30	7:00	6:00	6:00	6:30	6:30	5:00	7:00	8:30	8:30
Area 5	3:45		3:00	3:30	3:00	3:00	3:00	3:30	3:30	2:00	4:00	5:30	5:30
	6:45		6:00	6:30	7:00	6:30	6:30	6:30	6:30	5:00	7:00	8:30	8:30
Area 6				3:30	3:00	3:00	3:00	3:30	3:30				
				6:30	7:00	6:30	6:30	6:30	6:30				

TABLE 2
TEMPORARY VEHICLE STORAGE LOTS

LOCATION	DESCRIPTION OF SITE
Seattle	
Lot 5A	SR 5 at 56th Street: Park and Ride Lot in southwest corner of the 56th Street/Alaska Street intersection
Lot 5B	SR 5 at 38th Street: Metropolitan Park District of Tacoma, gravel parking area on 37th Street northwest side of 38th Street interchange.
Lot 5C	SR 5/I-705 interchange: Park and Ride Lot located under I-705 between Puyallup Avenue and East 26th Street
Lot 5D	SR 5 at Portland Avenue interchange: Lot located at Tacoma Sewer Treatment Plant under north end of Portland Avenue viaduct.
Lot 5E	SR 5 at Port of Tacoma interchange: Gravel lot north of World Trade Center of Tacoma.
Tacoma	
Lot 16A	SR 16 at Sprague Avenue: South end of parking lot for DSHS Building at Sprague Avenue and 19th Street
Lot 16B	SR 16 at Union Avenue: Target parking lot
Lot 16C	SR 16 at Center Street: Park and Ride Lot located adjacent to eastbound ramp terminals
Lot 16D	SR 16 at 6th Avenue: Spaces in Project Engineer's office parking lot at 6th Avenue and Pearl Street
Lot 16E	SR 16 at Jackson Avenue: Park and Ride Lot on 6th Avenue (old approach to the Narrows Bridge)

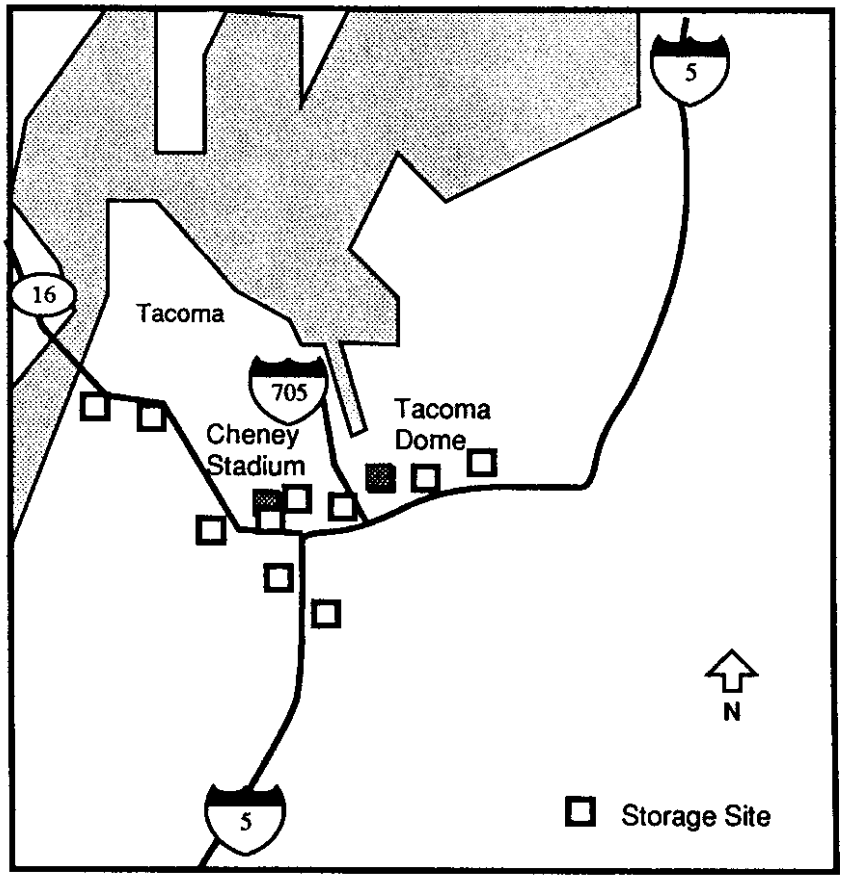

Figure 6. Disabled Vehicle Temporary Storage Sites

FINDINGS

The findings of this study were based primarily on the review and analysis of the WSP's CAD data and the incident reports the service patrol drivers submitted. The WSP data served as the primary tool for evaluating the impacts of the service patrols. The information provided by drivers was used to support the conclusions found with the CAD data.

The principle limitations with these data (or any incident related data) were that incidents were fairly rare occurrences and had a large inherent variability. (That is, a small incident could last a very short time, while a large incident could last several hours.) This led to a situation in which the impacts of specific response measures were very difficult to measure and statistical confidence in those impacts or in measured changes in incident characteristics was almost impossible to provide .

WSP CAD DATA

A specific limitation of the CAD data was that they only reflected the incidents that WSP dispatch officers broadcast on the WSP radio frequency. Thus, in Tacoma, Goodwill Games tow truck drivers discovered and removed some incidents without WSP dispatchers ever being notified. These limitations in the available incident response database caused significant limitations in the analyses conducted for this study and other incident response analyses.

CAD data were collected for five areas in the Puget Sound region during the Goodwill Games (July 17th through August 5th) and for a similar time period in 1989. The areas covered included:

- Interstate 90,
- Interstate 5 in Tacoma,
- Interstate 5 in Seattle,
- State Route 520 from I-405 to I-5, and
- State Route 16 near Tacoma

Insufficient data were available from 1989 for the SR-16 highway sections to make accurate comparisons of the performance of the service patrols on that facility. The researchers were unable to determine whether the lack of SR-16 incidents in the 1989 WSP CAD files was a result of limitations in the WSP CAD system (the dispatch system had only recently been computerized, and SR-16 may not have been completely within the system in the summer of 1989), few incidents occurred on SR-16 in 1989, or some limitation in the data storage technique within the CAD system limited access to those records. SR-16 was thus dropped from the analysis of the Tacoma tow truck demonstration.

In most cases, the CAD data identified the causes of incidents to which WSP officers responded. The CAD grouped incidents into six categories:

- abandoned vehicles,
- accidents,
- disabled vehicles,
- erratic drivers,
- traffic (debris on the roadway), and
- traffic stoppage (an officer writing a ticket for a moving violation).

In addition, the CAD file noted when a truck was involved in an incident and when a tow truck or other special equipment had to be called to the scene.

Of the above categories, "erratic driving" and "traffic stoppage" were not analyzed for this report. Actions included in these two categories had little impact on incidents because they were actually police enforcement rather than incident response actions. In addition, so few vehicles were abandoned during the study that while these actions were included in the database, no comparisons within this category were possible for this report.

Number of Incidents

The number of incidents reported in the CAD system from July 17th through August 5th increased between 1989 and 1990 from 927 to 1,188. The distribution of these incidents among geographic study areas is shown in Figure 7. This increase was attributed to three factors:

- an increase in hazardous conditions on the studied facilities,
- an increase in traffic volumes (and thus exposure rates) between 1989 and 1990 because of both traffic growth and the Goodwill Games, and
- increased detection of incidents as a result of the service patrols.

The greatest increase (73 percent) in detected incidents occurred in the disabled vehicle category in the Seattle I-5 section of the study area. The fact that this area had the largest increase in incidents supports the theory that at least part of the increase in reported incidents was due to the greater presence of WSP officers in the study area. (The Tacoma area added non-WSP patrol vehicles, and many of their smaller assists were not reported to WSP dispatch and thus did not make the CAD file.) The larger presence of WSP officers as a result of the service patrol effort increased the likelihood that a WSP officer would see disabled vehicles and also placed WSP officers in a better position to assist vehicles stalled on that facility.

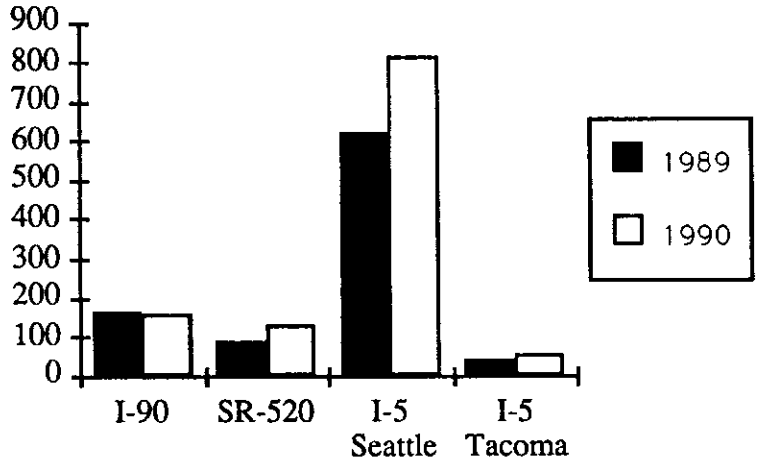

Figure 7. Number of Incidents Reported

Two of the other study areas (I-5 Tacoma and SR-520) also saw increases in the number of incidents reported in 1990. While these increases were fairly small in number, they were a fairly large percentage. Incidents on I-5 in Tacoma increased by 30 percent, while incidents on SR-520 increased 44 percent. Increases of this magnitude tend to confirm the need for the state to apply more resources towards managing incidents to maintain freeway performance, but they say little about the effectiveness of the service patrols themselves.

The only facility that saw a decrease in incidents between 1989 and 1990 was I-90, which experienced a marginal decrease of 3 percent. This change was insignificant given the variable nature of incidents.

Accidents

The two response areas in which service patrols operated during the 1990 period (Tacoma on I-5, Seattle on I-5) showed decreases in the average duration of incidents involving accidents (see Figure 8). In contrast, the two geographic areas that did not have new service patrols both showed an increase in average accident duration.

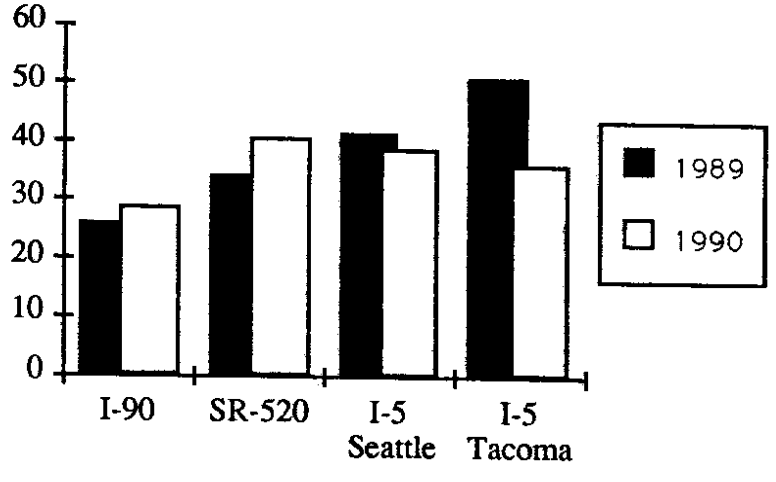

Figure 8. Duration of Incidents Involving Accidents

The largest decrease in the duration of incidents that involved accidents was over 15 minutes per accident on I-5 in Tacoma. I-5 in Seattle had a decrease of only 3 minutes. (See Figure 8 on the previous page.) The larger measured decrease in incident duration in Tacoma was expected because tow trucks served as the service patrol vehicles in that area. Use of tow trucks meant that a towing service would be on the scene quickly for all incidents, significantly reducing the time necessary to clear those incidents requiring a tow.

Despite the size of the decrease in accident duration time in the Tacoma I-5 study area, the measured change was not statistically significant. The change was not significant because of the large variation in the time required to clear incidents that involve accidents (caused by differences in the severity of accidents) and the relatively small number of accidents that occur in the Tacoma I-5 study area during a month. That is, this change could also have been due to a chance reduction in the number of very large accidents.

However, it is important to note that the standard deviation of the average accident duration also decreased in the areas that contained service patrols (see Figure 9). This decrease was mostly due to fewer long duration incidents.

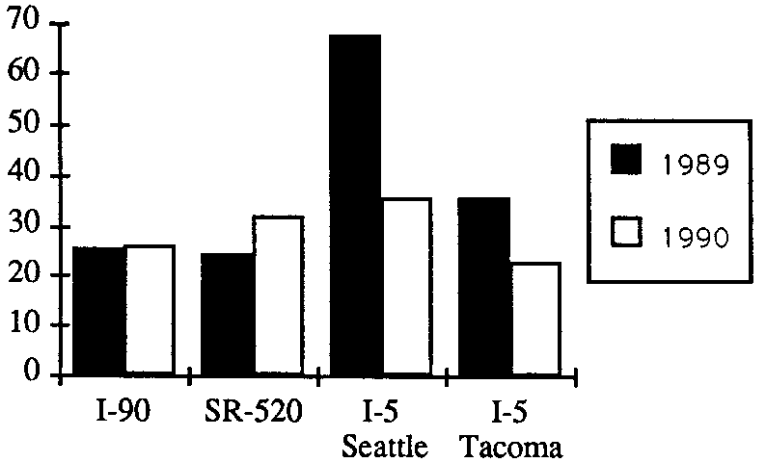

Figure 9. Standard Deviation of Accident Duration

As pointed out above, this reduction in long duration incidents was partly the result of luck (no gasoline truck accidents occurred in 1990) and partly the result of tow trucks (in Tacoma) or trained WSP officers (in Seattle) reaching the scene quickly, ensuring that equipment appropriate for the incident also arrived quickly at the scene.

Debris Clearance

In many cases, incidents are caused by debris that has been accidentally deposited on a roadway. First, vehicles that slow to avoid the debris cause congestion; second vehicles may hit the debris and become disabled or cause accidents. In both of the service patrol study areas, the number of incidents caused by debris increased slightly during the study period. The duration of incidents caused by debris decreased in the Seattle study area but increased in Tacoma (see Figure 10).

The decrease in the duration of incidents caused by debris in Seattle (from an average of 33 minutes to just under 15 minutes) was statistically significant at the 80 percent confidence level. The change in Tacoma was not statistically significant (and was probably meaningless) because only two debris related incidents occurred in the 1989 data collection period. The lack of data makes the statistical comparison of 1989 and 1990 untrustworthy for this statistic.

Figure 10. Duration of Incidents Caused By Debris

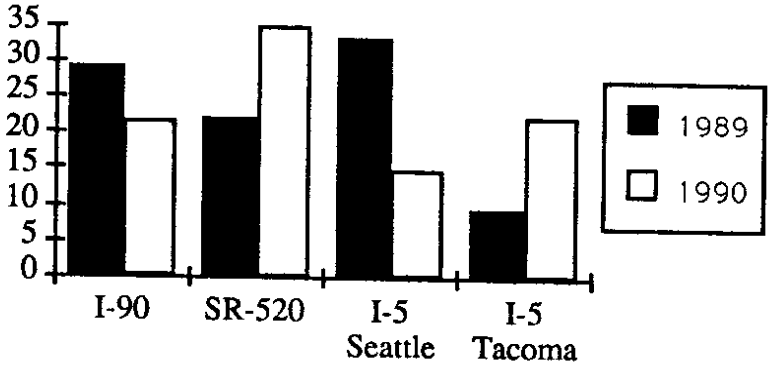

Figure 10. Duration of Incidents Caused by Debris

Tow Truck Service

In all four study areas, the time required to clear an incident that required a tow truck decreased during the service patrol demonstration (see Figure 11). This decrease was the greatest on I-5 in Tacoma because of the service patrol tow trucks. It was the smallest on I-90 (which was already serviced by two tow trucks during peak periods, and received only an incremental increase in tow truck service on the edges of the peak hours and plus new weekend service) and SR-520 (which received similar incremental increases in tow truck service).

As with incidents involving accidents, the standard deviation of the duration of incidents that required a tow truck also decreased in 1990. Again, this decrease was greatest on I-5 in Tacoma, where the average duration of an incident requiring a tow truck dropped over 14 minutes, and the standard deviation dropped over 20 minutes. This decrease in duration time for incidents requiring tow trucks was statistically significant at the 80 percent confidence level, and was directly attributed to the presence of tow trucks in the patrol area.

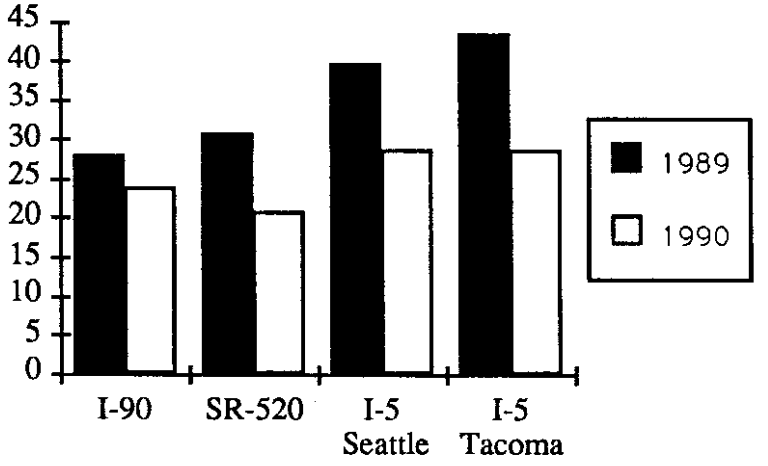

Figure 11. Duration of Tow Truck Involved Incidents

Disabled Vehicles

The impact of the service patrols on incidents involving disabled vehicles was also positive. The durations of disabled vehicle incidents were reduced in both Seattle and Tacoma on I-5. At the same time, in those parts of the service area without service patrols, the durations of these incidents either increased (SR-520) or decreased marginally (I-90). These differences are illustrated in Figure 12.

The decrease in the duration of disabled vehicle incidents on I-5 in Seattle was particularly substantial. A reduction of over 6 minutes in average incident duration (from 24.7 minutes to 18.4 minutes) was statistically significant at a 99 percent confidence level. It was directly attributed to the ability of WSP service patrol officers to quickly clear most disabled vehicles from the roadway, either by using push bumpers, tow straps, or extra supplies (such as gasoline) carried on the service patrol vehicles. In Seattle, the variation in the time required to clear disabled vehicles also decreased. Again, this was directly attributed to the early presence of WSP officers on the scene with enough equipment to clear the vast majority of incidents. The other three study areas did not see this kind of improvement.

These findings are particularly important because disabled vehicles caused over 60 percent of all reported incidents in the CAD system.

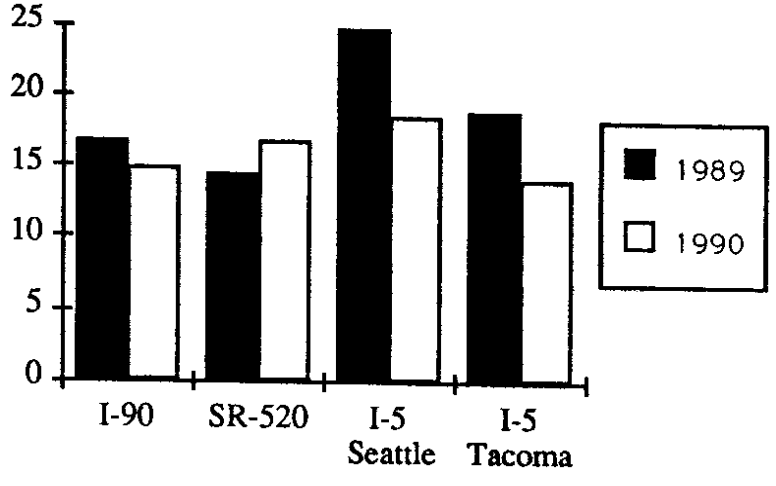

Figure 12. Duration of Disabled Vehicle Incidents

Truck Involved Incidents

Incidents that included trucks were noted within the CAD system. Because trucks pose special incident response difficulties, the impact of the service patrols on incidents involving trucks was studied separately from other incident types. These incidents are included within the other categories used above.

In Seattle, a decrease in the durations of incidents involving trucks occurred on both I-90 and on I-5. (Because of a lack of data on truck incidents from 1989, the I-5 site in Tacoma was removed from this part of the analysis.) Despite reflecting a measured drop of over 24 minutes, the change on I-5 was not statistically significant because of the extremely large degree of variability in the time required to clear truck incidents. (The standard deviation of the mean value in 1989 was 135 minutes.) While the change in durations on I-90 was statistically significant, the project team was able to identify at least two, long duration truck incidents that were missing (for unknown reasons) from the CAD records. These incidents would have increased the mean truck incident duration time enough that the measured change would not have been significant.

Response Times

When service patrol vehicles encountered a disabled vehicle or identified an accident before the detection of that incident by other means, they provided a significant improvement in response time for incidents. While the study could not measure the time savings provided by the patrolling vehicles (i.e., how long an incident would have remained undetected if the service patrol had not detected it), it could estimate the time a WSP officer usually took to reach an incident location after receiving a dispatcher's call. This time value represented the response time saved by service patrols, even if those patrols did not actually provide an improvement in the detection of incidents.

Analysis of the WSP CAD data indicate that on the average in 1989, a WSP trooper required almost 15 minutes to reach the scene of an incident on I-5 (in both Seattle and Tacoma) after that incident had been reported to WSP dispatchers. This

figure includes incidents that were initially discovered by a patrolling trooper and for which response time was essentially zero. (According to the CAD data, such discovery occurred roughly 25 percent of the time without service patrols.) The standard deviation of this initial response time was 23 minutes. These values show that in some instances, the response time required to reach an identified incident was quite high as a result of both congestion and the need for WSP officers to respond to more pressing emergencies.

In 1990, with service patrols added to the normal compliment of WSP officers, these values improved markedly. The average response time for a WSP officer dropped to just over 10 minutes (a 5 minute improvement), with a standard deviation of 18 minutes. Moreover, 37 percent of the incidents reported through the CAD system were discovered by WSP officers (including the WSP service patrol officers).

The impacts of service patrols were also apparent in other parts of Seattle. On SR-520 only 14.6 percent of the WSP CAD reported incidents were initially observed by a WSP officer, and the mean response time was just under 13 minutes. On I-90, the mean response time was 11 minutes and 20.3 percent of the incidents had no response time. Neither of these figures represents a significant change from 1989 values (13 minutes, 15.3 percent for SR-520 and 13.5 minutes, 19 percent for I-90), which was expected given the similarities of patrol coverage at these locations. The low percentage of WSP observed incidents compared to I-5 was partly caused by the presence of WSDOT tow truck operators during the peak periods who observe and clear incidents without WSP assistance. While the moderate response times reflect the central location of the bridges and the importance WSP's places on patrolling those facilities.

SERVICE PATROL DRIVER DATA

Each of the service patrol drivers filled out a data sheet describing the incidents (assists) at which they provided help. From this incident report form (IRF) database, the researchers obtained estimates of incident duration independent of the estimates provided

by the WSP CAD data. Because these data did not exist for any period before the introduction of the service patrol demonstration, it was not possible to determine the impact of the patrols on incident duration using this database. They could only be used as a "bias check" of the WSP CAD data.

While the CAD data could be used to make before-and-after comparisons, the CAD database had a number of limitations. The primary limitations were that the CAD data only included incidents that were handled through the WSP dispatch system, and the time values stored in the database were the times when radio calls were made, rather than when specific events actually occurred. These limitations may have biased the estimates of incident duration time. The IRF database did not have these limitations and thus may have provided a better estimate of the actual time taken to respond to and clear incidents.

The limitations of the IRF data were based on the requirement of service patrol drivers to write down the times when events took place. (The CAD system automatically recorded times.) If drivers were busy, they may not have immediately recorded the time an event occurred, but instead may have written it down after the assist had been completed. This delay probably caused a bias because the record was then the service patrol driver's estimate of when an event occurred, rather than a careful measurement that was entered onto the incident response form.

Correlation to WSP CAD Data

In general, the correlation between the Service Patrol data and the WSP CAD data was reasonably good. The mean duration times from the IRF database were slightly lower than the WSP CAD estimates in almost all cases. However, the standard deviations of the mean duration estimates were not as consistent between the IRF and CAD databases. Generally, the standard deviations of mean estimates from the IRF for Seattle values were higher than the corresponding values from the CAD system, while the standard deviations of the Tacoma values were usually lower.

Number of Incidents

The IRF database indicated that the service patrol in Seattle responded to just under 600 incidents between July 17 and August 5, 1990. This total was slightly less than the number of WSP CAD entries for the same period. This inconsistency was expected because assists performed by WSP officers assigned to normal patrol duties were included in the CAD files but were not present in the IRF database.

Assuming that incident assists occurred evenly throughout the 20-day demonstration, each service patrol officer made an average of five reported assists per 8-hour shift (including weekends).

In Tacoma, just over 300 assists were reported in the IRF database; only 89 WSP CAD system reports were recorded for the same period. The larger IRF value reflects the fact that more service patrol vehicles were in Tacoma than WSP patrol officers. As a result, the service patrols aided more incidents since the WSP CAD system only reported WSP activity, these results show that the WSP dispatchers were often not broadcasting service patrol tow truck activity unless a WSP officer was needed at the scene of the incident.

Accidents

For incidents that involved accidents, the IRF database's estimates of mean duration were below the WSP CAD system's estimates for both Seattle and Tacoma. The difference between the two estimates was smaller in Seattle (33.5 minutes versus 38.6) than it was in Tacoma (22.1 minutes versus 35.9). The standard deviation of the IRF estimate in Tacoma was also smaller than the corresponding CAD estimate (13.6 minutes versus 22.8). However, in Seattle, the standard deviation of the IRF was greater than the the CAD estimate (40.3 minutes versus 35.8).

Debris Clearance

Service patrol assists classified as "debris related" took an average of 8.3 minutes in Seattle and 3.6 minutes in Tacoma. Both of these estimates were considerably lower

than the WSP CAD estimates, which produced mean values of 14.8 minutes and 22.2 minutes, respectively. Part of the large discrepancy in Tacoma was caused by a lack of data in both the IRF and the WSP CAD system. Only six WSP CAD reports were included in this category, while the IRF file had only five entries for this category.

Disabled Vehicles

For disabled vehicles, the IRF database yielded a slightly lower mean value for incident duration in Seattle, but the estimates from the two databases for Tacoma were identical. In Seattle, the incident report form calculated an average response of 13.6 minutes, versus a WSP CAD estimate of 18.4 minutes. For Tacoma, both datasets estimated the mean duration as 14.1 minutes.

The standard deviations of the two estimates were also very close. In Seattle the IRF estimate of 16.1 minutes was slightly greater than the CAD estimate of 14.8 minutes, while the Tacoma IRF estimate of 17.9 minutes was essentially equivalent to the CAD estimate of 17.0 minutes.

USER PERCEPTION

After assisting a motorist, service patrol tow truck drivers in Tacoma gave the motorist a stamped, pre-addressed post card for comments on the service patrol assistance. In Seattle, WSP service patrol officers handed out a piece of paper describing the service and providing an address to which comments could be mailed, but did not provide a pre-addressed, stamped post card.

Of the Tacoma post cards, 36 (roughly 12 percent) were returned to the WSDOT. All of the 36 post cards, plus four letters (from people who had been helped by WSP officers in Seattle) were very positive about the program, and all thought that the program should be maintained.

Based on a telephone survey done by WSDOT after the service patrol demonstration, 90 percent of the respondents (388 of 430) thought that service patrols

were worth providing as an ongoing public service. This is somewhat surprising considering that less that one quarter of the people interviewed knew that service patrols had been operated.

INTERPRETATION OF THE FINDINGS

IMPACTS OF THE SERVICE PATROLS

The operation of service patrol vehicles was expected to produce the following results:

- decrease the time required to identify and locate incidents,
- decrease the time required to clear most incidents, and
- improve traffic flow by accomplishing the previous two tasks.

The data presented in the preceding chapter indicated that these goals were achieved, although the statistical confidence in this conclusion was weak because of the limitations inherent in measuring incident duration estimates.

The service patrol vehicles appeared to have succeeded in improving the ability of the WSDOT and WSP to both identify and locate incidents. This improvement was shown both by the increased number of incidents first reported by service patrol drivers and by the decreased response times required to reach the incident scenes. In addition, as shown by the consistent reduction in incident durations measured throughout the service patrol areas, those incidents were also cleared more quickly than before (or without) the service patrols. While the available data did not provide strong statistical confidence in the measured improvements in incident durations, a number of contributing factors provided support for the conclusion that the service patrols significantly improved incident response on the metropolitan freeway system.

One of the most important supporting facts was that the durations of incidents consistently decreased in the two study areas that contained service patrols, while the durations of similar incidents in areas without service patrols often increased. Since no other major changes in incident response procedures occurred during this study's time frame, the differences in incident response characteristics between the geographic areas could logically be attributed to the service patrols.

The second supporting factor was that the decreases in incident durations described in the preceding chapter did not include the savings in incident duration that resulted from improved detection time. While it was possible to provide a crude estimate of the response time saved by the WSP service patrols (close to 5 minutes per incident, according to the CAD database), the researchers could not estimate how long various incidents would have remained undetected before they were reported if a service patrol vehicle had not identified the incident. These improvements in identifying incidents are particularly important in areas like Tacoma, where no formal surveillance control and driver information (SC&DI) system exists. The 300 percent increase in incidents reported in Tacoma (IRF assists versus WSP CAD listed incidents) showed how valuable extra incident detection can be.

A third factor apparent from a comparison of the IRF and CAD files in Tacoma was that the service patrols provided responses to minor incidents that conventional WSP officers often could not provide because of various time and resource constraints. The fact that the Tacoma tow truck service patrols responded to more than three times as many incidents as were reported in the WSP CAD database showed how constrained WSP resources were in providing motorist assistance. Many of the incidents reported in the IRF but not in the CAD file consisted of disabled vehicles that would have initially been overlooked by otherwise occupied WSP troopers. Quick attention to, and removal of, these types of vehicles not only reduces distractions to motorists on the facility (and thereby improves facility performance), it also removes hazards from the roadway that cause additional incidents and other safety problems.

Unfortunately, the study could not measure the results of these improvements in terms of decreases in total vehicle delay or increased traffic performance. The available traffic monitoring data were insufficient to accurately monitor the impacts of the service patrols on traffic performance during the Goodwill Games. Traffic performance was too varied during the demonstration, and too many factors that impact traffic performance

were not "normal" or controlled during the service patrol demonstration. Thus, the researchers could not calculate changes in traffic flow attributable to the service patrol demonstration.

However, if the service patrols did cause the decreases in incident detection time, initial response time, and (in many cases) incident clearance time measured in this study, they would also have decreased the amount of time that incidents disrupted traffic.

Because traffic flow improvements could not be directly correlated to the service patrol vehicles, the researchers could not calculate a benefit to cost ratio relating the cost of the program to the dollar benefits provided to motorists.

The data collected for this study did not reveal whether the service patrols would have had a major impact on the duration times of incidents involving trucks if the incidents did not disable the trucks or the service patrol vehicles were large enough to remove the disabled trucks. Logically, the early presence of a trained service patrol driver on the scene of such an incident would benefit traffic performance because of the service patrol personnel's ability to provide better traffic control and quickly request additional equipment to remove the disabled truck (provided the appropriate training was provided to these personnel). However, an insufficient number of data points were collected to adequately measure these changes.

Finally, the effectiveness of the tow trucks driven by volunteers in Tacoma was difficult to compare with the jeeps driven by WSP officers in Seattle. Both of these techniques appear to be successful, but each performs some tasks more effectively than the other patrol option.

The use of a tow truck as the service patrol vehicle is definitely advantageous when the incident involves a vehicle that either can not be removed from the roadway under its own power or can not be pushed (or in some cases towed) from the roadway by an appropriately equipped service patrol vehicle. However, tow trucks are more costly to purchase and operate, and the number of incidents that require a fully equipped tow truck

are a fairly small percentage of the total number of incidents. Conversely, the jeeps the WSP officers used are less expensive to buy and operate and are more than adequate for the vast majority of incidents. However, they can not provide the same level of vehicle removal service possible with a tow truck.

Similarly, no real conclusion could be drawn from the available data about whether the use of WSP officers or trained tow truck drivers is more effective. The use of WSP officers allows better communication with WSP dispatchers and better interaction with motorists involved in an incident. However, the full training of a WSP officer is not required to provide effective service patrol assistance, and additional training on traffic control, vehicle maintenance, and possibly emergency medical care might provide a better background for this line of work.

The use of tow truck drivers also works well. As with the use of tow vehicles, when an incident requires use of a tow truck, a service patrol officer trained as a tow truck operator and driving a tow rig significantly improves the response time required to clear an incident. In addition, the vast majority of motorist assists performed by the service patrol, do not require WSP officer training. However, for incident work, the training provided to the tow truck operators should also be supplemented with traffic control, vehicle maintenance, and emergency medical training.

COMPARISON OF THE DATABASES

The two databases proved to be fairly consistent. The IRF database estimates of incident duration were slightly shorter than those provided by the WSP CAD system. This was expected because the IRF database included more small incidents than the WSP CAD file, and the response time in the IRF database was be shorter because the patrol vehicles often performed the initial identification of an incident.

Both databases showed some signs of minor biases in the data collected, but the similarities in the data obtained from the files indicated that the results from both files

were reasonably reliable. However, neither database in its current form was sufficient to provide on going monitoring of a response system to the degree needed for routine analysis of operations.

The WSP CAD data would be adequate for analysis purposes if the WSP operated the service patrol system, but the CAD system would have significant limitations if the patrols were operated by some other agency or contractor. In addition, if the CAD system were relied on to routinely provide data for analysis, modifications to the computer system would be needed to allow batch downloading of the non-sensitive WSP data. Currently, the system must be transcribed by hand from terminals with access to the database onto other computers that provide analysis capabilities. This process is too time consuming and cumbersome for routine data analysis.

The IRF database also requires too much manual data manipulation to be cost effective as a routine source of incident data. If WSP does not operate a future service patrol system, a more automated method for entering incident report information must be provided to the service patrol personnel to allow routine analysis of this information.

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