TRAFFIC INCIDENT MANAGEMENT

SERVICE PATROLS COVER ALMOST HALF (48 PERCENT) OF FREEWAY MILES IN MAJOR METROPOLITAN AREAS.

MANAGEMENT AND OPERATIONS

Managing traffic incidents is a proven strategy for addressing significant portions of the Nation's traffic congestion problems. Approximately 25 percent of all delay is the result of incidents on roadways.[346] Traffic crashes are the most time-consuming of these incidents, but the more numerous cases of stalled vehicles, roadway debris, and other incidents also contribute significantly to the problem.

Traffic incident management programs are widely deployed in metropolitan areas and are being extended into rural areas through a growing number of statewide programs. These programs make use of a variety of ITS technologies to successfully detect, manage, and clear traffic incidents; improving safety for travelers by reducing the risk of secondary crashes; and reducing time lost and fuel wasted in traffic backups.

To successfully manage traffic incidents, these programs utilize ITS deployed specifically to detect and manage traffic incidents, as well as components deployed for traveler information, freeway management, and arterial roadway management.

A variety of surveillance and detection technologies can help detect incidents quickly including inductive loop, microwave or acoustic vehicle detectors, and camera systems providing video surveillance of roadways. Information from wireless enhanced 9-1-1 systems, Mayday and automated collision notification (ACN) systems, as well as roadside call boxes can also help incident management personnel identify incidents quickly. Mobilization and response may include automated vehicle location (AVL) and computer-aided dispatch (CAD) systems, as well as response routing systems to help incident response teams arrive swiftly. Service patrols, which preceded the emergence of ITS technologies, are now frequently incorporated into traffic incident management programs. The patrol vehicles and staff, supported by an array of other ITS components, enable significant reductions in the time to respond to and clear incidents.

Several components of incident management systems help travelers safely negotiate travel around incidents on the roadway and facilitate the rapid and safe clearance of incidents and reopening of travel lanes. In some locations, incident management personnel can directly post incident-related information to roadside traveler information devices such as dynamic message signs (DMS) or highway advisory radio (HAR). On-site or transportation management center-based personnel can also relay messages to traveler information, freeway management, or arterial management systems, providing incident information to travelers via additional means including 511 systems and traveler information Web sites. Several technologies are available to speed the investigation of incident scenes and record necessary information for later analysis. Temporary traffic control devices help ensure the safety of incident responders and provide for the safe travel of vehicles around incident sites.

Traffic incident management programs are typically implemented concurrently with freeway management systems, but it is important to keep in mind that arterials can be included in incident management programs as well. Coverage of arterials by incident management programs is increasing: data collected in 2006 indicates that 6 percent of arterial streets have video monitoring for detection, and 11 percent have service patrols.[347]

Many of the techniques used to address unplanned traffic incidents are also used to manage operations during planned special events, which the freeway management chapter discusses in great detail. In addition, the emergency management chapter discusses ITS applied to larger scale emergencies such as hazardous materials incidents and evacuations for man-made or natural disasters.

TRAFFIC INCIDENT MANAGEMENT CATEGORIES IN THE ITS KNOWLEDGE RESOURCES

Surveillance and Detection

- Detectors
- Imaging/Video
- Wireless Enhanced 9-1-1
- Mayday/Automated Collision Notification
- Call Boxes
- Traveler Reported

Mobilization and Response

- Automatic Vehicle Location/ Computer-Aided Dispatch
- Response Routing
- Service Patrols

Information Dissemination

- Dynamic Message Signs
- Highway Advisory Radio

Clearance and Recovery

- Investigation
- Imaging/Video
- Temporary Traffic Control

In addition to the ITS technologies profiled in this chapter, the Next Generation 9-1-1 (NG9-1-1) initiative, a major ITS initiative currently being conducted by the U.S. DOT, has the potential to improve emergency communication which would, in turn, improve notification of traffic incidents. The NG9-1-1 initiative will establish the foundation for public emergency services in a wireless environment and enable an enhanced 9-1-1 system compatible with any communications device. The goal of the NG9-1-1 initiative is to enable the transmission of voice, data, or video from different types of communication devices to public safety answering points and onto emergency responder networks.[348] Additional information on this initiative is available at the ITS JPO's Web site: *www.its.dot.gov/ng*911.

Findings

Benefits

Traffic incident management programs have demonstrated success under each of the goals of ITS, as summarized in table 9. The most significant finding is likely the ability of the programs to dramatically reduce the duration of traffic incidents, from 15 to 65 percent, with the bulk of studies finding savings of 30 to 40 percent (as shown in figure 12).[349] These reductions in incident duration impact the safety of travelers through reduced likelihood of secondary incidents, affect the mobility and economic productivity of travelers through reduced incident related delay and associated costs, and impact the environment through reduced fuel consumption by idling vehicles. Service patrols are perhaps the most prominent and widely evaluated component of traffic incident management programs. Reports assessing customer satisfaction with the programs are unanimously positive.

Costs

As can be seen in figure 13, State DOTs can spend between $5.6 million and $13.6 million per year on service patrols. Regional service patrols are often in the range from $1.5 million to $2.5 million per year. However, for large, densely populated areas such as Los Angeles, California, the cost can be upwards of $20.5 million per year, or as low as $0.4 million in the Salt Lake City, Utah area. The cost of service patrols vary considerably depending on population, number of freeway miles covered, and the types and hours of services provided.[350]

Table 9—Traffic Incident Management Benefits Summary

	Safety	Mobility	Efficiency	Productivity	Energy and Environment	Customer Satisfaction
Traffic Incident Management	●	●	●	●	●	●

● Substantial positive impacts
✚ Positive impacts
❍ Negligible impacts
✱ Mixed results
✖ Negative impacts
blank Not enough data

OTHER ITS KNOWLEDGE RESOURCE CATEGORIES RELATED TO TRAFFIC INCIDENT MANAGEMENT

Refer to other chapters in this document.

Freeway Management

- Special Event Transportation Management

Emergency Management

- Response and Recovery: Emergency Vehicle Signal Preemption
- Emergency Medical Services

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HISTORICAL DATA SHOW THAT SERVICE PATROLS HAD BENEFIT-TO-COST RATIOS RANGING FROM 2:1 TO 36:1.

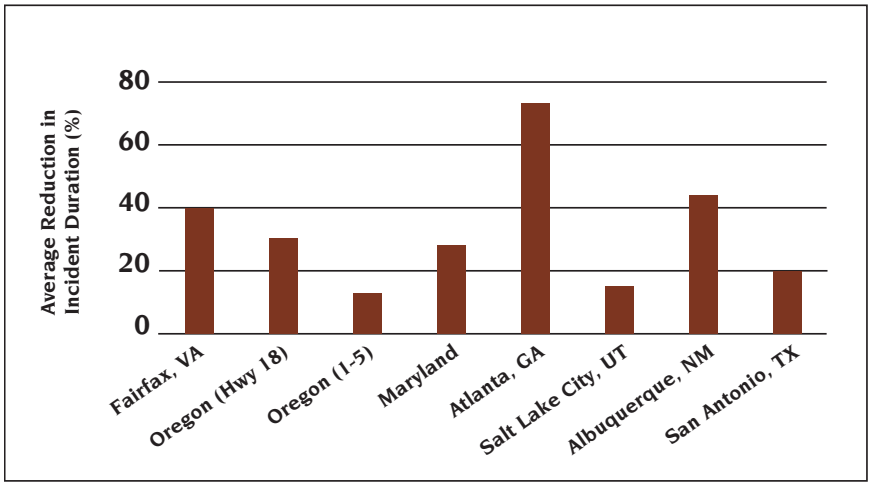

Figure 12 – Impact of Incident Management Programs on Incident Duration

Benefit-Cost Studies

Service patrols have also been the subject of numerous benefit-to-cost analyses over the course of their deployment, with 26 studies of the programs completed in 23 U.S. cities between 1994 and 2005. These studies document benefit-to-cost ratios ranging from 2:1 to 36:1.[351]

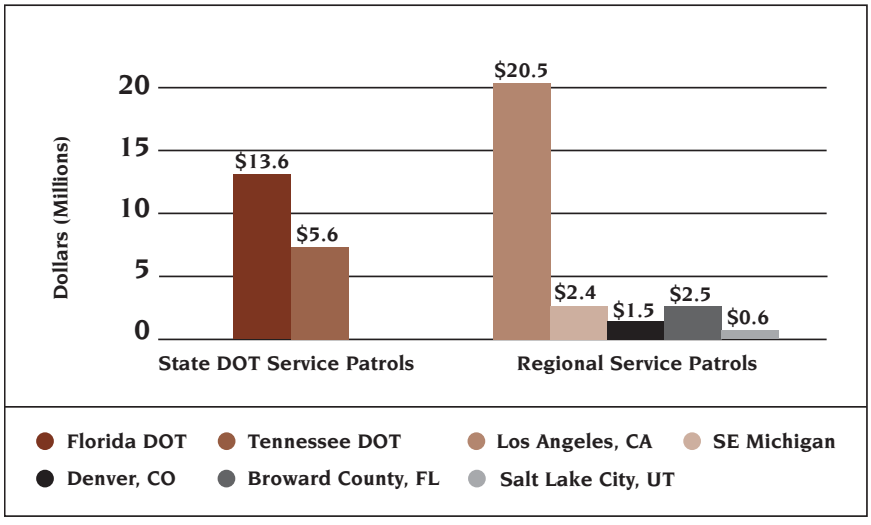

Figure 13 – Annual Cost Ranges of State DOT and Regional Service Patrols

SERVICE PATROLS POPULAR WITH TRAVELERS

Proactive incident management via service patrols represent a service heartily welcomed by travelers, as witnessed by these comments received by operating agencies:

- "This is the best service the State provides. I was back on the road within 30 minutes…He was very nice, friendly and was concerned for safety…" along I-55 in **Memphis, Tennessee**
- "The service was wonderful…great experience all around. Other States need to provide this also." **Washington**
- "Very glad to see him. He got us off the side and in a safe location and was very reassuring. It would be excellent if every State had this service…" along I-75 in **Chattanooga, Tennessee**
- "…like a guardian angel. He replaced the tire, checked the air, and even removed a dead bird from our front grill. Within fifteen minutes of the 'disaster' we were on our way home …." **Virginia**

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Deployment

The use of ITS technologies to improve traffic incident management is common in major metropolitan areas. Figure 14 shows trends for the deployment of key traffic incident management technologies based on changes in coverage of surveillance technologies on freeways and arterial streets from 1997 to 2006. These data are from a survey of 78 major metropolitan areas conducted over this period. As figure 14 shows, surveillance of arterial streets lags behind that of freeways.

Public safety agencies are beginning to take advantage of ACN systems to detect incidents. As of 2006, public safety agencies in 11 of the country's 108 largest metropolitan areas have access to ACN and public safety agencies in eight of these 108 metropolitan areas have access to advanced ACN that includes information on the severity of a vehicle crash. Public safety agencies in 11 of these 108 metropolitan areas have access to commercial ACN systems such as OnStar®.

Sharing data on the type, severity, and location of traffic incidents is a common practice of traffic incident management agencies. Sixty-eight (68) traffic incident management agencies in the country's 108 largest metropolitan areas share traffic incident data with public safety agencies, which tend to reciprocate the sharing of these data. Forty (40) traffic incident management agencies in these 108 metropolitan areas share traffic incident data with arterial management agencies.

In 2006, the survey of metropolitan areas was expanded to the country's 108 largest metropolitan areas. This survey is the source of deployment statistics presented later in this chapter unless otherwise noted.

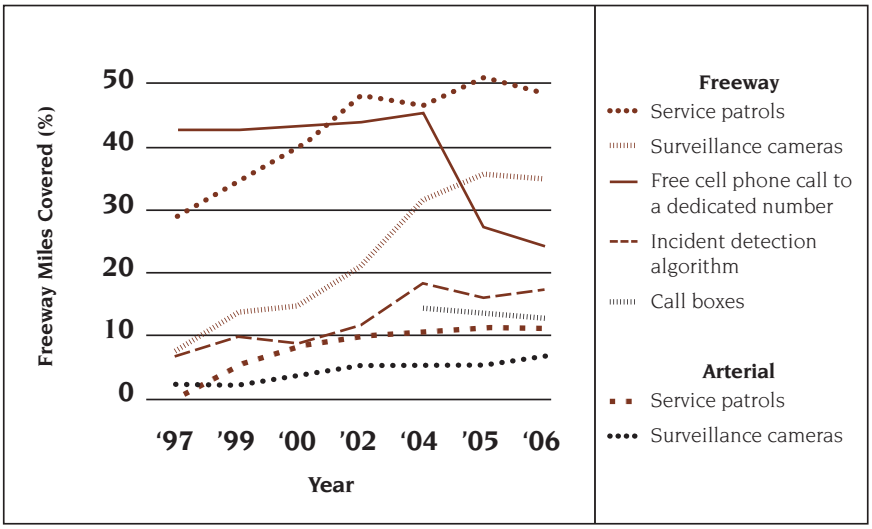

Figure 14 – Deployment Trends for ITS Technology on Freeways and Arterials Supporting Incident Management

STUDIES OF TRAFFIC INCIDENT MANAGEMENT PROGRAMS HAVE FOUND INCIDENT DURATION REDUCTIONS OF 15 TO 65 PERCENT.

Selected Highlights from the ITS Knowledge Resources on Traffic Incident Management

Surveillance and Detection

A variety of surveillance and detection technologies can help detect incidents quickly including inductive loop or acoustic vehicle detectors, and camera systems providing frequent still images or full-motion video. Information from wireless 9-1-1 systems, Mayday, ACN systems, and roadside call boxes help incident management system personnel identify incidents quickly.

Surveillance and Detection	
Deployment	
A variety of technologies are used to detect incidents. Traffic surveillance cameras monitor 34 percent of freeway miles in the country's 108 largest metropolitan areas. Free cellular telephone calls to a dedicated number are available for 24 percent of the freeway miles, automatic incident detection systems monitor 17 percent, and call boxes monitor 12 percent.	
Surveillance and Detection	
Benefits	
ITS Goals	**Selected Findings**
Customer Satisfaction	Transportation management center staff in Pittsburgh indicated that a real-time traffic information system used to monitor traffic density and congestion was useful and helped improve coverage for incident management.[352]
Surveillance and Detection	
Costs	
Unit Costs Data Examples (See Appendix A for more detail)	
Roadside Detection subsystem: • Inductive Loops on Corridor: $3K-$8K • Remote Traffic Microwave Sensor on Corridor: $9K-$13K per sensor • Closed Circuit Television (CCTV) Video Camera: $9K-$19K Transportation Management Center subsystem: • Software for Incident Detection: $83K-$101K • Labor for Incident Detection: $751K-$917K for multiple staff (annually) Roadside Telecommunications subsystem: • Conduit Design and Installation—Corridor: $50K-$75K (per mile) • Fiber Optic Cable Installation: $20K-$52K (per mile)	

LESSONS LEARNED

Develop an incident management program strategy and plan.

Incident management yields significant benefits through reduced vehicle delays and enhanced safety to motorists through the reduction of incident frequency, and improved response and clearance times. Across the nation, many existing incident management programs have delivered significant and measurable benefits. Many communities have found that it is necessary to prepare a strategic plan to develop a strong incident management program.

- Consider the needs of the program's customers—the traveling public.

To achieve high levels of information dissemination, efforts should be coordinated with the media and employers in the area.

- Adopt a structured strategic planning process for incident management at the regional and statewide levels.

(*Continued on next page.*)

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Surveillance and Detection
Costs
Sample Costs of ITS Deployments
Utah: The Utah CommuterLink advanced transportation management system includes over 230 cameras to observe incidents and congested areas. Camera coverage is primarily on freeways and grade-separated facilities; however, there are some deployments at key intersections on surface streets. The capital cost of the cameras, **$8.4 million**, includes the cameras and installation. Operational cost of the cameras is **$75,600 per year**.[353]

Mobilization and Response

Mobilization and response may include AVL and CAD systems, as well as response routing systems, to help incident response teams arrive swiftly.

Mobilization and Response	
Deployment	
Sixty-three (63) of the country's 108 largest metropolitan areas use AVL/CAD on fire, rescue and/or emergency medical services (EMS) vehicles and 95 of the country's 108 largest metropolitan areas use AVL/CAD on law enforcement vehicles, to assist in locating and assigning appropriate response to traffic incidents. Service patrols cover nearly half (48 percent) of freeway miles and 11 percent of arterial miles in the country's 108 largest metropolitan areas.	
Benefits	
ITS Goals	**Selected Findings**
Safety	The Coordinated Highway Action Response Team in Maryland reduced incident duration and related secondary incidents by 29 percent in 2002, eliminating 377 crashes within its coverage area.[354]
Mobility	***Summary Finding*:** Traffic incident management programs have reported reductions in incident duration from 15 to 65 percent.[355]
Productivity	***Summary Finding*:** Delay savings identified in studies of freeway service patrols implemented in Minneapolis-St. Paul, Minnesota; Denver, Colorado; Northwest Indiana; and Oregon documented annual benefits of $1.2 million to $3.2 million, through reductions in incident-related congestion.[356]
Energy and Environment	Reductions in incident-related delay also lead to fuel savings and related emissions reductions. A benefit-to-cost analysis of Florida's Road Ranger service patrol documented a savings of 1.7 million gallons of fuel across the state in 2004.[357]

Mobilization and Response	
Benefits	
Customer Satisfaction	***Summary Finding*:** Service patrols are well-received by the public. Operating agencies often receive thank you letters from grateful motorists assisted by service patrols. (See sidebar on page 106.)[358]
Costs	
Unit Costs Data Examples (See Appendix A for more detail)	
Transportation Management Center subsystem: • Labor for Incident Response: $107K-$131K (annually)	
Sample Costs of ITS Deployments	
Tennessee: The Tennessee DOT HELP program began in July 1999 for the purposes of reducing traffic congestion, improving safety, and assisting motorists in distress. HELP is a component of the DOT's statewide ITS program called SmartWay. Annual operating costs include salaries, vehicle operation and maintenance, fuel, supplies, and other related operating costs. The total annual operating cost for FY 2006 was **$6.5 million**. Total annual operating cost for FY 2005 was **$5.6 million**.[359, 360]	
Florida: Road Ranger is the name of the highway service patrol program in Broward County, Florida. The Road Ranger program includes contracted services and leased vehicles. The program utilizes 11 vehicles covering approximately 58 centerline miles on portions of I-95 and I-75, and all of I-595. Road Rangers provide 24-hour service. The 2006 annual operating cost for Florida DOT District IV Road Ranger Program was **$2.5 million**.[361] **Florida:** The Severe Incident Response Vehicle (SIRV) program provides a 24-hour incident command station and support to Florida DOT and Road Rangers during major incidents such a tractor-trailer rollovers, hazardous material incidents, and fatalities. The SIRV services are contracted out. Originally launched as a pilot program, the SIRV program was awarded in October 2006 with funding through 2012. The 2006 annual operating cost for the SIRV program was **$500,000**.[362] **Virginia:** One of the findings in a 2003 Virginia DOT Concept Study was that there would be significant benefit to integrating the Virginia State Police (VSP) Division I CAD system and the Richmond Smart Traffic Center (STC). Data from the VSP CAD system would contain near real-time status of events dispatched to the police. The development of the STC integration was completed during 2003-2004; project costs were **$249,200**.[363]	

LESSONS LEARNED

(*Continued from previous page.*)

With a structured strategic planning process, multiple agencies can participate in the program knowing that their needs are understood by their partners. The process should include a detailed analysis of resource needs, with each partner agency's contribution to the resource pool clearly defined. The phased implementation plan should be a multi-agency effort.

- Develop a combined strategy and implementation plan for coordinated arterial signal control during incidents.

Route diversion has proven to be an effective tool, especially during major incidents. Professionals that control the arterial traffic signals and those that run the freeway management systems usually operate out of different divisions and sometimes different agencies. A combined strategy and implementation plan will bring these groups together to coordinate effective diversion routes.[366]

Mobilization and Response
Benefit-Cost Studies
Georgia: The Highway Emergency Response Operators motorist assistance patrol program and NaviGAtor incident management activities in the Atlanta area saved more than 187 million dollars yielding a benefit-to-cost ratio over 4:1.[364]
Indiana: The Hoosier Helper freeway service patrol program in Northwest Indiana had a projected benefit-to-cost ratio of nearly 5:1 for daytime operations, and over 13:1 for 24-hour operations.[365]

Information Dissemination

Information dissemination systems help travelers navigate safely around incidents. Incident management personnel can provide incident-related information directly to travelers.

Information Dissemination
Deployment
Many traffic incident management agencies use roadside systems to notify travelers of traffic incidents on both freeways and arterial streets. Seventy-nine (79) percent of traffic incident management agencies in the country's 108 largest metropolitan areas disseminate traffic incident information on freeways using DMS and 46 percent use HAR to do so. Sixteen (16) percent of traffic incident management agencies in the country's 108 largest metropolitan areas disseminate traffic incident information on arterial streets using DMS and 6 percent use HAR.
Costs
Unit Costs Data Examples (See Appendix A for more detail)
Roadside Information subsystem: • Dynamic Message Sign: $48K-$119K • Portable Dynamic Message Sign: $18.6K-$24K • Highway Advisory Radio: $15K-$35K
Transportation Management Center subsystem: • Software for Traffic Information Dissemination: $17K-$21K • Labor for Traffic Information Dissemination: $107K-$131K (annually) Roadside Telecommunications subsystem:: • Conduit Design and Installation—Corridor: $50K-$75K (per mile) • Fiber Optic Cable Installation: $20K-$52K (per mile)

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Information Dissemination
Costs
Sample Costs of ITS Deployments
Florida: In 2006, Florida DOT District IV deployed 31 DMS. The cost of deployment was **$11 million** and included the signs, associated structures, foundations, controllers, cabinets, and installation, plus approximately 37 miles of in-ground fiber optic communications. The operating cost covered electricity and was estimated at **$22,320 per year**. Maintenance costs of approximately **$620,000** included spare parts, and labor for trouble-shooting problems and preventative maintenance. DMS maintenance was contracted out. Florida DOT notes that employing an ITS maintenance contractor "… helps to avoid/minimize system downtime, reduces total cost of operation, improves effectiveness, and extends the life of ITS assets." Forty-one (41) additional DMS were planned for 2007.[367]

LESSONS LEARNED

Provide joint training among incident re-sponse agencies to improve response times and on-site management.

Training and knowledge of incident responders provides the necessary details to deploy the appropriate personnel and equipment. Training the responding agency personnel on a regular basis helps improve coordination, communication, and trust among agencies and other responders (e.g. safety service patrols, towing and recovery service providers, fire, rescue, and EMS). Fostering these relationships improves response times and on-site management of an incident, resulting in improved clearance times.

- As an example, at the TransGuide Center in San Antonio, regional partners participate in three variations of training activities: mock incidents, tabletop exercises, and classroom workshops. Each activity is structured in such a manner as to encourage participation by each responder.

Joint training among agencies may improve relationships and the understanding of each agency's role in the effective clearance of an incident.[370]

LESSONS LEARNED

Cultivate relationships with fire, rescue, and emergeny medical service agencies when developing a coordinated multi-agency traffic incident management program.

The transportation communities' objectives of improved incident response and clearance include: safe and timely removal of all vehicles, wreckage, and debris, and restoring the roadway back to its full capacity, while maintaining the safety of the responders and motorists. Fire, rescue, and emergency medical service agencies have different priorities when responding to traffic incidents. Their first concern is the safety of the victims and motorists. Getting traffic flowing again is a secondary issue. Including fire, rescue, and EMS in the planning and development of an incident management program and maintaining consistent communication will help secure their cooperation during an incident. Traffic management agencies may even want to consider providing the fire, rescue, and EMS agencies with an enticement, such as providing a CCTV feed for video surveillance. Goodwill gestures help cultivate multi-agency ties. Effective communication through relationship building is key to a successful incident management program.[371]

Clearance and Recovery

Several technologies are available to speed the investigation of incident scenes and record necessary information for later analysis. Temporary traffic control devices help ensure the safety of incident responders and provide for the safe travel of vehicles around the incident site.

Clearance and Recovery
Deployment
Fifty-four (54) percent of law enforcement agencies in the country's 108 largest metropolitan areas use automated measuring equipment to investigate major traffic incidents. More than two-thirds (69 percent) of freeway management agencies and one-third of arterial management agencies in these 108 metropolitan areas use temporary traffic control devices, such as portable DMS and lane control technologies, to help ensure the safety of traffic incident scenes.
Costs
Unit Costs Data Examples (See Appendix A for more detail)
Transportation Management Center subsystem: • Automated Incident Investigation System: $14.1K
Sample Costs of ITS Deployments
Arizona: Computer-aided incident investigation equipment was purchased as part of the Phoenix, Arizona model deployment to reduce incident clearance time and improve the quality of crash investigations. The initial cost of the project, **$147,000**, included hardware, software, and training. Operating and maintenance costs were **$4,305 per year** (not including labor).[368] **Minnesota:** Minnesota DOT and the Minnesota State Patrol have implemented a pilot automated field reporting system that enables law enforcement officials to use an in-vehicle computer to record and submit incident information. Costs are **$8,000 to $10,000 per vehicle**.[369]

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