

Public Roads

— featuring developments in Federal
highway policies, programs, and
research and technology —



September/October 2003 · Vol. 67 · No. 2

ARTICLES

September/October 2003

DEPARTMENTS

Getting Traffic Moving Again by Robert L. Bertini and Galen E. McGill

Guest Editorial

A study documents Oregon's rural incident response program and quantifies the benefits for transportation agencies and motorists.

Along the Road

A tanker truck overturned on Interstate 5 just south of Salem, OR, because the driver was going too fast and lost control of the vehicle while changing lanes. The crash blocked several lanes of traffic for 4 hours. Traffic congestion, standstills, and delays from incidents like the truck overturn are all too common for motorists in Oregon just as these situations are for motorists across the country.

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This tanker truck overturn occurred on I-5 south of Salem, OR.



The ODOT incident response team provided service during another truck rollover incident.

Immediate response and a plan are critical. In 1995, the Oregon Department of Transportation (ODOT) initiated one of the first documented incident management programs in the rural United States. With the cooperation of Oregon State Police and several local agencies, ODOT administers the Region 2 incident response program on Highway 18 and Interstate 5 in the northwestern part of the State.

As defined by the Federal Highway Administration's (FHWA) *Freeway Management Handbook*, "incidents" are vehicle crashes, breakdowns, and other random events that occur on the highway system. According to Jeffrey Lindley in FHWA's *Quantification of Urban Freeway Congestion and Analysis of Remedial Measures*, incidents involving work zones or resulting from weather conditions or other causes contribute to approximately 50-60 percent of the congestion delay on U.S. highways. They lead to major road closures and adversely affect safety by increasing exposure to hazardous conditions and contributing to secondary crashes.

Incident management programs serve as the "eyes and ears" of the highway system and are a well-known strategy for reducing the effects of incidents on traffic flow. Team members who operate the patrol vehicles in Oregon's incident response program help at crash scenes, assist disabled vehicles, and provide complimentary services such as changing flat tires, refilling radiators, providing fuel, and giving directions. The patrol vehicles also work with local private towing firms to remove stalled vehicles from the roadway.

The work of the incident response teams helps relieve nonrecurrent congestion through quick problem detection and fast verification, response, removal, and cleanup. The proactive efforts of the team members may reduce delays, fuel consumption, crash exposure, and environmental impacts such as air pollution, and improve ODOT's resource allocation by freeing other highway maintenance personnel from the need to address incident response, reactively. In addition, through ODOT's transportation operations center, the team can notify the proper authorities of roadway-related problems that affect safety or traffic flow now or in the future.

Documenting the Program's Effectiveness

In 2001 ODOT initiated a research study, *Evaluation of Region 2 Incident Response Program Using Archived Data*, funded by the Oregon DOT and supported by FHWA, to measure the effectiveness of the program using two test corridors on Highway 18 and Interstate 5. The study focused on data collected during the period 1995-2000.

"This study is a valuable resource in identifying the benefits of implementing incident response in both small urban and rural settings," says Nathaniel Price, intelligent transportation system (ITS) and operations engineer for FHWA's Oregon Division Office. "The results from this study will help identify the need for further investment in ITS and operations activities in small urban and rural areas."

The Oregon study used archived computer-aided dispatch data for an 82-kilometer (51-mile) segment of Highway 18 from McMinnville to Lincoln City and a 66-kilometer (41-mile) section of Interstate 5 within the Lane County limits in the Eugene area. ODOT selected the two corridors in collaboration with the agency's technical advisory committee, which chose Highway 18 because it is a rural road with heavy weekend and recreational traffic. With no parallel detour roads, it is a major truck route to the Oregon coast and therefore poses an economic impact if closed for any length of time. In addition, few emergency response resources are available nearby. ODOT and the technical advisory committee selected Interstate 5, in contrast, because it is a typical commuter corridor with emergency resources nearby.

The Oregon research, performed by Portland State University, included a statistical analysis of archived incident data since 1995, estimation of reductions in fuel consumption and delay, calculation of program costs, and development of a decisionmaking tool for future expansion of the program to other highways. The methodology consisted of a statistical analysis of incidents using data from two distinct phases since the inception of the incident response program. *Phase 1* covers the period between February 1995-March 1997, and *Phase 2* the period from March 1997-December 2000. It was not possible to conduct a true before-and-after study, since the incident response staff themselves are the roving data collectors and are monitoring the status of the roadways more thoroughly than was done in the past.

During *Phase 1* on Highway 18, incident response personnel invested approximately

36 hours per month, while during *Phase 2*—and continuing today—ODOT deploys the equivalent of one full-time incident response team member, totaling 173 hours per month. On Interstate 5, the staffing level also has increased over time.

Benefits of Incident Response

The incident response program provides numerous benefits to the public, ODOT, and transportation agencies.

Benefits to the public:

- Reduced delay
- Reduced fuel consumption
- Improved air quality
- Improved safety and security (avoided secondary crashes)
- Improved flow of commerce
- Reduced harm to wildlife, soil, and water quality

Benefits to transportation agencies:

- Reduced cost for maintenance crews
- Increased value of extra maintenance performed (from freeing maintenance crews from incident response)
- Increased recovery of "charges against others" from motorists' insurance companies
- Increased awareness of potentially hazardous situations requiring maintenance
- Improved information on de-icing
- Improved public relations and good will

Data Analysis

Incident data collected for the research included 15 database fields for both roads over the study period. The data include details regarding the incident type, location, time reported, time cleared, and other pertinent information.

To prepare the data for analysis, the Portland State University researchers entered the raw information into a database that includes information on more than 67,000 unfiltered incidents. The researchers subsequently filtered errors from the raw data to isolate 3,900 actual incidents. Additional filtering to remove duplicates resulted in analysis of 2,500 incidents.

The researchers analyzed the data for consistency and then in terms of the severity of the incident, duration, timing, and location to determine whether the incidents actually caused delay to the motoring public. This analysis resulted in reduction of the raw data to a total of 485 delay-causing incidents along the study corridors.

The analyses also characterized the benefits versus the costs associated with administering and operating the incident response program. Quantitative comparison of potential benefits included consideration of possible reductions in incidents, traffic congestion, pollution, and resource requirements for ODOT and law enforcement agencies.

The researchers performed additional analyses to assess the impact of the incident response program on maintenance productivity. In Oregon, outside the Portland metropolitan area, maintenance personnel typically managed incidents on an as-needed, reactive basis. Given that incidents do not occur only during the hours when maintenance personnel are working, overtime charges were necessary for response to major incidents on weekends and nights.

A more detailed analysis for the year 2000 analyzed additional data on ODOT's efforts to recover costs incurred during incidents that damaged State property such as a collision with a guardrail or bridge. The analysis was to determine whether cost recovery had increased due to the presence of the incident response personnel, who can serve as additional witnesses to damages.

The evaluation of the benefits aims to provide threshold levels of inputs (traffic

volumes and number of incidents) that would indicate that ODOT should create an incident response program for a particular route or expand an existing program. In addition, the research identified qualitative benefits of the incident response program, such as motorists' sense of safety or environmental impacts. Although these benefits are not directly measurable, their presence increases the value of the program.

The analysis took into consideration that many short-duration incidents probably go unreported; this was particularly true before the implementation of the program. The number of reported incidents as opposed to the actual number of incidents is thought to have increased since the program began.

The data revealed that the number of reported incidents increased from 8,883 in 1996 to 14,688 in 2000. This increase has to do in part with the fact that the incident response personnel use radios that enable them to report incident data quickly and efficiently. In addition, since 1995, the prevalence of cellular phones has increased the reporting rate by the public. "The reporting accuracy and timeliness improved as well as the frequency," says Edward Anderson, senior ITS engineer, Oregon DOT.



ODOT incident responder provides gasoline to a stranded motorist.

Results

The study revealed that the program handles more than 30 major incident assists per month, and a significant finding was that vehicle crashes account for as much as 75 percent of the delay-causing incidents. This result indicates that, for future planning, a review of the crash data alone may suffice when determining routes that would be candidates for new or expanded programs.

The analysis provided surprising results in terms of traffic volume and number of crash occurrences on the two highways. The average daily traffic on both routes has increased substantially since 1995, with no increases in capacity.

Based on statewide data, the crash rate on Highway 18 decreased 13 percent over the period that the incident response program has been in effect. The rate increased 58 percent, however, on Interstate 5.

The analyses of incident duration revealed that some time lapse takes place between the occurrence of an incident and the time that it is actually reported. Also, the roadway may be cleared of an incident several minutes before the clearance is reported to dispatch. The researchers observed that an incident's impact lasted a long time after it was cleared from the roadway. On Highway 18, the majority of incidents analyzed took 45 minutes to 1 hour to be cleared.

The primary benefit of the incident response program is to decrease the duration of incidents, thus reducing their impact on driver delay. The duration of delay-causing incidents decreased substantially with the implementation of the incident response program. The drop in duration was approximately 30 percent on Highway 18 and approximately 15 percent on Interstate 5.

Reduction in mean incident duration resulted in a reduction in delay imposed on other motorists. The average delay per incident decreased by 66 percent on Highway 18 and 36 percent on Interstate 5.

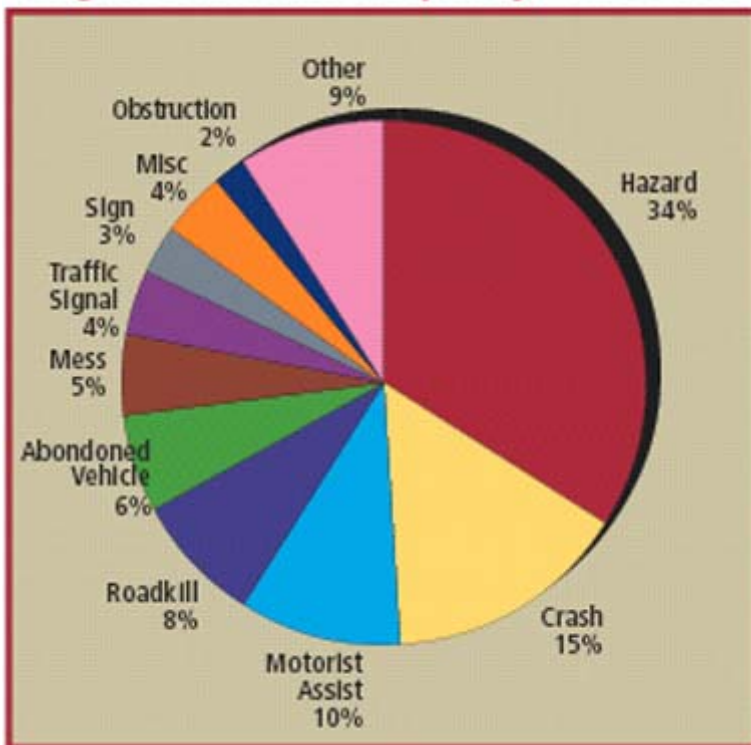
When delay is reduced, so is fuel consumption and drivers' commute time. The study revealed a user cost reduction between 1995-2000 of 66 percent on Highway 18 and 36 percent on Interstate 5. The financial benefit is a major incentive of the program. Based on estimated reductions in delay and fuel consumption, since its inception the program has provided a total return on investment of \$885,000 on Highway 18 and \$1,010,000 on Interstate 5. It is likely that further benefits have been realized due to secondary crashes that were prevented, but this is difficult to measure.

The study revealed that nonrecoverable costs, such as replacement of a guardrail that cannot be charged against an insurance company of the driver, declined in the Eugene metro area, and the researchers attribute this decline to improved incident reporting. For the year 2000, nonrecoverable crew costs declined while charges against other revenues increased. Costs for maintenance staff plus overtime hours resulted in additional labor and equipment savings. The value of the extra maintenance performed because the crews were not diverted to incident response was significant.

The incident response program on Highway 18 is justified based on savings in agency costs alone, without considering savings to the user in reduced traffic delays or reduced fuel consumption. On Interstate 5, the cost of the program is higher than it is on Highway 18, but so are the delay and fuel savings (given the higher volume of commuter traffic). On Highway 18, the annual return on the program in terms of agency savings and user delay and fuel savings is \$250,000. On Interstate 5, it is \$279,090.

ODOT used the results of the Highway 18 and Interstate 5 analyses to derive a procedure for determining the viability of future incident response programs. By modeling the roadway length, average daily traffic volume, and the crash rate, the researchers estimate the delay on similar facilities under different scenarios. The results of the modeling do not necessarily provide a definitive answer as to whether an incident response program will provide immediate returns, but they can determine whether a given roadway should be given consideration for a future incident response program.

Region 2 Incident Frequency, 1995-2000



Analysis of 67,000 reported incidents on Highway 19 and Interstate 5 revealed that the majority were classified as hazards (34 percent), which include anything left on the roadway that poses a threat to the motorist public, followed by crashes (15 percent) and motorist assist (10 percent). Sixty percent of all incidents fall under these major categories. Of delay-causing incidents, however, the majority are attributable to crashes.

Recommendations

The results of the study indicate that ODOT's Region 2 incident response program is successful and significantly cost effective. For faster, more precise review of current and future programs, other States might find it beneficial to train dispatchers and responders to provide more detailed information on incident and roadway characteristics, use standard terminology to report incidents, implement Automatic Vehicle Location to measure time allocated to incidents on particular highway segments, and create more detailed designations in the hazard category.

The incident response personnel serve as the public face of the transportation agency in Oregon. Surveys of motorists who were assisted by the program and the general response from the public indicate favorable support. Not only does the program reduce congestion and delays on the roadways, it also provides a more pleasant driving experience for motorists. Finally, connecting a human face to the transportation infrastructure is a significant benefit of incident response programs.

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Galen E. McGill has been the manager of ODOT's intelligent transportation systems since the inception of the agency's ITS program in 1998. He has worked for ODOT for 15 years in various positions related to new technology development and implementation. McGill is a registered professional engineer in Oregon. He has an M.B.A from Willamette University's Atkinson Graduate School of Management and a B.S. in electrical engineering from Oregon State University.

Acknowledgements

The authors are grateful to Martin G. Klug, Dan Dollar, and Becky Knudson of ODOT for project management and oversight. Dan Dollar, Richard Peek, Sylvia Vogel, Tim Thex, Jennifer Campbell, and Mark Willis generously assisted in obtaining data. Finally, Bill Williams and Kevin Kinney arranged valuable field reconnaissance. Sutti Tantianugulchai and Edward Anderson developed the database, Roger Lindgren assisted with the literature review, and Monica Leal helped with preparation of data summaries and graphics.

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