Project Summary Report 4907-S
Project 7-4907: Functional Process Specifications for Improving Incident Response

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PROJECT SUMMARY REPORT

Measuring and Improving Incident Response

Even with the deployment of advance transportation management centers, incidents continue to be a major source of congestion and driver delay and frustration in our urban areas. Prompt and effective response to incidents is critical to limiting the impacts of incidents on traffic performance. While the Texas Department of Transportation's role in responding to incidents is one of support, the department wants to assist other agencies in exploring ways to improve their incident response. The goal of this project was to identify techniques and develop functional specifications that agencies could use to improve their incident response.

What We Did . . .

To accomplish this goal, we used a combination of site visits and field data collection to first document the tasks (or events) that occur as TxDOT and other agencies respond to incidents. We then stationed observers in the TransGuide (San Antonio) and TranStar (Houston) transportation management centers to measure the duration of these tasks as they occurred in actual incidents. The data were used to identify "bottlenecks" in the incident response process. Using the available literature and interviews with noted experts in the incident management field, we identified methods that could be used to reduce the agency response times. We examined how photogrammetry could potentially be used to reduce the time to take critical measures at an incident scene. Surveys of both control center personnel and motorists in Houston were used to assess the feasibility and acceptance of altering the normal set of incident-related messages that is displayed on dynamic messages signs. We also developed a model standard operating procedure that could be used by TxDOT as a starting point for developing procedure manuals in many of the new and existing transportation management centers.

What We Found . . .

From our site visits, we found the incident response process is not a series of linear events (as often alluded to in the literature). The process actually varies from incident to incident depending upon who is the first responding agency on the scene. In terms of improving incident response, we found that those centers that had a direct line of communications with the law enforcement agencies in their areas (either we had an officer present in the control center, or through direct radio contact with the police dispatching center) knew about incidents and were able to respond sooner and more effectively. We also noticed that in some control centers, especially those that had multiple agencies and multiple personnel on the control center floor, noise made it difficult for some operators to communicate with one another.

We also measured the response times to different incident events at two of the control centers in Texas. We found that the first official responder to the incident arrived approximately 8 minutes after the incident was reported in the control center. We also found that it took approximately 20 minutes from the time that the first official responder arrived on the scene until the first vehicle was allowed to leave the incident scene. Average duration of a lane blockage was 29 minutes, while the total duration of the incident was 36 minutes. Table 1 shows the average measured response times from these field studies.

In contrast, TxDOT's response time was approximately 3.5 minutes. This response time is the time from when the incident is first reported to the control center until TxDOT finishes executing its "official" response. In most cases, this response consisted of activating a dynamic message sign in the vicinity of the incident, but also included dispatching courtesy patrol vehicles, changing lane control signs, etc.

Table 1. Average Times for Typical Events to Occur During Response to Incidents.

Events in Incident Response and Clearance	Average Time (minutes)
"Response" Time[1]	7.9
TxDOT Response Time[2]	3.5
"Investigation" Time[3]	20.2
"Extraction" Time[4]	20.6
"Clearance" Time[5]	26.1
Lane Blockage Duration[6]	29.2
Total Response Time[7]	36.3

1 The time from when the incident was first reported in the control center until the first official responder appeared on scene.
2 The time from when the incident was first reported in the control center until TxDOT completed their response to the incident.
3 The time from when the first official responder arrived on the scene until the first vehicle was allowed to leave the scene.
4 The time from when the first emergency service unit (not including law enforcement personnel) arrived on the scene until the last emergency service vehicle departed the scene.
5 The time from when the first official responder arrived on the scene until the last vehicle was allowed to leave the scene.
6 The total time that traffic was impeded by either the incident itself or the response vehicle.
7 The total time from when the incident was first reported in the control center until the vehicles (both response vehicles and those vehicles involved in the incident) left the scene.

One technique that we identified as having the potential for reducing the duration of incidents was photogrammerty. Photogrammetry is the process of making reliable three-dimensional measurements from photographs taken at the incident scene. Through our review of the available literature and through interviews that we conducted with law enforcement personnel who are familiar with photogrammetry, we found that it could potentially be a cost-effective and time-saving tool for reducing the duration of major incidents; however, this technique is still in the testing phases. In a Utah pilot test, the Utah Highway Patrol (UHP) was able to reduce its response times from 75 minutes (with total stations) to 35 minutes using photogrammetry. UHP is planning on using photogrammetry for all serious incidents that occur during the Winter Olympics in 2002. Many other law enforcement agencies are also considering using this system.

Photogrammetry does, however, sometimes have drawbacks:

- it takes longer to analyze the incident in the office,
- it is harder to get all the measures from large incident scenes,
- it is hard to get good-quality pictures of the incident scene at night, and

- it takes extensive training to become proficient in the use of the technique.

TTI also examined how the incident response process could be improved by providing more status information about the incident on the dynamic message signs used in many transportation management centers in Texas. We wanted to know if more information about the status of different incident responders (i.e., whether they had been notified, en route, on scene, or clearing the scene) could replace the "Expect Delay" message that is commonly used as part of the incident response message. Many of the TxDOT districts were not in favor of changing the message design to provide this information, citing concerns of increased operator workload, liability, and difficulty in obtaining information. A survey of motorists in Houston revealed that the majority of the motorists liked the "Expect Delay" message and did not find the status information extremely useful.

A model Standard Operating Procedure (SOP) was developed using the information from the site visits. It shows some of the language and items that can and should be included in the SOP for any new and existing control center. Examples of some of the items addressed in the model SOP include the following:

- job descriptions of the personnel located in the control center,
- normal hours of operations and staffing levels,
- normal procedures for responding to incidents, and
- normal procedures for using the video surveillance system, dynamic message signs, highway advisory radio system, and lane control signals.

The model SOP is intended to be a framework that TxDOT districts can modify to satisfy their local requirements and needs.

The Researchers Recommend . . .

Based on the results of this research, researchers recommend the following.

- TxDOT's response time to incidents is generally good (on the order of three minutes or so). The bottleneck in the incident response process appears to be law enforcement investigation time. TxDOT should continue to work with local law enforcement personnel to develop good procedures for clearing and removing incidents from the travel lanes.
- TxDOT would greatly benefit from improving its record-keeping of incidents. In many cases, the type of information recorded on the incident report in the system software is not consistent. Also, there is too much manual data entry of incident information. TxDOT should continue to revise its system software so that the system logs can record more accurate information about incidents. Specific information about the arrival times and departure times of the response personnel from different agencies would help TxDOT to continuously monitor the incident response process locally for bottlenecks and to evaluate the effectiveness of strategies that would improve incident response.
- Our research has shown that having good communications with law enforcement dispatching leads to quicker and more effective TxDOT response. TxDOT should continue to incorporate direct communication links to police agencies in the architecture of its developing control centers.
- Noise levels can be a problem in some of the existing control centers. In those areas where joint operations are going on, procedures need to be established that limit the amount of noise generated.
- Photogrammetry has the potential to be a cost-effective and timesaving tool that can substantially reduce the amount of time needed to take measurements at major incident scenes. Because use of this technique is still in its testing phase nationwide, TxDOT should continue to monitor applications of this technique. TxDOT should consider working with some of the major law enforcement agencies to establish its own test of the potential applications and benefits of the technique for responding to incidents.
- For the time being, TxDOT should continue to use the "Expect Delay" message as part of standard incident-related messages displayed to motorists on dynamic message signs. In limited surveys, motorists favored this message over messages that provided them with information about the status of the incident response (e.g., "Police En Route," "Police On Scene," etc.).
- Every transportation management center should have a written procedure that describes the standard procedures for how they handle incidents, use equipment, hours of operations, etc. A model Standard Operating Procedure (SOP) was developed as part of this project that can be used as a starting point for each center to develop its own operating procedures.

For More Details . . .

If you would like to find out more about the results of this research, the following products have been delivered to TxDOT on this project:

- *Measurements of Incident Response in Houston and San Antonio, Texas*. Draft Research Report 4907-1. Submitted for review and approval in March 2000.
- *Use of Photogrammetry for Investigation of Traffic Incident Scenes*. Letter Report 4907-2. February 2001.
- *A Model Standard Operating Procedure for TxDOT Transportation Management Centers*. Draft Letter Report 4907-P1. Submitted for review and approval in January 2001.
- *Examining Motorist Information Needs for Travel Under Incident Conditions*. Letter Report 4907-4. February 2001.

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To obtain copies of the report, contact Dolores Hott, Texas Transportation Institute, Information & Technology Exchange Center, (979) 845-4853, or e-mail d-hott@tamu.edu. See our catalog on-line at http://tti.tamu.edu.

TxDOT Implementation Status
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Some of the research recommendations may be already implemented, being implemented or to be implemented in the near future at some or all existing Traffic Management Centers (TMCs). This would include establishing good communications with law enforcement dispatchers, reducing noise levels in the control center, using the best DMS message selection, and maintaining a detailed written SOP.

The model SOP will provide a useful reference tool for current TMCs, the ones in development, and future ones. The research has demonstrated the importance of having a good SOP in place and the need to periodically review it and update it if needed.

The use of photogrammetry may be something for TxDOT to consider for implementation after further study and field experience. The Utah pilot study results may give an indication as to future potential use of this incident management tool.

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YOUR INVOLVEMENT IS WELCOME!

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