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The objectives of this project are to investigate the causes of long clearance times of major traffic incidents, and identify and propose ways to reduce major incident clearance times. The research team (1) examined regional sources (or causes) of incident clearance delay, (2) identified appropriate responsive traffic incident management (TIM) tools and strategies—based on the state-of-the-practice and specific incident clearance delay characteristics in each region—shown to be successful in reducing incident clearance times, and (3) provided recommendations for improving ongoing performance measurement to support continuous improvement in safe, quick incident clearance. Information to support this research effort originated from various sources including detailed analyses of all major incidents in Caltrans Districts 3 and 4, TIM stakeholder workshops focused on regional TIM operations, literature and the state-of-the-practice reviews, TIM stakeholder surveys and inventories of practice focused on performance measurement.

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## **Quick Clearance of Major Traffic Incidents**

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Final Report for Agreement 65A0422

September 2014

CALIFORNIA PARTNERS FOR ADVANCED TRANSPORTATION TECHNOLOGY

## **ABSTRACT**

The objectives of this project are to investigate the causes of long clearance times of major traffic incidents, and identify and propose ways to reduce major incident clearance times. The research team (1) examined regional sources (or causes) of incident clearance delay, (2) identified appropriate responsive traffic incident management (TIM) tools and strategies—based on the state-of-the-practice and specific incident clearance delay characteristics in each region—shown to be successful in reducing incident clearance times, and (3) provided recommendations for improving ongoing performance measurement to support continuous improvement in safe, quick incident clearance. Information to support this research effort originated from various sources including detailed analyses of all major incidents in Caltrans Districts 3 and 4, TIM stakeholder workshops focused on regional TIM operations, literature and the state-of-the-practice reviews, TIM stakeholder surveys and inventories of practice focused on performance measurement.

## **ACKNOWLEDGEMENTS**

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## EXECUTIVE SUMMARY

The California Department of Transportation (Caltrans) recognizes the importance of quick clearance of traffic incidents. Thus, one of the performance measures identified at Caltrans for improving incident management is to track the percentage of major incidents cleared in less than 90 minutes on a quarterly basis. Major incidents are defined as those taking 30 minutes or more to clear. Although slight improvements were observed since Caltrans started reporting this performance measure in 2005, the average clearance time for major incidents for the quarter ending December 31, 2008 was 3 hours and 15 minutes. This is still a long way from the target clearance time of 90 minutes or less. Therefore, it is critical to investigate why it takes over three hours to clear a major incident, and what can be done to reduce major incident clearance times.

To fulfill the requirements this research effort, researchers from California PATH and the Texas A&M Transportation Institute (TTI) examined traffic incident management (TIM) operations throughout the State of California, distinguishing differences in safe, quick incident clearance activities and outcomes among rural and urban districts. The goals of this research project were to produce two categories of results:

- Recommendation for data integration and data transfer efficiency. One direct benefit of this undertaking will be the minimization of redundant efforts by different agencies in acquiring and maintaining data, while the other major benefit is to ensure that there exists a generally accessible and comparable database to serve as the foundation for all future endeavors.
- Implementation strategies to improve the incident clearance practices in California. The benefits that can be derived from this result are far reaching and significant in that highway operation efficiency and ancillary benefits in safety and environment are invaluable.

Specifically to this research project, the research team: (1) examined regional sources (or causes) of incident clearance delay, (2) identified appropriate responsive TIM tools and strategies—based on the state-of-the-practice and specific incident clearance delay characteristics in each region—shown to be successful in reducing incident clearance times, and (3) provided recommendations for improving ongoing performance measurement to support continuous improvement in safe, quick incident clearance. Information to support this research effort originated from various sources including TIM stakeholder workshops focused on regional TIM operations, literature and the state-of-the-practice reviews, TIM stakeholder surveys and inventories of practice focused on performance measurement, and the existing knowledge and expertise of participating PATH and TTI researchers.

### **Analysis of Total Incident Duration**

The research team conducted an analysis of all major incidents in Districts 3, 4, and 6 from January 2011 to April 2012. Major incidents as defined in this project and included in the dataset either took 90 minutes or more to clear or those that required the response of multiple agencies such as Caltrans and California Highway Patrol (CHP). The duration of an event was defined as the time between the first notification by any responsible party, typically CHP or the Caltrans Traffic Management Center (TMC) cameras, and the time of all lanes open as reported to Caltrans by either CHP or the Caltrans maintenance staff on scene. Included in the total durations were those incidents where Caltrans had to close at least one lane to perform repair or maintenance actions as a result of the incident.

Table 1 below shows that total duration of the major incidents by district. The analysis showed that the average total duration of major incidents – from first notification to when incident was removed from the roadway – ranged between 3 hours and 19 minutes to 4 hours and 39 minutes. Total incident duration in the more rural districts (District 3 and District 6) was slightly longer than those in the urban district (District 4).

**Table 1. Total Duration for Major Incidents by Caltrans District**

Caltrans District	Total Incident Duration (Hours: Minutes)		
	Average	Median	95 <sup>th</sup> Percentile
3	3:23	2:12	9:12
4	3:19	1:43	12:56
6	4:39	3:41	10:58

In looking further into the possible the sources of the delays, the research team learned those incidents that have the longest clearance times always involved overturned commercial vehicles with spilled loads either with a hazardous material spill or involved utilities. The presence of hazardous material can greatly increase incident duration. Table 2 shows the average incident duration for those incidents involving hazardous materials ranged between 5 hours and 26 minutes to over 7 hours, with median duration times ranging from 3 hours and 49 minutes to 5 hours and 8 minutes.

**Table 2. Duration of Incidents Involving Hazardous Materials by District**

District	Average	Median	Standard Deviation	Number of Samples
Three	5:37	4:40	3:21	23
Four	7:37	5:08	6:50	17
Six	5:26	3:49	4:23	15

The research team found significant differences in incident durations between those incidents where the cleanup required the use of the Caltrans hazardous material contractor compared to those incidents where the cleanup could be accomplished using Caltrans forces only. For example, in District 4, those hazardous material incidents where Caltrans crew could handle the removal of the materials averaged 3 hours and 19 minutes, while those incidents that required a contractor to remove the hazardous materials required over 8 hours to clear the incident. It should be noted, however, that the types of hazardous material incidents that generally require a contractor to perform the cleanup tend to be more complicated incidents and one would expect their clearance time to be longer than the types of events that can be cleared by Caltrans crews.

The analysis also found that major incidents in which damage to a utility occurred increase clearance times considerably. For example, in District 6, the average clearance time of major incidents averaged nearly twice as long when a utility was involved compared to when a utility was not involved -- 7 hours and 20 minutes for those major incidents involving damage to a utility, as opposed to 4 hours and 39 minutes for those major incidents not involving a utility.

Contrary to the research team's original thinking, fatality incidents, while more numerous than hazardous material spills or incidents involving utilities, did not result in the highest incident durations. The review of total incident durations showed that out of a total of 30 incidents that had the longest total durations, only two involved fatalities. The average duration of those incidents involving a fatality ranged from 3 hours and 2 minutes in District 3 to 4 hours and 2 minutes in District 6, with the median duration in all three districts just slightly over 2 hours. As expected, clearance times in the more areas were higher than those urban areas, primarily due to the longer distances the coroner had to travel to reach the incident

scene. District 6's total duration were on average 40-60 minutes longer due primary the long travel distances from county centers.

### **Incident Responder Workshops**

PATH and TTI researchers conducted regional TIM stakeholder workshops, focused on implementation of the recommended quick clearance tools and strategies as well as the performance measurement framework. A series of workshops were held at two of the Caltrans districts: District 3 and District 6. These workshops included representatives from state and local incident responders, including Caltrans district traffic operations and maintenance; California Highway Patrol (CHP) patrol and dispatch; Caltrans district hazardous material response teams; local and regional fire, law enforcement and sheriff departments; regional coroner's offices; dispatchers and operators for regional public-safety answering points (PSAP); local tow truck operators; regional metropolitan planning organizations, and others. The purpose of these workshops was follows:

- Understand and document the lines of communications and notification procedures that exist between responders to major traffic incidents.
- Identify and discuss issues that impact responses and clearance times of major traffic incidents
- Identify practical, implementable strategies and techniques to reduce response and clearance times to major traffic incidents.

The following issues and observations were identified by the research team based on comments and the discussion generated in the workshops.

1. Caltrans maintenance crews do not operate 24-hours/7-days a week. During normal work hours, maintenance crews are often working at other locations at the time an incident call comes in. This means that if they are at a job site when a call comes in, they have may have break off of their work activity to respond to the incident. During non-normal times, maintenance crews are at home and it takes time at assemble appropriate personnel. At times, it can be difficult to assemble a response crew quickly. Caltrans maintenance personnel have little "incentives" to participate in after hour responses. The responding maintenance staff for traffic incidents is not designated as "on-call" employees during non-working hours.
2. Recent changes in Caltrans' policy on vehicle home storage permits have resulted in difficulties by some maintenance supervisors responding to incident scenes rapidly. With the changes in policy, some supervisors are now required to travel first to the maintenance yard to pick up an official vehicle and/or equipment (including radio communication) before heading to the incident scene. In the past, maintenance supervisors had the ability to initiate responses directly from their residence before leaving to go to the scene. For some incidents, a supervisor may have to drive pass the incident scene on their way from their residence to a Caltrans maintenance facility to obtain a vehicle. The additional travel time will increase delays in initiating a response for incidents.
3. Several communications issues between Caltrans and field response personnel were identified during the workshops. Common communications issues identified across multiple districts include the following:
  - On-site responders will frequently request specific equipment to be dispatched to the scene (e.g., a sweeper), without fully describing the extent of the incident. Occasionally, this practice has resulted in the wrong equipment being sent to the incident site. A better practice would be for the field personnel to provide a complete description of the incident (e.g., overturned dump truck carrying a full load of sand covering right lane and shoulder) that would allow the Caltrans maintenance supervisor to determine the appropriate equipment needed to clear the incident (e.g., front end loader).

- Information that on-site responders relay to dispatch is not always forwarded to other responders, particularly the field responders.
  - To overcome some communications issues, some Caltrans districts have generated quick reference guides that provide guidelines as to when to notify Caltrans for specific incidents. These have been distributed to include in “Beat Book” of local responders.
4. Not all requests for Caltrans resources flow through the TMC or maintenance dispatch, particularly with incidents in rural areas. Field responders will often communicate directly with one another to request resources. When this occurs, it becomes difficult to track response times of individual responders.
  5. A knowledge drain exists as more experience CHP and Caltrans field personnel retire or leave their respective agencies. Replacement personnel do not have the knowledge or previous experience to know who to contact for specific responses or pieces of equipment. “Succession” planning has not been a priority with many Caltrans districts.
  6. Rural area responses are different than urban area responses. Rural staffing levels are different and may have alternative work week shifts. Also, travel in rural areas is considered “pleasure travel,” and therefore, most significant impacts caused by incidents occur on weekends or during non-standard commute times, when staff is not present. Furthermore, the opportunities and options for detouring traffic during major incidents are limited in rural areas.
  7. Caltrans’ TMC academies are urban centric. There is a need to have a rural centric academy that can focus on issues specific to rural areas.
  8. Incident response and clearance times are significantly higher when an incident involves damage to a utility. Incident response times seem to be significantly impacted by the utility company’s work rules and regulations. Utility companies do not seem to have the same sense of urgency to restore roadway operations as other incident responders. Their policies and procedures do not match the Caltrans quick clearance policies.
  9. Many major incidents with long duration times involve hazardous materials (HAZMAT). Response times for incidents involving HAZMAT should be examined separately from other incidents. Incidents that require a HAZMAT contractor to assist in the clean-up will add time to the clearance timeline. Often, the HAZMAT response teams will have to come from multiple counties away from the incident location.
  10. In some districts, trucking companies are responsible for cleaning up their own spilled loads and allowed to contact their own responders first. If a timely response cannot be provided, Caltrans and CHP will contact a clean-up crew and charge the trucking company later for the accrued costs.

## **Recommendations**

Based on the discussions for the participants from the workshops, the research team recommends that following actions be taken by Caltrans:

1. Each district should consider establishing an Incident Management Review Team. These teams would be composed of representatives for the major incident responders in the region. These teams should meet on a regular basis (e.g., every quarter) and focus on addressing issues of coordination and collaboration, communications, and logistics between incident response agencies in each district or region.
2. Each district should consider developing a formal incident management strategic plan specific for their region. This strategic plan should define the collective vision, goals and objectives for incident management in the region as well as response and traffic management processes and procedures specific to the region, including contact information. Alternate route plans could also be developed as part of this effort.

3. Each district should consider establishing an incident coordinator position. This should be a full-time position and the individual would be responsible for coordinating the incident management efforts for the district, including the planning and coordinating the Incident Management Review Team meetings, and the development and implementation of the district's incident management strategic plan.
4. Districts should consider holding annual workshop/summits similar to the ones performed as part of this project to discuss issues affecting regional responses, new innovations in traffic incident management, and regional training needs and initiatives. This workshops/summits should be held at least annually and include representatives and supervisory personnel from all incident responders in the region, including
  - Caltrans district traffic management and maintenance personnel.
  - Caltrans traffic management teams and hazardous material response times.
  - Caltrans TMC and dispatch personnel.
  - CHP patrol supervisor and dispatch personnel.
  - Local police, fire, and emergency service personnel.
  - Local and regional traffic management/department of public works
  - Local tow truck operators or towing associations
  - Metropolitan planning organizations and/or council of governments
  - Special interest groups (including national and state park services, coroner's office, Pacific Gas and Electronic, etc.)
  - Federal Highway Administration/Federal Transit Administration regional offices
5. Each district should implement a policy to perform after action review for all incidents lasting over 2 hours, or any incident where significant issues occurred in the response. After Action Review should focus on the following:
  - What was supposed to happen?
  - What actually happened?
  - What went well and why?
  - What needs to be improved and how?
6. Caltrans should update "Ready Reference Cards" for CHP Dispatchers and local field personnel. Include "checklist" of questions that need to be answered to convey the information needed by Caltrans to generate appropriate response. These should be distributed statewide to all first responder agencies (not just CHP).
7. Caltrans and CHP need to develop policies and procedures for overcoming data exchange challenges. Potential areas for improved coordination include the following:
  - Establish agreements as to what
  - Develop a common data dictionaries
  - Establish common time and spatial referencing system (i.e., GPS time, etc.)
  - Establish a policy that requires first responder agencies that respond to incident to provide notification, arrival, and departure times for all major incidents which take over 90 minutes in clearance.
8. Caltrans should consider re-implementing "quick strike teams" for rural areas where Caltrans can reach any incident scene on major facilities or routes of regional significance within a designated timeframe (e.g., less than 30 minutes). These quick strike teams should be on "ready, standby" so that they can reach an incident scene quickly, establish temporary traffic control and on-scene routing, and assist removal. These teams should be equipped with basic equipment needed for most common types of incidents.
9. Caltrans TMCs should work to involve and integrate Caltrans' Public Information Office more into the incident management process. These individuals can be critical in assisting in disseminating information to the media about major incidents.

10. Caltrans should consider implementing regular joint training activities that involve both dispatchers and field responders that will allow better communications between these entities, particularly in rural areas who may, in many cases, be volunteers. Caltrans should implement a program to provide regular training to rural responders on proper incident notification, traffic incident management and traffic control procedures, including proper flagging procedures, vehicle positioning/ scene protection procedures, and emergency vehicle light usage procedures.
11. Caltrans should consider implementing a pilot towing and recovery program to mitigate incident involving heavy duty, commercial vehicles and tractor-trailer rigs. Under this program, select heavy-duty towing and recovery companies would be provided with a financial incentive to rapidly respond to and clear major incident involving trucks from the roadway. To receive a financial incentive, the towing and recovery companies must arrive at the scene with all basic equipment within a predefined time (e.g. 30 minutes after notification). Companies can receive additional financial incentives if the roadway is then cleared and open to traffic within another predefined time (e.g. 90 minutes). In locations where this strategy has been deployed average duration involving large trucks has been reduced from 269 minutes to 106 minutes with an 11:1 benefit cost ratio.
12. Caltrans should consider implementing a pilot program to use photogrammetry as an alternative means of collecting information at large incident management scenes, particularly in rural areas. Photogrammetry procedures allow data collection and investigative measurements needed for accident reconstruction to be performed using digital photographs. All scene measurements can occur back in the office, away from the incident scene. This tool has the potential to reduce the time needed to perform the investigative work by on-scene responders so that the incident can transition more quick from response to clearance.
13. Caltrans should also consider developing tools and protocols that provide for sharing descriptive information about major incident between responders. This might include the development of an application that allow emergency responders to share photographs of incident scenes so that other responders have a good understanding of what resources and assets are needed at the incident scene.

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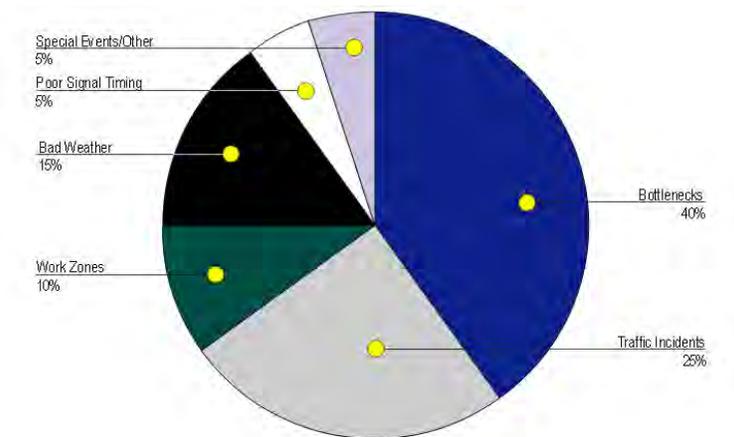
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# CHAPTER 1

## INTRODUCTION

### 1.1 Problem Statement

Congestion—historically concentrated on major freeways in the largest urban areas—continues to increase, affecting U.S. cities of all sizes and extending into rural areas. Delay costs from congestion are estimated at more than \$1 trillion per year; affecting U.S. productivity, health-care, transportation, manufacturing, service industries, and overall quality of life [1]. In urban areas, the most recent Urban Mobility Report attributes 52 to 58 percent of the total motorist delay to crashes and vehicle breakdowns [2]. The National Traffic Incident Management Coalition estimates that traffic incidents account for approximately 25 percent of congestion on all U.S. roadways [3]. California studies have shown that incident-based congestion is up to 25-30% of total congestion delay during the peak period on California freeways [4,5]. Finally, the FHWA has long stated that incidents are the second largest generator of congestion behind capacity constraints (e.g. geometric bottlenecks) as shown in Figure 1.1.



**Figure 1.1 Sources of Congestion Delay (Source: FHWA, <http://www.ops.dot.gov/aboutus/opstory.htm>)**

Several studies illustrate the impacts to the traffic stream when an incident occurs. Figure 1.2 taken from the HRP Synthesis 318 [6] shows that in a two-lane freeway segment operating at volume/capacity (v/c) ratio of 0.7, a 10 minutes of blocking a travel lane will increase delay by 100%. Figure 1.3 shows the estimates of freeway capacity reduction due to incidents based on the 2010 Highway Capacity Manual [7]. It can be seen a blocking one lane on a four-lane freeway can reduce capacity by 42%.

Figure 1.4 below shows the distribution of incident delays based on analysis of the California's PeMS system [8] detector data from several freeways in the state. It can be seen that most of the incidents cause small delays; 10% of the incidents are responsible for the 90% of the delays on the freeway ("the 90-10" rule); these are the incidents with long durations that reduced freeway capacity due to lane blockages. Any reduction in the duration of these major events produces large benefits.

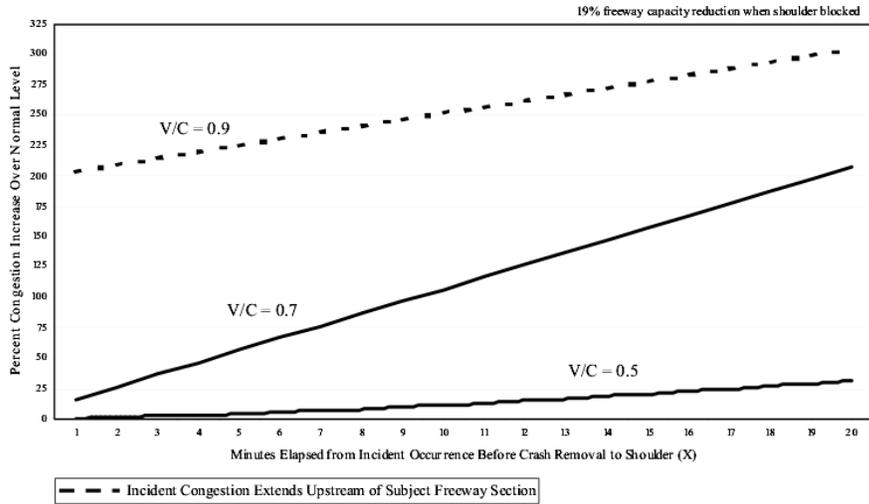


Figure 1.2 Delay Impacts of Lane Closure (Source: NCHRP Synthesis 318)

EXHIBIT 22-6. PROPORTION OF FREEWAY SEGMENT CAPACITY AVAILABLE UNDER INCIDENT CONDITIONS

Number of Freeway Lanes by Direction	Shoulder Disablement	Shoulder Accident	One Lane Blocked	Two Lanes Blocked	Three Lanes Blocked
2	0.95	0.81	0.35	0.00	N/A
3	0.99	0.83	0.49	0.17	0.00
4	0.99	0.85	0.58	0.25	0.13
5	0.99	0.87	0.65	0.40	0.20
6	0.99	0.89	0.71	0.50	0.26
7	0.99	0.91	0.75	0.57	0.36
8	0.99	0.93	0.78	0.63	0.41

Figure 1.3 Reduction in Freeway Capacity due to Incidents (Source: HCM2010)

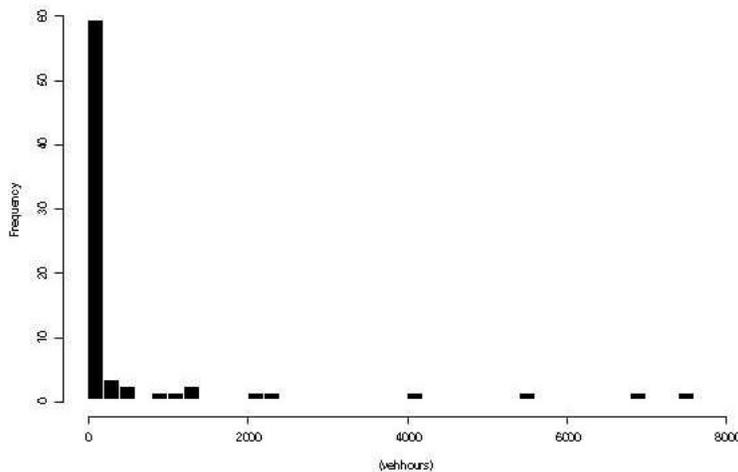


Figure 1.4 Distribution of Incident Related Delays (PeMS System)

The Incident impacts extend beyond travel delay and congestion to safety. Motorists directly involved in the incident are at risk for resulting injury or death. In addition, secondary incidents (an incident that occurs as a result of an earlier incident) caused by unsuspecting approaching motorists may increase both the number and severity of injuries attributable to incidents. Although no standard measure is defined to identify secondary incidents, most estimates suggest that between 14 to 18 percent of the total incidents are secondary in nature.

Effective TIM programs have the potential to minimize traffic congestion and improve highway safety by quickly and safely clearing damaged or disabled vehicles from roadways. Over time, various tools and strategies have been developed and implemented in an effort to improve overall TIM efforts, with a recent focus on the safe, quick clearance of traffic incidents. The nature and extent of tools and strategies in use are highly variable across the Nation and within States—reflecting different priorities, congestion effects, levels of program maturity, and investment. As a direct result, the observed or reported effectiveness of individual or combined strategies is inconsistent, challenging implementation decision-making by public agency administrators.

Caltrans recognizes the importance of quick clearance of traffic incidents. Thus, one of the performance measures identified at Caltrans for improving incident management is to track the percentage of major incidents cleared in less than 90 minutes on a quarterly basis. Major incidents were defined as those taking 30 minutes or more to clear. Although there was slight improvement since Caltrans started reporting this performance measure in 2005, the average clearance time for major incidents for the quarter ending December 31, 2008 was 3 hours and 15 minutes. This is still a long way from our target clearance time of 90 minutes or less. Therefore, it is critical to investigate why it takes over three hours to clear a major incident, and what can be done to reduce major incident clearance times.

## **1.2 Project Objectives**

To effectively improve Statewide TIM operations and achieve their objectives for safe, quick clearance of major incidents, supplemental information is required to adequately respond to three fundamental questions:

- What are the current sources (or causes) of incident clearance delay and how do these differ among distinct regions (mountain, valley, urban, and desert) within the State?
- Based on the identified sources of incident clearance delay and proven state-of-the-practice, what TIM tools or strategies will most effectively reduce incident clearance times?
- Given the numerous agencies involved in TIM and the often conflicting TIM data sources, what is the best approach for measuring incident clearance performance accurately and cost-effectively to support continuous improvement?

The overall goal of this research is to adequately respond to these three fundamental questions, allowing Caltrans staff to effectively identify current TIM challenges, implement appropriate TIM tools and strategies in response to these challenges, and accurately demonstrate the effectiveness of these tools and strategies over time. Specific project objectives include the following:

Identify regional sources of incident clearance delay,

Map appropriate TIM tools and strategies proven to reduce incident clearance times for major incidents, and

Develop a framework to accurately and cost-effectively monitor incident clearance performance over time to ensure continuous improvement in TIM operations.

The proposed research effort considered traffic incident management (TIM) operations throughout the State of California, distinguishing differences in safe, quick incident clearance activities and outcomes among distinct mountain, valley, urban, and desert regions. Specifically, PATH and TTI researchers (1) identified regional sources (or causes) of incident clearance delay, (2) identified appropriate responsive TIM tools and strategies—based on the state-of-the-practice and specific incident clearance delay characteristics in each region—proven successful in reducing incident clearance times, and (3) developed recommendations for ongoing performance measurement to support continuous improvement in safe, quick incident clearance. Information to support this research effort will originate from various sources including TIM stakeholder workshops focused on regional TIM operations, literature and the state-of-the-practice reviews, TIM stakeholder surveys and inventories of practice focused on performance measurement, and the existing knowledge and expertise of participating PATH and TTI researchers.

Special focus was directed towards implementing the results of this research to achieve improved safe, quick incident clearance in California. Specifically, a second series of regional TIM stakeholder workshops was conducted, subsequently focused on implementation of the recommended quick clearance tools and strategies as well as the performance measurement framework. As a final task in this research effort, PATH and TTI researchers presented the results from this effort to other interested parties Department-wide, and recommended strategies for expanding these results from the regional case study locations to other locales to improve safe, quick incident clearance throughout the State.

### **1.3 Organization of the Report**

This is the final project report for the study. It describes in detail the work performed and presents the research findings and recommendations. Chapter 2 is the literature review with emphasis on incident management performance measures. Chapter 3 identifies the sources of incident delay and presents the findings from the first series of workshops. Chapter 4 presents the methodology and findings from the analysis of incident data. Chapter 5 discusses strategies for improvements and recommendations of the traffic incident management along with the findings from the second series of workshops. The final Chapter summarizes the major findings and outlines future research. The presentation materials slides and other materials in the workshops are included in the report appendices.

## CHAPTER 2

### LITERATURE REVIEW

This Chapter reviews the state of the art and practice on management of major traffic incidents.. Emphasis is placed on identification of performance measures, and the benefits of effective incident management strategies.

#### 2.1 State-of-the-Practice

##### *Safe, Quick Clearance Tools and Strategies*

Quick clearance is the practice of rapidly and safely removing temporary obstructions—including disabled or wrecked vehicles, debris, and spilled cargo (including hazardous material cargo)—from the roadway. A comprehensive quick clearance program consists of: (1) operational procedures, (2) supporting equipment and infrastructure, and (3) enabling laws and policies aimed at affecting the safe and timely removal of traffic incidents. Safe, quick clearance programs serve to eliminate common barriers to incident removal such as improper/delayed response; prolonged site investigations; and indecision driven by unclear policies, standard operating procedures, and liability concerns.

A number of related “best practice” documents have been developed in an effort to address the need for safe, quick clearance guidance including *NCHRP Synthesis 318: Safe and Quick Clearance of Traffic Incidents* [6], I-95 Corridor Coalition *Quick Clearance and “Move It” Best Practices* Final Report [9], I-95 Corridor Coalition *Quick Clearance Toolkit* [10,11], and *Best Practices on Traffic Incident Management* [12]. Table 2.1 below shows a sample of incident management strategies from the Best Practices Report [12].

**Table 2.1 Sample Quick Incident Clearance Strategies [12]**

QUICK CLEARANCE AND RECOVERY STRATEGIES	Abandoned Vehicle Hazards	Lengthy Minor Incident Clearance	Lengthy Major Incident Clearance	Liability Concerns	EXAMPLE APPLICATIONS
Abandoned Vehicle Legislation/Policy	●				21+ U.S. Metropolitan Areas, IN, NC
Safe, Quick Clearance Laws—Driver Removal		●			~25 States, including FL, GA, MD, NC, OH, SC, TN, TX, VA, WI
Service Patrols		●			130+ U.S. Metropolitan Areas, AZ (Phoenix), CA, FL, GA (Atlanta), IN, MD, MN, NM (Albuquerque), OR, TN, UT (Salt Lake City)
Vehicle-Mounted Push Bumpers		●			CA (Redding, Stockton), MD (Baltimore), NJ/PA (Delaware Valley Region), OH (Cincinnati), TN (Chattanooga), TX (Austin), UT (Salt Lake City)
Incident Investigation Sites		●			16+ U.S. Metropolitan Areas, TX (Houston)
Safe, Quick Clearance Laws—Authority Removal		●	●	●	AZ, CA, CO, FL, GA, IL, IN, KY, MO, NM, NC, OH, OR, SC, TN, TX, VA, WA
Quick Clearance/Open Roads Policy		●	●		35+ U.S. Metropolitan Areas, CA, FL, GA, ID, IN, LA, MD, NV, NH, TN, UT, WA, WI
Non-cargo Vehicle Fluid Discharge Policy		●	●		FL, MN
Fatality Certification/Removal Policy		●	●		PA, TN, TX (Austin), WA
Expedited Crash Investigation			●		93+ U.S. Metropolitan Areas, FL, IN, TX (North Central Region), UT
Quick Clearance Using Fire Apparatus			●		TX (Austin)
Towing and Recovery Quick Clearance Incentives			●		FL, GA, WA
Major Incident Response Teams			●		DE, FL, IL (Chicago), LA, MD, NJ, OH (Cincinnati, Columbus), NY, TX (Dallas Co.), WA

## Performance measurement

Performance measurement to support safe, quick incident clearance often requires data originating from multiple agencies and disparate agencies. Common challenges to effective performance measurement stem from inconsistent definitions, a lack of consensus and supporting data, and limited data sharing and accessibility.

At the National level, the recently developed *National Unified Goal (NUG) for Traffic Incident Management* recommends setting goals for performance and progress as a primary strategy [13]. Performance measurement provides the necessary feedback to TIM responders to allow them to improve operations. Equally important, performance measurement provides decision makers with the data to demonstrate the value of TIM programs and justify their related expenditures. States that were early to adopt, track, and report improvements in average incident clearance time as a TIM-specific performance metric describe it as a powerful tool for communicating with their State legislatures and with the public. Departments of transportation in both Maryland and Washington have made progress in securing more consistent, reliable TIM program funding from their State legislatures as a result of TIM performance measurement.

In 2003, FHWA began facilitating annual self-assessments of TIM programs (TIMSA) in the largest 75 urban areas of the United States. Early participants were asked to respond to 34 questions related to program and institutional, operational, and communications and technology issues using a five-point relative scale ranging from 0 (no progress in this area) to 4 (efforts in this area are outstanding). In 2008, the TIMSA was revised to better align with the NUG and NIMS and incorporate performance measurement. Annual self-assessments have enabled State and local program managers and practitioners to evaluate their TIM programs and identify strengths and weaknesses in their programs in order to prioritize program activities and initiatives. At a National level, the assessments enable FHWA to evaluate progress in TIM and to identify National TIM program initiatives.

More recently—and in partnership with transportation and law enforcement agencies in 11 States—FHWA completed a focus state initiative on TIM performance measures that resulted in three uniformly defined, TIM-specific objectives and associated performance metrics [14]. These objectives and associated performance metrics include the following:

*Reduce roadway clearance time*—the time between the first recordable awareness of the incident by a responsible agency and the first confirmation that all lanes are available for traffic flow.

*Reduce incident clearance time*—the time between the first recordable awareness of the incident by a responsible agency and the time at which the last responder has left the scene.

*Reduce the number of secondary incidents*—the number of unplanned incidents beginning with the time of detection of the primary incident where a collision occurs as a result of the original incident either within the incident scene or within the queue in either direction.

Early pilot testing of the roadway clearance time and incident clearance time metrics confirmed that States are able to use the same TIM-specific performance metrics to analyze their respective programs, collect and analyze the necessary data to support TIM-specific performance metrics although the methods of data collection may vary, and compare program-level TIM performance using common metrics. The secondary incident performance metric has not yet been field-tested.

FHWA recently made available the *TIM Performance Measurement Knowledgebase* and listserv [14]. The knowledgebase allows users to search for or browse information by resource type, performance measures, or related conferences and events. Participants can join the listserv—intended to allow users to share knowledge and insights with the broader TIM community—by sending an email to [TIMPM@dot.gov](mailto:TIMPM@dot.gov).

Taking a more proactive approach to implementation, a follow-on investigation—led by TTI and sponsored by FHWA—is currently underway to encourage adoption of these three standard TIM-specific performance metrics by States [15]. Specific objectives of the *Traffic Incident Management Performance Metric Adoption Campaign* include: (1) adequately documenting existing

TIM performance measurement practices, including performance metrics and data collection, processing, sharing, and reporting practices; (2) establishing a National baseline for roadway clearance time, incident clearance time, and secondary incidents in the 40 key metropolitan areas to support ongoing assessment of TIM programs and operations; and (3) providing recommendations for expanding the National baseline and associated database to include additional metropolitan areas.

Table 2.2 below shows performance measures used by, or recommended for, in several states—California, Connecticut, Florida, Georgia (Metro Atlanta), Idaho, Maryland, Minnesota (Twin Cities), Utah, Virginia Washington and Wisconsin.

**Table 2.2 Summary of Performance Measures**

<b>State/Region</b>	<b>Performance Measure</b>	<b>Target</b>
<b>California</b>	Clearing major incidents	Less than 90 minutes
	Percent of major incidents cleared in less than 90 minutes (Major incidents are defined as those to which both the CHP and Caltrans respond)	60 percent
<b>Connecticut</b>	Average highway incident duration time	<ul style="list-style-type: none"> <li>• Cars: less than 45 minutes.</li> <li>• Jackknifed tractor-trailers: less than 3 hours.</li> <li>• Overturned tractor-trailers: less than 5 hours.</li> </ul>
<b>Florida</b>	All incidents cleared from the roadway	Within 90 minutes of the arrival of the first responding officer
<b>Georgia (Metro Atlanta)</b>	Clearance of incidents with significant impact on roadways	Within 90 minutes
<b>Idaho</b>	Period from incident detection to when traffic is fully restored	<ul style="list-style-type: none"> <li>• Response A: Up to 30 minutes. Includes stalled vehicles, minor traffic accidents or any impacts to traffic that can be safely moved to shoulders.</li> <li>• Response B: 30 minutes to 2 hours. Includes most severe traffic accidents that require investigation or cleanup.</li> <li>• Response C: More than 2 hours. Includes catastrophic traffic accidents, hazardous materials or local disasters</li> </ul>
<b>Maryland</b>	User cost savings for the traveling public that reflect the tangible benefits of the Coordinated Highways Action Response Team (CHART) incident management program	Annual savings of \$1 billion
	Received time, dispatched time, arrival time, cleared time and confirmed time (used by CHART to evaluate efficiency and effectiveness)	None
<b>Minnesota (Twin Cities)</b>	Clearance time for incidents on urban freeways	35 minutes or less

<b>Utah</b>	Clearing incidents	<ul style="list-style-type: none"> <li>• Noninjury incidents in 30 minutes or less.</li> <li>• Serious injuries in 60 minutes or less.</li> <li>• Fatalities in less than 2 hours.</li> </ul>
<b>Virginia</b>	Average and median incident duration (Duration of an incident is the time elapsed between first notification until all lanes have been cleared)	Unknown
<b>Washington</b>	Clearing highway traffic incidents	90 minutes
	Average length of time to clear major incidents lasting more than 90 minutes on key highway segments (actual 1% of all incidents in 2010—464)	155 minutes (actual in 2010 162 min)
<b>Wisconsin</b>	Traffic Incident Management Enhancement Program (TIME). Measures: Response Time, Incident management time	Unknown

Table 2.3 shows Towing Programs that are designed to reduce the clearance times of major incidents in seven states.

**Table 2.3 Summary of Towing Programs**

<b>State/Region</b>	<b>Towing program</b>	<b>Description</b>
<b>California</b>	Big Rig Tow	Contract with towing company to assist heavy-duty vehicles requiring short-term mechanical assistance along the I-710 corridor
<b>Colorado</b>	Heavy Tow	Contract with towing company to provide standby wreckers at strategic locations along I-70 during weekends, holidays and adverse weather
<b>Florida</b>	Rapid Incident Scene Clearance (RISC)	Incentive-based program for the rapid removal of more complex incidents; most commonly used when incidents cause complete roadway closures on limited-access highways
	Towing and Roadside Repair Services (TARR)	The TARR program provides light and medium duty towing and minor vehicle repairs on Florida's Turnpike for a fee to the customer. Specific tow companies are authorized to provide this service with maximum fees to the customer set by the Turnpike. Certified TARR operators are trained to work safely under high-speed traffic conditions
<b>Georgia (Metro Atlanta)</b>	Towing and Recovery Incentive Program (TRIP)	Financial incentive program for expedited towing and recovery services for large commercial vehicle incidents on the metro Atlanta Interstate system
<b>New York</b>	High-Bid Contract Towing Program	The High-Bid Contract Towing Program is administered by the NYSDOT, supervised by New York State Police, and awarded on the basis of competitive bidding. Towing agencies who have been assigned contracts perform towing services under strict qualifications and guidelines, and are subject to regular inspections. These tow firms provide towing services on designated segments of the highways in the region within a specified rate schedule which is posted on every authorized tow vehicle and

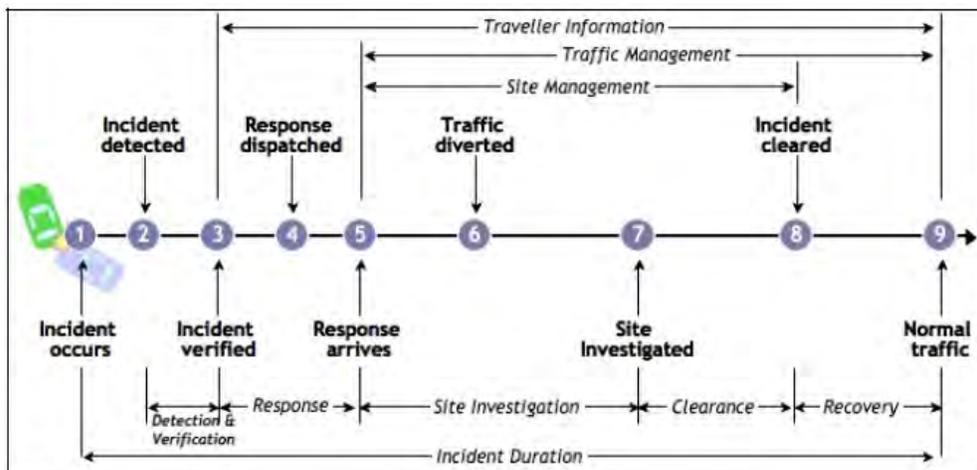
		respond to calls within 30 min. A similar program is administered in NYSDOT Region 10 (Long Island)
<b>Texas (City of Houston)</b>	SAFEClear	A private sector freeway patrol that divides Houston's freeways into segments with assigned operators responsible for their own segments
<b>Washington</b>	Blok-Buster Major Incident Tow Program	Incentive program to remove heavy-truck collisions faster; participating tow companies are eligible for bonus compensation if they meet quick-clearance requirements at major incidents
	Instant Towing Program	This light-duty towing program dispatch tow trucks and Washington State Patrol troopers simultaneously, rather than waiting for verification of the incident by a trooper. Washington DOT estimates that Instant Tow saves 15 minutes per dispatch

## 2.2 Benefits of Incident Management

The Traffic Incident Management Handbook reports five stages of traffic incident management [16] with several components in traffic incident management within these five stages, as illustrated in Figure 2.1.

The five major components of traffic incident management are as follows [17]:

- i. Detection and verification
- ii. Response
- iii. Site management, investigation and clearance
- iv. Traffic management
- v. Traveler information



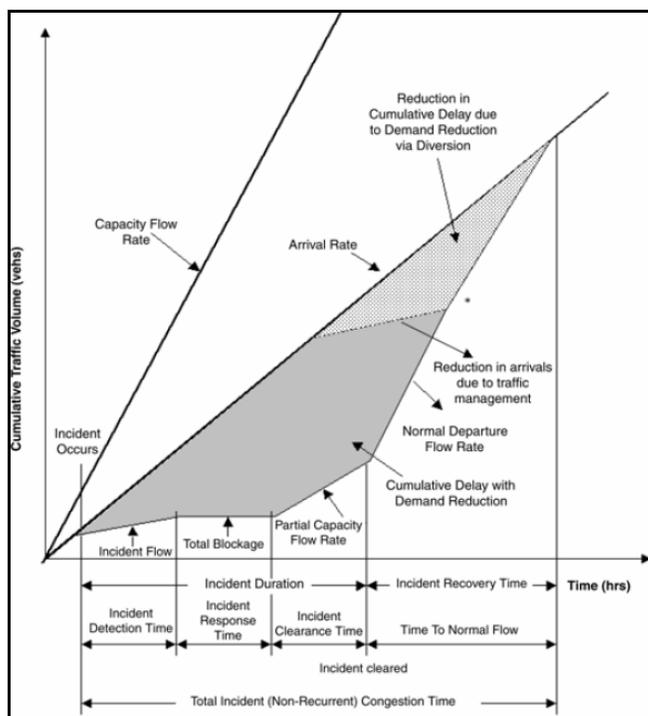
**Figure 2.1: Time Line for Traffic Incident Management [17]**

Detection refers to the means by which response agencies become aware of incidents. Examples include, 911 calls, closed circuit TV cameras, incident response teams, and automated incident detection algorithms based on loop detector data. Verification refers to confirming that an incident has occurred and refining and collection information on nature, extent, and location of the incident for an effective response. Transportation agencies used to verify incident include: cameras from traffic management centers and incident response units.

The dispatch of necessary resources after verification of an incident refers to response to the incident. The response team contains appropriate personnel, equipment and materials as soon as sufficient verified information is available about an incident. Investigation of an incident refers to document the causes of traffic incidents, to assign liability, fulfill the requirement of insurance, etc. Incident clearance refers to

timely removal of any stalled vehicles, wreckage, debris, or spilled material from the roadway and the restoration of the roadway to its full capacity. Timely response and clearance are critical because every minute of a freeway lane blocked during peak periods results in additional 4 minutes of delay, during and even well after the lane is closed [18]. Site management refers to the management of resources to remove the incident and reduce the impact on traffic flow. In this stage involves coordination of activities by various responding agency personnel.

The traveler information stage involves disseminating incident information to road users, which is an essential element to traffic management. Variable message signs (VMS), radio broadcasts traffic news updates, and on-line services help divert to alternate routes. Figure 2.2 shows the reduction of incident delay because of the reduction in traffic demand at the incident location because of diverting traffic to alternative routes.



**Figure 2.2 Effect of Demand Reduction in Incident Delay [25]**

An effective traffic incident management program results in several qualitative and quantitative benefits. The quantitative benefits include: reduction in delay, improved reliability of travel times, reduction in fuel consumption, improved air quality, reduction in occurrence of secondary incidents, and improved safety of respondents, and motorists. Qualitative benefits include: enhanced traveler information services, increased driver warning capabilities, improved coordination and cooperation of response agencies, improve public perception of agency operations, and reduced driver frustration.

The Maryland State Highway Administration (MSHA) has conducted a comprehensive evaluation of its incident response and management program, named CHART (Coordinated Highways Action Response Team). The findings show significant reductions in traffic delay, fuel use and air pollutant emissions [21]. The estimated benefit/cost ratio was 15.20. In a recent annual report published by Houston TranStar (2009) estimated the annual benefit/cost ratio of incident management program to be 9.9.

A major accident may incur a number of secondary incidents due to a dramatic change in the traffic condition, such as the rapid spreading of queues. It has been reported that for each additional minute in primary crash clearance time, the likelihood of a secondary crash occurrence increased by 2.8 percent

[22]. There is no universal definition for secondary incidents, unless they can directly observed in the field. The following definitions are commonly used [21]:

- Incidents incurred within two hours from the onset of a primary incident and also within two miles downstream of the primary incident location; or
- Incidents incurred in the opposite direction that are within a half-hour from the onset of a primary incident and lie within either downstream or upstream of the primary incident location.

Informing drivers and keeping them upstream of a primary crash should reduce the likelihood of secondary crashes. Recent active traffic management strategies such as speed harmonization are effective in reducing the probability of secondary crashes.

Incident frequency and severity have major impacts on the travel time reliability along freeway routes. Figure 2.3 shows the number and duration of traffic incidents along a 14-mile stretch of Interstate 405 in Seattle, Washington during peak travel periods for the first four months of 2003 [24]. The irregularity in incident occurrence can be seen in the frequency and duration of traffic incidents. The variation in traffic incidents shows, some days are relative incident-free while others have numerous traffic incidents. Travel time report from another major commuter route (11.5 – mile segment of SR 520) in Seattle, Washington shows that the longer travel time is 37 percent longer with the presence of incidents. If there was no congestion travel times would be approximately 11.5 minutes. On other days, the average travel time was 17.5 minutes. But when Incidents are present, it could take nearly 25 minutes.

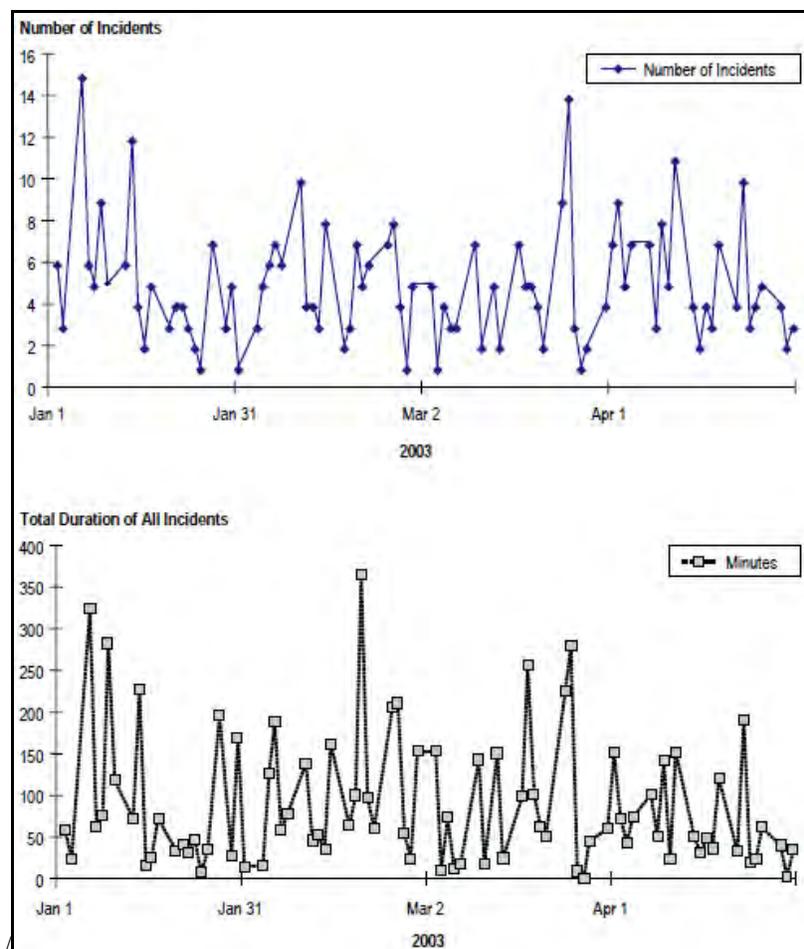


Figure 2. 3 Daily Variation of the Number and Duration of Incidents [24]

## CHAPTER 3

### IDENTIFICATION/CHARACTERIZATION OF SOURCES OF INCIDENT DELAY

Responding and clearing major incidents can be a complex logistical problem, involving cooperation, communication, and coordination between many different responders and agencies. Ensuring the right resources are identified, dispatched and arrive at the scene at the right time is critical to minimizing the time required to clear the incident scene. This requires clear and direct lines of communications between all incident responders, as well as processes and procedures that minimize potential sources of delays in getting assets to the scene.

One goal of this research effort was to identify and characterize sources (or causes) of incident clearance delay. To accomplish this, Texas Transportation Institute (TTI) researchers facilitated a series of regional “case study” workshops that examined potential institutional and operational Traffic Incident Management (TIM) challenges. The workshop had the following objectives:

- Identify and characterize the current sources of incident clearance delays in the region
- Identify potential strategies for reducing or eliminating sources of delay by identifying:
  - Activities that could be accomplished in less time
  - Activities that could be accomplished concurrently instead of sequentially
  - Activities that could be potentially be postponed to a less critical time
- Identify potential performance measures to be used to measure the effectiveness of the entire incident management response process and program, from a regional perspective versus an agency perspective

#### 3.1 Structure of the Workshops

The workshops used scenario-based exercises to identify emergency response processes and to develop reporting/notifications timelines and relationships. The scenarios focused on the more severe types of incidents (i.e., injury crashes, fatality crashes, hazardous material spills, etc.) typically classified as major incidents. The workshop agenda is shown in Figure 3.1. A copy of presentation and the scenarios scripts are provided in Appendix A.

Each incident scenario began with a description of the event. Workshop participants were prompted for responses to a variety of procedural questions related to incident detection and verification, response, site management, clearance and recovery, and traveler information (if time allowed). Workshop participants were asked to speak to the typical response actions from their experience at similar incidents and their level of familiarity with the opportunities and constraints presented by the road environment at selected locations (e.g., alternate routes, narrow shoulder). Each incident scenario included a timetable that provided elapsed time in 5-minute intervals since the incident occurred and prompted the workshop participants to list independent and concurrent activities and their respective durations. This exercise format was intended to:

- (1) identify activities that could be accomplished in less time,
- (2) identify activities that could be accomplished concurrently instead of sequentially
- (3) demonstrate the magnitude of time-savings that could result through implemented improvements.

**REGIONAL TRAFFIC INCIDENT MANAGEMENT RESPONSE ISSUE**

**IDENTIFICATION WORKSHOP**

**AGENDA**

A. Overview and Introductions (15 mins)	8:30 AM
B. <i>Incident Scenario #1: Injury Incident</i> (30 mins)	8:45 AM
<b>Break (15 mins)</b>	9:15 AM
C. <i>Incident Scenario #2: Major Incident with Fatality</i> (30 mins)	9:30 AM
<b>Break (15 mins)</b>	10:00 AM
D. <i>Incident Scenario #2: Major Incident with Fatality</i> (30 mins)	10:15 AM
E. <i>Incident Scenario #3: Multi-Agency Responses</i> (30 mins)	10:45 AM
F. <i>Adjourn</i>	11:00 AM

**Figure 3.1 Agenda for Regional TIM Response Identification Workshop**

Representatives from each of the major incident responder agencies within each Caltrans District were invited to attend. Agencies represented in each workshop included Caltrans Traffic Management and Maintenance, California Highway Patrol (CHP), dispatch, state and local fire departments, county and city law enforcements, local and regional public-safety answering points (PSAP)/911 dispatch centers, Caltrans Hazardous Material Teams, local towing companies and associations

**3.2 Summary of the Workshop Findings**

**3.2.1 Dispatch and Notification Procedures**

One purpose of the first series of workshops was to examine the procedures and lines of communications associated with responding to major traffic incidents. This process is very complex and varies considerably among incidents and can also vary from each Caltrans district.

Figure 3.2 shows the general notification lines of communications associated with major traffic incidents. For most incidents, the process begins with a call from a driver to a 911 Public-Safety Access Point (PSAP). These calls are automatically relayed to the either a county or CHP dispatch depending upon the location from which the call was initiated. Call takers are responsible for taking essential information such as the location of the incident, a general description of the incident, the number of vehicle involved, and the potential for any injuries and/or fatalities. If the caller identifies potential injuries, the call is immediately forwarded to medical dispatch for further details.

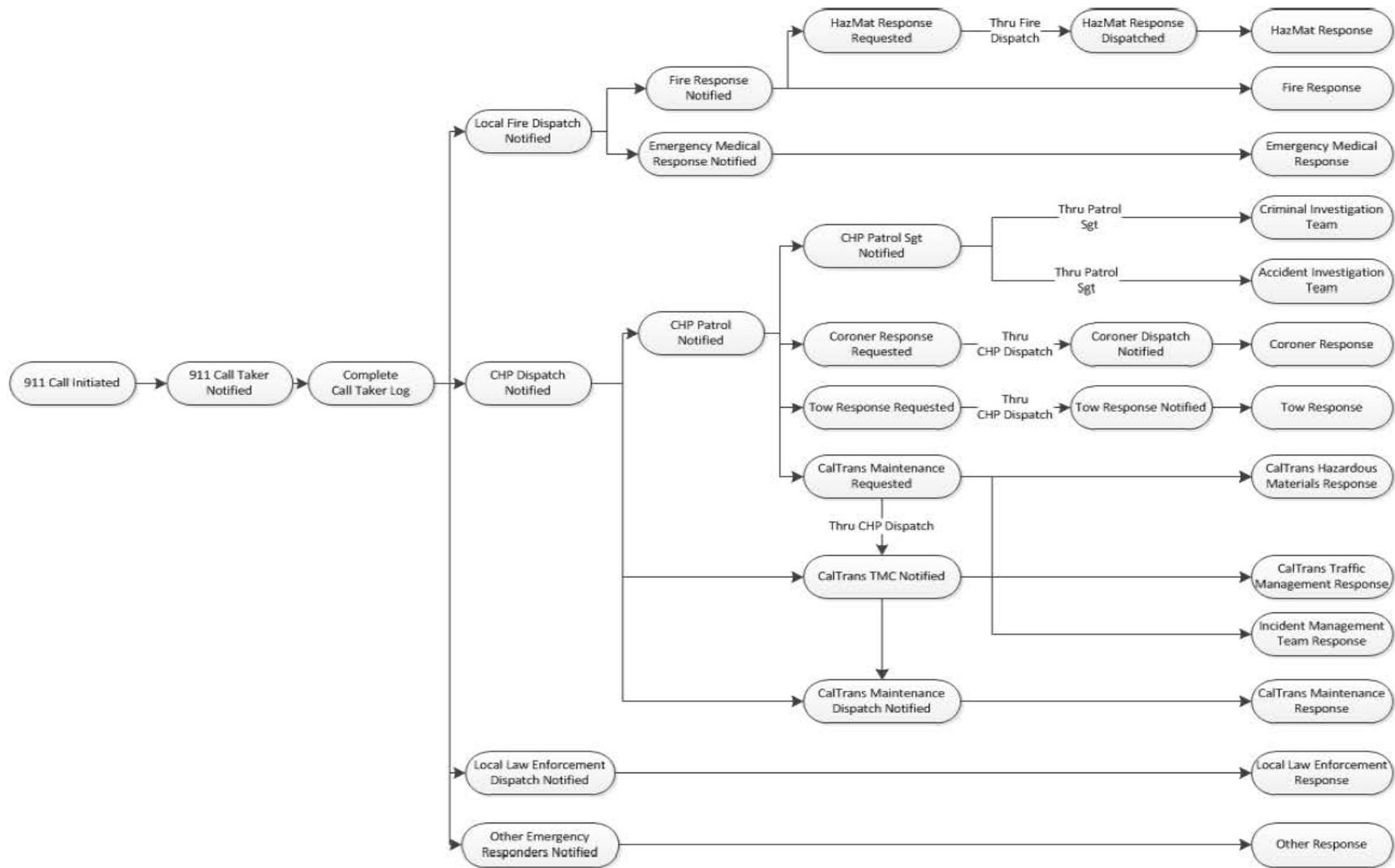


Figure 3.2 Typical Notification Tree for Major Incident Involving CHP, Caltrans, and Others

In cases where the incident is on a state highway, the local PSAP will forward the call to CHP dispatch for further processing. CHP dispatch will obtain additional details about the incident and then will broadcast a call for available units to respond to the incident scene. Usually, the nearest available units will respond to the incident. Depending on the location of the incident (i.e., whether it is in an urban or rural area), units generally arrive on scene within 5 to 10 minutes. For most major traffic incidents, multiple units are likely to respond during normal work hours; however, during the night time, only a single CHP unit may respond. Similarly in a rural area, the response time is usually about 20 minutes. Frequently, local law enforcement units that are closer to the scene may respond to secure the scene (particularly in rural areas) until CHP arrives, but will hand over the scene to CHP when they arrive.

Medical personnel are generally dispatched to all incidents where potential injuries exist. When the medical emergency personnel receive the dispatch, they will confirm the details of the incident and get additional details regarding injuries to assess the type of response. The number of responding medical units that are dispatched to the scene depends on the number of reported potential injuries. In some cases, medical and fire are dispatched from the same location and share computer-aided dispatching (CAD) system, so any notes or additional information entered by medical dispatch is available for other vehicle to see and use.

Caltrans response is initiated in several ways. Generally CHP dispatch will notify the Caltrans Traffic Management Center (TMC) when a major incident occurs. Depending on the availability of video camera in proximity of the incident scene, TMC operators will perform a visual confirmation of the incident and then notify Caltrans maintenance dispatch. Caltrans will also dispatch local Traffic Management Teams (TMT) or service patrols to the incident scene. These individuals can assist CHP secure the incident scene by establishing proper lane closures.

Once the initial response has been dispatched and the traffic control has been established on scene, the Caltrans TMC will then notify Caltrans maintenance about the incident. At this time, Caltrans maintenance supervisors will begin formulating their response based on the initial information provided from the scene. In some districts, Caltrans supervisors have the ability to monitor CHP radio traffic. They will frequently use information they hear from the radio to begin their response before being notified by the TMC. The TMC will then begin the process of implementing response message of Caltrans dynamic message signs located in the immediate area around the incident scene. For most major incidents, a Caltrans maintenance supervisor will be present on scene to monitor the situation and provide technical assistance at the request of CHP. Maintenance teams will be dispatched to most major incidents, depending on the scope of the incident and the estimated duration to clear the incident.

### **3.2.2 Injuries and Fatalities**

For incidents involving injuries and/or fatalities, the initial process for detecting and dispatching an initial response is the same regardless of whether an injury or fatality has occurred. With cases where possible injuries or fatalities are reported, additional medical units are frequently dispatched to the scene. In some jurisdictions, a fire chief is also dispatched to the scene to provide additional logistical support. The first medical response team arriving on scene will appraise the situation and assess the need for additional support. These initial responders will ask for additional assistance if it is needed or cancel the additional units in route if they determine they are not needed on scene.

In the case of fatalities, CHP is responsible to notify the coroner when a fatality has occurred at the incident scene. Unless it is obvious that the collision resulted in a fatality, the CHP on-scene incident commander will generally wait to request a coroner until the medical first responders have confirmed that fatalities are present. At that point, the CHP on-scene incident commander will then notify the CHP dispatch that a coroner is needed on scene, and CHP dispatch is then responsible for notifying the coroner.

The response times and process for getting the coroner to the scene can vary greatly from county to county. In the more rural counties, the response time of the coroner will often depend on the time of day at which the incident occurred and if the coroner is available to immediately respond to the request (e.g., not busy with another request). In the most urban areas, the coroner office generally has more than one individual who can respond to request. In these cases, the response time is generally the time required to the scene (assuming the personnel are available). In some districts, additional delays can occur with the coroner's response during non-work hours, as frequently, the coroner must first drive from their residence to the office to pick up the necessary equipment and then travel to the incident scene. Coroners frequently reported difficulties in accessing incident scenes due to congestion surrounding the scene. Coroners are not considered "first responders" and therefore do not have the same availability to access a scene rapidly as other first responders.

Once on scene, the coroner will begin their investigation immediately, generally starting with everything except the investigation of the victim. Usually, the examination of the victim does not occur until transport is available on scene. This is done so as to minimize distraction to motorists as the victims are being investigated. Generally, transport services are notified when the coroner is leaving for the scene. In some of the more rural counties, the coroner does not have the equipment to transport deceased individual and must rely on private entities (usually a mortuary or a private ambulance service) to provide transport, and some locations transport services are provided by contract.

Workshop participants also discussed the type of data collected on-scene by CHP and local coroners. Generally, the investigative process is divided as follows: CHP is responsible for investigating and determining the cause of the crash, while the coroner is responsible for determining the cause of death. While there is some overlap in the investigative process, each agency is responsible for collecting their own information and the sharing of data common to both investigations is generally not considered to be feasible or practical.

### **3.2.3 Home Storage Permits**

One issue that most districts reported as having a major change in their ability to respond quickly to incidents was the recent change in Caltrans policy regarding the home storage of Caltrans maintenance vehicles. Prior to the administrative change, many maintenance supervisors were able to take their vehicles home with them at the end of their normal work day. This allows them to leave their place of residence and travel directly to the incident scene when notified of an incident. Radios in the vehicles were also used to gather additional information about the incident and coordinate response assets prior to traveling to the incident scene. With the restriction on the number of home storage permits, some maintenance supervisors are no longer allowed to take their vehicle home with them at the conclusion of their work day. When an incident occurs during non-working hours, the maintenance supervisors are now required to first go to the maintenance facility to retrieve an official vehicle before initiating a response. As maintenance supervisors are critical in determining what roadway repairs are needed to get the roadway open after an incident, the additional travel time to the incident scene can cause increases in initiating a response by Caltrans maintenance forces.

### **3.2.4 Performance Measures**

General consensus existed between the incident responders that having good performance measures was critical in determining how to improve the incident response; however, the participants noted that many factors, some of which are beyond their ability to control, can influence response times. It was noted in the workshops that not all requests for actions and responses were coordinated through the Caltrans TMC or dispatch. Therefore, records of when response assets were requested, when they arrived on scene, and when they left the scene often resides in multiple locations. This information was often located in different databases making it difficult to generate a clear and accurate timeline for all events.

## CHAPTER 4

### DATA ANALYSIS AND EVALUATION

This Chapter describes the data collection, processing and analysis of the major incidents in three Caltrans Districts: 3 (Sacramento), 4 (Bay Area) and 6 (central Valley).

#### **4.1 Identification of Data Resources and Responsible Agencies**

The data list for the project included incident reports from California Highway Patrol (CHP) and Caltrans within Districts 3, 4, and 6, as well as modified incident reports from the Performance Measurement System (PeMS) database. Supplemental information was obtained from local coroner offices and fire departments. It was the hope to get more information from all coroner offices within the three districts as well as information from Hazardous Material (HAZMAT) teams, local fire and ambulance, and tow services. Both data quality and consistency continue to be significant obstacles when trying to assess stakeholder performance for clearance time of major incidents. However, with the advent of the PeMS database and the transfer of portions of CHP incident logs to the public domain, the task has become somewhat easier for the analyst. Examination of incidents that had HAZMAT concerns were also easier due to Federal requirements that an incident log be recorded when a HAZMAT situation occurs; these logs were found in the Caltrans Integrated Maintenance Management System (IMMS) system.

The following is a list of sources used in the data analysis portion of this report, followed by individual components taken from each source.

#### **List of Data Sources and Components Utilized**

1. Caltrans Major Incident Database (MIDB)
  - A. Beginning and End of Incident
  - B. Type of Incident (HAZMAT, fatality)
  - C. Qualitative Incident Description
  - D. Caltrans Notification and Arrival Times
  - E. Incident Location and Milepost
2. Caltrans Incident Dispatch Logs
  - A. Beginning and End of Incident
  - B. Caltrans Notification and Arrival Times
  - C. Stakeholder Arrival and Departure Times
  - D. Incident Location and Milepost
3. Caltrans Traffic Accident Surveillance and Analysis System Database (TASAS)
  - A. Beginning and End of Incident
  - B. Type of Incident (HAZMAT, fatality)
4. Caltrans Integrated Maintenance Management System (IMMS)
  - A. HAZMAT Stakeholder Arrival and Departure Times
5. PeMS Incident Database
  - A. Beginning and End of Incident
  - B. Stakeholder Arrival and Departure Times
6. CHP Computer Aided Dispatch (CAD) Logs for Caltrans District 3
  - A. Beginning and End of Incident
  - B. Stakeholder Arrival and Departure Times
7. CHP CAD Logs for Caltrans District 4
  - A. Beginning and End of Incident
  - B. Stakeholder Arrival and Departure Times

8. City of San Mateo Fire Incident Logs
  - A. Fire Arrival and Departure Times
9. Fresno County Coroner Incident Logs
  - A. Coroner Arrival and Departure Times
10. Contra Costa County Coroner Incident Logs
  - A. Coroner Arrival and Departure Times
11. Marin County Coroner Incident Logs
  - A. Coroner Arrival and Departure Times
12. Fatal Accident Reporting System (FARS)
  - A. Quantity of Fatal Incidents by Year
13. Caltrans Traffic Data Branch
  - A. Freeway Traffic Volumes
14. United States Decadal Census
  - B. County Population Data

In regards to the data components, there are three main data points that have differing levels of reporting accuracy:

1. Start of Incident
2. All Lanes Open
3. End of Incident

The most consistent and easily obtained data point is “all lanes are open” time point, which for the purposes of this report is utilized as the end of the incident. This is when the CHP officer at the scene reports to Caltrans and/or his/her dispatch that all lanes are open, although this does not necessarily mean that traffic is at free flow. Caltrans logs and CHP logs corroborate this time point with a high degree of accuracy. The second point, the official start of the incident, is available but not as easily identified. Very often, Caltrans may start their incident report significantly after the actual start of the crash even in a major incident (usually when Caltrans gets notification). On multiple occasions, fatalities were confirmed by a responsible party (either a Cal Fire paramedic or an ambulance paramedic) prior to the start of the incident on the Caltrans log. However, the Caltrans log will note the beginning of the incident from CHP on the incident log activity list, typically in the first few lines of activities. This time is the actual start of the incident, but requires the analyst to request physical files from Caltrans to see the activity list. Lastly, the third data point of end of incident is sometimes much harder to find. Caltrans logs do not note activity beyond all lanes open, even if emergency workers are still in the shoulder/median. If Caltrans remains to work in the shoulder or median to deal with fencing or other cleanup, this is sometimes noted. CHP logs do not necessarily note additional time beyond all lanes open, if it is not their equipment.

Logs and data points from other stakeholders were very difficult to obtain, however when this information was available it added greatly to the creation of the incident timeline. Information that proved helpful included both fire department and coroner records. The major impediment to obtaining this information was getting these specific stakeholders to actually respond to communication and do their own research. Where it was possible to have a one-on-one connection between the researcher and stakeholder, for example at a major incident workshop, the odds of obtaining helpful information improved dramatically. For most stakeholders, there is not enough manpower to do the proper research nor is there any political will to force them to do so. While Caltrans has been successful in attaching CHP incident logs to the PeMS database, Caltrans incident logs as well as other stakeholder information has not been attached. Behind all of these impediments are issues of privacy, which are to be expected. For example, CHP logs accessible through PeMS have a majority of the information regarding fatalities (time of death, arrival of coroner) scrubbed prior to being made available to the public. It is understood that this is a reasonable procedure particularly since fatalities are also crime scenes.

Secondarily, it was also found that there is an issue of geography in regards to reporting data. The investigation revealed that PeMS typically did not contain any information concerning crashes on state roads that were not on freeways. For example, most incidents on limited access state roads, such as SR 152 in the Central Valley, have not been reported to the PeMS database as frequently as incidents on state freeways or interstates. In counties that do not have interstates, particularly in the rural counties of District 3 (e.g. Yuba, Butte, Nevada), there was no clear way to access information on major incidents. This in part stems to differences in response, as on occasion the county sheriff and Cal Fire will arrive significantly earlier than CHP, and the nature of coroner services and HAZMAT teams being on contract.

#### **4.2 Data Quality and Consistency Issues**

This section addresses the following key questions regarding incident data:

1. What is the quality of each data set?
2. Can data sets be linked and compared to eliminate disparities?
3. Are there institutional issues for integration?

The limited data from the primary responders (Caltrans and CHP) was generally of a quality good enough to be analyzed. Independent time stamps from IMMS, the Caltrans Major Incident Database (MIDB), Caltrans dispatch, and CHP generally were consistent within five to ten minutes when documenting arrivals and departures from the scene. Comparison of these data sets was done by hand as the formats of each set were different. Formats ranged from spreadsheets, PDF files, or just paper records. It is unclear whether the formats can be reconciled, meaning whether data output that comes in fixed form (e.g. PDF) can also be extracted in a form that can be modified, such as a spreadsheet or another database format. It is likely not cost effective to utilize scant financial resources to try and formalize a specific electronic format as opposed to requiring stakeholder responders to submit information to Caltrans databases.

While the primary responder data was of sufficient quality for analysis, there was still a significant amount of scrubbing was undertaken to remove bad data points. Many of the incidents had incomplete information involving time stamps and were removed from the data set. This scrubbing effort also included those incidents that were caused exclusively by natural disasters or road closures that were completely out of Caltrans' control. Natural disasters include snowfall, rock fall, mudslides, and floods; for example within District 6 there were snowfall events in 2011 that closed state highways for multiple days. Other events outside of Caltrans' control that were removed include fires and police actions that required road closures. However, as will be discussed further, other atypical incidents remained in the analysis. This included power lines falling onto the road, cargo being dumped on the road while traffic is moving, or someone taking their own life by jumping into the path of a moving vehicle.

Data from independent stakeholders were underwhelming, mostly due to a lack of data as opposed to poor quality. Although some stakeholders were very helpful in accommodating Caltrans requests, most did not respond which has left the researchers to rely on the beginning and end of the incidents, as well as CHP data. Without independent time stamps from tow services, fire, ambulance and utilities, it is very difficult to create a comprehensive timeline and the ability to check whether the data is consistent. This highlights the need to institutionalize the data gathering effort into one portable CAD data file (or similar system) accessible by Caltrans and CHP. Even with the limited data currently available, trends have already appeared and will be addressed upcoming in this report.

Institutional concerns within the data collection process are not insurmountable. A clear path to improving research on crash analysis would be to agglomerate all of the resources into one database. The existing Caltrans Traffic Accident Surveillance and Analysis System Database (TASAS) database

at Caltrans could serve as the basis for a much larger set of information. The State of California could require that all parties involved in the incident report crucial time points to the editors of TASAS in a web-based form. For example, all rotational tow units would have to log in when they were called, when they arrived, and when they finished, similar to Freeway Service Patrol (FSP) inputs in the Ranger system. These forms would not have to be complex, and virtually all of this information is already written down somewhere in stakeholder logs. With the advent of smart phones and computer tablets, this could all be done from the driver's seat of the emergency vehicle. Within Caltrans District 4, the Metropolitan Transportation Committee (MTC) is already experimenting with this sort of smart phone app based product for incident management. Staffers at Caltrans who are responsible for managing TASAS would not gain additional work from this task if it were appropriately automated.

At a lower level, very often at the Traffic Management Center (TMC) Caltrans and CHP work in very close proximity. At the least, Caltrans and CHP should always reconcile the end time for the TASAS database by noting it in the activities log similar to the start time. In terms of the other stakeholders, it is likely that each one, particularly those other than Cal Fire, utilize their own specific paper form. Due to the inability by researchers to get information from other stakeholders, it is hard to know where their information is catalogued. These additional stakeholders include fire, coroner services, HAZMAT contractors, specialty towing, utilities, and freeway service patrols tow services. Again, when face-to-face contact was made between the researchers and the stakeholders at workshops and meetings, progress was usually made. However, without that contact, stakeholder response was very low, virtually negligible. Since rural stakeholders had the lowest response rate and rural incidents are not always posted on the PeMS database, responses and timelines based on rural results were limited. Many rural stakeholders are contract workers and data from those sources proved to be one of the most difficult tasks when trying to create the proper incident timeline. The only exception to this rule, as has been stated before, was involving HAZMAT incidents, where in many cases Caltrans documented the call and arrival of HAZMAT contractors in the IMMS system.

It has been emphasized by stakeholders within Caltrans and state government that coordination among different responders is the most important piece for creating an accurate timeline. Caltrans and CHP, when possible, note the arrival and departure of responders but automated coordination will be the true breakthrough in this effort. Perhaps with accurate GPS each incident will have a specific responder page with individuals logging in by tablet devices installed in vehicles. The GPS tracking will be able to tag when the vehicle arrived at the scene. When the incident was cleared, the responder would log out of the incident page, returning to privacy. The benefits to having this data in one place are substantial. Caltrans would be able to see performance and would be able to identify areas of concern and help individual districts improve specific issues that appear on the timeline.

#### **4.3 Summary of Findings from Data Analysis**

A basic dataset was created consisting of all major incidents in Caltrans Districts 3, 4, and 6 from January 2011 to April 2012. Major incidents as defined in this project and included in the dataset either took 90 minutes or more to clear or those that required the response of multiple agencies such as Caltrans and CHP. The duration of an event was defined as the time between the first notification by any responsible party, typically CHP or the TMC cameras, and the time of all lanes open as reported to Caltrans by either CHP or the Caltrans maintenance staff on scene. Caltrans may be present at the incident for much longer or shorter than the overall duration shown in the findings. Many times, even though all lanes are open, Caltrans will continue to perform cleanup or reconstruction of safety devices (e.g. guardrail) in the shoulder. There were incidents with long durations because Caltrans had to close a lane to perform these actions and all lanes were not open for many hours even though the incident was cleared by CHP.

While the limited dataset from stakeholders other than CHP and Caltrans did reduce the strength of the findings, there were some notable results. They are listed as follows:

1) Clearance Times by Location

- Clearance times for major incidents were fairly similar across the three districts. In many examinations District 6 tended to have the longest clearance times which can be attributed to the rural nature of the district; the increased clearance time was not statistically significant, however.
- By county, the median clearance times were clearly the lowest in the urban counties of District 4. For three counties within District 4, there was significance of one standard deviation as compared to some rural counties in District 3 and 6.

2) Caltrans Response

- There was a possible significant difference in the time from the start of the incident to Caltrans notification in District 6. Median times were 10 minutes longer than in Districts 3 and 4.
- There were no differences in time among districts between the start of the incident and Caltrans arrival.

3) Attributes of the Worst Incidents

- Incidents with the longest duration always involved big rigs with HAZMAT or a utility being impacted.
- Fatalities were not commonly found when examining the Top 10 worst incidents by District. Detailed data from the Fresno County coroner supported this argument that fatalities are not the worst incident attribute.

4) Incidents Involving Fatalities

- Clearance times for incidents with fatalities were even across districts, indicating the ability of coroner contract services to meet the response times of the professional services.
- In comparing urban vs. rural, District 3 had a median increase in clearance time of 33 minutes, and District 6 had an increase of one hour. These were not statistically significant but are likely to be practically significant.
- The only freeway with a fatal crash rate that was significantly higher than the other freeways was Business I-80 / SR 51 in Sacramento.

5) Incidents Involving HAZMAT

- There is an enormous amount of variability in clearance times for incidents with HAZMAT. Most of that variability is due to whether or not a contractor is called (which dramatically increases clearance times) or if Caltrans can use in-house equipment to do the cleanup (which keeps the clearance time short).
- Caltrans response to HAZMAT is generally very good as long as the first responders know how to identify a HAZMAT situation.

6) Other Atypical Incidents

- Utilities are a huge drag on clearance times in all districts. In District 6 which had a majority of these incidents, the difference approached three hours which was one standard deviation above the District 6 mean.

#### 4.4 Detailed Findings

This section describes in detail the analysis of incident data. The findings are shown by level of refinement; the first results are those at the district level. In this initial set, the average, median (50<sup>th</sup> percentile) as well as the 95<sup>th</sup> percentile and standard deviation are shown to illustrate the reliability of the data. Data points within one standard deviation of the average represent approximately 70% of the data points. Many times incidents with multiple responders, particularly in urban areas, were well below 90 minutes and improved the statistical analysis for that particular region as they were still defined as a major incident. Therefore, results are shown at the district level with and without these

specific shorter incidents, as well as without the ten worst incidents to eliminate outliers as much as possible. The district effort was repeated by county. At the highest level of detail, one specific county (Fresno) was examined more closely. In all of these more detailed analyses, the average, median, and standard deviation were shown, as the 95<sup>th</sup> percentile in most cases was inappropriate to report and skewed due to sample size.

Following the area-wide analyses, the top ten incidents in each district were examined to try and determine trends for these outlier incidents. Lastly, three different categories of incidents, fatalities, HAZMAT, and atypical were analyzed separately. Fatal accidents include are self explanatory; for fatal incidents, enough information was available from CHP data and coroner services to create a timeline of events. HAZMAT incidents were defined by the broad Caltrans definition, if the “HAZMAT” tag was attached to the incident log then the incident was considered a HAZMAT even if Caltrans itself was able to perform the environmental cleanup. As will be stated later, atypical incidents are those that involved something unusual such as a power line falling onto the freeway, a police action, or a truck losing its cargo while moving.

#### 4.4.1 Incident Duration by Caltrans District

The results of the data analysis as obtained from Caltrans, CHP, and other sources are shown in the following tables. All values in all tables are shown in hours and minutes.

**Table 4.1 Incident Duration of Major Incidents by Caltrans District**

Caltrans District	Average	Median 50 <sup>th</sup> Percentile	95 <sup>th</sup> Percentile	Standard Deviation	Number of Samples
3	3:23	2:12	9:12	3:41	178
4	3:19	1:43	12:56	4:04	145
6	4:39	3:41	10:58	3:12	128

**Table 4.2 Incident Duration of Incidents Greater Than 90 Minutes**

Caltrans District	Average	Median 50 <sup>th</sup> Percentile	95 <sup>th</sup> Percentile	Standard Deviation	Number of Samples
3	4:16	2:54	11:30	3:58	130
4	5:31	3:37	15:42	4:34	77
6	4:53	3:53	11:06	3:10	120

**Table 4.3 Incident Duration of Incidents with Top 10 Longest Removed & All Over 90 Minutes**

Caltrans District	Average	Median 50 <sup>th</sup> Percentile	95 <sup>th</sup> Percentile	Standard Deviation	Number of Samples
3	3:25	2:48	7:03	1:47	120
4	4:04	3:16	9:45	2:31	67
6	4:11	3:35	8:22	2:05	110

The last table reveals that when you eliminate incidents less than 90 minutes, a product of district specific responder distance, as well as the ten worst in each district you are left with average and median response times that are fairly similar. Examining the medians, District 4 is approximately 28 minutes longer with District 6 approximately 47 minutes longer. District 6 is a more rural district which should lead to longer response times to major incidents. However, both Districts 3 and 6 are of similar and both contain freeways with a high percentage of trucks. The difference in response time between District 3 and District 6 may be due to the fact that District 3 has over twice as many counties (11 to 5) and many of the first responder services are county based. Additionally, a larger part of District 3 could

be considered urban.

#### 4.4.2 Incident Duration by County

Results by county are shown in the following set of tables. Incidents under 90 minutes were not excluded due to smaller sample size but percentage of these incidents is shown. Additionally, as a proxy for urban and rural the counties will be sorted by population density. It is important to note that with small sample size, incidents with long durations can have an outsized influence on averages, making the median perhaps a better data point for comparison. For example, the average duration in San Francisco of 5:47 (hh:mm) is skewed by only four samples of highly varying length. The crash durations ranged from 1:44 to 10:19, with the latter involving a long lane closure due to concrete damage on an elevated section of freeway.

**Table 4.4 Incident Duration by Caltrans District/County**

Caltrans district	County	Density Per Sq Mi	Average	Median 50%	Standard Deviation	Number of Samples	% > 90min
<b>3</b>	Sacramento	1400	3:19	2:46	2:32	55	80%
	Placer	230	5:07	2:37	6:48	28	79%
	Yolo	200	2:34	1:55	2:17	11	73%
	Sutter	160	2:15	2:16	0:59	8	75%
	Butte	130	3:40	2:27	2:53	9	66%
	Yuba	110	3:10	1:56	3:02	16	81%
	El Dorado	100	2:50	1:22	3:29	19	47%
	Nevada	100	2:47	1:35	3:05	19	58%
	Glenn	21	2:01	-	1:13	2	50%
	Colusa	19	2:53	2:56	0:59	8	100%
	Sierra	3	3:57	2:41	3:15	3	66%
<b>4</b>	San Francisco	17200	5:47	5:33	3:47	4	75%
	Alameda	2050	2:29	1:15	2:51	44	43%
	San Mateo	1600	2:51	1:47	4:02	17	53%
	Santa Clara	1400	5:36	3:40	5:40	26	77%
	Contra Costa	1300	2:42	1:28	2:57	16	44%
	Solano	460	2:17	1:15	3:09	8	50%
	Marin	300	5:02	3:24	5:38	6	50%
	Sonoma	270	2:33	1:19	3:36	18	44%
	Napa	180	1:26	1:22	0:37	4	50%
	<b>6</b>	Fresno	150	4:15	3:20	2:21	35
Kings		110	5:10	4:40	2:38	7	100%
Kern		100	5:28	4:21	3:54	52	92%
Tulare		90	4:24	3:43	2:53	22	100%
Madera		70	2:34	2:24	1:19	12	75%

As shown in Table 4.4, a much greater percentage of incidents in District 6 lasted more than 90 minutes resulting in a much higher median result. Not surprisingly, counties within District 6 cover a much larger area which would explain potential longer response times. However, density itself is not a good

proxy for median response time, as median response times in the smaller highly rural counties of District 3 were significantly less than those in District 6. For example, consider El Dorado County and Kern County, two counties of equivalent density. El Dorado County, at 1,700 square miles is long and thin with one major freeway, US 50, that is more easily covered by emergency services provided there isn't heavy snowfall. Kern County is over 8,000 square miles and has three major freeways, Interstate 5, State Route 99 and State Route 58, with in some cases hundreds of miles of farmland separating them.

An additional comparison might be to compare El Dorado County in District 3 with one of the worst counties in District 4, Santa Clara County. Both had similar numbers of major incidents, 19 incidents in El Dorado County and 26 incidents in Santa Clara County. However, half of El Dorado County's incidents were cleared in 90 minutes and over 75% of incidents in Santa Clara County required longer than 90 minutes to clear. Again, 18 out of 19 incidents in El Dorado County were on one 60 mile stretch of US 50, primarily a rural arterial, and many of them were single vehicle incidents. By contrast, Santa Clara County's incidents, by virtue of being on freeways, involved more vehicles.

#### 4.4.3 Caltrans Response

A subset of this district-wide analysis is to see how Caltrans specifically responds to incidents. By breaking down the response times by county, one might be able to see trends by region. The following table shows by district when Caltrans was notified and when they reported arriving at the scene.

The results reflect intuition that District 6, by virtue of being more rural, would have longer response times. One concern might be the median time from the start of the incident to Caltrans notification is similar in Districts 3 and 4, but over ten minutes more in District 6. While this is not statistically significant, it could very well be significant in practice. It is also worth noting that Districts 3 and 6 appear to be more reliable in that the standard deviation of the time from the start of the incident to the arrival of Caltrans at the scene is lower than the average, which indicates a tighter distribution of response times than in District 4. This agrees with intuition as the amount of total congestion in District 4 exceeds the other districts and Caltrans responders are more likely to be affected by said congestion even if the density of maintenance vehicles is as high as District 3. The following tables further break down the response times by county.

**Table 4.5 Caltrans Response by District**

District	Time from Start To Caltrans Notification				Time from Start To Caltrans Arrival			
	Average	St. Dev	Median (50%)	95 <sup>th</sup> Percentile	Average	St. Dev	Median (50%)	95 <sup>th</sup> Percentile
3	0:12	0:17	0:06	0:42	0:44	0:37	0:41	1:49
4	0:18	0:48	0:05	0:55	1:07	1:08	0:52	2:44
6	0:29	0:44	0:17	1:37	1:14	0:58	0:59	2:51

**Table 4.6 Caltrans Response in by County**

Caltrans District	County	Density Per Sq Mi	Time from Start To Caltrans Notification	Time from Start To Caltrans Arrival
3	Sacramento	1400	0:14	0:54
	Placer	230	0:08	0:45
	Yolo	200	0:02	0:41
	Sutter	160	0:15	0:41
	Butte	130	0:12	0:50
	Yuba	110	0:16	1:04
	El Dorado	100	0:08	0:20
	Nevada	100	0:13	0:27
	Glenn	21	0:23	0:30
	Colusa	19	0:18	1:10
	Sierra	3	0:06	0:13

4	San Francisco	17200	0:08	1:50
	Alameda	2050	0:09	0:53
	San Mateo	1600	0:11	1:03
	Santa Clara	1400	0:39	1:38
	Contra Costa	1300	0:10	0:50
	Solano	460	0:08	1:07
	Marin	300	0:21	0:51
	Sonoma	270	0:31	1:03
	Napa	180	0:16	0:59

6	Fresno	150	0:26	1:03
	Kings	110	0:13	0:46
	Kern	100	0:38	1:28
	Tulare	90	0:26	1:20
	Madera	70	0:18	0:49

**Specific Findings of Incident Duration in Fresno County**

To better understand the different types of crashes and their timelines, an in-depth examination of one specific county within District 6, Fresno County, was undertaken. Fresno County was chosen because, as a large Central Valley county, it has both rural and urban districts and a broad range of roadway types. Furthermore, Fresno County has a professional coroner staff that was able to provide the research team times from their incident logs. Fresno County is one of the largest counties in California at 6,000 square miles and has approximately 1 million people. Over 50% of this population lives in an around the city of Fresno which is near the geographic center of the county. On the western side of the county is heavily used farmland of the San Joaquin River and Kings River basins, while to the east of Fresno city rises the Sierra Nevada mountains which can incur winter conditions with heavy snows. Two major freeways, I-5 and SR 99, run through Fresno County as well as three other minor freeways (SR's 41, 168, and 180) spur from SR 99. Within the agricultural region there are also several high-speed arterials such as SR 33 and SR 145.

During the study period of January 2011 to March 2012, Caltrans recorded 40 major traffic incidents within the Fresno County jurisdiction. Within those 40, 6 incidents were removed because they were natural disasters such as floods, rock fall, snowfall, and landslides. Additionally 4 incidents were removed because their lengths were determined by factors outside of Caltrans' control, two building

fires and two police standoffs that required road closures. The incident duration statistics of the remaining 30 incidents are shown in the Table below. An additional row was added with the 5 worst incidents removed. Removing these incidents dramatically reduced the standard deviation bringing the average value within thirty minutes of the median value. However, when only examining the incidents that occurred in the middle of the night, with a small sample size there is a dramatic increase in clearance time. Stakeholders can take longer to arrive at the crash site, and particularly in the more rural crashes the volumes are very small at night and allow for methodical progress as opposed to the usual pressure of clearing the road as soon as possible. Aside from SR 99 and I-5, even with a lane closure traffic is not likely to be impeded late at night.

**Table 4.7 Fresno County Incident Duration**

District 6	Average	Median	Standard Deviation	Number of Samples
All 30 Incidents	4:18	3:18	2:29	30
Top 5 Removed	3:23	3:00	1:24	25
Start Time 23:00-6:00	5:19	4:37	2:42	6

The five incidents with the longest clearance times were all in excess of eight hours and all had unique circumstances which led to a longer clearance time. They are shown in the following table.

**Table 4.8 Fresno County Longest Incidents in Duration**

Date	Route	Duration	Causes
7/17/11	99	10:17	During CHP pursuit suspect hit pedestrian on ramp, fatality
1/8/12	168	9:16	Vehicle exits roadway destroys 100ft of guardrail, rural
1/25/11	99	8:48	Big rig overturns on off ramp dumping citrus cargo
12/6/11	198	8:17	Big rig overturns dumps sulfuric acid on the roadway
2/22/12	180	8:12	Vehicle hits big rig, three fatalities and truck on fire

Examining these five incidents, it is hard to see any obvious trends. If the police pursuit had not been required, the worst incident would not have occurred. This first incident appears to have specific characteristics as the coroner was not called until 6 hours after the incident was reported and they were told shortly after to stand down as the deceased party was transported to the hospital. The second incident was on a rural stretch of SR 168 where the lane closure to repair the guardrail did not impede traffic. The vehicle itself was over the side of an embankment requiring a special type of towing service that may have not been immediately available, as the location was in the mountains over 30 miles from Fresno. The third and fourth incidents had big rigs losing their cargo, one extremely hazardous and one fairly inert but took time for potential salvage. The last incident had a large homicide investigation required due to fatalities in both vehicles that had been totaled with the big rig involved on fire.

A further macroscopic examination of the 30 incidents revealed some minor trends. Fully 1/3 of the incidents were big rigs overturning on ramps, sometimes losing their cargo. Both incidents involving power lines had long delays of 3-4 hours exclusively because of the inability of the power company to get assets on the scene in a reasonable amount of time. External factors caused 3 incidents such as dense fog or something foreign on the road such as an oil slick. Lastly, there were 9 incidents with fatalities summarized in the table below. In the majority of the incidents, the time the injured party was declared deceased was very quick, and the coroner appears to both arrive on the scene and conduct their investigation quite quickly. In the one incident that took a significant amount of time after the coroner arrival (2/22/12), there were three fatalities in two vehicles. While the coroner service has been criticized by other stakeholders for affecting the ability to clear crashes quickly, it appears at least in

Fresno County the coroner is arriving as quickly as possible to work at the accident scene. The following table summarizes the incident responses within the study period.

**Table 4.9 Incidents with Fatalities in Fresno County**

Date	Route	Start of Incident	Time of Death	Coroner Called	Coroner Arrived	End of Incident
1/5/11	99	1:15	1:24	5:00	5:54	7:05
3/27/11	198	11:47	11:54	12:16	Unknown	14:42
6/29/11	41	0:13	0:17	0:30	1:15	2:53
7/6/11	41	11:01	11:10	11:50	12:27	13:37
7/17/11	99	15:28	22:10	22:20	Called off	1:42
9/14/11	99	16:22	16:31	16:40	17:30	18:14
9/16/11	41	21:03	21:16	21:30	Unknown	22:59
10/11/11	99	10:37	11:02	11:15	11:49	13:54
2/22/12	180	2:34	2:55	3:00	4:10	10:49

#### 4.4.4 Examination of Top 10 Longest Incidents by District

As stated before, incidents of extended duration often skew the average time to clear in a very adverse way. It is extremely helpful to examine these outliers, largely incidents that took longer than 10 hours, to try and identify commonalities and specific variables. The following table shows the 10 worst incidents in each district by duration.

The analysis of the data reveals a stereotypical incident of extended duration: a severe crash involving a big rig with possibly a HAZMAT situation or issues with utilities, specifically power lines. In all three districts, the worst incident of the study period was a big rig truck that required a HAZMAT response. Looking further down the list, big rigs were involved in 19 out of 30 incidents, almost 2/3 of all of the incidents and majority of those 19 involved HAZMAT or at the least losing the contents of the trailer. The other major factor, problems involving public utilities, consisted of a downed power line caused by bad weather, a fallen tree, or a vehicle collision or an issue with a natural gas line. What was not seen on these lists were crashes with fatalities, as only 4 out of 30 involved a fatality with none in District 4. Two incidents, including two of the fatalities, involved a CHP situation with a suspect.

**Table 4.10 Longest Incidents in Duration**

Caltrans District	Date	County	Route	Duration	Causes
<b>3</b>	8/23/2011	Placer	65	35:39	Big rig propane tanker on fire
	9/10/2011	El Dorado	49	14:55	Power lines fall onto roadway
	5/5/2011	Nevada	80	14:07	Big rig exits roadway leaking diesel
	12/27/2011	Yuba	70	13:06	Pickup truck hits power line pole
	11/13/2011	Sacramento	99	12:54	Car chase ending in fatality of suspect
	3/15/2011	Sacramento	99	12:11	Big rig exits roadway leaking diesel
	3/18/2011	Placer	80	11:57	Multi car & truck fatal crash, snow
	10/11/2011	Placer	80	10:57	Jack-knife big rig catches on fire
	9/30/2011	Sacramento	99	9:15	Jack-knife big rig
	5/19/2011	Placer	80	9:12	Big rig exits roadway hitting tree
<b>4</b>	7/18/2011	Santa Clara	101	20:18	Big rig crash with HAZMAT response
	2/2/2011	Santa Clara	130	18:02	Big rig exits roadway hits power lines
	10/4/2011	San Mateo	84	17:49	Power lines fall onto roadway
	3/12/2012	Santa Clara	101	16:06	Big rig dumps debris on roadway
	3/15/2012	Alameda	580	15:36	Oversized Big Rig exits roadway
	8/17/2011	Marin	101	14:46	Police standoff causes road closure
	3/22/2011	Santa Clara	152	13:46	Telephone lines fall on roadway
	10/20/2011	Sonoma	101	13:10	Big rig hits big rig, fuel HAZMAT
	3/6/2011	San Fran.	80	12:00	Jack-knife big rig leaking diesel
	2/17/2011	Sonoma	116	11:11	Trees fall in roadway
<b>6</b>	3/7/2012	Kern	5	17:29	Big rig brake fire, hauling HAZMAT
	11/29/2011	Kern	5	15:16	Jack-knife big rig on off-ramp
	4/25/2011	Kern	58	14:06	Car vs. Big Rig head on collision, fatal
	2/24/2011	Tulare	65	12:58	Transformer falls into roadway
	7/12/2011	Kern	119	12:20	Power line pole falls onto roadway
	8/27/2011	Kern	119	11:39	Power lines fall onto roadway
	3/29/2011	Kern	5	11:05	Big rig on fire carrying HAZMAT.
	4/8/2011	Tulare	99	10:47	Big rig crashes in work zone loses cargo
	6/15/2011	Kern	178	10:27	Ruptured gas line in work zone
	7/17/2011	Fresno	99	10:14	Police pursuit pedestrian fatality

**4.4.5 Examination of Incidents Involving Fatalities**

At the workshops in Districts 3 and 6, there were two types of incidents that stakeholders believed caused long delays. These were those involving a fatality and those requiring a HAZMAT clean up. As has been discussed elsewhere, there can be delays in both calling the coroner and the coroner arriving, particularly at night and in rural areas. It has been hypothesized that areas with professional coroner offices are much quicker at arriving at the scene than coroners and funeral services that are on contract. Additionally, coroners have stated that the congestion caused by the incident sometimes affects their abilities to get to the scene, as coroner vans do not necessarily have sirens, overhead lights, or power to move traffic without a CHP escort. Fatalities are a fairly delicate situation as the crash scene turns into a crime scene and privacy issues arise among stakeholders. It is important to note that a small but significant percentage of fatalities are suicides, typically jumping off a bridge. How California

addresses mental health and suicide prevention is beyond the scope of this report.

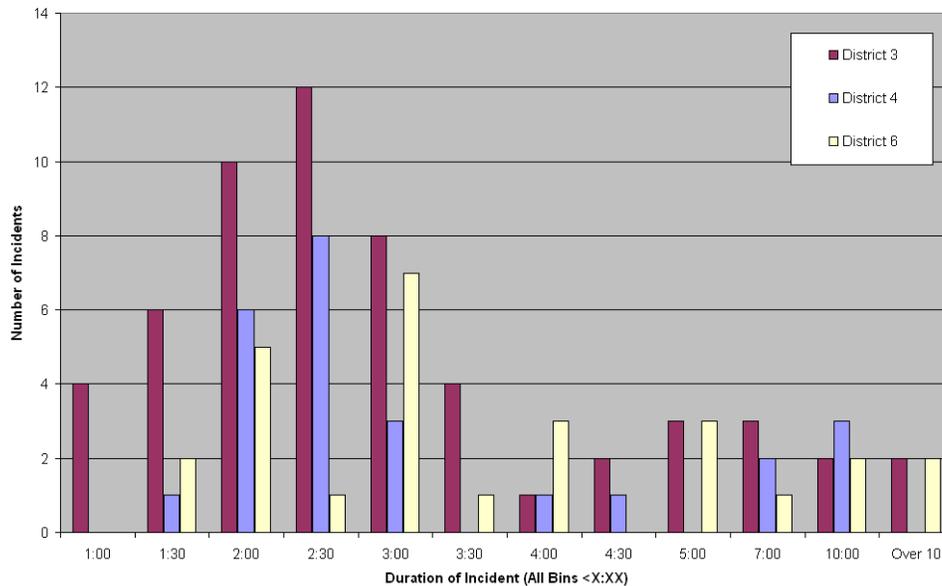
To create a timeline of a fatal accident, District 4 provided redacted CHP reports, and in District 6 the Fresno County Coroner was extremely helpful in providing information. Although information involving fatalities was usually scrubbed in the PeMS database, very often it was not scrubbed and proved helpful to constructing the timeline. The exception to this was in District 3, where not only virtually every incident was scrubbed PeMS but there was no assistance from outside stakeholders. This limited the sample size from that district for creating a timeline between the beginning and end of the incidents, particularly in the rural areas. The general problem of lack of reporting of incidents on state roads that are not freeways is especially of concern in District 3 where there are entire counties without interstate highways such as Sutter County and Yuba County. CHP was very helpful in utilizing their own records to fill in the timeline between time of death and the calling of the coroner for all districts. There are still not enough samples to make a judgment on the arrival performance of coroner services in District 3.

Nevertheless, with the start and finish of each incident as reported by the Caltrans incident logs some comparison is possible. The following table highlights the difference among districts and an overall comparison between night and day. Figure 4.1 shows the breakdown of fatal incidents by Caltrans District and clearance time.

**Table 4.11 Duration of Fatal Incidents by District and Time of Day**

District	Average	Median	Standard Deviation	Number of Samples
3	3:02	2:13	2:25	57
4	3:13	2:12	2:10	26
6	4:02	2:54	3:01	27
Overall Start 6:00-23:00	3:13	2:15	2:39	84
Overall Start 23:00-6:00	3:39	2:44	2:10	26

The median and average values of Districts 3 and 4 were virtually identical, which was a very interesting result considering coroner services in District 4 are entirely professional, while in District 3 many of the rural counties have coroner services on contract. District 3, particularly Sacramento County, had a much higher number of fatal incidents, although most of them were cleared fairly quickly. Length of incident is shown in the figure below with the length put into different bins. District 6 again lagged from 40-60 minutes, which again reflects the distances from county centers. Even in the rural counties of District 3, the actual sizes are small and therefore the contract coroner does not have very far to go. In Kern County coroner services based in Bakersfield might have to travel as far as 60 to 80 miles without leaving the county boundaries. Kern County also had the most severe fatal crash in terms of length of incident, the 14 hour incident on SR 58 described in the Top 10 section when a big rig hit a passenger vehicle head on and jack-knifed. In terms of time of day, it was expressed by stakeholders that night time calls took much longer because of wait time on coroner services and the data confirms an increase in the median by 29 minutes for those incidents starting between 23:00 and 06:00. However, this increase is perhaps less than the qualitative estimate presented by the stakeholders and is not statistically significant as it is well within the standard deviation of both samples.



**Figure 4.1 Fatal Incidents by District and Clearance Time**

#### 4.4.6 Timeline of a Fatal Incident

To create a timeline of the fatal incidents three different time points were taken from the data sources; confirmed death, request for coroner, and the arrival of the coroner. It was hoped that a fourth data point, the completion of the coroner investigation, would also be available but this was rarely recorded. Additionally, in some instances, the confirmed death and request for coroner were at the same point in the CHP logs (“Confirm 1044 Required Coroner”). Generally there was some lag from the official time of death to calling the coroner, which is to be expected as the crash shifts from simply an incident to a crime scene. As stated previously, help from CHP staff and their CAD logs enabled the authors to fill in the time line from the start of the incident to the calling of the coroner for all districts. However, in terms of response times for coroner service, the sample size was only large enough in District 4 and District 6. The following table describes the timeline of fatal incidents during the study period.

**Table 4.12 Timeline of Fatal Accidents by District**

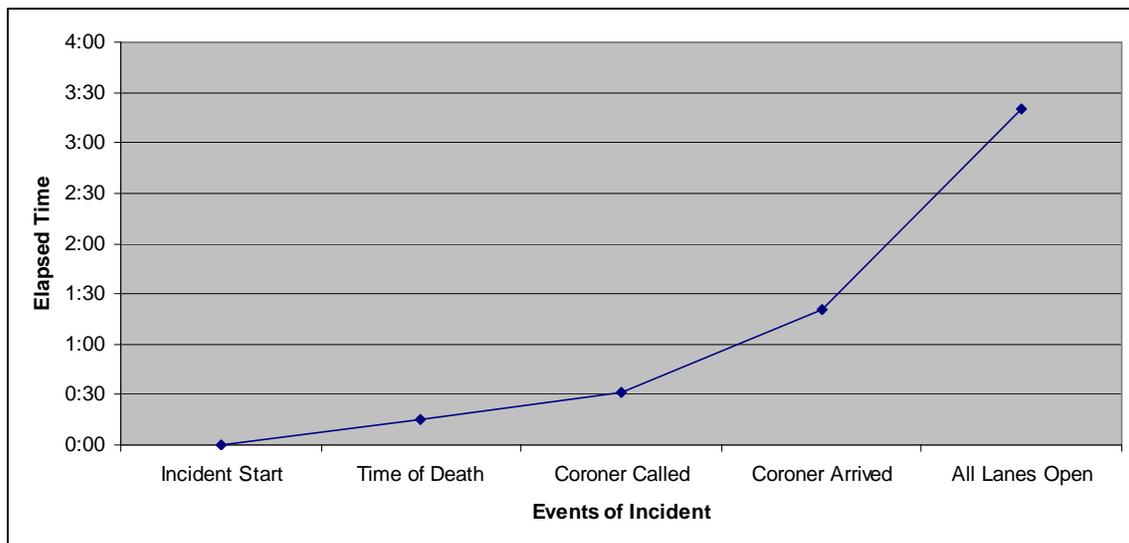
Fatality Timeline		Average	Median	Standard Deviation	Number of Samples
Start to Confirm	District 3	0:16	0:10	0:23	57
	District 4	0:10	0:09	0:10	18
	District 6	0:17	0:14	0:11	18
	Overall	0:15	0:11	0:19	93
Confirm to Call	District 3	0:19	0:12	0:27	39
	District 4	0:09	0:07	0:08	16
	District 6	0:14	0:13	0:10	13
	Overall	0:16	0:11	0:21	68
Call to Arrival	District 3	1:01	-	0:20	2
	District 4	0:49	0:43	0:25	12
	District 6	0:48	0:47	0:13	6
	Overall	0:50	0:47	0:21	20

The values across the three districts are fairly consistent, indicating a reasonable level of response from coroner services that can be expected in the event of potential fatality on the freeway. An important note is that a vast majority of the incidents in this data set, as opposed to the previous table, were in urban areas or relatively close to coroner teams. For example, in District 6 although Fresno County is almost 6,000 square miles including borders with multiple national parks, virtually all of the fatal incidents with more detailed data occurred near the City of Fresno. There were also several incidents, particularly in rural parts of District 3, where the confirmation of fatality precedes the start of the incident by CHP. This indicated a situation where the ambulance or another responsible party arrived prior to CHP, and these situations were coded with a value of zero between the start of the incident and the time of death.

As the data across districts is fairly uniform, we can construct a basic timeline of events when a fatality occurs at an incident in California. However, without seeing the logs of other services such as tow it is unclear whether the time to clearance can be decreased without comprising the investigations of CHP and the coroner. One might presume the investigation is critical path. In most cases where the duration of the fatal incident far exceeded the median, other special circumstances such as a fire or HAZMAT were indicated in the incident description. Below is an average timeline in text form and in graphical form (Figure 4.2).

### Timeline of an Average Fatal Incident

- 0:00** Incident Start according to CHP, noted as 1179 (Ambulance Needed) or 1180 (Major Injury), with possible 1144 (Fatal Accident)
- 0:15** Confirmed Time of Death (1144) by paramedics
- 0:31** Coroner service is called
- 1:21** Coroner arrives at scene
- 3:20** All lanes open



**Figure 4.2 Average Cumulative Time for a Fatal Incident**

### 4.4.8 Fatal Incident Response Rural vs. Urban

Stakeholders have questioned how much the location affects incident duration when requesting coroner services. By examining the location description, one can classify fatal incidents into categories to see whether urban vs. rural is an actual concern. The determination of whether a fatal incident is truly rural

was left to engineering judgment. Typically, if an incident location was within 5-10 miles of a major city, depending on the roadway, the incident was considered urban. District 4 was not included in this comparison as the only two truly “rural” incidents (Route 1 in Sonoma County and at the Pacheco Pass in Santa Clara County) did not have proper start and finish information. Colusa County and Sierra County within District 3 were considered rural in their entirety and all six fatal incidents within the study period were included. Although District 6 has the largest counties with perhaps the longest distances between population centers, the percentage of rural fatalities was only about 1/3. The following table highlights the difference in clearance times for Districts 3 and 6.

**Table 4.13 Comparison of Clearance Times with Fatalities, Rural vs. Urban**

District	Average	Median	Standard Deviation	Number of Samples
3 – Urban	2:56	2:10	2:26	36
3 - Rural	3:13	2:43	2:26	21
6 – Urban	3:28	2:40	2:31	17
6 - Rural	5:00	3:49	3:39	10

The difference appears to be quite pronounced in District 6, more so than District 3. However, due to sample size, there is a bit of exaggeration due to one specific incident in Kern County. This incident, located on SR 58 on the incline of Tehachapi Pass approximately 15 miles east of Bakersfield, had multiple fatalities and took fourteen hours to clear. As a result, in this specific analysis utilizing the median values might prove beneficial; the values show an additional 33 minutes in District 3 and 69 minutes in District 6. While these values are well within the standard deviations and are not statistically significant increases, they might be viewed as significant in practice however.

#### 4.4.9 Fatal Incident by Location

As shown in the previous charts, there are differences in overall numbers of fatal incidents by district, but these cannot be taken at face value without an investigation of volumes and lengths. A road with higher volume may seem more dangerous due to a higher number of incidents, but the calculations may reveal it is in fact safer. During the study period, District 3 had as many fatalities as District 4 and District 6 combined. To answer the question of are there certain roadways in District 3 that are more likely to generate fatalities, fatal incident rates were calculated utilizing the standard practice of crash rates. Only roadways with more than four fatal incidents were selected to decrease variability; there were fourteen such roads. The calculation is shown below:

$$Crash\ Rate = (N \times 1,000,000) / (L \times V \times 455) \quad (4-1)$$

Where:

N: the number of incidents

L: length of the roadway segment (miles)

V: the average daily traffic (AADT) on the freeway segment (taken from the 2011 Caltrans volumes)

The results from the calculations are shown below in the following table.

**Table 4.14 Fatal Crash Rate**

Freeway / County	District	Number of Incidents	AADT	Length of Roadway (miles)	Fatal Crash Rate	Average Time to Clear
SR 51 / B-80	3	8	125,000	9	0.0313	2:42
SR 49	3	6	20,000	70	0.0189	1:54
I-5 Rural (Colusa)	3	4	28,000	34	0.0185	2:51
SR 99 Rural (Butte, Sutter)	3	7	35,000	85	0.0103	1:54
SR 99 Urban (Sacramento)	3	8	120,000	30	0.0098	4:11
SR 20	3	5	30,000	100	0.0073	3:21
I-80 Rural (Placer, Nevada)	3	7	50,000	100	0.0062	3:34
I-5 Urban (Sacramento, Yolo)	3	8	100,000	64	0.0055	4:02
US 50 Urban (Sacramento)	3	5	180,000	30	0.0040	2:19
I-80 Urban (Alameda, San Francisco)	4	5	180,000	55	0.0022	2:02
I-880	4	4	190,000	46	0.0020	4:10
SR 99 (Fresno, Tulare)	6	6	70,000	150	0.0017	5:19
US 101	4	4	180,000	125	0.0008	2:36
SR 41	6	6	35,000	125	0.0060	2:19
				Average	0.0089	3:05
				Standard Deviation	0.0086	1:02

As expected, all of the crash rates are extremely low, with an average of 0.0089 fatal incidents per million miles traveled on the fourteen corridors. However, one roadway, the SR 51 portion of Business Route 80, stands out as being the only freeway corridor two standard deviations above the mean. This may imply some significance that the freeway is somewhat more dangerous. As will be discussed further in the comparison of the Caltrans Major Incident database (MIDB) with the Federal database known as the Fatality Analysis Reporting System (FARS), the rural vs. urban difference might be explained by the ability to exclude fatalities that did not require Caltrans support. SR 51 / Business 80 is exclusively an urban freeway and it is likely that all crashes with fatalities would need Caltrans for traffic control.

However, when examining the clearance times, which is the focus of this report, there are no obvious trends. Due to the small sample size per corridor, an incident of extended duration had an outsized effect on the corridor averages. An example of this would be the 10 hour incident in Fresno which skewed the average by over an hour. The expectation is that incidents within urban areas would be cleared faster due to more access to emergency services, and urban I-80 in District 4 was one of the lowest in the table. Nevertheless, some rural corridors also performed very well, such as SR 49 in

District 3. On SR 49, 4 out of the 6 incidents occurred in Nevada County, indicating perhaps a superior response by that county. A similar low value in a rural area was seen on SR 99 in Sutter County. The overall statistics confirm the primary thesis concerning incidents with fatalities; they are fairly well-defined and have a reasonable standard deviation as compared to other types of incidents. The standard deviation was significantly lower than the overall fatal incident value, confirming that responses to corridors with a higher rate of incidents may have a more streamlined process.

#### 4.4.10 Comparison of FARS, TASAS, and the MIDB

We compared the incidents within the Caltrans MIDB with incidents reported to the National Highway Traffic Safety Administration (NHTSA) in FARS. The following table shows the differences in the two databases. Of note, FARS typically includes fatal incidents on local roads not under Caltrans' jurisdiction. These incidents are not included in the tables. Additionally, comparing FARS to the Caltrans TASAS incident database revealed that all of the incidents in FARS are accounted for in TASAS.

**Table 4.15 Fatal Incidents in FARS by District/County**

Caltrans District	County	Fatal Incidents in Caltrans Database	Fatal Incidents in FARS Database	Percentage
3	Butte	3	7	43%
3	Colusa	4	4	100%
3	El Dorado	3	3	100%
3	Glenn	1	2	50%
3	Nevada	4	4	100%
3	Placer	8	11	73%
3	Sacramento	13	23	57%
3	Sierra	1	1	100%
3	Sutter	5	6	83%
3	Yolo	6	8	75%
3	Yuba	5	6	83%
<b>Total</b>		<b>53</b>	<b>75</b>	<b>71%</b>
4	Alameda	8	28	29%
4	Contra Costa	2	12	17%
4	Lake	1	7	14%
4	Marin	0	3	0%
4	Napa	0	4	0%
4	San Francisco	2	8	25%
4	San Mateo	3	31	10%
4	Santa Clara	5	30	17%
4	Solano	3	8	38%
4	Sonoma	4	9	44%
<b>Total</b>		<b>29</b>	<b>98</b>	<b>30%</b>
6	Fresno	10	23	43%
6	Kern	9	34	26%
6	Kings	1	6	17%
6	Madera	2	11	18%
6	Tulare	7	24	29%
Total		28	140	20%
<b>Overall</b>		<b>110</b>	<b>313</b>	<b>35%</b>

There was a fairly large discrepancy in percentages by district and county. This was attributed to the fact that for Caltrans by definition if Caltrans is not called then it is not tracked as a major incident in the MIDB. However, this raises some questions. It would appear that there is some institutional support for involving Caltrans in incidents with fatalities in District 3 as opposed to the other two districts, particularly if comparing Districts 3 and 6 which are more similar in geography and land use. One might propose that there is a question of roadway type. In Colusa County, all 4 of the fatalities occurred on I-5; similarly all 3 of the fatalities in El Dorado County were on US 50. These were high speed freeway class roads that virtually require Caltrans for traffic control at all times. Nevertheless, in Kings County within District 6 the 2 incidents with fatalities on I-5 did not appear in the Caltrans database, meaning they did not require a Caltrans response or Caltrans was not notified of the incident. There were incidents on I-5 in Kern County that also did not appear in the Caltrans database. The assumption in this situation is that first responder agencies within District 6 may be trained not to ask for Caltrans support unless it is absolutely necessary.

Within District 4, there is more certainty due to the urban nature. Virtually none of the crashes in San Mateo County and Santa Clara County were listed in the Caltrans MIDB indicating that these incidents, even on the freeways of I-280 and US 101, appear to be handled by local fire and CHP personnel.

#### 4.4.11 Major Incidents Involving Hazardous Materials / “HAZMAT”

As stated previously, the presence of hazardous materials resulted in the longest average set of durations other than the presence of a big rig truck. Across all district workshops stakeholders stated that when HAZMAT had to be called, the timeline gets extended quite a bit. The following table compares duration of HAZMAT incidents by district. In the event a HAZMAT situation took under 90 minutes, which did occasionally occur when all lanes were able to be opened before the HAZMAT team was finished with the clean-up, it was still included in the analysis. The following table highlights the duration by district.

**Table 4.16 Duration of HAZMAT Incidents by District**

District	Average	Median	Standard Deviation	Number of Samples
3	5:37	4:40	3:21	23
4	7:37	5:08	6:50	17
6	5:26	3:49	4:23	15

By utilizing CHP reports and data from PeMS, it became clear that the notification of HAZMAT was not the limiting factor. Across all districts, the time between the start of the incident and the identification of the HAZMAT situation was very fast, generally under 10 minutes. However, organizational issues about HAZMAT identification by type may still be a concern, although probably not as great as response time and clean up.

#### 4.4.12 District 4 HAZMAT Qualitative Analysis

For incidents where Caltrans responds, a report is typically filed in the IMMS. Its primary purpose is to log Caltrans staff time spent on each maintenance project and, as stated by Caltrans, to “to effectively plan, perform, and manage maintenance work.” Maintenance work, for the purposes of this report, primarily includes necessary work to Caltrans property after major incidents, such as the replacement of guardrail and fencing. However, due to federal reporting requirements, IMMS service logs are also required to have detailed timelines of any incidents that involve HAZMAT. It was the hope of PATH researchers that these timelines might contain helpful information on constructing the incident timeline of

HAZMAT incidents in the Caltrans MIDB. There was unfortunately no information available from the HAZMAT contractors themselves.

During the study period of January 2011 – April 2012, the MIDB contained 24 HAZMAT incidents in District 3, 16 within District 6, and 16 within District 4. Unfortunately, in Districts 3 and 6 the variation of information given in the IMMS comments was very high. Only 4 in District 3 and 8 within District 6 had time stamps that were organized enough to try and create a timeline, which is too small a sample. However, due to the apparent nature of the HAZMAT supervisors in District 4, 13 such incidents had appropriate information. In general, the IMMS times for the start of the incident and the end of the incident agreed with the MIDB.

Examining the time stamps for the HAZMAT incidents within the study period for District 4, two conclusions revealed themselves from the data, both of which are well-known by Caltrans personnel. First, if the HAZMAT situation is small enough to be handled exclusively by Caltrans, for example a small leak of diesel fuel, then the time to clear is very fast *as long as the Caltrans HAZMAT team is notified in a timely manner*. Caltrans exclusive HAZMAT incidents generally only took one to two hours to clean up the entire incident starting from the time that a HAZMAT team member arrived on the scene. Often, this is because Caltrans dispatch can communicate the necessary field equipment before the HAZMAT team arrives, particularly when sweepers are needed. Nevertheless, the time between the start of the incident to the arrival of a HAZMAT team member ranged from only 20-30 minutes to over 2 hours for one incident on I-580 in Alameda County, even though the actual clean up took just over 1 hour.

The second conclusion, which was also documented in the small sample size from District 3 and District 6, is that when a HAZMAT contractor is involved, the time to clear lengthens dramatically. The time from when the contractor is called to the time the clean-up actually begins varied widely but was generally multiple hours. The average among all districts when the contractor was called to when the contractor started the clean-up was 2.5 hours with a standard deviation of 1.5 hours. Obviously, location of the incident is an important factor in this average, particularly in District 6, but times exceeding 1.5 hours were seen in the urban counties of District 4, with the highest value overall in Alameda County. It is important to note that this report did not produce any conclusions concerning the speed of the contract HAZMAT teams once they arrived on the scene. Clearly, every HAZMAT situation is different and requires a diverse set of resources. However, the variance in time between the call to the contractor and the actual start of clean up by the contractor is quite high and should be examined to improve quick clearance, particularly since HAZMAT incidents are often the incidents that take the longest time to clear. The following table summarizes the contractor analysis:

**Table 4.17 HAZMAT Performance by Task**

Task	Average	Median	Standard Deviation	Number of Samples
Total Cleanup Time No Contractor Call	3:19	2:12	2:19	12
Total Cleanup Time Contractor Required	8:29	6:30	5:12	11
HAZMAT Contractor Call to Start of Clean-Up	2:32	2:00	2:00	9

**4.4.13 Additional Atypical Incidents and Their Response**

Within the incident data set, there were 42 incidents that could be classified as “atypical” or unusual which were either affected or caused by unusual circumstances. Some of these incidents, such as a

structure fire, were removed from the calculation, but others, such as single car vehicle hitting a utility pole, were not. This selective procedure stands in opposition to closures due to natural causes such as snow or mudslide which were universally removed. Atypical incidents could be classified into four groups, suicides, utility issues, emergency activities (fire or police), or miscellaneous. Miscellaneous could include a tree falling in the roadway, a truck losing its cargo of tomatoes, or a major incident inside a rest area. The following table highlights the numbers of incidents in each district.

**Table 4.18 Atypical Incidents by District**

Type of Incident Per District	District 3	District 4	District 6
Suicide	4	1	1
Utility Issues	4	4	10
Emergency Activity	3	3	8
Miscellaneous	1	1	2
Total	12	9	21

District 6 appeared to have more of these types of incidents than the other districts combined. In terms of impact on incident duration, these incidents can have a significant influence. Examining the worst incidents for District 4, 4 of the Top 10 were atypical incidents, a fallen tree and 3 incidents of utility poles falling over. A fifth also involved a utility pole when struck by a big rig, which is not considered atypical as it was hit by a vehicle as opposed to falling down in high winds. Nevertheless, 50% of the top ten listed in that particular district had something to do with an atypical situation. In District 6, similarly half of the incidents in the top 10 worst had an atypical element to them. It cannot be emphasized enough that utility companies are a significant drag to incident management in California. Examining the 10 utility based incidents in District 6, the duration was significant higher than the general pool, as shown in the following chart. The average was almost one full standard deviation above the overall district average. Again, these ten incidents are utility issues that caused road closures but do not include vehicles on the roadway hitting poles. The table below shows the differences between the utility incidents and the district average in District 6.

**Table 4.19 Incidents with Utility vs. District Average**

District 6 Incident Type	Average	Median	Standard Deviation	Number of Samples
Atypical Utility Only	7:20	6:31	4:12	10
Overall	4:39	3:41	3:12	128

#### 4.5 Discussion

As has been stated before, the limited data from stakeholders outside of Caltrans and CHP constrained the robustness of the data analysis. However, there were still some definite conclusions. The most significant variables are the presence of big rigs, a HAZMAT situation, or a utility. As such, programs to reduce big rig rollovers and incentives/penalties to improve both HAZMAT contractor and utility timeliness should be priorities for Caltrans implementation. Although fatal incidents do have lengthy clearance times, they do not tend to be the worst incidents although again incentives to improve response time could help, although this may necessitate the need for the ability of coroner services to use sirens or other first responder methods to bypass incident related congestion. Parallel to the efforts described above, an important endeavor should be to streamline the data collection process and provide a central database for all stakeholders to enter their timestamp data. Mandatory requirements on the submission of this data would vastly improve the ability of Caltrans to see areas of improvement.

## CHAPTER 5

### TOOLS/STRATEGIES FOR IMPROVING CALTRANS' INCIDENT MANAGEMENT RESPONSES AND FRAMEWORK FOR TIM MANAGEMENT

Based on the analysis of response times and the results of the first series of workshops, the research team performed a task to identify tools and strategies for improving traffic incident management responses in the various Caltrans regions and districts. The approach used to identify appropriate tools and strategies involved supplementing existing responses in the regions with current TIM best practices. The research team started with the TIM national best practices and mapped them to local regional needs. The research team conducted two workshops to facilitate the implementation of the recommendations to regional incident responders. The purposes of these workshops were to:

- Review findings from the response time analysis and the previous workshops
- Discuss strategies for improving regional responses.
- Discussed the need for regional partnership agreements, integrating traffic incident management into the planning process and the differences between rural and urban responses.
- Identify actions items and next steps for individual districts.

Two workshops were conducted in District 3 and District 6. These workshops included representatives from state and local incident responders, including Caltrans district traffic operations and maintenance; California Highway Patrol (CHP) patrol and dispatch; Caltrans district HAZMAT response teams; local and regional fire, law enforcement and sheriff departments; regional coroner's offices; dispatchers and operators for regional public-safety answering points (PSAP); local tow truck operators; regional metropolitan planning organizations, and others. Each participant was provided with a workbook containing the slides used to facilitate the discussion. Each workshop was held in the morning beginning at 8:30 and running through 11:30. The agenda for the workshop is shown in Table 5-1. A copy of the presentation materials used in the workshops is provided in Appendix B.

**Table 5.1 Agenda for Caltrans Quick Clearance for Major Traffic Incidents Workshop #2**

<b>Time</b>	<b>Topic</b>
8:30 a.m.	Welcome and Introductions
	Benefits of Incident Management
	Review of Outcomes of Previous Workshop
	Strategies for Improving Regional Coordination and Cooperation
9:45 a.m.	Break
10:00 a.m.	Analysis of Incident Response Times
	Quick Clearance Tools and Strategies
	Action Items/Next Steps
11:30 a.m.	Adjourn

Because District 4 already has an established Incident Management Task Force (IMTF) to facilitate responder communication and development of strategies to reduce clearance times, a separate workshop was not conducted for this project. Instead, the project team participated in existing forums for responders to support this research effort, including monthly and quarterly IMTF meetings, a workshop sponsored by FHWA, and an IMTF sponsored Dispatch Communication Workshop. These forums included responders of all disciplines.

### **5.1 Benefits of Incident Management**

Each workshop began with a discussion of the potential benefits to be achieved through better incident management. The material presented as part of this discussion was provided courtesy of Sergio Venegas of Caltrans District 6. The material provided used a standard input-output analysis to demonstrate the potential effects of an incident occurring during the normal commute period on US-101. The section of freeway has five lanes where vehicle demands during the morning commute (7 a.m. to 8:30 a.m.) normally exceed the available capacity. For illustration purposes, a rear-end collision that closed a single lane was assumed to have occurred at 7:30 a.m. Full capacity to the freeway was restored at 8:30 a.m.

Using an input-output analysis, the effects of the incident was estimated to be as follows:

- Estimated total delay = 9,250 vehicle-hours
- Estimated congestion clearance time = 10:00 a.m.
- Estimated total delay costs to travelers = \$144,300

The same scenario was then used to demonstrate the effects associated with reducing the time necessary to detection, verify, respond to, and clear the incident by 15 minutes. The demonstration shows that reducing the total duration of the incident by 15 minutes can generate the following savings:

- Reduced the total delay by 1,690 vehicle-hours.
- Reduced total delay costs to travelers by \$26,360

### **5.2 Strategies and Recommendations for Improving Caltrans Incident Response**

The following provides a summary of the recommendations and action items presented for consideration to the regional traffic incident management responders for improving the incident response process in their regions.

#### **Recommendation #1: Caltrans should implements formal after action reviews/incident debriefing after each major incidents lasting longer than 4 hours.**

Many agencies have found after action reviews to be a particularly good way of improving incident responses coordination and cooperation. Borrowed from the military and other agencies where effective responses depend on close coordination, after action reviews are a formal process of reviewing what went well in response to a particular incidents and what needs to be improved in a response. If done properly, after action reviews can provide immediate input to assist with planning and executing future responses to similar types of incidents. The lessons learned by reviewing past incidents can also lead to revisions in standard operating procedures and actions. After action reviews should focus answering the following four questions:

- What was supposed to happen?
- What actually happened?
- What went well and why?
- What can be improved and how?

Note, the purpose of an after action review is not to criticize particular individuals or agencies, but to improve coordination and collaboration among responders that can result in better responses in subsequent events.

The process of conducting an after action review generally involves the following individuals:

- Actual responders who participated in the particular event being reviewed.
- Response coordinators from the various responses agencies
- A facilitator

Ideally, the facilitator should be a neutral party to the response – such as someone for a metropolitan planning organization (MPO), consultant, or a research university. The facilitator remains neutral in the review process and should guide the discussion to focus on identifying improvements and away from assessing blame.

Caltrans is strongly encouraged to establish formal, written criteria and/or policy for when an after action review should be performed. Sample criteria used by many agencies for when to perform an after action review include the following:

- Any incident last two hours or more.
- Any major incident where significant response issues existed.

Ideally, after action reviews should occur within the 2 weeks after the incident, but not more than 1 month after the incident. Typically, this timeframe allows the responders to think more clearly and rationally about the issues and concerns that occurred during the response. It is critical to remember that the purpose of this review is to identify strategies and techniques for improving coordination and cooperation and to avoid “finger pointing” associated with any one responding agency.

To be effective, Caltrans need to establish ground rules for holding after action reviews. As the purpose of the review is to solicit ideas for improving the traffic incident response process, the discussion must be open and honest. Each agency needs to approach the review for the position of identifying improvements and not assessing blame. Everyone on the team should be included in the discussions, without too much attention focused on any one particular agency or responder. Participants should focus on the results of the event, avoiding criticism of any one particular agency, and identify ways of sustaining what worked well in the response to other events. Most importantly, participants should refrain from passing judgment about individuals or agency responses.

To assist Caltrans in conducting after action reviews, the research team has developed an after action review form. This after action review form is provided in Appendix C. The form is intended to assist Caltrans record the following:

- The agencies participating in the after action review

- The description of the incidents (i.e., the type, number and severity of the injuries, the number of vehicles involved, etc.)
- The timeline/sequence of events associated with the incident
- The types of traffic management responses implemented with the incidents
- The traffic management and incident response strategies/techniques that were successful associated with the incidents
- The specific actions and activities that need to be improved in future responses.

**.Recommendation #2: Caltrans districts should routinely conduct regional traffic incident management forums**

Another common strategy used by agencies to improve cooperation and coordination among traffic incident responders is through regional forums. These forums are usually held quarterly or every other month and are intended to provide public safety and transportation partners a regular opportunity for discussing issues related to traffic incident management and responses. In these forums, the following items are usually discussed:

- Results of major incident and/or after action reviews
- Updates on initiatives and activities undertaken by each incident response agency
- Updates on construction/maintenance and/or special events that might impact traffic incident management responses.
- Lessons learned and new best practices identified in research.
- Legislative, policy, and/or procedural changes impacting the incident responders.
- Changes in agency personnel and/or responsibilities.

One ongoing example of a traffic incident management regional forum occurs in the San Francisco Bay area. Originally established in 2002, the Bay Area Incident Management Task Force (IMTF) is an interagency committee comprised of staff from Caltrans, CHP Golden Gate Division, the Metropolitan Transportation Commission (MTC) and other first response agencies. This group meets quarterly. During these meetings, member agencies use roundtable discussions to identify and solve pressing issues and challenges for providing safe and quick clearance of traffic incidents in the region. The forums also allow agencies to provide information about resources and tools that are currently available in the region for traffic incident management. Participants draw on their collective expertise to identify a list of actionable items that can be used to shape incident management for the region.

**Recommendation #3: Caltrans should consider implementing regional towing and recovery incentive programs.**

In recent years, towing and recovery incentive program have been implemented in several states as a tool for reducing roadway clearance times for traffic incidents involving trucks and tractor-trailer rigs. In these programs, tow truck operators are paid an incentive by departments of transportation of achieve specified response and clearance times to traffic incidents.

In early 2008, the Georgia Department of Transportation (GDOT) introduced the Towing and Recovery Incentive Program (TRIP) in the metropolitan Atlanta area [26]. The program provided monetary incentives to qualified heavy-duty tow truck operators to assist in clearing large commercial vehicle

incidents. As part the program, certified tow operators receive an incentive payment if they arrive to an incident scene involving a large commercial truck and open all lanes to traffic within a specified time. An evaluation study compared the clearance times from 24 incidents prior to implementing the TRIP with clearance times after implementing TRIP. The evaluation found in the first year that clearance times of incidents involving commercial heavy vehicles reduced by at least 165 minutes (2 hours and 45 minutes). This equated to a benefit/cost ratio of 10.96 to 1, savings almost eleven dollars to every dollar invested.

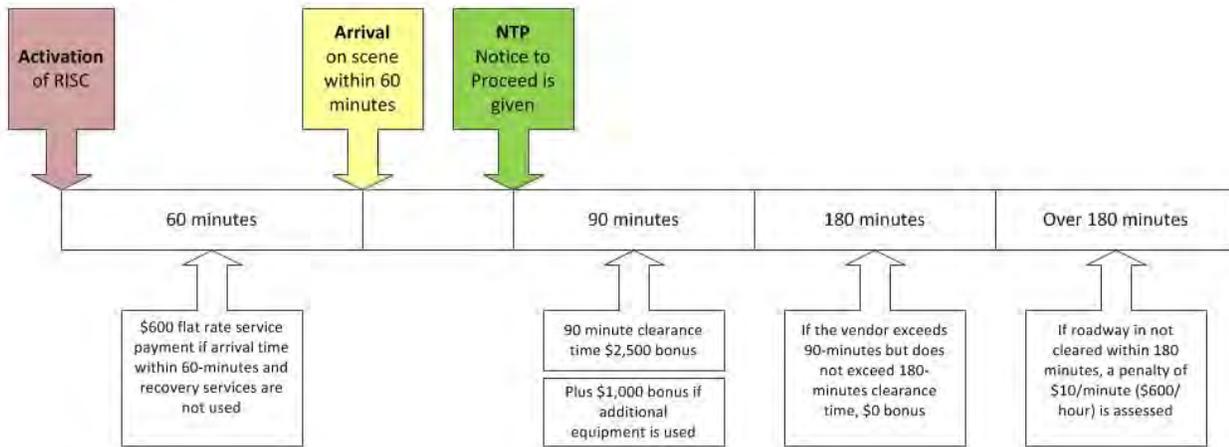
The Rapid Incident Scene Clearance (RISC) is another example of tow and recovery program. The program supports Florida's Open Roads Policy goal of safely clearing major highway incidents and truck crashes in 90 minutes or less [27]. RISC was first implemented on Florida's Turnpike Enterprise roadways and now is being expanded for statewide usage. This is an incentive-based program that requires specialized equipment and trained operators to quickly remove wreckage from the roadway, where major crashes close most lanes or causes significant travel delays.

Towing and recovery companies must comply with specific the qualifications to become a RISC vendor. Once approved, the vendor can then respond to RISC activation requests. The RISC contract has a very specific list of equipment requirements that the vendor must either own or have contracts with companies who can rapidly respond with them when requested:

- One 50-ton capacity (or heavier) wrecker and one 35-ton capacity (or heavier) wrecker
- A recovery support vehicle with roof-mounted arrow board stocked with the Federal Highway Administration's *Manual on Uniform Traffic Control Devices* compliant traffic control devices along with additional tools and equipment.
- One heavy-duty skid steer loader with bucket, broom, and fork attachments
- A disposal company that can deliver dumpsters for incident debris
- One tilt bed lowboy semi-trailer
- One tandem axle tractor
- One rubber tired front end loader
- A source of bulk sand
- A maintenance of traffic contractor
- A vacuum or suction service

The RISC incident response timeline is shown in Figure 5.1. Operationally managed at the district level, RISC contractors have the responsibility to respond to the incident within 60 minutes of the request to activation request. Once provided a notice to proceed by the lead official on scene, the contractor is required to open the travel lanes for traffic within 90 minutes. If the proper equipment arrives on scene within 60 minutes and the tow truck operator clears the travel lanes within 90 minutes, the contractor is eligible for the bonus as outlined in the contract.

Many times during major commercial vehicle crashes, trailers loaded with cargo are damaged and spill their loads onto the highway or adjacent areas. The RISC contract requires the vendor to have specified extra equipment on hand or available 24 hours a day/7 days a week to respond to the these major incidents. The tow truck operator can receive an extra incentive for the staging and/or use of this extra equipment in the incident clearance process.



Source: Florida Department of Transportation

**Figure 5.1 RISC Incident Timeline**

The Washington State Department of Transportation (WSDOT) and the Washington State Patrol (WSP) have implemented a similar towing and recovery incentive program for major traffic incidents [28]. Similar to Caltrans, WSDOT and WSP have established a mutual goal of safely clearing highway traffic incidents within 90 minutes; however, in spite of the efforts of both agencies, average clearance times for incidents involving heavy trucks with fatalities remained high. WSDOT requested and received legislative funding to implement a Major Incident Tow (MIT) program designed to speed up the removal of heavy truck collisions. Modeled after Florida’s program, the MIT program raises minimum training and equipment requirements for program participants, and provides a \$2500 incident payment when quick-clearance goals are met. Under the contract, program participants are eligible to receive incentive payments for the follows:

- DOT agrees to pay the contractor a flat rate Emergency Response Mobilization Fee of \$2500 when services were authorized by WSP and/or the WSDOT. To qualify for the emergency response and mobilization fee the contractor must:
  - Be en route to the incident scene with two (2) heavy-recovery tows within 15 minute from the official notification by WSP during regular business hours, and 30 minutes after business hours. All other required clearance and recovery equipment and necessary trained personnel shall be readily available if needed.
  - Have completed the removal and clearance of all collision scene vehicles, cargo, debris and nonhazardous vehicle fluids and opened all travel lanes within 90 minutes after the notice to proceed was given by a WSP and/or WSDOT authorized representative.
- If after the contractor has mobilizes and is en route to the incident scene, and WSP and/or WSDOT deems by that the recovery services are not needed, the WSDOT will pay the contractor a flat cancellation fee of \$600.

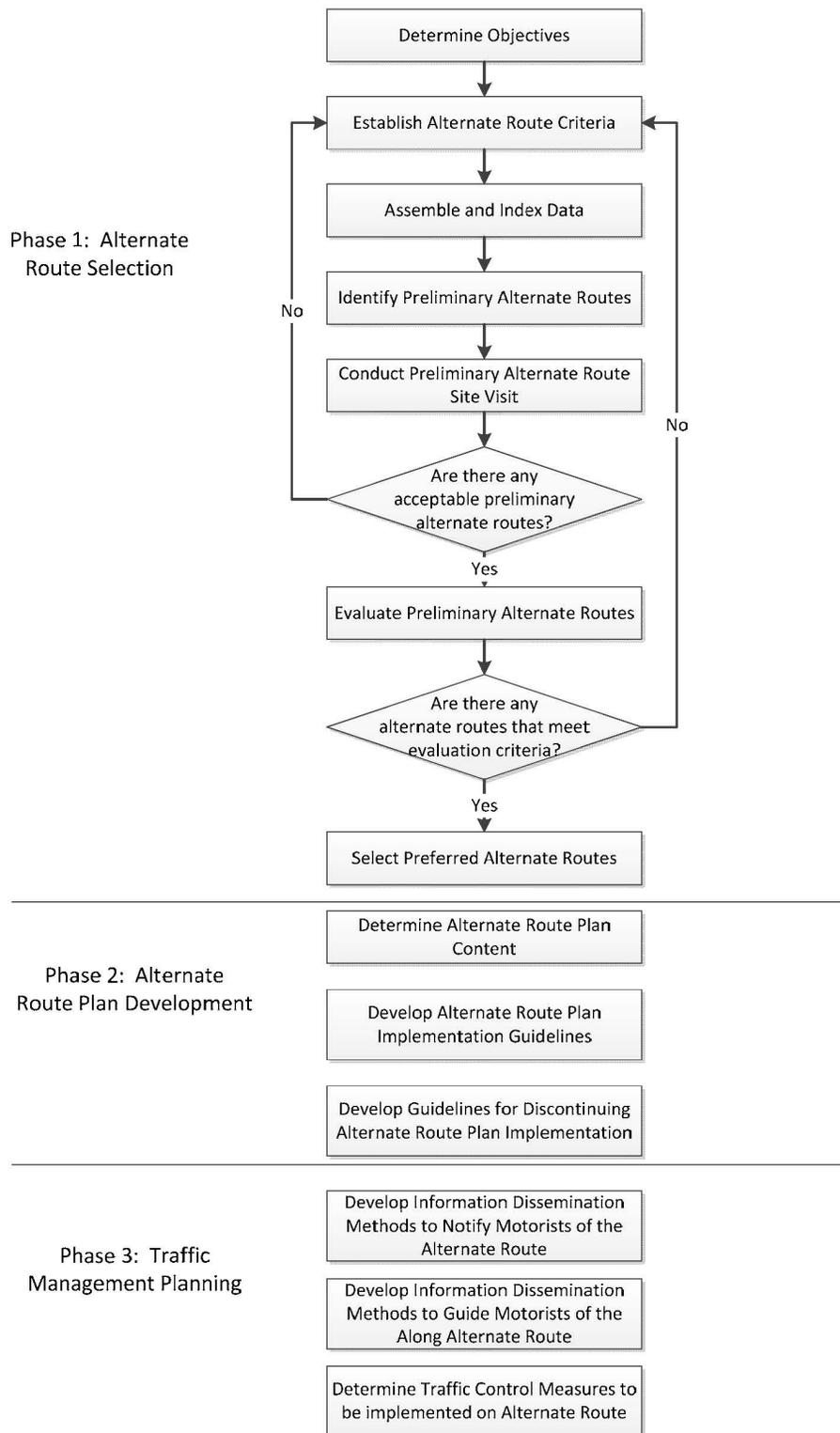
The contract stipulates that no performance payment will be made to the Contractor if the job has not been completed and all travel lanes are not open to traffic ninety (90) minutes after given the notice to proceed. If WSP, WSDOT, or any other emergency responder assisting in the investigation requests the contractor, once on scene, to wait to begin their roadway clearance activity, they will not be penalized for the time they were delayed. This extended time must be documented by the WSP TIC and recorded in WSP CAD logs. In this instance the “net clearance time” will determine whether the MIT activation was successfully completed in less than 90 minutes

#### **Recommendation #4: Caltrans districts should conduct alternate route planning**

Having clear, predefine alternate routes would be one strategy that Caltrans could implement to lessen the effects of incident on traffic operations, particularly in rural area. Alternate route planning involves the process of identifying suitable route on which traffic can be diverted in response of major traffic incident, hazardous material spills, construction activities, or major catastrophes (such as floods, snowstorms, earthquakes, bridge collapse, acts of violence, etc.) *prior* to the event. Alternate route planning eliminates the need for and/or reduces the time necessary to establish ad-hoc diversion routes in response to major roadway closures. Other benefits associated with alternate route planning the following [29]:

- Reductions in secondary incidents, vehicle fuel consumption, and vehicle emission cause by congestion upstream of the incident location.
- Reductions in the time needed by emergency responders to identify and execute an response
- Reductions in motorist stress and aggressive driving behavior
- Reductions on the impacts of regional freight movement

The process for developing alternate route plans is illustrated in Figure 5.2. The process consists of three phases: 1) Alternate Route Selection, Alternate Route Plan Development, and Traffic Managements Planning. Guidance in developing alternate route plans is provided in FHWA's *Alternate Route Plan [29]*.



Source: FHWA's *Alternate Route Handbook*

**Figure 5.2 Process for Planning Alternate Routes for Incidents and other Traffic Emergencies**

The process for developing alternate route plans should be by consensus with all appropriate stakeholders. Factors to consider in identifying appropriate route include the following:

- Proximity of alternate route to closed roadway
- Ease of access to/from alternate route
- Safety of motorists on alternate route
- Height, weight, width, and turning restrictions on alternate route
- Number of travel lanes/capacity of alternate route
- Congestion induced on alternate route
- Traffic conditions on alternate route
- Number of signalized, stop-sign controlled and unprotected left turns on alternate route
- Travel time on alternative route
- Pavement conditions on alternate route
- Type and intensity of residential development on alternate route
- Existence of schools and hospitals adjacent to alternate route
- Percentage of heavy vehicles on route from which traffic is to be diverted
- Vertical alignment on alternate route
- Type and intensity of commercial development on alternate route
- Availability of fuel, rest stops, and food facilities along alternate route
- Noise pollution
- Transit bus accommodations
- Air quality
- Ability to control timing of traffic signals on alternate route
- Ownership of roadway
- Availability of detection and surveillance equipment on alternate route
- Availability of information dissemination equipment on alternate route

Once an appropriate alternate route has been identified, the next step in the process is to develop an alternate route plan. An alternate route plan shows not only the route to which traffic will be diverted, but also include detailed information on how to implement the alternate route. This would include the following:

- Duties and responsibilities of each stakeholder prior to, during, and after implementation of the alternate route
- Contact information of pertinent response personnel
- Checklists of appropriate signing and traffic control devices (including information to be posted on dynamic message signs)
- Location of supporting detection/surveillance equipment
- Appropriate/accepted traffic signal timing plans
- Appropriate traveler information messages.

The responders in each Caltrans district should achieve consensus on the determine decision criteria on when to implement an alternate route plan. Some agency incident responders or Incident Commanders may choose to implement the alternate route plan whenever there is at least one lane closed, while others may only implement the alternate route plan when the entire roadway is closed. The choice of when to

implement the alternate route plan is typically a function of traffic capacity lost on the mainline due to roadway closure and the traffic capacity available on the alternate route.

Each district should develop a decision matrix included with the alternate route plan indicating the conditions when a plan is appropriate. The decision matrix should include criteria for determining not only when and where to activate a plan, but also when to deactivate (or discontinuing) the alternate route plan. Factors to consider in developing the deployment criteria include the following:

- The time of day, day of week, and anticipated impact to traffic of the closure
- The normal traffic volume expected during throughout the duration of the closure
- The estimated time required to clear the incident
- The estimated time need to deploy and remove the alternate route
- The perceived impact/effectiveness of the alternate route to relieve congestion at the incident site.

The final step in determining alternate route plans is to develop a traffic management plan for implementing the response. Developing a traffic management plan involves the following:

- Determining the appropriate methods for notifying motorists of the alternate route
- Determining the appropriate methods of guiding motorists along the alternate route
- Determining the traffic control measures to be implemented along the alternate route

The traffic management plan needs to contain the type and location of the information to be conveyed to travelers when the alternate route in is affect. Information on available alternate routes needs to be provided a sufficient distance upstream of the diversion point so that travelers can determine which action (to divert or remain on the main route) is appropriate for them. Although agencies establish different guidelines regarding what information should be disseminated, the three types of information to be disseminated include (1) a mandatory diversion message, (2) a voluntary diversion message, or (3) information on traffic conditions only, leaving motorists to determine whether to divert from the primary route to an alternate route.

The traffic management plan should also identify what traffic control is needed to manage traffic along the alternate route. Examples of common traffic control techniques used to manage traffic operations on alternate routes include the following:

- Use of law enforcement personnel to control.
- Modified traffic signal timings to provide additional green time to the alternate route.
- Ramp metering override to prevent long queues.
- Suspension of tolls.
- Suspension of HOV restrictions.
- Suspension of roadwork activities along the alternate route.
- Enforcement of parking restrictions along the alternate route.
- Alternative lane operations

**Recommendation #5: Caltrans re-examine the use of home storage permits.**

Recent changes in Caltrans policy on vehicle home storage permits have resulted in difficulties by some maintenance supervisors responding to incident scenes rapidly. With the changes in policy, some supervisors are now required to travel first to the maintenance yard to pick up an official vehicle and/or equipment (including radio communication) before heading to the incident scene. In the past, maintenance supervisors had the ability to initiate responses directly from their residence before leaving to go to the scene. Under the current policy, a supervisor may be required to drive pass the incident scene on their way from their residence to a Caltrans maintenance facility to obtain a vehicle. The additional travel time will increase delays in initiating a response for incidents. Furthermore, many maintenance supervisors used the radios in their vehicles to initiate and coordinate responses prior to leaving for the incident scene. Including those maintenance supervisors that have incident management responsibility as part of those individuals who are permitted to have a Caltrans vehicle at their home would help reduce delays in getting Caltrans forces to the scene after normal work hours.

**Recommendation #6: Caltrans districts should develop personnel and equipment resource lists.**

Rural area responses are different than urban area responses. Incident response assets in urban areas tend to be more plentiful and distance (and therefore, time) required to get assets to the scene are generally less. In rural areas, travel distances are longer and specialized incident management assets have to come from further away to reach the incident scene.

Many transportation agencies have found that having a compiled list of the traffic incident management personnel, equipment, and resources is a good strategy for improving incident responses. Information compiled in these resource lists should include geographic or jurisdictional response areas, telephone numbers, fax numbers, pager numbers, procedures for radio contact, alternative contacts, available equipment, available supplies or materials, and anticipated response times. This information should be provided for both daytime and nighttime conditions, particularly for nonemergency, support agencies (e.g., transportation departments) that do not operate 24 hours a day. Resource lists should be regularly updated to ensure continued benefit.

**Recommendation #7: Caltrans should re-established Incident Quick Strike Teams, particularly in rural areas.**

Caltrans maintenance crews do not operate 24-hours/7-days a week. During normal work hours, maintenance crews are often working at other locations at the time a major incident occurs. This means that if they are at a job site when a call comes in, they may have to break off of their work activity to respond to the incident. During non-working hours when maintenance crews are at home, it takes additional time to assemble appropriate personnel. Many times, it can be difficult to assemble a response crew quickly. Because responding maintenance staff for traffic incidents is not designated as “on-call” employees during non-working hours, little incentive exists for Caltrans maintenance personnel to respond to incidents after normal working hours.

In the past, Caltrans had established incident quick strike teams in rural areas. The purpose of these teams was to provide assets where Caltrans can reach any incident scene on major facilities or routes of regional significance within a designated timeframe (e.g., less than 30 minutes). These quick strike teams were on “ready, standby” so that they can reach an incident scene quickly, establish temporary traffic control

and on-scene routing, and assist removal. These teams were equipped with basic equipment needed for most common types of incidents. Re-implementing these teams, particularly in rural areas, would be a good strategy to improving traffic incident management responses.

**Recommendation #8: Caltrans should pre-position incident response equipment in rural areas**

Another strategy which might assist Caltrans implementing faster responses in rural areas might be to acquire and pre-position incident response equipment for routes of significance. This equipment might include the following:

- Traffic signs, cones, barricades, and flares
- Customized detour signs and trailblazers
- Temporary warning and directional signs
- Portable changeable message signs
- Highway advisory radio transmitters
- Work and emergency warning lights
- Generators
- Fuel and fuel containers
- Spill containment equipment
- All-terrain vehicles, boats, or other vehicles for critical access in rugged terrain.

**Recommendation #9: Caltrans should develop and implement training TIM training for rural responders.**

Caltrans should consider sponsoring and conducting traffic incident management drills and exercises with rural incident responders. The purpose of these training exercises and drills would be to build core competencies and foster relationships with rural incident responders, many of whom many be volunteers and have limited traffic management experience. These exercises and drills should be tailored to the types of events and situations that typically occur in rural areas. At a minimum, training exercises should focus improving core competencies of all incident responders including the following:

- Processes and procedures for establishing and securing incident management scene/vehicle placement
- Use of emergency vehicle lighting and basic flagging procedures
- Proper staging and placement of incident management resources
- Managing major traffic incidents using the incident command system
- The needs and requirements from proper personnel protection and situational awareness in and around incident scenes.

**Recommendation #10: Caltrans should encourage the use of photogrammetry and other photographic techniques to reduce time to document incident scene**

Photogrammetry is the science of measuring distances and objects from photographs or digital images. Photogrammetry has been used for years to produce topographical maps and digital terrain models. More recently, photogrammetry is being used as a tool for accident reconstruction and crime scene investigation. The process involves taking photographs of a crash scene with key and relevant objects designated with evidence markers. To obtain a three-dimensional representation of the incident scene, the

markers must be photographed from three different angles. At least one photograph needs to include a scale measurement – usually an object of known dimension placed near the incident scene. Once the photographs have been taken, specialized software back in the offices can be used to perform measurements and produce scaled drawings and computer-generated diagrams of the incident scene.

The Dallas County Sheriff Department began using photogrammetry in November 2000 for the investigation of traffic incidents in order to reduce the average clearance time. The department established an overall average of 20 minutes as the goal for clearing accidents to which its officers responded. Researchers obtained data for 34 incidents to which deputies responded during the period February through May 2001. Eighteen of the incidents were classified as major (i.e. with injuries) and occurred on four roadways. Three key statistics were calculated.

- Clearance time (defined as the difference in time from when the deputy arrived on scene until there was no freeway lane blocked): the average was 17 minutes and 39 seconds, well below the goal of 20 minutes. In every incident, freeway lanes were opened in less than 1 hour.
- Blockage time (defined as the total time there was any lane blockage on the freeway, calculated from the time the call was received until the deputy advised there were no lanes blocked: the average was 22 minutes and 38 seconds.
- Deputy clear time (defined as the total time spent on the incident by deputies): the average was 26 minutes and 31 seconds.

In June 2009, Indiana State Police and some County Sheriff Departments were trained in photogrammetry. Since then, photogrammetry has proven to be an effective way to minimize the time spent investigating crash scenes. This new technology is saving an average of 1 hour and 34 minutes per incident scene during 80 incidents over the use of total station technology. Through 140 documented incidents, photogrammetry saved 1 hour and 47 minutes per incident scene [30].

### **Recommendation #11: Caltrans should improve the collaboration and cooperation with Traffic Operations Division**

The need for increased coordination between Caltrans districts and the Traffic Operations Divisions was identified as a critical issue in all the workshops. Recently, the Caltrans Traffic Operation Division released *Traffic Incident Management Guidelines*. This guide is intended to be used by traffic incident responders to facilitate decision making in the field related to managing incidents. This manual provides guidelines and recommendations related to the following:

- An introduction to the incident command system and the general roles and responsibilities of different incident responders.
- An overview of the incident notification and incident response process
- Processes and procedures to be used by first responders for initially blocking and securing the incident scene.
- Processes and procedures for assessing damage to Caltrans property
- Recommendations for modifying procedures during adverse weather conditions (such as limited visibility, high winds, heavy rain, and snow)
- Hazardous materials considerations
- Guidance for identifying towing and recovery needs at an incident scene.

- Guidance on establishing helicopter landing zones.
- Process for dispatching and duties of Caltrans Traffic Management Teams.

Each district should coordinate with the Traffic Operations Division to develop a formal incident management strategic plan specific for their region. This strategic plan should define the collective vision, goals and objectives for incident management in the region as well as response and traffic management processes and procedures specific to the region, including contact information. Alternate route plans could also be developed as part of this effort.

The Traffic Operations Division should also consider holding annual workshop/summits similar to the ones performed as part of this project to discuss issues affecting regional responses, new innovations in traffic incident management, and regional training needs and initiatives. These workshops/summits should be held at least annually and include representatives and supervisory personnel from all incident responders in the region, including

- Caltrans district traffic management and maintenance personnel.
- Caltrans traffic management teams and hazardous material response times.
- Caltrans TMC and dispatch personnel.
- CHP patrol supervisor and dispatch personnel.
- Local police, fire, and emergency service personnel.
- Local and regional traffic management/department of public works
- Local tow truck operators or towing associations
- Metropolitan planning organizations and/or council of governments
- Special interest groups (including national and state park services, coroner's office, Pacific Gas and Electronic, etc.)
- Federal Highway Administration/Federal Transit Administration regional offices

Caltrans TMCs should also work to involve and integrate Caltrans Public Information Office more into the incident management process. These individuals can be critical in assisting in disseminating information to the media about major incidents.

**Recommendation #12: Caltrans should improve the collaboration and cooperation with non-traditional incident responders.**

The research team found incident response and clearance times to be significantly higher when an incident involved damage to a utility. Incident response times seem to be significantly impacted by the utility company's work rules and regulations. Utility companies do not seem to have the same sense of urgency to restore roadway operations as other incident responders. Their policies and procedures do not match the Caltrans' quick clearance policies. Caltrans should take steps to include utilities in training exercises and meeting related to incident management.

Districts should also consider establishing an incident coordinator position. This should be a full-time position and the individual would be responsible for coordinating the incident management efforts for the

district, including the planning and coordinating the Incident Management Review Team meetings, and the development and implementation of the district's incident management strategic plan.

Finally, Caltrans should consider implementing regular joint training activities that involve both dispatchers and field responders that will allow better communications between these responder entities, particularly in rural areas who may, in many cases, be volunteers. Caltrans should implement a program to provide regular multi-agency training to rural first responders on proper incident notification, traffic incident management and traffic control procedures, including proper flagging procedures, vehicle positioning/ scene protection procedures, and emergency vehicle light usage procedures. The Division is currently facilitating this effort through the SHRP II Train the Trainer workshops developed and hosted by FHWA.

**Recommendation #13: Caltrans should strengthen the connection between traffic incident management and regional transportation planning.**

Federal legislation requires urbanized areas over 50,000 in population to have a formal continuing, cooperative, and comprehensive process for identifying and programming transportation improvements which utilize federal funds. Long-range planning takes a comprehensive, holistic look at the future transportation needs of a region that reflects the vision, goals, and priorities of the community. The process is intended to allow communities to identify and assess possible transportation improvement strategies for addressing these needs using diverse viewpoints and the collaborative participation of all stakeholders in the community. The process involves elected leaders, major providers of transportation facilities and services, and key user groups, with input from the public, to shape a vision of the future and to establish goals and priorities that help describe that vision.

Integrating traffic incident management into the transportation planning process has the potential to benefit both transportation managers and transportation planners. The potential benefits of including traffic incident management in the transportation planning process include the following:

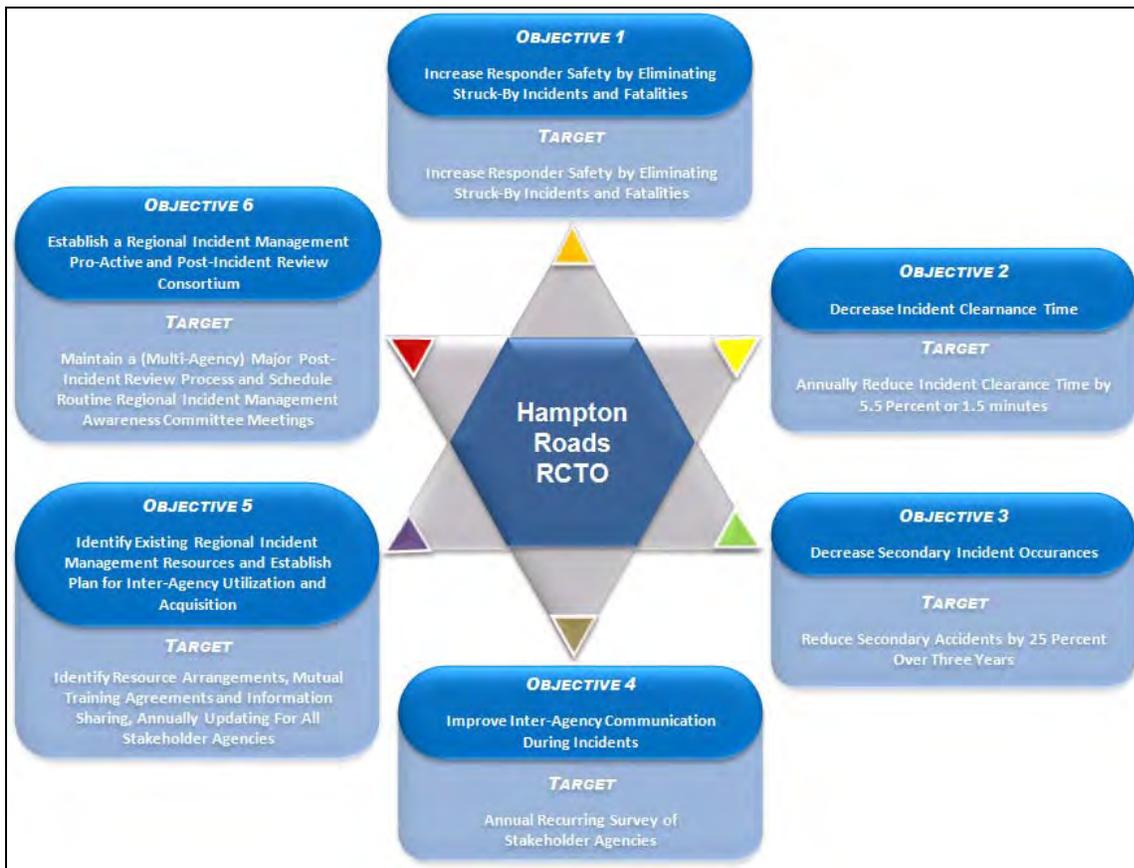
- Expanded access to regional resources that can be used to fund equipment and personnel expenditures related to incident management.
- Increased opportunities to collaborate with other traffic incident management stakeholders in the region.
- Improved access to multi-agency, multi-disciplinary training.
- Elevated visibility among transportation decision-makers.

Regional transportation planners benefit from incorporating traffic incident management into the planning process for the following reasons:

- Traffic incident management is a tool that addresses one of the major sources of congestion in a region. Incidents are estimated the cause of over 40 percent of the congestion in many urban areas.
- Traffic incident management strategies tend to be low cost, high return ways of improving mobility and safety in a region.
- Incident responders can supply expert opinion, and field knowledge and data to support transportation planning decision making.

- Traffic incident responders can provide good data to track and justify transportation improvement investments.
- Traffic incident management strategies can help transportation agencies meet legislative requirements to mitigate the effects of congestion as part of the Congestion Management Process (CMP).

Figures 5.3 and 5.4 show a typical example of how one region – Hampton Roads in Virginia – incorporated traffic incident management is a part of their overall planning for addressing congestion and mobility issues in the region. The region started out by identifying specific goals and objectives they wanted to achieve related to their incident management process. They then identified specific performance targets for meeting those objectives. These performance objectives focused on non-recurring delay/congestion, system reliability, secondary incidents, responder safety, and incident clearance times. The stakeholders then identified specific strategies, actions and programs that the region plans to use to achieve identified objectives (see Figure).



Source: Hampton Roads Transportation Planning Organization [31]

**Figure 5.3 Example of the Traffic Incident Management Program Objective and Performance Target Incorporated in the Transportation Planning Process for a Region.**



**OBJECTIVE 1**

**Increase Responder Safety by Eliminating Struck-By Incidents and Fatalities**

Ensuring the safety of responders is a great concern in regard to HIM. If highway incidents are not secure, then the ability of responders to work in a safe environment is severely compromised. This results in not only higher numbers of responder injuries, but undermines any attempt to reduce the time it takes to clear highway incidents.

**TARGET**

**Increase Responder Safety by Eliminating Struck-By Incidents and Fatalities**

The target represents what the RCTO Working Group considers to be the only logical number in reference to responder safety. No injury or fatality incurred during the incident management process should ever be considered acceptable.

**Action Item**

**Start a Regional Public Awareness Campaign Concerning the "Slow Down, Move Over" Law and the "Move It" Law**

Virginia's "Slow Down, Move Over" law requires motorists to approach cautiously when an emergency vehicle is stopped on two or four lane roadways with emergency lights flashing. Motorists are required to change lanes away from the emergency vehicle if they can do so safely (<http://www.vsp.state.va.us/>). Motorists who are unable to change lanes due to heavy traffic must slow down. In regards to public awareness of the law, The RCTO Working Group will explore methods of getting the message out on a consistent basis to the widest possible regional audience. Only then can optimal levels of awareness be achieved and maintained. Please view [http://www.its.dot.gov/its\\_publicsafety/index.htm](http://www.its.dot.gov/its_publicsafety/index.htm).

There is also Virginia's "Move It" law, which mandates that if vehicles involved in an incident can be safely moved to the shoulder or other safe area and no one has been injured, then the motorists involved should do so in order to ensure not only their safety, but that of others who are approaching the scene. The RCTO Working Group can utilize the same avenues it identifies to increase awareness of the "Slow Down, Move Over" to also increase awareness of the "Move It" law.

**Action Item**

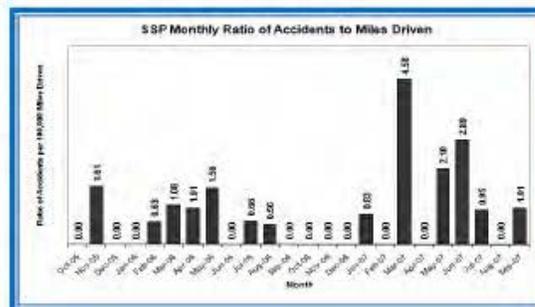
**Encourage Optimal Lighting and Traffic Control Equipment for Secondary Responder Vehicles**

The use of emergency-vehicle lighting is essential to all incident responders. However, secondary responders such as the Virginia Department of Environmental Quality (DEQ) are not required to adhere to the same vehicle lighting standards that first responders are required to adhere to. This is due to the fact that there is no agency or association in place to dictate lighting standards for secondary responders. The RCTO Working Group will explore ways of getting vehicle lighting for secondary response vehicles more in line with that of primary response vehicles.

are required to adhere to. This is due to the fact that there is no agency or association in place to dictate lighting standards for secondary responders. The RCTO Working Group will explore ways of getting vehicle lighting for secondary response vehicles more in line with that of primary response vehicles.

**Performance Measures**

The two performance measurement categories which are tied to this objective are "Ratio of Crashes per 100,000 Miles Driven for Virginia State Police (VSP) and Safety Service Patrol (SSP)" and "Incidents Involving Vehicle Fires." In terms of the first category, a reduction in the crashes involving these entities should provide insight into whether progress is being made toward meeting the stated target. The second category will be useful to the RCTO because it will identify incidents that most greatly compromise the safety of responders.



**FACT**

"71 percent of Americans have not heard of 'Move Over' laws, 86 percent support enacting 'Move Over' laws in all 50 states, and 90 percent believe traffic stops and roadside emergencies are dangerous for law enforcement and first responders."  
- Mason Dixon Polling and Research, sponsored by the National Safety Commission

**7**

Source: Hampton Roads Transportation Planning Organization [31]

**Figure 5.4 Example of Identified Actions and Performance Measures Associated with Regional Traffic Incident Management Objectives**

**Recommendation #14: Caltrans districts should incorporate performance management techniques into their regional traffic incident management programs.**

The last recommendation for improving performance is to develop a comprehensive, coordinated system for generating and tracking performance measures related to incident response. Having a good set of performance measures is essential to leverage traffic incident management resources. Performance measures allow agencies to accomplish the following [32]:

- Quantify effectiveness and value of program.
- Identify areas for improvement.
- Justify program continuation and expansion.

While Caltrans reports traffic incident management performance measures as an agency, it is important that each individual district develop and implement a performance monitoring system specific for their region or district. This allows each individual district to identify issues and take corrective actions specific in their district. For example, the analysis of response times in District 6 indicated that incidents involving damage to the power lines was a significant source of delays in incident clearance times. As a result, District 6 is taking corrective measures reduce these clearance times. District 6 should continue to track these incidents to determine the effectiveness of the strategies implemented to reduce these times.

At the national level, the Federal Highway Administration has identified three key performance measures for tracking the effectiveness of incident management responses in various regions. These performance measures are shown in Table below. Law enforcement and transportation representative from eleven states (including California) worked together to develop consensus on these national program-level performance measures. These performance measures were selected because they capture the overall effectiveness of all agencies involved in the incident response process rather than focusing on the performance of an individual agency.

**Table 5.2 National Program-Level TIM Performance Measures**

<b>TIM Program Objective</b>	<b>Related Performance Measures</b>
Reduce “Roadway” Clearance Time	Time between first recordable awareness of incident by a responsible agency and first confirmation that all lanes are available for traffic flow.
Reduce “Incident” Clearance Time	Time between first recordable awareness of incident by a responsible agency and time at which the last responder has left the scene.
Reduce the Number of Secondary Crashes	Number of unplanned crashes beginning with the time of detection of the primary incident where a collision occurs either a) within the incident scene or b) within the queue, including the opposite direction, resulting from the original incident.

Source: *Traffic Incident Management Handbook* [32]

In addition to tracking these program-level performance measures, FHWA has identified the several candidate performance measures that agencies may want to use to track the effectiveness of their incident management responses from a regional planning perspective. These performance measures are shown in Table.

National research has shown that the most common issues associated with sharing data to generate performance measures revolve around different agencies collect and use data [32]. To facilitate the development of agency wide performance measures, the research team recommends that Caltrans consider implementing the following national recommendations with their various traffic incident management partners (CHP, CalFire, and others):

- Establish agreements to preclude compromising sensitive data
- Develop common data dictionaries
- Establish common time stamp and geographic coordinates necessary
- Identify and agree to a defined standard or group of standards
- Identify and agree upon method for integrating text, video, and audio formats
- Use consistent data collection practices within and between agencies

Adoptions of these recommendations would facilitate the generation of meaning performance measures.

**Table 5.3 Potential Supplemental Traffic Incident Management Performance Measures**

<b>Traffic Incident Management Goal</b>	<b>Potential Performance Measure</b>
Improve Responder and Motorist Safety	<ul style="list-style-type: none"> <li>• Number of traffic incident responders struck by incidents per year.</li> <li>• Number of responder incidents occurring while in transit to and from incident scenes</li> <li>• Number of responder fatalities during incident responses over 5 years.</li> <li>• Percent of accident victim survival</li> </ul>
Reduce Secondary Incidents	<ul style="list-style-type: none"> <li>• Number of incidents that occur either a) within the primary incident scene or b) within the queue – including a queue in the opposite direction – resulting from the original incident</li> </ul>
Improve Incident Detection and Verification	<ul style="list-style-type: none"> <li>• Average incident notification time of necessary response agencies</li> <li>• Average tie for incident verification (defined as the time between the first agency’s awareness of an incident and the determination of the precise location and nature of the incident</li> <li>• Number of inaccurate notifications to response agencies per month regarding incident location and type</li> </ul>
Reduce Incident Response Times	<ul style="list-style-type: none"> <li>• Mean time for needed responders to arrive on-scene after notification.</li> <li>• Time for necessary HAZMAT equipment and personnel to arrive on-scene following notification of a HAZMAT incident</li> <li>• Time between request of two trucks and the arrival of appropriate tow trucks on scene.</li> </ul>
Improve Incident Scene Management and Traffic Control	<ul style="list-style-type: none"> <li>• Rate of use of MUTCD-compliant Traffic Incident Management Areas.</li> <li>• Rate of use of response vehicle placement and on-scene emergency lighting procedures.</li> <li>• Percent of incident response personnel demonstrating proficiency in Incident Command System concepts and process.</li> <li>• Rate of use of the Incident Command System</li> </ul>

	<ul style="list-style-type: none"> <li>• Usage rate of policies and procedures for HAZMAT and fatal accident response.</li> <li>• Percentage of routes in regions with average daily volume over X with alternate route plans.</li> <li>• Rate of use of alternate route plans.</li> </ul>
Reduce Incident Clearance and Recovery Time	<ul style="list-style-type: none"> <li>• Mean incident clearance time per incident.</li> <li>• Mean roadway clearance time per incident.</li> <li>• Mean time of incident duration.</li> </ul>
Reduce Person and Freight Hours of Delay	<ul style="list-style-type: none"> <li>• Person hours (or vehicle hours) of delay associated with traffic incidents.</li> <li>• Freight (in tons) hours of delay associated with traffic incidents.</li> <li>• Commercial vehicle hours of delay associated with traffic incidents.</li> </ul>
Improve Traveler Information	<ul style="list-style-type: none"> <li>• Time to alert motorists of an incident/emergency.</li> <li>• Number of repeat visitors to traveler information websites (or 511 systems).</li> <li>• Time between recovery from incident and removal of traveler alerts</li> <li>• Rate of accuracy of traveler information messages provided by government agencies.</li> <li>• Percent of intermediate and major incidents for which alternate route information was provided to travelers.</li> <li>• Percent of impacted/potentially impacted travelers receiving traveler information on incidents and emergencies.</li> </ul>
Improve Inter-Agency Coordination	<ul style="list-style-type: none"> <li>• Percentage of incident management agencies in region participating in multi-modal information exchange network.</li> <li>• Number of agencies in the region with interoperable voice communications.</li> <li>• Number of participating agencies in a regionally coordinated incident response team.</li> <li>• Number of TIM corridors in the region covered by regionally coordinated incident response teams.</li> <li>• Number of multi-agency after-action reviews per year.</li> <li>• Percentage of responding agencies participating in after-action reviews.</li> <li>• Percentage of TIM-related agencies in the region that participate in a resource/equipment sharing agreement to support TIM activities.</li> <li>• Percentage of TIM-related agencies in the region that have adopted and track standard TIM objectives and performance measures.</li> <li>• Percentage of TIM-related agencies in the region that have agreed to use standard terminology for TIM.</li> </ul>

Source: *Making the Connection: Advancing Traffic Incident Management in Transportation Planning* [33].

## CHAPTER 6

### CONCLUSIONS

The objectives of this project are to investigate the causes of long clearance times of major traffic incidents, and identify and propose ways to reduce major incident clearance times. The research team (1) examined regional sources (or causes) of incident clearance delay, (2) identified appropriate responsive TIM tools and strategies—based on the state-of-the-practice and specific incident clearance delay characteristics in each region—shown to be successful in reducing incident clearance times, and (3) provided recommendations for improving ongoing performance measurement to support continuous improvement in safe, quick incident clearance. Information to support this research effort originated from various sources including TIM stakeholder workshops focused on regional TIM operations, literature and the state-of-the-practice reviews, TIM stakeholder surveys and inventories of practice focused on performance measurement.

We analyzed of all major incidents in Caltrans Districts 3, 4, and 6 from January 2011 to April 2012. Major incidents as defined in this project and included in the dataset either took 90 minutes or more to clear or those that required the response of multiple agencies such as Caltrans and California Highway Patrol (CHP). The average total duration of major incidents – from first notification to when incident was removed from the roadway – ranged between 3 hours and 19 minutes to 4 hours and 39 minutes. Total incident duration in the more rural districts (District 3 and District 6) was slightly longer than those in the urban district (District 4).

The incidents that have the longest clearance times always involved overturned commercial vehicles with spilled loads either with a hazardous material spill or involved utilities. The presence of hazardous material can greatly increase incident duration. The average incident duration for those incidents involving hazardous materials ranged between 5 hours and 26 minutes to over 7 hours, with median duration times ranging from 3 hours and 49 minutes to 5 hours and 8 minutes.

There were significant differences in incident durations between those incidents where the cleanup required the use of the Caltrans hazardous material contractor compared to those incidents where the cleanup could be accomplished using Caltrans forces only. For example, in District 4, those hazardous material incidents where Caltrans crew could handle the removal of the materials averaged 3 hours and 19 minutes, while those incidents that required a contractor to remove the hazardous materials required over 8 hours to clear the incident. It should be noted, however, that the types of hazardous material incidents that generally require a contractor to perform the cleanup tend to be more complicated incidents and their clearance time is expected to be longer than the types of events that can be cleared by Caltrans crews.

Major incidents in which damage to a utility occurred increase clearance times considerably. For example, in District 6, the average clearance time of major incidents averaged nearly twice as long when a utility was involved compared to when a utility was not involved -- 7 hours and 20 minutes for those major incidents involving damage to a utility, as opposed to 4 hours and 39 minutes for those major incidents not involving a utility. Fatality incidents, while more numerous than hazardous material spills or incidents involving utilities, did not result in the highest incident durations. The average duration of those incidents involving a fatality ranged from 3 hours and 2 minutes in District 3 to 4 hours and 2 minutes in District 6, with the median duration in all three districts just slightly over 2 hours. As expected, clearance times in the rural more areas were higher than those urban areas, by about 40-60 minutes primarily due to the longer distances the coroner had to travel to reach the incident scene.

Workshops were held at Caltrans districts 3 and 6. These workshops included representatives from Caltrans district traffic operations and maintenance and hazardous material response teams; CHP; local

and regional fire, law enforcement and sheriff departments; regional coroner's offices; dispatchers and operators for regional public-safety answering points (PSAP); local tow truck operators; regional metropolitan planning organizations, and others. The following issues were identified based on discussion generated in the workshops:

1. Caltrans maintenance crews do not operate 24-hours/7-days a week. During normal work hours, maintenance crews are often working at other locations at the time an incident call comes in. This means that if they are at a job site when a call comes in, they have may have break off of their work activity to respond to the incident. During non-normal times, maintenance crews are at home and it takes time at assemble appropriate personnel. At times, it can be difficult to assemble a response crew quickly.
2. Recent changes in Caltrans' policy on vehicle home storage permits have resulted in difficulties by some maintenance supervisors responding to incident scenes rapidly, and often results in additional travel time will increase delays in initiating a response for incidents.
3. Several communications issues between Caltrans and field response personnel were identified during the workshops. Common communications issues identified across multiple districts include the following:
  - On-site responders will frequently request specific equipment to be dispatched to the scene (e.g., a sweeper), without fully describing the extent of the incident. Occasionally, this practice has resulted in the wrong equipment being sent to the incident site.
  - Information that on-site responders relay to dispatch is not always forwarded to other responders, particularly the field responders.
  - To overcome some communications issues, some Caltrans districts have generated quick reference guides that provide guidelines as to when to notify Caltrans for specific incidents. These have been distributed to include in "Beat Book" of local responders.
4. Not all requests for Caltrans resources flow through the TMC or maintenance dispatch, particularly with incidents in rural areas. Field responders will often communicate directly with one another to request resources. When this occurs, it becomes difficult to track response times of individual responders.
5. A knowledge drain exists as more experience CHP and Caltrans field personnel retire or leave their respective agencies. Replacement personnel do not have the knowledge or previous experience to know who to contact for specific responses or pieces of equipment. "Succession" planning has not been a priority with many Caltrans districts.
6. Many major incidents with long duration times involve hazardous materials (HAZMAT). Response times for incidents involving HAZMAT should be examined separately from other incidents. Incidents that require a HAZMAT contractor to assist in the clean-up will add time to the clearance timeline. Often, the HAZMAT response teams will have to come from multiple counties away from the incident location.
7. In some districts, trucking companies are responsible for cleaning up their own spilled loads and allowed to contact their own responders first. If a timely response cannot be provided, Caltrans and CHP will contact a clean-up crew and charge the trucking company later for the accrued costs.

Several recommendations were formulated based on the findings and the data analysis:

1. Each district should consider establishing an Incident Management Review Team focusing on addressing issues of coordination and collaboration, communications, and logistics between incident response agencies in each district or region.
2. Each district should consider developing a formal incident management strategic plan specific for their region. This strategic plan should define the collective vision, goals and objectives for incident management in the region as well as response and traffic management processes and

procedures specific to the region, including contact information. Alternate route plans could also be developed as part of this effort.

3. Each district should consider establishing an incident coordinator position. This should be a full-time position and the individual would be responsible for coordinating the incident management efforts for the district, including the planning and coordinating the Incident Management Review Team meetings, and the development and implementation of the district's incident management strategic plan.
4. Districts should consider holding annual workshop/summits similar to the ones performed as part of this project to discuss issues affecting regional responses, new innovations in traffic incident management, and regional training needs and initiatives.
5. Districts should implement a policy to perform after action review for all incidents lasting over 2 hours, or any incident where significant issues occurred in the response.
6. Caltrans should update "Ready Reference Cards" for CHP Dispatchers and local field personnel. Include "checklist" of questions that need to be answered to convey the information needed by Caltrans to generate appropriate response. These should be distributed statewide to all first responder agencies (not just CHP).
7. Caltrans and CHP need to develop policies and procedures for overcoming data exchange challenges. Potential areas for improved coordination include the following:
8. Caltrans should consider re-implementing "quick strike teams" for rural areas where Caltrans can reach any incident scene on major facilities or routes of regional significance within a designated timeframe (e.g., less than 30 minutes).
9. Caltrans TMCs should work to involve and integrate Caltrans' Public Information Office more into the incident management process. These individuals can be critical in assisting in disseminating information to the media about major incidents.
10. Caltrans should consider implementing regular joint training activities that involve both dispatchers and field responders that will allow better communications between these entities, particularly in rural areas who may, in many cases, be volunteers. Caltrans should implement a program to provide regular training to rural responders on proper incident notification, traffic incident management and traffic control procedures, including proper flagging procedures, vehicle positioning/ scene protection procedures, and emergency vehicle light usage procedures.
11. Caltrans should consider implementing a pilot towing and recovery program to mitigate incident involving heavy duty, commercial vehicles and tractor-trailer rigs. Under this program, select heavy-duty towing and recovery companies would be provided with a financial incentive to rapidly respond to and clear major incident involving trucks from the roadway.
12. Caltrans should consider implementing a pilot program to use photogrammetry as an alternative means of collecting information at large incident management scenes, particularly in rural areas. Photogrammetry procedures allow data collection and investigative measurements needed for accident reconstruction to be performed using digital photographs.
13. Caltrans should also consider developing tools and protocols that provide for sharing descriptive information about major incident between responders. This might include the development of an application that allow emergency responders to share photographs of incident scenes so that other responders have a good understanding of what resources and assets are needed at the incident scene.

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**APPENDIX A**  
**1<sup>st</sup> WORKSHOP SLIDES AND INCIDENT SCENARIOS**



## Quick Clearance for Major Traffic Incidents Workshop Agenda

Caltrans District 6 North Region  
Maintenance Conference Room  
1635 West Pine Avenue, Fresno  
8:30 AM -11:00 AM



## Workshop Objectives

- Identify and characterize the current sources of incident clearance delays in the region
- Identify potential strategies for reducing or eliminating sources of delay by identifying:
  - Activities that could be accomplished in less time
  - Activities that could be accomplished concurrently instead of sequentially
  - Activities that could be potentially be postponed to a less critical time
- Identify potential performance measures to be used to measure the effectiveness of the entire incident management response process and program, from a regional perspective versus an agency perspective



# Workshop Agenda

- Overview and Introductions 8:30 AM
- Incident #1: Injury Incident 8:45 AM
- Break 9:15 AM
- Incident #2: Major Incident with Fatality 9:30 AM
- Break 10:00 AM
- Incident #3: Multi-Agency Responses 10:15 AM
- Wrap-Up and Next Steps 10:45 AM
- Adjourn 11:00 AM



# Methodology

- Use table-top exercises adapted to region – include variety of severity levels and unique challenges
- Each incident scenario includes timetable that provides elapsed time in 5-minute interval
- Prompt workshop participants to identify activities that could be accomplished in :
  - Less time
  - Concurrently (instead of sequentially)
- Demonstrate the magnitude of time-savings



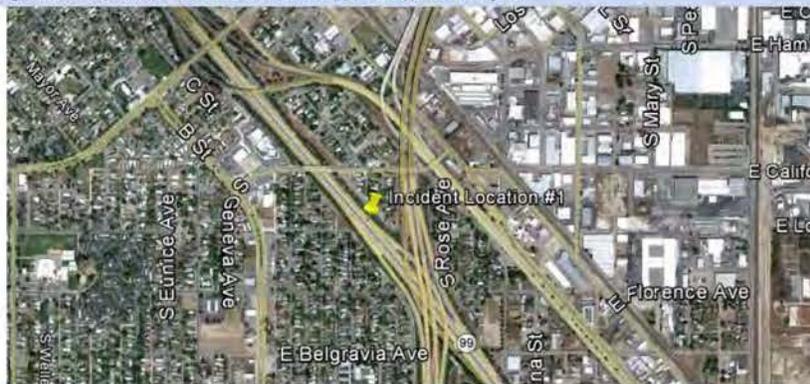
# Introductions

- Name
- Organization
- Responsibility



# Incident Scenario #1

**DATE/TIME:** 11:15 AM on Monday.  
**LOCATION:** Northbound on Golden State Highway (State Hwy 99) just north of Yosemite Freeway (State Hwy 41)/ Golden State Highway (State Hwy 99) interchange.  
**CIRCUMSTANCES:** Vehicle #1 entering SH 99 from the SH 41 northbound on-ramp crossed the gore stripe, sideswiping Vehicle #2 traveling northbound on SH 99. Upon impact, Vehicle #2 braked abruptly and was rear-ended by Vehicle #3. The three involved vehicles are blocking the two rightmost travel lanes of SH 99. At least one of the vehicle drivers appears to be injured.



## Incident Scenario #1 (Continued)



## Incident Scenario #2



**DATE/TIME:** 3:35 PM on Monday.

**LOCATION:** Eastbound on SH 1980 South of the Abby Street exit.

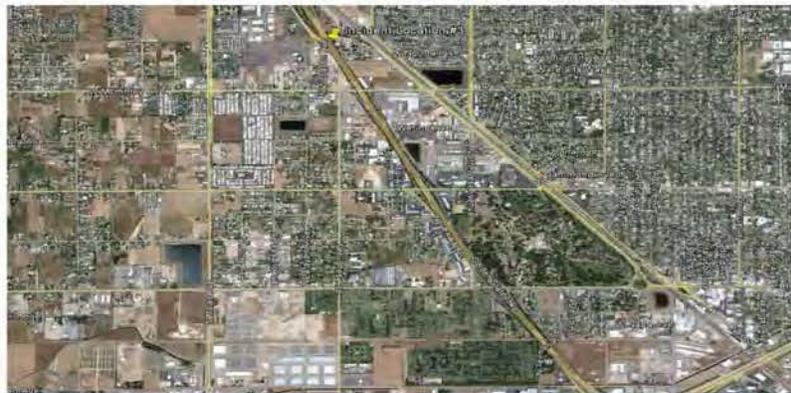
**CIRCUMSTANCES:** A vehicle traveling eastbound in the center lane, struck an object in the roadway and overturned, resting in the inside shoulder lane. Unfortunately, a passenger in the vehicle was ejected. Another vehicle, a mini-van with multiple occupants, also travel eastbound swerved to the right to miss the debris and was struck at a right angle by a third vehicle. There are multiple injuries in the second collision and smoke has been reported from the third vehicle. All travel lanes are blocked.



## Incident Scenario #2 (Continued)



## Incident Scenario #3



**DATE/TIME:** 4:35 PM on Thursday.  
**LOCATION:** Northbound SH 99 just south of Clinton Ave..  
**CIRCUMSTANCES:** Vehicle #1, traveling in the leftmost lane, abruptly swerved across two lanes in an attempt to access the exit ramp. In doing so, Vehicle #1 caused the driver of a large tractor semi-trailer (Vehicle #2) to lose control of his vehicle following sudden braking. The tractor semi-trailer jack-knifed and overturned, damaging the trailer and spilling the load of small electronics across the roadway. The driver sustained only minor injuries but the vehicle and debris are blocking all three travel lanes.



## Incident Scenario #3 (Continued)



## National Incident Management Performance Measures

Performance Measure	Description
Reduce Roadway Clearance Time	Time between first recordable awareness of incident by a responsible agency and first confirmation that all lanes are available for traffic flow.
Reduce Incident Clearance Time	Time between first recordable awareness of incident by a responsible agency and time at which the last responder has left the scene.
Reduce Secondary Incidents	Number of unplanned incidents beginning with the time of detection of the primary incident where a collision occurs either (a) within the incident scene or (b) within the queue, resulting from the original incident.



# Thank You!

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**INCIDENT SCENARIO #1**  
**LANE-BLOCKING, INJURY CRASH**

**DATE/TIME:**

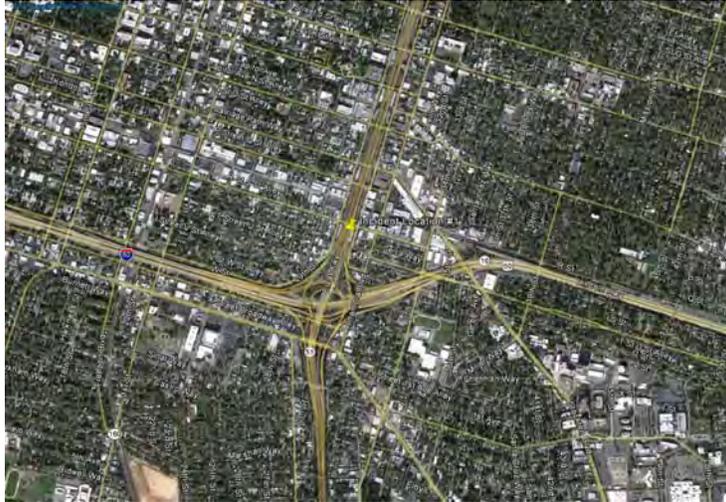
11:15 AM on Monday.

**LOCATION:**

Eastbound on I-80 just north of Lincoln Highway (US 50/ SH 16)/ I-80 interchange.

**CIRCUMSTANCES:**

Vehicle #1 entering I-80 from the Lincoln Highway northbound on-ramp crossed the gore stripe, sideswiping Vehicle #2 traveling northbound on I-80. Upon impact, Vehicle #2 braked abruptly and was rear-ended by Vehicle #3. The three involved vehicles are blocking the two rightmost travel lanes of I-80



f

the vehicle drivers appears to be injured.



**ALTERNATE CIRCUMSTANCES:**

1. How would this scenario change if this incident occurred outside city limits?

## DETECTION AND VERIFICATION

### Exercise

1. How will this incident first be detected (e.g., cell phone reports, CCTV, roving patrols)? How quickly?
2. Who is the first point of notification?
3. How will the circumstances of this incident be verified (e.g., patrol dispatched to scene, CCTV)? How quickly?
4. Who will ultimately be notified of this incident? How quickly?

State Police	Coroner	State DOT Maintenance
Co. Sheriff	County OEM	State/City Traffic Signals
City Police Dept.	City OEM	Towing and Recovery
City Fire Dept.	State DOT TMC/TOC	Media
City/Co EMS	Service Patrols(?)	Other

5. What kind of information is logged by each agency? Where and how?

Time	Independent and Concurrent Activities			
11:15 AM	Incident occurs			
11:20 AM				
11:25 AM				
11:30 AM				
11:35 AM				
11:40 AM				
11:45 AM				
11:50 AM				
11:55 AM				
12:00 PM				
12:05 PM				
12:10 PM				
12:15 PM				
:				

### Supplementary Discussion Questions

- Does detection occur quickly enough?
- Are too many reports received?
- Does verification occur quickly enough?
- Do current verification methods provide enough information to accurately dispatch response?
- How accurate are reports from motorists? Is there ever any confusion over location?
- Are all appropriate parties being adequately notified (e.g., early enough and with sufficient information)?
- What role is TMC currently serving in incident detection? Verification?

## MOTORIST INFORMATION

### Exercise

1. When will the media or motorists be notified? By whom?
2. How often will this information be updated? By whom?
3. What tools or strategies are currently used to provide information to motorists?
4. What kind of information is logged by each agency? Where and how?

Time	Independent and Concurrent Activities			
11:15 AM	Incident occurs			
11:20 AM				
11:25 AM				
11:30 AM				
11:35 AM				
11:40 AM				
11:45 AM				
11:50 AM				
11:55 AM				
12:00 PM				
12:05 PM				
12:10 PM				
12:15 PM				
12:30 PM				
12:35 PM				
12:40 PM				
12:45 PM				

### Supplementary Discussion Questions

- How accurate and timely is the information that is given to motorists?
- How close is the estimation of incident duration? Is the estimate typically too long or too short?
- How are media relations?
- What role is TMC currently serving in providing motorist information?

## RESPONSE

### Exercise

1. Who will immediately respond? How quickly?
2. Who will ultimately respond? How quickly?

State Police	Coroner	State DOT Maintenance
Co. Sheriff	County OEM	State/City Traffic Signals
City Police Dept.	City OEM	Towing and Recovery
City Fire Dept.	State DOT TMC/TOC	Media
City/Co EMS	Service Patrols(?)	Other

3. What would be a typical route to this incident scene?
4. How long is it likely to take to respond to this incident? How long is it likely to take to get all assets on scene?
5. What kind of information is logged by each agency? Where and how? Is there a record of who arrives and when?

<b>Time</b>	<b>Independent and Concurrent Activities</b>			
11:15 AM	Incident occurs			
11:20 AM				
11:25 AM				
11:30 AM				
11:35 AM				
11:40 AM				
11:45 AM				
11:50 AM				
11:55 AM				
12:00 PM				
12:05 PM				
12:10 PM				
12:15 PM				
12:30 PM				
12:35 PM				
12:40 PM				
12:45 PM				

**Supplementary Discussion Questions**

- What occurs most often - over-response or under-response?
- What prevents quick response (i.e., inability to communicate with other responders, lack of information, non-preemptive traffic signals, mistrust of others' assessment)?
- How timely is response after hours?
- How accessible are incident scenes for responders?
- How consistent is response (i.e., is Caltrans called out each time for similar incidents?)
- What role is TMC currently serving in supporting response?

**SITE MANAGEMENT**

**Goals and Objectives**

The goals and objectives of this exercise is to uncover areas for improvement related specifically to site management. In addition, participants are asked to start thinking about potential tools or strategies that can improve their current efforts.

**Exercise**

1. Who will do what at the incident scene?
2. What do you need to effectively manage an incident site?
3. Describe response vehicle parking once on-scene? (use graphic)
4. Describe the traffic control established at the scene? How quickly is this put in place? (use graphic).
5. Describe existing site management efforts.
6. Describe the shortcomings of existing site management efforts.
7. What kind of information is logged by each agency? Where and how?

**Supplementary Discussion Questions**

- Describe communications capabilities at the scene. Are problems equipment-related or personnel-related?
- Are there ever any conflicts over “who’s in charge?” How are these conflicts resolved?
- Are there problems of maneuverability at the incident scene? What are common sources of blockage?
- What specific incident management functions might be best served by a TMC?

- What, if any, incident management functions are currently served by a TMC?
- Describe the shortcomings of any TMC-related efforts.
- Who should be involved with a TMC?
- What should their role be?

## **CLEARANCE**

### **Goals and Objectives**

The goals and objectives of this exercise is to uncover areas for improvement related specifically to clearance. In addition, participants are asked to start thinking about potential tools or strategies that can improve their current efforts.

### **Exercise**

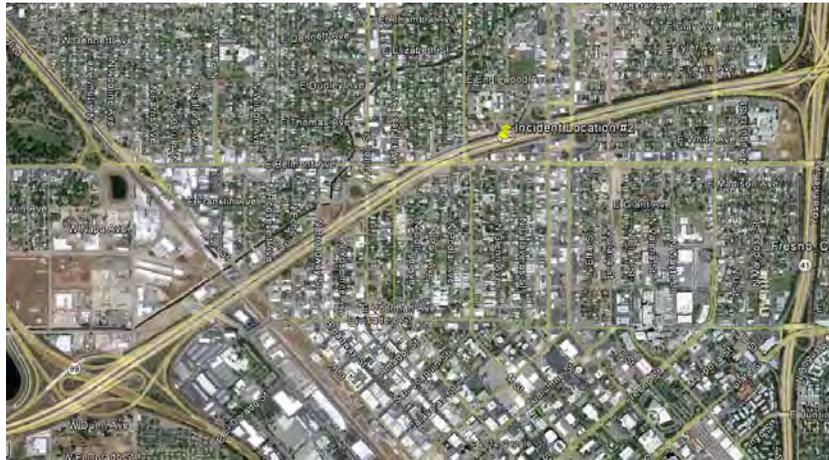
1. How and when will this incident be cleared?
2. What do you need to effectively clear an incident?
3. Describe existing clearance efforts.
4. Describe the shortcomings of existing clearance efforts.
5. What kind of information is logged by each agency? Where and how?

### **Supplementary Discussion Questions**

- Is there concern over liability?
- How long do vehicle typically remain on the shoulder?
- What prevents quick clearance (i.e., inadequate equipment, procedural limitations, etc.)?
- Who condemns spilled cargo? Who formally declares death? Are any clearance actions taken before either of these actions?
- What specific incident management functions might be best served by a TMC?
- What, if any, incident management functions are currently served by a TMC?
- Describe the shortcomings of any TMC-related efforts.
- Who should be involved with a TMC?
- What should their role be?

## INCIDENT SCENARIO #2 MAJOR ACCIDENT WITH FATALITY

**DATE/TIME:** 3:35 PM on Monday.  
**LOCATION:** Eastbound on I-80 East of the Raley Street entrance.  
**CIRCUMSTANCES:** A vehicle traveling eastbound in the center lane, struck an object in the roadway and overturned, resting in the inside shoulder lane. Unfortunately, a passenger in the vehicle was ejected. Another vehicle, a mini-van with multiple occupants, also travel eastbound swerved to the right to miss the debris and was struck at a right angle by a third vehicle. There are multiple injuries in the second collision and smoke has been reported from the third vehicle. All travel lanes are blocked.



### ALTERNATE CIRCUMSTANCES:

- How would this scenario change if it occurred in a rural area instead of an urban area?
- How would this scenario change if it occurred at 3:15 AM instead of 11:15 AM?
- How would this scenario change if the vehicle was on fire?
- How would this scenario change if the driver of this vehicle had a medical emergency?

## DETECTION AND VERIFICATION

### Exercise

1. How will this incident first be detected (e.g., cell phone reports, CCTV, roving patrols)? How quickly?
2. Who is the first point of notification?
3. How will the circumstances of this incident be verified (e.g., patrol dispatched to scene, CCTV)? How quickly?
4. Who will ultimately be notified of this incident? How quickly?
 

State Police	Coroner	State DOT Maintenance
Co. Sheriff	County OEM	State/City Traffic Signals
City Police Dept.	City OEM	Towing and Recovery
City Fire Dept.	State DOT TMC/TOC	Media
City/Co EMS	Service Patrols(?)	Other
5. What information is logged/kept by each agency and where?

Time	Independent and Concurrent Activities			
3:35 PM	Incident occurs			
3:40 PM				
3:45 PM				
4:00 PM				
4:15 PM				
4:30 PM				
4:45 PM				
5:00 PM				
5:15 PM				
5:30 PM				
5:45 PM				
6:00 PM				
6:15 PM				
⋮				

### Supplementary Discussion Questions

- Does detection occur quickly enough?
- Are too many reports received?
- Does verification occur quickly enough?
- Do current verification methods provide enough information to accurately dispatch response?
- How accurate are reports from motorists? Is there ever any confusion over location?
- Are all appropriate parties being adequately notified (e.g., early enough and with sufficient information)?
- What role is CTECC currently playing in incident detection? Verification?

## MOTORIST INFORMATION

### Exercise

1. When will the media or motorists be notified? By whom?
2. How often will this information be updated? By whom?
3. What tools or strategies are currently used to provide information to motorists?
4. What kind of information is logged by each agency? Where and how?

## RESPONSE

### Exercise

1. Who will immediately respond? How quickly?
2. Who will ultimately respond? How quickly?

State Police	Coroner	State DOT Maintenance
Co. Sheriff	County OEM	State/City Traffic Signals
City Police Dept.	City OEM	Towing and Recovery
City Fire Dept.	State DOT TMC/TOC	Media
City/Co EMS	Service Patrols(?)	Other
3. What would be a typical route to this incident scene?
4. How long is it likely to take to respond to this incident? How long is it likely to take to get all assets on scene?
5. What kind of information is logged by each agency? Where and how? Is there a record of who arrives and when?

### Supplementary Discussion Questions

- What occurs most often - over-response or under-response?
- What prevents quick response (i.e., inability to communicate with other responders, lack of information, non-preemptive traffic signals, mistrust of others' assessment)?
- How timely is response after hours?
- How accessible are incident scenes for responders?
- How consistent is response (i.e., is Caltrans called out each time for similar incidents?)
- What role is TMC currently serving in supporting response?

## SITE MANAGEMENT

### Goals and Objectives

The goals and objectives of this exercise is to uncover areas for improvement related specifically to site management. In addition, participants are asked to start thinking about potential tools or strategies that can improve their current efforts.

### Exercise

1. Who will do what at the incident scene?
2. What do you need to effectively manage an incident site?
3. Describe response vehicle parking once on-scene? (use graphic)
4. Describe the traffic control established at the scene? How quickly is this put in place? (use graphic).
5. Describe existing site management efforts.
6. Describe the shortcomings of existing site management efforts.
7. What kind of information is logged by each agency? Where and how?

### Supplementary Discussion Questions

- Describe communications capabilities at the scene. Are problems equipment-related or

personnel-related?

- Are there ever any conflicts over “who’s in charge?” How are these conflicts resolved?
- Are there problems of maneuverability at the incident scene? What are common sources of blockage?
- What specific incident management functions might be best served by a TMC?
- What, if any, incident management functions are currently served by a TMC?.
- Describe the shortcomings of any TMC-related efforts.
- Who should be involved with a TMC?
- What should their role be?

## **CLEARANCE**

### **Goals and Objectives**

The goals and objectives of this exercise is to uncover areas for improvement related specifically to clearance. In addition, participants are asked to start thinking about potential tools or strategies that can improve their current efforts.

### **Exercise**

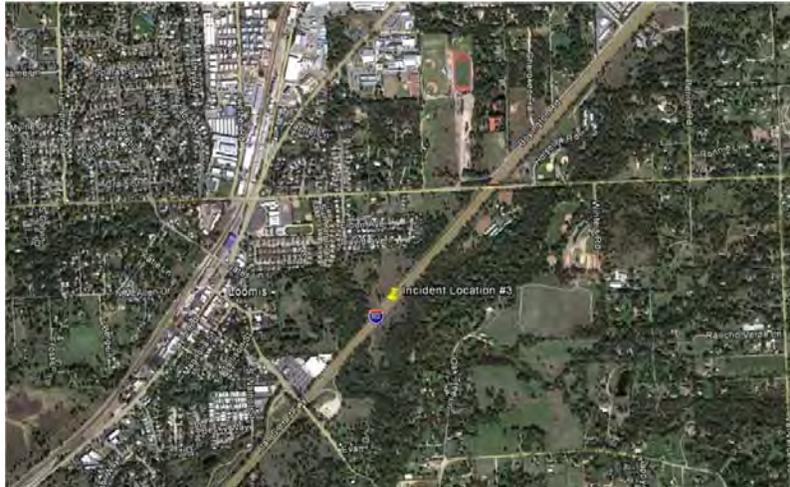
1. How and when will this incident be cleared?
2. What do you need to effectively clear an incident?
3. Describe existing clearance efforts.
4. Describe the shortcomings of existing clearance efforts.
5. What kind of information is logged by each agency? Where and how?

### **Supplementary Discussion Questions**

- Is there concern over liability?
- How long do vehicle typically remain on the shoulder?
- What prevents quick clearance (i.e., inadequate equipment, procedural limitations, etc.)?
- Who condemns spilled cargo? Who formally declares death? Are any clearance actions taken before either of these actions?
- What specific incident management functions might be best served by a TMC?
- What, if any, incident management functions are currently served by a TMC?.
- Describe the shortcomings of any TMC-related efforts.
- Who should be involved with a TMC?
- What should their role be?

### INCIDENT SCENARIO #3 LARGE TRUCK-INVOLVED CRASH

**DATE/TIME:** 4:35 PM on Thursday.  
**LOCATION:** Eastbound I-80, near Loomis.  
**CIRCUMSTANCES:** Vehicle #1, traveling in the leftmost lane, abruptly swerved across two lanes in an attempt to access the exit ramp. In doing so, Vehicle #1 caused the driver of a large tractor semi-trailer (Vehicle #2) to lose control of his vehicle following sudden braking. The tractor semi-trailer jack-knifed and overturned, damaging the trailer and spilling the load of small electronics across the roadway. The driver sustained only minor injuries but the vehicle and debris are blocking all three travel lanes.



#### ALTERNATE CIRCUMSTANCES:

- How would this scenario change if the tractor semi-trailer was transporting livestock?
- How would this scenario change if the tractor semi-trailer was transporting hazardous materials?

## DETECTION AND VERIFICATION

### Exercise

1. How will this incident first be detected (e.g., cell phone reports, CCTV, roving patrols)? How quickly?
2. Who is the first point of notification?
3. How will the circumstances of this incident be verified (e.g., patrol dispatched to scene, CCTV)? How quickly?
4. Who will ultimately be notified of this incident? How quickly?

State Police	Coroner	State DOT Maintenance
Co. Sheriff	County OEM	State/City Traffic Signals
City Police Dept.	City OEM	Towing and Recovery
City Fire Dept.	State DOT TMC/TOC	Media
City/Co EMS	Service Patrols(?)	Other

Time	Independent and Concurrent Activities			
4:35 PM	Incident occurs			
4:40 PM				
4:45 PM				
4:50 PM				
4:55 PM				
5:00 PM				
5:05 PM				
5:10 PM				
5:15 PM				
5:20 PM				
5:25 PM				
5:30 PM				
5:35 PM				
:				

### Supplementary Discussion Questions

- Does detection occur quickly enough?
- Are too many reports received?
- Does verification occur quickly enough?
- Do current verification methods provide enough information to accurately dispatch response?
- How accurate are reports from motorists? Is there ever any confusion over location?
- Are all appropriate parties being adequately notified (e.g., early enough and with sufficient information)?
- What role is TMC currently playing in incident detection? Verification?

## DETECTION AND VERIFICATION

### Goals and Objectives

The goals and objectives of this exercise is to uncover areas for improvement related specifically to detection and verification. In addition, participants are asked to start thinking about potential tools or strategies that can improve their current efforts.

### Exercise

1. How will this incident be detected? How quickly?
2. What do you need to effectively detect an incident and verify its occurrence?

3. Describe existing detection and verification efforts.
4. Describe the shortcomings of existing detection and verification efforts.

#### **Supplementary Discussion Questions**

- Does detection occur quickly enough?
- Are too many reports received?
- Do current verification methods provide enough information?
- How accurate are reports from motorists?
- What specific incident management functions might be best served by a TMC?
- What, if any, incident management functions are currently served by a TMC?
- Describe the shortcomings of any TMC-related efforts.
- Who should be involved with a TMC?
- What should their role be?

### **MOTORIST INFORMATION**

#### **Goals and Objectives**

The goals and objectives of this exercise is to uncover areas for improvement related specifically to motorist information. In addition, participants are asked to start thinking about potential tools or strategies that can improve their current efforts.

#### **Exercise**

1. When will the media or motorists be notified? By whom?
2. What do you need to effectively provide motorist information?
3. Describe existing motorist information efforts.
4. Describe the shortcomings of existing motorist information efforts.

#### **Supplementary Discussion Questions**

- How accurate and timely in the information that is given to motorists?
- How close is the estimation of incident duration? Is the estimate typically too long or too short?
- How are media relations?
- What specific incident management functions might be best served by a TMC?
- What, if any, incident management functions are currently served by a TMC?
- Describe the shortcomings of any TMC-related efforts.
- Who should be involved with a TMC?
- What should their role be?

### **RESPONSE**

#### **Goals and Objectives**

The goals and objectives of this exercise is to uncover areas for improvement related specifically to response. In addition, participants are asked to start thinking about potential tools or strategies that can improve their current efforts.

#### **Exercise**

1. Who will immediately respond? Who will ultimately respond?
2. What do you need to effectively respond to an incident?
3. Describe existing response efforts.
4. Describe the shortcomings of existing response efforts.

#### **Supplementary Discussion Questions**

- What occurs most often - over-response or under-response?
- What prevents quick response (i.e., inability to communicate with other responders, lack of information, mistrust of others' assessment)?
- How timely is response after hours?

- How accessible are incident scenes for responders?
- What specific incident management functions might be best served by a TMC?
- What, if any, incident management functions are currently served by a TMC?
- Describe the shortcomings of any TMC-related efforts.
- Who should be involved with a TMC?
- What should their role be?

## **SITE MANAGEMENT**

### **Goals and Objectives**

The goals and objectives of this exercise is to uncover areas for improvement related specifically to site management. In addition, participants are asked to start thinking about potential tools or strategies that can improve their current efforts.

### **Exercise**

1. Who will do what at the incident scene?
2. What do you need to effectively manage an incident site?
3. Describe existing site management efforts.
4. Describe the shortcomings of existing site management efforts.

### **Supplementary Discussion Questions**

- Describe communications capabilities at the scene. Are problems equipment-related or personnel-related?
- Are there ever any conflicts over “who’s in charge?” How are these conflicts resolved?
- Are there problems of maneuverability at the incident scene? What are common sources of blockage?
- What specific incident management functions might be best served by a TMC?
- What, if any, incident management functions are currently served by a TMC?.
- Describe the shortcomings of any TMC-related efforts.
- Who should be involved with a TMC?
- What should their role be?

## **CLEARANCE**

### **Goals and Objectives**

The goals and objectives of this exercise is to uncover areas for improvement related specifically to clearance. In addition, participants are asked to start thinking about potential tools or strategies that can improve their current efforts.

### **Exercise**

1. How and when will this incident be cleared?
2. What do you need to effectively clear an incident?
3. Describe existing clearance efforts.
4. Describe the shortcomings of existing clearance efforts.

### **Supplementary Discussion Questions**

- Is there concern over liability?
- How long do vehicle typically remain on the shoulder?
- What prevents quick clearance (i.e., inadequate equipment, procedural limitations, etc.)?
- Who condemns spilled cargo? Who formally declares death? Are any clearance actions taken before either of these actions?
- What specific incident management functions might be best served by a TMC?
- What, if any, incident management functions are currently served by a TMC?.
- Describe the shortcomings of any TMC-related efforts.
- Who should be involved with a TMC?
- What should their role be?

## APPENDIX B: RESEARCH RESULTS SUMMARY

### Research Results Summary

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Program Steering Committee (PSC): Transportation Safety & Mobility

June 2014

Title: Quick Clearance for Major Traffic Incidents

Task Number: 2245

Start Date: 09/01/10

Completion Date: 12/31/14

Product Category: New or improved business practice, procedure, or process

Task Manager:

Melissa Clark, Transportation Engineer (Electrical), *melissa.clark@dot.ca.gov*

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#### **TITLE:**

Quick Clearance for Major Traffic Incidents

#### **SUBHEAD:**

An analysis of the time-based components of major incidents including the process of notification and the performance of responders.

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#### **WHAT WAS THE NEED?**

The Federal Highway Administration has made the quick clearance of incidents a priority and has set 90 minutes as the goal average clearance time for every State. With a current average of over three hours, Caltrans has been compelled to investigate these major incidents to seek ways to reduce clearance time. Caltrans lacks the institutional knowledge of response times and notification speeds, and it is currently very difficult to find problems in the response process. A better understanding of incident information is required to produce proper recommendations for Traffic Incident Management (TIM).

#### **WHAT WAS OUR GOAL?**

The primary objective was to create a temporal profile of different types of major incidents by examining response times and to generate a series of best practices in TIM for future use. This would in turn create a multi-agency TIM-based effort within California to reduce the clearance time of major incidents toward the 90 minute requirement by the FHWA.

The findings will enable Caltrans staff to effectively identify current TIM challenges, implement appropriate TIM tools and strategies in response to these challenges, and accurately demonstrate the effectiveness of these tools and strategies over time.

## **WHAT DID WE DO?**

The researchers have conducted and produced: (1) a project Kick-Off Meeting and subsequent project meetings (2) Two sets of regional TIM workshops for first/emergency responders (3) Quarterly progress reports and financial reports (4) presentations of research results to Caltrans, CHP and other stakeholders and (5) a final report with recommendations on quick clearance improvements. More specifically, the researchers developed a baseline incident timeline as well as an “Incident Notification Tree” based upon input from responders at the TIM workshops and data from Caltrans, CHP, and other stakeholders. They identified sources of delay in each of the regional locations in support of subsequent tasks to identify appropriate TIM tools and strategies for improvement and have presented those strategies in follow-up workshops.

The final step in this project includes developing implementation guidance of new incident management strategies. Final report and presentations of the major study findings were conducted in the summer of 2014.

## **WHAT WAS THE OUTCOME?**

- Data Review
  - Average clearance time by district ranged from 3:20-4:30
  - Median (50<sup>th</sup> percentile) clearance was 1 hour below the average reflecting the effect of the worst incidents
  - HAZMAT and Utility issues can add many hours to the clearance time due to contractor or utility company delay
  - Incidents with fatalities were not the worst incidents
- Workshop Findings
  - Assembling a Caltrans response crew can be difficult
  - Loss of home storage permits is a concern among Caltrans employees
  - Communication breakdowns can occur between Caltrans and other responders
  - Caltrans is experiencing a knowledge drain for clearing of incidents
  - There are significant differences between urban and rural responses that have not been addressed
- Recommendations
  - Consider establishing a review team that examines responses to all major incidents over a certain threshold (“After Action Review”)
  - Assign one member of each district to be the district Incident Management Coordinator
  - Hold annual / bi-annual meeting for all stakeholders and responders
  - Consider financial incentives for tow companies
  - Consider photogrammetric tools that can viewed by all responders
  - Make sure all responders are up to date on current TIM practices and provide updated Ready Reference cards

## **WHAT IS THE BENEFIT?**

With effective implementation, Caltrans should observe a noticeable decrease in major incident clearance times over time. Improved TIM operations would increase reliability throughout the transportation system. Broadly, a comprehensive safe quick clearance program comprising of appropriate operational procedures, equipment and infrastructure, laws and policies should enhance the safety of responders and motorists while reducing incident-related congestion and delay.

**LEARN MORE**

Link should be provided to final Caltrans location (if it is public).

To view the evaluations:

xxx@xxx.xxx

**IMAGES**

**Typical Incident Notification “Tree”**



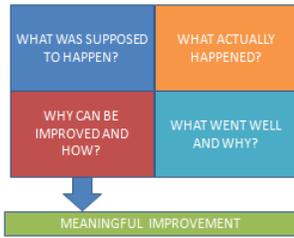
**Key Elements of a Sustainable TIM Program**

Element	Purpose
<b>Legislative or Administrative Authorization</b>	Provides top-down authorization for resource sharing and joint operations.
<b>Strategic Mission and Accompanying Goals</b>	Sets direction and establishes accountability for program performance.
<b>Written Operational Policies</b>	Provides unambiguous guidance for on-scene operations.
<b>Dedicated Staff</b>	Establishes TIM as core job function rather than secondary or tertiary activity.
<b>Ongoing Training</b>	Keeps responder skills current based on most recent state-of-practice.
<b>Well-Defined Responsibilities</b>	Solidifies relationships across disparate agencies and mitigates “turf battles” among responders.
<b>Clear Reporting Channels</b>	Establishes chain of command and ensures accountability.
<b>Dedicated Funding</b>	Lessens impact of budgetary fluctuations.

Source: 2010 Traffic Incident Management Handbook  
[http://www.ops.fwa.dot.gov/eto\\_tim\\_pse/publications/timhandbook/tim\\_handbook.pdf](http://www.ops.fwa.dot.gov/eto_tim_pse/publications/timhandbook/tim_handbook.pdf)

**After Action Reviews**

- Improve understanding of collective performance
- Provide immediate input in planning and executing future responses
- Produce list of lessons learned
- Improve coordination and collaboration



**Connecting TIM with Long-Range Transportation Planning**

<b>Guidance</b>	Vision, Goals, Objectives, Performance Measures, and Standard of Performance	<ul style="list-style-type: none"> <li>✓ Senior officials serve advisory role to policy makers</li> <li>✓ Crafting specific goals and objectives</li> </ul>
<b>Current &amp; Future Issues</b>	Safety, Operations, Reliability, Efficiency, Accessibility, Connectivity, Availability, Capacity	<ul style="list-style-type: none"> <li>✓ Daily experience with physical and operational needs</li> </ul>
<b>Potential &amp; Preferred Solutions</b>	TIM programs, TSM&O, Land Use, Active Modes, Closing Gaps, Expanding Service, Building More	<ul style="list-style-type: none"> <li>✓ Have technical knowledge on how strategies performs in the field</li> </ul>
<b>Cost Feasible Plan</b>	Prioritizing Programs/Strategies/Projects, Determining Affordability Over Time	<ul style="list-style-type: none"> <li>✓ Can provide input data on costs and effectiveness for TIM improvements over time</li> </ul>
<b>Implementing &amp; Monitoring</b>	Coordination, Partnering, Data Sharing, Action, Follow-Up, Evaluation, Reporting, Refinement	<ul style="list-style-type: none"> <li>✓ Collect data and generate performance reports to support evaluation of target areas</li> </ul>

Source: Making the Connection: Advancing Traffic Incident Management in Planning, FHWA-HQP-13-044

**Overall Incident Duration of Major Incidents by Caltrans District (hrs:min)**

District	Average	Median 50 <sup>th</sup> Percentile	95 <sup>th</sup> Percentile	Standard Deviation	Number of Samples
3	3:23	2:12	9:12	3:41	178
4	3:19	1:43	12:56	4:04	145
6	4:39	3:41	10:58	3:12	128

Sample Qualitative Examination of 10 Worst Incidents by District  
 Example District 6

Date	County	Route	Duration	Causes
3/7/2012	Kern	5	17:29	Big rig brake fire, hauling HAZMAT
11/29/2011	Kern	5	15:16	Jack-knife big rig on off-ramp
4/25/2011	Kern	58	14:06	Car vs. Big Rig head on collision, fatalities
2/24/2011	Tulare	65	12:58	Transformer falls into roadway
7/12/2011	Kern	119	12:20	Power line pole falls onto roadway
8/27/2011	Kern	119	11:39	Power lines fall onto roadway
3/29/2011	Kern	5	11:05	Big rig on fire carrying HAZMAT
4/8/2011	Tulare	99	10:47	Big rig crashes in work zone loses cargo
6/15/2011	Kern	178	10:27	Ruptured gas line in work zone
7/17/2011	Fresno	99	10:14	Police pursuit results in pedestrian fatality

**APPENDIX B**  
**2<sup>nd</sup> REGIONAL TIM IMPLEMENTATION WORKSHOPS**  
**AGENDA AND PRESENTATION MATERIALS**

**CALTRANS RESEARCH PROJECT P715/TASK: 2245**  
**QUICK CLEARANCE FOR MAJOR TRAFFIC INCIDENTS**  
**Regional TIM Implementation Workshops**

The purpose of the workshop is to identify potential TIM strategies and techniques for improving traffic incident management responses and to assist regional partners in developing an “action plan” for implementing identified responses specific for each region. The proposed agenda for these workshops are as follows:

8:30 Introductions and Overview

8:45 Review of Analysis of Response Times

- Review results of Responses Times/Incident Duration analyses
- Review of previous workshop findings
- Differences between urban and rural responses

9:15 Strategies Improving Regional Cooperation and Coordination

- Review of Partner Standard Operating Procedures Documents and Protocols
- After Action Review
- Exercise: Mock After Action Review -- This involves taking a major recent major incident and stepping through response timeline. Agencies would need to agree beforehand to incident and bring their response records so we could reconstruct what happened. Each agency would need to be able to identify FROM THEIR OWN PERSPECTIVE what when well with their response and what didn't go well.

10:15 Break

10:30 Round Table Discussion of Strategies for Institutionalizing TIM in region

- Regional partnership agreements
- Integrating TIM into the Planning process
- Rural versus Urban Issues
- Coordination with Caltrans Division

11:15 Development of Action Items for Regions

11:45 – Wrap-Up and Conclusions

Noon – Adjourn.



# Quick Clearance for Major Traffic Incidents

Workshop #2

Sponsored by  
Caltrans Division of Research Innovation and System Information



Caltrans Quick Clearance for Major Traffic Incidents -- Workshop #2

1



## Welcome and Introductions

- Name
- Agency
- Responsibility in TIM process



Caltrans Quick Clearance for Major Traffic Incidents -- Workshop #2

2



## Project Objectives

---

- Identify regional sources of incident clearance delay
- Examine strategies and tools to reduce incident clearance times for major incidents
- Develop a framework for monitoring incident clearance performance over time

## Purpose of Meeting

---

- **Review Findings**
  - Response Times Analysis
  - Previous Workshop
- **Strategies for Improving Regional Responses**
  - After Action Review
  - Standard Operating Procedures
  - Tools and strategies
- **Roundtable Discussion**
  - Regional partnership agreements
  - TIM in Planning Process
  - Rural versus Urban Responses
  - Coordination with Caltrans Division of Traffic Operations
- **Action Items and Next Steps**



## Schedule for Workshop

---

- 8:30 Welcome and Introductions
- 8:45 Review Outcomes of Previous Workshop
- 9:15 Strategies for Improving Regional Coordination and Cooperation
  
- 9:45 **BREAK**
  
- 10:00 Analysis of Incident Response Times
- 10:30 Quick Clearance Tools and Strategies
- 11:15 Action Items/Next Steps
- 11:30 Adjourn





## **BENEFITS OF INCIDENT MANAGEMENT**

**COURTESY OF SERGIO VENEGAS CALTRANS, DISTRICT 6**

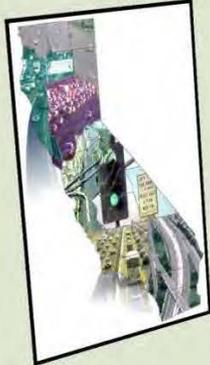


Caltrans Quick Clearance for Major Traffic Incidents -- Workshop #2

6



## What are the Benefits of a TMC in Incident Management?



Traffic Mobility Workshop

- Reduce Traffic Delays
- Reduce Traffic Incidents
- Save Fuel
- Improve Air Quality
- 8:1 Benefit/Cost Ratio

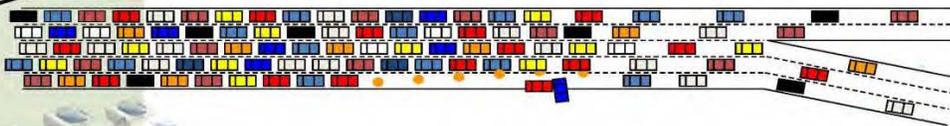
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## Benefits of a TMC - Nonrecurring Congestion Analysis (example)



### Example Incident

- Southbound US-101 – 5 lane section
- Weekday morning commute period
- Vehicle demand exceeds capacity from 7 A.M. to 8:30 A.M.
- Rear-end collision occurs at 7:30 A.M. that causes a lane closure
- Incident is cleared at 8:30 A.M.



Traffic Mobility Workshop

8

Total vehicle-hours of delay = 9,250  
 @ \$15.60 per vehicle-hour  
 Total cost of delay = \$144,300

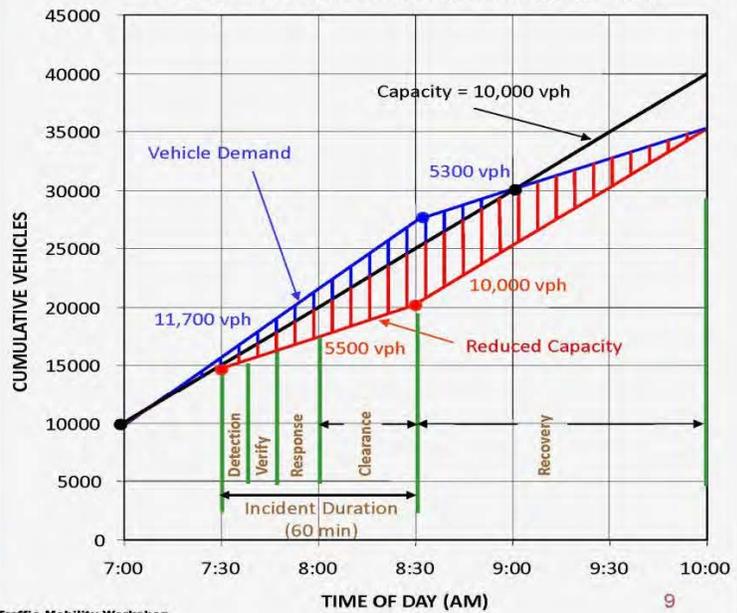
**How can we Reduce Delay?**

- Reduce Incident Duration
- Reduce Demand



**VEHICLE DEMAND VS CAPACITY**

Benefits of a TMC - Nonrecurring Congestion Analysis (example)



Traffic Mobility Workshop

Reduced vehicle-hours of delay = 1,690  
 @ \$15.60 per vehicle-hour  
 Total cost of reduction = \$26,360  
**A 18% Savings**

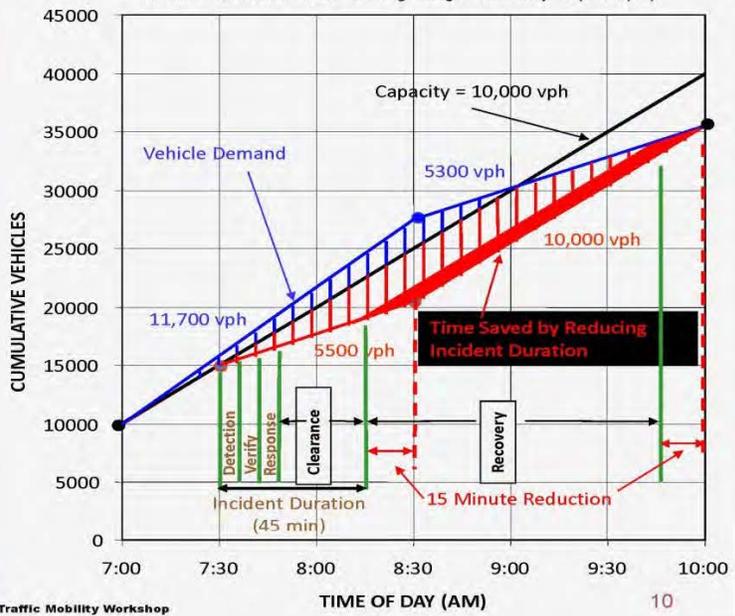
**Reduce Incident Duration**

- **Detection**  
 CAD  
 Loop detectors  
 Field units
- **Verification**  
 CCTV  
 CAD  
 Field units
- **Response**  
 CHP  
 Maintenance  
 TMT  
 Tow service / FSP  
 Hazmat contractor  
 others
- **Clearance**  
 All lanes reopened



**VEHICLE DEMAND VS CAPACITY**

Benefits of a TMC - Nonrecurring Congestion Analysis (example)



Traffic Mobility Workshop

10

Additional Reduction = 2,060 veh-hrs  
 Total Reduced = 3,750 veh-hrs  
 @ \$15.60 per veh-hrs  
 Total cost of reduction = \$58,500  
**A 41% Savings**

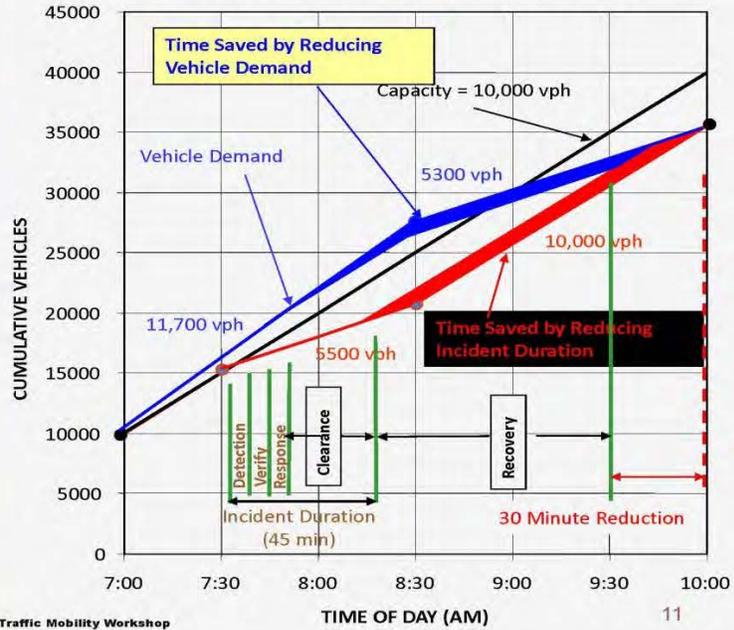
**Reduce Demand**

- Motorist information  
 CMS  
 TMT  
 HAR  
 Radio / Television  
 Internet
- Volume control  
 Ramp metering  
 Connector metering
- Detours  
 TMT  
 CHP  
 Maintenance



**VEHICLE DEMAND VS CAPACITY**

Benefits of a TMC - Nonrecurring Congestion Analysis (example)



Traffic Mobility Workshop

**How Much Does A Collision Like This Cost?**

- Emergency Airtel \$4000.00
- Department of Ecology \$500.00
- WSP \$4200.00
- Damage to Vehicles \$20,000.00
- The Gasperson \$50.00
- Local Police Response \$2000.00
- Trucking Company \$80,000
- Department of Transportation \$13,000.00
- Clean-up \$6800.00
- Ambulance \$4500.00
- Towing \$10,000.00

**Costs not included:**  
 Hospital / Medical  
 Court / Fines  
 Increased Insurance  
 Societal Costs (lost time and revenue due to delay)

**Total Cost = \$155,070.00 (Estimated Minimum)**

Source: Phillips R., D. MacDonald, and P. Hammond, 2006, Traffic Incident Management in Washington State.

Traffic Mobility Workshop



## ASSESSMENT OF CLEARANCE TIMES OF MAJOR TRAFFIC INCIDENTS



### Major Incident Clearance Times by Location

Clearance Times By  
District (HH:MM)

District	Average	50%	95%
3	3:23	2:12	9:12
4	3:19	1:43	12:56
6	4:39	3:41	10:58

Clearance Times By  
District (HH:MM)  
Top 10 Removed, All  
Over 90 Minutes

District	Average	50%	95%
3	3:25	2:48	7:03
4	4:04	3:16	9:45
6	4:11	3:35	8:22



## Caltrans Response Time

	District	Average	50%	95%
Start Time to Caltrans Notification (HH:MM)	3	0:12	0:06	0:42
	4	0:18	0:05	0:55
	6	0:29	0:17	1:37

	District	Average	50%	95%
Start Time to Caltrans Arrival (HH:MM)	3	0:44	0:41	1:49
	4	1:07	0:52	2:44
	6	1:14	0:59	2:51



## Qualitative Assessment of Worst Incidents

---

- Incidents with the longest duration almost always involved a big-rig jack-knife with either a hazmat and/or a utility, or utility alone (trees fall on power lines)
- Fatalities were not found in the worst incidents by district (only 2 out of 30).

## Incidents With Fatalities (1) Clearance Times (HH:MM)

District	Average	50%	Standard Deviation
3	3:02	2:13	2:25
4	3:13	2:12	2:10
6	4:02	2:54	3:01
Incident Start 6:00-23:00	3:13	2:15	2:39
Incident Start 23:00-6:00	3:39	2:44	2:10

## Incidents With Fatalities (2) Clearance Times (HH:MM)

District	Average	50%	Standard Deviation
3 – Urban	2:56	2:10	2:26
3 - Rural	3:13	2:43	2:26
6 – Urban	3:28	2:40	2:31
6 - Rural	5:00	3:49	3:39

## Incidents with HAZMAT Clearance Times (HH:MM)

Task	Average	50%	Standard Deviation
Total Clearance w/o Contractor	3:19	2:12	2:19
Total Clearance w/ Contractor	8:29	6:30	5:12
Contractor Delay (Call to Arrival)	2:32	2:00	2:00

## Incidents With Utilities Clearance Times (HH:MM)

District	Average	50%	Standard Deviation
6 w/ Utility	7:20	6:31	4:12
6 w/o Utility	4:39	3:41	3:12

5 out of Top 10 worst incidents in District 6 had a utility issue



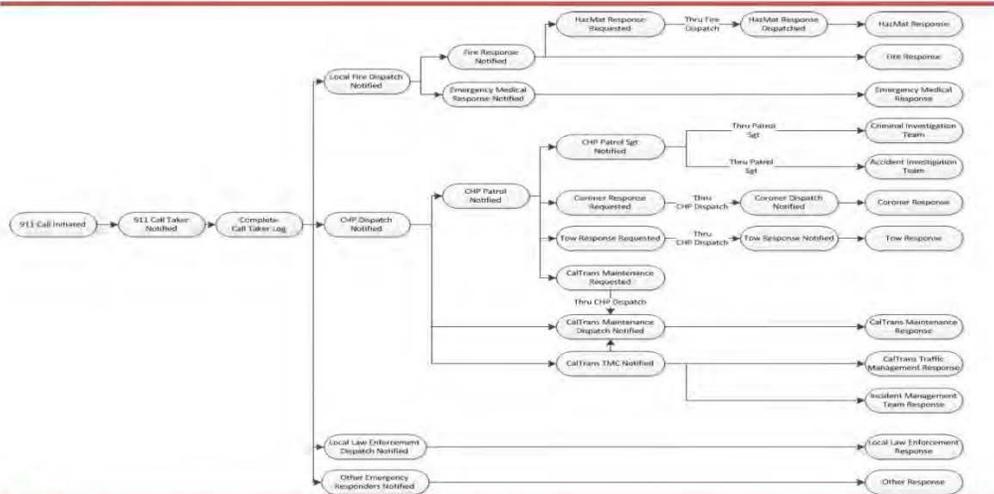


## FINDINGS FROM PREVIOUS WORKSHOPS

## Past workshops

- 
- 3 Workshops in 2012
  - Purpose of workshops
    - Identify sources of clearance delays
    - Discuss potential strategies for reducing/ eliminating delays
    - Identify potential performance measures
  - Methodology
    - Scenario based: 3 major incidents of different types
    - Roundtable discussion

# Typical Incident Notification “Tree”



## Common Themes of Workshops

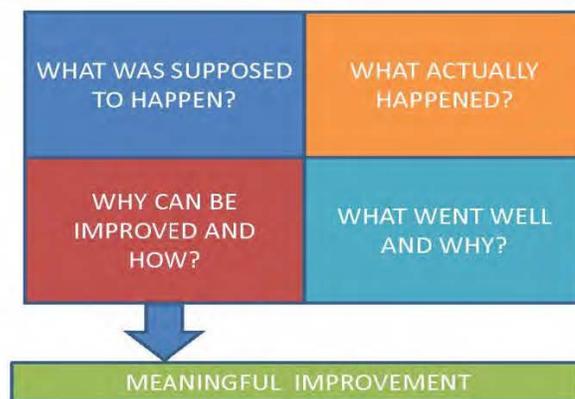
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- Inconsistent use of standard operating procedures
- Experience of responders a HUGE factor in requesting appropriate response – knowledge drain
- TMTs have positive impact, but limited to urban areas
- Longer response times in rural areas
  - Longer travel times
  - Fewer resources
  - Harder to locate resources
- Need for better coordination among entities at strategic level



## AFTER ACTION REVIEWS

## After Action Reviews (AAR)



**"WITHOUT AN AAR, YOU KEEP LEARNING THE LESSONS AGAIN THE HARD WAY!"**

## Goals of “After Action Reviews” in TIM

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- Improve understanding of what was good, bad and average about collective performance of responders
- Provide immediate input in planning and executing future responses
- Produce list of lessons learned that can lead to revised SOPs/actions
- Improve coordination and collaboration among responders that results in better responses in subsequent events.

## AAR Criteria

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- When is an AAR needed?
  - Any incident last two hours or more
  - Any major incident where significant response issues existed
  - Remember: Purpose is to improve coordination; not point finger
- Who needs to be involved?
  - Actual responders to the event (if possible)
  - Response coordinators
  - Facilitator
- When should an AAR occur?
  - Ideally, within 2 weeks of incident
  - No more than 1 month after incident

**Recommendation: Establish a written policy/agreement as to when an AAR should be done**



# Ground Rules for AAR

- Open and honest professional discussion
- Participation by everyone on team
- Focused on results of event
- Identify ways to sustain what was done well
- Refrain from passing judgment



# After Action Review Form

TRAFFIC INCIDENT MANAGEMENT AFTER ACTION REVIEW FORM	
Date of Incident	Date
Location	State
County	County
City	Incident Reference Number
<b>Participating Agencies</b> List the agencies participating in the review.	
<b>Description of Incident</b> Briefly describe the incident including information about the type, number, and severity of injuries, number of vehicles involved, number of lanes blocked, type of response needed, etc.	
<b>Timeline/Sequence of Events</b> Briefly identify, in order of key events in response, including notification times, arrival times, and clearance times of key responders. Other key components to be included include: <ul style="list-style-type: none"> <li>• Time of first notification</li> <li>• Time that all lanes are available for traffic flow</li> <li>• Time that last responder departed scene</li> </ul>	
<b>Employed Traffic Management Response</b> Briefly describe the traffic management response implemented including TSM activities, alternate routes, detours implemented, ramp work, closures, etc.	
<b>What went well and why?</b> Identify strategies/techniques that were successful so that they can be incorporated into future responses.	
<b>What can be improved and how?</b> Identify specific actions that could have been done better, given the information and knowledge available at the time. Identify needed changes in training, standard operating procedures, communications, coordination, resources, policies and procedures, etc.	



## TIM Regional Forums

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- Intended to provide public safety and transportation partners a regular forum for discussing TIM-related issues.
- Typical Agenda
  - Welcome and Introduction
  - Incident Debriefings
  - Updates on TIM Program Initiative
  - Special Events/Construction Updates
  - What's new in TIM?
    - Lesson Learned
    - New Best Practices
    - Procedures/Legislation/Policies Changes
    - Personnel/Responsibility Changes
- Quarterly/Every 2-months





## SF Bay Area Traffic Incident Management



### Sample Agenda

- 9:00 Welcome and Introduction
- 9:10 Incident Management: The National Unified Goal (NUG)
- 9:15 Allied Agency Roles in Incident Management
- 10:00 Freeway Service Patrol: What They Can Do for You
- 10:15 Traffic Management Center and Critical Incident Management
- 10:35 Roundtable Discussion: Working with Outside Partners
- 11:25 Next Steps: The Bay Area Incident Management Task Force
- 11:40 Closing Remarks/Action Plan, Workshop Evaluations
- 11:50 Networking Lunch



For more information <http://www.timbayarea.org/>



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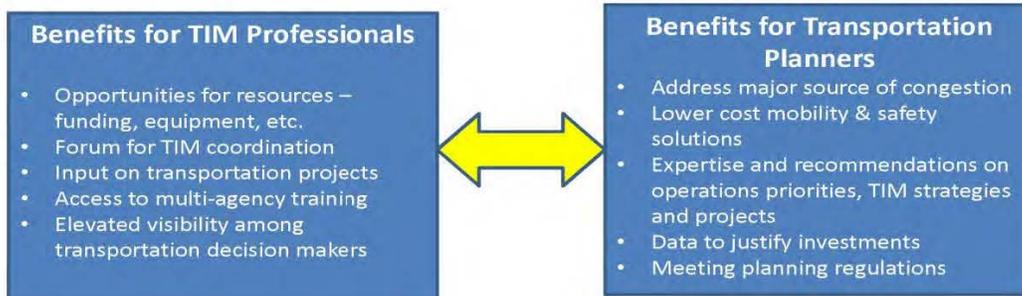
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## CONNECTING TRAFFIC INCIDENT MANAGEMENT IN PLANNING

## Connecting TIM to Transportation Planning



Source: *Making the Connection: Advancing Traffic Incident Management in Planning, FHWA-HOP-13-044*

## Typical Steps to Developing a Metropolitan Transportation Plan

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<b>Guidance</b>	Vision, Goals, Objectives, Performance Measures, and Standard of Performance
<b>Current &amp; Future Issues</b>	Safety, Operations, Reliability, Efficiency, Accessibility, Connectivity, Availability, Capacity
<b>Potential &amp; Preferred Solutions</b>	TIM programs, TSM&O, Land Use, Active Modes, Closing Gaps, Expanding Service, Building More
<b>Cost Feasible Plan</b>	Prioritizing Programs/Strategies/Projects, Determining Affordability Over Time
<b>Implementing &amp; Monitoring</b>	Coordination, Partnering, Data Sharing, Action, Follow-Up, Evaluation, Reporting, Refinement

Source: *Making the Connection: Advancing Traffic Incident Management in Planning*, FHWA-HOP-13-044



Caltrans Quick Clearance for Major Traffic Incidents -- Workshop #2  
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## What can TIM Responders Contribute to Planning Process?

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<b>Guidance</b>	Vision, Goals, Objectives, Performance Measures, and Standard of Performance	<ul style="list-style-type: none"> <li>✓ Senior officials serve advisory role to policy makers</li> <li>✓ Crafting specific goals and objectives</li> </ul>
<b>Current &amp; Future Issues</b>	Safety, Operations, Reliability, Efficiency, Accessibility, Connectivity, Availability, Capacity	<ul style="list-style-type: none"> <li>✓ Daily experience with physical and operational needs</li> </ul>
<b>Potential &amp; Preferred Solutions</b>	TIM programs, TSM&O, Land Use, Active Modes, Closing Gaps, Expanding Service, Building More	<ul style="list-style-type: none"> <li>✓ Have technical knowledge on how strategies performs in the field</li> </ul>
<b>Cost Feasible Plan</b>	Prioritizing Programs/Strategies/Projects, Determining Affordability Over Time	<ul style="list-style-type: none"> <li>✓ Can provide input data on costs and effectiveness for TIM improvements over time</li> </ul>
<b>Implementing &amp; Monitoring</b>	Coordination, Partnering, Data Sharing, Action, Follow-Up, Evaluation, Reporting, Refinement	<ul style="list-style-type: none"> <li>✓ Collect data and generate performance reports to support evaluation of target areas</li> </ul>

Source: *Making the Connection: Advancing Traffic Incident Management in Planning*, FHWA-HOP-13-044



# Hampton Roads Region TIM Objects and Performance Targets



Source: Hampton Roads Highway Incident Management (HIM) Regional Concept for Transportation Operations (RCTO) Available at <http://www.hrtpo.org/uploads/docs/RCTOExecSummFinalCopy.pdf>



# Example of TIM in Strategic Plan

**MPO** **HAMPTON ROADS RCTO**

**OBJECTIVE 1**  
Increase Responder Safety by Eliminating Struck-by Incidents and Fatalities

**TARGET**  
Increase Responder Safety by Eliminating Struck-by Incidents and Fatalities

**Action Item**  
Start a Regional Public Awareness Campaign Concerning the "Slow Down, Move Over" Law and the "Move It" Law

Virginia's "Slow Down, Move Over" law requires motorists to approach cautiously when an emergency vehicle is stopped on two or four lane roadways with emergency lights flashing. Motorists are required to change lanes away from the emergency vehicle if they can do so safely (58.130 Code of Virginia). Motorists who are unable to change lanes due to heavy traffic must slow down, or attempt to pass awareness of the law. The RCTO Working Group will explore methods of getting the message out, and is committed to the most possible regional awareness. Only the best and optimal levels of awareness are achieved and maintained. Please view <http://www.virginia.gov/transportation>.

There is also Virginia's "Move It" law, which mandates that if vehicles involved in an incident can be safely moved to the shoulder or other safe area and no one has been injured, then the involved motorist should do so in order to remain not only their safety, but that of others who are approaching the scene. The RCTO Working Group will explore ways of getting vehicle lighting for secondary response vehicles made in line with that of primary response vehicles.

**Performance Measures**  
The two performance measurement categories which apply to this objective are "Rate of Crashes per 100 Miles Driven for Virginia State Police (VSP) and Safety Service Patrol (SSP)" and "Incidents involving Vehicle Fires". In terms of the first category, a reduction in the crashes involving these entities should provide insight into whether progress is being made toward meeting the stated target. The second category will be useful to the RCTO because it will identify accidents that most greatly compromise the safety of responders.

**FACT**  
"If percent of emergency responders with flashing "Slow Down" laws, 80 percent required meeting "Move Over" laws on all 67 routes, and 80 percent follow traffic stops and vehicle impoundments are responsible for law enforcement and their resources."  
Western Climate Planning and Research, sponsored by West National Safety Consortium

For Each Objective and Performance Target Identified in Strategic Plan

Action Items Identified

Performance Measures Highlighted

Source: Hampton Roads Highway Incident Management (HIM) Regional Concept for Transportation Operations (RCTO) Available at <http://www.hrtpo.org/uploads/docs/RCTOExecSummFinalCopy.pdf>



## Focus State Performance Metric

TIM Program Objective	Related Performance Measures
Reduce "Roadway" Clearance Time	Time between first recordable awareness of incident by a responsible agency and first confirmation that all lanes are available for traffic flow.
Reduce "Incident" Clearance Time	Time between first recordable awareness of incident by a responsible agency and time at which the last responder has left the scene.
Reduce the Number of Secondary Crashes	Number of unplanned crashes beginning with the time of detection of the primary incident where a collision occurs either a) within the incident scene or b) within the queue, including the opposite direction, resulting from the original incident.

Source: *Making the Connection: Advancing Traffic Incident Management in Planning, FHWA-HOP-13-044*



## Example of Performance Measures and Targets – Madison, Wisconsin

Performance Measure	Performance Target
Freeway Non-Recurring Congestion	70% of non-recurring congestion should not last longer than 30 minutes
Freeway Incident Index	Total lane-hours of closure per average weekday < 2.0
Urban Arterial Street Travel Time Index	1.75 (traffic speeds on 30-40 mph roadways should not experience incident-related speed reductions of more than 30 percent)
Urban Arterial Street Non-Recurring Delay	Average Incident Clearance Time < 1 hour Special Event traffic management plans in place for all events

Source: *Making the Connection: Advancing Traffic Incident Management in Planning*, FHWA-HOP-13-044



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# Overcoming Data Exchange Challenges

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- Establish agreements to preclude compromising sensitive data
- Develop common data dictionaries
- Establish common time stamp and geographic coordinates necessary
- Identify and agree to a defined standard or group of standards
- Identify and agree upon method for integrating text, video, and audio formats
- Use consistent data collection practices within and between agencies

Source: 2010 Traffic Incident Management Handbook Update  
[http://www.ops.fhwa.dot.gov/eto\\_tim\\_pse/publications/timhandbook/tim\\_handbook.pdf](http://www.ops.fhwa.dot.gov/eto_tim_pse/publications/timhandbook/tim_handbook.pdf)



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# Break

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## QUICK CLEARANCE TOOLS AND STRATEGIES



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## Common Regional Investments in TIM

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- Towing and Recovery Incentive Program
- Training, Material, and Supplies
- Intelligent Transportation System
- Incident Management Equipment
- Collaboration and Coordination
- Highway/Freeway Vehicle Pullouts and Turnarounds
- Highway Service Patrols

Source: 2010 Traffic Incident Management Handbook Update

[http://www.ops.fhwa.dot.gov/eto\\_tim\\_pse/publications/timhandbook/tim\\_handbook.pdf](http://www.ops.fhwa.dot.gov/eto_tim_pse/publications/timhandbook/tim_handbook.pdf)



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## FDOT's Rapid Incident Scene Clearance Program

- Pays financial incentives clear major incidents within specified period
  - The TMC notifies contractor to mobilize and provide the details and estimated time of arrival to FHP.
  - One hour to arrive on scene with the required equipment. If not needed, receives a flat rate service payment of \$600.
  - Once given a "notice to proceed" has 90 minutes to "open all travel lanes"
  - To receive payment of \$2,500, must have both arrived within one hour and opened all travel lanes within 90 minutes.
  - If requested to provide "Additional Trucks and Heavy Equipment", paid \$600 if the equipment is not used, and \$1000 if the equipment is used.
  - If fails to perform the recovery within 90 minutes, no performance payment will be issued.
  - Failure to clear a non-hazardous materials incident within 3-hours will result in a flat rate penalty of \$600. An additional \$600 will be assessed for each additional hour or \$10 per minute (\$600 per hour).
- FDOT recovers costs from the responsible parties' insurance companies

Source: Florida Department of Transportation District Four  
<http://www.smartsunguide.com/TIM.aspx#RISCPProgram>



## Alternate Route Planning

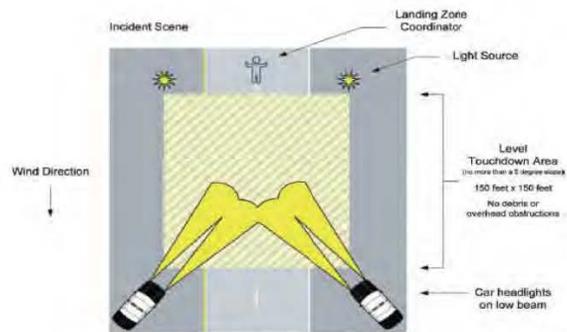
- Use state highway and/or truck routes with higher speed limits (preferred)
- Roadway design and geometry (e.g., number of lanes, lane widths, shoulder widths, limited secondary access, etc.)
- Proximity of alternate to diverted highway
- Existing signing (back to primary route)
- Truck/trailer weight, height and turning movement restrictions
- Presence of traffic control devices such as signals and stop signs
- Impacts of additional traffic on emergency response routes
- At-grade railroad crossings with a high frequency of trains
- Current pavement conditions
- Popular pedestrian areas
- Residential areas or school zones
- Presence of construction activity or work zones

Source: FHWA's *Alternate Route Handbook*  
[http://www.ops.fhwa.dot.gov/publications/ar\\_handbook/index.htm](http://www.ops.fhwa.dot.gov/publications/ar_handbook/index.htm)



# Helicopter Emergency Landing Zones

- Establish policies and procedures
  - Landing Zone Coordinator and Tail Rotor Guide
  - Types of Landing Zone
  - Communications
- Include Safety Considerations in training activities



Source: Wisconsin DOT *Emergency Traffic Control and Scene Management Guidelines*  
<http://www.dot.wisconsin.gov/travel/stoc/docs/emer-tc-sm-guidelines.pdf>

## SHRP 2 Train-the-Trainer

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- Outcome of Strategic Highway Research Program (SHRP 2) study
- Developed a “train-the-training” course for traffic incident responders
- Taught by former emergency responders
- “Ins and outs” on providing traffic incident response
- <http://www.fhwa.dot.gov/everydaycounts/springsummit/>





## RURAL VS. URBAN

### Incidents With Fatalities (2) Clearance Times (HH:MM)

District	Average	50%	Standard Deviation
3 – Urban	2:56	2:10	2:26
3 - Rural	3:13	2:43	2:26
6 – Urban	3:28	2:40	2:31
6 - Rural	5:00	3:49	3:39

## Discussion

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- What about rural locations that creates such long clearance times?
- How are these incidents reported?
- Who responds to traffic incidents in rural areas?
- To what extent are volunteer fire-fighters providing responses in rural areas?
- What kind of incident management training do they get? Who provided that training?
- What type of training do rural responders get in terms of on-scene protection?
- What are some strategies might be applied?

## Potential Ideas

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- Examine the type of training rural responders are getting (particularly volunteers)
  - Core competencies: Personnel protection and situational awareness
  - Establishing safe scene control (basic flagging procedures, vehicle placement, emergency light usage, etc.)
- Provide alternate storage location of incident management traffic control
- Establish rural response protocols/rural TMTs
- Collection and dissemination of information through dispatch

# Reducing Incident Duration

- Use of Photogrammetry



## Incidents With Utilities Clearance Times

District	Average	50%	Standard Deviation
6 w/ Utility	7:20	6:31	4:12
6 w/o Utility	4:39	3:41	3:12

5 out of Top 10 worst incidents in District 6 had a utility issue

## Discussion

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- Why does it take longer to clear incidents when utilities are involved?
  - Is it notification (not knowing who to contact)?
  - Is it getting correct response?
  - Is it clearance equipment?
- Recommendations:
  - Sit down with utility companies and talk to them about the issue
  - Schedule a mock training exercise where they are included.
  - Have utility companies provide cross-training to incident responders on who to contact and how to secure scene
  - Can Caltrans provide/store emergency equipment?

## Coordination is Caltrans Division of Traffic Operations

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- Training – SHRP 2 Train-the-Trainer
- Caltrans Traffic Incident Management Response Guidelines
- Recommendation: Create an annual Caltrans Statewide TIM Conference
  - Involve Caltrans TMC and incident responders
  - Discuss common issues related to incident management with Districts (peer-to-peer exchange)
  - Develop a network of incident management experts within Caltrans
  - Webinar

## Key Elements of a Sustainable TIM Program

Element	Purpose
<b>Legislative or Administrative Authorization</b>	Provides top-down authorization for resource sharing and joint operations.
<b>Strategic Mission and Accompanying Goals</b>	Sets direction and establishes accountability for program performance.
<b>Written Operational Policies</b>	Provides unambiguous guidance for on-scene operations.
<b>Dedicated Staff</b>	Establishes TIM as core job function rather than secondary or tertiary activity.
<b>Ongoing Training</b>	Keeps responder skills current based on most recent state-of-practice.
<b>Well-Defined Responsibilities</b>	Solidifies relationships across disparate agencies and mitigates "turf battles" among responders.
<b>Clear Reporting Channels</b>	Establishes chain of command and ensures accountability.
<b>Dedicated Funding</b>	Lessens impact of budgetary fluctuations.

Source: 2010 Traffic Incident Management Handbook.  
[http://www.ops.fhwa.dot.gov/eto\\_tim\\_pse/publications/timhandbook/tim\\_handbook.pdf](http://www.ops.fhwa.dot.gov/eto_tim_pse/publications/timhandbook/tim_handbook.pdf)



## Next Steps and Action Items

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# Thank You!



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Caltrans Quick Clearance for Major Traffic Incidents -- Workshop #2

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**APPENDIX C**  
**EXAMPLE TRAFFIC INCIDENT MANAGEMENT**  
**AFTER ACTION REVIEW FORM**

## TRAFFIC INCIDENT MANAGEMENT AFTER ACTION REVIEW FORM

Date of Incident:	Time: AM / PM
Roadway:	Mile Marker:
Cross Street:	County:
City:	Incident Reference Number:

### **Participating Agencies**

List the agencies participating in the review

### **Description of Incident**

Briefly describe the incident including information about the type, number and severity of injuries; number of vehicle involved, number of lanes blocked, type of response needed, etc.

### **Timeline/Sequence of Events**

Briefly identify times of key events in response, including notifications times, arrival times, and departure times of key responders). Critical time components to be collected include:

- Time of First Notification
- Time that all lanes are available for traffic flow

- Time that last responder departed scene

**Deployed Traffic Management Response**

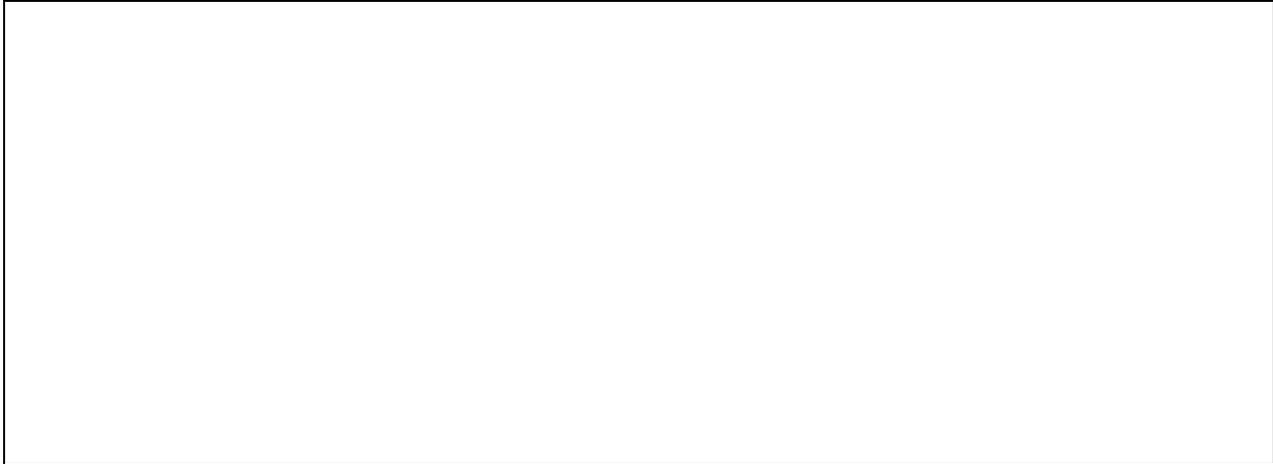
Briefly describe the traffic management response implemented including ITS activities, alternate routes/detours implemented, ramp/lane closures, etc.

**What went well and why?**

Identify strategies/techniques that were successful so that they can be incorporated into future responses.

**What can be improved and how?**

Identify specific actions that could have been done better, given the information and knowledge available at the time. Identify needed changes to training, standard operating procedures, communications, coordination, resources, policies and procedures, etc.



### **Probing Questions**

1. Were there any issues relating to the principles of NIMS, incident command, and unified command at the scene? Were there any issues related to communications between on scene responders?
2. Were on-scene tasks performed concurrently (in parallel) and with a sense of urgency?
3. Were the principles of quick clearance followed to the extent possible? Were as many lanes as possible opened as quickly as possible?
4. Were the correct resources (both equipment and staffing) available at the time they were needed?
5. Were the appropriate number of people and vehicle present on the scene?
6. Did the scene have adequate protection? Were the response vehicles properly positioned to provide the appropriate level of on-scene protection while at the same time minimizing the amount of disruption to the traffic? Did all response personnel have the appropriate level of personal protection (vests, hard hats, etc.)?
7. Did the traffic control comply with the requirements of the MUTCD and agency policies?
8. Was traffic at the scene, across from the scene, and at the back of the queue managed appropriately and proactively?
9. Was everyone notified appropriate and at the appropriate time? Was the information provided accurate and timely? What information did you not have that you wished you had had?
10. Was the public notification handled appropriate? Were the Public Information Officers used appropriately?