

NCHRP

REPORT 525

Surface Transportation Security *Volume 6*

Guide for Emergency Transportation Operations

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES



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NCHRP REPORT 525

Surface Transportation Security
Volume 6
Guide for
Emergency Transportation
Operations

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WASHINGTON, D.C.

2005

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

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The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

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NCHRP REPORT 525: Volume 6

Project 20-59(11)

ISSN 0077-5614

ISBN 0-309-08829-1

Library of Congress Control Number 2004111186

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Price \$21.00

NOTICE

The project that is the subject of this report was a part of the National Cooperative Highway Research Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the program concerned is of national importance and appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration, U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical committee according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

Published reports of the

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

are available from:

Transportation Research Board
Business Office
500 Fifth Street, NW
Washington, DC 20001

and can be ordered through the Internet at:

<http://www.national-academies.org/trb/bookstore>

Printed in the United States of America

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FOREWORD

By S. A. Parker
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This sixth volume of *NCHRP Report 525: Surface Transportation Security* is designed to assist transportation agencies in adopting the National Incident Management System (NIMS). In his September 8, 2004, letter to state governors, DHS Secretary Tom Ridge wrote that “NIMS provides a consistent nationwide approach for Federal, State, territorial, tribal, and local governments to work effectively and efficiently together to prepare for, prevent, respond to, and recover from domestic incidents, regardless of cause, size, or complexity.”

The objective of *Volume 6: Guide for Emergency Transportation Operations* is to support the development of a formal program for the improved management of traffic incidents, natural disasters, security events, and other emergencies on the highway system. This report outlines a coordinated, performance-oriented, all-hazard approach called “Emergency Transportation Operations.” The NIMS-friendly Guidance was developed as part of a series requested by The American Association of State Highway and Transportation Officials (AASHTO) through its Standing Committee on Transportation Security. It is based on current best practice on the part of state DOTs and is designed for maximum compatibility with the objectives of public safety agencies. It has also benefited from discussion with the National Transportation Incident Management Coalition, which brings together the combined perspectives of the transportation and public safety communities.

This guide is intended for both senior managers/policy makers and for agency program managers. The first five sections are for all readers. The sections entitled “The Institutions and Leadership Self-Assessment” and “The Institutions and Leadership Guidance” are for senior managers/policy makers and focus on the importance of a coherent policy, organizational, and financial framework. The section entitled “The Operations and Technology Self-Assessment and Guidance” is for agency program managers involved in the development, management, and improvement of processes, equipment, and relationships that constitute such a program.

PB Consult and Science Applications International Corporation prepared this volume of *NCHRP Report 525* under NCHRP Project 20-59(11).

Emergencies arising from terrorist threats highlight the need for transportation managers to minimize the vulnerability of travelers, employees, and physical assets through incident prevention, preparedness, mitigation, response, and recovery. Managers seek to reduce the chances that transportation vehicles and facilities will be targets or instruments of terrorist attacks and to be prepared to respond to and recover from such possibilities. By being prepared to respond to terrorism, each transportation agency is simultaneously prepared to respond to natural disasters such as hurricanes, floods, and wildfires, as well as human-caused events such as hazardous materials spills and other incidents.

This is the sixth volume of *NCHRP Report 525: Surface Transportation Security*, a series in which relevant information is assembled into single, concise volumes—each pertaining to a specific security problem and closely related issues. These volumes focus on the concerns that transportation agencies are addressing when developing programs in response to the terrorist attacks of September 11, 2001, and the anthrax attacks that followed. Future volumes of the report will be issued as they are completed.

To develop this volume in a comprehensive manner and to ensure inclusion of significant knowledge, available information was assembled from numerous sources, including a number of state departments of transportation. A topic panel of experts in the subject area was established to guide the researchers in organizing and evaluating the collected data and to review the final document.

This volume was prepared to meet an urgent need for information in this area. It records practices that were acceptable within the limitations of the knowledge available at the time of its preparation. Work in this area is proceeding swiftly, and readers are encouraged to be on the lookout for the most up-to-date information.

Volumes issued under *NCHRP Report 525: Surface Transportation Security* may be found on the TRB website at <http://www.TRB.org/SecurityPubs>.

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THE CALL TO ACTION

This guide is designed to support the development of a formal program for the improved management of traffic incidents, natural disasters, security events, and other emergencies on the highway system. It outlines a coordinated, performance-oriented, all-hazard approach called “emergency transportation operations” or “ETO.” The concept of this guidance has grown out of discussion within the National Transportation Incident Management Coalition, which brings together the combined perspectives of the transportation and public safety communities.

The guidance focuses on an enhanced role for state departments of transportation (DOTs) as participants with the public safety community in an interagency process. The recommendations focus on the context of the upper-level roadway system, but are also applicable to larger local government jurisdictions.

This guide is intended for senior managers/policy makers and for agency program managers. The first five sections are for all readers.

The sections entitled “The Institutions and Leadership Self-Assessment” and “The Institutions and Leadership Guidance” are for senior managers/policy makers and focus on the importance of a coherent policy, organizational, and financial framework.

The section entitled “The Operations and Technology Self-Assessment and Guidance” is for agency program managers involved in the development, management, and improvement of processes, equipment, and relationships that constitute such a program.

A resources guide contains additional references that may be useful to readers; it is published as NCHRP Web Document 73.

THE CHALLENGES

The highway network is vulnerable to disruption from a variety of events—traffic incidents, weather, construction, natural disaster, and security-related incidents. This vulnerability is increasing with increased traffic, urban development in vulnerable areas, and the threat of terrorism. Closures are more frequent and long back-ups often accompany even modest incidents. Those that occur on the upper-level systems—typically under state DOT jurisdiction—tend to be more serious and disruptive. Indeed, *more than half of highway delay results from nonrecurring causes* of this type. Furthermore, such incidents are the major contributor to the lack of predictability and reliability of highway transportation service. These events also involve significant impact to life safety, property damage, and responder safety.

It is apparent that effective management of highway system operations is critical for transportation agencies to improve public safety and mobility when any type of incident or emergency occurs. Handling the wide range of incidents that happen to occur on highways in the traditional generic “all incidents are really alike” manner is no longer appropriate on highly traveled roadways where “business as usual” can cause tremendous disruption on top of the incident or emergency itself.¹

Resolving highway incidents and delays in the shortest possible time is important to both public safety and mobility. It contributes to more timely victim treatment, reduced accident exposure, and a minimum of public inconvenience. There is not likely to be a more cost-effective approach meeting customer objectives and advancing public credibility. Therefore, traffic incident management (TIM) has increasingly focused on the subject of more organized planning on the part of both state DOTs and public safety communities.

At the same time, there is heightened public focus on the critical function transportation plays in disaster response, including terrorist events, because transportation roadway networks, whether or not directly affected by an emergency, are always the means by which response and recovery are facilitated. In this context, the Department of Homeland Security’s (DHS) National Incident Management System (NIMS) calls for more rigorous emergency management protocols with its principles of incident command, joint planning and standardization, and performance-based improvement.

The overlap between TIM and the transportation aspects of disaster response, emergency management, and security-related operations is obvious and compelling. This guide provides strategies for the development of a comprehensive, coordinated, performance-oriented approach among the transportation, public safety, and emergency management communities in responding to traffic incidents, natural disasters, and other types of emergencies. *For purposes of this guide, this integrated approach is called emergency transportation operations (ETO).*

¹ Throughout this guide, reference will be made to state DOT current practice. While not specifically discussed, the same issues and approaches are applicable to local government operations.

KEY DRIVING FORCES

The imperative for a more formal approach to dealing with the traffic implications of incidents, emergencies, and disasters arises out of a set of driving forces that characterize the external environment for state DOTs and their public safety partners, as well as the legacy institutional environments in which they operate. Seven key forces can be perceived:

1. Highway incidents and traffic-related emergencies are a major cause of delay and safety problems,
2. The broad and growing array of hazards that involve highways directly or indirectly has varying implications for response,
3. State DOTs and local government transportation departments are not clearly focused on accountability for ETO,
4. There is no clear “best practice” that is widely accepted,
5. New technology is available that could support improved ETO,
6. There is limited institutional commitment to traffic incident and related emergency operations as part of ETO, and
7. Significant highway performance improvement opportunities are being missed.

Together these compose a powerful incentive to break away from conventional practice. These forces are described in the next section of this guide.

A SERIOUS COMMITMENT TO ETO

A review of the state of the practice suggests that improving the performance of ETO presents a significant opportunity to improve mobility and safety. However, this will require a reorientation of the state DOTs’ role and a higher degree of cooperation among DOTs, law enforcement, fire and rescue, towing and recovery, and other contributing agencies.

Public safety agencies have principal incident command authority and long-standing conventions both for generic incident response and emergency management procedures, including those that take place on or impact highways. Their priorities are on law enforcement, life safety, and property protection. Improvements in the mobility dimension of ETO must respect the priorities and conventions of public safety agencies, but there is an increased public safety understanding of the DOT role, as evidenced in recent national fire service guidance on TIM (the *Incident Management Model Procedures Guide for Highway Incidents*, published by the National Fire Service Incident Management System Consortium and the U.S. Department of Transportation [USDOT]).

To fulfill their mobility mission, many DOTs will have to upgrade the position of incident management and emergency operations activities beyond their often fragmented, part-time, and reactive character. The operational performance level of incident response in terms of detection, response, site management, and clearance times is rarely tracked.

The best technology for communication and site documentation and the best procedures (as presented in the new *Manual of Uniform Traffic Control Devices* [MUTCD]) are not widely deployed. These characteristics reflect the fact that TIM is not a formal, budgeted, managed program. At the same time, state DOTs' emergency operations in support of state and emergency management are also often part-time responsibilities and fail to exploit the full potential of DOTs to contribute. These same concerns apply to county and municipal governments with significant freeway and major arterial responsibilities.

In addition to moving toward a more formal state program for ETO on the part of state DOTs, a new level of cooperation among state DOTs, law enforcement, fire and rescue, towing and recovery, and other contributing agencies will be essential. It must focus on policies, procedures, organization, technology, and performance. However, in pursuing this agenda, state DOTs will have to earn credibility through consistent, aggressive conduct of their own responsibilities.

SELF-ASSESSMENT AGAINST BEST PRACTICE

There are no nationally accepted standards for incident management against which current practice can be measured—or that can be used for accreditation purposes. The review of evolving best practices (see *NCHRP Web Document 73*, Section A, Best Practices) indicates that there is tremendous variation nationwide in the conventions of ETO, including who responds, when and how, chain of command, and in-field procedures. Many of the challenges to be faced are derived from the legacy of informal, personality-dependent approaches rather than standardized practice. Within individual state DOTs, shortcomings in practice can be identified through a direct self-assessment of specific approaches to both institutional issues (policy and organization) as well as operations and technology (field protocols, roles, and relationships). Key questions include

1. Are the DOT's responsibilities and capabilities across the full range of transportation-related events fully integrated within the emergency management community and vice versa?
2. Is there a formal ETO program with senior executive responsibility and accountability at the state DOT's district and headquarters levels?
3. Is there a clear, sustainable resource allocation process that reflects the DOT's priority on ETO?
4. Are the managers of ETO response being held accountable for performance through a performance reporting process?
5. Is there a clear sustainable policy commitment to operations, including statutory authorization for an efficient program?

An organized improvement program will not be starting from scratch. ETO responsibilities already exist. Most DOTs have incident management programs that are manned by a combination of traffic operations personnel in transportation management centers (TMCs) and maintenance personnel, with long-standing relationships among DOT and public safety field staff. An improved approach must build on current strengths such as

DOT TMC operations and incident response patrol programs and must be developed in close cooperation with the other responder entities. In the long run, clear standards must be set by which improved practice may be measured.

STRATEGIES TO IMPROVE CURRENT PRACTICE

Improvement strategies and tactics for overcoming the gaps between current and best practice for ETO are presented in this guide. The strategies focus on a more formal, all-hazard approach, developed on an interagency basis using agreed-upon performance objectives. The strategies are organized into two general areas: Institutions and Leadership and Operations and Technology.

Five basic improvements have been identified that require executive action, the implementation of which would reflect a new cooperative commitment with public safety agencies to service improvement. The needed changes are institutional and organizational in nature and require top management support to provide leadership, policy and program definition, and top-level liaison with public safety agencies. They also suggest the logic of making ETO a formal program of the department.

Basic Strategies for Improving ETO

REALITY	BASIC STRATEGY IMPLIED
1. Need to accommodate the full range of incidents, emergencies, and hazards.	Develop an approach to ETO on an integrated, comprehensive, all-emergency/hazard/discipline basis.
2. Absence of widely accepted best practice approaches.	Develop a structured ETO process with joint protocols and procedures with full regard to the range of objectives while minimizing traffic disruptions.
3. Effective technology not integrated.	Examine technology opportunities and cost-effectiveness to introduce new technology and improve efficiency, effectiveness, and safety.
4. Absence of performance measures.	Measure performance in the field to provide the basis for continuous improvement.
5. Informal, fragmented activities.	Formalize ETO as a program with appropriate policies, authorization, organization, structure, and resources.

THE IMPORTANCE OF EXECUTIVE LEADERSHIP

Executive-level support is crucial to the development of a more formal program approach and to ensure that the responsibilities and resources are mobilized and targeted. Raising what is now a part-time, fragmented set of responsibilities to the level of a resourced, managed program must overcome bureaucratic traditions and inertia, compete for resources, support new approaches, and forge new external relationships. These challenges require top executive leadership—starting at the policy level in agency headquarters and executed under the responsibility of the district and regional management levels. Such executive initiative and oversight is essential to ensure

- Fostering of an interagency focus on the complete array of incidents and emergencies;
- Establishment of a formal program with senior responsibility, organization, and reporting;
- Allocation of adequate resources;
- Establishment of objectives with related performance measures and accountability; and
- Development of agency policy, laws, regulations, and interagency agreements.

Given a decision to move ahead, top-level agreement must be reached among the DOT, law enforcement, fire and rescue, towing and recovery, and state and local emergency response entities on a joint focus for improvement. Cementing this relationship is crucial, and DOTs can serve as conveners to create a positive environment for change. Policy commitment and joint agreements within the responder community can then be converted into a manageable program working simultaneously on joint interagency improvements and the department's own internal approach to achieving a higher level of sustainable activities and commitment to continuous, measurable improvement. This will require development of a strategic business plan, specifying responsibilities, resources, and performance targets.

THE GUIDE

Addressing the ETO challenge will require careful guidance and assignment of roles and responsibilities within and across agencies. The first five sections of this guide are for all readers. The sections addressing Institutions and Leadership are for policy makers and senior managers to establish the case for increased programmatic attention to ETO. The section addressing Operations and Technology is for program-level managers to develop specific plans and projects based on the evolving institutional framework established by senior managers. The resources guide, which is published as *NCHRP Web Document 73*, provides reference materials.

Two related tools for process improvement are provided:

1. A self-assessment that allows managers to determine current strengths and weaknesses and thereby focus on the relevant part of the guidance material.
2. General strategies and tactics related to five areas of principal weakness described in a subsequent section of the guide.

In the material that follows, **Driving Forces** and **State of the Practice** describe key challenges to be overcome in three key areas—institutions, operations, and technology. The subsequent **Improvement Strategies** section serves as the basis for the guide and sets forth areas for change based on current problems. The **Guidance Framework** is then explained, followed by **Self-Assessment** and **Guidance** sections, which are organized around strategies and tactics for improvement.



It is important to recognize that this guidance material represents a starting point in identifying and consolidating related needs and practices to improve management of transportation-related emergencies. The material included necessarily represents a first cut at this consolidation—a point of departure—focused principally on the mix of incidents that impact the upper-level roadway systems (freeways and expressways). The same issues and approaches are substantially applicable on the lower-level components of the roadway network. Furthermore, the material developed in this guide can be used as the basis for further, more detailed guidance appropriate for specific jurisdictions and the mix of emergencies experienced in a given state, region, or jurisdiction (for example, more/less weather emergencies or planned events).

DRIVING FORCES

The imperative for a more formal approach to dealing with the traffic implications of incidents, emergencies, and disasters arises out of a set of driving forces that characterize the external environment for state DOTs and their public safety partners, as well as the legacy institutional environments in which they operate. Seven key forces can be perceived.



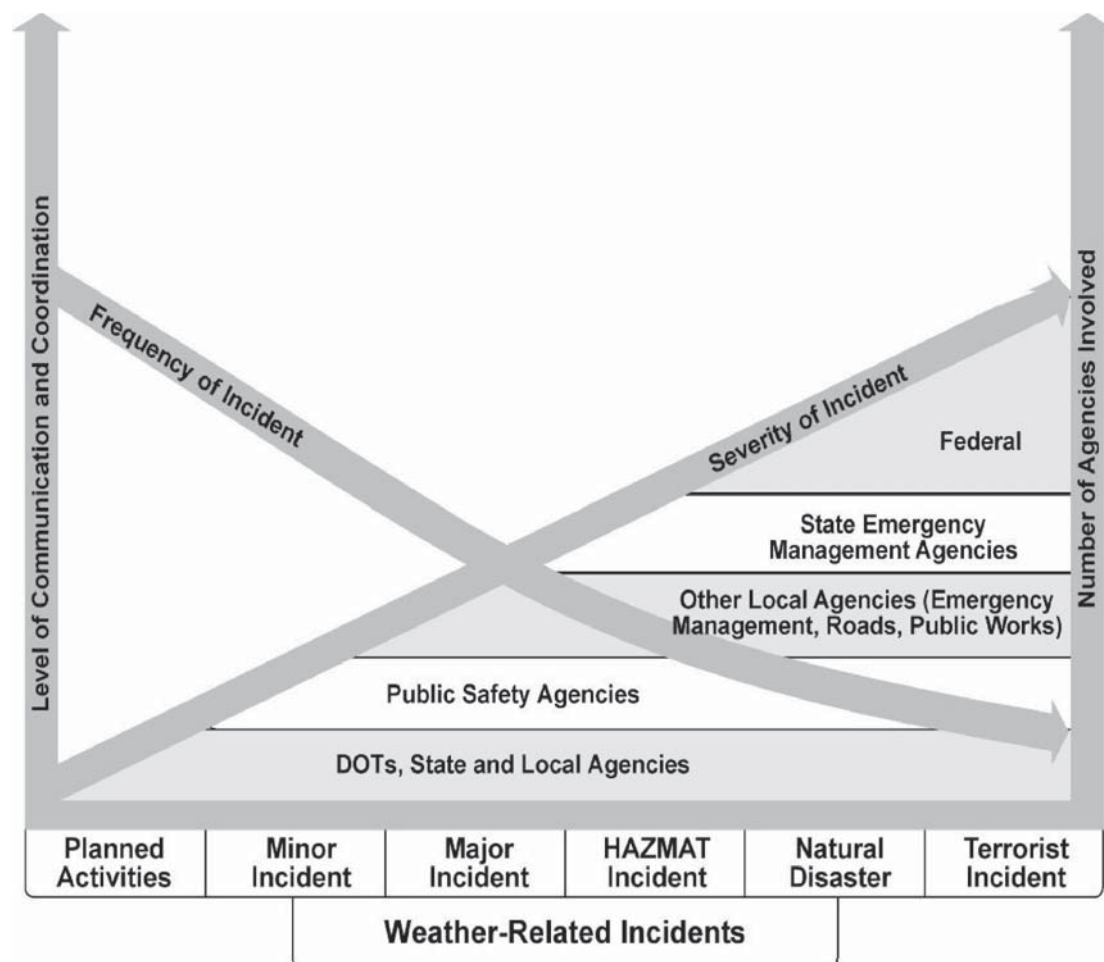
1. Highway incidents and traffic-related emergencies are a major cause of delay and safety problems. Nonrecurring congestion (traffic incidents, weather, construction) is responsible for about one-half of total daily metropolitan highway delay. While there are many minor incidents on local arterials, the broadest range of serious incidents takes place on the upper-level roadway systems—typically under state DOT jurisdiction. Traffic incidents alone (crashes, breakdowns, debris, hazardous materials [HAZMAT]) are a major component of nonrecurring congestion, responsible for much of the total delay and a high proportion of roadway unreliability. Some types of incidents are becoming more frequent due to denser traffic and more extended urbanization.

According to the 2003 urban mobility studies by the Texas Transportation Institute, congestion-related delay in the 75 largest metropolitan areas is estimated to cost more than \$72 billion per year in time and fuel costs. The potential of improved TIM is significant. Even today's modest level of incident management covering one-half of the surveyed freeway mileage is reducing delay by an average of 5% (\$3.6 billion). Secondary crashes in incidents are also a major concern, estimated in many larger urban areas to constitute 10 to 25% of total fatalities.

As major back-ups become more widespread, surveys suggest that this unpredictable delay is of special concern to travelers and shippers as the uncertainty requires an allowance of "buffer time" to ensure timely arrival. At the same time, these events introduce a range of hazards including safety, security, and property damage. Additionally, according to some studies, secondary crashes caused by incident queues account for 10 to 25% of all Interstate highway fatalities. Incident responders also experience major risk en-route to and at the scene.

There is also a wide range of natural disasters and major weather events (such as hurricanes, floods, and earthquakes) that introduces safety risks and traffic disruptions, requiring extraordinary emergency operations for emergency access and speedy recovery. Terrorist threats add to this urgency and introduce the need to anticipate weapons of mass destruction (WMD) hazards. Even when not damaged, highways are always part of the response and recovery activities. As suggested in **Figure 1**, while the most severe incidents are less frequent, the severity of impacts is often greater, involving a larger number of agencies with attendant coordination and communication problems.

Figure 1. The Complexity of ETO



2. The broad and growing array of hazards that involve highways directly or indirectly has varying implications for response.

ETO implications vary significantly depending on the nature of the emergency event. **Table 1** provides a high-level summary of five major categories of ETO events, arranged from the most to least predictable. Some of the key transportation-related characteristics associated with each category are indicated. Each characteristic implies a demand placed on ETO activities. As suggested in the table, some of the less frequent but more severe traffic-related emergencies have features and dynamics that do not lend themselves to traditional, real-time, reactive improvisation. These features include larger geographic scales, the rapid pace of incident development, and the range of life safety risks to those directly involved or to responders.

Table 1. ETO Events – Unique Requirements and Practices

ETO Event	Transportation-related Emergency Characteristics	ETO Scope Implications
1. Planned Activities – Special event – Work zone – Amber alert – Crime control – Civil disturbance	• Disruption is planned and impacts are predictable	• Repetition permits agencies to learn from experience • Provision of early warnings • Location-specific traffic control procedures
	• Crowd and rumor control may be necessary	• Manage information to minimize panic • Provide enhanced law enforcement presence
	• Directions to drivers may be important	• Pre-specify message strategies
	• Law enforcement actions are underway	• Coordinate enforcement traffic control procedures
2. Traffic Incidents – Break-down – Crash (major/minor) – HAZMAT release	• Traffic backups, delays, and accident exposure take place quickly	• Reduced detection and response time is critical • Establish quick clearance policies among agencies • Improve public safety/DOT communications
	• Medical treatment can cause delays	• Install advanced medical communications
	• Cargo spills, HAZMAT disruptions are possible	• Formalize on-call special equipment and expertise
	• Large combination of vehicles may be involved	• Formalize on-call special towing rigs
3. Weather-related – Fog – Snow and ice – Wildland fire – Utility failure – Rock/mud/avalanche	• Major injury and fatality investigation may be needed	• Implement advanced accident investigation procedures
	• Occurrence may be predictable, but conditions are variable and can develop rapidly	• Standard call out criteria and routines • Advance decisions for evacuation pre-notification • Advanced warning messages for drivers • Micro-level road weather information systems-based treatment plans
	• Off-road situations require emergency access	• Pre-planned routines for priority access
	• Damaged infrastructure can be a continuing risk	• On-call technical expertise and assessment needed
4. Natural Disaster – Earthquake – Hurricane – Tornado – Flood	• Time lags before damage extent is known	• Evacuation plans must include destinations
	• Units at scene may have difficulty determining location	• Interoperable interagency communications
	• Operating conditions may be unclear to drivers	• Coordinated real-time driver information essential
	• Scale of disaster may be regional	• Inter-jurisdictional preplanning and coordination are crucial
5. Terrorism/ WMD	• Emergency can occur in remote locations	• Development of wireless data and voice communications is essential
	• Critical assets may be attacked	• Asset countermeasures may be needed
	• Nature, location, and timing are not predictable	• Quick reaction and pre-planned protocols are essential
	• WMD may involve significant hazard risks	• HAZMAT expertise, protective measures needed
	• Response to a terrorism event is federal	• Standard security procedures required
	• Classified information is part of threat warning	• Clearance protocols needed
	• Public panic, although rare, may take place	• Pre-specified message sets needed
	• Possible multiple incidents	• Response capabilities may be overwhelmed

3. State DOTs and local government transportation departments are not clearly focused on accountability for ETO.

Responsibilities for ETO are currently divided among state and local jurisdictions, and while state DOTs typically own most of the upper-level roadway network, there are wide variations including some states with significant local government ownership of highways. Within state DOTs and their local counterparts, the responsibilities are often fragmented and fuzzy. Many DOTs—state and local—do not have formal incident management programs at the statewide level, nor are there clear responsibilities for the operational performance of the highways in the face of the full array of incidents or emergencies. Often there is an arms-length relationship with public safety agencies with on-the-road emergency response responsibilities. This minimizes opportunities to consider common issues, response needs, and resources/requirements across the full range of emergencies. This fragmentation and absence of clear accountability can result in a lack of meaningful DOT involvement in the management of traffic emergencies. These challenges are heightened by tight budgets for operations within state DOTs and the same competition for scarce resources in the public safety community.

4. There is no clear “best practice” that is widely accepted. While the phases and steps in TIM are widely understood (as shown in **Figure 2**), protocols and procedures employed locally for ETO vary widely nationwide. Unreconciled priorities of transportation and public safety agencies regarding life safety, security, property protection, and traffic disruption result in unnecessary risks and needless delays. Within TIM, there are no clear industry standards, thus limiting planning or training for multi-agency management of transportation emergencies. The gap between typical and the emerging best practice shown in **Figure 3** highlights the substantial difference in timely performance between typical duration and best practice. Very few agencies that respond to traffic incidents set any kind of performance goals for clearance times or similar performance-based metrics. However, national standards can be considered for various aspects of ETO including incident response and TMCs.

Figure 2. TIM Steps

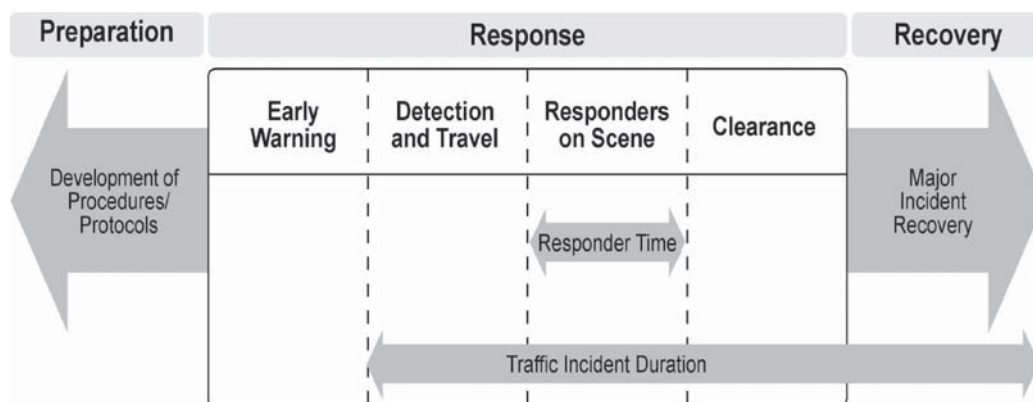


Figure 3. Traffic Incident Characteristics

Typical Incident Characteristics				
Type	Cause	Frequency	Typical Duration	Best Practice
Major	Collisions, injuries, fatalities, spills	Occasional	>2 hours	<1 1/2 hours
Moderate	Single vehicle crash	Many per week	1/2 to 2 hours	1/3 to 1/2 hour
Minor	Fender bender, disablement, debris	Many per day	<1/2 hour	1/3 hour

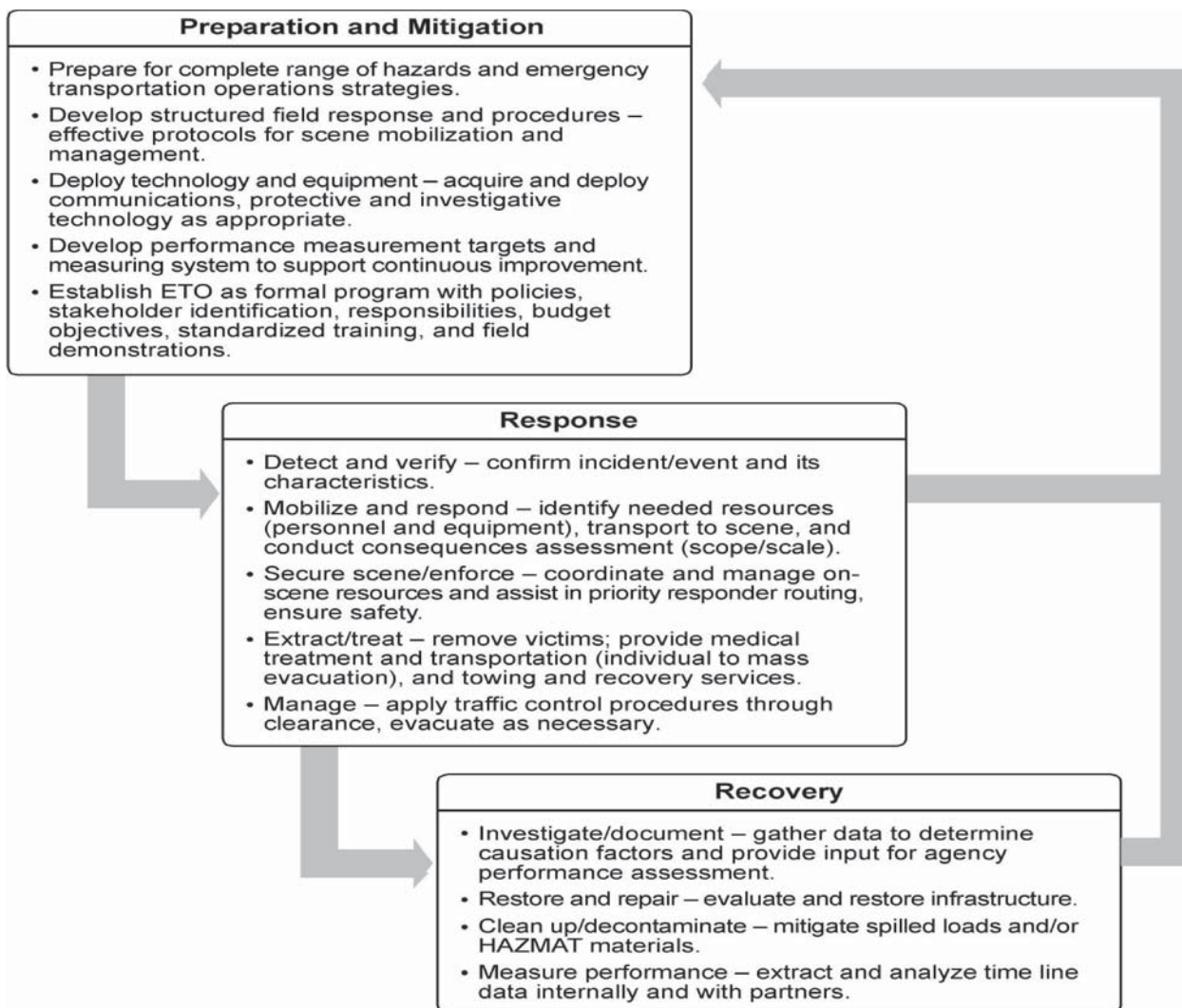
DHS now is requiring that federal agencies make NIMS compliance a condition for federal preparedness assistance—fostering adoption of an all-discipline, all-hazards approach and a multi-agency response for emergencies and command systems. The consistent

adoption of NIMS as a framework for all-hazard-related incident management framework establishes a powerful incentive to consider the approaches developed within this guidance.

5. New technology is available that could support improved ETO. ETO can benefit from a range of technology support including advanced detection, surveillance, communication, and personnel protection systems. It is acknowledged that today's emergency communications are lacking interoperable flexibility. The inefficiency in communications is a major source of delay in rapid response and quick resolution of incidents and emergencies. In addition, some technical resources—such as advanced surveillance systems possessed by state DOTs—are not well known to the public safety community. Personal protective equipment is not systematically available for transportation employees who work on or around critical facilities. Overall, these and other resources are potential opportunities to improve existing traffic incident and operations effectiveness.

6. There is limited institutional commitment to traffic incident and related emergency operations as part of ETO. State DOTs have evolved out of a public works culture and traditionally have shown a modest interest in systems operations. For the most part, existing highway-related ETO are part-time, ancillary activities of units with other primary responsibilities, such as intelligent transportation systems (ITS), traffic operations, or maintenance. Related activities are fragmented and unbudgeted with unclear reporting accountability. Interagency relationships are informal and not part of consistent public policy. The appropriate roles of the state DOT in incident management are reasonably understood but are not consistently practiced across all incidents, locations, and times. Furthermore, the key DOT contributions in detection, surveillance, and traffic management are not consistently integrated into the incident command protocols to have their full potential effect in reducing response and clearance times. The NIMS is now focusing on a more integrated approach with joint preparedness activities including planning, training, standard procedures, channels for communication and information sharing, the use of incident command, standard technology, and mechanisms for resource management. **Figure 4** indicates the consistency of these strategies with the NIMS in a highway context.

Figure 4. Activities in the Preparation, Response, and Recovery Phases



7. Significant highway performance improvement opportunities are being missed. The performance of incident management or emergency response is rarely evaluated. Despite the fact that delay in clearance amplifies the time for upstream flow to return to normal, clearance times are rarely measured or reported. Serious analysis of the practical problems faced in the field and potential improvement strategies are only just beginning. In addition, there is no accepted state of the practice by which to judge the quality of public agency performance related to the management of roadway emergencies of all types.

Collectively, these seven challenges represent significant implications for the scope of the ETO issues and the proposed solutions.

STATE OF THE PRACTICE—STRENGTHS AND WEAKNESSES



The steering group of the National Traffic Incident Management Coalition (NTIMC), an assembly of representatives from the public safety and transportation communities, identified three categories of issues related to TIM for its 2002 conference: Operations, Technology, and Institutions.

OPERATIONS

Addressing the Procedures, Processes, Roles, and Relationships Used in the Field in Responding to Incidents and Emergencies

Emergency response, general incident management, and TIM all have their own conventions consisting of agency roles, accepted procedures, headquarters functions, and ad hoc reactions by field personnel. Incidents and emergencies are not perceived in state DOTs and public safety agencies in the same way regarding their traffic service implications. From a transportation point of view, major improvements in safety and efficiency have been demonstrated by developing and integrating comprehensive approaches based on coordinated and prepared operational regimes, rapid provision of emergency response, and speedy recovery of service. However, highway-related protocols and procedures employed locally for ETO vary widely nationwide among responders. Quick clearance policy is in force in a handful of areas, MUTCD-compliant traffic control is not widely used, traffic control training for responders is modest, and proper staging and emergency lighting are not widely employed. A major concern is the lack of training to formalize an approach designed to reduce the number and severity of secondary crashes. Furthermore, while the value of an all-hazard approach is widely acknowledged, the special operational needs associated with the range of incidents and emergencies are not approached on a coordinated basis. Highway-related emergency management procedures related to HAZMAT, WMD, and major disasters are not well-integrated with the incident management process in most states.

While there has been an increasing level of training in incident command (among most public safety agencies and some DOTs) and in TIM among DOTs, the field of ETO is not yet professionalized as part of basic training curricula and agency policies. In contrast to other areas of emergency services (fire and rescue), the concept of performance standards for clearance of incidents is not yet widely accepted. Traffic incident clearance and other traffic-related emergency functions are rarely tracked or benchmarked against best practice or prior performance. There is wide variation in practice, as measured by safety or delay, and a substantial gap exists between best emerging best practices and the general state of the practice.

TECHNOLOGY

Addressing the Communications and Other Equipment Used to Facilitate and Improve the Effectiveness of ETO

At the present time, the application of technology to ETO is limited and based principally on safety service patrols; regional public safety call and computer-aided dispatch

(CAD) centers; and the modest coverage of ITS surveillance, detection, and communications systems. The need for interoperable interagency communications is widely acknowledged, but represents an expensive challenge in many regions. More generally, information-sharing protocols for each significantly different emergency type (weather, security, planned event) are not uniformly developed and often involve different units within responder and supporting agencies. State DOTs, because of their interest in ITS technology, are well-positioned to work with and support their public safety agency partners regarding advanced technology applications. These efforts are reinforced by Federal Communication Commission (FCC) allocation of frequency to public safety functions and the new hardware emerging to supply this need.

For example, TMC/CAD dispatch integration benefits may be obvious, but only a few regions are moving in this area. TMC protocols for both rapid and appropriate response and effectively informing the public have been developed in only a few regions. An integrated approach to a broader range of hazards also introduces other technology issues. These involve the need for cooperation among the emergency management community and public safety and transportation entities, more shared real-time information, rapid access across public data sources and data types, and a need to develop access to special expertise on an on-call basis.

INSTITUTIONS

Addressing the Policy Framework for ETO and How the Operations and Technology Issues are Organized into a Program, Resource, and Performance Framework

“Institutionalization” of ETO evolving best practices is still in very early stages, and the transportation and public safety entities have different priorities. The objectives, priorities, and management style exhibited by the DOTs and public safety agencies are based in law, culture, and resources. The legal and regulatory environment also varies substantially by state. **Figure 5** illustrates in summary form the key agency objectives in emergency transportation response. As indicated, agency objectives may be complementary or diverge; however, the divergence may simply reflect lack of joint strategy to overcome apparent conflicts. For example, there are specific best practice approaches to ensuring safety at the scene while maintaining traffic flow.

Figure 5. Agency Objectives in Emergency Transportation Response

		DOT Primary Objectives at Incidents				
		Minimize Delay	Maintain Capacity	Eliminate Secondary Accidents	Provide Motorist Assistance	Divert Traffic
Public Safety Primary Objectives at Incidents	Victim Treatment and Extraction	-	-	=	+	+
	Ensure Safety of Scene, Responder, and Public	-	-	=	+	+
	Investigate Crime and Liability	-	-	=	+	+
	Control Traffic (Route/Detour/Evacuation)	-	-	=	+	+
	Enforce Law	-	-	=	+	+

Objectives Correlation	
DOT objectives diverge:	-
DOT objectives neutral:	=
DOT objectives supportive:	+

ETO is not treated as a formal, budgeted, managed program within most state DOTs. Rather, ETO is typically conducted as a fragmented, part-time reactive activity at the district level, with responsibilities divided among maintenance, traffic operations units, TMC management, and ITS project staff. Within the public safety community, traffic incidents and emergencies associated specifically with traffic often lack a separate program identity. As a result, key components (ITS, service patrols, communications) do not compete well for resources, and there is no clear professional cadre or related technical certification devoted to ETO. Formal inter-institutional relationships between state DOTs and public safety agencies are most common at the field level, and DOTs are often perceived as public works agencies rather than aggressive advocates for systems management. Despite the obvious overlap in responsibilities, personnel, infrastructure, and equipment appropriate to ETO, there is only a modest attempt to exploit common needs and resources or to develop common protocols covering both traffic and other emergencies among state DOTs and between DOTs and their public safety counterparts.

The Appendix presents a more detailed discussion of the state of the practice for each of the three categories of issues. Key strengths and weakness are identified based on interviews conducted for this project and the Federal Highway Administration's (FHWA's) "Traffic Incident Management Self-Assessment National Executive Summary Report" reported key incident management practices among the top 75 metropolitan areas.

IMPROVEMENT STRATEGIES



The improvement strategies are based on those set forth in (1) the limited guidance material focusing on TIM developed by the transportation and public safety communities; (2) the accepted literature on emergency management and emergency operations plans developed and circulated by federal, state, and local emergency management agencies; (3) the discussion in the professional literature regarding the impact of earthquakes, hurricanes, and the September 11, 2001, terrorist attacks; (4) FHWA surveys of incident management practice; and (5) project interviews in selected states. This literature is reported in *NCHRP Web Document 73*, in the annotated bibliography.

Improving the performance of ETO presents a significant opportunity to improve mobility and traffic safety. Incidents that can be ameliorated through effective management (crashes, breakdowns, weather, crime, planned events) may be responsible for up to half of all delay from congestion. Other emergencies, such as natural disasters or security events, place special importance on effective management as part of the emergency response role. The life safety and property benefits from improved ETO are also significant, whether measured in lives or reduced risks.

Therefore, a systematic approach to improved ETO can have considerable value. Toward that end, the state of the practice in operations, technology, and institutions has been reviewed to identify key vectors of improvement that can achieve the objectives of state DOTs while being consistent with the perspectives and approaches of DOTs' partners in law enforcement, fire and rescue, towing and recovery, and other contributing agencies.

BASIC IMPROVEMENT STRATEGIES

The basic challenges faced in improving ETO have been consolidated into five key areas ("realities") that characterize the current state of play. In response to each, strategies have been defined. Each strategy is selected to provide part of a framework to improve the performance of state DOTs and their public safety partners in accomplishing their shared goals, with a special emphasis on minimizing traffic disruption. The strategies are used as the basis for structuring the detailed elements contained within the guides.

Ultimately, expanded ETO is not only possible, but is an emerging requirement and responsibility of state DOTs to ensure public safety, mobility, and continuity of government. There probably is not a more cost-effective approach to meeting customer objectives for improving mobility and safety. Furthermore, the heightened consciousness of risks and media exposure have increased public and political expectations for high-quality emergency response. In the material that follows, the principal challenges presented by the current state of play are described together with the suggested strategic response.

Reality 1. Need to Accommodate the Full Range of Incidents, Emergencies, and Hazards

Many emergencies, whether generated through traffic, disaster, or criminal activity, have certain general traffic-related needs in common. Major, less frequent, or unique emergencies have other additional characteristics that must also be accommodated.

These include special hazards, regional scale, public panic, security issues, and diversion or evacuation strategies.

Strategy—Develop an Approach to ETO on an Integrated, Comprehensive, All-Emergency/Hazard/Discipline Basis

Proactive anticipation of common and unique hazards and development of hazard-specific protocols and technology are key to improving safety of those involved in and responding to incidents. Useful features are incorporated from preparation and response requirements to the complete range of special events and emergencies. As indicated in Figure 4, the responder agencies have distinct but complementary objectives that lend themselves to simultaneous achievement.

Reality 2. Absence of Widely Accepted Best Practice Approaches

There are some emerging “best practices” for ETO. They are found in a few regions around the country where strong leadership has recognized the need for improvement. However, they are not widely publicized, acknowledged, or accepted. The *Best Practices* section of the resources guide indicates some sources. Guidance and training exist, but are still substantially internal to each sector. The NIMS emphasizes the need for standardization via the development of a coordinated “system” by state and regional agencies to create common procedures, terminology, qualification, equipment, and communications. This is consistent with the need for a consolidated ETO approach.

Strategy—Develop a Structured ETO Process with Joint Protocols and Procedures with Full Regard to the Range of Objectives while Minimizing Traffic Disruptions

There appears to be significant efficiency and other benefits to combining the best practices from TIM and the range of ETO into a single comprehensive framework that can be organized, managed, and improved. The state DOTs and public safety agencies have different but overlapping objectives that must be accommodated. In general, the transportation community agrees that quick clearance for all incidents is a best practice to maintain the integrity of the transportation system. However, movement in this direction must be based on the negotiated development of protocols and procedures among DOTs, public safety agencies, and the towing and recovery community to establish effective command, coordination, and response for effective management. Reaching agreements will require overcoming long-term institutional conventions that optimize individual agency objectives without regard to systems disruption.

Reality 3. Effective Technology Not Integrated

The potentials of new technology are not widely understood nor widely deployed. There are technology-based system needs in common among all involved agencies (such as interoperable communications) and technologies that can substantially enhance the performance of each player. The potential range of technology applications covers communications, personal protection, incident prediction processes, investigations, warning and detection technology, and automated response protocols. When these systems are installed and used to improve the management of emergencies, they must be maintained at a high performance level.

Strategy—Examine Technology Opportunities and Cost-Effectiveness to Introduce New Technology to Improve Efficiency, Effectiveness, and Safety

The geographic scale of disruption and high public visibility of responsiveness for ice and snow removal has led most states to an organized, proactive, technology-supported approach including pre-event mobilization and computer dispatching. *NCHRP Report 526: Snow and Ice Control: Guidelines for Materials and Methods* provides a model regarding procedural specifications. Situation-specific strategy guidelines have been prepared, operational procedures are pre-specified and trained to, resources are allocated, and performance is tracked and reported. The outcomes are highly visible to the public.

Technology priorities and standard approaches must be identified and examined for their cost effectiveness. For state DOTs, many of the technologies that support improved ETO are part of traffic operations-oriented ITS systems in various stages of cost-constrained deployment.

In some cases, the effectiveness of technology depends significantly on the related analytics and utilization rather than on simple deployment. The dual use potential of ITS technology can be incorporated in the resource allocation process. Opportunities also exist for cost sharing among agencies.

Reality 4. Absence of Performance Accountability

The notion of ETO as a program to be managed toward increased efficiency and reduced traffic disruption on a continuous performance improvement basis is not typically part of the DOT or public safety culture. However, the public is increasingly holding responders accountable for the disruptive nature of many highway-related emergencies—this beyond administrative and political accountability to actual legal exposure. Legal liability on the part of state DOTs for secondary crash victims or other problems related to long closures that are not adequately managed are an emerging consideration for transportation and public safety agencies. Without performance measurement, improvement is unlikely. FHWA has sponsored a study of various types of performance measures used to evaluate the progress of TIM programs in several locations around the country. The study included performance data collected by both transportation and public safety agencies and examined how the data was classified, used and stored (<http://ops.fhwa.dot.gov/Travel/IncidentMgmt/docs/impmrptf/section1.htm>).

Strategy—Measure Performance in the Field to Provide the Basis for Continuous Improvement

Improvement in performance requires the establishment of clear objectives and related benchmarks together with the measurement of task time and resource use for the various phases of ETO. Agreement on what is to be measured across the traffic incident and emergency management community is essential. This can be considered with a formal process for review and identification and support for needed improvements.

The International City/County Managers Association Center for Performance Measurement collects and analyzes the performance of a range of public safety services performance data (typically police, fire, and rescue response times and other service characteristics) for more than 133 participating jurisdictions. This standardized database permits participants to benchmark their jurisdiction against comparables. *The Journal of Emergency Management* also conducts surveys and publishes average and best practices. See http://icma.org/documents/PerfMeas_small.pdf.

Reality 5. Informal, Fragmented Activities

Within state DOTs, there is limited institutional commitment to ETO on average, as evidenced in policy, program, budget, or professional training. ETO remains a part-time or subsidiary responsibility without the sustainable resources, staffing, or accountability of a formal program. While few state DOTs are yet concerned with maintaining real-time system performance as a priority, several are taking important steps in organization and accountability.

Strategy—Formalize ETO as a Program with Appropriate Policies, Authorization, Organization, Structure, and Resources

An effective approach will require “mainstreaming” ETO as a formal program in DOTs and public safety agencies—in recognition of the special requirements of improved performance. An appropriate policy and program framework must be developed with organizational accountability and resources as the basis for continuous improvement. The impact of the security and safety thrust of the NIMS institutionalization will provide further impetus. In addition, a greater degree of formality is essential in the relationship between state DOTs and the public safety agencies to provide the basis for refining more effective roles and relationships toward interagency cooperation.

The combination of these changes means transforming a set of ad hoc activities into a formal program and establishing binding interagency relationships, priorities, and procedures. Bringing together TIM, disaster and ETO, and other special emergency transportation preparations into a single management framework is the essence of ETO.

THE BOTTOM LINE: DEGREE AND TYPE OF CHANGE NEEDED

The logic of the guides is based on a belief that progress is possible and that the objectives of the various agencies can all be simultaneously met at a higher level of effectiveness. However, for state DOTs and public safety agencies, the focus on change in their respective approaches is quite different, related to their roles and objectives.

Public safety agencies have principal authority and long-standing conventions for generic incident response and emergency operations procedures. For public safety agencies,

introducing a focus on hazards, preparing tailored approaches, and requiring an efficiency emphasis will all require a modest change to current approaches without compromising their public safety orientation.

Working with public safety agencies to accommodate a new emphasis on responsiveness and performance, state DOTs must not only make procedural modifications in field practice, but also must adjust agency-level program activities. This should include changing priorities, establishing program structure, reorganizing lines of reporting, mobilizing resources on a sustainable basis, setting performance objectives, and negotiating inter-agency consensus. The changes are likely to involve both district (regional) and headquarters (division) level priority and resource reallocation.

THE GUIDANCE FRAMEWORK



There are no widely accepted benchmarks in ETO (beyond generic processes) by which to judge effectiveness. Furthermore, few DOTs or public safety agencies measure performance in quantitative terms. Therefore, guidance that can support the improvement of practice in the direction of greater institutionalized ETO is provided. While the guidance is designed for state and local transportation agencies, it should prove useful to public safety agencies in considering the appropriate directions of cooperative approaches.

The Guidance is designed to be responsive to the intent of the NIMS in its broad applicability, flexibility, and focus on coordination and cooperation among responder entities. Consistent with the NTIMC perspective, each of the basic strategies presented in the previous sections has institutional and leadership components as well as an operations and technology components. **Table 2** summarizes the basic strategies with their respective components.

As shown in the table, the guidance framework is presented in two sections. Each guidance section is preceded by a self-assessment to help the user identify possible areas for improvement.

Table 2. Basic Strategies and Tactics for Improving ETO

REALITY	BASIC STRATEGY IMPLIED	INSTITUTIONS AND LEADERSHIP STRATEGIES	OPERATIONS AND TECHNOLOGY STRATEGIES
– Need to accommodate the full range of incidents, emergencies, and hazards	Develop an approach to ETO on an integrated, comprehensive, all-emergency/hazard/discipline basis	Develop interagency preparations for complete array of incidents and emergencies	Make hazard-specific and proactive preparations within and across agencies
– Absence of widely accepted best practice approaches	Develop a structured ETO process with joint protocols and procedures with full regard for the range of objectives while minimizing traffic disruptions	Establish formal program with senior responsibility, organization, and reporting	Develop and implement coordinated protocols, procedures coordination, and training
– Effective technology not integrated	Examine technology opportunities and cost-effectiveness to introduce new technology and improve efficiency, effectiveness, and safety	Allocate adequate resources	Deploy advanced, interoperable technology and equipment
– Absence of performance measures for incidents, emergencies	Measure performance in the field to provide the basis for continuous improvement	Establish objectives with related performance measures and accountability	Measure and benchmark performance against best practice
– Informal, fragmented activities	Formalize ETO as a program with appropriate policies, authorization, organization, structure, and resources	Develop agency policy, laws, regulations and interagency agreements	<i>See Institutions and Leadership Strategies</i>

THE INSTITUTIONS AND LEADERSHIP SELF-ASSESSMENT



Based on the weaknesses and strategies outlined in the preceding sections, a brief self-assessment questionnaire has been developed (see **Table 3**). The questionnaire is designed for senior management at the district and headquarters levels. However, it could also be used by program-level staff as a point of comparison to indicate varying views of strengths, weaknesses, and needs. The questionnaire tracks the five principal strategies presented in the previous Improvement Strategies section.

The institutional guidance is designed to reveal areas where actions may be needed at the department level (headquarters). It is also intended to provide the necessary framework (policy, organizational, resources, and relationships) within which program and district-level actions can progress through more effective and efficient ETO.

The questionnaire responses should be in the boxes that most closely resemble the following:

- **Understood**—This means that the respondent understands the issue and is aware that little progress has been made to date.
- **Start-Up**—This means that the respondent understands the issue and believes that a deliberate effort is underway to respond to the issue as stated.
- **In-Place**—This means that a deliberate effort has been underway for some time and that the issues are substantially dealt with.

If the senior manager cannot confidently answer the questions, it is a sign that the program has considerable room for improvement. A limited number of check marks in the In-Place column suggests that proceeding to the next level of assessment will be useful. More rather than fewer checkmarks in the In-Place column will also indicate where some of the most promising areas for improvement may lie—in the areas of operations and technology or in the organizational, policy, and funding area.

Table 3. Department-Level Institutional Self-Assessment

	Understood	Start-Up	In Place
1. INTERAGENCY PREPARATIONS FOR COMPLETE ARRAY OF INCIDENTS AND EMERGENCIES			
Formal working relationships with state/regional emergency management agencies			
Formal working relationship with state/federal security entities			
Other state agencies fully briefed on DOTs capabilities			
2. FORMAL PROGRAM WITH SENIOR RESPONSIBILITY, ORGANIZATION, REPORTING			
Existing strategic business plan for ETO (incidents and emergencies)			
Clear organizational structure – headquarters and districts			
District level ETO program plans prepared for all hazards			
DOT response capability on 24x7 basis			
Appropriate staff expertise			
3. ADEQUATE RESOURCE ALLOCATION			
Line-item budget for ETO			
District-level allocation scheme for resources			
Joint project/resourcing opportunities discussed with public safety agencies			
Emergency and incident management co-location considered			
Joint federal/state funding opportunities discussed with public safety partners			
4. OBJECTIVES WITH RELATED PERFORMANCE MEASURES AND ACCOUNTABILITY			
Objectives for ETO performance identified			
Reasonable performance measures with public safety agencies negotiated			
Performance reporting process in place			
After-action review process used			
5. AGENCY POLICY, LAWS, REGULATIONS, AND INTERAGENCY AGREEMENTS			
Needed legislative changes identified and in process			
Interagency agreement on TIM and other events exists			
Rationale, benefits of improved program communicated to stakeholders			
Senior-level working relationships with public safety and emergency management leadership exist			

THE INSTITUTIONS AND LEADERSHIP GUIDANCE



The institutional guidance is oriented to the five basic strategies and is based on the weaknesses found to characterize most state DOT approaches to ETO. The guidance presented in this section suggests the logical next steps after the self-assessment—a set of tactics to implement that strategy—toward improved performance. The location of the action within the agency’s overall strategic/business planning process is indicated.

The institutional changes must be initiated by top management as they are likely to change agency-level priorities, organizational structure, and reporting and resource allocation. In addition, changes described must take place on an interagency basis because common priorities and procedures are essential to achieve the types of improvement that are the focus of the vectors in the guide.

STRATEGY 1: DEVELOP INTERAGENCY PREPARATIONS FOR COMPLETE ARRAY OF INCIDENTS AND EMERGENCIES

Preparation for the broad array of potential incidents and emergencies requires a range of actions appropriate to the situation (see **Table 4**). Traffic incidents, law enforcement, and HAZMAT, disaster, and security events invoke various authorities and require a range of process responses drawing on different combinations of expertise from the emergency response community. State DOTs play varying roles from central to peripheral across this array of emergencies. Even when the emergency does not involve highways directly, it is likely that emergency response and access will utilize highway assets.

Table 4. Tactics for Institutions and Leadership Strategy 1

Tactics	Location in Agency Planning
Develop Relationships with State/Regional Emergency Management Agencies (EMA) <ul style="list-style-type: none"> • Develop liaison with state/regional EMAs and clarify DOT emergency support functions for complete array of relevant incidents and emergencies. • Develop communications networks and protocols among state DOTs, public safety agencies, and the state and regional emergency management agencies. • Develop DOT operations plans with appropriate internal plans, response protocols, and procedures for mobilizing personnel and equipment. Carry out this activity in close coordination with public safety agencies that are likely to have incident command responsibilities during emergencies. • Ensure appropriate district-level relationships with regional EMAs and public safety agencies. 	Strategic planning (offline as senior management interagency relationships) Statewide program planning District planning
Develop Relationships with State/Federal Security Entities <ul style="list-style-type: none"> • Develop formal interagency relationships and communications networks and protocols among state DOTs and the security entities, including secure routings for classified information. • Working with the state coordinator for terrorism and security-related threats, develop appropriate response on department-wide and district basis to the Homeland Security Advisory System (HSAS) for terrorist threat levels. 	Strategic planning (offline as senior management interagency relationships)
Familiarize Other State Agencies with DOT Capabilities <ul style="list-style-type: none"> • Discuss with other state agencies with both emergency and security responsibilities the utilization of state DOT TMC-based and communications resources for multi-agency purposes. 	Strategic planning (management interagency relationships)
Develop Joint Interagency Strategy Plans and Coordinated Resourcing <ul style="list-style-type: none"> • Develop coordinated strategic plans and budgets for ETO among transportation and public safety agencies so that each agency can carry out its respective role and responsibility with assurance that all roles will be fulfilled. • Look for joint resourcing opportunities regarding funding from state and federal sources. 	Strategic planning (management interagency relationships)
Readiness to Advance DOT understands its role across the wide range of traffic incidents and other emergency operations responsibilities. DOT has clear relationships with the other emergency responders in command positions that understand DOT capabilities.	

STRATEGY 2: ESTABLISH FORMAL PROGRAM WITH SENIOR RESPONSIBILITY, ORGANIZATION, AND REPORTING

ETO responsibilities tend to be a set of part-time responsibilities for division and district staff. There are multiple lines of responsibility among traffic engineering, maintenance, and traffic operations center staffs as well as via ITS and special emergency operations assignments. The continuous improvement of ETO requires a more consolidated, formal program structure in order to mobilize resources, define objectives, and organize activities consistent with policy. This is an essential senior executive responsibility and is not likely to take place without first-level leadership and use of department-wide authority (see **Table 5**).

Table 5. Tactics for Instructions and Leadership Strategy 2

Tactics	Location in Agency Planning
Develop an Agency Strategic Business Plan for ETO <ul style="list-style-type: none"> • Identify departmental task force to consider policy and program issues including representatives from key divisions and districts. • Establish ETO in department mission and priorities as part of formal policy statements. • Incorporate ETO objectives into strategic planning for departmental and district-level priorities, including definition of program and responsibilities and desired outcomes. 	Strategic planning
Develop Organizational Structure <ul style="list-style-type: none"> • Assign appropriate senior-level staff as responsible for ETO, including authority and responsibility with clear span of control and lines of reporting. • Consider the allocation of responsibilities at the district level among units with special attention to potentially conflicting roles of maintenance and traffic operations/TMC/ITS responsibilities. 	Strategic and business planning District/division-level planning
Develop District-Level ETO Program Plans <ul style="list-style-type: none"> • Determine scope of program for District in response to overall department policy and local specific needs (special local emergencies). 	District/division - level planning
Convert to Full-Time Basis <ul style="list-style-type: none"> • Establish 24x7 program responsibilities at district and headquarters levels to achieve appropriate service and consistent relationships with public safety agencies, including evening and weekend basis manning, callout procedures, motorist information dissemination, and equipment disposition. 	Strategic and business planning
Develop Professional Capacities <ul style="list-style-type: none"> • Identify professional capacity needs via knowledge/skills/abilities specification for key positions and priorities, and identify policies on training (including joint training with public safety agencies). 	Strategic and business planning
Readiness to Advance DOT has a formal, sustainable program for ETO with effective senior executive responsibility, staffing, and management.	

STRATEGY 3: ALLOCATE ADEQUATE RESOURCES

Few states account for ETO activities beyond snow and ice control. Resources supporting a state DOT's ETO activities (including TMC operations, service patrols, maintenance staff response, administrative management, and related ITS infrastructure) are typically buried in other programs. Expanded responsibilities imply the need for additional resources (see **Table 6**).

Table 6. Tactics for Institutions and Leadership Strategy 3

Tactics	Location in Agency Planning
Develop Department Budget <ul style="list-style-type: none"> • Roll up current fully allocated costs as the basis for improvement-oriented ETO business planning. • Establish line items for activities and system improvements to ensure adequate and appropriate funding less subject to the individual discretion of units with other priorities. • Establish budget for deployment of improved TMC and field hardware and software. • Consider coordinated approach to multisource funding from all relevant state and federal sources. 	Business planning and annual budgeting and programming
Develop District/Division-Level Allocation Scheme <ul style="list-style-type: none"> • Ensure allocation of resources as necessary and available that are appropriate at the district level. 	Business planning and annual budgeting and programming
Consider Joint Project Strategies with Public Safety Partners <ul style="list-style-type: none"> • Look for opportunities to link ETO-related interagency programs to reduce procurement burdens and improve multi-use efficiency. • Look for opportunities to support joint activities in a fashion that encourages public safety participation, given the relative constraint on public safety agency resources. 	State-level and district/division-level program administration
Consider Co-location <ul style="list-style-type: none"> • Consider evolution of improvements in emergency management centers, traffic management centers, and police dispatching centers toward co-location to improve familiarity and coordination. 	State-level and district/division-level program administration
Identify and Secure Federal/State Emergency and Security Funds <ul style="list-style-type: none"> • Seek funds that are available from DHS and other sources to fund first responder and related needs such as communications. These funds typically require application. 	State-level and district/division-level program administration
Readiness to Advance The ETO program has adequate and predictable resources – staff, equipment, and infrastructure – to meet its responsibilities.	

STRATEGY 4: ESTABLISH OBJECTIVES WITH RELATED PERFORMANCE MEASURES AND ACCOUNTABILITY

Performance measurement is essential to determine that progress is being made consistent with declared departmental policy and strategy. Formal performance measurement can be applied to many steps in the ETO process because the occurrence and timing of incidents are already formally registered in police and DOT dispatch records (see **Table 7**).

Table 7. Tactics for Institutions and Leadership Strategy 4

Tactics	Location in Agency Planning
Develop Objectives for Performance <ul style="list-style-type: none"> • Recognize the institutional orientation of each agency involved and consider promising approaches to win-win adjustments of procedures that improve performance. • Organize agency teams to establish appropriate realistic stretch targets and metrics for a performance monitoring/reporting system. • Direct development of unit-level process for using measures to analyze performance outside exception limits. 	Strategic and business planning
Negotiate Reasonable Performance Measures with Public Safety Agencies <ul style="list-style-type: none"> • Develop cooperative process to meet with public safety agencies and agree on common performance targets and metrics for joint evaluation of performance progress. 	Strategic and business planning
Identify Performance Reporting Process <ul style="list-style-type: none"> • Develop departmental reporting vehicles such as internal dashboards and quarterly reports to constituents. • Identify internal staff leads and reporting relationships. 	Strategic and business planning
Readiness to Advance The ETO program is continuously improving on a demonstrable measured basis with regular performance reporting.	

STRATEGY 5: DEVELOP AGENCY POLICY, LAWS, AND REGULATIONS

Major changes in procedures and protocols related to roles, responsibilities, and authority of incident and emergency responders may be needed. Improvements in performance often involve modifications of these traditions, new laws, new policies, and interagency agreements (see **Table 8**).

Table 8. Tactics for Institutions and Leadership Strategy 5

Tactics	Location in Agency Planning
Identify Needed Legislative Changes <ul style="list-style-type: none"> Identify areas where changes in department policy or state law are necessary and appropriate, such as quick clearance, road closure and diversion liability, vehicle and cargo removal, and traffic control. In some cases, DOTs with their public safety partners may have to seek changes in current law. Best practice legislation samples are often available from other states. 	Special department task force
Negotiate Interagency Agreements <ul style="list-style-type: none"> Consider a top-down approach to develop agreements among DOTs and public safety agencies or EMAs, including formal interagency agreements on key features of incident/emergency management activities. 	Special department task force
Communicate Rationale and Benefits to Stakeholders <ul style="list-style-type: none"> Communicate the benefits of improved performance through ETO to key constituencies, including user groups, appropriate administration and legislative decision makers, staff, and public. 	Special department task force
Develop Regular Working Relationships with Public Safety Leadership <ul style="list-style-type: none"> Lead policy discussion with public safety agencies on developing a cooperative program, including mutually agreed-upon policies and procedures, formal agreements, and legislative and budget strategies. 	Special department task force
Link Performance Reporting Results to Agency's Incentives and Rewards <ul style="list-style-type: none"> Modify job position descriptions and tasks to meet overall institutional changes. Establish compensation systems commensurate with agency priorities. Establish "professional" role for ETO, including career path, training, and leadership responsibilities. 	Special department task force with human resources department
<p style="text-align: center;">Readiness to Advance</p> <p>The ETO program has developed stakeholder support and established formal relationships among the key partners.</p>	

IMPROVEMENT STRATEGIES AS PART OF AGENCY STRATEGIC PLANNING AND PROGRAMMING

The needed changes and improvements must become institutionalized in terms of policy, authorization, program structure, organization, accountability, and resources. The continuous improvement approach implies regular management oversight of and accountability for ETO activities. These realities imply the establishment of ETO as a formal department program with all the common institutional features of mainstream state DOT activities.

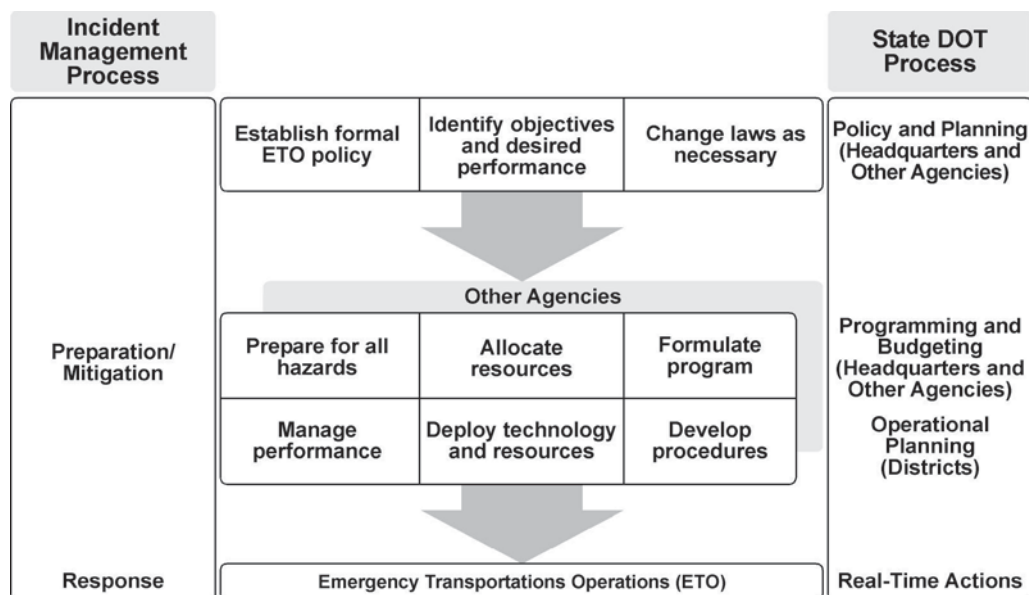
The policy rationale and objectives for a DOT-wide ETO program, including inter-agency policy alignment and legislative strategies, must be integrated with overall DOT strategic planning at headquarters as part of the policy and planning processes. Formalization of an ETO program with related organizational, reporting, and budgeting issues is also a matter for a department-wide task force as part of the department's programming and budgeting activities.

Development of operational plans, protocols, and procedures, including performance measures and technology infrastructure, is appropriately at the district level, tailored to each region. However, there is the need for continuous interaction between operational planning and the program-wide funding and organizational structure (institutional) issues presumably handled at the level of DOT headquarters divisions and senior management.

ETO will be "staff and training intensive" rather than "capital intensive." There are potential staff modifications to provide 24×7 responsiveness, like that of a public service entity. There are also capital requirements, many of which are dual use with current ITS programs. Resources for the program may be an issue but will be modest compared with the return on service available and compared with other expenditure options.

Figure 6 illustrates the proposed improvement strategies for ETO in relation to conventional DOT policies for development and planning. The figure identifies the key agency leaders and/or departments that must address the individual and collective strategies to institutionalize ETO within a DOT.

Figure 6. Relationship of ETO to Conventional State DOT Policy Development and Planning



MOVING FORWARD—THE IMPORTANCE OF EXECUTIVE LEADERSHIP

Given a decision to move ahead, top-level agreement must be reached with state and local emergency response entities as to the joint focus of improvement. Cementing this relationship is crucial, and DOT subsidy of certain joint costs to create a positive environment for change is worth considering. The policy commitment and joint agreement with the public safety agency can then be converted into a manageable program in which the department can work simultaneously on joint improvements and its own internal approach to achieving a higher level of sustainable activities as well as its commitment to continuous measurable improvement. Development of this program will require a strategic business plan specifying responsibilities, resources, and performance targets. As a “jump start” opportunity, training courses are available from FHWA and other sources in the state of the practice regarding response activities.

Introducing an institutionalized focus on improved operations regarding the improved service and reduced delay and disruption from incidents and emergencies will require continuous top-down leadership. Throughout this process, as in the case of any programmatic strategic change, departmental leadership will have to reassert the vision and policy commitment and hold those who are responsible accountable for measurable improvement.



THE OPERATIONS AND TECHNOLOGY SELF-ASSESSMENT AND GUIDANCE

The Operations and Technology Guidance is designed for the ETO program manager, namely the individual designated by senior management as responsible for implementing the key strategies through a series of coordinated tactics within and across agencies.

The guidance for operations and technology is divided into four basic strategy areas, and a brief questionnaire has been developed for each. (The fifth strategy area is covered in the Institutions and Leadership Guidance.) For each of the strategy areas, guidance is presented at two levels, related to the agency's current level of program development:

- **Base-Level Tactics**—Plans for achieving fundamental agency and cross-agency capabilities in ETO when little or no formal programs exist. Each strategy also contains indicators of readiness to progress from the Base to the Advanced level.
- **Advanced-Level Tactics**—Plans for enhancing existing components of an ETO capability or program within an agency, as well as across multiple agencies.

A self-assessment chart precedes each strategy to assist the ETO program manager in determining level of readiness for a particular strategy **Figure 7** illustrates this process. The questionnaire responses should be in the boxes that most closely resemble the following:

- **Understood**—The respondent understands the issue and is aware that little progress has been made to date.
- **Start-Up**—The respondent understands the issue and believes that a deliberate issue is underway to respond to the issue as stated.
- **In-Place**—A deliberate effort has been underway for some time and the issues are substantially addressed.

Based on the self-assessment scoring, if a majority of the marks are in the

- Understood column, proceed to the base-level tactics.
- Start-up column, then review the base-level tactics for completeness in this strategy, but also consider one or more of the tactics in the advanced-level listing.
- In-place column, then review the advanced-level tactics.

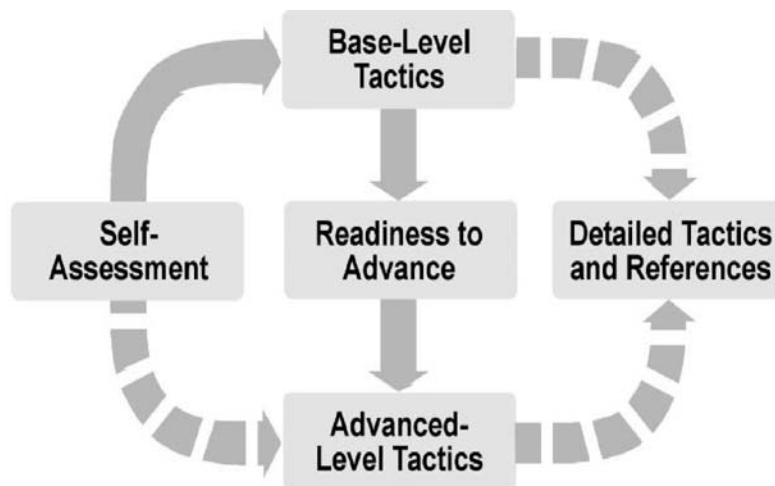


Figure 7. Process for Navigating the Operations and Technology Self-Assessment and Guidance

STRATEGY 1: MAKE HAZARD-SPECIFIC/PROACTIVE PREPARATIONS

Proactive anticipation of common and unique hazards and development of hazard-specific protocols and technology are key to improving the safety of those involved in incidents, as well as responders. Therefore, key useful features are incorporated from preparation and response requirements to the complete range of special events and emergencies (including major incidents, HAZMAT, criminal, severe weather, natural disasters, and terrorism) (see **Table 9**).

Table 9. Operations and Technology Self-Assessment for Strategy 1

	Understood	Start-Up	In-Place
ETO program addresses all types of roadway-related emergencies and hazards.			
Special response units (equipment, trained personnel) are available to address all hazard situations.			
Advanced detection and prediction technologies are available to assist with decision-making for an all emergency and all hazards situation.			
Contractual procedures are available to engage specialty towing and recovery services or special clearance equipment, e.g., for HAZMAT, WMD (not available through conventional agency resources) in a timely and efficient manner.			
Interoperable and secure communication systems exist among responders (public and private sector).			
Mutual aid agreements among jurisdictions and responders executed.			
SUMMARY SCORE (Tally number of checks in each column)			

Based on your self-assessment score, please select either the base-level or advanced-level tactics that are presented in **Tables 10 and 11**.

Table 10. Strategy 1 Base-Level Tactics

Base-Level Tactics	Key Objectives Addressed
Improve Emergency Prediction Capability Enhance the ability to predict emergencies (type, location, and timing) to minimize or reduce emergency response times and to prepare specific traffic and other emergency responses for pre-planned special events (celebrations, concerts, athletic); major weather events (hurricanes, floods, snow); and established patterns and locations of non-recurrent congestion (“hot spots”).	<ul style="list-style-type: none"> • Maintain capacity • Control traffic • Inform motorist
Improve Asset Threat Detection and Hardening Deploy appropriate critical asset countermeasures to ensure appropriate threat detection, deterrence, and hardening consistent with threat types and warning levels. Critical assets must be identified, their vulnerability assessed, and appropriate countermeasures deployed. These may include surveillance and detection technologies, lighting, barriers, key element lockouts, increased patrolling, and reduced access during periods of heightened threats.	<ul style="list-style-type: none"> • Maintain capacity • Control traffic
Allocate Personal Protective Equipment Allocate as appropriate personal protective equipment (detection, monitors, suits, masks, decontamination equipment) to protect first responders, including key public safety and certain DOT personnel, who may face road-related chemical, biological, or radiological threats from WMD.	<ul style="list-style-type: none"> • Ensure responder safety • Reduce victim fatality
Develop Advanced Traffic Incident and Emergency Management Plans for Predictable Emergencies/Incidents Develop advanced Traffic Incident and Emergency Management Plans for predictable disruption and high probability events (weather, construction, and special events) including pre-determined protocols (evacuation, diversion) and pre-positioned equipment.	<ul style="list-style-type: none"> • Ensure responder safety • Control traffic • Maintain capacity • Inform motorist • Clear roadway
Arrange for Towing and Recovery and Special HAZMAT Removal Capabilities Arrange for special clearance and control equipment and services for handling, removal, and treatment of heavy vehicles, debris, and HAZMAT to minimize responder risk and traffic disruption. The variety of on-road emergencies stemming from traffic, natural, and terrorism causes can introduce a range of on-site removal and treatment challenges including large vehicles and debris, hazardous materials, and WMD-associated hazards. Handling of removal and treatment problems introduced the need for specialized equipment for towing cargo and HAZMAT handling and disposal. Arrangements must be made for the availability of such equipment on a routine or exception basis in a timely fashion to reduce the safety and delay impacts – especially associated with major incidents.	<ul style="list-style-type: none"> • Reduce victim fatality • Investigate crime and liability • Control traffic • Enforce law • Maintain capacity • Minimize backup and secondary crashes • Clear roadway
Develop Functional Flexibility into TMC Equipment and Operations During incidents, the functions at the TMC are aligned to the scale and scope of the incident. These changes may include 24x7 operational requirements; access to special agency information systems (purchasing, design, personnel, etc.); or equipment inventories and locations. This requires forethought in the design and operation of the TMC that, depending on the event, may require the TMC to evolve into an auxiliary Emergency Operations Center, closely networked with other emergency responding agencies and centers.	<ul style="list-style-type: none"> • Reduce victim fatality • Investigate crime and liability • Control traffic • Enforce law • Maintain capacity • Minimize backup and secondary crashes • Clear roadway
Readiness to Advance <ul style="list-style-type: none"> • Independent, joint agency review and self-assessment of the degree of achievement of these tactics in support of the overall strategy. • Review of dispatcher logs and post-incident reports to assess incident management capacity and performance. • Existence and concurrence across agencies on the operational plans for pre-planned events and activities. • Accuracy and usefulness of prediction models. 	

Table 11. Strategy 1 Advanced-Level Tactics

Advanced-Level Tactics	Key Objectives Addressed
<p>Develop Interoperable Interagency Communications</p> <p>Develop and deploy interoperable interagency communications for both voice and data to better coordinate emergency detection and response among emergency responders who are typically hampered by communications difficulties on a field-to-field, field-to-center, and center-to-center basis.</p>	<ul style="list-style-type: none"> • Reduce victim fatality • Ensure responder safety • Inform motorist • Provide motorist assistance
<p>Deploy Specialized Advanced Medical Communications</p> <p>Equip emergency medical services (EMS) vehicles with appropriate communication to support improved patient care at scene and better prepare hospital pre-arrival protocols. Deploy real-time video voice and data communications so that emergency physicians (telemedicine) can target patient care on scene and en route. DOTs can support these efforts through shared use of ITS assets.</p>	<ul style="list-style-type: none"> • Reduce victim fatality • Ensure responder safety • Inform motorist • Provide motorist assistance
<p>Improve Contacts/Communications with Security Entities</p> <p>Develop formal interagency relationships and communications networks and protocols between state DOTs and the non-transportation public safety, emergency, and security communities including secure routings for classified information. Improved ties, both formal and informal, are essential to facilitate appropriate and timely communication of relevant strategic and tactical information including early warnings of elevated security threats. In this context, dealing with necessary federal and state security clearances and secure information handling will be essential.</p>	<ul style="list-style-type: none"> • Ensure responder safety • Investigate crime and liability • Maintain capacity
<p>Arrange for Special Clearance and Control Equipment</p> <p>Arrange for special clearance and control equipment and services for handling, removal, and treatment of heavy vehicles, debris, and HAZMAT to minimize responder risk and traffic disruption. The variety of on-road emergencies stemming from traffic, natural, and terrorism causes can introduce a range of on-site removal and treatment challenges, including large vehicles and debris, hazardous materials and WMD-associated hazards. Handling of removal and treatment problems introduced the need for specialized equipment for towing cargo and HAZMAT handling and disposal. Arrangements must be made for the availability of such equipment on a routine or exception basis in a timely fashion to reduce the safety and delay impacts – especially associated with major incidents.</p>	<ul style="list-style-type: none"> • Reduce victim fatality • Investigate crime and liability • Control traffic • Enforce law • Maintain capacity • Minimize backup and secondary crashes • Clear roadway • Inform motorists

STRATEGY 2: DEVELOP AND IMPLEMENT COORDINATED PROTOCOLS, PROCEDURES, AND TRAINING

There appears to be significant efficiency and other benefits to combining the best practices from TIM and the range of ETO into a single comprehensive framework that can be organized, managed, and improved. This must be based on the negotiated development of protocols and procedures among the DOT, public safety agencies, emergency management agencies, and the towing and recovery community to establish effective command, coordination, and response for timely management and clearance.

There are two levels of consideration. Development of plans and strategies—including their resource implications—is best carried out on an interagency basis. It is recognized that the key partners in response are all constrained regarding availability of adequate personnel and resources. For this reason, training is particularly important. This is essential if a coordinated approach is to be achieved with clear fulfillment of roles, coordinated common procedures, and interoperable technology.

At the operational level, the proper performance of ETO is dependent on the effectiveness of incident response performance at the scene, from arrival through clearance and recovery. Improvements are in the areas of safety of travelers and responders, quick clearance time, and minimal traffic disruption. Improving performance in the field requires the prior establishment of effective communications, coordination, pre-established protocols, cooperation with other responders, and multi-agency planning and training (see **Table 12**).

Table 12. Operations and Technology Self-Assessment for Strategy 2

	Understood	Start-Up	In-Place
Existence of joint protocols and procedures for quick clearance.			
Existence of joint protocols and procedures for site investigation.			
Existence of joint protocols and procedures for positive traffic control.			
Availability and use of joint agency training in protocols and procedures.			
Use of a 24x7 program to monitor and respond to ETO.			
Use of service patrols and other “probe vehicles” for ETO awareness, response, and recovery.			
Existence and use of first responder protocols and training for WMD response.			
Availability and use of specialized plans and programs for special events or emergency circumstances.			
Comprehensive and coordinated public information and messaging program.			
SUMMARY SCORE (Tally number of checks in each column)			

Based on your self-assessment score, please select either the base-level or advanced-level tactics that are presented in **Tables 13 and 14**.

Table 13. Strategy 2 Base-Level Tactics

Base-Level Tactics	Key Objectives Addressed
Develop/Negotiate Quick Clearance Policies Negotiate/develop quick clearance policies between state DOTs and public safety agencies for rapid removal of vehicles/debris on traveled lanes to minimize safety exposure and delay, reduce liability, and improve public image.	<ul style="list-style-type: none"> • Maintain capacity • Control traffic • Eliminate secondary accidents
Improve Site Investigation Procedures Crime scene preservation and documentation. Improve site investigation procedures, including better utilization of accident data collection technology and team procedures to minimize disruptions to traffic and responder exposure on roadways.	<ul style="list-style-type: none"> • Investigate crime and liability • Minimize delays
Develop Positive Traffic Control Implement positive traffic control (traffic management plans) including motorist alert, speed, and lane control as per MUTCD.	<ul style="list-style-type: none"> • Maintain capacity • Control traffic • Ensure scene responder and public safety
Deploy/Improve Service Patrols Service patrols have become a familiar and expected public service for motorist assistance. With a modest expansion of objectives and functions, service patrols can provide greater assistance in ETO. Key issues to resolve include reporting requirements; authority for on-scene operations and actions; resource allocation (number/coverage patterns/operational hours); and training.	<ul style="list-style-type: none"> • Ensure scene responder and public safety • Control traffic • Minimize delays • Eliminate secondary accidents • Divert traffic • Coordinate response • Maintain capacity
Arrange for Special Clearance and Control Equipment Arrange for call outs and/or availability of special clearance and control equipment and services for handling, removal, and treatment of heavy vehicles, debris, and HAZMAT to minimize delays. Arrangements must be made for the availability of such equipment on a routine or exception basis in a timely fashion to reduce the safety and delay impacts – especially associated with major incidents.	<ul style="list-style-type: none"> • Ensure responder safety • Control traffic • Maintain capacity • Inform motorist • Clear roadway • Enforce law
Establish 24x7 Program Consistent and customer-appropriate level and type of readiness by incident/emergency frequency/location (rather than business hours), including continued facility staffing, and vehicle/equipment disposition.	<ul style="list-style-type: none"> • Investigate crime and liability • Minimize backup and secondary crashes • Clear roadway
Provide Training in Quick Clearance and Site Management Collectively train DOT and public safety personnel in proper site management, prevention of secondary crashes, responder safety best practices, and quick clearance, including improved investigative methods, updated towing requirements, and improved spill clean-up procedures.	<ul style="list-style-type: none"> • Control traffic • Enforce law • Maintain capacity • Minimize backup and secondary crashes • Clear roadway
Provide Combined Training for Interagency Communications Train DOT and public safety personnel on the importance of clear and concise communications on the scene, in the area of the incident, and from traffic management/operations centers and emergency communications centers.	<ul style="list-style-type: none"> • Coordinate response • Control traffic • Ensure scene responder and public safety
Readiness to Advance <ul style="list-style-type: none"> • Number of program elements established after 1 year of top-level management commitment. • Existence of quick clearance policy signed by major agency leaders. • Individual and joint agency training and practice in the use of quick clearance and site management. 	

Table 14. Strategy 2 Advanced-Level Tactics

Advanced-Level Tactics	Key Objectives Addressed
<p>Establish Public Information and Messaging Program</p> <p>Establish standardized incident-related public information and messaging program to support informed driver decisions for routing and trip-making. Communicating with the driving public both on the road (including those within impacted areas, as well as upstream) and pre-trip is an essential component of minimizing traffic build up with associated safety and delay impacts as well as providing real-time information to improve individual decision-making, confidence, and comfort of those already or potentially impacted. Methods include use of Dynamic Message Signs (DMS), Highway Advisory Radio (HAR), broadcast media, and 511 systems.</p>	<ul style="list-style-type: none"> • Provide motorist assistance • Control traffic • Divert traffic • Minimize delays • Coordinate response
<p>Improve TMC-Based Detection and Response Procedures</p> <p>TMCs are evolving from a passive information collection role to one of fusing multiple sources of data to coordinate responses and support decision-making for the on-scene responders and general public. Effective TMCs have adopted this expanded mission and provide the appropriate training and resources for personnel. Activities include not only agency-based improvements, but cross-agency coordination, such as TMC-CAD interfaces, improved traffic detection algorithms, timely coordination with homeland security agencies, and improved public messaging and information.</p>	<ul style="list-style-type: none"> • Victim treatment and extraction • Ensure scene responder and public safety • Control traffic • Minimize delays • Divert traffic • Maintain capacity • Coordinate response • Provide motorist assistance
<p>Develop Special Emergency Traffic Management Plans</p> <p>Develop advanced Traffic Incident and Emergency Management Plans for predictable disruption and high probability events (weather, construction, and special events) including pre-determined protocols (evacuation, diversion) and pre-positioned equipment.</p>	<ul style="list-style-type: none"> • Ensure scene responder and public safety • Control traffic • Enforce law • Minimize delays • Eliminate secondary accidents • Divert traffic • Maintain capacity • Coordinate response • Provide motorist assistance
<p>Provide Combined Training in Incident Command and Unified Command Systems</p> <p>Train DOT personnel jointly with public safety agencies in incident command systems, as it is widely used by public safety agencies in a large range of emergencies.</p>	<ul style="list-style-type: none"> • All agency objectives
<p>Provide First Responder Training for WMD and Other Emergencies</p> <p>Include DOT personnel in training for first response to WMD hazards and related protocols as appropriate to minimize first responder risks.</p>	<ul style="list-style-type: none"> • All public safety objectives • Awareness of emergency management community objectives

STRATEGY 3: DEPLOY ADVANCED TECHNOLOGY/EQUIPMENT

The potential range of technology applications covers communications, personnel protection, incident prediction processes, and warning/detection technology with the potential for automated response protocols. Appropriate technology, equipment, and supplies should be deployed for their important role in reducing the impact of incidents by minimizing the time and cost of each phase of emergency response and improving its effectiveness. The development of interoperable field-to-field and field-to-center communications is a key step in improving ETO effectiveness. Other valuable technologies include those deployed to detect or mitigate incidents as well as analytical procedures to predict incident occurrence and potential impacts/outcomes. Sufficient pre-specification of potential emergency events allows for mitigation by protection, deterrence, or predetermined management tactics. Training in the use of these tools, as well as the results obtained in other regions, is important to help instill interest in the programs.

The activities of Strategy 3 include the development of concepts, methods, and systems to improve the timeliness and content of notification of incidents or emergency events to responders, TMC staff, and dispatchers. In some cases this would include pre-notification through prediction. They also include potential improvements in interoperable inter-agency communications to support DOT-public safety communications both at the TMC and field levels (that may be a by-product of improved law enforcement communications) as well as special medical communication, investigatory, and HAZMAT technology. Most of the deployment and associated costs are with law enforcement or other special emergency management entities, but DOT management can play a key role (including potential cost-sharing) in the stimulation or cooperation of advancing such projects (see **Table 15**).

Table 15. Operations and Technology Self-Assessment for Strategy 3

	Understood	Start-Up	In-Place
Use of state-of-the-practice incident/emergency detection and prediction technologies and systems.			
Availability and training in the use of advanced site investigation technologies.			
Use of advanced communication systems supporting interoperable voice, data, and video communications to aid in responder safety and victim care/treatment.			
Coordinated secured communication with other local, regional, state, and federal agencies to enable situation assessment, reporting, response, and recovery.			
Programs to assess and protect critical assets.			
SUMMARY SCORE (Tally number of checks in each column)			

Based on your self-assessment score, please select either the base-level or advanced-level tactics that are presented in **Tables 16 and 17**.

Table 16. Strategy 3 Base-Level Tactics

Base-Level Tactics	Key Objectives Addressed
<p>Improve Incident/Emergency Detection</p> <p>Upgrade incident and emergency detection technology and systems and coverage and related interagency communication systems coordination to support improved emergency response times and targeting. Incident detection approaches include a complete range from wireless 911 calls, automated collision notification (ACN), and service patrols.</p>	<ul style="list-style-type: none"> • Ensure scene responder and public safety • Control traffic • Eliminate secondary accidents • Provide motorist assistance • Divert traffic
<p>Develop Interoperable Interagency Communications</p> <p>Develop and deploy interoperable interagency communications for both voice and data to better coordinate emergency detection and response among emergency responders who are typically hampered by communications difficulties in the field-to-filed, field-to-center, and center-to-center basis. Interagency communications should also extend to towing and recovery service providers as well as individuals associated with victim extraction, if not already assigned to public safety agencies.</p>	<ul style="list-style-type: none"> • Victim treatment and extraction • Ensure scene responder and public safety • Control traffic • Divert traffic • Minimize delays • Coordinate response
<p>Acquire Advanced Site Investigation Equipment and Facilities</p> <p>Acquire and deploy the most up-to-date investigative technology such as geographic information system (GIS) mapping and “photogrammetry” to improve scene safety and minimize traffic disruption by reducing technician exposure and reducing overall traffic disruptions including secondary crash potential.</p>	<ul style="list-style-type: none"> • Investigate crime and liability • Minimize delays • Ensure scene responder and public safety • Coordinate response
<p>Improve Site Investigate Procedures</p> <p>Improve site investigation procedures, including better utilization of accident data collection technology and team procedures, to minimize disruption to traffic and responder exposure on the roadway.</p>	<ul style="list-style-type: none"> • Ensure scene responder and public safety • Minimize delays • Maintain capacity • Control traffic
<p>Arrange for Special Clearance and Control Equipment</p> <p>Arrange for special clearance and control equipment and services for handling, removal, and treatment of heavy vehicles, debris, and HAZMAT to minimize responder risk and traffic disruption. The variety of on-road emergencies stemming from traffic, natural, and terrorism causes can introduce a range of on-site removal and treatment challenges including large vehicles and debris, hazardous materials, and WMD-associated hazards. Handling of removal and treatment problems introduced the need for specialized equipment for towing cargo and HAZMAT handling and disposal. Arrangements must be made for the availability of such equipment on a routine or exception basis in a timely fashion to reduce the safety and delay impacts – especially associated with major incidents.</p>	<ul style="list-style-type: none"> • Ensure scene responder and public safety • Victim treatment and extraction • Coordinate response
<p style="text-align: center;">Readiness to Advance</p> <ul style="list-style-type: none"> • Number of technology components or programmatic elements established after 1 year of top-level management commitment. • Case study review of technology effectiveness. • Joint training and certification in specialized technologies. 	

Table 17. Strategy 3 Advanced-Level Tactics

Advanced-Level Tactics	Key Objectives Addressed
<p>Deploy Specialized Advanced Medical Communications</p> <p>Equip EMS vehicles with appropriate communication to support improved patient care at the scene and better prepare hospital pre-arrival protocols. Supply real-time video voice and data communications to emergency physicians (telemedicine) so they can target patient care on scene and en route. DOTs can support these efforts through shared use of ITS assets.</p>	<ul style="list-style-type: none"> • Victim treatment and extraction • Ensure scene responder and public safety • Coordinate response
<p>Improve Critical Asset Threat Detection and Hardening</p> <p>Critical assets must be identified, their vulnerability assessed, and appropriate countermeasures deployed. These may include surveillance and detection technologies, lighting, barriers and key element lockouts, and increased patrolling and reduced access during periods of heightened threats.</p>	<ul style="list-style-type: none"> • Ensure scene responder and public safety • Control traffic • Enforce law • Minimize delays • Divert traffic • Maintain capacity • Coordinate response
<p>Improve Contacts/Communications with Security Entities</p> <p>Develop formal interagency relationships and communication networks and protocols between state DOTs and the non-transportation public safety agencies, emergency and security communities including secure routing for classified information. Improved ties – both formal and informal – are essential to facilitate appropriate and timely communication of relevant strategic and tactical information, including early warning of elevated security threats. In this context, dealing with necessary federal and state security clearances and secure information handling will be essential.</p>	<ul style="list-style-type: none"> • All agency objectives
<p>Allocate Personal Protective Equipment</p> <p>Allocate as appropriate personal protective equipment (detection, monitors, suits, masks, decontamination equipment) to protect first responders including key public safety and certain DOT personnel who may face road-related chemical, biological, or radiological threats from WMD. These protective measures may need to extend to the towing and recovery specialists as well as other agencies or individuals assisting with an emergency.</p>	<ul style="list-style-type: none"> • Ensure scene responder and public safety

STRATEGY 4: MEASURE/BENCHMARK PERFORMANCE AGAINST BEST PRACTICE

The establishment of clear objectives and related benchmarks together with the measurement of task time and resource utilization are essential for the establishment of a meaningful and worthwhile performance improvement strategy. While it is unlikely that agencies will see a significant increase in budgets for ETO, the establishment of key performance measures will be invaluable in determining how other elements of an agency's programs and activities are contributing to ETO.

Because the measurement of performance is such a fundamental concept for the overall success of ETO, an advanced level of tactics is not included; the advanced tactics will likely be an outgrowth or innovation from the findings at the base level (see **Table 18**).

Table 18. Operations and Technology Assessment for Strategy 4

	Understood	Start-Up	In-Place
Identification of process maps for major emergency/all hazard circumstances.			
Measurement of performance for key process elements or performance targets.			
Use of automated data collection for performance assessment.			
Pre-planned data reduction and analysis methods, including preferred summary findings and report formats.			
Periodic independent review and assessment of the performance improvement program.			
SUMMARY SCORE (Tally number of checks in each column)			

Based on your self-assessment score, please select either the base-level or advanced-level tactics that are presented in **Tables 19 and 20**.

Table 19. Strategy 4 Base-Level Tactics

Tactics	Key Objectives Addressed
Identify Basic Performance Metrics For each key field activity affecting safety or mobility, identify one or more key metrics to reflect performance in customer (output) terms – recognizing that data limitations may require reliance on secondary data.	<ul style="list-style-type: none"> • Initiate consensus on use of performance measures • Capitalize on available data
Develop Data System for Performance Data Install necessary “systems” (including reporting formats and ITS technology) to detect performance changes.	<ul style="list-style-type: none"> • Ensure scene responder and public safety • Minimize delays • Maintain capacity • Control traffic
Measure Performance Measure and evaluate performance of ETO based on a combination of field and CAD reporting/logging, using agreed-upon definitions of stages of components as the basis for continuous cooperative improvement.	<ul style="list-style-type: none"> • Ensure scene responder and public safety • Control traffic • Minimize delays • Eliminate secondary accidents
Negotiate Clearance Time Targets Develop reasonable targets with all involved agencies, choosing reasonable targets based on current best practice and continuous improvement.	<ul style="list-style-type: none"> • Investigate crime and liability • Minimize delays • Ensure scene responder and public safety • Enforce laws • Eliminate secondary accidents • Coordinate response
Develop Incentive/Disincentive Contracts with Towing and Recovery and HAZMAT Responders Enhance the performance and responsiveness of the towing and recovery community through the use of certification/training requirements, to-scene response times, availability of the proper equipment and trained personnel upon first-time arrival, and speed and safety in towing and recovery activities.	<ul style="list-style-type: none"> • Ensure scene responder and public safety • Minimize delays • Maintain capacity • Control traffic
Develop Regular Reporting Mechanism Determine use of data for both performance improvement in field and progress in service for customer reporting and develop regular reporting mechanisms.	<ul style="list-style-type: none"> • Establish basis for field activity performance improvement • Customer service reporting
Readiness to Advance <ul style="list-style-type: none"> • Use of advanced techniques and technologies to automate some of the data collection process. • Use of the metrics to dispel “myths” about current practices and develop continuous improvements. • Conduct baseline levels of analysis (e.g., summary statistics, trend analysis) to assess overall ETO objectives by agency or participant. • Basis for budget justification and program enhancements. • Prioritize training activities. • Develop outreach with non-traditional partners. 	

Table 20. Strategy 4 Advanced-Level Tactics

Tactics	Key Objectives Addressed
Refine/expand performance measures consistent with network and objectives scope.	<ul style="list-style-type: none">• Ensure scene responder and public safety• Minimize delays• Maintain capacity• Control traffic
Conduct formal interagency evaluation of performance and establish next-level improvement targets.	<ul style="list-style-type: none">• Ensure scene responder and public safety• Minimize delays• Maintain capacity• Control traffic

MOVING FORWARD—IDEAL STATE OF THE PRACTICE FOR ETO

The ideal state for ETO represents a balanced approach to institutional, operational, and technology issues. It is a carefully crafted and monitored program enhanced through a performance-based improvement process. The ETO program is reflected as a major priority for each agency, possibly incorporating elements of the ETO into each agency's mission/vision statement, as well as in interagency agreements containing clear lines of authority and responsibility that are sustainable through administrations and budget cycles.

The successful ETO program is heavily dependent on the efficiency and effectiveness of the incident response and performance at the scene, from arrival through clearance and recovery. Effective traffic incident and emergency event response focuses on the safety of travelers and responders, quick clearance time, and minimum traffic disruption. Exceptional performance requires effective communications, coordination, pre-established protocols, cooperation with other responders, and frequent multi-agency planning and training.

Appropriate technology, equipment, and supplies are deployed for their important role in reducing the impact of incidents and emergency events by minimizing the time and cost of each phase of emergency response and improving its effectiveness. ETO are continuously improved through advanced techniques, such as problem-specific and location-impact-specific prior actions, implying a combination of technology, operational, and institutional effectiveness. This "proactivity" depends on the ability of early warning or sufficient pre-specification of potential emergency events so that their potential impacts can be mitigated by protection, deterrence, or predetermined management measures. Training within and across agencies in the use of these technical tools and techniques, as well as the results obtained in other regions, are important to help maintain and improve the program.

Finally, the successful ETO program is acknowledged by the general public, elected officials, and the media as a superior operation and valued for its contribution to mobility, safety, and security.

APPENDIX: THE STATE OF THE PRACTICE

OPERATIONS—STATE OF THE PRACTICE

The actual field activities in response to incidents or other emergencies take place within traditional frameworks designed for generic incidents and emergencies. Emergency response, general incident management, and TIM all have their own conventions consisting of agency roles, accepted procedures, headquarters functions, and ad hoc reactions by field personnel.

Emergency Management Conventions

The conventions of the transportation aspects of emergency management grow out of the function of state and regional emergency management agencies (EMAs) pursuant to Federal Emergency Management Agency (FEMA) and DHS guidelines. Principal features include the following:

- **Leadership by local and state EMAs.** In major non-highway emergencies with highway implications (such as evacuation), the EMAs call on law enforcement, fire service, medical service, health/human services, and DOTs for specific emergency support functions (ESFs), sometimes using pre-developed response strategies. When the size of the emergency reaches a certain level, the Emergency Operations Center (EOC) for the area encompassing the emergency is activated. A state or federal EOC may also be activated for major emergencies or terrorist attacks.
- **An organization of process around generic protocols for three defined phases: preparation, response, and recovery.** Responsibilities and communications are pre-identified for each stage. The emphasis on phase depends on the type of emergency, usually characterized by scope, location, type of facility, and severity.
- **An “all-hazards” approach** assuming tactics that have been developed for general emergencies are used as the basis for each presumed unique event.
- **Recovery speed as a secondary focus** with emphasis placed on thorough investigation and documentation.

Terrorism Annexes

Since September 11, 2001, many states have updated their state and regional emergency management plans to add a terrorism annex specifying explicit authorities, responsibilities, contacts, and protocols in the event of elevated threat warnings or response to a terrorism event. These annexes follow general emergency management protocols. The DHS HSAS for terrorist threat levels and the NIMS for command and control provide additional structures to be built into all-hazard ETO.

General Incident Management Conventions and the National Incident Management System

Generic incident management has been the standard process employed by the authorized agency that has incident command (fire service and/or law enforcement). Supporting roles were previously established by convention for other services such as emergency

medical services and transportation. Manuals and procedures of national fire, police, insurance, and standards organizations delineate various aspects of a generic incident management process facilitated by formal Incident Command Systems (ICS) to ensure that key responsibilities are executed and understood.

Under 2003 Homeland Security Presidential Directive-5, DHS has developed the National Incident Management System. NIMS sets forth a series of principles that agencies must adopt in incident management with respect to emergency prevention, preparedness, response, recovery, and mitigation. Consistency with this system will be a condition for certain classes of federal aid to state and local governments. The principles of NIMS are designed to be standardized but flexible and include

- The use of incident or unified command;
- Joint preparedness activities including planning, training, and personnel qualification;
- Mechanisms for resource management;
- Standard procedures and channels for communication and information sharing;
- Standard, compatible, and interoperable technology; and
- Continuous, performance-based improvement.

TIM

Activities occurring in the field in response to traffic incidents or other emergencies on the highway take place within conventions that have evolved from general incident management. By law, policy, or tradition, incident command has rested with law enforcement or fire service entities, with DOTs in a support role. Over the last few years, changes in the National Fire Protection Association Guidelines and the development of NIMS have called for better use of unified command procedures for multi-agency responses.

Most state DOTs have a basic incident management response program for traffic control and alternate routing, either for major incidents or upon request to support the public safety community. TIM procedures in the field are developed by each agency and are sometimes referenced in national publications developed by agencies or organizations such as FHWA, the USDOT, the International Association of Chiefs of Police (IACP), the U.S. Fire Administration (USFA), and the National Fire Protection Association (NFPA). These conventions generally reflect

- Established roles and procedures for police, fire and rescue, emergency services, state DOTs, and towing and recovery organizations within an incident or unified command framework.
- Introduction of the concept of specific steps in the TIM process, including detect and verify, mobilize and respond, secure the scene, manage traffic, document, and restore and recover.

- State DOTs offering regular TIM support within rush hours but not the same level of support during other hours, even though it is common for the most severe incidents to occur late at night or in the early morning.
- Coordination of field and DOT TMC/dispatch activities between DOTs and law enforcement (detection, response, investigation, motorist information, site management, clearance, recovery).

A revision to the MUTCD (Chapter 6.I) sets forth concepts for temporary traffic control in an incident context. However, these conventions are not yet well integrated into practice.

OPERATIONS—STRENGTHS AND WEAKNESSES

Excerpts of the FHWA “Traffic Incident Management Self-Assessment National Report” indicate that the majority of regions surveyed are making progress in some of the operations areas of TIM but that progress is uneven. Key strengths and weaknesses are discussed below in **Table 21**, combining selected survey results with indications from interviews used in this guide.

Table 21. Example Operational Strengths and Weaknesses from the FHWA TIM Self-Assessment

	Percent with Strong Efforts or Better
Strengths	
Have specific policies and procedures for hazardous materials response?	69
Have a pre-identified contact list for incident clearance and HAZMAT resources/equipment?	66
Use motorist assist service patrols?	70
Utilize the Incident Command System?	54
Have specific policies and procedures for fatal accident investigation?	51
Weaknesses	
Utilize traffic control procedures for the end of the incident traffic queue?	14
Have established criteria for what is a “major incident” – incident levels or codes?	17
Utilize on-scene traffic control procedures for levels of incidents in compliance with MUTCD?	29
Have quick clearance policies?	36
Train all responders in traffic control procedures?	30

Operational Strengths

Improvements in ETO—as evidenced in TIM practices—have been modest and tentative, typically driven by middle-management champions in state DOTs and their public safety counterparts. There has been some focus on the part of various stakeholders on the need to improve processes—for example, a study released over ten years ago by American Trucking Associations and the formation of the NTIMC. Increased attention to TIM within FHWA has produced case studies, a self-assessment, updates to a TIM handbook, and National Highway Institute TIM training material.

Within the public safety community, the *Incident Management Model Procedures Guide for Highway Incidents*, published by the National Fire Service Incident Management System Consortium and USDOT, focuses on a range of traffic incident command settings. The Towing and Recovery Association of America also has developed guidance material.

The increased attention to disaster management—especially for hurricanes—and to post-9/11 security has also brought more formal attention to the potential role of highway ETO. In a small number of regions there has been more formal protocol development, joint DOT/public safety training in ICS and incident management, and some focus on improved technology. In addition, workshops by the American Association of State Highway Transportation Officials and FHWA have looked at state DOT roles regarding terrorist events. Homeland security exercises such as the Top Officials (TOPOFF) exercise series included a formal role for transportation agencies.

Operational Weaknesses

There is wide variation in the state of the practice in ETO. This variation is due more to a lack of focus and commitment than to local context differences. There is no formally recognized and documented best “state of the practice.” As suggested by Table 21, some of the transportation-oriented operational issues have not yet been widely addressed. The efficiency of an all-hazard approach calls attention to the differing characteristics and dynamics of various incidents and emergencies. These include the varying time scales, pace of incident development, and incident persistence. Still, the special operational needs associated with the range of incidents and emergencies have not been approached on a coordinated basis. Highway-related emergency management procedures related to HAZMAT, WMD, and major disasters have not been well-integrated into the incident management process in most states.

There may be differing priorities at the scene of an emergency. Incidents and emergencies are not perceived in state DOTs and public safety agencies in the same way regarding their traffic service implications. The use of ICS is appropriate for field tailoring to unique events with minimal external impacts. This flexibility sometimes diverts focus from substantial opportunities to carry out life safety, law enforcement, and property preservation activities while at the same time accommodating key transportation needs.

From a transportation point of view, major improvements in safety and efficiency have been demonstrated through developing and integrating comprehensive approaches based on coordinated and prepared operational regimes, rapid provision of emergency response, and speedy recovery of service. However, highway-related protocols and procedures employed locally for ETO vary widely nationwide. For example, quick clearance policy is in force in only a handful of areas, MUTCD-compliant traffic control is not widely used, traffic control training for responders is modest, and proper staging and emergency lighting are not widely employed. A major concern is the lack of training to formalize an approach designed to reducing the number and severity of secondary crashes.

Although there has been an increasing level of training in incident command (among most public safety agencies and some DOTs) and in TIM among DOTs, the field of ETO has not yet been professionalized as part of basic training curriculums and agency policies. State DOTs are not yet consistently committed to incident management in terms of

maintaining traffic service performance, reflected in the reluctance to adopt a 24 × 7 service provider regime.

In contrast to other areas of emergency services (fire and rescue), the concept of performance standards for clearance of incidents is not yet widely accepted. Traffic incident clearance and other traffic-related emergency functions are rarely tracked or benchmarked against best practice or prior performance. There is wide variation in practice, as measured by safety or delay, and a substantial gap exists between best practices and the general state of the practice. With traffic incidents now being defined as temporary work zones for traffic control purposes, DOTs will have to evaluate how they will deliver traffic control services to support other responders at major traffic incidents during non-business hours.

TECHNOLOGY—STATE OF THE PRACTICE

At present, the applications of technology to ETO are limited and based principally on standard ITS surveillance, detection, and communications systems. These systems are operated from state DOT TMCs and public safety call and CAD centers. Some new technology related to real-time medical communications, interagency interoperability, and HAZMAT personnel protection is being applied. However, as indicated in the FHWA “Traffic Incident Management Self-Assessment National Report,” the FHWA ITS Deployment Tracking Program, and the interviews conducted in developing of this guide, the application of technologies, especially those related to communications and data development, is still in the early stages.

TECHNOLOGY—STRENGTHS AND WEAKNESSES

Excerpts from the FHWA “Traffic Incident Management Self-Assessment National Report” indicate that the majority of regions surveyed is making progress in the some of the technology areas of TIM but that progress is very modest. Key strengths and weaknesses are discussed in **Table 22**, combining selected survey results with the indications from interviews for this guide.

Table 22. Example Technology Strengths and Weaknesses from the FHWA TIM Self-Assessment

	Percent with “Strong Efforts or Better”
Strengths	
Use TMC(s) to coordinate incident notification and response?	43
Developed technical infrastructure for surveillance and rapid detection of traffic incidents?	30
Weaknesses	
Have two-way interagency voice communications for direct on-site communications?	19
Provide data and video information transfer, e.g., TMC-CAD integration?	11
Have specific policies and procedures for traffic management during incident response?	21
Have a real-time motorist information system providing incident-specific information?	24

Technology Strengths

Although each agency has its own internal communications network, with very limited interoperability with other agencies, developing interagency interoperable communications is currently a popular public safety agenda item. Other technologies such as site investigation systems are sporadically being introduced. The potential of DOT surveillance and communications systems as part of a more comprehensive approach to incident and emergency operations is only gradually being understood.

As indicated in the 2003 FHWA “Traffic Incident Management Self-Assessment National Report,” some ITS technology has long been applied by state DOTs in most major metropolitan areas and, despite partial deployment, is being utilized for incident detection, verification, and public information. Approximately 80 metropolitan areas also have roving highway service patrols that play key roles as first responders and managers of many minor incidents.

Technology Weaknesses

The lack of interoperable voice and data communications and the problems created were starkly revealed by the events of September 11, 2001. The need for interoperable interagency communications is widely acknowledged but represents an expensive challenge in many regions. More generally, information-sharing protocols for each significantly different emergency type (weather, security, planned event) are not uniformly developed and often involve different units within responder agencies.

Many metropolitan TMCs offer substantial capabilities in surveillance and communications that are not widely appreciated or exploited by the general emergency management community. For example, TMC/CAD dispatch integration benefits may be obvious, but few regions are yet moving in this area. DOT staff working in traffic centers are sometimes reluctant to call emergency response agencies to share information. Motorist information devices are available that could be utilized in a wide range of emergencies

but are not yet effectively used from either timeliness or information perspectives. Amber Alerts have brought a large increase in public understanding of the capabilities of dynamic signs and have focused attention on how to make better use of these devices.

An integrated approach to a broader range of hazards also introduces other technology issues. These involve the need for cooperation among the emergency management community and public safety and transportation entities, more shared real-time information, and a need to develop access to special expertise on an on-call basis.

INSTITUTIONS—STATE OF THE PRACTICE

The FHWA “Traffic Incident Management Self-Assessment National Report” interviews conducted in the development of this guide and the reference materials in the resources guide (*NCHRP Web Document 73*) indicate that “institutionalization” of ETO best practices is still in very early stages and that transportation and public safety entities have different priorities.

Public Safety Agencies

Primary authority and commitment to both TIM and roadway-related emergency operations lie with public safety agencies. By virtue of patrol responsibilities, traffic officers or highway patrol vehicles are likely to be the first on the scene in many other types of incidents in response to police dispatching. Even for major emergencies (such as hurricanes) for which response is coordinated by state and local EMAs, either police or fire services have field command. However, who has command varies around the country by local law and tradition. State police may have state-level command structure, whereas fire services are often designated as the emergency incident command agency by local government.

Overall, there is an enormous dedication to public safety (especially responder safety and property preservation) and secondarily to public convenience. Most law enforcement and fire and rescue services treat traffic incidents within a widely accepted framework of standard all-hazard/all-incident procedure that is applied on an ad hoc, informal basis.

EMAs

State and local EMAs are in the key coordinating position under state law for major emergencies. They are responsible for planning and coordinating the key activities within the standard emergency management phases—preparation, response, and recovery. In each phase, state and local emergency responders each have designated ESF roles that are specified in the EMA’s plan. The ESF response roles are defined at a high level and coordination procedures are defined, but the field activities are left to normal incident command. The DOT’s roles are typically detailed in DOT emergency operations plans. In many state and regional Emergency Management Plans, the state DOT roles are focused principally on supplying equipment that may be useful in recovery, traffic management device supply, conditions assessment, repairing infrastructure, and coordination with law enforcement.

State DOTs

State DOTs exhibit a range of approaches to traffic incidents and highway-related emergencies. At the department policy level, there is a growing trend for DOTs to be proactive

regarding planned or anticipated highway “events” such as significant snow and ice, special events, and construction disruption where there is a clear public expectation of agency accountability. Emergency response, especially in areas subject to repeated major weather threats (hurricanes, flooding) or perceived as being vulnerable to terrorist threats, is gradually being formalized as a department-level concern.

The role of DOTs in unanticipated problems varies substantially by state and region. In the case of TIM, key responsibilities are at the district level with the responsibilities divided among maintenance, traffic operations units, TMC management, and ITS project staff. To some degree, most state DOTs support the TIM and emergency operations activities of public safety agencies and EMAs. However, the extent and effectiveness of this involvement vary widely as do roles in detection, response, traffic control, and system restoration. Detection support is most typically provided via freeway service patrols of traffic operations staff who discover traffic incidents as part of their patrol activities or by monitoring of cameras.

DOT responders are an important source of the mobilization process by virtue of direct face-to-face communications with responders and by their link to CAD and TMCs. DOT field presence at incidents is often a reflection of requests by public safety agencies in response to the need for major traffic control, as well as debris removal and facility repair, unless the DOT has a proactive TIM and motorist assist program. Operational levels vary by time of day without a clear relationship to severity of incidents or the disruption they cause.

Emergency operations plans, as part of formal emergency management programs, are handled as a function that supports the state or regional EMA. Formal state DOT planning is largely limited to identification of contacts and chain of command, with actual response procedures left to ad hoc responses at the discretion of responsible units. Ice and snow removal as a form of incident management is a major exception to this reactive approach.

It is apparent that, as suggested in **Table 23**, there is substantial overlap in objectives between transportation and public safety entities. Even among objectives where priorities mostly diverge, there appears to be considerable room for “simultaneous optimization.”

INSTITUTIONS—STRENGTHS AND WEAKNESSES

Excerpts from the FHWA “Traffic Incident Management Self-Assessment National Report” indicate that the majority of regions surveyed are making progress at the level of regional program administration but that the programs are largely informal and unevaluated.

Table 23. Example Institutional Strengths and Weaknesses from the FHWA TIM Self-Assessment

	Percent with “Strong Efforts or Better”
Strengths	
Use TMC(s) to coordinate incident notification and response?	43
Developed technical infrastructure for surveillance and rapid detection of traffic incidents?	30
Weaknesses	
Have two-way interagency voice communications for direct on-site communications?	19
Provide data and video information transfer, e.g., TMC-CAD integration?	11
Have specific policies and procedures for traffic management during incident response?	21
Have a real-time motorist information system providing incident-specific information?	24

Institutional Strengths

As indicated in the FHWA “Traffic Incident Management Self-Assessment National Report,” institutionalization of ETO is in its early stages. DOTs are forging better working relationships among DOT and public safety personnel, but there is a long way to go in the establishment of formal programs within and among agencies.

The emergency operations responsibilities of state DOTs have been given heightened visibility, especially since September 11, 2001; the 2003 blackout; and the natural disasters of the last decade. Most state DOTs have a responsible senior staff person at headquarters and general communications and mobilization protocols for major emergencies. In addition, many states have developed more formal procedures for security-related procedural responses to elevated threat levels.

Institutional Weaknesses

The objectives, priorities, and management style exhibited by the key stakeholders (police, emergency medical services, fire and rescue, DOTs, and towing and recovery) are different, based in law, culture, and resources. The legal and regulatory environment also varies substantially by state.

TIM is not treated as a formal, budgeted, managed program in most state DOTs. There is rarely a declared department policy on its responsibility or objectives regarding traffic incidents and little commitment to performance outcomes regarding management of incidents or other highway-related emergencies that disrupt traffic. Although congestion, traffic incidents, and emergencies are often cited in DOT policy, there is rarely a strategic plan with committed resources, clear lines of authority, or performance accountability. Rather, TIM is typically conducted as fragmented, part-time reactive activities under district management with responsibilities divided among maintenance, traffic operations units, TMC management, and ITS project staff. Key components (ITS, service patrols, communications) do not compete well for resources, and there is no clear professional cadre of related technical certification devoted to ETO. In contrast with this informal approach, the state DOT approach to snow and ice control suggests the potential of an organized institutionalized approach.

State DOT relationships with public safety agencies vary widely. The strongest relationships are in the field, where there is often a high degree of cooperation, informal communication, and respect. However, formal inter-institutional relationships on an ongoing basis are the exception. DOTs are often perceived as public works agencies with a 9-to-5 commitment to operations rather than full-time partnership in systems management.

Within the public safety community, traffic incidents and emergencies associated specifically with traffic often lack a separate program identity. In the case of fire service activities, they also lack statewide consistency. Road-related incidents are often treated as a sub-variant of the general mission rather than as a separate activity with distinct procedures and resources. This is most characteristic of contexts in which incident command is under a fire service or law enforcement entity that is not dedicated to the highway setting.

Nationwide, there are very few formal interagency agreements on policy, procedures, or performance tracking. Combined training and debriefing are almost non-existent. Lacking formal program status, ETO management, training, and funding resources are modest. In addition, programs are not subjected to continuous improvement.

The institutional setting for ETO within the general emergency management institutional arena is quite different. ETO planning is typically set forth in a formal plan document with specifications for appropriate communications, contacts, and chain of command. Actual response procedures for system restoration often are left to ad hoc responses in the field.

Despite the obvious overlap in responsibilities, personnel, infrastructure, and equipment appropriate to ETO, there is only a modest attempt to exploit common needs and resources or to develop common protocols covering traffic and other emergencies both among state DOTs and between DOTs and their public safety counterparts.

Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation