

**Transportation and Emergency Services:
Identifying Critical Interfaces, Obstacles, and Opportunities**

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ABSTRACT

Transportation and emergency services agencies have many shared and overlapping responsibilities in a myriad of situations, ranging from routine traffic incidents to large-scale events that threaten public health and safety. The importance of effective coordination among these groups has been heightened by the need to improve highway operations, ensure homeland security, and enhance all-hazards emergency management. This research examines the commitment to improved coordination among highway transportation and emergency services organizations and seeks to identify and evaluate the underlying obstacles and opportunities. A wide range of institutional, operational, technological, and financial factors are considered. Most of the findings and conclusions are based on a survey administered to transportation and emergency services professionals in five states. Based on the survey results and subsequent focus group discussions, recommendations are offered for short-term improvement of emergency transportation operations and for additional research.

INTRODUCTION

Transportation and emergency services professionals and their respective agencies interact in a myriad of situations, ranging from routine traffic incidents to large-scale events that threaten public health and safety. For even the simplest of those incidents and events, coordination is needed to minimize the adverse, system-wide effects and to optimize the use of limited resources. From a highway transportation perspective, perhaps the most obvious and long-recognized need for coordination is with law enforcement, relative to shared responsibilities for highway safety, traffic regulation, and response to traffic incidents. However, changing circumstances call for a more integrated system linking transportation and all aspects of emergency services. Contributing circumstances include the increased emphasis on highway operations, as opposed to the more limited focus on just construction and maintenance, continuing concerns for homeland security, and the need to improve overall emergency management at all levels of government (1, 2, 3).

The importance of coordination among transportation and emergency services and the need for improvements are evidenced by the many initiatives underway at the federal, state, and local levels. These include the ITS Public Safety Program in the U.S. Department of Transportation, the TRANSCOM program in the New York, New Jersey, and Connecticut metropolitan region, the CapWIN initiative in the Washington, D.C. area, and the newly-formed National Traffic Incident Management Coalition (4, 5, 6, 7).

Although the importance of improved coordination is becoming more transparent and widely recognized, the factors that influence the effectiveness of such efforts are not well understood. A literature review identified anecdotal information and one systematic study, by Bunn and Savage, which examined integration issues relative to specific projects and identified factors that seem to influence project success (8).

The goal of the research described in this paper was to examine the commitment for improved coordination among highway transportation and emergency services organizations, identify and evaluate the underlying obstacles and opportunities, and identify practical and cost-effective strategies to improve coordination.

For the purposes of this research, the following terms were defined. *Emergency transportation operations (ETO)* is used to describe a wide range of activities, including response, recovery, mitigation, prevention and preparedness, relative to incidents or circumstances that impact the transportation system by reducing capacity, increasing demand, or otherwise threatening public health and safety. ETO, as defined here, applies to all of the following situations:

- Minor traffic crashes, disabled or abandoned vehicles, debris in the roadway, and other circumstances that disrupt traffic flow and create hazards
- Major traffic crashes involving fatalities, injuries, overturned vehicles, and serious property damage
- Highway construction and maintenance work zones
- Special events that attract large crowds and create exceptional traffic demands
- Law enforcement and security activities that cause major traffic disruptions
- Hazardous material spills on or near the transportation infrastructure
- Severe weather and natural disasters, including events that require large-scale evacuation

- Public health emergencies or other events that require large-scale travel restrictions or quarantines
- Acts of terrorism that target the transportation system or that create exceptional transportation demands

Transportation agencies refers to state departments of transportation, toll road authorities, and local highway, public works, and traffic engineering organizations—the public agencies directly responsible for the construction, maintenance, and operation of roadways in a particular state or community. The focus of this research was on highway transportation, although some of the findings and conclusion may be applicable to other modes.

Emergency services agencies refers to law enforcement, fire and rescue services, emergency medical services (EMS), emergency communications, emergency management agencies (EMA), and homeland security.

Many other disciplines and organizations also have critical roles in ETO, including towing and recovery operators, hazardous material cleanup companies, commercial vehicle operators, environmental regulators, and the news media. This research, however, focused on the core transportation and emergency services organizations listed above, since these agencies have the most direct responsibilities for the full range of incidents that impact the transportation system on a frequent basis. Improved coordination among these core agencies was presumed to be a necessary foundation for more effective ETO involving the larger group of stakeholders.

Factors Influencing Coordination

The factors that were examined most closely in this research were divided into four categories: institutional, operational, technological, and financial. *Institutional factors* include the policy-level framework for ETO within the community and state, the delineation of responsibilities among affected organizations, the organization of resources and programs within agencies, and agency missions, priorities, cultures, and performance metrics. *Operational factors* that affect interagency coordination and integration include tactical planning and preparation for incidents, procedures that guide incident response and management, and the informal work practices that define the way work is carried out. *Technological factors* include the development, deployment, and use of equipment, networks, and systems, and the associated hardware and software that support ETO. Finally, *financial factors* include funding sources, operating budgets, competing priorities, and economic incentives for improving integration.

METHODOLOGY

To gather information and determine the opinions of leaders in the highway transportation and emergency services communities, a survey was developed and administered to key professionals in state and local agencies in five southeastern states: Kentucky, Georgia, Tennessee, North Carolina, and South Carolina.

A focus group comprised of transportation and emergency services officials in the Nashville and Knoxville metropolitan areas validated the pertinence of the topics addressed and the appropriateness of survey questions. The survey instrument was pilot tested with members of the focus group and other selected transportation and emergency services practitioners.

Surveys were administered to the officials whose positions most closely align with the following titles in each of the five states:

- Law enforcement—Commissioner (secretary) of the state department of safety, head of the state patrol, head of commercial vehicle enforcement, director of state law enforcement academy, police chiefs in the three largest cities, elected officers of the state association of chiefs of police (typically president, vice-president, and one other)
 - Fire and rescue—State fire marshal, director of state fire academy, fire chiefs in the three largest cities, elected officers of the state association of fire chiefs (typically president, vice-president, and one other)
 - EMS—State director of EMS, directors of EMS in the three largest cities, directors of emergency services at the largest hospital in each of the three largest cities
 - Emergency communications—State director for 9-1-1, directors of emergency communications in the three largest cities
 - EMA—State director of emergency management, emergency managers in the three largest cities, officers of the state association of emergency managers
 - Homeland Security—State director of homeland security, disaster preparedness coordinators at the largest hospital in the three largest cities
 - Transportation (State DOT)—Commissioner (secretary) of transportation, chief engineer, state traffic engineer, intelligent transportation systems director, incident management director, state DOT liaison for the emergency management agency, head of maintenance, public information director, head of transportation planning
 - Transportation (Local)—Directors of public works in the three largest cities, traffic engineers in the three largest cities, coordinators for the three largest metropolitan planning organizations

The surveys were mailed to a total of 272 individuals, by name and title. A hyperlink to an online version of the survey was e-mailed to these same persons. The survey instrument was designed to obtain information and opinions concerning the following topics:

- Need for improvements in ETO and the importance of interagency coordination
- Need for institutional, operational, and technological changes to improve ETO
- Potential benefits from improved ETO
- Mutual understanding of missions, capabilities, and limitations
- Importance of specific institutional/operational factors in interagency coordination
- Incident scenarios most needing improved coordination
- Response actions most needing improved coordination
- Potential benefits of specific technologies for improving ETO
- Familiarity with existing initiatives
- Priorities for resource allocation and opinions regarding funding sources

Based on an analysis of the completed survey results, the researchers developed a list of initiatives to improve coordination between these two groups. A second focus group comprised of transportation and emergency services professionals was subsequently convened to prioritize the list of initiatives using two criteria—expected impact and operational feasibility.

RESULTS

Of the 272 surveys that were distributed, 166 completed responses were received, representing a 61% response rate. The number of responses and response rate by agency type appear in Table 1. The distribution of the total responses, by state, was: Georgia (18%), Kentucky (24%), Tennessee (24%), North Carolina (18%), and South Carolina (16%).

TABLE 1 Response Rate by Agency Type

Category	Surveys Distributed	Surveys Returned	Response Rate
Law Enforcement	50	35	70%
Homeland Security	20	9	45%
Fire and Rescue	40	26	65%
EMS	22	13	59%
EMA	34	22	65%
Emergency Communications	18	11	61%
Transportation	88	50	57%
Total	272	166	61%

Need for Improvements in ETO and the Importance of Interagency Coordination

Table 2 presents survey results related to the perceived need for improvements in ETO and the importance of interagency coordination from the perspectives of transportation and emergency services officials, respectively. The respondents solidly support the idea that improvements in ETO are needed and that coordination between emergency services and transportation agencies is necessary to achieve those improvements. The majority also indicated that the other group (transportation or emergency services) had demonstrated an interest in better coordination.

The majority of transportation respondents felt their agency could also improve ETO through their own agency's independent actions regardless of emergency service agency involvement. The transportation respondents also felt that emergency services organizations could improve ETO through independent action. The majority of emergency services respondents also felt that independent action by transportation agencies could improve ETO, but that emergency services agencies could *not* improve ETO through independent actions. The implication seems to be that emergency services organizations expect leadership, or at least initiative, from transportation agencies.

TABLE 2 Need for Improved Coordination

Based on your experience and observations, do you agree that... <i>(Please check one box on each line.)</i>	Group	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Emergency transportation operations (ETO) can be improved in my community/state.	T	38%	60%	0%	0%	2%
	ES	18%	72%	4%	1%	4%
Improvements in ETO in my community/state will require more effective coordination or integration of efforts by multiple agencies.	T	56%	42%	2%	0%	0%
	ES	26%	70%	0%	1%	3%
My agency could significantly improve ETO through our own actions using our own resources, regardless of other agencies.	T	8%	52%	28%	12%	0%
	ES	1%	29%	45%	14%	11%
Emergency services (transportation) agencies in my community/ state could improve ETO through their own actions, regardless of my agency.	T	18%	56%	14%	8%	4%
	ES	6%	57%	28%	6%	3%
My agency's role in ETO does not require improved coordination with emergency services (transportation) agencies.	T	2%	10%	56%	28%	4%
	ES	3%	10%	64%	17%	5%
Emergency services (transportation) agencies in my community/ state have shown little interest in better coordination with my agency.	T	2%	16%	56%	14%	12%
	ES	1%	21%	51%	16%	11%

T=Transportation ES=Emergency Services

Need for Institutional, Operational, and Technological Changes

The majority of transportation and emergency services respondents “agreed” and another large percentage “strongly agreed” that institutional, operational, and technological changes are needed to improve ETO (see Table 3). These responses indicate that changes are needed in all three categories (institutional, operational, and technological) and that improvements in ETO will be extremely difficult without improvements in *each* of the three categories. This suggests that that efforts to improve ETO can best be achieved by a multi-faceted approach, and that attempts that focus on just one aspect of change will have a lower chance of success.

TABLE 3 Need for Institutional, Operational, and Technological Changes for ETO

Based on your experience and observations, do you agree that... (Please check one box on each line.)						
	Group	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
<i>Institutional</i> changes are needed to improve emergency transportation operations (ETO) in my community/state.	T	24%	64%	6%	0%	6%
	ES	15%	69%	8%	2%	7%
Without <i>institutional</i> changes, improvements in ETO will be extremely difficult.	T	18%	56%	14%	0%	12%
	ES	11%	62%	17%	1%	10%
<i>Operational</i> changes are needed to improve emergency transportation operations (ETO).	T	30%	58%	6%	0%	6%
	ES	12%	72%	9%	1%	6%
Without <i>operational</i> changes, improvements in ETO will be extremely difficult.	T	20%	56%	16%	0%	8%
	ES	10%	70%	11%	0%	9%
<i>Technological</i> advancements are needed to improve emergency transportation operations (ETO).	T	30%	62%	4%	0%	4%
	ES	15%	73%	5%	0%	7%
Without deploying new or improved <i>technologies</i> , improvements in ETO will be will be extremely difficult.	T	18%	56%	16%	2%	8%
	ES	12%	66%	12%	0%	10%

T=Transportation ES=Emergency Services

Potential Benefits

To help evaluate the motivations for transportation and emergency services agencies to work together for improved emergency transportation operations, participants were asked to assign importance to specific potential benefits. The results are shown in Table 4, ranked in order of the mean of the scores assigned by the transportation group.

The majority of the respondents assigned at least some importance to each of the listed potential benefits, but the two groups differed significantly in the rank order of importance. The top reasons for transportation professionals to seek ETO improvements were: (1) reduce time to restore normal traffic conditions following an incident, (2) improve incident response times, and (3) improve the accuracy and timeliness of information provided to motorists and the public.

In contrast, the top reasons for emergency services professionals were: (1) improve scene and responder safety, (2) reduce the impact of major disasters, terrorist attacks, or other large-scale events, and (3) avoid or reduce the frequency and severity of hazardous material releases. The greatest difference in rankings between the two groups was for “avoid or reduce the economic costs of travel disruptions/delays,” which received a high ranking from the transportation group and one of the lowest rankings among the emergency services group.

Thus, while both groups see benefits from improved ETO and are presumably willing to invest some of their resources to gain those benefits, the two groups perceive different benefits,

or at least place different values on those benefits. The only benefit that appeared in the top five for both groups was to “avoid or reduce secondary crashes caused by traffic backups.”

TABLE 4 Potential Benefits for Improved Emergency Transportation Operations

Reason/Potential Benefit	Transportation (T) Mean	Emergency Services (ES) Mean	Percent Difference (T-ES)
Reduce time to restore normal traffic conditions following an incident*	2.72	2.09	23%
Improve incident response times	2.42	2.23	8%
Improve the accuracy and timeliness of information provided to motorists and public	2.42	2.21	9%
Avoid or reduce secondary crashes caused by traffic backups	2.39	2.41	-1%
Avoid or reduce the economic costs of travel disruptions/ delays*	2.34	1.71	27%
Reduce the impact of major disasters, terrorist attacks, or other large-scale events*	2.22	2.56	-15%
Improve scene and responder safety*	2.19	2.67	-22%
Avoid or reduce the frequency and severity of hazardous material releases*	2.19	2.46	-13%
Reduce the time required for investigations and reports*	2.16	1.81	17%
Improve medical care for victims	2.11	2.31	-9%
Avoid or reduce the potential for terrorist attack*	1.98	2.42	-22%
Assist stranded motorists	1.82	1.77	3%
Protect the environment*	1.80	2.10	-17%
Reduce operating costs for the responsible agencies	1.60	1.71	-7%
Protect residences and businesses along major travel corridors*	1.53	1.88	-23%

0 = Not Important, 1 = Somewhat Important, 2 = Important, 3 = Very Important

* Significantly different means (Transportation vs. Emergency Services) according to ANOVA test at alpha .05

Mutual Understanding of Missions, Capabilities, and Limitations

Transportation professionals were asked how well the leaders in their respective organizations understand the missions, capabilities, and limitations of emergency services organizations and how well they believe that emergency services agencies understand the transportation groups’ missions, capabilities, and limitations. Emergency services professionals were asked the same questions about transportation agencies.

The majority of respondents from both groups felt that “limited knowledge and understanding of some aspects” best described the existing level of understanding (see Table 5). None of the transportation officials selected “thorough knowledge and understanding,” and only a few of the emergency services officials thought that the mutual knowledge and understanding could be described as “thorough.” A slightly larger number selected “serious lack of knowledge and understanding.” These results point to some fundamental gaps in mutual understanding—gaps which both groups recognize. The survey did not address the implications, i.e., the extent to which this limited knowledge and understanding impacts the effectiveness of ETO. However, improvements in these basic, mutual understandings seem to be an obvious and essential step toward more effective coordination.

TABLE 5 Understanding Missions, Capabilities, and Limitations

Based on your experience and observations... <i>(Please check one box on each line.)</i>	Group	Thorough knowledge and understanding	Good knowledge and understanding of the most critical aspects	Limited knowledge and understanding of some aspects	Serious lack of knowledge and understanding	No opinion
How well do most emergency services (transportation) agencies understand <i>your agency’s</i> mission, capabilities, and limitations?	T	0%	32%	50%	12%	6%
	ES	3%	39%	43%	10%	5%
How well do most of the leaders in <i>your organization</i> understand the mission, capabilities, and limitations of emergency services (transportation) agencies?	T	0%	44%	46%	6%	4%
	ES	3%	41%	43%	7%	5%

T=Transportation ES=Emergency Services

Importance of Specific Institutional and Operational Factors

Respondents were asked to rate the importance of specific factors in their agency's interactions with their counterparts, and the results are displayed in Table 6. Although the rank order is different between the transportation and emergency services respondents, four of the five top choices are the same:

- Emergency management or incident response planning
- Field decisions made as part of formal Incident Command Systems
- Joint training or participation in drills or exercises
- State or local laws/ordinances

The transportation group included “personal relationships” in their top five. Emergency services respondents added “internal protocols, orders, or SOPs formally adopted by my organization.”

TABLE 6 Importance of Institutional and Operational Factors in Coordination

Factors that Influence Interactions	Transport (T) Mean	Emergency Services (ES) Mean	Percent Difference (T-ES)
Emergency management or incident response planning	2.23	2.45	-10%
Personal relationships	2.17	2.12	2%
Field decisions made as part of formal Incident Command Systems (ICSs)*	2.15	2.50	-16%
Joint training or participation in drills or exercises*	2.07	2.49	-20%
State or local laws/ordinances	1.98	2.16	-9%
Directions or requests relayed through EMAs or other organizations	1.93	2.10	-9%
Internal protocols, orders, or SOPs formally adopted by my organization*	1.89	2.18	-15%
Formal agreements or contracts with emergency services agencies	1.81	1.99	-10%
Practices widely used by organizations in my area of expertise*	1.74	2.04	-17%
Informal practices developed over a period of years	1.68	1.79	-7%

0 = Not Important, 1 = Somewhat Important, 2 = Important, 3 = Very Important

* Significantly different means (Transportation vs. Emergency Services) according to ANOVA test at alpha .05

Incident Scenarios Most Needing Improved Coordination

Although improved coordination offers some potential benefits regardless of the incident scenario, the need for improved coordination may be relatively more acute for particular scenarios. Respondents were asked to rate the need for improved coordination between their agency and their counterparts for specific incident scenarios. Average scores for each item were compiled as a reflection of the overall need for improvement (see Table 7).

TABLE 7 Incident Scenarios Needing Improved Coordination

Incident Type or Circumstance	Transport (T) Mean	Emergency Services (ES) Mean	Percent Difference (T-ES)
Terrorist attack causing major shifts in transportation demands and/or travel patterns	2.31	2.18	5%
Freeway traffic crashes*	2.16	1.72	20%
Terrorist attack directed against the transportation system	2.15	2.25	-5%
Failure or blockage of major road, bridge, tunnel, or other infrastructure	2.02	1.86	8%
Major fire or hazmat incident on or near a freeway	1.96	1.84	6%
Highway construction and maintenance work zones	1.85	1.76	5%
Natural disasters (e.g., hurricanes, earthquakes, flooding)	1.77	1.70	4%
Surface street (non-freeway) traffic crashes	1.71	1.48	14%
Public health emergencies requiring travel restrictions or quarantines*	1.54	2.05	-33%
Adverse weather (snow, ice, fog)	1.52	1.52	0%
Major community or sporting event	1.37	1.47	-7%

0 = Status quo is adequate, 1 = Minor improvements needed, 2 = Some improvements needed, 3 = Significant improvements needed

* **Significantly different means (Transportation vs. Emergency Services) according to ANOVA test at alpha .05**

The most significant differences in the responses were for “freeway traffic crashes,” rated significantly higher by the transportation group, and “public health emergencies requiring travel restrictions or quarantines,” rated significantly higher by the emergency services group. Also, almost 29% of the transportation participants selected “No Opinion” relative to “public health emergencies requiring travel restrictions or quarantines,” the largest such non-response to any question in the survey.

The two scenarios for which the two groups assigned the highest combined scores both involved terrorism, one scenario being an attack directed against transportation infrastructure and the other scenario an attack causing major shifts in transportation demand. The two scenarios for which both groups indicated the least overall need for improvement were “major community or sporting event” and “adverse weather.”

Activities and Response Actions Most Needing Improved Coordination

The survey also included a question addressing the relative need for improvements in the types of activities and response actions (e.g., communicating, planning, advising motorists) regardless of the scenarios. Respondents were asked to rate the need for improved coordination between their agency and their counterparts for specific response actions, and the results appear in Table 8.

The key actions identified as requiring improved coordination involve communication and planning. For both groups, the action most in need of improvement was “communication during emergency situations,” and both groups included “evacuation planning” in their top five choices.

Potential Benefits of Specific Technologies

Survey respondents were asked to rate the potential benefits offered by a list of 15 specific technologies to improve emergency transportation operations. Each of the listed technologies was judged by both groups to have at least moderate potential benefits for ETO. The combined scores for the two groups were the highest for the following:

- Interoperable radio communications
- Changeable (dynamic) message signs
- GPS- and GIS-based systems
- Closed circuit television (CCTV) roadway surveillance systems
- Enhanced 911 systems

The greatest differences in perceived benefits were for “sensors and detectors for weapons of mass destruction (WMD) (seen by emergency services as more beneficial), “CCTV roadway surveillance systems” (seen by transportation as being more beneficial), and “overhead message signs” (also seen by transportation as more beneficial). However, as noted above, both groups thought that all three of these technologies offered at least moderate potential benefits.

TABLE 8 Activities and Response Actions Needing Improved Coordination

Institutional or Operational Activity	Transportation (T) Mean	Emergency Services (ES) Mean	Percent Difference (T-ES)
Communicating during emergency situations*	2.05	2.34	-14%
Evacuation planning	1.89	1.90	-1%
Emergency operations planning (all-hazards)	1.86	1.86	0%
Developing and using performance measures for incident management	1.82	1.85	-2%
Planning and conducting terrorism exercises	1.80	1.92	-7%
Advising motorists and the public regarding incidents and roadway conditions	1.80	1.84	-2%
Proposing new or revised laws/ordinances*	1.80	1.46	19%
Pre-planning routes for emergency vehicle responses to key locations	1.78	1.87	-5%
Setting and enforcing highway speed limits and other traffic regulations*	1.74	1.35	22%
Assigning radio frequencies and establishing communication protocols*	1.69	2.08	-23%
Conducting all-hazards transportation risk assessments	1.57	1.84	-17%
Pre-planning diversion routes for emergency road closures	1.65	1.81	-9%
Planning and managing highway work zones	1.55	1.62	-4%
Planning & conducting highway safety campaigns	1.47	1.42	3%

0 = Current level of coordination/ integration is adequate, 1 = Minor improvements needed, 2 = Some improvements needed, 3 = Significant improvements needed

* **Significantly different means (Transportation vs. Emergency Services) according to ANOVA test at alpha .05**

Familiarity with Existing Initiatives

Many federal, state, and local agencies have already responded to the need for improved coordination among transportation and emergency services, and a variety of programs and projects have been implemented. Survey participants were asked to rate their level of familiarity with a representative group of programs and projects to determine the relative visibility, and, by inference, the potential influence of such programs and projects on coordination in the states and communities represented in the survey group. The results are shown in Table 9.

TABLE 9 Familiarity with Existing Initiatives

Initiative	Transportation (T) Mean	Emergency Services (ES) Mean	Percent Difference (T-ES)
National Intelligent Transportation System Architecture*	2.40	0.92	62%
Chapter 6I of the Manual on Uniform Traffic Control Devices*	2.21	0.69	69%
U.S. DOT ITS Public Safety Program*	1.65	1.22	26%
Georgia Navigator*	1.69	0.52	69%
National Response System*	1.08	2.04	-88%
IEEE 1512 Standards*	0.79	0.41	48%
NIMS*	0.62	2.05	-233%
TRANSCOM (NY)	0.62	0.39	37%
SAFECOM/PSWN*	0.40	0.70	-73%
CapWIN Project	0.50	0.45	10%
CADTIP (CA)	0.38	0.20	46%

0 = Never heard of it, 1 = Vaguely aware but not sure what's involved, 2 = Aware of purpose; some knowledge of content, 3 = Very familiar and knowledgeable, 4 = Extensive, hands-on experience

* **Significant difference in means (Transportation vs. Emergency Services) according to ANOVA test at alpha .05**

The list of programs and projects used in the survey instrument includes some that were initiated by the transportation community and some by emergency services. Some are examples of interagency cooperation that have been suggested as worthy models for other areas or as a source of lessons learned. Others included in the list have been set forth as national standards or recommendations. Some are focused on transportation, and some have a broader purpose.

Not surprisingly, emergency services professionals were much more familiar with initiatives coming from the public safety and emergency management sectors than with those coming from the transportation sector, and vice versa. However, the differences between the two groups were more dramatic for this set of questions than for any other question in the survey. The differences in awareness between the two groups were significant for seven of the eleven listed initiatives.

Perhaps more important, however, is that not a single initiative received an overall average rating greater than "Vaguely aware but not sure what's involved." Regardless of the

differences between the responses from transportation and emergency services, the level of awareness of these programs and projects was very low among both groups.

The majority of the survey respondents showed very limited awareness of initiatives to improve ETO, lessons learned, or national standards and recommendations that have been set forth relative to emergency transportation operations. It seems apparent that additional efforts are needed to facilitate the sharing of information about ETO improvements and interagency experiences.

Resource Allocation and Funding Sources

Participants were asked to evaluate the relative priorities for the allocation of resources to ETO, recognizing that all of the organizations have multiple responsibilities beyond just emergency transportation operations. As shown in Table 10, the most prevalent response was “moderate priority/importance.” Transportation and emergency services professionals rated ETO as a moderate priority in nearly every aspect, from the need for additional manpower to the need for additional training. Interestingly, relative to “all the highway needs in your community/state,” the transportation group assigned a higher priority to ETO than the emergency services group; i.e., the emergency services group more than the transportation group seems to believe that other transportation needs might warrant higher priority than improvements in ETO.

Finally, participants were asked their opinions on funding for ETO, including the need for additional funds and potential funding sources (see Table 11). The majority of respondents agree that more funding is needed to accomplish ETO improvements and that dedicated state and federal funding sources are needed. Based on the responses, the emergency services representatives believe that transportation agencies have more funding available and should use those resources to pay for ETO. However, most of the transportation respondents disagree. Emergency services respondents are more optimistic than the transportation group about public support for shifting funds from other sources.

TABLE 10 Resource Allocation Priorities

Based on your experience and observations... <i>(Please check one box on each line.)</i>	Group	High priority/ importance	Moderate priority/ importance	Low priority/ importance	No opinion
Relative to all of your agency's current responsibilities, how important are emergency transportation operations (ETO)?	T	35%	42%	23%	0%
	ES	41%	44%	15%	0%
Relative to your agency's need to invest in more effective relationships with all other state and local agencies, how important are your relationships with emergency services agencies?	T	42%	42%	17%	0%
	ES	41%	46%	12%	2%
Relative to all of your agency's needs for additional manpower, how important are your manpower needs for ETO-related activities?	T	31%	35%	33%	0%
	ES	24%	45%	25%	6%
Relative to all of your agency's needs for expanded/enhanced training, how important are the needs for ETO-related training?	T	25%	46%	27%	2%
	ES	25%	54%	17%	4%
Relative to all of your agency's needs for new or improved technology, how important are the technologies needed for improved ETO?	T	38%	42%	19%	2%
	ES	36%	45%	15%	4%
In your agency's plans for the future, what priority is given to ETO?	T	25%	42%	29%	4%
	ES	9%	54%	29%	7%
Relative to all the highway needs in your community/state (e.g., maintenance, added capacity, improved signalization, hazard elimination), what priority do you believe should be assigned to ETO improvements?	T	49%	34%	15%	2%
	ES	38%	49%	9%	4%

T=Transportation ES=Emergency Services

TABLE 11 Funding for Emergency Transportation Operations

Based on your experience and observations, do you agree that...
(Please check one box on each line.)

	Group	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
The most needed ETO improvements can be accomplished without new sources of funding.	T	6%	15%	52%	25%	2%
	ES	2%	17%	53%	24%	4%
Dedicated federal funding sources are needed to pay for ETO projects and programs.	T	38%	54%	8%	0%	0%
	ES	29%	59%	5%	0%	6%
Dedicated state funding sources are needed to pay for ETO projects and programs.	T	25%	60%	13%	2%	0%
	ES	24%	59%	8%	1%	8%
Transportation agencies have more funding available than emergency services agencies and should share those resources to improve ETO.	T	0%	21%	31%	29%	19%
	ES	24%	37%	10%	1%	29%
The public would support shifting funds from other existing programs to improve ETO.	T	8%	25%	40%	8%	19%
	ES	12%	32%	21%	7%	28%

T=Transportation ES=Emergency Services

INITIATIVES TO IMPROVE COORDINATION

Following analysis of the survey results, a separate focus group was convened with individuals representing state and local transportation agencies, emergency medical services, fire and rescue, emergency communications, and law enforcement, all from the Nashville region. The purpose was to review and confirm the survey results and, based on those results, attempt to identify practical and cost-effective strategies to improve coordination. The focus group received the survey results prior to the work session, and their comments and suggestions influenced the interpretations offered in preceding sections of this paper.

At the work session, the focus group was presented with a list of six highly-ranked objectives for improved ETO and asked to evaluate the achievability of each objective relative to institutional, operational, technological, and financial factors, using a relative scale of high, medium, and low. Each member completed the matrix individually, and the group then discussed and agreed on overall rankings.

The group concluded that the objectives that seemed most achievable (i.e., would encounter the fewest institutional, operational, technological, and financial obstacles) were “advising the public of incidents and roadway conditions” and “reducing the time to restore normal traffic conditions after an incident.” “Improving incident response times” was also seen as achievable subject to financial constraints. The group also confirmed the survey findings that achieving these objectives will require attention to the full range of institutional, operational, technological, and financial constraints.

The focus group was then asked to evaluate a list of potential strategies for short-term action to improve emergency transportation operations. This list was prepared by combining the scenarios identified in the survey as most in need of improved coordination with the response activities identified as most in need of improvement. The scenarios most needing improved coordination included terrorist attacks, freeway crashes, public health emergencies, and failure or blockage of transportation infrastructure. The response activities identified as most important for improved ETO were planning, training, communicating, advising motorists, and evacuation and quarantine planning. Four strategies for short-term actions emerged as the top priorities, and those are described in the following section.

SUMMARY AND CONCLUSIONS

The findings from this research indicate that emergency transportation operations can and should be improved, and that both highway transportation and emergency services organizations recognize the importance. Both groups acknowledge the ability to improve ETO through their own independent actions, but interagency coordination is seen as an overarching requirement. Institutional and operational issues are considered just as important as the technological and financial issues. Although not conclusive, the results seem to indicate that emergency services agencies expect transportation agencies to take the lead. Certainly, the emergency services respondents believe that transportation agencies have more financial resources and that more of those resources should be used for ETO.

The two groups (transportation and emergency services) have very different views, however, on many other aspects of emergency transportation operations. An important conclusion of this research is that more intensive efforts are needed to develop mutual understanding, priorities, and goals.

For instance, the two groups agree on the rank order of importance for only one of the multiple reasons for improving ETO—avoiding or reducing secondary crashes. This establishes some common ground, but the transportation respondents showed significantly less concern than emergency services agencies for efforts to “improve scene and responder safety.” Emergency services agencies showed significantly less concern than transportation agencies for improvements that would “reduce the time to restore normal traffic conditions.”

The two groups seem to agree on the importance of improving coordination relative to terrorist attacks, regardless of whether the attacks are directed at the transportation infrastructure or are directed at other targets and create exceptional demands on the transportation system. However, transportation agencies do not assign as much importance as emergency services agencies relative to “public health emergencies requiring travel restrictions or quarantines.” Emergency services are less concerned than transportation agencies about improving coordination relative to “freeway crashes.”

To some extent, these different views may be because the transportation and emergency services agencies have fundamentally different missions, and the responses simply reflect differences in priorities that correspond to these missions. However, the survey results also reveal significant gaps in mutual understanding of basic organizational missions, capabilities, and limitations. Both groups seem to recognize their lack of knowledge about the most basic aspects of the other group’s organizations. A fundamental conclusion from this research is that efforts to improve ETO should include measures to expand the shared knowledge and understanding of the core missions, capabilities, and limitations of all the partner agencies.

Likewise, responses to the question measuring awareness and knowledge of implemented programs to improve ETO (e.g., NIMS, Chapter 6I of the MUTCD) revealed large gaps between the two groups. Further, the responses indicate a general lack of knowledge of most of these initiatives, regardless of whether the initiative came from the transportation or emergency services community. Thus, another fundamental conclusion from this research is that more effective efforts are needed to share interagency experiences to improve ETO, examine the lessons learned, and disseminate the adopted national standards and recommendations.

The transportation and emergency services respondents seem to be in close agreement on the use of technology to improve ETO, and that agreement could provide a starting point for more comprehensive interagency coordination. Both groups assigned at least a moderate potential benefit to each of the candidate technologies included in the survey. Several of the choices received very high rankings from both groups, including interoperable radio communication systems, dynamic message signs, and GPS- and GIS-based information systems.

The concluding focus group's evaluations of achievability and the potential strategies identified for short-term action could also motivate efforts to improve coordination in specific locations. The strategies judged by the focus group to warrant the highest priority were:

- Include more transportation topics in training for emergency response personnel and more emergency services topics in training for transportation personnel
- Implement new interagency (joint transportation and emergency services) training programs
- Increase participation in multi-agency operations planning for all types of hazards
- Improve interoperability of communication and other information technologies

Of these four, improving interoperability is probably the most complex; but, arguably, has received the most national attention and has seen the most advancement since 9/11/2001. Improvements in cross-disciplinary and joint training and more effective multi-agency planning may seem simple on first consideration, and much could be accomplished with relatively small investments. However, the very obstacles that those measures would help to overcome stand in the way. More leadership and commitment seem to be needed, more examples of successful initiatives at the state and local levels, and perhaps more standardization. The accomplishments of the National Incident Management System (NIMS) Integration Center seem promising (9).

Finally, this research only begins to identify and clarify factors that can impact the effectiveness of interagency coordination to improve emergency transportation operations. Additional exploration is needed to understand the relationships between competing priorities, core missions, and the lack of common understanding of the other organizations' missions. Additional research is needed to examine the links between organizational goals and objectives and the performance and accountability of the managers and on-scene responders who make key decisions during critical events. Also, research is needed to more fully examine the influences of organizational design, internal culture, training, performance measurement, and other aspects of organizational behavior on these inter-organizational relationships and the cumulative effects on emergency transportation operations.

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REFERENCES

1. Bunn, M. and G. Savage. *Integrated Traffic Management and Emergency Response: Success Factors*. University of Alabama, University Transportation Center for Alabama Report 01101, 2003.
2. Capital Wireless Integrated Network (CapWIN). "CapWIN Goals." <http://www.capwin.org/goals.html>. Accessed July 2004.
3. Helman, D. Traffic Incident Management. *Public Roads*. 68: (3), November/December 2004.
4. Kalhammer, V. and P. Bella. National Summit on Transportation Operations: Building the Future of Transportation Operations. *ITE Journal*, 71(12), pp. 38-40, 2001.
5. TransCom. Transportation Operations Coordinating Committee. <http://www.xcm.org/transcom.html>. Accessed August 2004.
6. U.S. Department of Homeland Security. *National Response Plan*. 2004.
7. U.S. Department of Transportation, What is the ITS Public Safety Program? http://www.itspublicsafety.net/what_is_itspub.htm. Accessed August 2004.
8. U.S. Department of Transportation, John A. Volpe National Transportation Systems Center. *Effects of Catastrophic Events on Transportation System Management and Operations: Cross Cutting Study*. U.S. Department of Transportation, ITS Joint Program Office, 2003.
9. Federal Emergency Management Agency, U.S. Department of Transportation. The National Incident Management System (NIMS) Integration Center. <http://www.fema.gov/nims/nims.shtm>. Accessed June 2005.