Commission Briefing Paper 4E-01

Evaluation of the System's Ability to Support Safe Evacuation of Citizens During Times of Emergency

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Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU. The papers are intended to synthesize the state-of-the-practice consensus on the issues that are relevant to the Commission's charge outlined in Section 1909, and will serve as background material in developing the analyses to be presented in the final report of the Commission.

This paper presents information on the transportation system's ability to support local, State, regional or Federal emergency managers in planning for and executing safe evacuations during emergencies or disasters. It emphasizes that the implementation of a safe and effective evacuation triggered by either manmade or natural disasters depends upon the local knowledge of the capabilities and availability of both public and private response and recovery resources. The focus on ***local*** capabilities is intentional since most expertise in evacuating populations resides with local authorities. The paper discusses the nature of disasters triggering an evacuation, transportation's role in evacuations, transportation emergency planning and emergency evacuation operational decisions.

Background and Key Findings

The system's ability to support safe evacuation of citizens during emergencies depends on the effective use of the evacuation planning process to develop plans and capabilities to address all aspects related to evacuations. The Department of Homeland Security (DHS), in its National Plan Review Phase 2 Report, stated "No single plan or resource base in a State or urban area is expected to shoulder the entire burden of a catastrophic event." The resources and capabilities of transportation agencies will be recognized by the emergency management community for planning, capacity building and operations.

Safe evacuations also depend on the involvement of key state and local government, transportation authorities and private sector officials throughout the planning process. Finally, State, regional and local officials must coordinate their activities with representatives of the Federal government and continually inform the public about changing evacuation plans.

National Evacuation Expertise Exists with Local & State Authorities

Although the nation has focused on evacuation capacity in the post-Katrina era, it is important to note that evacuations occur on a daily basis in the United States. A 2003 report issued by the U.S. Nuclear Regulatory Commission (NRC) provides select case studies on evacuations that occurred from January 1, 1990, through June 30, 2003. Based on its research, the NRC observed that a large-scale evacuation involving 1,000 or more people occurs about every three weeks.

The NRC study shows that the leading cause of evacuations during that time period was natural disasters (58%), with wildfires accounting for 23% of these evacuations. Technological disasters accounted for 36% of evacuations. These causes included hazardous material releases, train derailments and traffic incidents. Malevolent acts—including terrorist attacks—accounted for 6% of evacuations. Most of these evacuations, however, do not require National-level support—except for individual and public assistance—thereby reinforcing a basic concept of the National Response Plan: Incidents are typically managed at the lowest possible geographic, organizational and jurisdictional level. The lessons learned from the success of local response activities are that municipalities can identify, obtain, and manage localized resources during localized incidents.

Mass evacuations are rare. The 2003 NRC study also found that only 17 of the 230 evacuations over the 13½ years of the study period involved 100,000 people or more. Of these evacuations, 15 were from hurricanes and two were from the 1993 and 2001 World Trade Center attacks.

Based on the frequency of evacuation operations in this country, it is reasonable to conclude that expertise exists to handle small to moderate evacuations. That operational expertise lies with local and to a lesser degree, State authorities and not the Federal government. Since 1991, the Federal government has been asked to aid evacuations only for Hurricanes Katrina and Rita.

Evacuations Lead to Transportation Challenges

The NRC researchers analyzed 50 incidents in considerable detail. One element of this analysis was the impact of the evacuation on transportation facilities and the creation of transportation problems. For the great majority of the evacuations, the analysis concluded that there were no major problems caused to the transportation system. As might be expected, transportation problems were closely correlated to the size of the evacuation. Almost all of the evacuations involving 10,000 or fewer people experienced no transportation problems. Large-scale evacuations with 100,000 or more evacuees such as those in response to Hurricanes Andrew and Floyd, all resulted in transportation problems.

The DHS's 2004 *National Response Plan* defines catastrophic events as those that result in sustained national impacts over a prolonged period of time and almost immediately exceed available resources available to government and private sector authorities in the impacted area. Catastrophic events represent the greatest challenge to those transportation officials involved in emergency response.

Key Findings

The bullets below show key findings that affect the current system's ability to support safe evacuation of citizens during times of emergencies.

- The participation of all stakeholders in developing evacuation plans is crucial and must be reinforced by formal agreements, such as Memoranda of Understanding.
- Transportation officials must be involved in all aspects of the evacuation process including planning and operations.
- The general public must participate in the development of evacuation plans and be informed about changes in transportation elements such as detours and contraflow (lanes reversed to speed traffic movement) routes.

- Evacuation expertise exits with local and state authorities and the great majority of evacuations are planned and managed by local authorities.
- Catastrophic disasters may result in the evacuation of tens of thousands of people and represent the major challenges.
- Areas and populations to be evacuated need to be quickly identified and clearly communicated to the public to prevent needless evacuations and overloading the transportation system.
- Evacuation plans must be carefully developed for populations with "special needs." Such organizations as hospitals, nursing homes and treatment centers must participate both in planning evacuations and exercises.

Importance of Transportation Considerations and Involvement in Effective Emergency Response Evacuation Plans

The aftermath of 9/11 brought significant changes to Federal, State and local governments as well as the private industry. Many tasks and responsibilities, once the sole function of a singular entity, became standard operating procedure for multiple agencies. Safety and Security became more than buzz words; they became a way of life. A reduction in available resources caused governmental agencies at all levels to make themselves indispensable by concentrating on what that agency could do better than any other agency, both in legal authority and in terms of available resources. With the changing face of State governments, traditional partners have been replaced by new State agencies, and the relationship between federal agencies and State partners has grown stronger. The safe evacuation of citizens during incidents is anchored in the ability of officials at all levels to compile emergency response plans that are comprehensive, implementable, and continuously updated based upon and offset by this continual change in responsibilities.

The effectiveness of the transportation system's ability to support evacuations depends on all system components –whether contributed by the public, private or volunteer sectors— functioning effectively and harmoniously with other groups charged with other functional activities, such as sheltering, feeding, public information, etc. One example of this is found in the evacuation of New Orleans in response to Katrina when large numbers of buses were mobilized in advance of the storm, but the effort was ineffective when qualified drivers were unavailable. One common thread throughout all reports and studies on evacuation operations is that the efficiency and effectiveness of ***the transportation system's ability to support evacuations depends heavily on the involvement of transportation officials in the planning, capacity building, exercising and operations related to evacuating populations.***

Transportation operations are one of the key elements of planning and implementing a safe and effective mass evacuation. The US DOT's and DHS's Catastrophic Plan Evaluation report shows that the Incident Command System (ICS) is one of the primary practices that were incorporated into the National Incident Management System (NIMS). NIMS documentation defines the operations, management, and organization of incident management and emergency response operations that are utilized from the beginning to the end of an incident. Transportation officials at a number of levels of governments are to be included in plan preparation if the transportation system is to be used to its peak efficiency and if transportation assets are used effectively. This includes officials from different transportation disciplines (e.g., highways, rail,

air, maritime, transit) from both the public and private sectors. Supporting transportation industries are also being included in the planning process. These could include privately owned bus, railroad and ferry companies, and public sector transit operators. This also includes construction companies with heavy duty debris removal equipment, communications companies, owners of traveler information systems, etc. As more roads become privatized (e.g., toll roads) and as jurisdictions try to put stand-by contracts in place for use during emergencies, it is critical that the private sector be engaged in planning and have a stake during operations.

State and local authorities have benefited from Intelligent Transportation Systems (ITS) in their attempts to better manage traffic flow, evacuation operations, information gathering and dissemination, and general support to incident management. The most effective ITS tools used in supporting evacuation operations are those used by a jurisdiction on a regular basis in their Traffic Incident Management (TIM) efforts. ITS have proven to be invaluable for evacuations.

Identifying the Area to be Evacuated

A major challenge for emergency response transportation operations is that risk analysis is often incorrect or incomplete and areas likely to be affected by the disaster are not accurately identified. During the DHS and US DOT studies, many jurisdictions commented that they don't face catastrophic risks, like a Hurricane Katrina, and don't see the need to spend valuable resources on evacuation planning and preparedness. As such, many jurisdictions don't consider all scenarios and potentials. Since the risk areas are not often identified, the risks are not communicated to operations personnel and the public. Risks of the levee breaches in New Orleans during the onslaught of Hurricane Katrina had not been fully considered and the surrounding population not told of the potential risks.

Identifying the area likely to be affected by the disaster and quickly communicating it to operations personnel and the public is critical. Rapid decision making is required and must be based on the nature of the hazard and threat. For a chemical release as example, officials must also be able to calculate potential damage to surrounding population areas by calculating the likely movement of a plume. There are many new technologies in place for communications during disasters, including Next Generation 911, personal emergency alerts systems, and highway advisory radio.

An area that is incorrectly identified as being fully affected by a disaster could result in transportation officials being preoccupied with problems created by the movement of thousands of citizens evacuating their homes needlessly, seeking public transportation, or being evacuated from special-care facilities. This needless, or "shadow," evacuations add to congestion and may contribute to gridlock on the roadways or other modes, frustrating attempts by people truly in harm's way from evacuating. For example, in Houston during Hurricane Rita in 2005, thousands of residents in large parts of the city protected by their elevation from a storm surge evacuated needlessly. Moreover, in an attempt to salvage their possessions, some families split up and drove every vehicle they owned, increasing the amount of traffic on the evacuation routes. General evacuation orders were issued at first to include these residents but when the order was corrected, it was already too late. Instead of the 1.25 million people that should have been evacuated under their three county plan, anywhere from 2.5 million to 3.5 million people left the

area. Gridlock on the highways ensued. Hundreds ran short of fuel as their vehicles idled in the traffic jams and congestion on the roadways needlessly intensified.

To enable officials to take appropriate action and to adjust operations based on current realities, decision makers must have the most up-to-date monitoring equipment, tools, and models that enable them to forecast which areas are likely to be affected by a natural or manmade event and then also have the tools to communicate this information to other officials and the public. The transportation industry—with road cameras, counters, toll booth operators, etc.—have many tools that can contribute to providing the most up to date information. Much of this monitoring and analysis capability resides in Traffic Management Centers. During operations, emergency management officials ensure that this information is continually fed into the emergency operations center (EOC) either electronically or through a transportation liaison situated in the EOC. As the capability of modeling tools improves, the areas to be evacuated will be better defined. Advanced modeling tools may someday make real-time decision making a reality. The identification of evacuation routes will improve as the capabilities of these tools improve.

Enhancing the Skills of Emergency Responders & Building Capacities

The ability to successfully evacuate populations depends upon the ability of officials of potentially affected jurisdictions to develop emergency response plans. The plans must be prepared in a manner that includes all stakeholders—*including transportation officials*—and must use a systems approach to institutionalizing the plans. As such, the transportation system's ability to support safe evacuation of citizens during incidents first depends upon emergency response plans, with detailed emergency transportation plans that are comprehensive, implementable, and continuously updated and trained. This means that a very close working relationship must be established at the local, State and Federal levels among emergency managers, transportation officials, first responders and other providers of succor during times of need.

The National Response Plan (NRP)—the DHS revision of the Federal Response Plan and current base guidance document on developing Federal, State and local emergency plans—states, "A basic premise of the NRP is that incidents are generally handled at the lowest jurisdictional level possible." The U.S. Department of Transportation's *Catastrophic Hurricane Evacuation Plan Evaluation: a Report to Congress* demonstrated that evacuation plans and the planning process in the Gulf Coast States reflected this premise and the most current planning guidance issued by the Federal Emergency Management Agency (FEMA) for State and local planners, namely the "*Guide for All-Hazards Operations Planning."* Using their own resources and based on then-current planning guidance, States have successfully conducted preparedness, prevention, response and recovery activities without the assistance of Federal agencies, to a multitude of large and small incidents. Memoranda of Understanding were executed between adjacent jurisdictions, State agencies, and adjoining States. However, a catastrophe of the magnitude of Hurricane Katrina quickly exhausted available resources amongst the cosigners. Hurricane Katrina also revealed that insufficient guidance was provided to the States in the areas of public communications and preparedness, evacuation of people with special needs, the use of all modes of transportation during evacuations, and evacuation-related sheltering considerations. Most importantly, it is clear in many studies and post-Katrina after-action reports that the

transportation public sector often was not involved in developing these plans, Memoranda of Understanding or other tools and was not routinely included in exercises. Transportation is a missing component in most current evacuation plans.

The national agenda includes a focus on updating local, State and Federal emergency plans—including evacuation plans—ever since the September 11, 2001, attacks and the impact of hurricanes Katrina and Rita on the Gulf State region in 2005. In response to the September 11, 2001 attacks, President Bush authorized the release of Homeland Security Presidential Directive (HSPD)-5, which directed the newly-appointed Secretary of Homeland Security to develop and administer a National Incident Management System (NIMS). The NIMS has been adopted at all levels of government, and by all functional disciplines and many private entities. A key requirement of NIMS is resource management. The DHS released the *Nationwide Plan Review Phase 2 Report* in June of 2006 and identified resource management as the 'Achilles heel' of emergency planning. Furthermore, Congress tasked the DHS with conducting an evaluation of emergency response plans—including evacuation plans—and with helping local, regional, State and Federal authorities with improving their plans. DHS has already conducted the evaluation and is embarking upon improving planning through its National Plan Review program. Concurrently, Congress tasked the Department of Transportation to study evacuation plans in the Gulf State Region. The NPR and the US DOT studies found that the involvement of transportation officials could have improved emergency response and evacuation plans.

In the short term, emergency training, drills and exercises institutionalize, test, and help to make for effective emergency response plans. Emphasis is placed on quick decision making, management, support, administration and quality assurance to ensure that plans/exercises are effectively evaluated, analyzed, developed, designed and implemented. The use of web-based updates/refreshers saves in the exorbitant costs of on-site training.

As transportation takes a more active role in the daily operations of traffic incident management, congestion mitigation, and traffic management for planned special events, the full capabilities of the transportation agency will be realized and their place in the first responder community will be recognized. Currently, transportation officials are not included in most emergency response plans, training, drills, or exercise design or play. As a result, the efficiency of the transportation system is not being tested, meaning that jurisdictions are losing out on valuable opportunities to test the transportation system to support evacuations and emergency operations.

Evacuation Experience

Although prior evacuation experience for transportation officials proves to be useful, this is not always the case for the public. In New Orleans before Katrina, previous evacuations, surveys and exercises uncovered that many residents would not be able to leave the city in personal vehicles because many thousands of residents did not own personal transportation. Clearly, the next evacuation would have to utilize alternative means of transportation. Previous experience with warnings for storms that resulted in minimal damage and evacuations that proved to be unneeded worked to reduce community compliance with an evacuation order. In New Orleans, the evacuations associated with Hurricane Katrina were less effective because thousands of people decided to remain in their homes based on their past experiences. A Harvard University study released in June 2006 stated that 33% of those subject to an evacuation order would refuse

to evacuate. Communication on preparedness and evacuation procedures must be improved and targeted to the diverse communities within major population areas.

Other experiences in disaster recovery involve the private sector and impediments to their ability to respond. For example, the increased use of the private sector as initial responders places a burden on these entities to comply with NIMS-mandated training.

Finally, those making decisions on whether to evacuate are usually public-elected officials, such as the mayor, county executive through the State governor. Decision makers often lose valuable time because they are concerned about making a bad decision and costing millions in revenue to the private sector (e.g., evacuating tourists from beaches) or in lawsuits from those who were moved needlessly for an event that doesn't happen. Improved information, including that from the transportation sector, and the use of event modeling information will help alleviate the decision maker's concerns and improve his/her comfort in the operational snapshot and risks.

Sheltering-in-Place and Vertical Evacuations

For some incidents, there is the potential to order people who should be protected from a threat to remain in their homes (commonly referred to as shelter-in-place). As the highway and rail transportation of hazardous materials increases, the potential of a chemical release increases correspondingly. Depending on the nature and timing of a catastrophe, emergency managers may advise the public whether it is safer to evacuate or to shelter in place. In some instances, it is safer for people to quickly seek shelter indoors—in homes, schools, businesses, or public buildings—than to try to travel. While this is often used when a potentially harmful hazardous material is released, it could also be used when the numbers of people exceed the capacity of the transportation assets. In some major cities, the use of vertical or interior evacuation is used to prevent people from being stuck in the elements trying to evacuate as a storm comes through. Vertical evacuation may be used when flooding prevents escape through roadways.

Coordinating Evacuations of those with Special Movement Requirements

In its August 2006 report titled "Disaster Response and Recovery Resource for Transit Agencies," the FTA defines special needs population as including the following categories of people needing special movement assistance or who must be assisted in an evacuation by transit:

1) Individuals who can independently get to a pick up point (evacuation location);
2) Individuals who live independently and require transportation from their location;
3) Individuals who live in a group setting (e.g., group home, assisted living center, etc) that require transportation directly from their location;
4) Individuals in acute care/in-patient facilities;
5) Individuals with disabilities; and
6) Individuals with limited English proficiency.

Definition of special needs vary. For example, many include those: with service animals, in correction facilities, without permanent addresses as groups needing special communication, security or handling during movements. To provide assistance for these individuals, State and local officials must coordinate a wide range of important activities that include: identification of individuals, their locations and requirements for special assistance. They must also clearly define the roles, responsibilities, and

dispatching functions for paratransit services so special needs individuals can be evacuated safely and effectively. They must ensure that plans to use multiple modes are synchronized and that reception points are identified and cleared with the operator of the reception point (e.g., mass care facility, hospital, etc.) Finally, plans must be in place for the resumption of critical health care functions such as dialysis treatments, at the new locations.

The aging of the population and demographic changes, (25% of population being centered in California, Florida, and Texas by 2025) will increase the need for public transportation and sheltering away from vulnerable coastal/geographic areas. Retirees have traditionally moved to warmer, coastal communities. The immigrant population is expected to increase in these states. This population is also among the transportation dependent. Increased recreational travel by visitors without vehicles to coastal regions will also increase the need to evacuate these groups.

Transportation officials, shelter operators (e.g., American Red Cross), health sector, translators, etc., work together with a coordinating entity to establish coordinated records and computer mapping systems that enables the transit provider working with the emergency response team to continuously update locations and changing needs of the special needs population. Current technology such as Automatic Vehicle Location and Traffic Light Preemptions systems are installed on many response vehicles to allow for exact location identification and easy access through intersections. A patient information management system is needed for patients requiring specialized treatment. This information would accompany each evacuee in the form of a badge worn around the neck and would enable the paratransit provider to be aware of any special treatment or equipment needs both during the trip and at the destination. Similarly, specific evacuee information is needed for post event coordination and of special needs patients in shelter settings and in providing transportation to return them to their homes.

An aging population in the United States means that more focus on those with special movement support will be required in the future and more people will require special needs facilities, such as assisted living complexes and long-term nursing care. This will put an added strain on evacuating populations needing special movement support. Additional planning and resources will have to be given to this evacuation activity. For a special needs facility evacuation, a decision would have to be made on how buses or ambulances could reach and leave the facility. One issue is whether bus and ambulance drivers should be trained in the use of respirators to be able to respond to evacuations caused by chemical spills.

Contraflow Systems

A contraflow system in which traffic lanes are reversed to speed movement of vehicles away from a disaster is recognized as an effective approach for moving greater numbers of evacuees, but is not always the best way to handle mass evacuations. National conferences have been held on the implementation of an effective contraflow program. Nevertheless, according to the US DOT/DHS Catastrophic Hurricane Plan Evacuation Report, there is still some debate concerning how to address certain issues such as how to provide for incoming emergency response vehicles and when to implement the contraflow system. Contraflow is resource intensive and requires extensive pre-planning and coordination with neighboring jurisdictions and States. It must be realized that adjacent partners will be inundated with their own requirements during a catastrophic event. Moreover, contraflow planning must also allow for incoming responders and response resources that are being positioned closer to the potential

impact area. Contraflow operations can impede local, regional, State or Federal efforts to be ready to respond quickly in the "Golden 24-Hours" after an event, when life saving and reduction of suffering is essential.

Future Trends that Will Impact the Transportation System's Abilities to Support Evacuations

The following selected future trends will likely impact the transportation system's abilities to support safe evacuations.

- *Deteriorating transportation infrastructure*: The current transportation infrastructure will continue to deteriorate over time. Increased public investment will be made to ensure that the infrastructure is adequate for evacuation needs. Otherwise, evacuation effectiveness will be compromised.
- *Increasing movement of hazardous materials*: Increased movements of hazardous materials are likely to result in a greater number of incidents requiring evacuations. This is especially true for those materials such as chlorine that are shipped in bulk quantities via railroad tank cars. Evacuation planners must prepare for these events.
- *New technologies to communicate with the public*: New technologies such as VII, NG911, a new emergency alert system under development by DHS/FEMA, should provide the foundation for improved emergency communication between the public and emergency responders. These technologies should improve evacuation effectiveness by enabling enhanced 9-1-1 calls from most types of communication devices
- *Increasing reliance on public transportation*: The increasing reliance on public transportation in large cities should improve evacuation operations if public transportation is effectively integrated, in evacuation planning.
- *Ability to relay on the military to support catastrophic operations*: The military played a large role in emergency response during catastrophic disasters in the 1990s through 2001. Based on current demands for the military, the strain on these resources may limit their support for evacuations. The civilian emergency response sector may have to shoulder some of this burden in the future
- *Improvements in modeling tools and information collection*: These changes will enable decision makers to be more comfortable with making quick decisions on evacuating populations. Tools such as hurricane forecasting tools have improved considerably since the early 1990s. These tools will assist transportation officials in more effectively targeting transportation resources.
- *Increase severity of natural disasters such as hurricanes and fires*: Future storms are likely to increase in intensity and pose a greater threat to coastal areas in the Southeast. The intensity of forest fires in the western United States is also likely to increase in the future.
- *Concerns for Pets*: As evidenced by recent hurricane evacuations, people are reluctant to leave their pets. Pets must be factored into evacuations through the establishment of evacuation policies and accommodations for pets in shelters and temporary kennels in relocation areas.

Conclusion

The effectiveness of the transportation system's ability to support safe evacuations may depend on a number of system components –whether contributed by the public, private or volunteer

sectors—functioning effectively and harmoniously with other groups charged with other functional activities, such as sheltering, feeding, public information, etc.

CONSOLIDATED COMMENTS FROM MEMBERS OF THE BLUE RIBBON PANEL OF TRANSPORTATION EXPERTS - PAPER 4E-01

Several reviewers combined their comments as follows:

It would be helpful if there were more emphasis on the importance of public communications prior to any evacuation event and about the transport options available to the public.

Shelter-in-place should also be given even more emphasis. This is particularly relevant to terrorist threat of chemical and biological attacks.

While the paper notes that mass evacuations are rare, even moderate levels in major metropolitan areas could involve more than 1 million people.

A single entity or organization is need to be responsible and accountable for ensuring that evacuation plans are in fact completed, operational and all inclusive. This is particularly critical in larger multi-jurisdictional regions.

The paper correctly notes that transportation is "missing" in most evacuation plans as well as the necessary advance training, drills and exercises.

Consideration be given to a formal Memorandum of Understanding among responsible agencies to memorialize operational responsibilities and protocols as part of evacuation plan. A format and template model to be used on a broad basis should be developed and include particular emphasis on unique and complex provisions such as utilizing contra flow systems.

National demographic trends warrant even further emphasis on "special needs" population including aging, disabled and language limited. This population puts added strain on the evacuation system and requires special movement support.

Aging infrastructure assets in most areas are strained to meet the normal daily operational needs of our surface transportation system. The ability to meet the additional critical needs in times of emergency is continuing to be eroded as investment levels lag meeting ongoing accruing capital needs. This additional element is a key component in developing the overall national policy and appropriate funding levels.