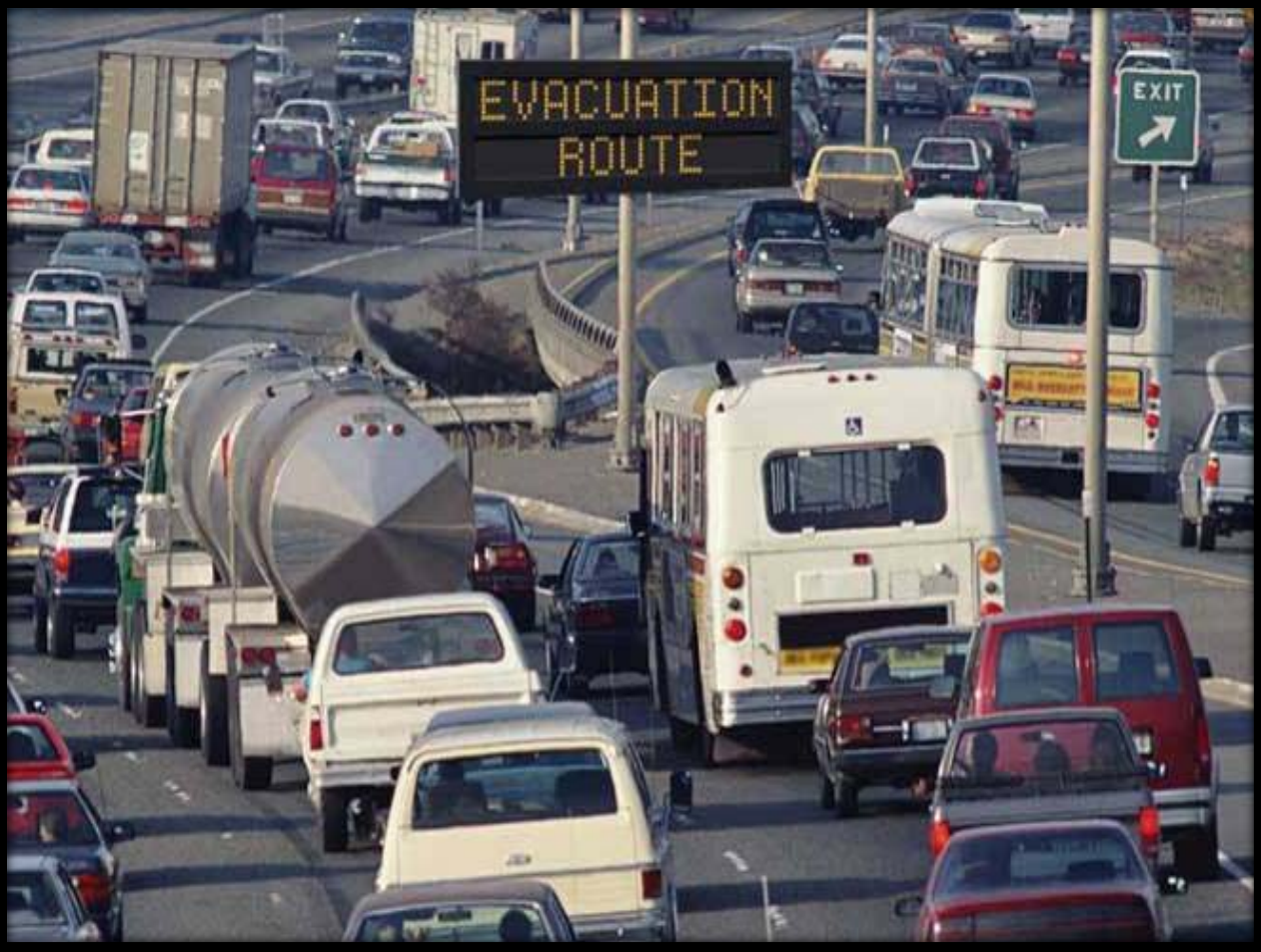
Highway Evacuations in Selected Metropolitan Areas: Assessment of Impediments



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The FHWA recognizes the interviewers (Sandra Jackson, Tim Lane, Ray Murphy, Paul Olson, Nathaniel Price, Laurel J. Radow, and Chung Tran) and the numerous State and local officials who gave their expertise and time to aid in producing this report.

16. Abstract

Almost 5 years after hurricanes Katrina and Rita battered Louisiana and Texas, respectively, public officials remain focused on the Nation's ability to safely evacuate large numbers of people. As a part of the Fiscal Year 2010 U.S. Department of Transportation (DOT) appropriations (Public Law 111-117), the U.S. Congress requested the DOT, in cooperation with the Department of Homeland Security (DHS), to:

- *assess mass evacuation plans for the country's high-threat, high-density areas and identify and prioritize deficiencies on those routes that could impede evacuations* and
- *conduct an analysis of how national highway system (NHS) projects under construction west of the National Capital Region (NCR) could increase the NCR's evacuation capacity and provide a detailed plan to accelerate such projects*.

The following information addresses both assessments and involves a broad view of what local authorities in 26 metropolitan areas view as the greatest impediments of their NHS routes in supporting a mass evacuation within their region, as well as a section dedicated to assessing construction and options for accelerating work along NHS routes west of the NCR that would facilitate the movement of NCR evacuees from danger as necessary.

The Federal Highway Administration (FHWA) led the multiagency effort to gather and consolidate information. The planning, interview and review teams included representatives of various FHWA offices, the Office of the Secretary of Transportation, the DHS Office of Infrastructure Protection, and the Federal Emergency Management Agency (FEMA) offices of Response and of the National Capital Region Coordination (NCRC). Inquiries on the report should be directed to the authors: Jeff Lindley, Associate Administrator, FHWA Office of Operations; Mark Kehrli, Director, FHWA Office of Transportation Operations; or Kimberly C. Vásconez, Team Leader, FHWA Emergency Transportation Operations.

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Highway Evacuations in Selected Metropolitan Regions: Assessment of Impediments

Foreword

Almost 5 years after hurricanes Katrina and Rita battered Louisiana and Texas, respectively, public officials remain focused on the Nation's ability to safely evacuate large numbers of people. As a part of the Fiscal Year 2010 U.S. Department of Transportation (DOT) appropriations (Public Law 111-117), the U.S. Congress requested the DOT, in cooperation with the Department of Homeland Security (DHS), to:

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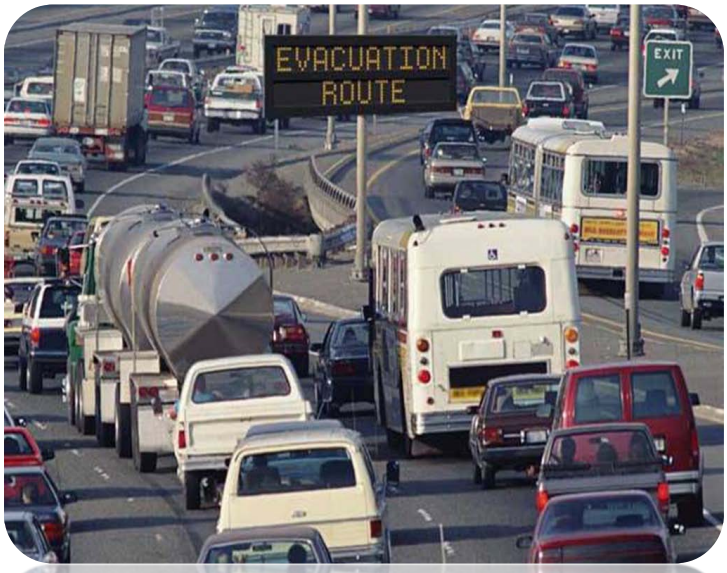


Highway Evacuations in Selected Metropolitan Regions: Assessment of Impediments

Executive Summary

Almost 5 years after hurricanes Katrina and Rita battered Louisiana and Texas, respectively, public officials remain focused on the Nation's ability to safely evacuate large numbers of people. As a part of the Fiscal Year 2010 U.S. Department of Transportation (DOT) appropriations (Public Law 111-117), the U.S. Congress requested the DOT, in cooperation with the Department of Homeland Security (DHS), to:

- *assess mass evacuation plans for the country's high-threat, high-density areas and identify and prioritize deficiencies on those routes that could impede evacuations*, and
- *conduct an analysis of how national highway system (NHS) projects under construction west of the National Capital Region (NCR) could increase the NCR's evacuation capacity and provide a detailed plan to accelerate such projects*.

The Federal Highway Administration (FHWA) addressed this request in two phases. First, it collaborated with DHS and internal stakeholders to identify the top 26 metropolitan areas in the country that would meet the "high-threat, high-density" criteria, but would also be representative of areas based on geographic locations and threat variances (e.g., hurricanes, hazardous materials releases, wildfire-urban interface issues, floods, and terrorist threats). The FHWA reviewed existing plans from the 26 locations and conducted interviews of FHWA Division staff, State and/or local transportation officials and State and/or local emergency management and homeland security professionals. The interviews resulted in the State and local descriptions of their plans, as well as their view of the top impediments that would frustrate mass evacuation operations. The following chart illustrates a general summary of the top impediments reported by the jurisdictions. The FHWA decided not to extrapolate further findings from these as differences in local situations make definitive findings difficult to capture. However, it is clear that jurisdictions share several common perceptions of what might impede their mass evacuation plans (e.g., day-to-day congestion, infrastructure constraints, and communications equipment and frequencies). Many of the interviewees noted that while contraflow operations, or reversal of lanes, may be practical for hurricane-prone States, it would not constitute a viable option to a quick-onset incident. However, some interviewees also noted that large-scale, mass evacuations would be extremely unlikely, especially in the case of certain "quick-onset" incidents, and for many incidents it would be preferable for citizens to shelter-in-place rather than evacuate.

Summary of Jurisdictional Perceptions of Impediments by Location

Location	Top Impediments/Challenges
Atlanta, GA	Contraflow Constraints; Infrastructure Limitations; Arterial Road Systems with Overpasses Cannot Accommodate Trailer Heights; Bridge Weight Restrictions Impede Movements; and Traffic Data is Scattered Throughout the Region
Baltimore, MD	Evacuation Plan Needs Updating; Infrastructure Impediments-Roadways; and Region Lacks a Coordinated Signal Timing System
Boston, MA	Contraflow Constraints; Shoulders May Not be Able to Support Additional Evacuation Traffic; and No Place for Sheltering
Charleston, SC	Infrastructure Constraint I-26; East-West Evacuation Routes; Lane Restrictions; ITS Capabilities along Evacuation Routes; and Incident Responder Coverage Along I-26, Charleston to Columbia
Chicago	Traffic Congestion; Emergency Vehicle Access; Railroad Crossing/Street Blockage; Contraflow Operations Would Impede Evacuations; and Real-Time Highway Information for Responders and Public
Dallas/Ft. Worth, TX	Infrastructure Limitations; Lack of Cameras along Key Routes; and Evacuation Plans Do Not Exist
Denver. CO	No Evacuation Plan; No Evacuation Routes Identified; No Lane Assignments for Emergency Services; Infrastructure Limitations; Traffic Flow Analysis on Evacuation Routes; and Weather Hindrances
Detroit, MI	Infrastructure Conditions Impede Responder Operations; Congestion; and Bottlenecks on Freeways, including Narrow Freeway Lanes and Limited Shoulders
Hampton Roads, VA	Traffic Signal Timing; Number of Water Crossings; Limited ITS Deployment Along Key Evacuation Routes; Flood-Prone Infrastructure; and Human Resources to Manage Evacuation Operations and Tools
Houston, TX	Bottlenecks; Communications with the Public; Number/Type of Resources to Deploy; More CCTV Cameras; and Modeling Timeliness
Jacksonville, FL	Work Zones; Limited Fueling Stations; No DMSs on westbound I-10; and No ITS Deployment on Key Interstates
Las Vegas, NV	Insufficient Lanes and Daily Congestion; Coordination with Other States on Evacuation Routes; Communications Systems Would Not Support Evacuation Operations; Deployable Traffic Signs and Evacuation Route Signage; and Traffic Flow Monitoring
Los Angeles, CA	Congestion and Evacuation Route Capacity; Communications Capabilities; and Public Outreach and Understanding Evacuation Process
Miami, FL	Insufficient Road Capacity; Damage to Critical Infrastructure; Work Zones on Major Routes; Traffic Signal Timing; and Lack of ITS Devices on Major Arterial Roads
Minneapolis-St. Paul, MN	Infrastructure Capacity and Congestion; Lack of Coordinated Plan and Universal Agreement on the Benefits of Evacuation; Disconnected Transportation and Emergency Operations Centers; Need for More Signage and Public Education; Coordination of Signal Timing Plans; Address Equipment Gaps for Pedestrian Movements; and Develop Multiple Options for River Crossing
National Capital Region (DC, MD & northern VA)	Regional GIS Database; Traffic Signal Coordination on Arterials; Limited Roadway Capacity; Institutional Coordination; Communication Interoperability and Protocols; and VIP Movements and Security
New Orleans, LA	Highway Flooding; Additional ITS Capacity; Insufficient Capacity; and Lack of Emergency Lanes
New York City, NY	Infrastructure Condition and Limitations; Need Improved Coordination between State/Local Transportation Officials and Responders; Limited Deployment of ITS Impact on Sharing Situational Awareness Data; Weather Impacts; and Need for Public Information Campaign
Philadelphia, PA	Expressway Congestion; Need for Situational Awareness; Emergency Signal Timing Coordination; Operational Coordination; and Toll Waivers
Phoenix, AZ	Communication Capabilities; Community Outreach and Education Program; Rural Evacuation Route Signing and Information (public outreach) Strategy; Mass Evacuation Regional Command and Control Center; and Evacuation Route Signing
Portland, OR	Bridge Vulnerability; Capacity and Infrastructure Limitations; Communications and Coordination with Neighboring Jurisdictions and the Public; Communications and ITS Technology for Incident Operations; Improved Traffic Management and Safety; More Robust Planning for Evacuation Operations; and Identification and Use of Resources
San Diego, CA	Communication Capabilities; Evacuation Route Capacity; and Need Public Outreach Campaign
San Francisco, CA	Communication Capabilities if Damaged; and Infrastructure (Roads, Bridges and Overpasses) along Evacuation Routes
Seattle, WA	Congestion; Limited Infrastructure; and Insufficient Responder Resources to Manage an Evacuation
St. Louis, MO	Limited Capacity; and Highway Capacity and Bridges
Tampa-St. Petersburg, FL	Highway Infrastructure Capacity; Bridge Infrastructure Capacity; Bridge Vulnerability to Damage; Highway Vulnerability to Damage; and Limited Evacuation Routes due to Geographic Limitations

Summary of Jurisdictional Perceptions of Top Impediments: General Categories [1]

General Categories	Location Reporting as Top Impediment
Communications Equipment & Frequencies, Including Interoperability	Houston, Las Vegas, Los Angeles, National Capital Region (NCR), Phoenix, San Diego, San Francisco
Communications with Responders or Public	Houston, Portland
Congestion/Capacity	Chicago (2), Detroit, Las Vegas, Los Angeles, Minneapolis-St. Paul, Miami, NCR, New Orleans, Philadelphia, Portland, San Diego, Seattle, St. Louis, Tampa (2)
Contraflow Issues	Atlanta, Boston, Chicago
Coordination, including with internal Partners, Responders & other States	Las Vegas, Minneapolis-St. Paul, NCR, New York City, Philadelphia, Portland
Evacuation Route Identification	Denver
Infrastructure-Bridges & Overpasses	Atlanta (2), Charleston, Portland, San Francisco, St. Louis, Tampa-St. Petersburg(2)
Infrastructure-Roads including Bottlenecks, Condition, Emergency Vehicle Access Lanes, etc.	Atlanta, Baltimore, Boston, Charleston(2), Chicago, Dallas/Ft. Worth, Denver(2), Detroit(5), Hampton Roads, Houston, Las Vegas, Miami(2), NCR, New Orleans(2), New York City, San Francisco, Seattle
ITS[2] Infrastructure General	Charleston, Hampton Roads, Jacksonville, Miami, New York City, Philadelphia, Portland
ITS-DMS	Jacksonville
ITS-CCTV Traffic Cameras & Detectors	Dallas/Ft. Worth, Houston, New Orleans
ITS-Ramp Metering	Hampton Roads
Plans Need Updating or Developed	Baltimore, Dallas/Ft. Worth, Denver, Minneapolis-St. Paul, Portland
Plans-Alternate Modes of Transport	Minneapolis-St. Paul
Public Outreach/Education	Los Angeles, Minneapolis-St. Paul, New York City, NCR, Philadelphia, Phoenix(2), San Diego
Real-Time Data	Chicago, New York City, Philadelphia
Resources-Equipment for Pedestrian Movements	Minneapolis-St. Paul
Resources-Fueling Stations	Jacksonville
Resources-Responder Staff	Charleston, Dallas/Ft. Worth, Hampton Roads, Houston, Portland, Seattle
Safety/Service Patrols-Increased Presence	Charleston
Sheltering	Boston, Portland
Signage-Evacuation Route or Other	Chicago, Las Vegas, Minneapolis-St. Paul, Phoenix
TMC Data Sharing & EOC Connectivity	Atlanta, Minneapolis-St. Paul, New York City, Phoenix
Toll Waivers	Philadelphia
Traffic Analysis or Modeling	Denver, Houston
Traffic Control & Monitoring	Chicago, Las Vegas
Traffic Signal Timing	Baltimore, Hampton Roads, Miami, Minneapolis-St. Paul, NCR, Philadelphia
VIP Movements & Security	NCR
Weather or Geographic Hindrances	Denver, Hampton Roads, New Orleans, NCR, New York City, Tampa-St. Petersburg
Work Zones	Jacksonville, Miami

[1] Where a parenthesis and number follow a location, e.g., Charleston (2), that indicates that two of Charleston's top impediments fall into this category.

[2] Intelligent Transportation Systems (ITS) includes Dynamic Message Signs (DMS) Closed Circuit TV (CCTV), Traffic Cameras, Traffic Management Centers (TMCs), Emergency Operations Centers (EOCs), etc.

The second part of this study addressed how NHS projects under construction west of the NCR could increase the NCR's evacuation capacity. The FHWA conducted research and extensive interviews with FHWA Division staff and authorities from the States of Maryland and West Virginia, the Commonwealth of Virginia, and the Washington Council of Governments to discuss corridors and planned construction on the NHS and arterial routes that evacuees departing the NCR would use to evacuate the region.

Through this research and interviews FHWA: (1) identified NHS roads that would qualify for this study, (2) analyzed NHS projects (or phases of large multi-phase projects) west of the NCR currently under construction that could increase evacuation capacity, and (3) provided options to accelerate NHS projects (or phases of large multi-phase projects) under construction.

The FHWA reviewed the areas considered outside and to the west of the NCR and NHS routes in the following counties:

Virginia: Albemarle, Alleghany, Augusta, Bath, Clarke, Culpeper, Fauquier, Frederick, Greene, Highland, Madison, Nelson, Orange, Page, Rappahannock, Rockbridge, Rockingham, Shenandoah and Warren.

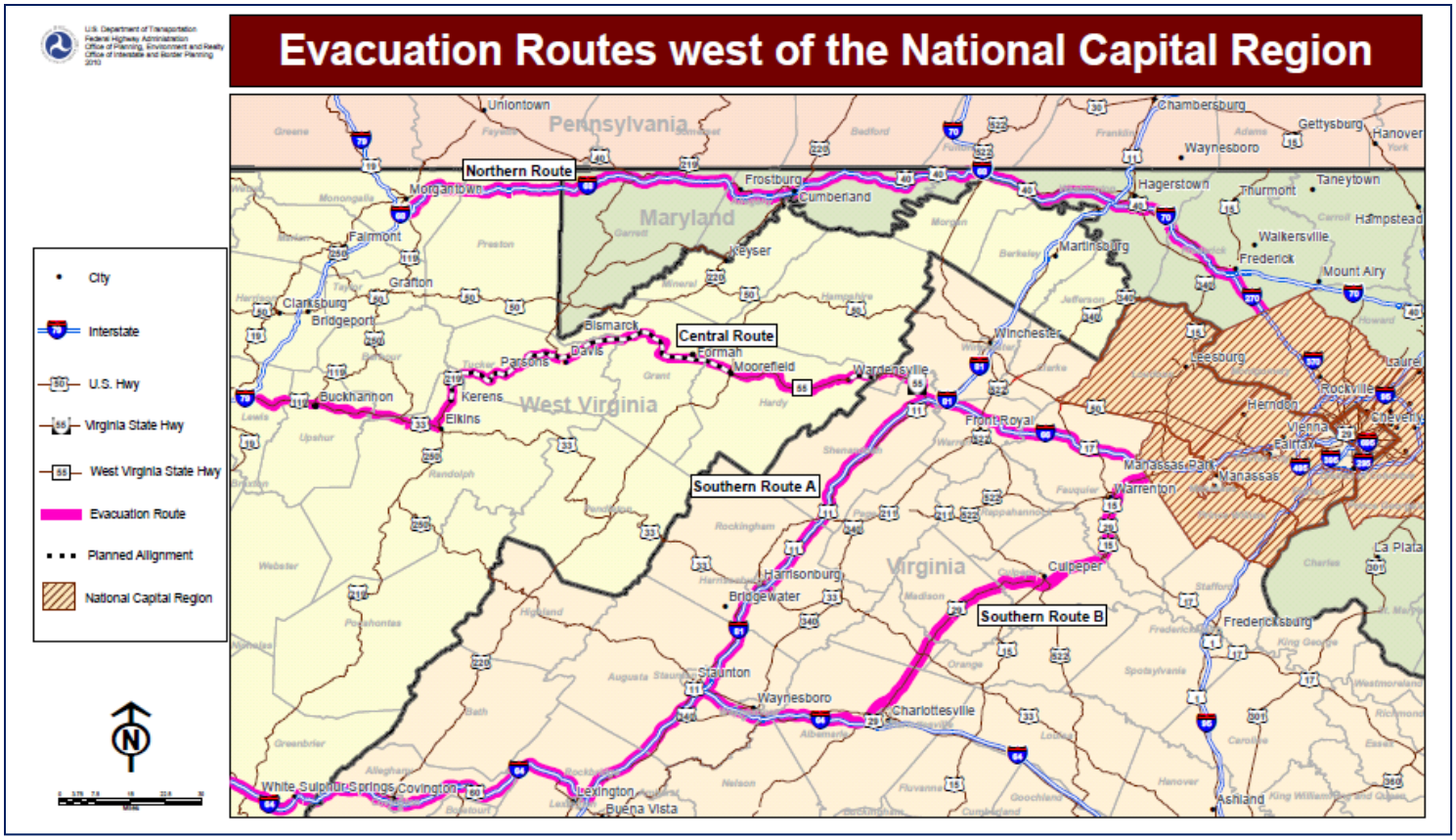
Maryland: Allegany**,** Frederick, Garrett, and Washington.

West Virginia: Barbour, Grant, Greenbrier, Hampshire, Hardy, Harrison, Jefferson, Marion, Monongalia, Pendleton, Pocahontas, Preston, Randolph, Tucker, and Upshur.

Corridors studied include the following as depicted on the map below:

- **Northern Route:** I-270 (MD) to I-70 (MD) to I-68 (MD) to I-68 (WV)
- **Central Route:** I-66 (VA) to I-81 (VA) to the Appalachian Corridor H Alignment (VA-55 and WV-55)
- **Southern Route A:** I-66 (VA) to I-81 (VA) to I-64 (VA) to I-64 (WV)
- **Southern Route B:** US 29 (VA) to I-64 (VA) to I-64 (WV)

The FHWA gathered and analyzed information on ongoing highway projects (or phases of large multi-phase projects) west of the NCR that had the potential to increase evacuation capacity. This analysis revealed no ongoing projects that have the potential to increase evacuation capacity on either of the two southern NHS routes (US 29 to I-64 and I-66 to I-81 to I-64). Therefore, FHWA dropped both of these two routes from further analysis.
Through its research and interviews, FHWA identified opportunities to accelerate construction projects on the various routes studied. Since most opportunities to accelerate construction



depend on innovative means to carry out project financing, project development, and contract administration, the research team consulted with numerous FHWA, Maryland State Highway Administration (MDSHA), Virginia Department of Transportation (VDOT), and West Virginia Department of Transportation (WVDOT) specialists in order to identify viable options for the identified projects. The FHWA has been a leader in identifying and advocating the use of contract administration and project finance options to accelerate construction time on all highway projects, with particular focus on large and complex projects. The table below summarizes which specific project finance and contract administration options examined in this study have been, or will be, considered by the MDSHA and the West Virginia Department of Highways (WVDOH) to accelerate construction, or time to construction, for the six projects (or phases of large multi-phase projects) identified that would increase evacuation capacity on key NHS evacuation routes west of the NCR.

Summary of Project Options to Accelerate Construction

Options	Projects to Consider Option
Project Finance Options:	
Potential Revenue Sources:	
• User Fees	
• State/Local Taxes	
• Value Capture	
Federal-aid Grants Management:	
• Advance Construction	I-70 Phase 4, Corridor H (All Phases)
• Partial Conversion of Advance Construction	I-70 Phase 4, Corridor H (All Phases)
• Flexible Match	
• Tapered Match	
• Toll Credits (Soft Match)	I-70 Phase 4
• Transfers Between States	Corridor H (All Phases)
• Advances Between States	Corridor H (All Phases)
• Transfers Between Projects	Corridor H (All Phases)
Federal Credit Programs:	
• Transportation Infrastructure Finance and Innovation Act (TIFIA)	
• State Infrastructure Banks (SIBs)	
• Section 129 Loans	
Bonds/Debt Financing:	
• Grant Anticipation Revenue Vehicles (GARVEEs)	Corridor H (All Phases)
• Availability Payments	Corridor H (All Phases)
• Shadow Tolls	
• Private Activity Bonds (PABs)	
• 63-20 Issuance	
• Build America Bonds (BABs)	
Contract Administration Options:	
Construction Manager At Risk	
Cost-Plus-Time	I-70 Phase 4
Design-Build	I-70 Phase 4, Corridor H (All Phases)
Design-Build-Maintain (Operate)	
Incentive/Disincentive (I/D) Provisions for Early Contract Completion	I-70 Phase 4, Corridor H (All Phases)
Interim Completion Dates	Corridor H (All Phases)
Multi-Parameter Bidding including Quality (A+B+Q Bidding)	
No Excuse Incentives	
Stipulated Sum	I-70 Phase 4
Project Phasing	I-70 Phase 4, Corridor H (All Phases)
Lane Rental	
Partnering	I-70 Phase 4

Highway Evacuations in Selected Metropolitan Regions: Assessment of Impediments

Introduction

Almost 5 years after hurricanes Katrina and Rita battered Louisiana and Texas, respectively, public officials remain focused on the Nation's ability to safely evacuate large numbers of people. As a part of the Fiscal Year 2010 Department of Transportation Appropriations Conference Report (Public Law 111-117), the U.S. Congress requested DOT, in cooperation with DHS, to:

- *assess mass evacuation plans for the country's high-threat, high-density areas and identify and prioritize deficiencies on those routes that could impede evacuations*, and
- *conduct an analysis of how national highway system projects under construction west of the National Capital Region (NCR) could increase the NCR's evacuation capacity and provide a detailed plan to accelerate such projects*.

The section titled "Regional Findings" addresses the first assessment and involves a broad view of what local authorities view as the greatest impediments on their NHS routes in supporting a mass-evacuation operation within their region. The portion titled "Options for Accelerating Projects to Increase Evacuation Capacity West of the National Capital Region" will address the second study outlined in 2010 Conference Report accompanying P.L. 111-117.

> *"Ensuring the success of mass evacuations—The conferees direct the Department of Transportation (DOT), in cooperation with the Department of Homeland Security (DHS), to assess mass evacuation plans for the country's most – high-threat, high-density areas and identify and prioritize deficiencies on those routes that could impede evacuations. The conferees also direct DOT, in cooperation with DHS and the Office of the National Capital Region Coordination, to conduct an analysis of how national highway system projects under construction west of the National Capital Region (NCR) could increase the NCR's evacuation capacity and provide a detailed plan to accelerate such projects. DOT shall submit its report to the House and Senate Committees on Appropriations no later than 90 days after the enactment of this Act."*
>
> Departments of Transportation & Housing & Urban Development and Related Agencies Appropriations Act, 2010 Conference Report (111-366) to Accompany HR 3288 & Public Law 111-117, FY 2010 Consolidated Appropriations Act

Background

Evacuation operations occur daily throughout the Nation. Local jurisdictions manage evacuations, involving a single building, a neighborhood or an entire city. As such, evacuation expertise—including evacuation routes and potential impediments—lies with local authorities. In

a 2005 Nuclear Regulatory Commission report titled, "***Identification & Analysis of Factors Affecting Emergency Evacuations,***" the Sandia National Laboratories studied events that triggered evacuations over a 13-year period. Researchers discredited the common belief that hurricanes constitute the primary trigger of evacuations. They found that wildfires constituted the number one trigger of evacuations and that an evacuation of 1,000 or more people occurs every 2 to 3 weeks in the United States. The FHWA publishes "Evacuations in the News" on its Emergency Transportation Operations Web site-http://opsdev.fhwa.dot.gov/eto_tim_pse. This data informally demonstrates the validity of the NRC report, which identifies the triggers of evacuations depicted in Figure 4-2.

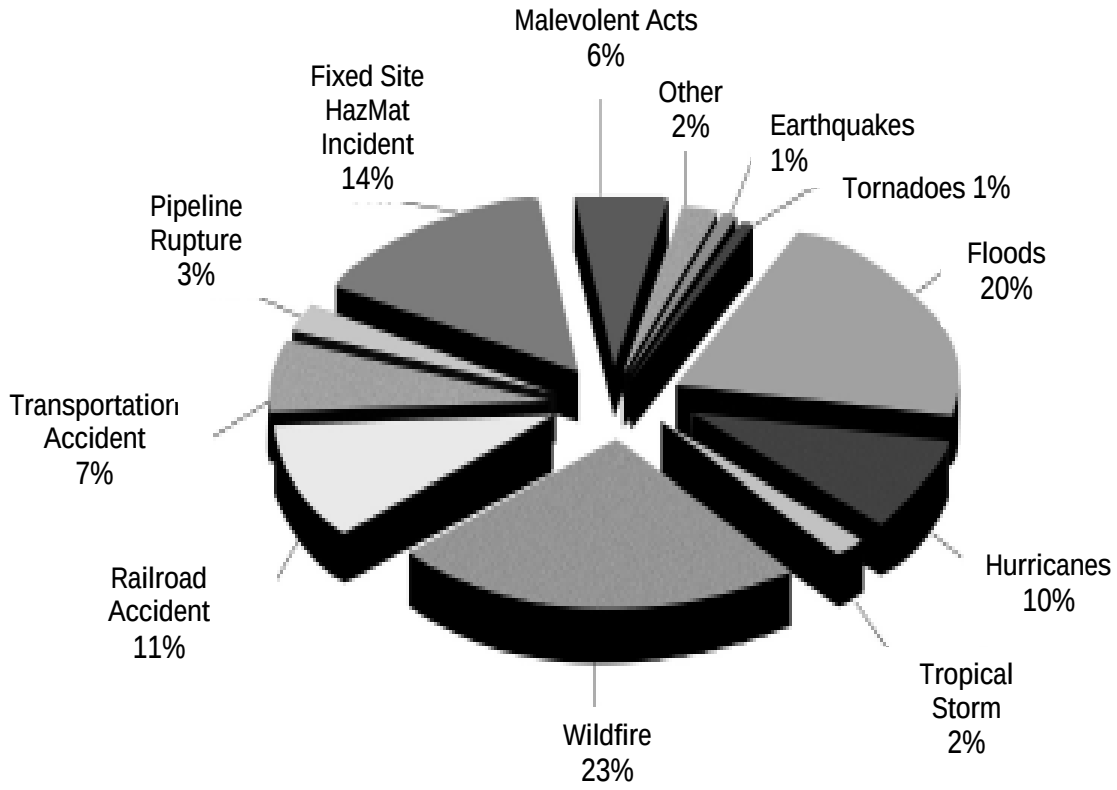
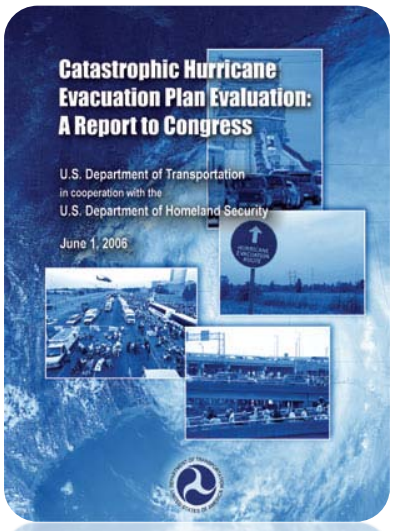


Figure 4-2. Principal Causes of Large-Scale Evacuation in the United Sates 1/1/1990-6/30/2003
Nuclear Regulatory Commission (NRC) *"Identification & Analysis of Factors Affecting Emergency Evacuations*," 2004

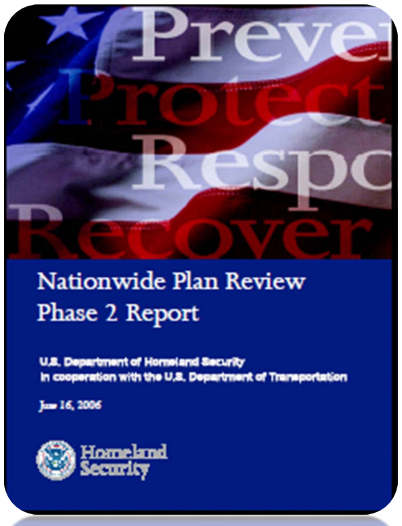
The importance of this research as applied to this report is that many of the metropolitan areas included below often experience evacuations, generally on a localized, small scale. Those jurisdictions not threatened by storms or hurricanes that may be provided with advance warning often stated that contraflow operations—a key tool to evacuate populations along the East Coast and Gulf States—would not work in their area. They commented that the proclivity of incidents

common to their area do not offer an advance warning. As such, readers should keep in mind that potential evacuation-level events will vary depending upon the jurisdiction. For example, while hurricanes and tropical storms may plague Louisiana and Florida, wildfires, flash flooding, or hazardous materials incidents may be the primary evacuation trigger in places like Denver, Chicago, or the Northeast.

This study complements assessments published in June 2006. Immediately following hurricanes Katrina and Rita, the U.S. Congress requested that DOT team with DHS in conducting two complementary studies of the efficacy of existing mass evacuation plans for Gulf Region States and emergency plans for local jurisdictions at risk from major hurricanes and other catastrophic events. In Section 10204 of the ***Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users*** (SAFETEA-LU) (P.L. 109-59) and Section 187 of the FY 2006 Department of Transportation Appropriations Act (P.L. 109-115), Congress specified that this assessment should include:



(1) all safe and practical modes of transportation available for evacuations;
(2) the extent to which evacuation plans are coordinated with neighboring States and adjoining jurisdictions;
(3) methods of communicating evacuation plans and preparing citizens in advance of evacuations;
(4) methods of coordinating communication with evacuees during plan execution;
(5) the availability of food, water, restrooms, fueling stations, and shelter opportunities along the evacuation routes;
(6) the time required to evacuate under the plan;
(7) the physical and mental strains associated with the evacuation; and
(8) the costs of the plans.



Congress directed that the Gulf State Evacuation Plan study also include the unique issues that arose during the evacuations in connection with hurricanes Katrina and Rita along with lessons learned in evacuations associated with other major catastrophic events.

Concurrent with the study of mass evacuation plans for the Gulf Coast Region, DOT collaborated with DHS on a study of catastrophic planning in States, territories, and major urban areas called for in the Conference Report (H.R.109-241) to the Department of Homeland Security Fiscal Year 2006 Appropriations Act (P.L. 109-90). Congress requested that DHS assess the status of catastrophic planning in all States and in 75 of the Nation's largest urban areas. This report, titled National Plan Review II, included a section assessing whether plans addressed three mass evacuation criteria.

This study differs from the 2006 reports. Congress asked that DOT and DHS focus on identifying and prioritizing deficiencies within the NHS that would impede effective mass evacuation operations. Where the ***Catastrophic Hurricane Evacuation Plan Evaluation***[3] and the ***National Plan Review***[4] evaluated the strategic elements of the plans, this assessment focuses on a singular tactical component—the road systems—as a part of effective evacuation plans. Therefore, readers should not construe large-scale, mass evacuations via the National Highway System as the only means by which localities respond to incidents. Nevertheless, many lessons learned from the 2006 studies are useful in establishing a frame of reference for this report.

Methodology

For this study, the DOT used a structured methodology to collect, review and assess information on mass evacuations in high-risk, high-population locations around the country. Based on the conference report language, FHWA used the following definitions in preparing the report:

- "…identify and prioritize current deficiencies on the recommended evacuation routes that could impede evacuations if not addressed" — Deficiencies were interpreted as any highway infrastructure, operations and ITS impediments perceived by local jurisdictions as a likely impediment to evacuation traffic flow.

- "To assess the mass evacuation plans for the country's most high-threat, high-density areas…" — The country's most high-threat locations include areas at risk from all hazards, whether natural or man-made, and will be included among the DHS Urban Area Security Initiative (UASI) regions.

- "…The conferees also direct DOT, in cooperation with DHS and the Office of the National Capital Region Coordination, to conduct an analysis of how national highway system projects currently under construction west of the National Capital Region (NCR) could increase the NCR's evacuation capacity and provide a detailed plan to accelerate such projects…." — This portion of the requirement will be covered in a separate section within this report, titled "Options for Accelerating Projects to Increase Evacuation Capacity West of the National Capital Region." This section differs from the "*Regional Findings*" section that precedes it due to the specific geographic requirements and the need to address how accelerating projects currently under construction might address impediments in those specific geographies.

- "…to conduct an analysis of how national highway system…" — Although mentioned in reference to the second study on deficiencies and suggested improvements west of the NCR,

Regions Included in the Study

Atlanta	**Minneapolis-St. Paul**
Baltimore	**National Capital Region**
Boston	**(DC, MD & northern VA)**
Charleston	**New Orleans**
Chicago	**New York City**
Dallas/Ft. Worth	**Philadelphia**
Denver	**Phoenix**
Detroit	**Portland, OR**
Hampton Roads, VA	**San Diego, CA**
Houston	**San Francisco**
Jacksonville	**Seattle**
Las Vegas	**St. Louis, MO**
Los Angeles	**Tampa-St. Petersburg**
Miami, FL	

[3] http://www.fhwa.dot.gov/reports/hurricanevacuation/

[4] http://www.dhs.gov/xlibrary/assets/Prep_NationwidePlanReview.pdf

the researchers determined that the focus of this study would also be restricted to a review of highways, not arterial routes. This study does not address transit issues; therefore, the deficiencies refer only to the use of highways to evacuate populations, not the interrelated transit and highway systems often used in major metropolitan areas during evacuations. Again, readers should understand that the road system is only one aspect of an overall approach localities would implement to protect residents in the event of an incident.

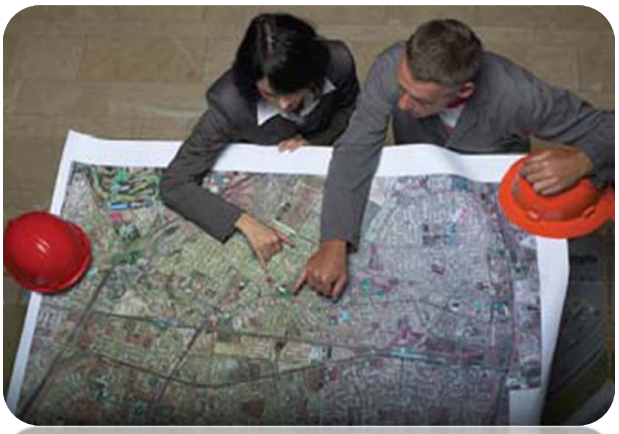
Because the DHS *Urban Area Security Initiative (UASI)* requires that 75 UASI areas develop an evacuation plan, FHWA elected to select the areas for this study from the UASI locations. Time constraints prohibited an assessment of all 75 UASI areas. As a result, FHWA narrowed the list of candidate regions to include in the study. Researchers used the following criteria to identify jurisdictions. The target areas had to be:

- subject to a range of threats that would trigger mass evacuations that include, but are not limited to, hurricanes/tropical storms, wildfires, floods, hazardous materials accidents and releases, and terrorist threats;
- among the top 100 most populated areas based on the U.S. Census (2000);
- geographically dispersed so that all regions of the Nation were represented in the study; and
- actively involved in emergency planning, increasing the likelihood that such that plans would be available for review.

Next, FHWA gathered stakeholders to discuss the requirements. The group included representatives of the DOT Office of the Secretary; the FHWA offices of Operations, Infrastructure, Policy, and Planning; the DHS Office of Infrastructure Protection and the Federal Emergency Management Agency (FEMA) Office of National Capital Region Coordination (NCRC) and Office of Response.

The FHWA collected plans from selected metropolitan areas and assembled a research team. After reviewing the plans and discussing the planned methodology with the DOT and DHS stakeholders, FHWA decided to supplement the plan review with interviews of the local planners since local jurisdictions possess the most relevant information on the highway impediments that would frustrate mass evacuation operations. The FHWA interviewed local jurisdiction points of contacts and included State DOTs and the FHWA Division Offices in the interviews. The results of these interviews constitute the primary source of the information that follows. Therefore, this report reflects the perceptions of interviewees as to the impediments they might face in an evacuation and should in no way be misinterpreted as a scientific analysis of data validating impediments likely to occur.

Regional Findings



The study found that almost every city cited daily congestion as one of the greatest impediments to planning for mass evacuations. As a result, the following snapshots of the studied metropolitan areas include results from plan assessments, interviews with local planners, and information contained in the ***INRIX® National Traffic Scorecard: 2009 Annual Report***.[5] The INRIX® scores indicate how severe congestion is relative to other parts of the country and provides a starting point for how severe day-to-day congestion is when considering how to plan for a highway-based evacuation. The data provides additional insight into the highway impediments that will frustrate area attempts to execute a mass evacuation. The INRIX® study looks at 100 metropolitan areas and the routes shown below in green. The areas in red constitute the worst bottlenecks along these routes, as described in the report, and on the individual city maps in the case studies.
The information presented below represents a composite assessment of plans provided by the

Figure 1. Map from INRIX® National Traffic Scorecard: 2009 Annual Report

[5] INRIX® authorized FHWA to use data from its copyrighted report, *INRIX® National Traffic Scorecard: 2009 Annual Report*

locations and interviews with city, State and Federal highway division officials, as noted in ***Appendix 1***. The plans are referenced in ***Appendix 2***. However, a few plans are considered "Sensitive," and the full document may not be available to the public.

Atlanta, Georgia

#11-Most Congested #8-Population (5,376,000)
INRIX® National Traffic Scorecard 2009

The Plan

While localized evacuations occurred in the fall of 2009 due to inundating rain, Georgia's most recent large-scale, mass evacuation occurred in 2004. A chemical fire impacted Rockdale County, to the east of Atlanta. Authorities evacuated approximately 8,000 people, giving instructions based on the direction of the plume. Since then, the State and local jurisdictions have discussed how best to update evacuation plans.

The March 2009 plan provided to FHWA for this study represents the Atlanta Region's most current evacuation plan proposal. This plan assumes a no-notice trigger. Once local plans are updated and the regional plan has more detail, the goal is to incorporate the plan into the State plan. It includes the 10 counties of the Atlanta Regional Commission's (ARC) planning area and 10 of the transportation planning area's 18 counties. The ARC[6], one of 12 regional commissions in Georgia and a Metropolitan Planning Organization (MPO), led this planning effort. Several years ago, the Georgia DOT (GDOT) hired a consultant firm to undertake an evacuation study of a 1-mile radius around the State Capitol in downtown Atlanta. The study provided data and input into the Atlanta Regional Evacuation Plan.

The March 2009 plan resulted from an 18-month effort that included transportation staff, public officials, emergency management agency directors, American Red Cross representatives and Georgia Emergency Management Agency (GEMA) staff. The mayor of Atlanta asked the ARC Board to work cooperatively to develop a regional evacuation plan, resulting in the strong support of elected leadership. The GEMA and the Fulton County Emergency Management Agency pooled funds and leveraged DHS grants with ARC transportation funds, using an MPO staff representative to participate on the Planning Advisory Team to develop the plan. The Fayette County manager, a former county Emergency Management Agency director and a former chair of the Area 7 All Hazards Council was a key leader and visionary of regional evacuation planning

[6] The Atlanta Regional Commission membership includes chief elected officials of the region and appointed citizen members.

and participated in the process. The ARC has a strong history of developing multidisciplinary plans as an MPO, an Area Agency on Aging, and other planning responsibilities in the areas of workforce development, regional development planning and water supply planning.

The most recent planning effort used a community-wide workshop concept, drawing more than 100 representatives from all levels of government, the United Way, the American Red Cross and other private and non-profit stakeholders. As a result, the plan emphasizes roles and responsibilities among responders. The Atlanta Regional evacuation plan includes a discussion of mutual aid agreements that arose from post 1996-Olympics legislation, as well as a discussion on how to incorporate the concerns of the special needs population into the plan.

Currently, authorities plan to include the following in the next iteration of the March 2009 plan:

- local annexes;
- discussion of database under development to identify special needs populations;
- updated arterial study;
- updated discussion on mutual aid and cooperative agreements to address liability weaknesses;
- section on how to use buses since school buses are not available for 4 hours to enable schools to evacuate school children, alleviating congestion on rural routes caused by parents heading toward schools;
- information on a traffic clearance tool, which is a database that may be populated with real-time traffic information so the public and authorities can get up-to-date traffic conditions information, and
- traffic signal coordination.

The next revision will be done within 3 years. The current plan identifies 12 evacuation zones and describes how people should travel out of those zones. Interviewees noted that the revised plan should include local participation to ensure that the localities agree with those evacuation zones. During the next planning cycle, officials will update the regional transportation plan by addressing the next level of detail, specifically at the local government level. The ARC notes that the next Transportation Improvement Plan (TIP) will include activities that support the following goals: promote safety, improve congestion, and integrate public safety and transportation efforts. Also, ARC will incorporate evacuation policy and assumptions into the next update of the 2005 Regional ITS architecture.

The GDOT is currently implementing a coordinated traffic signal project that will allow the Department to actively manage 300-400 traffic signals on certain key, cross-jurisdictional corridors. The corridor identification has not been finalized, but evacuation route designation was *not* a criterion for selection. It is possible that one or more routes selected by GDOT are designated for primary evacuation purposes. While the primary purpose of the project is to alleviate peak-hour congestion, it could also serve as an improvement for evacuation purposes.

Top Highway Impediments

The interviewees reported that the following impediments would impact a large-scale, mass evacuation from the Atlanta area:

1. **Contraflow Constraints** – Authorities believe that they will not be able to organize and execute a contraflow operation if needed. The current plan assumes that the expressway system will serve as the major evacuation route for cars, but interviewees indicate that they may not be practical for contraflow operations. For this reason, planning must include an emphasis on moving evacuees over arterial roads as well as freeways.

2. **Infrastructure Limitations** – Absent a contraflow operations plan, roads may lack sufficient lanes for a mass evacuation event. Also, poor drainage results in flooding and road closures (particularly during hurricane events), and the current designation of NHS routes does not exactly align with strategic evacuation routes.

3. **Arterial Road Systems with Overpasses Cannot Accommodate Trailer Heights** –The NHS includes many arterial systems. In Atlanta, NHS arterial roads include overpasses whose design complicates the accommodation of the height of 18 wheelers as well as military equipment moved on flatbeds. This might lead to potential blockages and clearance issues that would impede an evacuation along NHS arterial roads.

Top Highway Impediments ATLANTA

- **Contraflow Constraints**
- **Infrastructure Limitations**
- **Arterial Road Systems with Overpasses Cannot Accommodate Trailer Heights**
- **Bridge Weight Restrictions Impede Movements**
- **Traffic Data is Scattered Throughout the Region**

4. **Bridge Weight Restrictions Impede Movements** - Weight limits on bridges in parts of the Atlanta area would force heavier truck traffic onto NHS roads, increasing congestion on those roads and slowing an evacuation operations.

5. **Traffic Data is Scattered Throughout the Region** – There is no single source for mobility performance data in the Metro Atlanta Region. Instead, most local jurisdictions collect, manage, and maintain their own data to address their own local needs. The GDOT Office of Transportation Data maintains a statewide traffic counting program called STARS (State Traffic and Report Statistics), which is Web accessible. STARS includes historic and current traffic count data, and is either updated or estimated on a 2-year cycle (updated 2009 data will be available in mid-2010). As part of the regional Congestion Management Process (CMP), ARC is developing an architecture for maintaining a regional performance data clearinghouse that will allow local jurisdictions, as well as regional planning partners, to upload their data into a single location. The ARC is also exploring ways to encourage planning partners and jurisdictions to collect mobility data that meets certain minimum specifications and parameters (e.g., intersection turning movement counts must include a consecutive 48-hour time period).

   The ARC is currently undertaking a Strategic Regional Thoroughfare Plan, which will incorporate assumptions, findings, and recommendations of the 2009 Regional Evacuation Plan to help develop the Regional Thoroughfare Network (TFN) as well as associated policies and guidelines.

Baltimore, Maryland

#16-Most Congested #20-Population (2,667,000)

INRIX® National Traffic Scorecard 2009

The Plan

The Baltimore evacuation plan, written in 2004, is the oldest of the plans currently in use. The MDSHA plans to finish the modeling portion for evaluating and monitoring the plan.

All of the State's evacuation plans link together to ensure that should motorists need to evacuate from whatever city or site, they can be directed to the appropriate roads. As funding becomes available and when major changes in the roadway network occur, the older plans are updated. The Southern Maryland plans were completed about 18 months ago; the Eastern Shore plan is updated annually or bi-annually depending on any recent changes. The Eastern Shore plan is developed collaboratively with Delaware. The Anne Arundel County plan was completed about a year ago and links both the Washington, Baltimore, and Southern Maryland plans with the Eastern Shore and vice versa.

New planning efforts in the Baltimore metropolitan area will focus on Harford and Cecil counties north of Baltimore. This will also help address the needs for evacuation from such places as Aberdeen Proving Grounds, Peach Bottom Nuclear Plant, and other hazards including hurricane scenarios as well as routes to Delaware. This effort will be completed by the summer of 2010. When the Baltimore plan is updated, the transportation plan will incorporate a number of the many technologies and tools that the MDSHA has developed in recent years. One such tool used in this plan is the Regional Evacuation Traffic Monitoring and Management tool which relies on vehicle detection deployed in critical junctions along the roadway network which is the basis for real-time information and modeling for the Eastern Shore, Washington, DC, region, and, soon, the Baltimore region. As a result of including these tools, the Baltimore plan will be more dynamic. The use of real-time information and modeling will provide dynamic information that will allow for real-time changes and decisions. During an evacuation, operators can monitor evacuation routes to see which roads are at capacity and will be able to shift traffic in real time. What remains is to get the necessary infrastructure in place to accommodate these traffic shifts.

In addition, work is being done to see which roads out of Baltimore can be used for contraflow operations. Multimodal models and how transit can help to evacuate both Baltimore and the NCR will also be incorporated into the plan.

The MDSHA staff facilitates the preparation of the evacuation plan and relies on local stakeholders to develop the plans. Virginia, Delaware, Washington, DC, and Pennsylvania coordinate with MDSHA in the development of their plans. Pennsylvania approached the MDSHA as they were developing their plans to coordinate border plans for Harford County. Eventually, through the All Hazards Consortium, the Maryland plans will reach to West Virginia.

Top Highway Impediments BALTIMORE

- **Evacuation Plan Needs Updating**
- **Infrastructure Impediments-Roadways**
- **Region Lacks a Coordinated Signal Timing System**

Top Highway Impediments

Study respondents reported that the most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the Baltimore metropolitan area include:

1. **Evacuation Plan Needs Updating** – The Evacuation Plan is the oldest provided for the study, but it will be updated in the near future.
2. **Infrastructure Impediments-Roadways** – In the unlikely event that contraflow were to be implemented, to be effective for moving large numbers of people out of Baltimore, Route 295 does not have enough receiving lanes and would require some reconfigurations and crossovers. While there are not enough lanes, when the shoulders are used, movement is less constrained. Improvements would also be needed for the medians.
3. **Region Lacks a Coordinated Signal Timing System** - Baltimore does not have a regional, coordinated traffic signal timing system.

Boston, Massachusetts

#8-Most Congested #10-Population (4,523,000)

INRIX® National Traffic Scorecard 2009

The Plan

The Boston evacuation planning documents provided by the Massachusetts Department of Transportation (MassDOT) constitute the State's most current evacuation plan for the region. The plan extends as far as Route 128 and to I-95. The city of Boston has not had a reason to evacuate, except in a limited response to the September 11, 2001, attacks. Though Cape Cod has prepared plans to evacuate should a hurricane hit, they have not had to execute the evacuation plan.

The MassDOT plans to augment the

plan with further updates in 2010. To date, the Massachusetts State Police has identified 184 traffic control points in the Metropolitan Boston area that would require the deployment of law enforcement personnel and transportation resources to facilitate the flow of traffic away from the city. The MassDOT plans to review these points with the State Police and identify what specific MassDOT resources in the form of equipment, systems, vehicles and personnel would be best deployed to the points to support the flow of traffic. Plans to procure consultant support for this endeavor are being activated. This will be followed by a traffic modeling study to be completed by the Central Transportation Planning Staff that will validate assumptions and/or identify other considerations, including how transit organizations could support the effort.

The MassDOT reports the revision will be completed during the summer of 2010, and the modeling study completed by the end of the year. Once the work addressing the traffic control points has been completed, the results will become an annex to the State's comprehensive emergency management plan.

Should an evacuation occur, MassDOT would rely on the Massachusetts Emergency Management Agency (MEMA) to activate mutual aid agreements with local cities and towns. The State's concept of operations comes from the working relationship that includes MassDOT, the Executive Office of Public Safety and Security, the Massachusetts State Police, MEMA and the Department of Fire Services.

Boston currently benefits from a Homeland Security Grant to address evacuation planning as a part of catastrophic planning. The DHS/FEMA Regional Catastrophic Preparedness Grant Program (RCPGP) provides catastrophic events planning grants to the 10 highest risk urban areas and surrounding regions, including: Chicago, Los Angeles, Houston, New York, San Francisco, Washington, DC, ***Boston***, Honolulu, Norfolk, and Seattle.

Top Highway Impediments

The interviewees reported that the following impediments would impact a large-scale, mass evacuation from the Boston area:

1. **Contraflow Constraints** – Many of the roads in the Boston metropolitan area do not lend themselves to contraflow as the roads have multiple access points and off ramps. As the roads are very "exit heavy" it would be very labor intensive to manage a contraflow effort.
2. **Shoulders May Not be Able to Support Additional Evacuation Traffic** – Shoulders—or the dirt area off the road commonly called the breakdown lane—in the Boston area may not be used to consistently to support the safe flow of traffic. While motorists may use these to get through congested areas, shoulders cannot support the added traffic associated with an evacuation for extended periods of time, and their use would negatively impact the ability to use the shoulders for emergency service operations.
3. **No Place for Sheltering** – Once evacuees have left the city center, there are no large areas along the roadways that could be utilized to shelter motorists and large populations.

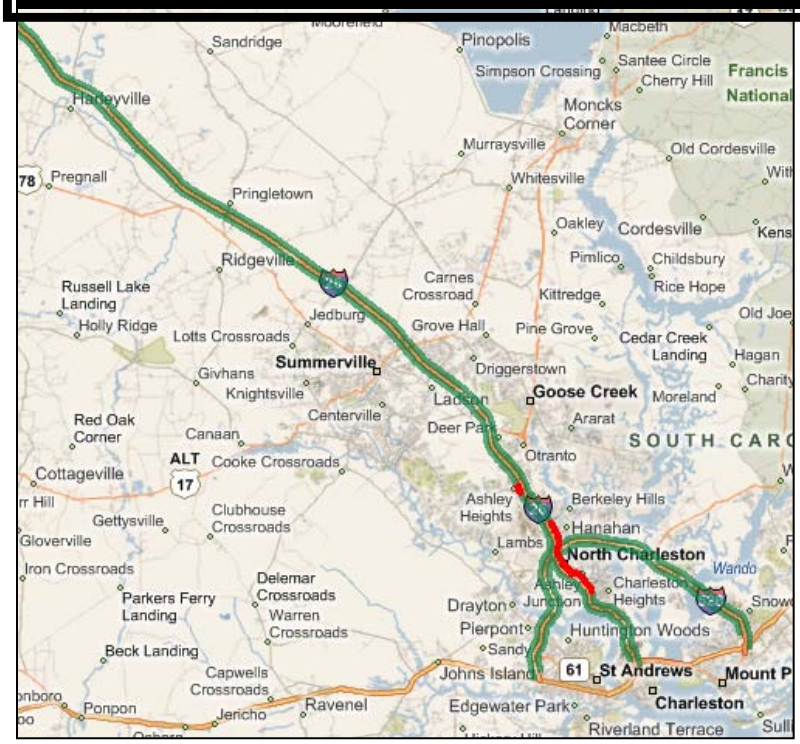
Top Highway Impediments BOSTON

- **Contraflow Constraints**
- **Shoulders May Not Be Able to Support Additional Evacuation Traffic**
- **No Place for Sheltering**

Charleston, South Carolina

#69-Most Congested #80-Population (645,000)

INRIX® National Traffic Scorecard 2009



The Plan

South Carolina improved its evacuation plans after Hurricane Floyd moved through the southeast in 1999, triggering one of the largest evacuations and contraflow operations in U.S. history until Katrina devastated Louisiana. Since then, South Carolina and its at-risk jurisdictions have been reviewing, revising, exercising, integrating, and improving their evacuation plans annually in preparation for hurricane season. South Carolina officials stated that the Charleston evacuation plan is current and is incorporated into the State and local emergency management agency's Emergency Response and Evacuation Plans.

The South Carolina DOT established and continues to sustain strong partnerships with the Highway Patrol and local communities to maximize the plan's effectiveness and efficiency. Every other year South Carolina conducts a table top exercise of the plan. On the opposite years a full field test of the plan is conducted with deployment of personnel and equipment. Authorities use lessons learned and good practices to enhance the plan during its annual revision.

The existing plan covers jurisdictions along the entire coastline. It establishes Evacuation Zones designed to minimize "clearance time," which is defined as the time it takes to move the first person to the last person out of an affected or high-threat area. The zones cover:

- Zone One (North) - Myrtle Beach, Georgetown, North Myrtle Beach, Surfside Beach, Garden City, Pawley's Island, and Conway
- Zone Two (Central) – Charleston, Mt. Pleasant, Isle of Palms, Johns Island, James Island, Kiawah Island, Sea Brook Island, and Edisto Island
- Zone Three (South) - Hilton Head and Beaufort

Authorities designed the plan with the assumption that they must move the affected population 100 miles away from the coast.

Top Highway Impediments

The interviewees reported that the following impediments would impact a large-scale, mass evacuation from the Charleston area:

1. **Infrastructure Constraints - I-26** – Current capacity on 1-26 would be exceeded during a mass evacuation event.
2. **East-West Evacuation Routes** –East-West evacuation out of Charleston, as well as other coastal areas to include the Hilton Head Island/Beaufort and Myrtle Beach areas, would be improved by additional routes and crossings.
3. **Lane Restrictions** – Respondents stated that a significant deficiency exists along current evacuation routes where traffic lanes reduce from four to two travel lanes, e.g., US 521/SC 261 from Andrews S.C. to US 378.
4. **ITS Capabilities along Evacuation Routes** - Expand the ability to share real-time information with Highway Patrol and Emergency Responders by adding surveillance cameras and Dynamic Message Signs (DMS) to routes.

Top Highway Impediments CHARLESTON

- **Infrastructure Constraint I-26**
- **East-West Evacuation Routes**
- **Lane Restrictions**
- **ITS Capabilities along Evacuation Routes**
- **Incident Responder Coverage Along I-26, Charleston to Columbia**

5. **Incident Responder Coverage Along I-26, Charleston to Columbia** - Safety/Service Patrols and Law Enforcement officers constitute important resources to clearing NHS roadway incidents on a daily basis. However, most are concentrated along roads within major metropolitan areas. Charleston believes that the limited coverage outside of the metro Charleston area would impact the flow of evacuation traffic along the I-26 corridor between Charleston and Columbia if such responders were not available and positioned along the corridor to address incidents during the evacuation.

Chicago, Illinois

#3-Most Congested #3-Population (9,570,000)
INRIX® National Traffic Scorecard 2009

The Plan

In Cook County, Illinois, (home to Chicago) during certain incidents, authorities may ask selected County residents to relocate for their safety. Illinois law delegates the responsibility for the protection of life and property, including evacuation decisions, to the affected jurisdictions' Mayor/ Village President and the County Board President of Cook County.

Interviewees report that the Illinois *Emergency Operations Plan* (IEOP) is the most current. The Illinois Emergency Management Agency (IEMA) Bureau of Disaster Assistance and Preparedness maintains and updates the IEOP. This document addresses

evacuation as part of Emergency Support Function #1 (ESF #1), Transportation. The Illinois Department of Transportation - Highways (IDOT-H) serves as the primary State agency for ESF #1 under the plan, and collaborates with the Illinois Commerce Commission, Illinois Department of Central Management Services, Illinois Department of Corrections, Illinois Department of Human Services, Illinois Department of Military Affairs, Illinois Department of Natural Resources, Illinois Department of Transportation - Division of Aeronautics, and the Illinois State Police. State officials are currently updating the 2-year-old IEOP after a recent annual review with the city of Chicago and to address after-action comments following the fall 2009 tabletop exercise. The update will be completed by the end of 2010 and will include new gated-ramp locations, improved exhibits for field personnel use, and better definition or correction of assumptions made in previous issues of the documents. The statewide plan incorporates the Chicago Central Business District (CBD) evacuation plan.

Each jurisdiction must develop a primary evacuation plan and transportation annex specific to community needs that will guide evacuation decisions and ensure a coordinated evacuation operation. The Cook County Department of Homeland Security and Emergency Management (DHSEM) coordinates the development of a county-wide evacuation plan, and the Cook County Sheriff's Police Department and suburban law enforcement conduct evacuation efforts, designate evacuation routes, provide traffic and movement control, and establish security in evacuation areas. Officials have identified basic primary, secondary, and tertiary relocation routes and described an implementation methodology in various Cook County emergency plans. A Regional Catastrophic Planning Team (RCPT) develops and maintains a multi–State, county, local jurisdiction evacuation plan.[7] The Sheriff's Police Department Command Center and the Cook County EOC house appropriate Geographic Information Systems (GIS) and maps displaying these pre-determined evacuation routes.

As a post 9-11 preparedness action, Illinois and Chicago considered plausible scenarios that would trigger a mass evacuation and identified vulnerabilities, hazards and risks to build into a plan. In Chicago's case, this would entail evacuating about 660,000 people from the Chicago CBD. The evacuation plan, shared with the Regional Transit Security Working Group (RTSWG), is reviewed annually and includes Pace Bus as a resource.

The city evacuation plan includes evacuation of the city of Chicago out to the far suburbs and beyond and procedures to notify suburban officials. The new draft addresses how the Chicago agencies will work together and recognizes the Chicago Transit Authority (CTA) plan because exiting the Chicago CBD requires either personal transportation or CTA resources. The Chicago evacuation plan includes various evacuation components from CTA, Metra, and IDOT. While the plan generally addresses evacuation within Cook County, planners recognize that they would require resources from other metropolitan Chicago counties. The CTA plan goes no further than the outer limits of the CTA service area, but covers the northern and southern boundaries of Cook County, Lake Michigan on the east and State Route 83 on the west. As part of the DHS/FEMA RCPGP, planners will extend the scope of the evacuation plan to the 10 northeast Illinois counties, Kenosha County, Wisconsin, and five northeast Indiana counties.

Chicago currently benefits from a Homeland Security Grant to address evacuation planning as a part of catastrophic planning. The RCPGP provides catastrophic events planning grants to the 10

[7] The RCPT includes the Cook County DHSEM, Chicago's Office of Emergency Management and Communications (OEMC), other Metro County Emergency Management Agencies, and the IEMA.

highest risk Urban Areas and surrounding regions, including: ***Chicago***, Los Angeles, Houston, New York, San Francisco, Washington, DC, Boston, Honolulu, Norfolk, and Seattle.

Top Highway Impediments

The interviewees reported the following impediments along NHS routes that may impact effective large-scale, mass evacuations from the Chicago metropolitan area. Respondents also stated that impediments on arterials and other endemic challenges will frustrate efforts to move citizens out of harm's way.

Top Highway Impediments CHICAGO

- **Traffic Congestion**
- **Emergency Vehicle Access**
- **Railroad Crossing/Street Blockage**
- **Contraflow Operations Would Impede Evacuations**
- **Real-Time Highway Information for Responders & the Public**

1. **Traffic Congestion** – Traffic congestion in the CBD constitutes the most significant deficiency. There are various pinch points along many routes as they leave the city. In considering evacuating Chicago, IDOT considers the ½ million cars that transit into the CBD each morning and trying to get them out of the area, as well as those that will depend on transit to access their vehicles parked outside the CBD.
2. **Emergency Vehicle Access** – The city needs clear routes reserved solely for movement of emergency vehicles into and out of the zone being evacuated.
3. **Railroad Crossings/Street Blockage** – Traffic attempting to evacuate an area without sufficient traffic control can create blockages of at-grade rail crossings and arterials being utilized as evacuation routes.
4. **Contraflow Operations Would Impede Evacuations** – After extensive review of contraflow operations as an option to conduct mass evacuations, it is the consensus of local metropolitan officials that using contraflow would be a deficiency impacting the overall goal of moving people out of the CBD in the case of a "no-notice" event that required mass-evacuation. The IDOT addresses contraflow operations as a tab in its evacuation plan. However, because respondents believe contraflow operations could not be implemented in an immediate emergency situation, Chicago planners have not fully developed these plans. Only one NHS route in the area has reversible lanes established to ease contraflow. However, after careful review, respondents concluded that contraflow planning and operations would not be effective and could serve to congest an entire roadway that could be used for emergency vehicles. Officials concluded that impediments would impact the time and cost for conducting evacuations. They noted that while contraflow may work well in hurricane scenarios where there is time to coordinate and execute such an operation, they doubt the effectiveness of contraflow for immediate-impact incidents or no-notice events. Chicago officials expressed a major concern about their ability to execute a contraflow operation along any of their highways in response to a "no-notice" catastrophic event. Officials indicate that such an operation would require a very complex command and control system that would involve representatives of all the jurisdictions along those evacuation routes. This would entail integrating regional plans, designation of Incident Commanders, development of Memoranda of Understanding (MOUs) among all local governments, and

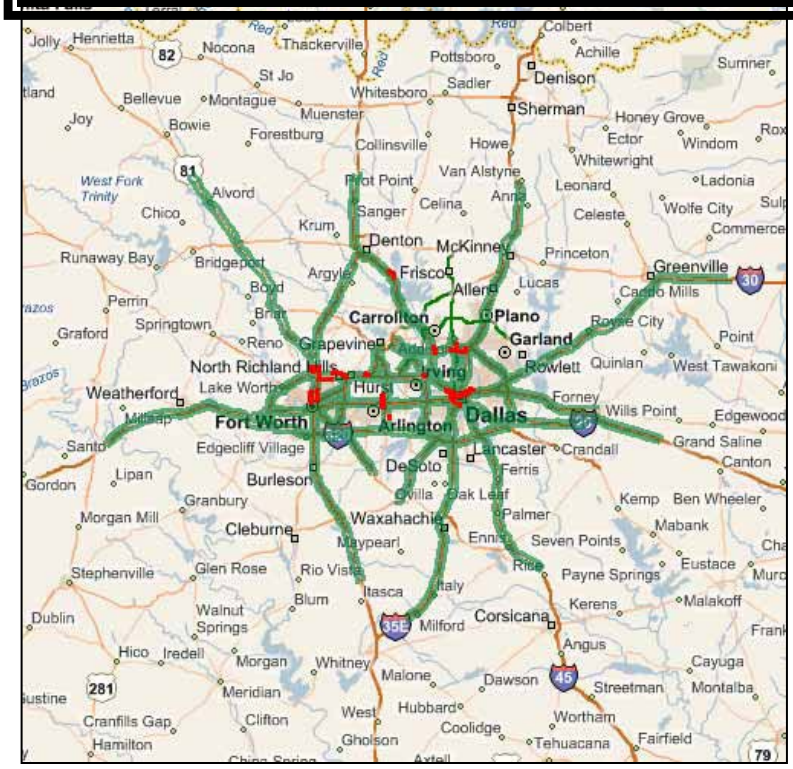
coordination of communication (e.g., radio, data, GIS sharing) resources and activities among all involved agencies.

5. **Real-Time Highway Information for Responders and the Public** – From an emergency management perspective, accurate and timely information and directions issued to the impacted populations on what actions to take is critical and must be provided through a Joint Information System (JIS), which will coordinate information among agencies across jurisdictional lines. Real-time situational awareness information on highway conditions, alternative routes, and evacuation instructions is critical to the evacuees and responders.

Dallas/Ft. Worth, Texas

#5-Most Congested #4-Population (6,300,000)

INRIX® National Traffic Scorecard 2009



The Plan

The Texas DOT (TxDOT) does not have a mass evacuation plan for the Dallas-Ft. Worth area. In 2007, the North Central Texas Council of Governments for the Dallas/Ft. Worth (DFW) region hosted a workshop to discuss evacuations and incident response. Participants did not produce a plan since they concluded that citizens would be better to shelter-in-place rather than on the freeway system. The city's plans for large events with sufficient advance notice such as a hurricane work well, but short-notice, localized incidents would be difficult to plan for in advance.

Respondents noted that based on potential threats endemic to the region, emergency officials would rather have people shelter-in-place. For example, a high wind event (e.g., tornado) constituted the most serious concern to DFW responders, and they would rather residents stay home in their basements than be out on the road in their cars. During the interview, DFW officials also commented that they do not see a need for contraflow plans or operation in the region. They said that it would not be clear which direction to push the evacuation and felt that contraflow was more appropriate for coastal areas where there is a clear direction to send people (e.g., inland).

The DFW region received an Integrated Corridor Management Grant from DOT which when complete will greatly enhance the ability to manage traffic on the pilot corridor. These systems and experiences will then be spread throughout the DFW region and would greatly assist the region's ability to respond to an evacuation, if needed.

Top Highway Impediments

Local officials noted that mass evacuation is not their top transportation planning priority. However, through responses to the FHWA survey, the following would impede a large-scale, mass evacuation in the DFW region, should one be ordered:

Top Highway Impediments
DALLAS-FT. WORTH

- **Infrastructure Limitations**
- **Lack of Cameras along Key Routes**
- **Evacuation Plans Do Not Exist**

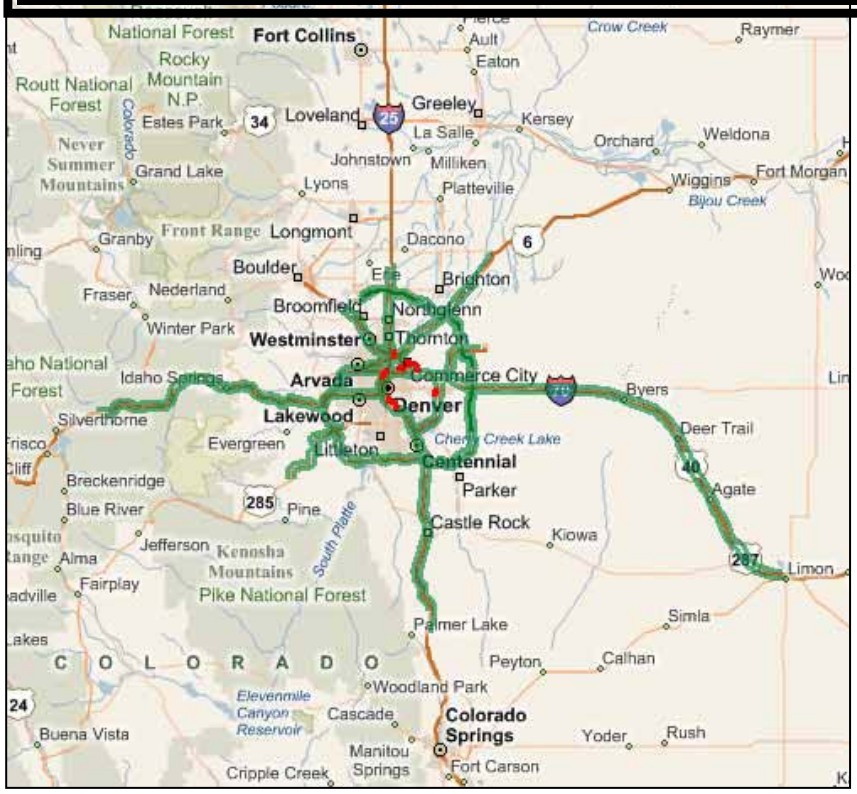
1. **Infrastructure Limitations** – Specific impediments include lane reductions on I-35W north of the I-30 interchange, which constrains north- and south-bound movements, as well as limited capacity on I-35W, Loop 820 north, and SH-121.

2. **Lack of Cameras along Key Routes** – Officials stated that traffic cameras and staffing at the TMCs to monitor the video input are insufficient to provide full situational awareness during evacuation operations on key Interstates and State highways.

3. **Evacuation Plans Do Not Exist** –Officials could more effectively coordinate evacuation operations if a scenario-based evacuation plan existed. Officials could then coordinate plans with potentially impacted neighboring jurisdictions and exercise them to identify their strengths and areas for improvement.

Denver, Colorado

#15-Most Congested #21-Population (2,507,000)
INRIX® National Traffic Scorecard 2009



The Plan

Currently, no Colorado DOT (CDOT) plan specific to evacuation operations exists. However, individual communities develop and maintain evacuation plans to address events such as fires or floods. The North Central Region, which is comprised of 10 counties in the Denver metropolitan area, has begun to develop an evacuation plan that covers a 25-mile radius outside the Denver metropolitan area. The plan is titled the *North Central Region Mass Evacuation Plan* (draft-June 2008). This plan is only focused on evacuation of some parts of the metro area and not all areas at one time. An interviewee noted that the reason an evacuation plan was

developed for the North Central Region was because it is part of the DHS UASI, which requires that 75 UASI areas develop an evacuation plan.

Top Highway Impediments

The interviewees reported that the following impediments would frustrate large-scale, mass evacuation efforts in the Denver and the North Central Region of Colorado:

1. **No Evacuation Plan** – Interviewees noted that since there is no final plan, there are no elements that would be identified in a plan, such as evacuation routes and signs or directional indicators to identify evacuation routes. One respondent stated that the next step for the North Central Region is to hold a workshop and to start working through some of the more specific issues identified in the ***North Central Region Mass Evacuation Plan***, such as the risk-based areas of exit. This workshop is scheduled for May 2010. The plan does not address contraflow operations.

2. **No Evacuation Routes Identified** - No evacuation routes are identified.

3. **No Lane Assignments for Emergency Services** – Denver authorities maintain no designated lane assignments for the movement of evacuees and emergency services equipment.

4. **Infrastructure Limitations** – Respondents noted that the Denver area has only one major highway running north to south (I-25) and one running east to west (I-70). These highways have significant restrictions in the number of lanes, curves and choke points which severely affect traffic throughput. These two highways are the only major roads which exit the metro area. Several other smaller highways feed these two which will also increase traffic volume in the event of an evacuation. Those interviewed indicated that the biggest limitation is that all the routes out of Denver turn into two lanes outside the metropolitan area. An evacuation study that collected additional information regarding system choke points would aid evacuation planning and operations.

Top Highway Impediments DENVER

- **No Evacuation Plan**
- **No Evacuation Routes Identified**
- **No Lane Assignments for Emergency Services**
- **Infrastructure Limitations**
- **Traffic Flow Analysis on Evacuation Routes**
- **Weather Hindrances**

5. **Traffic Flow Analysis on Evacuation Routes** – During the interview, it was noted that one analysis that has not been done is a traffic flow analysis to determine the maximum capacity of highway infrastructure, particularly on I-25 and I-70 and some of the arterials that would support an evacuation. Most of those interviewed do not believe that any time-model studies exist on the capacity of infrastructure that might be used for an evacuation. These studies, for example would consider how long it would take to move 50,000 people during off-peak and peak hours. However, one respondent associated with the North Central Region planning effort noted that their traffic management committee conducted a general analysis for all of the major routes, looking at the different levels of service and capacities. The draft ***North Central Region Plan*** includes a diagram showing the city and its major highways including contraflow lanes leaving the city. The committee made an assumption that inside the C-470 loop there is not a lot that can be done to control traffic movement.

6. **Weather Hindrances** – Depending on the time of year the incident occurs, another impediment may be weather-related, specifically snow, rain, or flooding. Officials noted that one assumption about the potential for evacuating populations from Denver is there are no events that could occur within the State of Colorado that would give enough advance notice to execute an evacuation. As a result, instead of evacuating to escape harm's way, officials may evacuate to mitigate any threats to the population, such as a chemical spill or some type of nuclear device detonation where there is little to no notice.

Detroit, Michigan

#27-Most Congested #11-Population (4,425,000)
INRIX® National Traffic Scorecard 2009

The Plan

Planners in the Detroit metropolitan region believe that since the area is not subject to the type of emergencies and disasters that affect other parts of the country the potential for mass evacuations is low. As a result, they do not dedicate many county or local resources to plan and prepare for a mass evacuation. For this reason, Detroit lacks a mass evacuation plan.

Nevertheless, city of Detroit officials reported that a few years ago they developed internal, baseline evacuation plans within each city police district. In downtown Detroit, an area called Eastern Market, sits near multiple expressways. Officials, concerned about a tornado scenario given only 20 minutes notification, started to develop a program to address evacuations in this area. Another scenario involved mass evacuations for a planned special event, particularly the 4th of July fireworks in downtown Detroit that typically includes up to 1 million people concentrated along the river. In that plan, Detroit officials plan for contraflow operations, basically turning every route outbound. Detroit officials noted that historically most evacuations are localized, not "mass"—or larger scale—evacuations. Detroit officials conceded that they must consolidate all of the District-based plans into one plan to assess the plan from a strategic perspective.

Michigan uses three plans as the basis for organizing and conducting mass evacuations. These include the:

- ***Emergency Highway Traffic Regulation (EHTR)*** plan, which also addresses disaster recovery and moving responders into an area while evacuating large populations and is

updated every 1 to 3 years and coordinated with various State and Federal governmental agencies. It currently is being updated.

- Michigan Department of Transportation's (MDOT's) ***Emergency Response Plan***, updated every 3 to 6 months; and

- State of Michigan ***Emergency Management Plan***, updated every 5 years. Since Michigan last updated the Emergency Management Plan in 2005, it is due for a revision in 2010.

Michigan authorities established these plans to manage and control the use of highway systems in a post-nuclear attack or other severe situation. Although it is not called an evacuation plan by name, it provides a framework and the related authorities to move traffic in a severe situation. To prepare for various scenarios, MDOT stated that they have addressed traffic planning for special events, but not for natural disasters or catastrophic events that would cause mass evacuations. During the interview, officials indicated that the mobility issues addressed in consideration of planned events that occur in the downtown Detroit area may be applied to organizing and conducting a mass evacuation triggered by natural or man-made events.

Top Highway Impediments DETROIT

- **Infrastructure Conditions Impede Responder Operations**
- **Congestion**
- **Bottlenecks on Freeways, including Narrow Freeway Lanes and Limited Shoulders**

Top Highway Impediments

The interviewees reported the following most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the Detroit metropolitan area.

1. **Infrastructure Conditions Impede Responder Operations** – Poor conditions of NHS roads would impede responder attempts to manage traffic incidents during an evacuation or reach motorists in distress. For example, the shoulder width and disrepair along many stretches wide would frustrate responder attempts to reach incidents or motorist efforts to pull disabled vehicles to the side of the road.

2. **Congestion** – County respondents indicated that some of the areas within the Detroit CBD could become very congested because the potential evacuation routes constitute existing three-lane Interstates with narrow shoulders.

3. **Bottlenecks on Freeways, including Narrow Freeway Lanes and Shoulders** - Freeways and Interstates would impede an evacuation in key congested areas such as I-75, I-94, I-96, I-275, and I-696 as travelers go west. The eastbound traffic will be limited due to the two existing vehicular border crossings including the approaches.

The MDOT reported that although contraflow operations are addressed at a very high level within the Emergency Response Plan, they have never been tested—nor is testing desired—because it would be extremely complicated and would apply only to the State highways.

Hampton Roads, Virginia
(Virginia Beach, Norfolk & Newport News)

#31-Most Congested #35-Population (1,658,000)
INRIX® National Traffic Scorecard 2009

The Plan

Authorities updated the Hampton Roads evacuation plan in 2009 (updates occur annually). The 2009 version includes transportation changes. Authorities integrated the Hampton Roads evacuation plan into State and local EMA plans.

The Commonwealth of Virginia maintains an evacuation plan only for Hampton Roads though they are currently working on a plan for the National Capital Region. The Commonwealth shares their evacuation plan with North Carolina. Every spring, North Carolina and Virginia meet to share plans with both the State and local agencies. The meeting rotates between Virginia and North Carolina each year. Although Virginia has never ordered an evacuation of the Hampton Roads area, North Carolina has had to evacuate its Eastern shore populations several times, particularly in response to a hurricane or tropical storm. In addition to coordination meetings with North Carolina, Virginia meets with neighboring States, including Delaware and Maryland, to update its plan. This occurs quarterly, where Virginia, Delaware, and Maryland representatives discuss issues of mutual concern, including evacuation planning.

The Commonwealth's Emergency Response plan incorporates the entire State due to the potential need for sheltering populations. Most pre-identified shelter sites lie along the I-81 corridor or other locations in western Virginia. The pre-identified shelters large enough to take care of people and animals are located on the campuses of universities in the western part of Virginia, including the University of Virginia and James Madison University.

Norfolk, one area within the Hampton Roads region, currently benefits from a Homeland Security Grant to address evacuation planning as a part of catastrophic planning. The DHS/FEMA RCPGP provides catastrophic events planning grants to the 10 highest risk Urban Areas and surrounding regions, including: Chicago, Los Angeles, Houston, New York, San Francisco, Washington, DC, Boston, Honolulu, ***Norfolk***, and Seattle.

Top Highway Impediments

The interviewees reported the following most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the Hampton Roads region:

Top Highway Impediments HAMPTON ROADS

- **Traffic Signal Timing**
- **Number of Water Crossings**
- **Limited ITS Deployment Along Key Evacuation Routes**
- **Flood-Prone Infrastructure**
- **Human Resources to Manage Evacuation Operations & Tools**

1. **Traffic Signal Timing** – The limited ability to properly adjust traffic signal timing could impact the region's ability to evacuate populations.

2. **Number of Water Crossings** – The Hampton Roads area has five bridge-tunnel crossings that hamper the ability to evacuate the population. These crossings are known bottlenecks during daily traffic and would be expected to be more so during evacuations.

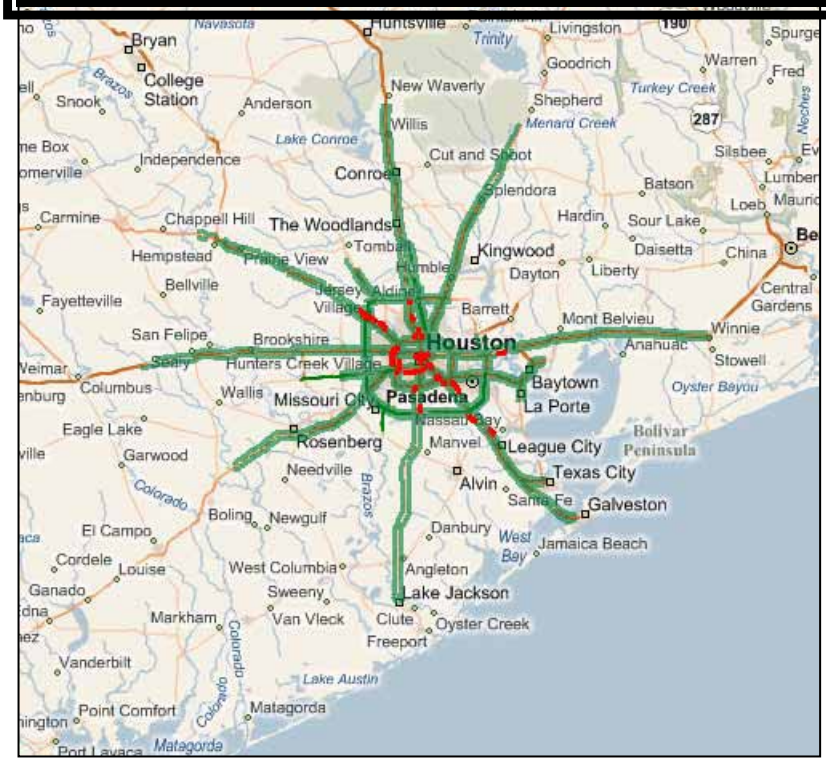
3. **Limited ITS Deployment Along Key Evacuation Routes** - The ITS technology is only deployed along the Interstates, though most evacuees would use US routes 460 and 58 and possibly 60 and 17. Having ITS on these routes would help manage evacuations.

4. **Flood-Prone Infrastructure** – The Tidewater region is a low lying area and routes 17, 460, and 58 are prone to flooding so they would need to evacuate residents before the floods. The biggest concern would be back-to-back storms that would limit the ability to get to people before or during the second storm.

5. **Human Resources to Manage Evacuation Operations and Tools** - Highway Advisory Radio (HAR) covers Tidewater routes in the Hampton Roads area. Also, statewide 511 provides real-time traveler information to regional motorists. However, both staff and contractor availability remains a significant issue that would limit the effectiveness of an evacuation. Though Virginia would depend on Commonwealth employees to staff contraflow operations, a contractor manages I-64. Though the contractors are supposed to help during these events, currently the task to do so is not included in their contract. The contract comprises a number of subcontractors, and it is unknown if the subcontractors will be available if needed. To staff the lane reversal, VDOT would have to pull in hundreds of VDOT staff from outside the area to help manage the activity.

Houston, Texas

#6-Most Congested #6-Population (5,728,000)
INRIX® National Traffic Scorecard 2009



The Plan

The June 2006 plan provided by the Texas Department of Public Safety (DPS) for this study represents the most recent version of the State evacuation plan. State authorities rely on local officials to develop their portion of the State plan. Though local involvement previously existed in plan development, involvement in plan updates increased at all levels of government as they discovered gaps from recent major events, including Hurricane Rita.

Good communication exists between the coastal area and the cities some 30 to 50 miles away, such as Houston. This enables decision-makers to ensure timely actions are taken to evacuate coastal populations first. Often, these authorities make evacuation decisions in real-time as updated weather and road conditions information is received. Recent plan changes include who makes the evacuation decision. Before the change, the State decided when and who would be evacuated.

In the six months prior to the start of the Atlantic hurricane season, Houston authorities update public maps, share them with the public, and coordinate on improvements for the upcoming season. Houston area leadership meets regularly at TranStar, Houston's regional traffic and emergency management center which also houses public safety and Houston Metro, to discuss hurricane, hazardous materials or other triggers that might lead to an evacuation. Often, the team discusses the evacuation and shelter-in-place plans, the latter used for chemical release or weather events. Galveston and Austin collaborate through a formal agreement in which Austin would shelter Galveston evacuees. In addition, other cities in Galveston County partner with sister cities that agree to accept the evacuees. Some cities issue monitoring wrist bands to allow the State's EMA to track evacuees.
The local MPO may support evacuation planning by developing tools for their jurisdictions and aiding in regional coordination. For example, the Houston-Galveston Area Council of Governments (HGAC), as the Region's MPO, developed a database with all of the traffic management locations. This information is shared with the DPS, and the MPO shares it with other agencies as requested. The Houston MPO is much more active in the development of the plan than the receiving cities' MPOs. The respondents noted that the officer making the

calls in the local region maintains the updated version, from which local decision makers base their evacuation decisions.

Each year, regional DPS officers meet with local jurisdictions to review the plan and update it to reflect new road construction and other changes. While individual plans are edited, the State-approved plan does not reflect these edits. The lengthy review process before the revised State plan can be approved results in a time lag between changes in local plans and changes to the State DPS-approved plan.

Those areas that are more likely to evacuate meet regularly to ensure the plan is up-to-date. As a result from what was learned from Hurricane Rita, Houston realized that their evacuation plan needed to extend 100 miles outside the city. In such an event, Dallas would serve as a receiver city. Dallas and Houston meet annually to discuss updates to the plan that concern both cities. Dallas and Houston exercise and train together annually to test their portion of the plan. Galveston and Houston meet annually to discuss plans and updates. County judges, who are the officials responsible for making the decision for the county to evacuate, host these meetings.

For Houston, police monitor the traffic control points during an evacuation, and consider improvements to the transportation portion of the plan. More critical to the success of the plan is that both the police and emergency managers make changes to the plan together. Both the police and emergency managers talk to the transportation operation people about routes, roads, including talking with engineers regarding traffic signals to ensure that the plan includes updates and that they understand current limitations. An example of one such limitation recently addressed dealt with Highway 6 which goes through several jurisdictions. Though it is a TxDOT facility, Highway 6's signalized traffic control system in some cities is operated by those cities. As a result of shared control, officials undertook a coordinated effort to develop a plan for the corridor.

The interviewees reported that communication among agencies, including the Department of Public Works, continues to improve due in part to the success in migrating to the Regional Radio System (800MHz). In addition, the city of Houston is implementing a completely new public safety communications system (700 MHz). The communications equipment purchased by Houston works on both the 700 MHz and 800MHz to allow integrated communications.

Figure 2. Evacuation of Houston prior to Hurricane Rita on I-45

In early April 2010, the Houston TranStar announced the launch of a new Web-based emergency evacuation mapping system that will improve the coordination of major evacuation efforts in the Gulf Coast region. The interactive evacuation status map will allow transportation managers, law enforcement and other first responders to use real-time information to coordinate and monitor traffic flow, personnel deployment, weather and other conditions during large-scale evacuations. Houston TranStar created the state-of-the-art evacuation system by incorporating the latest ITS technologies to improve the safety and efficiency of major evacuation efforts.

Houston currently benefits from a Homeland Security Grant to address evacuation planning as a part of catastrophic planning. The DHS/FEMA RCPGP provides catastrophic events planning grants to the 10 highest risk Urban Areas and surrounding regions, including: Chicago, Los Angeles, ***Houston***, New York, San Francisco, Washington, DC, Boston, Honolulu, Norfolk, and Seattle.

Top Highway Impediments

The interviewees reported the following most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the Houston metropolitan area.

Top Highway Impediments HOUSTON

- **Bottlenecks**
- **Communications with the Public**
- **Number/Type of Resources to Deploy**
- **More CCTV Cameras**
- **Modeling Timeliness**

1. **Bottlenecks** – As the population of Houston travels outward, they would encounter roads that narrow to 2 lanes which may create bottlenecks under certain heavy outflow scenarios. TxDOT is developing plans to limit bottlenecks. For example, authorities can order a halt to construction/work zone operations to alleviate bottlenecks when an event occurs.

2. **Communications with the Public** – State officials work with local authorities on thresholds and how to inform people when to evacuate. During Hurricane Ike in 2008, local officials demonstrated that they had made progress to communicate a consistent message. Since Texas has increased technology that enables decision makers to see conditions far beyond the local area, such as where traffic is moving, they are now able to tell those who do not need to evacuate to stay.

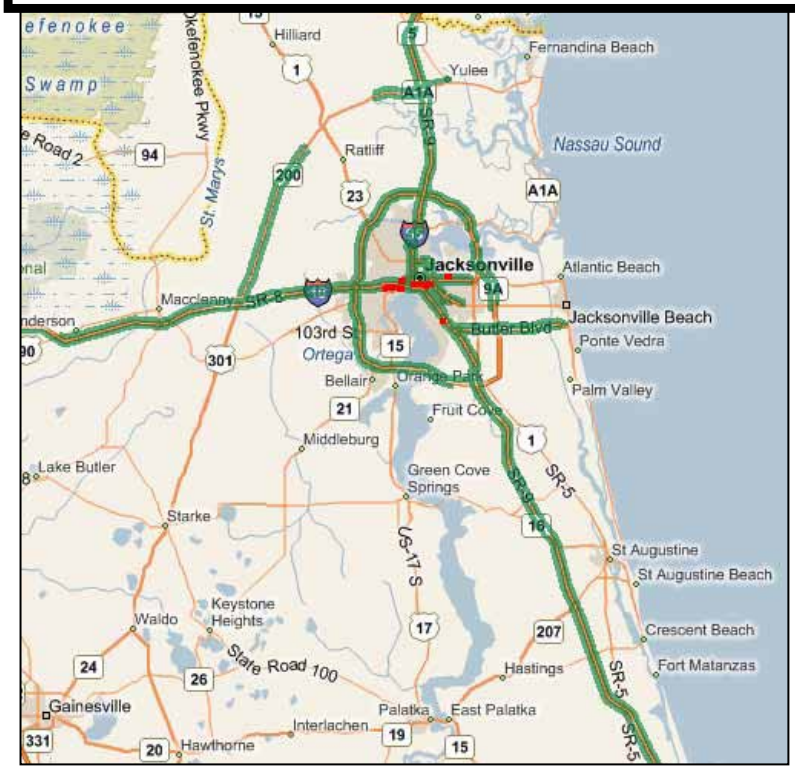
3. **Number and Type of Resources to Deploy** – Officials continue to struggle with how many, what types, and where to deploy responders and other resources to support evacuation operations.

4. **More CCTV Cameras** – The various cameras along the evacuation corridors allowed officials to observe traffic and make better projections on when the congestion will dissipate.

5. **Modeling Timeliness** – The local MPO is investing in modeling software to aid decisions to evacuate. However, most software programs take a long time to process data. The MPO seeks a software package that will take 2 to 3 hours (versus overnight) to provide information. As part of that effort, the MPO is working with three universities on different models as well as looking at different technologies.

Jacksonville, Florida

#49-Most Congested #40-Population (1,313,000)
INRIX® National Traffic Scorecard 2009



The Plan

Florida is one of the States that is on the forefront of emergency readiness, response and planning. In 2005, Florida developed the Contraflow plan for the Florida Interstate Highway System (FIHS). This plan identified the following routes that could be used for evacuation: *Sarasota County's I-75 Shoulder Use Plan*, ***Jacksonville's I-10 Contraflow Plan,*** *Space Coast's SR 528 (Beeline Expressway) Contraflow Plan*, *Tampa Bay's I-4 Contraflow Plan*, *Florida Turnpike Contraflow Plan for Southeast Florida and Southeast/ Southwest Florida,* and *Contraflow Plan for I-75/Alligator Alley*. The Florida Department of Transportation (FDOT) State Traffic Engineering office in Tallahassee keeps the plans current. Within this office, the Deputy Traffic Engineer for Incident Management manages this program.

Florida has spent close to $1 billion to deploy ITS technology to enhance highway operations. As a part of that effort, the State migrated to a single statewide TMC Software (SunGuide) beginning in 2004. All TMCs across the State in Miami, Tampa, Jacksonville, Fort Myers, Fort Lauderdale, Orlando, and the Florida Turnpike in Orlando and southeast Florida use the SunGuide software. The State EOC in Tallahassee also installed the SunGuide software for use by the Emergency Support Function #1 (Transportation) liaison that operates at the EOC when activated during time of emergency operations. This single platform enables the State to share controls of cameras and other devices in real-time.

In November 2006, FDOT and the Florida Department of Emergency Management—in concert with FEMA—initiated the development of the comprehensive "**Florida Catastrophic Planning Project,"** which considers two, large-scale incidents resulting in projected consequences of catastrophic proportions: a breach of the Herbert Hoover Dike (HHD) around the waters of Lake Okeechobee and a Category 5 hurricane impacting the entire South Florida peninsula, which has a population of nearly 7 million.

This project includes data collection and comprehensive capability assessments of local, State, and Federal resources to support response to a failure of the HHD and a Category 5 hurricane striking South Florida. Analysis of the assessments and draft county plans will help to identify resource gaps, inconsistencies, and competing interests for limited resources.

For the purpose of this study, respondents reported that the State plan is current, the Florida Catastrophic Plan will be completed soon, and the FIHS Contraflow plan, published in 2005, undergoes continuous updates. While Florida maintains a robust support system for evacuations, local authorities call for an evacuation, and coordinate evacuation decisions with neighboring counties. The State views evacuation operations from a strategic view and supports the local efforts by ensuring requested assistance is available.

The FDOT also provides support to local jurisdictions during evacuation operations, for example, with FDOT service patrols. In addition, FDOT makes available DMS to support evacuations and maintains a vendor list of those that have these resources available during an incident. The demand for these units is at a premium during mass evacuations.

In the Jacksonville area, Florida District 2 (FDOT–D2), covering Central Office, the city of Jacksonville, Duval County, St. Johns County, and the First Coast MPO, developed a comprehensive plan for evacuation of the First Coast region. Officials from FDOT-D2 also implemented a comprehensive ITS program to support this activity, as well as a service patrol program which could support the evacuation efforts when needed.

The only evacuation plan that FDOT controls related to the Jacksonville area is the I-10 Contraflow Plan. In Florida, the county Emergency Manager is statutorily responsible for determining the evacuation routes in their county. The highest elected official (Sheriff or Mayor) is the only person that can call for an evacuation of a county in Florida. The FDOT only operates in a support role during evacuations. Every State road in Florida is considered an evacuation route.

The city of Jacksonville and Duval County maintain numerous evacuation plans, including those for countywide evacuations, downtown evacuations, beach evacuations, etc. They also retain scenario-based plans that deal with all incident types that could cause an evacuation, such as; hurricanes, tornadoes, nuclear release, terrorist attack, fire, etc. The FDOT sits as a member of their Planning Council and offers input and direction on all evacuation routes. Ultimately, the city/county authorities make the final decision on the implementation of an evacuation.

Respondents noted that authorities update all plans discussed during the interview on at least an annual basis. The Jacksonville evacuation plan covers an area approximately 60 miles to the west on I-10 from the western border to I-75. Once they approach I-75, the evacuee would then have the choice of going north-south or continue west into the Panhandle.

Top Highway Impediments
JACKSONVILLE

- **Work Zones**
- **Limited Fueling Stations**
- **No Dynamic Message Signs**
- **No ITS Deployment on Key Interstates**

Top Highway Impediments

The interviewees reported the following most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the Jacksonville metropolitan area.

1. **Work Zones** - Work zones on I-10 at the interchange with I-95 and the addition of Interchanges on I-10 west of Jacksonville could impede evacuations in the short-term. These are the only issues on the NHS at this time. Provisions

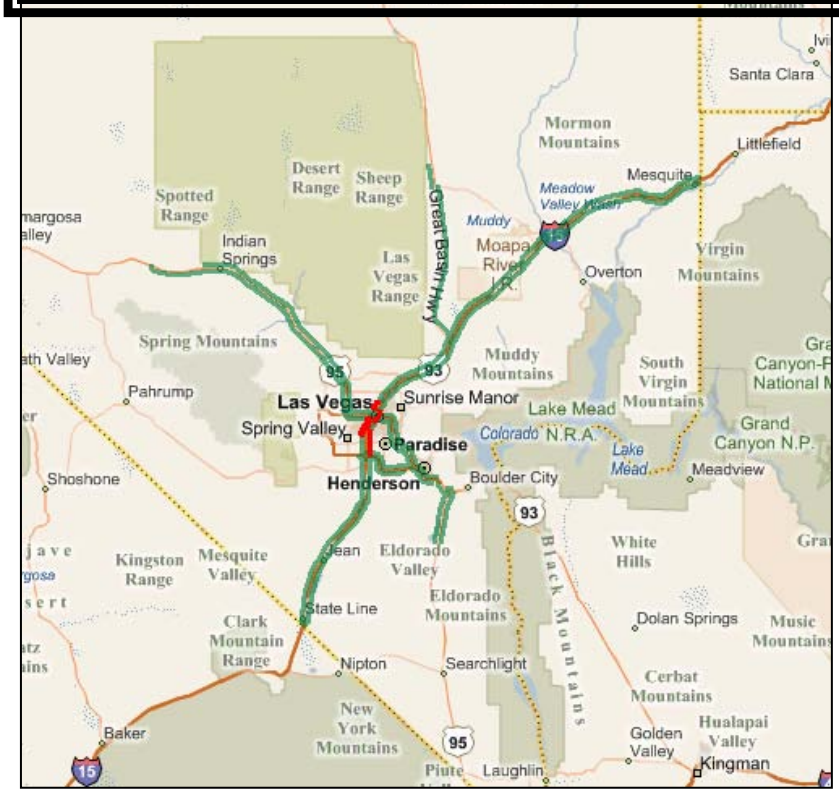
in the construction contracts note that during times of evacuation, the contractor will halt work and make available all lanes possible to handle evacuation traffic. Also, the contractors make available for FDOT use of all DMS, barricades, cones, etc., that are already set up on the construction site.

2. **Limited Fueling Stations** - along the I-10 route.
3. **No Dynamic Message Signs** - for westbound traffic on I-10.
4. **No ITS Deployments on Key Interstates** – The lack of ITS tools on key roads could impede mass evacuations on I-10 west of I-295 and on I-95 in St. Johns County. For example, motorists being evacuated from South and Central Florida take this route, which has DMS and CCTV cameras up to the Flagler/St. Johns County line. From there, no ITS exists until the Duval County line.

Las Vegas, Nevada

#30-Most Congested #30-Population (1,866,000)

INRIX® National Traffic Scorecard 2009



The Plan

The following information provides some details regarding evacuation planning statewide, with the focus on the large metropolitan area of Clark County (Las Vegas). The Southern Nevada Evacuation/ Emergency Planning project reviewed the ***Clark County Emergency Operations Plan*** and found the plan comprehensive and generally complete. Moreover, DHS gave the plan high marks. The review also found that the Clark County local area plan does not delineate extensive roles and responsibility for Nevada Department of Transportation (NDOT) participation.

The project recommends that future updates to the Clark County emergency plans would benefit if NDOT ensured that the local area emergency plans include more detail on NDOT's roles, responsibilities, and capabilities. Respondents indicated that this could be achieved by simply referencing the NDOT emergency plans—primarily the District-Level plan—in the local area emergency plans, rather than expanding the emergency plans with extensive NDOT-specific detail. Moreover, with the relatively recent expansion of Advanced Transportation Management Systems (ATMS) in the Freeway and Arterial System of Transportation (FAST) TMC and on the Las Vegas Metropolitan

area freeway system, the region would benefit from an ATMS inventory and capabilities and better understanding of how ATMS applications could be used by emergency managers.

Respondents provided the following plans for this study, all of which are the most recent:

- ***State Comprehensive Emergency Management Plan (SCEMP)*** 2005
- ***NDOT State Level Emergency Operations Plan***
- ***NDOT District Emergency Operations Plan***
- ***Clark County Emergency Plan*** 2004

The NDOT, when possible, obtains copies of the evacuation plans for each jurisdiction within the State to determine any identified tasks that would require NDOT participation. The large majority of pre-determined evacuation routes are State/Federal highways, which fall under NDOT's responsibilities. Once NDOT determines its roles, NDOT incorporates these details into the District-level plan.

The NDOT Maintenance and Operations Division, Emergency Management Section, is covered by performance measures which are reported to the State legislature. These performance measures require that each NDOT staff be trained and exercised on the Emergency Operations Plan and that NDOT updates the Plan on a 3-year cycle.

The statewide plan covers the entire State at a high level. The NDOT also maintains a Southern Nevada Evacuation Plan, but it is principally a strategic plan. It does not provide details on NDOT response to an evacuation event. The NDOT currently is involved in the development of a statewide evacuation plan being funded with a DHS Grant. The statewide evacuation plan is currently conducting a traffic study to determine the most appropriate evacuation routes and the responsibilities of the different agencies, both State and local, to support an evacuation along those routes. The current focus of this planning effort is Northern Nevada.

Top Highway Impediments

Study respondents reported that the most significant impediments along NHS routes that may impact effective large scale, mass evacuations from the Las Vegas metropolitan area include:

1. **Insufficient Lanes & Daily Congestion** - The Las Vegas area has designated the following major evacuation routes in the event a large-scale evacuation is needed: I-15 North to Mesquite, NV; U.S. 95 North to Reno, NV; I-15 South to Southern California; U.S. 95 South to Laughlin, NV; and U.S. 93 East to Kingman, AZ. Considering the current population of the Las Vegas valley along with the high numbers of visitors in the area on a daily basis, in the unlikely event of a large-scale, mass evacuation, capacity would be exceeded if the evacuation were implemented in a short period of time.

Top Highway Impediments
LAS VEGAS

- **Insufficient Lanes & Daily Congestion**
- **Coordination with Other States on Evacuation Routes**
- **Communications Systems Would Not Support Evacuation Operations**
- **Deployable Traffic Signs and Evacuation Route Signage**
- **Traffic Flow Monitoring**

2. **Coordination with Other States on Evacuation Routes** – Most evacuation routes designated by Southern Nevada emergency managers lead to other States. Coordination with the other involved States is currently taking place through quarterly meetings of the emergency managers from the DOTs of each State. There is currently no formal structure to these coordination meetings. Details have not yet been determined on the specific logistics of moving large numbers of people from one State to the next.

3. **Communications Systems Would Not Support Evacuation Operations** - Respondents stated that the communications system, including older analog cellular communications technology and equipment on portable DMSs, would not be adequate to support communication needs among responders working on the NHS roads or connecting the responders with TMCs or EOCs as they relay critical information.

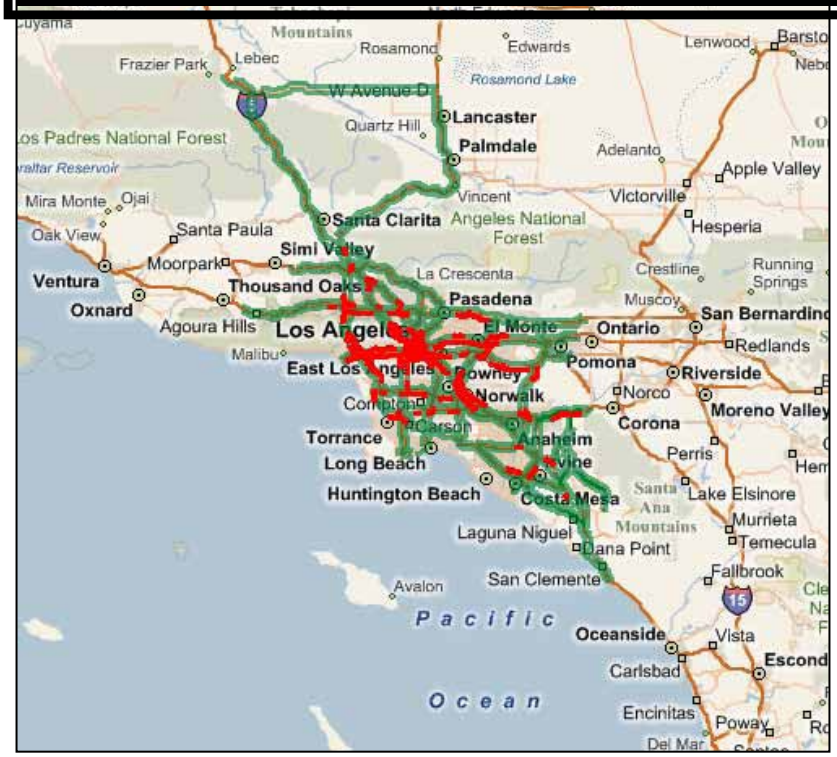
4. **Deployable Traffic Signs & Evacuation Route Signage** - Agencies within the area maintain a supply of portable trailblazer signs that can be quickly deployed and operated to guide motorists on detour routes during an emergency evacuation. However, the signs currently cannot be enabled remotely. In addition, local and regional emergency and traffic management agencies are considering a permanent signing program that would designate primary evacuation routes, similar to signing programs that designate hurricane evacuation routes in other States.

5. **Traffic Flow Monitoring** - Local agencies are working cooperatively with FAST to develop a plan for the deployment of limited permanent traffic flow monitoring capabilities at strategic locations outside the beltway on the primary mass evacuation routes.

Los Angeles, California

#1-Most Congested #2-Population (12,873,000)

INRIX® National Traffic Scorecard 2009



The Plan

Respondents noted that the evacuation plan is incorporated into the State Emergency Plan (SEP), which is still in draft pending official signature. Authorities last reviewed the plan in July 2009.

Those interviewed commended Los Angeles County, which has been very proactive in developing their plans and is in the process of expanding them to accommodate large-scale evacuations. The County's annex plan serves as a framework or template from which the County's various municipalities can use to incorporate their own plan. The County's mass evacuation

plan is currently in draft form. The County plan generally does not extend beyond the County limits. Evacuation plans are reviewed every 3 years, or when the need presents itself after a major event. After-action reports are evaluated and may potentially affect the overall evacuation plan.

The California SEP establishes the California Emergency Functions (CA-EFs) as a key component of California's system for all-hazards emergency management. The California Emergency Management Agency (Cal EMA) initiated the development of the CA-EFs in cooperation with California's emergency management community including Federal, State, tribal and local governments, public/private partners and other stakeholders to ensure effective collaboration during all phases of emergency management. The development of the CA-EFs involves organization of the participating stakeholders and gradual development of emergency function components. This development also includes a process to maintain each of the CA-EFs as a permanent component of California's emergency management system.

As described in Section 13 of the SEP, the CA-EFs consist of 17 primary activities deemed essential to addressing the emergency management needs of communities in all four phases of emergency management. Based upon authorities and responsibilities, a lead agency has been designated for the development of the State government level CA-EFs. As the CA-EFs development expands to include other stakeholders from the emergency management community, the CA-EFs will determine a governance structure. The governance structure will be developed with the administrative direction of Cal EMA and be flexible to allow for the participation of future stakeholders. Evacuation Planning is one of the listed 17 CA-EFs.

Figure 3. Long Beach Evacuations from Battering Storms 2010

In the Los Angeles Operational Area, an alliance of emergency responders—including but not limited to the California Department of Transportation (Caltrans), Los Angeles County Police, Sheriff, and Fire Departments—formed to establish guidelines for mass evacuation. The Mass Evacuation Guide is almost complete. The alliance is currently working on a Mass Care and Shelter Guide. As part of the alliance's efforts, the Los Angeles City Emergency Management Department (EMD) and Los Angeles County Office of Emergency Management (OEM) will share responsibility for coordinating the maintenance and updates of the Guide.

Los Angeles currently benefits from a Homeland Security Grant to address evacuation planning as a part of catastrophic planning. The DHS/FEMA RCPGP provides catastrophic events planning

grants to the 10 highest risk Urban Areas and surrounding regions, including: Chicago, ***Los Angeles***, Houston, New York, San Francisco, Washington, DC, Boston, Honolulu, Norfolk, and Seattle.

Top Highway Impediments
LOS ANGELES

- **Congestion & Evacuation Route Capacity**
- **Communications Capabilities**
- **Public Outreach & Understanding Evacuation Process**

Top Highway Impediments

Those interviewed identified four key impediments to evacuating populations from the Los Angeles metropolitan area:

1. **Congestion and Evacuation Route Capacity** – Currently identified evacuation routes are congested and often filled to capacity during peak travel periods on a daily basis. The strength of the existing evacuation plan(s) and a comprehensive communication infrastructure may serve to minimize this deficiency.

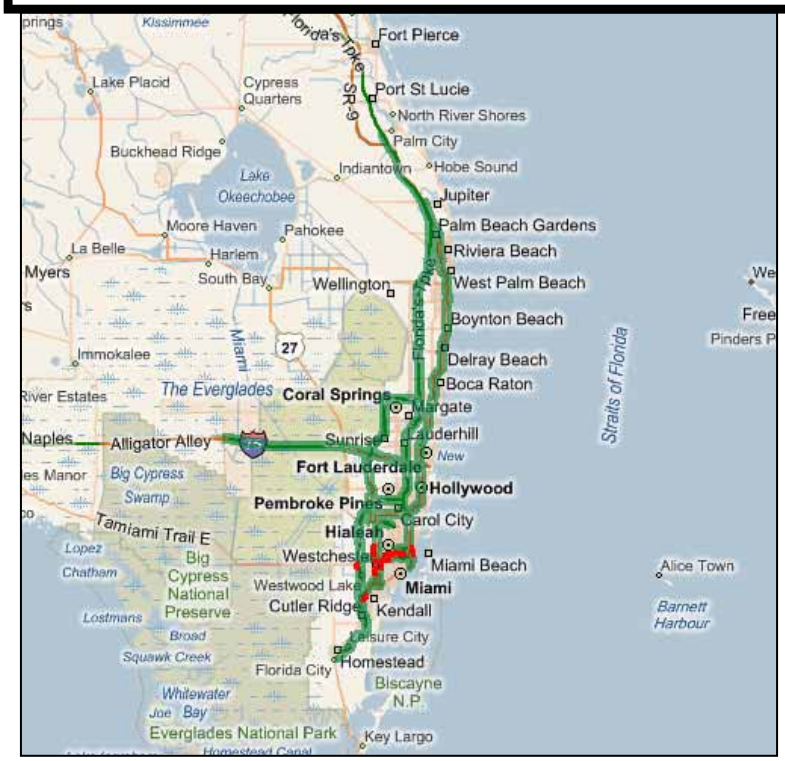
2. **Communication Capabilities** - The capability or capacity of the existing communication infrastructure meets current needs, but evacuation planners stated that a failure in the communication system would have a significant impact on regional evacuation operations.

3. **Public Outreach and Understanding Evacuation Process** – Officials noted that more effort in public outreach should focus on getting the public to understand the evacuation process. They cited recent mudslides as an example. A review of evacuation operations during this incident found that people may not understand when they need to evacuate and why they may not be able to return to their home when they (the homeowner) perceive the threat is over. This greatly affected evacuation operations. The public also lacks an understanding of the responsibilities of first responders versus the rights of those that do not wish to evacuate.

Figure 4. Evacuations from the 2009 Wildfires that Plagued LA County

Miami, Florida

#13-Most Congested #7-Population (5,415,000)
INRIX® National Traffic Scorecard 2009



The Plan

Florida is one of the States that is at the forefront of emergency readiness, response, and planning. In 2005, Florida developed the Contraflow plan for the Florida Interstate Highway System (FIHS). This plan identified the following routes that could be used for evacuation: *Sarasota County's I-75 Shoulder Use Plan, Jacksonville's I-10 Contraflow Plan, Space Coast's SR 528 (Beeline Expressway) Contraflow Plan, Tampa Bay's I-4 Contraflow Plan,* ***Florida Turnpike Contraflow Plan for Southeast Florida***, and ***Southeast/Southwest Florida Contraflow Plan for I-75/Alligator Alley***. The FDOT State Traffic Engineering office in Tallahassee vetted and keeps the plans current. Within this office, the Deputy Traffic Engineer for Incident Management manages this program.

Florida has spent close to $1 billion to deploy ITS technology to enhance highway operations. As a part of that effort, the State migrated to a single statewide TMC Software (SunGuide) beginning in 2004. All TMCs across the State in Miami, Tampa, Jacksonville, Fort Myers, Fort Lauderdale, Orlando, and the Florida Turnpike in Orlando and southeast Florida use the SunGuide software. The State Emergency Operations Center (EOC) in Tallahassee also installed the SunGuide software for use by the Emergency Support Function #1 (Transportation) liaison that operates at the EOC when activated during time of emergency operations. This single platform enables the State to share controls of cameras and other devices in real-time.

In November 2006, FDOT and the Florida Department of Emergency Management—in concert with FEMA—initiated the development of the comprehensive "Florida Catastrophic Planning Project," which considers two, large-scale incidents resulting in projected consequences of catastrophic proportions: a breach of the Herbert Hoover Dike (HHD) around the waters of Lake Okeechobee and a Category 5 hurricane impacting the entire South Florida peninsula, which has a population of nearly 7 million.

This project includes data collection and comprehensive capability assessments of local, State, and Federal resources to support response to a failure of the HHD and a Category 5 hurricane striking south Florida. Analysis of the assessments and draft county plans will help to identify resource gaps, inconsistencies, and competing interests for limited resources.

For the purpose of this study, respondents reported that the State plan is current, the Florida Catastrophic Plan will be completed soon, and the FIHS Contraflow plan, published in 2005, undergoes continuous updates.

While Florida maintains a robust support system for evacuations, local authorities call for an evacuation, and coordinate evacuation decisions with neighboring counties. The State views evacuation operations from a strategic view and supports the local efforts by ensuring requested assistance is available. The FDOT also provides support to local jurisdictions during evacuation operations, for example with FDOT service patrols, known as Road Rangers. In addition, FDOT makes available DMS to support evacuations and maintains a vendor list of those that have these resources available during an incident. The demand for these units is at a premium during mass evacuations.

The FDOT District 6 (D-6) covers the Miami area, which has one of the most mature ITS programs in Florida. Miami's TMC was one of the first to integrate law enforcement operations. Over time, Miami developed unique partnerships with other transportation providers to ensure the best operation within the area. The FDOT D-6 integrated operations with District 4 (D-4) Fort Lauderdale, District 8 (D-8) Florida Turnpike, city of Miami and Miami-Dade Expressway (toll authority). These transportation agencies meet regularly to ensure cross coordination across all domains within their transportation system. Miami also maintains a very robust safety/service patrol program. Partners meet on a regular basis.

The State's most current plan will be updated in 2010. The State plan addresses area threats and responses regionally. The Florida's Turnpike Enterprise also maintains contraflow plans. Interviewees caution that voluntary evacuations will overlay mandatory evacuations, skewing the outcome of planning assumptions (Florida manages mandatory evacuations by locations; however, others moving into the evacuation stream cause congestion on the facility.) State and regional plans undergo annual updates. However, after each incident, authorities also conduct an After-Action Review (AAR) to evaluate every component of the plan. As the AAR process uncovers deficiencies, authorities adjust corresponding plans.

Top Highway Impediments

Information provided by those interviewed identified five impediments to evacuating the Miami metro area as follows:

Top Highway Impediments MIAMI

- **Insufficient Road Capacity**
- **Damage to Critical Infrastructure**
- **Work Zones on Major Routes**
- **Traffic Signal Timing**
- **Lack of ITS Devices on Major Arterial Roads**

1. **Insufficient Roadway Capacity** – Roadway capacity in the Miami area would be exceeded during large scale mass evacuation.
2. **Damage to Critical Infrastructure** – Damage to infrastructure such as bridges and overpasses would greatly reduce the ability to evacuate the population.
3. **Work Zones on Major Routes** – Work zones on key routes such as I-595, I-95, etc., would seriously impede an evacuation of the Metro-Dade area, particularly if given little to no notice.
4. **Traffic Signal Timing** – Authorities must coordinate local traffic signals for optimization.
5. **Lack of ITS Devices on Major Arterial Roads** – FDOT D-6 deployed many ITS devices on the Interstates. However, these tools—which provide critical situational awareness information, can aid in transportation operations and may be used to alert the public to changes in traffic patterns or dangers on the roadways—are not deployed along major arterial roads, which may be used as evacuation routes.

Minneapolis-St. Paul, Minnesota #12-Most Congested #16-Population (3,230,000)

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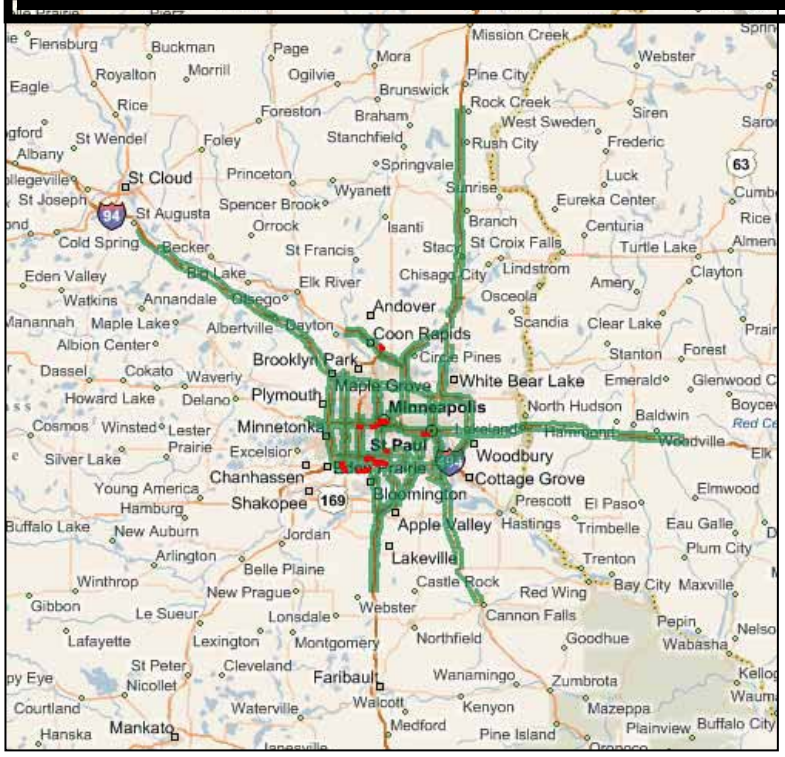

The Plan

Officials developed the ***Metro Evacuation Traffic Management Plan*** in 2005. Respondents noted that this plan serves more as a traffic layout/plan, or only one piece of the puzzle when discussing evacuations. The ***Metro Evacuation Traffic Management Plan*** covers multiple jurisdictions and exceeds the boundaries of the cities of Minneapolis and St Paul. The development of this plan included the nine counties within the Twin Cities Metropolitan Area (Hennepin, Dakota, Ramsey, Washington, Scott, Anoka, Wright, Carver, and Chisago).

The Director of the Office of Emergency Management in St. Paul concurred that the 2005 plan submitted for this review is only a traffic study that all agreed served as a good starting point for the traffic management aspect of a comprehensive regional evacuation plan. He noted that moving forward proved difficult for three reasons:

- The 2005 regional evacuation planning effort has been suspended, as at this time, stakeholders have allocated staffing resources to higher priority projects.

- Planners struggle to identify scenarios that would require a mass evacuation – an entire city or a major portion of the metro region. It's been difficult to develop a credible scenario that would require evacuation of the entire metro area.
- Planning efforts are not well-coordinated. The approach has been piece-meal, and if it must be done, the region must dedicate significant resources and support a concerted effort to address all of the areas.

Officials recently renewed efforts to restart efforts to revise the Minneapolis-St. Paul Metropolitan Regional Evacuation Plan, which is the transportation component mentioned above. Updating this plan is a combined effort by the counties, cities and Minnesota DOT (MnDOT). Respondents noted that the new version should incorporate a traffic routing tool produced by the University of Minnesota to aid in evacuation efforts. The MnDOT would manage the tool and the plan.

One interviewee noted that evacuation planning to date has taken a local/sub-regional perspective focused on high-risk areas or areas with large people concentrations. These plans focus on evacuating several blocks, not the whole metro region. One of the respondents observed that if a mass evacuation was needed, the NHS routes would quickly fill not because of impediments, but because the NHS alone cannot serve the role by itself and must be supported by the overall transportation system.

A respondent from the city of Minneapolis noted that they have a tremendous amount of evacuation experience. He relayed a local-level scenario, stating that the city conducted a mass evacuation and a shelter-in-place operation for "one of our Hawkins Chemical fires." One of the first actions taken by the fire department was to pull situation maps that were laminated based on "box-runs" – a system set up in the late 1890s that's still in place today. For this particular incident, box 419A, this means 4th district, 19th ward which is a footprint within the city. The city used these maps as a template to go door to door to notify the public of their order to evacuate or shelter-in-place. In conjunction with that, he noted that the city is working with the MnDOT on maps and strategies.

It appears that evacuation planning is moving forward in the region. Minneapolis-St. Paul and Minnesota officials provided several late 2009 and early 2010 products for this study that demonstrate forward movement in the construction of a Regional Evacuation Plan. The products indicate that the new plan will include more than transportation route plans.

Top Highway Impediments

Those interviewed identified the following as potential impediments to a large-scale, mass evacuation in the Minneapolis-St. Paul region:

1. **Infrastructure Capacity and Congestion** – Roadways are currently congested. There is no capacity in the system for accommodating large numbers of people and vehicles.

2. **Lack of Coordinated Planning and a Universal Agreement on the Benefits of Evacuation** – One respondent noted that "evacuation" is not a universally acceptable public protection action. The individual continued to explain that there are other more feasible actions that may have higher priority and effectiveness. A MnDOT respondent noted that MnDOT can identify choke points, but MnDOT does not control citywide evacuations. The Twin Cities area mass exodus scenario has not been a critical issue in MnDOT's planning activities.

3. **Disconnected Transportation and Emergency Operations Centers** – TMCs and local Emergency Operations Centers are not connected except by phone. As a result, emergency responders and managers lack good situational data to create a common operational picture.

4. **Need More Signage and Public Education** - The public needs to know what to do, in the event an evacuation is ordered. Moreover, the region needs more signs on certain routes and increased DMS capabilities to give direction to the public during an evacuation.

5. **Coordination of Signal Timing Plans** – Authorities noted that effective signal timing involved multijurisdictional coordination.

6. **Address Equipment Gaps for Pedestrian Movement** - Authorities should address equipment gaps that support pedestrian traffic, which will be significant during an evacuation of the Central Business Districts in both Minneapolis and St. Paul.

Top Highway Impediments
MINNEAPOLIS-ST. PAUL

- **Infrastructure Capacity & Congestion**
- **Lack of Coordinated Plan & Universal Agreement on the Benefits of Evacuation**
- **Disconnected Transportation and Emergency Operations Centers**
- **Need for More Signage & Public Education**
- **Coordination of Signal Timing Plans**
- **Address Equipment Gaps for Pedestrian Movements**
- **Develop Multiple Options for River Crossing**

7. **Develop Multiple Options for River Crossing** – Planners should consider non-traditional river crossing options, particularly between the Twin Cities Central Business Districts.

New Orleans, Louisiana #41-Most Congested #46-Population (1,134,000)

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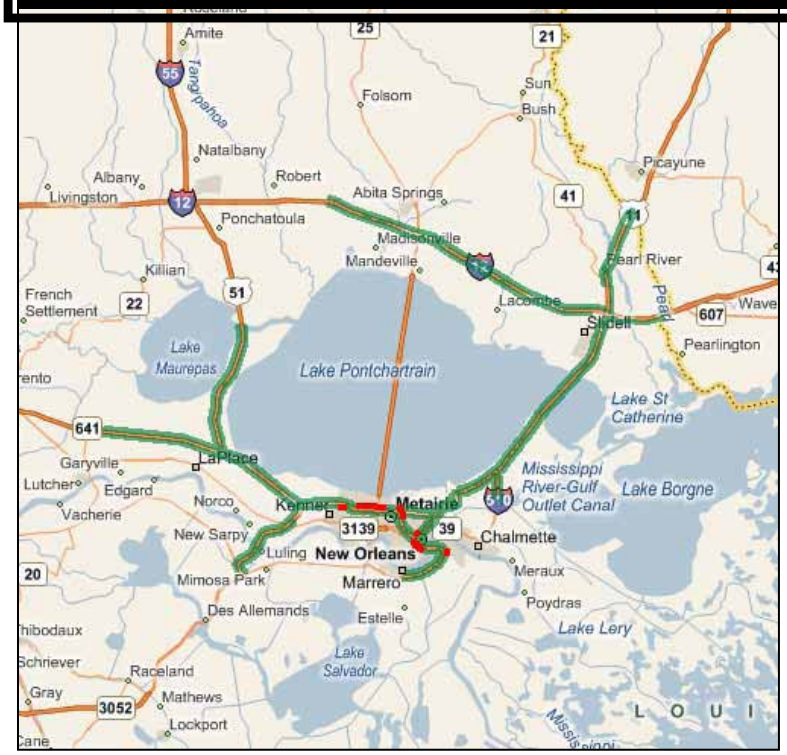

The Plan

According to interviewees, authorities update the New Orleans evacuation plan annually. The current plan is integrated into the Louisiana State Evacuation Plan, which is maintained by the Louisiana Emergency Management Agency. The New Orleans plan was developed right before Hurricane Katrina, and it has evolved based on lessons learned, corrective actions taken after Katrina and a couple of subsequent storms, and the adoption of good practices. Since Katrina, authorities expanded the designation of evacuation routes into Mississippi for the southeast and south-central parts of the State. Officials treat the plan as a "living" document which requires continual updates.

The New Orleans evacuation plan covers areas from New Orleans proper extending to all of southeast Louisiana, including Jefferson, St. Charles, and St. John the Baptist, Tangipahoa, and St. Tammany parishes, as well as Plaquemines and St. Bernard parishes located south and east of New Orleans. The plan designates routes that continue into Mississippi. Officials coordinate New Orleans plans with other State and parish highway agencies, including Mississippi DOT. One interviewee mentioned that they would like to add evacuation routes through the southeast and south-central parts of Louisiana, especially through the Lafayette area, which is along the Mississippi coast.

Top Highway Impediments

Those interviewed identified the top five impediments to evacuating the New Orleans metropolitan area, as follows:

1. **Highway Flooding** - Flooding of low lying portions of I-10 east of downtown New Orleans and flooding of low lying areas along US 90 in St. Charles Parish.
2. **Additional ITS Capacity** - Authorities noted that ITS camera and detector coverage along I-10 east and west would improve evacuation operations.
3. **Insufficient Capacity** - Capacity on National Highway System routes out of New Orleans would be exceeded during a large scale mass evacuation.

Top Highway Impediments NEW ORLEANS

- **Highway Flooding**
- **Additional ITS Capacity**
- **Insufficient Capacity**
- **Lack of Emergency Lanes**

4. **Lack of Emergency Lanes** - The highways designated for evacuating populations lack an emergency lane for emergency vehicles. Officials reported that once contraflow operations commence, they lose the ability to move emergency vehicles along those routes. They noted that emergency vehicles use other nearby routes, but no in-bound access routes exist for that purpose, other than Airline Highway. Respondents reported that the twin-span does not present a problem, since emergency responders use the shoulder of the twin-span as a third lane and contraflow is not conducted on that section. Emergency vehicles have some return access options, such as US 51 that parallels I-55. However, flooding problems at a couple of interchanges along US 51 could impede movement along US 51, although a project to correct the flooding is underway. Authorities report similar problems with routes that parallel I-55.

New York, New York

#2-Most Congested #1-Population (19,007,000)

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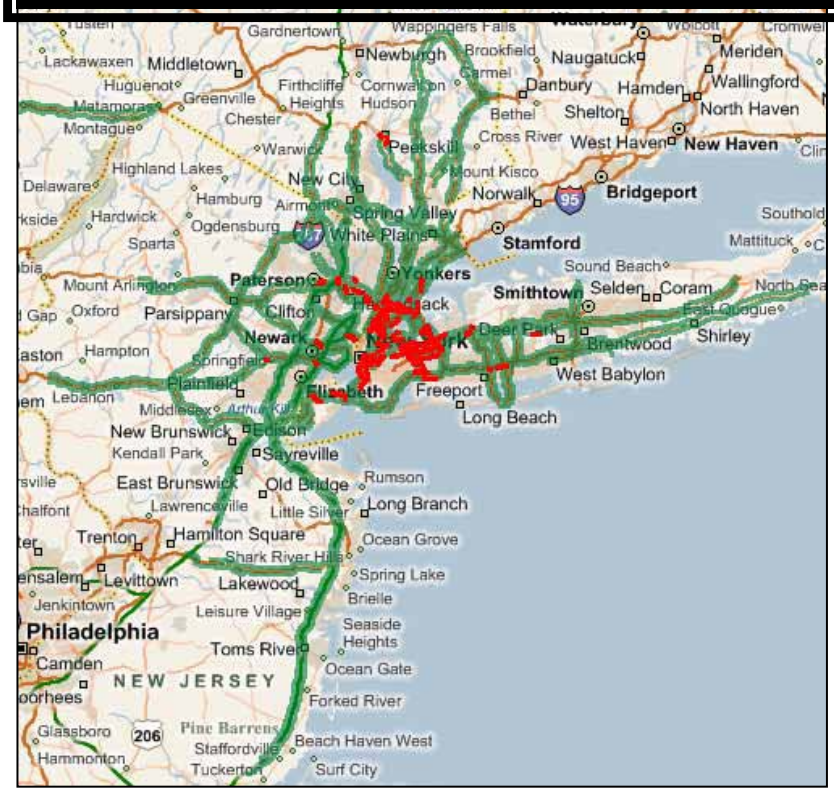


The Plan

The New York State DOT (NYSDOT) supports local agencies in the New York City (NYC) region in their evacuation planning. In New York State, such planning is handled by individual localities

Respondents noted that some of the local jurisdictions maintain very robust plans, but the authorities coordinate the plans largely through the county. All plans are updated on an annual basis and reviewed as needed. Current efforts include evacuation planning for lower Hudson Valley, NYC, Long Island coordinated by the Regional Catastrophic Planning Team (RCPT), Regional Evacuation Liaison Team (RELT) and the group from the Hudson Valley TMC.

The respondent from the NYC Office of Emergency Management commented that the NYC plan extends beyond the five boroughs in a couple of ways:

1. The hurricane evacuation study conducted for the region covered NYC, Nassau, Suffolk and Westchester counties, so clearance times of these areas serve as a foundation for timelines and decision-making.
2. The plan factors in traffic from Long Island through NYC, which makes the plan regional in nature.

3. Developing the NYC plan involved working closely with the Metropolitan Transportation Authority (MTA) and the Port Authority and their transportation assets which extend upstate.
4. The plan addresses the operations of the RELT, which is a regional coordination mechanism.

Figure 5. Pedestrian Evacuation after 9/11 Terrorist Attack on NYC

A combination of the regional plans developed for jurisdictions within the NYC metropolitan area have been coordinated with outside jurisdictions. All planning efforts include coordination with organizations that serve multiple jurisdictions in the area, such as MTA and the Port Authority of New York and New Jersey for very practical operational purposes. For example, if MTA or Port Authority bridges are to close, information must be relayed to Long Island authorities about 3 to 6 hours before the closure to ensure that people using these facilities have enough time to evacuate or do not journey to these facilities only to find that bridges are closed, and they are stranded. Another example includes Nassau and Suffolk counties, which based their plans on a 120-hour, advance-notice coastal storm that would trigger an evacuation. Most of the transportation agencies for rail and buses as well as the electrical provider, the Long Island Power Authority (LIPA), coordinate closely with each other because of the time involved in getting the rolling stock secured and out of surge zones. Most plans tend to be coastal storm oriented. Future plan improvements will address intermodal coordination and intergovernmental coordination.

New York City currently benefits from a Homeland Security Grant to address evacuation planning as a part of catastrophic planning. The DHS/FEMA RCPGP provides catastrophic events planning grants to the 10 highest risk Urban Areas and surrounding regions, including: Chicago, Houston, Los Angeles, ***New York***, San Francisco, Washington, DC, Boston, Honolulu, Norfolk, and Seattle.

Top Highway Impediments

Respondents noted the following impediments might frustrate the evacuation of the New York City metropolitan area:

1. **Infrastructure Condition and Limitations** – The condition of the roadway infrastructure within NYC (vertical clearance restrictions, bridge loading limitations) would frustrate evacuation operations. Limitations associated with transportation infrastructure (e.g., limited bridge/tunnel capacity) and facilities—especially in the Central Business District in Manhattan—would impede a mass evacuation of people from NYC. Within the NYC network, there are a number of transportation agencies that manage facilities that connect to State

highways. One respondent noted that they are moving toward some type of integration between the NYC and NYSDOT facilities. Moreover the area lacks gates to inhibit traffic flow when needed for an evacuation or other traffic incidents. The limited infrastructure would impede emergency responders—including transportation authorities—from conducting logistics support operations on the roadways, including towing, safety/service patrols, gasoline trucks or City National Guard (CNG) transporters.

Top Highway Impediments NEW YORK CITY

- **Infrastructure Condition & Limitations**
- **Need Improved Coordination between State/Local Transportation Officials and Responders**
- **Limited Deployment of ITS Impact on Sharing Situational Awareness Data**
- **Weather Impacts**
- **Need for Public Information Campaign**

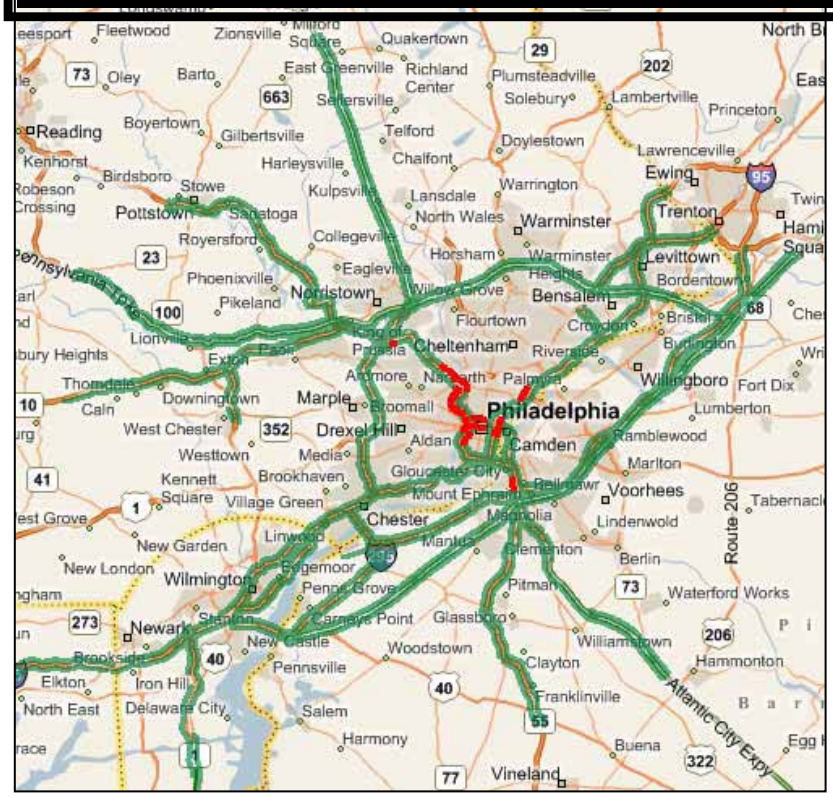
2. **Need Improved Coordination between State/Local Transportation Officials and Responders** - The coordination between State and local transportation, law enforcement, and response agencies in the region could be improved. Moreover, State and local DOTs require close coordination during disaster responses or major road incidents. One interviewee noted that the jurisdictions surrounding NYC, but considered part of the region, are somewhat different than other regions because they do not have their own maintenance forces and depend on NYC DOT for support. He noted that the jurisdictions contract for highway maintenance, but do not maintain in-house forces. As such, maintenance requires coordination and planning, which is as not easy when an emergency occurs. Planners should collectively look at timelines, including evacuation start vs. time needed to move all people.

3. **Limited Deployment of ITS Impact on Sharing Situational Awareness Data** - The ability to collect and disseminate real-time traffic information to the public due to the limited deployment of ITS technologies. An ITS deployment covers just under 200 center lane miles with some type of ITS deployed on about 140 miles. One interviewee noted that this constitutes about 2/3rds of the planned deployment program. Another respondent shared that the City embarked on an effort to develop the NY Metro Transportation Project, a real-time common operating environment to be shared among the operations agencies. The NYSDOT is working closely with the Army Corp of Engineers to develop decision-making tools to provide more real-time insights into each agency's operations. This project will use freeway management data sharing components to capture information and provide it quickly to all users.

4. **Weather Impacts** – During coastal storms, the approaches to bridges to the mainland and other low-lying roads flood, and high winds cause the closing or slowing of traffic on bridges to the mainland.

5. **Need for Public Information Campaign** – Respondents noted that the public would benefit from a public information campaign. Many area residents lack knowledge of planned shelter locations and when to begin an evacuation. A public education campaign could reduce the effect shadow evacuations could have from clogging roads and transportation networks.

Philadelphia, Pennsylvania (Urban Area) #10-Most Congested #5-Population (5,838,000)
INRIX® National Traffic Scorecard



The Plan

The Philadelphia urban area published the *"Southeastern Pennsylvania Emergency Transportation Plan"* in June 2009. The regional plan includes routes to be used and provides for the estimation of evacuation times and covers four suburban Pennsylvania counties surrounding the city of Philadelphia—including Bucks, Chester, Delaware, and Montgomery counties—plus the city of Philadelphia. Philadelphia maintains its own plan, and planners integrated the Philadelphia City plan into the regional plan. It also integrates the five county-specific Emergency Response plans created by the Emergency Management Agencies into a unified plan for the region. The Southeastern Pennsylvania Regional Task Force coordinated plan development with Lancaster, Berks, Lehigh and Northampton counties, the States of New Jersey and Delaware, and turnpike authorities in Pennsylvania and New Jersey. The Task Force conducted post-development outreach on the plan with adjacent regions in Pennsylvania, New Jersey, Delaware, and Maryland, as well as other Pennsylvania partner task forces that adjoin the Southeastern Task Force and cover Allentown and Harrisburg. Currently the plan encompasses five south-eastern Pennsylvania areas (estimated population of 4.3 million) and ranges from about 30 miles west of Philadelphia to 30 miles north and south.

City officials note that additional work needs to be performed, especially analyzing individual evacuation routes through the conduct of traffic modeling studies. Officials report that they do not expect the routes being used for evacuations to change as a result of the traffic modeling exercise. Southeastern Pennsylvania Regional Task Force members do anticipate that this effort will help improve regional coordination over time. Interviewees also expect improvements through the use of task forces that will support and manage key locations during an event. Responders with jurisdiction over the specific areas indicate that ITS tools will aid in situational awareness and enhance the use of available resources. The plan will be updated to further study each evacuation route in more detail. The Task Force hopes to update the regional plan and maps every 2 years. Municipal and county evacuation plans may be reviewed as often as every 12 months.

Top Highway Impediments

The interviewees reported the following most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the Philadelphia metropolitan area.

Top Highway Impediments PHILADELPHIA

- **Expressway Congestion**
- **Need for Situational Awareness**
- **Emergency Signal Timing Coordination**
- **Operational Coordination**
- **Toll Waivers**

1. **Expressway Congestion** - Major expressway routes in the Philadelphia area would not be able to handle surge in traffic from a large-scale, mass evacuation. Lack of dedicated HOV or bus lanes would also hamper attempts to conduct mass evacuations. Long-term construction also adversely affects available capacity. In most cases, only a two-lane Interstate/expressway would be available for use by evacuees. This would physically limit the Region's ability to use a contraflow strategy to reverse lanes. Moreover, most NHS arterials that lead out of the area are single lane, which would cause considerable congestion during an evacuation operation.

2. **Need for Situational Awareness** - There is a lack of situational information available about congestion, construction activity, or incidents on arterial highways. Those interviewed stated that ITS and signal timing (*see #3, below)* constitute key elements to ensuring expeditious travel. Philadelphia's EOC and 911 Center have benefited greatly from their ability to view real-time traffic cameras on the Pennsylvania Department of Transportation (PennDOT) system since 2004. However, current technology implementation of CCTV and DMS has only reached the Interstates/urban expressways in the area and is not yet deployed on the arterials. Philadelphia needs consistent situational awareness capability shared by the EOCs, DOT TMC, and State and local police and local municipalities.

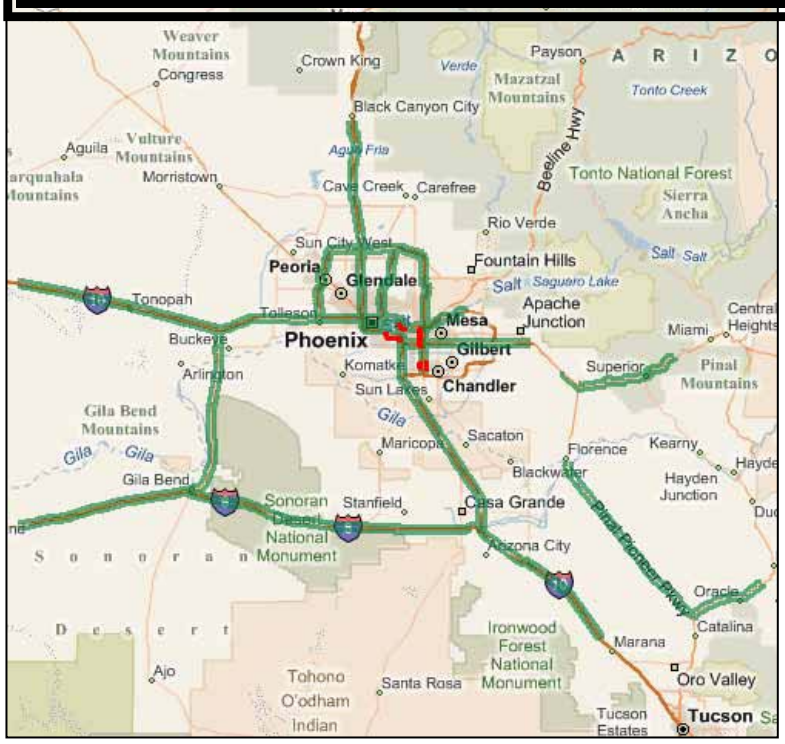
3. **Emergency Signal Timing Coordination** - Municipalities own and operate traffic signals in Pennsylvania. Even though most of the NHS arterials have signal systems, it will be nearly impossible to implement emergency signal timing plans. Potentially 100+ municipalities will have to be contacted and told which timing plans to implement, and many municipalities do not have the expertise to quickly change timing plans. Those interviewed noted that the management of signals (placing emergency timings into place to aid an evacuation) by the TMC would be an important function that could be carried out by the operators when needed.

4. **Operational Coordination** - Coordination is a major issue. In the Philadelphia urban area there are 9 counties, 375 municipalities (this includes both the NJ and PA portions of the region), and 6 toll authorities; and this does not include Delaware, less than 40 miles from Philadelphia. Due to local home rule, most municipalities operate their own police and public works departments; municipalities can have multiple fire companies. To develop and execute an evacuation plan requires working with the municipalities, counties, State police, and toll authorities. Ultimately, they will be responsible for closing expressway ramps, staffing traffic control points, and directing lost motorists. Additional connectivity of ITS tools (such as cameras), additional monitoring systems along corridors, and TIM equipment and resources (such as Safety/Service Patrols and TMCs) among States would greatly enhance operational coordination of mass evacuations.

5. **Toll Waivers** – With tolling affecting two States involved in mass evacuations in the Philadelphia area, the question "Who will decide to waive tolls during an emergency?" remains an important topic in the region.

Phoenix, Arizona

#14-Most Congested #12-Population (4,282,000)
INRIX® National Traffic Scorecard 2009



The Plan(s)

The most current plans were provided for the Phoenix metropolitan area, including:

- ***State of Arizona Mass Evacuation and Reception Plan***
- ***Maricopa County Emergency Evacuation Strategy Plan*** (July 2004)
- ***Maricopa County Emergency Evacuation Strategy Plan – Phase II*** (Dec 2007)

All three are integrated into the State EMA's evacuation plans. It has been agreed upon by participating jurisdictions that the State plan will serve as a model plan for the design and implementation of the overall evacuation strategy. The plans are reviewed, evaluated and updated annually, as required by the Arizona State EMA. The reviews are directed at the overall strategic and tactical value of the plan as well as progress toward integrating rural evacuation strategies into the overall State plan.

A unique approach or design of this plan is that it adopts a statewide evacuation and reception strategy. The plan incorporates the plans for the two largest counties, Pima and Maricopa, and serves as a model plan for rural jurisdictions currently working on evacuation/reception strategies. Additionally, this plan establishes a corridor coalition that supports strategies outside State boundaries. A featured aspect of the plan outlines stress points specifically for reception protocols. For example, Yuma County is identified as a primary reception area based on past evacuation experiences, primarily involving southern California. Transportation infrastructure capabilities and necessary support services/impediments have been identified.

Top Highway Impediments

The most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the Phoenix area include:

1. **Communication Capabilities** - The capability or capacity of an aging communication system puts the overall success of the State evacuation and reception plan in jeopardy. Evacuation planners agree that the most significant deficiency affecting the plan is communication. The system currently depends on an analog processor. This system is over 20 years old and is approaching the end of its life expectancy.

2. **Community Outreach and Education Program** - It has been established that a more aggressive outreach/education effort is needed to maximize effectiveness of the current plan.

3. **Rural Evacuation Route Signing and Information (Public Outreach) Strategy** - Developing and implementing an effective strategy to foster community awareness and buy-in on developed evacuation plans.

4. **Mass Evacuation Regional Command and Control Center** - Current emergency operation center capabilities fall below plan expectations. A more robust and comprehensive system is needed.

Top Highway Impediments PHOENIX

- **Communication Capabilities**
- **Community Outreach & Education Program**
- **Rural Evacuation Route Signing & Information (Public Outreach) Strategy**
- **Mass Evacuation Regional Command & Control Center**
- **Evacuation Route Signing**

5. **Evacuation Route Signing** - Developing a clear and effective system of signing is critical to the overall success of the plan.

Portland, Oregon

#22-Most Congested #23-Population (2,207,000)

INRIX® National Traffic Scorecard 2009

The Plan

Portland and Oregon State officials noted that to address mass evacuations, planners must first answer the question "What would cause us to evacuate the city?" Portland urban area residents are vulnerable to no-notice events, such as earthquakes, wildland/urban interface fires, landslides, and volcanoes; however, none of which would trigger a full-scale evacuation. These no-notice events complicate transportation responses due to the range of locations that might need to be evacuated. Moreover, in most cases, authorities would encourage residents to shelter-in-place.

The city of Portland conducted a 2008 Gap Analysis that identified regional planning as a needed component of the City of Portland Evacuation Annex update. Information from the 2008 workshop series examined roles and responsibilities, alternate transportation routes, route carrying capacity, and a decision matrix to determine mass-care site criteria. These three reports, or "Technical Memoranda," along with the emergency exercise and incident reports, will support regional evacuation planning efforts in 2010.

State and city authorities met recently to discuss deficiencies of the transportation system. The group addressed transportation as related to mass evacuations. The group agreed that:

- there would be no or little notice for most events which would cause populations to evacuate;
- no current hazard faced by the region would trigger a mass evacuation;
- planning must focus on localized evacuations if one was deemed necessary;
- notification of the public will be problematic;
- planning must be adaptable to population diversities and behaviors;
- regional planning for evacuation is necessary because of shared assets, resources and liabilities; and
- the current ground transportation system is at its capacity.

Transportation, police, emergency management and fire agencies also concluded that contraflow techniques, although highly unlikely and situation dependent, could be planned for and accomplished for localized and small scale events.

Top Highway Impediments

Respondents identified the most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the Portland metropolitan area. These include:

1. **Bridge Vulnerability** – Portland evacuees must navigate over many bridges that may be vulnerable to damage or closure during an event. The city of Portland is divided by the Willamette River and bordered to the north by the Columbia River which divides the States of Oregon and Washington. Four highway bridges traverse these rivers. Only 2 of the four bridges have been earthquake-retrofitted, and all of the bridges sit in liquefiable soil adding to the instability of major transportation corridors. The bridges pose a highly vulnerable link in the transportation infrastructure, so the region is affected if the bridges are impacted.

The city owns 157 overpasses and bridges, none of which cross the Columbia or Willamette rivers. In an earthquake, these overpasses could fall onto the major

Top Highway Impediments PORTLAND

- **Bridge Vulnerability**
- **Capacity & Infrastructure Limitations**
- **Communications & Coordination with Neighboring Jurisdictions & the Public**
- **Communications & ITS Technology for Incident Operations**
- **Improved Traffic Management & Safety**
- **More Robust Planning for Evacuation Operations**
- **Identification & Use of Resources**

thruways of the region and interfere with emergency response vehicle transport. Emergency Transportation Routes[8] have been identified and listed in priority order for damage assessment and coordination.

2. **Capacity and Infrastructure Limitations** – In Portland, the NHS roadway infrastructure operates at capacity during peak periods. This is most noticeable at the slightest stall of a car in rush hour, which delays traffic and impedes response vehicles. This situation would be greatly exacerbated if officials conducted an evacuation operation over these roads. Several choke points in the urban area cause problematic congestion and would greatly restrict evacuation operations in these areas. Through a 2007 study, the Portland Operations Steering Committee identified the primary reasons for congestion and made recommendations. Information gathered from this report will be included in mitigation and education plans in preparation for evacuation.

3. **Communications and Coordination with Neighboring Jurisdictions and the Public** – Regional coordination needs to address coordinated use of technology, collaborative planning, communication between agencies and between agencies and the public, management of multiagency responses and cooperative agreements that document the decisions between agencies, jurisdictions and disciplines. Authorities continue to plan public communication strategies. Regional public information concept of operations and public messaging templates are currently being validated within the region. Warning Annexes, DMS, cameras and Web site capabilities are being examined with the intent of greater cooperation in traffic management during extreme situations. Authorities also noted that the region must develop agreements for response and mitigation of roads traversing and impacting multiple jurisdictions.

   A focal point of communication was consistent messaging and the strategy to develop and implement agreed upon messages for the public. Different from the technology tools, communication strategies relates to what is in the message, who is involved in the message transmission and what the content of the different messaging strategies are (e.g., policy, decisions, warning or education).

4. **Communications and ITS Technology for Incident Operations** – Authorities noted that the region must make better use of communication and other ITS technology. Transportation agencies in the Portland urban area have many technological tools at their disposal for use in communicating with the public and with each other. The problem and the deficiency in these tools are their interconnectivity, interoperability and integration into emergency response. An ITS for the region includes the typical metropolitan systems: CCTV video recording, DMS, TOCs at both Oregon DOT (ODOT) and the city of Portland, traffic signal operations and highway system cameras. Regional partners use ITS primarily for day-to-day traffic and incident management. An adequate number of DMS on arterial streets and enough to be placed at a distance from an incident were identified as needs.

   Some TIM corridors exist where the counties, Portland and ODOT have placed route guidance and improved signal operations on parallel routes to the highway system. Deficiencies in networking capability and the interoperability of communications between agencies were

[8] An Emergency Transportation Route is a route needed during a major regional emergency or disaster to move response resources such as personnel, supplies, and equipment to heavily damaged areas.

identified as top impediments to the operations of evacuations. With so many tools to use, the difficulty becomes the reliability and consistency of the message. Internet communications technologies such as Twitter, Facebook, TripCheck, transit Automated Rider Boards, public alerts, Web EOC and Ops Center all are rapidly developing and must be included, tracked and documented through agreements, plans and policies. Public Radio broadcasts and Reverse 911 messages need to be a part of the communications technology plan. A regional Gap Analysis for Public Works regarding interoperability of radio and telecommunications is in the first stage of development as part of a DHS UASI Initiative grant project.

5. **Improved Traffic Management and Safety** – Authorities concluded that the region should focus upon improving safety and traffic flow on multiple road interchanges within the highway system.

6. **More Robust Planning for Evacuation Operations** – Respondents commented that the Portland urban area would like to do more with planning for evacuations. They noted that they must strategically plan to manage multiple modes of transportation and describe it in an evacuation annex. They would like to look at different areas over a 24-hour period and determine the different evacuation needs based on time of day. The urban area population centers, geography and transportation system (including mass transit, bridges/overpasses, road capacity) impact decisions of evacuation planning. Planners are reviewing assets and risks that could impede or improve public service recovery, evacuation or isolation. Regionally, counties are conducting continuity of operations planning to determine service capabilities that could aid the public when disaster strikes and evacuation is or is not implemented. Reception planning has begun through the identification of emergency needs for congregation sites and the criteria for each site's operation. Such sites reviewed are sheltering, transportation connection, points of distribution, medical care points and feeding facilities. The research conducted in 2008 will enhance discussions about adjacent counties within the urban areas reception centers in the next phases of evacuation planning.

7. **Identification and Use of Resources** – Respondents noted that they need to look at their transportation assets, regional response route map, and regional roles and responsibilities prior to an emergency to identify what might be used, the parameters of use, and how the resource might be adjusted for evacuation operations. While Portland urban area planners have discussed the use of buses for mass evacuation, more understanding of their plans and capabilities are needed. C-Tran has a Bus Mobilization Plan that is coordinated with Clark Regional Emergency Services Agency. However, Tri-Met has no plan and there is no regional emergency management agency with a governance structure to manage such an agreement. Authorities must know the limitations of public and private transportation resources during disaster, and agreements need to be drawn between the agencies. Many multicounty agreements have been created that allow sharing of resources and accountability for those resources in disaster. But there is a regional shortage of current private resources that can be used in any response including evacuation. Part of future planning will be to identify the shortage gaps and ways to fill them.

San Diego, California

#17-Most Congested #17-Population (3,001,000)
INRIX® National Traffic Scorecard 2009

The Plan

California and San Diego officials affirmed that the draft plan provided is the most current version, having been reviewed in July 2009, and that the San Diego evacuation plan is incorporated into the State plan, which is awaiting final signature. The San Diego plan generally does not extend more than 30 miles beyond the metropolitan area. Evacuation Plans are reviewed every 3 years, or when the need presents itself after a major event. After-action reports are evaluated and may potentially affect the overall evacuation plan.

The California, State Emergency Plan (SEP) establishes the California Emergency Functions (CA-EFs) as a key component of California's system for all-hazards emergency management. The California Emergency Management Agency (Cal EMA) initiated the development of the CA-EFs in cooperation with California's emergency management community including Federal, State, tribal, and local governments, public/private partners and other stakeholders to ensure effective collaboration during all phases of emergency management. The development of the CA-EFs involves organization of the participating stakeholders and gradual development of emergency function components. This development also includes a process to maintain each of the CA-EFs as a permanent component of California's emergency management system.

As described in Section 13 of the SEP, the CA-EFs consist of 17 primary activities deemed essential to addressing the emergency management needs of communities in all four phases of emergency management. Based upon authorities and responsibilities, a lead agency has been designated for the development of the State government level CA-EFs. As the CA-EFs development expands to include other stakeholders from the emergency management community, the CA-EFs will determine a governance structure. The governance structure will be developed with the administrative direction of Cal EMA and be flexible to allow for the participation of future stakeholders. Evacuation Planning is one of the listed 17 CA-EFs.

Top Highway Impediments

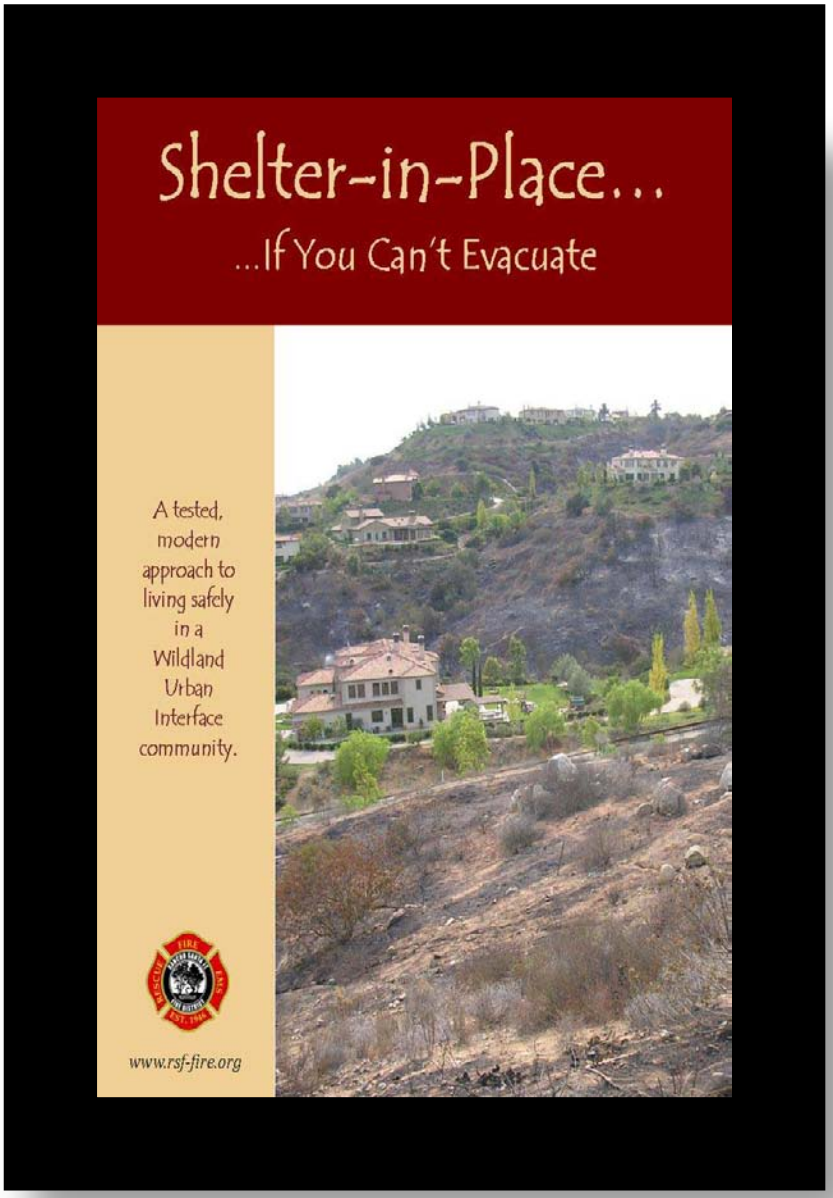
Respondents identified the most significant impediments along the NHS routes that may impact effective large-scale, mass evacuations from the San Diego metropolitan area.

Top Highway Impediments
SAN DIEGO

- **Communication Capabilities**
- **Evacuation Route Capacity**
- **Need Public Outreach Campaign**

1. **Communication Capabilities** - Although the capability or capacity of the existing communication infrastructure meets current needs, evacuation planners stated that a failure of the communication system would significantly impact evacuation operations.

2. **Evacuation Route Capacity** – Currently identified evacuation routes remain congested and are often filled to capacity during daily operations. The strength of the existing Evacuation Plan(s) and comprehensive communication infrastructure could minimize this deficiency.



3. **Need Public Outreach Campaign** - Outreach would help authorities and the public understand evacuation plans. Authorities believe that improving outreach programs would benefit current evacuation plans. Respondents indicated that this is a priority and would improve the likelihood of a successful evacuation operation.

San Francisco, California

#7-Most Congested #13-Population (4,275,000)
INRIX® National Traffic Scorecard 2009

The Plan

Respondents confirmed that the July 2009 State plan provided for this study is the most recent and that it serves as a model for county and local plans. The State Plan was reviewed during a 2008 grant-funded planning session and addressed in 2009 under a Grant Planning Validation Workshop. Planners review the California State plan annually, with additional planning and review sessions occurring as needed, particularly after a major incident, such as last year's wildfire-related evacuations throughout the State. Available on the California Emergency Management Agency Web site, the State plan does not address evacuations. The State did produce an evacuation Guideline document for use by local governments in developing their plans.

Interviewees noted that the ***Regional Catastrophic Earthquake Mass Transportation/ Evacuation Plan*** (January 22, 2010, DRAFT) addresses needs for a worst-case scenario, or earthquake in the San Francisco area. The regional plan incorporates the major cities of San Francisco, Oakland, and San Jose while including the surrounding nine counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma. The comprehensive plan takes into account the possibility of catastrophic damage to the existing surface transportation infrastructures. Regional Mass Evacuation Planners agree that a full evacuation of the San Francisco metropolitan area is improbable, while a more regionalized evacuation scenario is more likely. The Mass Evacuation Strategy is comprehensive and adaptive to all likely scenarios.

San Francisco currently benefits from a Homeland Security Grant to address evacuation planning as a part of catastrophic planning. The DHS/FEMA RCPGP provides catastrophic events planning grants to the 10 highest risk Urban Areas and surrounding regions, including: Chicago, Houston, Los Angeles, New York, ***San Francisco***, Washington, DC, Boston, Honolulu, Norfolk, and Seattle.

Top Highway Impediments

Respondents identified the most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the San Francisco area as follows:

1. **Communication Capabilities if Damaged** - The communications infrastructure constitutes one of the strengths of the regional plan. However, if a catastrophic event occurs and disrupts communication, this may present a significant evacuation deficiency. Efforts are underway by evacuation planning partners to improve "real-time" information exchange. The California Highway Patrol is prepared to utilize aircraft and existing systems to accomplish this effort. Efforts are underway to improve the regional communication capabilities, such as expanding use of ITS. However, expanding and upgrading regional communications capabilities involves inherent challenges due to funding constraints that limit inclusion of robust system redundancies and continuous system maintenance and operations.

Top Highway Impediments SAN FRANCISCO

- **Communication Capabilities if Damaged**
- **Infrastructure along Evacuation Routes: Roads, Bridges & Overpasses**

2. **Infrastructure along Evacuation Routes: Roads, Bridges, and Overpasses** - To date, authorities have retrofitted more than 2,000 bridges and overpasses on the State Highway System to current earthquake standards. Certain structures identified along "life-line routes" have been retrofitted or constructed to higher standards, such as the new span of the Benicia-Martinez toll bridge. Retrofit work continues on only a handful of highway bridges. While the Bay Area toll bridges in general exceed minimum standards, other more typical highway structures, which do not, may sustain damages in case of a significant seismic event, impacting respective routes and mass evacuation. Another constraint to evacuation capability is the variant changes in roadway geometrics along facilities, particularly shoulder width and number of auxiliary lanes. Authorities have investigated the potential use of contraflow schemes for mass evacuation in some areas.

Seattle, Washington

#9-Most Congested #15-Population (3,345,000)
INRIX® National Traffic Scorecard 2009

The Plan

Washington State DOT (WSDOT) respondents reported that while Seattle has no evacuation plan, they maintain a well-developed Emergency Response Plan that addresses many areas critical to evacuating at-risk populations. Many of the plausible scenarios envisioned by Puget Sound planners are limited to smaller communities and groups of people so the thought of evacuating the whole city seems extremely remote. Nevertheless, they noted that the plans are regularly activated so they have significant experience in executing emergency operations. For example, in 2009, WSDOT coordinated and planned

for evacuations in response to flooding risks in the Green River Valley. The WSDOT also worked with the State Emergency Management Division on evacuation planning along with local jurisdictions including Seattle and conducted a technical assistance visit to San Diego to discuss evacuation practices.

Authorities noted that they would rather have people stay put, given the threats endemic to the region. For example, if Mt. Rainier erupted violently and suddenly, Puget Sound authorities would direct people to higher ground and avoid putting thousands of people on the highway network that would be vulnerable to debris flows and flooding. Respondents expressed the view that for the type of threats they face, conducting mass evacuation operations would not be the first thing that they would want to do.

The Puget Sound Region recently received a Federal grant to address evacuation planning. The DHS/FEMA RCPGP provides catastrophic events planning grants to the 10 highest risk Urban Areas and surrounding regions. The objectives of the grant funding include: (1) addressing shortcomings in existing plans, (2) building regional planning processes and communities, and (3) linking operational and capabilities-based planning with resource allocation.

The Puget Sound Catastrophic Preparedness Planning Region constitutes an eight-county region that includes Island (city: Oak Harbor), King (cities: Bellevue, Kent, Renton, and Seattle), Kitsap (city: Bremerton), Mason (city: Shelton), Pierce (city: Tacoma), Skagit (city: Mount Vernon), Snohomish (city: Everett), and Thurston (city: Olympia) counties.

Top Highway Impediments

During the interview, they noted that Seattle has higher priorities than mass evacuation planning. Moreover, Seattle must deal with moving people around bodies of water or mountain ranges that constrain transportation and limit the potential for evacuation routes. However, information presented in the interview identified a few impediments that may impact effective large-scale, mass evacuations from the Seattle area, including:

Top Highway Impediments SEATTLE

- **Congestion**
- **Limited Infrastructure**
- **Insufficient Responder Resources to Manage an Evacuation**

1. **Congestion** – Based upon everyday congestion, Puget Sound officials know where their bottlenecks would constrain a mass evacuation.

2. **Limited Infrastructure** –Although interviewees indicated known road bottlenecks would constrain a mass evacuation, interviewees suggested that building a roadway network large enough for a possible mass evacuation of the city would not constitute good fiscal stewardship since excess capacity would either be wasted, immediately filled with traffic from new development, or create negative environmental impacts from such construction in the area.

3. **Insufficient Responder Resources to Manage an Evacuation** – Authorities noted that, even if they could accommodate a mass evacuation, they don't have the responder resources available to direct and manage a mass evacuation operation on the NHS roads.

St. Louis, Missouri

#21-Most Congested #18-Population (2,817,000)

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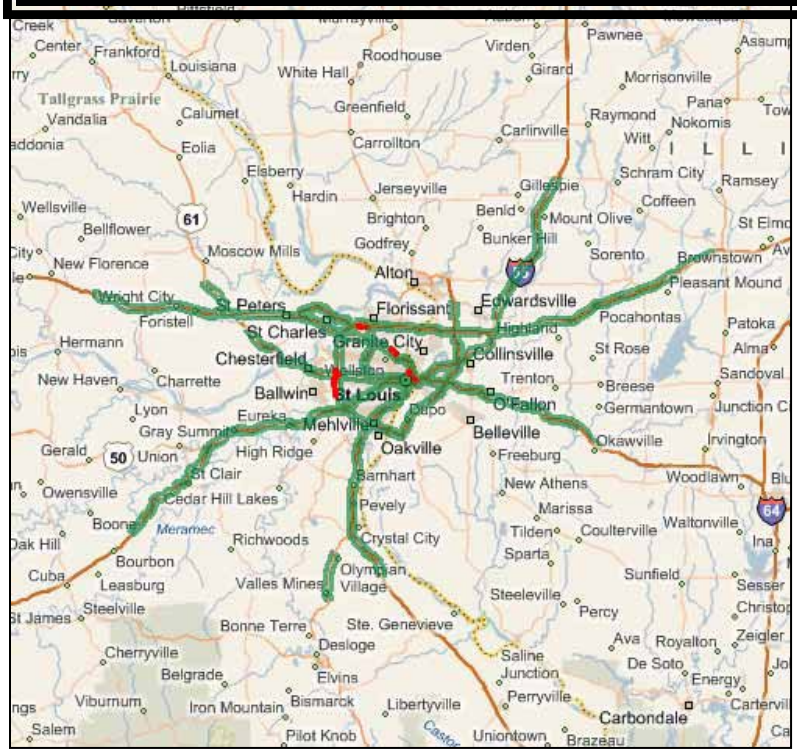


The Plan

Missouri Department of Transportation (MoDOT) officials reported that mass evacuation and predetermined events are not scenarios that they plan for and that they use a very high-level statewide plan that is not prescripted. As such, interviewees indicate that St. Louis does not have an emergency plan for the metropolitan area. The closest to a regional plan is the bi-State Gateway Guide produced by the St. Louis MPO.

In Missouri, evacuation is the responsibility of the Office of the Governor. The Missouri State Emergency Operations Plan does not contain an evacuation section, although MoDOT is a supporting agency along with many other agencies to the State Emergency Management Agency in executing the Plan. The MoDOT maintains an Incident Response Plan (IRP), but not an "evacuation plan," per se. The MoDOT IRP is an "all-hazards" plan that focuses on process rather than specific pre-scripted responses. The MoDOT official said that there are no scenarios that would result in a mass evacuation anywhere in Missouri and that all anticipated situations would be localized.

Top Highway Impediments ST. LOUIS

- **Limited Capacity**
- **Highway Capacity & Bridges**

Top Highway Impediments

Interviewed officials noted that since mass evacuation is not an anticipated response in Missouri, it is difficult to identify highway impediments that would curtail an evacuation. However, they did offer some insights on the highway system that suggest that an evacuation could be impeded by various infrastructure, operations, technology, and resource impediments.

These are as follows:

1. **Limited Capacity** - Based on several Weapons of Mass Destruction (WMD) exercises focused on bridge attacks and chemical releases in very small areas, officials found that if city leadership called for a no-notice mass evacuation of St. Louis, existing capacity would not be sufficient. At best, the DOT can use DMS, service patrols and the tools currently available to help move the traffic, but will never alleviate the congestion in the unlikely event a mass evacuation is ordered.

2. **Highway Capacity and Bridges** - In St. Louis, the Mississippi and Missouri Rivers present the greatest obstacle to evacuation. St. Louis lacks the highway capacity for a mass evacuation. Contraflow is not realistic due to physical constraints and the manpower required. This is complicated by the fact that the most likely evacuation events are no-notice events in the Midwest. The MoDOT officials recognize that while more highway capacity is the best way to address any potential for mass evacuations, it is not very practical.

Tampa-St. Petersburg, Florida #29-Most Congested #19-Population (2,734,000)

INRIX® National Traffic Scorecard 2009

The Plan

Florida is one of the States that is at the forefront of emergency readiness, response, and planning. In 2005, Florida developed the plan for the Florida Intrastate Highway System (FIHS). This plan identified the following routes that could be used for evacuation: *Sarasota County's I-75 Shoulder Use Plan, Jacksonville's I-10 Contraflow Plan, Space Coast's SR 528 (Beeline Expressway) Contraflow Plan,* ***Tampa Bay's I-4 Contraflow Plan*****,** *Florida Turnpike Contraflow Plan for Southeast Florida,* and *Southeast/Southwest Florida Contraflow Plan for I-75/Alligator Alley*. The FDOT State Traffic Engineering office in Tallahassee keeps the plans current. Within this office, the Deputy Traffic Engineer for Incident Management manages this program.

Florida has spent close to $1 billion to deploy ITS technology to enhance highway operations. As a part of that effort, the State migrated to a single statewide TMC Software (SunGuide) beginning in the early 2000s. All TMCs across the State in Miami, Tampa, Jacksonville, Fort Myers, Fort Lauderdale, Orlando, and the Florida Turnpike in Orlando and southeast Florida use the SunGuide software. The State Emergency Operations Center (EOC) in Tallahassee also installed the SunGuide software for use by the Emergency Support Function #1 (Transportation) liaison that operates at the EOC when activated during time of emergency operations. This single platform enables the State to share controls of cameras and other devices in real-time.

In November 2006, FDOT and the Florida Department of Emergency Management—in concert with FEMA—initiated the development of the comprehensive "**Florida Catastrophic Planning Project,"** which considers two, large-scale incidents resulting in projected consequences of catastrophic proportions: a breach of the Herbert Hoover Dike (HHD) around the waters of Lake

Okeechobee and a Category 5 hurricane impacting the entire south Florida peninsula, which has a population of nearly 7 million.

This project includes data collection and comprehensive capability assessments of local, State, and Federal resources to support response to a failure of the HHD and a Category 5 hurricane striking south Florida. Analysis of the assessments and draft county plans will help to identify resource gaps, inconsistencies, and competing interests for limited resources.

For the purpose of this study, respondents reported that the State plan is current, the *Florida Catastrophic Plan* will be completed soon, and the FIHS contraflow plan, published in 2005, undergoes continuous updates.

While Florida maintains a robust support system for evacuations, local authorities call for an evacuation and coordinate evacuation decisions with neighboring counties. The State views evacuation operations from a strategic vantage and supports local efforts by ensuring requested assistance is available.

The FDOT also provides support to local jurisdictions during evacuation operations, for example, with FDOT service patrols. In addition, FDOT makes available DMS to support evacuations and maintains a vendor list of those that have these resources available during an incident. The demand for these units is at a premium during mass evacuations.

The FDOT's District 7 (D-7) serves the Tampa Bay-St. Petersburg metropolitan region. The region hosts a number of major routes that could support the mass evacuation of its inhabitants, including I-75 to the north and south, the Veterans Expressway and US 19 to the north, and I-4 to Orlando. Critical infrastructure in the greater Tampa region includes bridges and a causeway: The Howard Frankland Bridge, Grandy Bridge, and Courtney Campbell Causeway constitute three major facilities that support the evacuation of Pinellas County (St Petersburg). Damage to the bridges or causeways would significantly affect an evacuation operation in this area.

As with other major regions within Florida, the Tampa Bay-St. Petersburg region maintains an evacuation plan and dedicates staff to the upkeep of the plan. The FDOT D-7 continually works with the Tampa Bay Regional Planning Council, its MPO, to enhance the plan and other evacuation activities. As with all Florida regions, Tampa Bay–St. Petersburg region may provide the following assets to support evacuation:

- FDOT safety/service patrols, known as "Road Rangers," in the Greater Tampa Bay Area.
- "Asset Contractors" as well as FDOT Maintenance personnel for maintenance and work zone issues.

Respondents noted that the Greater Tampa Bay area maintains a number of well-coordinated, frequently reviewed and updated evacuation plans, which are incorporated into the State and/or local emergency management agency's evacuation plan. These include three "Reverse Lane" plans that impact the Tampa Bay-St. Petersburg area. The I-4 plan is well-established and has been tested twice for "set-up" response times. The I-75 plan is not complete and has not been tested. Finally, authorities recently completed the *Leroy Selmon Crosstown Expressway Plan*, and all involved agencies approved the product.

The current plan provided for the study represents the most recent version; however, the Tampa Bay Regional Planning Council is in the process of updating the regional evacuation study as part of the Statewide Regional Evacuation Study program. The study relating to the Tampa Bay area was finished by March 2010. In addition, the Statewide Regional Evacuation Study program should be completed for the four-county (Hillsborough, Manatee, Pasco, and Pinellas) area in March. The findings will be incorporated into district and county plans. The area is in the process of implementing the use of new transportation analysis, evacuation models and user interface which should provide a much greater planning capability within the State of Florida.

Overall agreement within Florida dictates that the counties will cover motorist assistance on arterials within their boundaries during evacuations and the FDOT will be responsible for the Interstates. These plans have not been formalized and could be considered as the region without a formalized regional evacuation plan, per se. This may be viewed as a deficiency.

Preliminary discussions have taken place regarding transit plans and intra-regional light rail, especially a connection between Pinellas/Tampa International Airport/Tampa (USF area), to support evacuation from vulnerable areas to safer areas within the region. Preliminary discussions regarding the use of high speed rail for evacuation will be contemplated when the completion date for the first phase is known.

Top Highway Impediments

Respondents identified the most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the Tampa-St. Petersburg region, as follows:

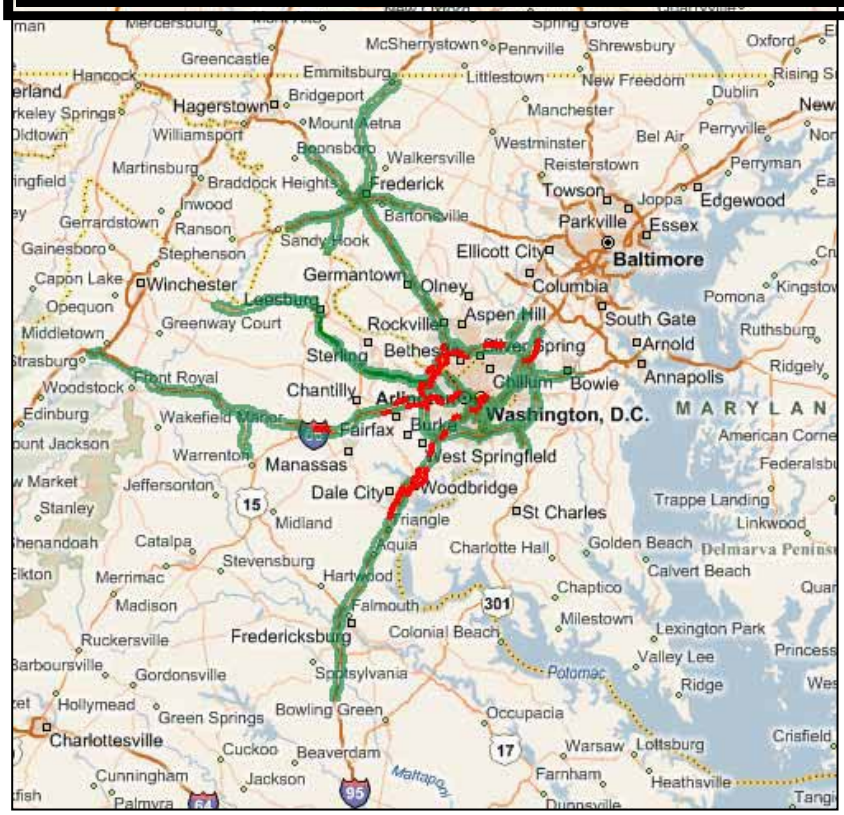
Top Highway Impediments TAMPA-ST. PETERSBURG

- **Highway Infrastructure Capacity**
- **Bridge Infrastructure Capacity**
- **Bridge Vulnerability to Damage**
- **Highway Vulnerability to Damage**
- **Limited Evacuation Routes due to Geographic Limitations**

1. **Highway Infrastructure Capacity** - The capacity of existing facilities would be significantly exceeded during a mass evacuation. .
2. **Bridge Infrastructure Capacity** - Tampa Bay–St. Petersburg has a number of bridges and a causeway. These are the critical locations and bottlenecks for evacuation.
3. **Bridge Vulnerability to Damage –** Some of these structures could be susceptible to "hydraulic lifting" which will impact the evacuation process.
4. **Highway Vulnerability to Damage -** Hurricane winds or other hazards could damage the highway facilities and other devices on the facility.
5. **Limited Evacuation Routes (Geographic Limitations) –** Tampa Bay–St. Petersburg has a very limited number of routes for evacuation due to waterways surrounding the region.

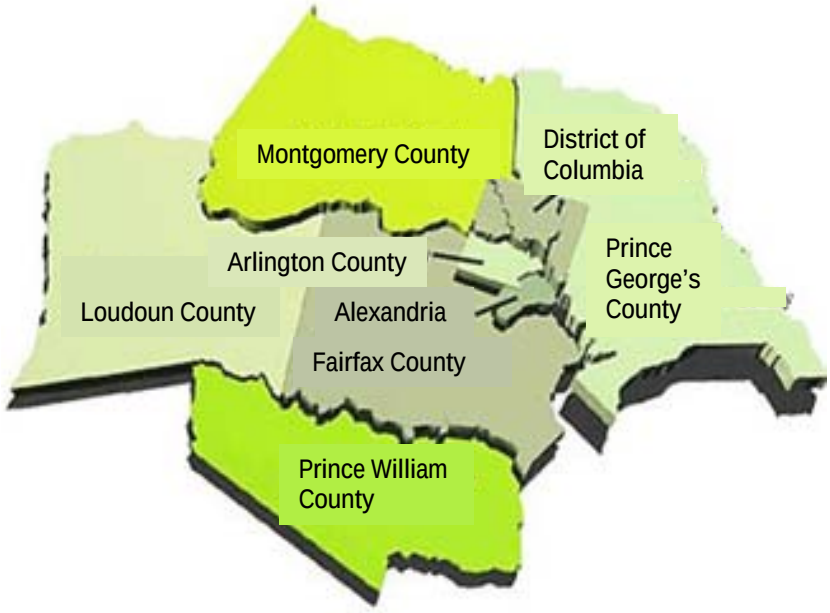
National Capital Region
(District of Columbia, Maryland & Northern Virginia)

#4-Most Congested #9-Population (5,358,000)
INRIX® National Traffic Scorecard 2009



Various definitions exist for the area referred to as the National Capital Region (NCR). For this report, FHWA selected the characterization established by the DHS's NCRC, as defined by Congress pursuant to the National Capital Planning Act of 1952, 40 USC 71. The Act defines the NCR as the District of Columbia; Montgomery and Prince George's Counties in the State of Maryland; Arlington, Fairfax, Loudon, and Prince William counties in the Commonwealth of Virginia; and all cities existing in Maryland or Virginia within the geographic area bounded by the outer boundaries of the combined area of these counties.

Today, the NCR includes the District of Columbia plus 11 local jurisdictions in the State of Maryland and the Commonwealth of Virginia. (See map)



The Plan

The Metropolitan Washington Council of Governments (MWCOG) is a regional organization of Washington-area, local governments comprising 21 local governments surrounding the Nation's Capital, plus area members of the Maryland and Virginia legislatures, the U.S. Senate, and the U.S. House of Representatives. The MWCOG provides a focus for action and develops regional responses to such issues as the environment, affordable housing, economic development, health and family concerns, human services,

population growth, public safety, and transportation. The MWCOG serves the region by coordinating evacuation and other disaster planning.

District of Columbia: The District of Columbia's (DC) EMA produced the *2009 District of Columbia Evacuation Plan*, DC's most current evacuation plan. The District of Columbia Department of Transportation (DDOT) updates the Emergency Transportation Annex (ETA) in this Plan. The most recent ETA update occurred in late 2008 through early 2009. Each year, the District's DHS, which manages District ESF responsibilities, spearheads the annual review and plan update. Since the District hosts many special events, it must review the evacuation plan on an ongoing basis. For example, DDOT evaluates the plan through their implementation of events such as the 2009 Presidential Inauguration or the 4th of July live regional test of the plan that looks at evacuation routes, traffic signalization, congested intersections with a review of and where to send resources including staff and portable dynamic message signs; how to set up evacuation routes; and how to communicate across jurisdictions. Each year, DDOT tests the plan and focuses on a different corridor to find weak spots and looks for ways to address those weaknesses. In addition, DDOT uses other regularly scheduled special events such as the home baseball games to test the required external and internal coordination to ensure that these communication flows are in place. Officials continually update the plans based on lessons learned from recent events (e.g., 2010 snow incidents). The next plan update, including the transportation annex, is expected to occur in the summer or fall 2010. Though the base plan will not change significantly with the emergency routes expected to stay the same, DDOT will reexamine secondary routes and expects to increase the use of technology into the plan.

The District EMA's evacuation plan integrates the DDOT annex into the overall plan. More importantly, plans developed by other jurisdictions within the NCR also incorporate DDOT's plan. When first developed and throughout the updating process, DDOT coordinated with its regional partners, including other DOTs, the Washington Metropolitan Area Transit Authority [WMATA], and the Metropolitan Police Department. Any time DDOT revises its plan, DDOT uses the MWCOG ESF-1 (Transportation) meetings to vet the plan, as most of those representatives on the MWCOG mirror the agencies DDOT invited in the initial discussions of the plan. The DDOT believed it very important to include all of these stakeholders during the development of the plan since evacuation routes lead into Virginia and Maryland via District bridges, tunnels, and roads. As such, DDOT needs the support of those jurisdictions to ensure a transparent evacuation.

Moreover, an evacuation could likely involve a pedestrian walk-out operation. In this case, numerous other key agencies, including the Capitol Police and the National Park Service, must know where pedestrians would congregate and where they would go in Virginia, and to a lesser degree, Maryland. The District requires a pedestrian walk-out because many of the people who work in the District during the day do not live within the District.

The DDOT seeks to move those evacuating out of the city to the receiving jurisdiction safely. To ensure that the motorists have choices, the District plan directs evacuees going to Maryland out toward the Beltway and beyond, but not as far as I-270. For those who evacuate to Virginia, the District plan directs them to the Alexandria or Arlington, Virginia,

side of the bridges that begin in Washington, DC. The District attempts to create a very transparent plan so that the adjoining jurisdictions will not change routes as a way to limit confusion for those who are driving out. This approach is based on what has been learned from the twice-daily commutes which moves a major portion of the region's population among the two States and the District.

Communication among agencies continues to improve. Through the past decade, DDOT has participated in more coordination with agencies and individuals talking about their specific needs. What hadn't been made clear prior to these discussions was the concerns and needs that are specific to Washington, DC, as the seat of the Federal Government. As a result of these conversations, DDOT now has a far more realistic understanding and perspective of what is needed to move both Congress and the President should an evacuation occur. The DDOT has come to understand how to coordinate the evacuation of these principals without affecting the rest of the city. In the past couple of years, DDOT has asked to have that process explained to them so that evacuation won't have an adverse effect on the evacuation of District citizens.

Washington, DC, currently benefits from a Homeland Security Grant to address evacuation planning as a part of catastrophic planning. The DHS/FEMA RCPGP provides catastrophic events planning grants to the 10 highest risk Urban Areas and surrounding regions, including: Chicago, Los Angeles, Houston, New York, San Francisco, ***Washington, DC,*** Boston, Honolulu, Norfolk, and Seattle.

Maryland: Maryland currently is engaged in an effort to finish the Maryland portion of the NCR evacuation plan. The MDSHA staff expects to complete this section no later than the fall 2010. Modifications will involve a different approach to how Maryland has prepared plans. Changes include adjusting the plan by considering employment sites that can be considered soft targets such as National Institutes of Health, the National Naval (Bethesda) Medical Center, as well as other large campuses and how to evacuate these sites. As these sites are large employers and some involve large patient populations, the plan will incorporate another level of complexity. For example, one site has 17,000 employees and another has 4,500. Further complicating the development of the evacuation plan is that two of these key sites are essentially across the street from each other, which could result in a bottleneck in the evacuation's initial phase.

As part of how best to deal with large campuses, the plan currently under development will also incorporate pedestrian movement, vehicles, and on-campus traffic control points. Other new components that will be added include the use of transit assets as well as the use of pick-up points - if Metro is running – to allow transit users to walk from Metro rail to pick-up points where they can board vehicles that will take them to reception centers.

Maryland coordinates its portion of the NCR plan with Virginia and the District. As part of the regional effort, the three jurisdictions are attempting to consolidate critical information into one database. To discuss common transportation concerns, MDOT, DDOT, and VDOT meet regularly.

Currently, the only two active evacuation plans include the Maryland DOT evacuation plan and the Virginia EMA evacuation plan. Maryland agreed that it was important that these two plans are coordinated and will work to do so in the future. Though the person interviewed from Maryland is a member of the NCR Emergency Managers Working Group, he was not aware that the Maryland plan is part of the NCR's EMA plan. Maryland did note that the initial NCR plan lacks information on how best to address Traffic Control Points.

Maryland reviews, evaluates and updates their plan as budgets allowed. The accuracy of the plan depends on regular review by local agencies in order to update it based on changes in local roads. As a result, the State works with local agencies to ensure those updates, such as when a traffic control point changes. Maryland uses a regional GIS database to facilitate changes to the plan. Unfortunately, no such database exists that would allow Maryland, Virginia and the District to update the plan in one place or in a consistent way.

The Maryland portion of the NCR regional plan goes beyond Maryland's border to US-301 into Virginia; across the Bay Bridge to Delaware; and west to I-270 to wherever motorists choose to go. The plan also looks at traffic volumes and traffic patterns to understand how best to keep traffic on the Capital Beltway moving. An important aspect of the plan is that it is designed to restrict motorists from portions of the Beltway which may force people to go west on I-270 and then force them to go through Frederick or go further west in a very large loop before allowing them to go home. Another portion of the plan is to deny access onto the Beltway to those motorists exiting Washington, DC, on the Indian Head highway.

Virginia: Though no studies exist to verify this, Virginia estimates that should an evacuation occur, 70 percent of the traffic will not use the Interstates. Even if the exact percentage is unknown, what is known is that all usable routes will serve as evacuation routes. Interstates in the Virginia plan are the essential routes and every other route can be considered as a potential route.

The State emergency manager provided the most recent Northern Virginia Evacuation Plan developed by the State EMA. The Virginia DOT has the lead to develop the transportation component of the VEMA Emergency Operations plan and, as such, works with VEMA to develop that portion also known as ESF-1 or transportation annex of VEMA's State Evacuation Plan for Northern Virginia. The VDOT works closely with VEMA to determine the evacuation routes for the Interstate and the arterials. The VEMA as the lead State agency updates the State plan every 4 years with the next update expected in January 2013. In addition, VDOT is developing its transportation operations plan, which differs from the State's evacuation plan, and expects that operations plan to be revised before the 2013 VEMA plan update is released. One updated component of the VDOT operations plan is transportation models. The VDOT will provide the updated section to VEMA once completed. The distinction between the two plans is that VEMA's transportation plan is written at a strategic level, and the VDOT plan is more operational in its focus. The DHS funding that VEMA received enabled VDOT to do more comprehensive planning work for signal work for the arterials and the Interstate, as well as where to locate the more critical locations for the evacuations.

The VDOT's more detailed operational plan is constantly being updated as lessons learned are incorporated into the plan. As part of its constant review, the VDOT plan is revised based on the current level of equipment they have and, based on the funds VDOT has available, the technology they can purchase. As part of a mutual agreement, VEMA, as part of the team, reviews the VDOT proposal to the evacuation plan to make sure all of the agencies agree with the plan. In addition to coordinating with VEMA, VDOT also coordinates their plan with localities.

The VEMA's State Evacuation Plan for Northern Virginia only addresses the NCR. Though the governor has approved the evacuation routes in the Northern Virginia plan to go as far west to I-66 and as far as Richmond to the south, if at all possible, VDOT would rather not evacuate people any further than a 30-mile range or to the boundary of the NCR. The VDOT portion of the plan has as its prime focus to evacuate people out of the District. As such, VDOT works with their regional partners and with FEMA on how to manage a no-notice event out of the District into Maryland and Virginia.

With the understanding that an event in one part of the State will force them to move people away from the incident, VDOT has as part of its Tidewater plan to evacuate those residents into the NCR should a hurricane hit the southern part of the State. Should people need to be evacuated, it is the intent of the State that whenever possible to keep their citizens in the State.

Top Highway Impediments
NATIONAL CAPITAL REGION

- **Regional GIS Database**
- **Traffic Signal Coordination on Arterials**
- **Limited Roadway Capacity**
- **Institutional Coordination**
- **Communication Interoperability & Protocols**
- **VIP Movements & Security**

Top Highway Impediments

District, Maryland, and Virginia respondents identified the most significant impediments along NHS routes that may impact effective large-scale, mass evacuations from the NCR, as follows:

1. **Regional GIS Database** – The region would benefit from a database that consolidates all critical infrastructure and operational ability.
2. **Traffic Signal Coordination on Arterials** – Maryland and Virginia identified the coordination of traffic signals on arterial corridors as a critical deficiency.
3. **Limited Roadway Capacity** – The roadway network capacity in Northern Virginia would be exceeded in a mass evacuation. Limited capacity on bridges from Virginia to Maryland would also impede evacuations. Maryland also reports that choke points exist on return roads that may make the reentry after the event difficult. Bottlenecks exist on I-270 where the road narrows from six lanes to four lanes in some stretches.
4. **Institutional Coordination** – Northern Virginia could benefit from closer coordination among VDOT, law enforcement and local jurisdictions since VDOT must work with them to restrict traffic movement.

5. **Communication Interoperability and Protocols** – Although VDOT does have interoperability capabilities, the agency does not yet have the ability to communicate among the multiple agencies needed to conduct a successful evacuation. The VDOT noted that they need protocols on how best to communicate among agencies including first responders.

6. **VIP Movements and Security** – The movement of key government officials, including the President of the United States—during an incident would create severe gridlock as security details impede the travel of other evacuees. To address these concerns, DDOT and its Federal partners recently worked through various scenarios that would involve the evacuation and movement of the President and how to implement different evacuation plans. Based on this exercise, DDOT recognizes that different streets within the District have different levels of importance. As the President moves on a daily basis, DDOT gains insight from a traffic-management perspective about how VIP movements will affect an evacuation.

Options for Accelerating Projects to Increase Evacuation Capacity West of the National Capital Region

Introduction

This section of the report examines how construction projects that would increase evacuation capacity on NHS evacuation routes west of the NCR could be accelerated. It differs from the preceding section in that it provides a discussion of options that may be further considered by State departments of transportation in Maryland, West Virginia, and Virginia to accelerate NHS construction projects discussed in this study. This portion of the report focuses only on routes leading westward from the confines of the NCR and provides:

- A description of the major NHS evacuation routes that lead westward from the NCR;
- Identification of large (often multi-phase) ongoing projects included in Capital Construction Plans and Statewide Transportation Improvement Programs (STIPs) and Transportation Improvement Programs (TIPs) in Maryland, Virginia, and West Virginia that could increase evacuation capacity on the major NHS evacuation routes west of the NCR; and
- Identification of options for accelerating large (often multi-phase) ongoing projects that could increase evacuation capacity on NHS evacuation routes west of the NCR.

For this section of the report, FHWA asked Federal, State, and regional highway contacts in Maryland, Virginia and West Virginia about specific NHS routes under major construction and suggestions on how to accelerate work on key projects. A list of those interviewed is included in *Appendix 1*.

Background

In order to understand the scope of this report, a description of both the NCR and the NHS are provided. In addition, existing (pre-study) information on the issue of evacuating west of the NCR is provided.

The National Capital Region: Various definitions exist for the area referred to as the NCR. In order to analyze and describe options for accelerating construction projects to the west of the NCR, this report: (1) adopts one definition for the NCR, and (2) identifies the NHS roads that will be analyzed for this report. The FHWA selected the definition established by the DHS's NCRC for the NCR.

Congress established the geographic definition used in this report pursuant to the National Capital Planning Act of 1952, 40 USC 71. The Act defines the NCR as the District of Columbia; Montgomery and Prince George's counties in the State of Maryland; Arlington, Fairfax, Loudon, and Prince William counties in the Commonwealth of Virginia; and all cities existing in Maryland or Virginia within the geographic area bounded by the outer boundaries of the combined area of these counties. Today, the NCR includes the District of Columbia plus 11 local jurisdictions in the State of Maryland and the Commonwealth of Virginia. (See map)

The MWCOG[9] defines the NCR differently. It specifically includes the city of Frederick and

National Capital Region Facts

2,500 square miles

11 local jurisdictions, the State of Maryland, Commonwealth of Virginia, and the District of Columbia

3 branches of Federal Government (executive, judicial, legislative)

271 Federal departments and agencies
340,000 Federal workers

Over 5 million residents

More than 20 million visitors annually

4th largest U.S metropolitan area

Gross Regional Product (GRP) of nearly $288.3 billion (4th nationally)

Headquarters for the World Bank, the International Monetary Fund and the Organization for American States

Over 2,100 non-profit organizations

More than 40 colleges and universities – over 130,000 students annually

2nd largest rail transit system and the 5th largest bus network in the U.S.

2 major airports serving more than 40 million passengers a year

Source: DHS/FEMA Office of National Capital Region Coordination

[9] The Metropolitan Washington Council of Governments, or MWCOG, constitutes a regional organization of Washington-area local governments comprising 21 local governments surrounding the nation's capital, plus area members of the Maryland and Virginia legislatures, the U.S. Senate, and the U.S. House of Representatives. MWCOG provides a focus for action and develops regional responses to such issues as the environment, affordable housing, economic development, health and family concerns, human services, population growth, public safety, and transportation.

Frederick County, Maryland. For the purposes of this report, the congressionally mandated definition was adopted, so Frederick County is considered west of the NCR.

The National Highway System: The NHS is approximately 160,000 miles (256,000 kilometers) of roadway important to the Nation's economy, defense, and mobility. The NHS includes the following subsystems of roadways[10]:

- **Interstate:** The Eisenhower Interstate System of highways retains its separate identity within the NHS.
- **Other NHS Routes:** These are highways in rural and urban areas which provide access between an arterial and a major port, airport, public transportation facility, or other intermodal transportation facility.
- **Strategic Highway Network (STRAHNET):** This is a network of highways which are important to the United States' strategic defense policy and which provide defense access, continuity and emergency capabilities for defense purposes.
- **Major STRAHNET Connectors:** These are highways which provide access between major military installations and highways which are part of the STRAHNET.
- **Intermodal Connectors:** These highways provide access between major intermodal facilities and the other four subsystems making up the NHS.

The NHS was developed by the DOT in cooperation with the States, local officials, and MPOs. The FHWA Office of Planning offers maps of the NHS on its Web site at www.fhwa.dot.gov/planning/nhs/.

This report focuses on the portion of the NHS that extends westward from the NCR. To understand what routes evacuees would take from the NCR, an understanding of the NHS roads that cover each area is necessary.

In addition, a brief description of the **Appalachian Development Highway System (ADHS)** is being provided as one of its corridors, Corridor H from the Virginia State line to Elkins, West Virginia, will be included in the analysis to identify options for accelerating large (often multi-phase) ongoing construction projects that could increase evacuation capacity on NHS evacuation routes west of the NCR. The ADHS was created by the Appalachian Regional Development Act of 1965. Its purpose was to provide a system of development highways and access roads which would contribute to economic development opportunities in the Appalachian regions of 13 States—Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia. West Virginia has six corridors (D, E, G, H, L, and Q) on its portion of the ADHS. The only unfinished ADHS corridor in West Virginia is Corridor H.

Evacuating the Populations Westward from the NCR: After monitoring evacuations of New Orleans and Houston resulting from the 2005 hurricanes Katrina and Rita, West Virginia officials expressed concern regarding the potential effect of westward-moving evacuees from the NCR that would enter the State. West Virginia authorities raised their concerns about

[10] A specific highway route may be on more than one subsystem.

the impact of an NCR evacuation at a number of All Hazards Consortium meetings during the past several years[11]. In 2005, the State of West Virginia commissioned an Urban-to-Rural (U2R) Task Force[12] to address the potential for receiving populations evacuating from the NCR including Northern Virginia and Maryland in response to an evacuation order. In September 2006, the West Virginia U2R Evacuation State Planners Workshop was held with key participants from surrounding States to discuss evacuation routes leading into West Virginia. During the workshop, the West Virginia EMA shared findings from a survey conducted by West Virginia University which included identification of target destinations for those selecting to self-evacuate in the event of a natural disaster in the Washington, DC, metro area. As shown in the figure, the survey found approximately 33 percent would potentially evacuate to or through West Virginia.

However, Maryland and Virginia believe that West Virginia will be minimally affected by an evacuation from the NCR. In 2005, the University of Virginia conducted a poll of 1,071 NCR households to determine if residents would practice community shielding, or staying in place while responders deliver supplies to the affected area, if attacked with a dirty bomb or a biological agent.[13] Virginia, Maryland, and District officials interviewed for this study note that most events would cause NCR residents to shelter-in-place, not evacuate. For example, a detonation of a chemical, biological, radiological, nuclear explosive (CBRNE) device, such as may be used during a terrorist attack or other malevolent event, would result in a shelter-in-place order until first responders determine the hazards and if an evacuation is warranted. For those that would evacuate, the University of Virginia study found that approximately 40 percent would evacuate to Virginia, 31 percent to Maryland, and less than 3 percent to West Virginia.[14]

[11] The All-Hazards Consortium helps create new resources and funding opportunities for the States to support regional multistate collaboration efforts among its stakeholders from government, private sector, higher education and non-profit/volunteer organizations. Member States include: the Delaware, District of Columbia, Maryland, North Carolina, New Jersey, New York, Pennsylvania, Virginia and West Virginia

[12] The U2R Task Force included representatives from the WV State police, the Federal Bureau of Investigations (FBI), American Red Cross, School board authorities, and WVDOT.

[13] *Community Shielding in the National Capital Region: A Survey of Citizen Response to Potential Critical Incidents,* Prepared for the Critical Incident Analysis Group University of Virginia National Capital Region Project June 2005

[14] *NCR Behavioral Survey: Behavioral Aspects of Sheltering and Evacuation Planning for the National Capital Region – Preliminary Results December 18, 2009 – Slide Presentation, Center for Survey Research, University of Virginia, slide number 66.*

Methodology

The FHWA assembled a team that included more than 15 technical experts from the FHWA Division office in the District of Columbia, Maryland, Virginia and West Virginia (*See Appendix 1*).

The group's charge was to:

1. Identify NHS roads that would qualify for this study, e.g., corridors leading west from the NCR,
2. Analyze NHS projects west of the NCR currently under construction that could increase evacuation capacity, and
3. Provide options to accelerate NHS projects under construction.

Assumptions: To delineate parameters for the study, the following assumptions were used:

- Since the study specified westward movement, the following corridor routes were not considered:
  - north/south routes leading through Maryland into Pennsylvania,
  - north/south routes through Virginia into North Carolina, and
  - eastbound routes through Maryland or Virginia into eastern Maryland or Delaware.
- The requirements of the study specified examination of projects west of the NCR. However, there are some large projects within the boundaries of the NCR (including Fairfax and Loudoun counties) that have the potential to increase evacuation capacity west of the NCR. Discussion of such projects, and options to accelerate them, are not included in this report.
- The study called for a review of "how highway system projects currently under construction west of the NCR could increase the NCR's evacuation capacity." Large construction projects, that increase system capacity, can often consist of multiple smaller projects (or phases) that are advanced based on availability of funding. In this study, projects (or phases of large multi-phase projects) were identified and options for accelerating each were provided, depending on where in project development cycle it currently stands.
- In terms of providing a "detailed plan to accelerate such projects," a list of specific options the State has considered, or plans to consider, to accelerate construction, or time to construction, for each ongoing project (or phase of a large multi-phase project) was developed.

Identification of Routes for Study: FHWA reviewed the areas considered outside and to the west of the NCR and NHS routes in the following counties:

- **Virginia:** Albemarle, Alleghany, Augusta, Bath, Clarke, Culpeper, Fauquier, Frederick, Greene, Highland, Madison, Nelson, Orange, Page, Rappahannock, Rockbridge, Rockingham, Shenandoah and Warren.
- **Maryland:** Allegany**,** Frederick, Garrett, and Washington.

- **West Virginia:** Barbour, Clarksburg, Grant, Greenbrier, Hampshire, Hardy, Jefferson, Marion, Monongalia, Pendleton, Pocahontas, Preston, Randolph, Tucker, and Upshur.

Identification of Construction Projects: After selecting the corridors that met the above criteria, Maryland, Virginia, and West Virginia STIPs and TIPs, were collected and reviewed. Based on this initial information, planning staff in all three FHWA Division Offices were asked to provide additional information (description, location, phasing, scope, etc.) for ongoing projects (or phases of large multi-phase projects) west of the NCR that could increase evacuation capacity on key NHS routes.

Identification of Options to Accelerate Construction: Through its research and interviews, FHWA obtained information offered through the plans and interviewed officials on opportunities to accelerate construction projects on the various NHS roads that form an evacuation corridor. These opportunities would accelerate construction on the corridor routes, thus potentially expanding the capacity for evacuees to flow westward if parts of the NCR were ordered to evacuate. The team interviewed officials, including engineers and planners, from the FHWA Division Offices, State DOTs, and the MPOs in Maryland, Virginia and West Virginia. Since most of the opportunities to accelerate construction depend on innovative means to carry out project financing, project development, and contract administration, the research team consulted with numerous FHWA, MDSHA, VDOT, and WVDOT specialists in order to identify viable options for the identified projects. The FHWA has been a leader in identifying and advocating the use of contract administration and project finance options to accelerate construction time on all highway projects, with particular focus on large, complex and often multi-phased projects.

Findings

This section includes the results of the study, including a map and description of the key NHS evacuation routes west of the NCR, a description of the ongoing highway projects (or phases of large multi-phase projects) on each of these routes that could increase evacuation capacity, and a listing and discussion of options that have been, or will be, considered to accelerate construction, or time to construction, on these projects.

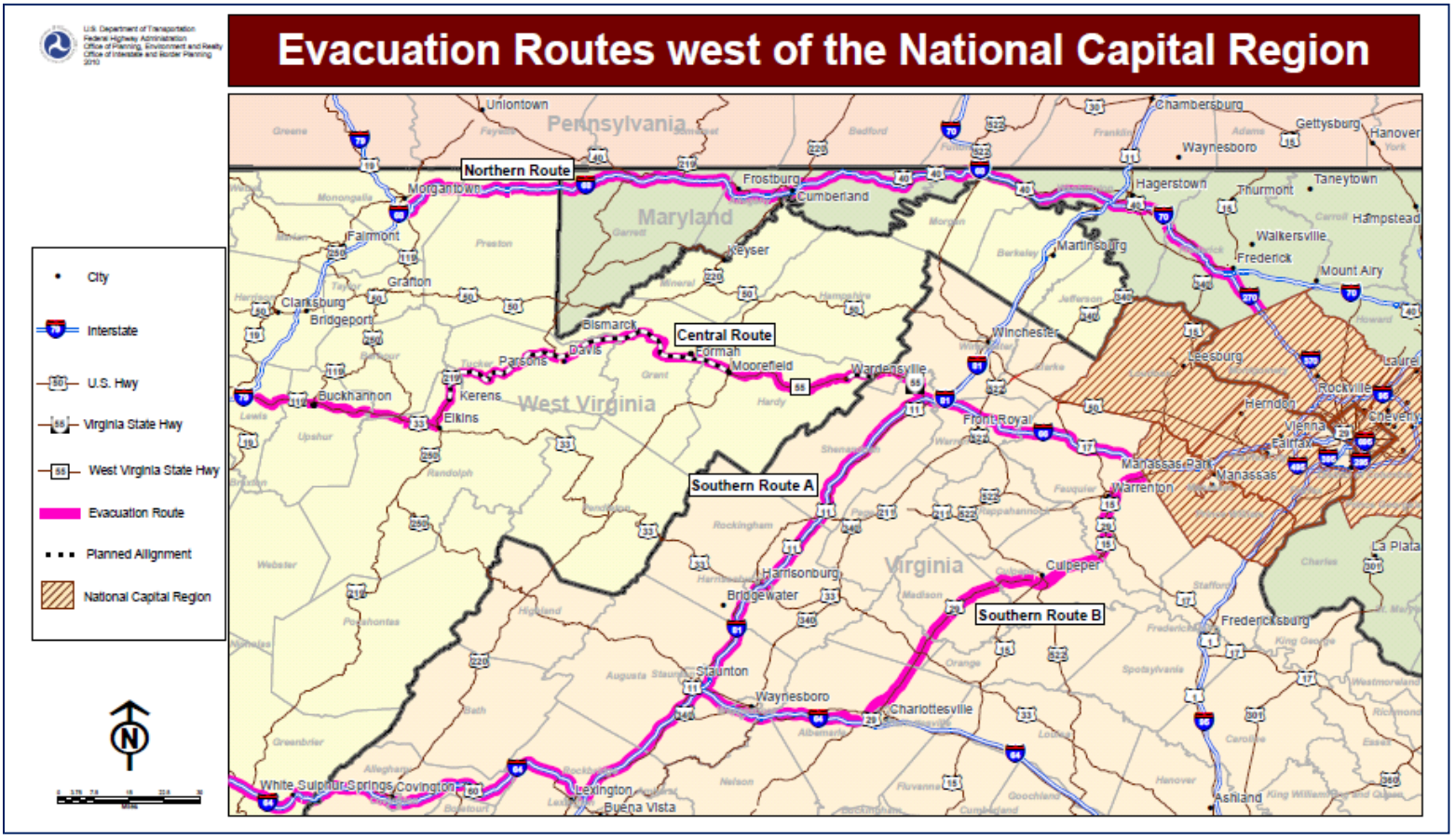
The NHS Evacuation Routes: The FHWA's Office of Planning produced a map to aid in visualizing the routes under study for this report. This map identifies the location of four key NHS evacuation routes that lead NCR residents westward away from the region.

Northern Route: I-270 (MD) to I-70 (MD) to I-68 (MD) to I-68 (WV)

- I-270 (MD) is a four-lane freeway (two lanes in each direction) from Montgomery County line to I-70 with interchanges located at MD80, MD85, and I-70.
- I-70 (MD) is a four-lane freeway between its interchange with I-270 in Frederick County and its interchange with I-68 in Washington County.
- I-68 (MD & WV) is a four-lane limited access highway between I-79 at Morgantown, West Virginia, and I-70 at Hancock, Maryland. I-68 handles westerly traffic to/from the Baltimore-Washington area, heading to the Ohio Valley and west.

Central Route: I-66 (VA) to I-81 (VA) to the Appalachian Corridor H Alignment (VA 55 and WV 55)

- I-66 is a four-lane limited access highway.
- I-81 is a four-lane limited access highway and is used in this routing for about 4 miles between exit 300 (I-66) and exit 296 (VA 55).
- VA 55 (the eastern most portion of the Appalachian Corridor H Alignment) has limited capacity as it is a two-lane road. Traffic volumes are low at only about 5,000 vehicles per day (vpd). There are currently no planned capacity improvements along this portion of the corridor. This situation diminishes the effectiveness of this alternative as a key NHS evacuation route into western Virginia and destinations further west.
- WV 55 and the West Virginia portion of the Appalachian Corridor H Alignment. This portion of the alternative is being constructed in several separate projects (or phases). Two of the nine projects (or phases) have been completed and are open for traffic. When complete, the facility will be a four-lane limited access divided highway with roughly two breaks in access per direction per mile. Somewhat similar to the comment above regarding VA 55, this situation (seven incomplete Corridor H project [or phases]) diminishes the effectiveness of this path as a key NHS evacuation route into West Virginia and destinations further west.



Southern Route A: I-66 (VA) to I-81 (VA) to I-64 (VA) to I-64 (WV)

- I-66 is a four-lane limited access highway.

- I-81 is a four-lane limited access highway between I-66 (exit 300) and I-64 west at Lexington (exit 191). It is a significant freight corridor, with trucks accounting for 30 percent of total traffic on I-81 between Lexington and Staunton (I-64 overlap section).
- I-64 from Charlottesville to the West Virginia State line is a four-lane limited access highway.
- I-64 between the Virginia State line and its intersection with I-77 near Beckley, WV, is a 66-mile, four-lane rural Interstate. Approximately 50 percent of the corridor was constructed in the early 1970s with the remainder completed and opened to traffic in 1988. Traffic counts range from 13,000 vpd to 23,000 vpd. Traffic volumes are higher nearer to Beckley (MP 118 to MP 125) and in the vicinity of Lewisburg and White Sulphur Springs (MP 156 to MP 170). Generally, bridge clearances all meet or exceed standards. There are 12 interchanges along this section, all servicing small towns and smaller rural roads.

Southern Route B: US 29 (VA) to I-64 (VA) to I-64 (WV)

- US 29 is a divided highway (between four and eight lanes) between Gainesville and I-64 in Charlottesville. Sections of US 29 around Culpeper and Charlottesville are limited access facilities. There are sections of US 29 in the Charlottesville area carrying more than 50,000 vpd. Similar traffic volumes exist on US 29 near Gainesville. Currently, there are no planned capacity improvements on US 29.
- I-64 from Charlottesville to the West Virginia State line is a four-lane limited access highway. It runs jointly with I-81 from Staunton to Lexington.
- I-64 between the Virginia State line and its intersection with I-77 near Beckley, WV is a 66-mile, four-lane rural Interstate. Approximately 50 percent of the corridor was constructed in the early 1970s with the remainder completed and opened to traffic in 1988. Traffic counts range from 13,000 vpd to 23,000 vpd. Traffic volumes are higher nearer to Beckley (MP 118 to MP 125) and in the vicinity of Lewisburg and White Sulphur Springs (MP 156 to MP 170). Generally, bridge clearances all meet or exceed standards. There are 12 interchanges along this section, all servicing small towns and smaller rural roads.

The FHWA gathered and analyzed information on ongoing highway projects (or phases of large multi-phase projects) west of the NCR that had the potential to increase evacuation capacity. ***This analysis revealed no ongoing projects*** (or phases of large multi-phase projects) ***that have the potential to increase evacuation capacity on either of the two southern routes*** *(US 29 to I-64 and I-66 to I-81 to I-64).* ***Therefore, FHWA dropped both of these two routes from further analysis, leaving only the Northern Route and the Central Route for consideration.***

The Construction Projects: State and local agency highway contacts identified two large multi-phase ongoing projects on the Northern Route and the Central Route that could increase capacity for NCR evacuees to travel westward.

Northern Route: I-270 (MD) to I-70 (MD) to I-68 (MD) to I-68 (WV)

- **Project #1 - I-70 Phase 4 Project in Frederick County**: I-70 is planned to be widened in the westbound and eastbound direction to construct a third travel lane in each direction from MD 85 to MD 144 to meet current highway standards. The project is located in Frederick County, Maryland, and extends from I-270 to Mt. Phillip Road. This project is currently on hold due to lack of funding. The project is currently in the STIP, and the environmental document for Phase 4 is complete. However, due to traffic growth and land use changes, a possible reevaluation of the environmental document and the proposed design may be needed. An

inside widening of I-70 is being considered. Estimated project cost is $90 million, and construction timeframe is 2018 to 2020.

Central Route: I-66 (VA) to I-81 (VA) to the Appalachian Corridor H Alignment (VA 55 and WV 55)

- **Project #2 - Corridor H (Bismarck to Forman Phase)**: This section is partially under construction. The WV Department of Highways (DOH) approved an amended Record of Decision (ROD) in May 2001. Final design is underway for the 14.5-mile Bismarck to Forman section in Grant County. Portions of this section have some ongoing construction activity, and the remaining sections are included in the approved STIP. The WVDOH anticipates that the Bismarck to Foreman section of Corridor H will be completed in late 2013. Estimated cost for this phase is $260 million (2007 dollars).[15]

- **Project #3 - Corridor H (Davis to Bismarck Phase)**: The environmental and design components of this portion of Corridor H have been completed. The remaining pre-construction issue to resolve is the purchase of right-of-way from corporate land holders. The project is currently in the STIP, and the amended ROD was completed in April 2001. Final design is underway for the 16.2-mile Davis to Bismarck section in Tucker and Grant Counties. A contract, including a bridge, west of Bismarck is anticipated to be advertised in early 2010. Estimated cost for this phase is $215 million (2007 dollars), and construction timeframe is 2012 to 2015.

- **Project #4 - Corridor H (Kerens to Parsons Phase)**: The Kerens to Parsons section of Corridor H is located almost entirely within the Monongahela National Forest. The FHWA and the WVDOH are working with the United States Forest Service, to finalize the alignment. Final design for the 15.5-mile section through Randolph and Tucker Counties is anticipated to begin in 2014. This project is currently in the long-range plan, and the WVDOH anticipates that the Kerens-to-Parsons section will begin construction in 2018. Estimated cost for this phase is $350 million (2007 dollars).

- **Project #5 - Corridor H (Parsons to Davis Phase):** The environmental work for this 10-mile section is not complete. As part of a court-approved Corridor H Settlement Agreement that allowed other phases of the corridor to advance, a Supplemental Environmental Impact Statement was performed on this section. The FHWA is working with WVDOH to complete the environmental process, allowing for the execution of an amended ROD. Estimated cost of this phase is $150 million (2007 dollars), and design component is expected to be completed between 2025 and 2031.

- **Project #6 - Corridor H (Wardensville to VA State Line Phase):** The FHWA approved the amended ROD on the 6.8-mile section of Corridor H connecting Wardensville to the Virginia State line on May 16, 2003. Final design of the section through Hardy County is anticipated to begin in 2020. Construction tentatively is scheduled to begin in 2027. However, the Corridor H Settlement Agreement places certain restrictions on WVDOH's ability to advance this phase of the project. As a part of the settlement agreement, construction of this section would be postponed for 20 years until certain traffic conditions are met. If traffic increases on WV 55 meet the agreed to threshold and evacuation strategies suggest an increased need, this section could potentially be accelerated in the funding plan for Corridor

[15] June 27, 2007 letter from WVDOH to FHWA regarding Financial Plan for APD Corridor H

H. However, as mentioned earlier in this report, without a plan to construct the VA 55 portion of Corridor H, the effectiveness of evacuating along the Central NHS route would be diminished as a viable option to increase evacuation capacity into West Virginia. Estimated cost of this phase is $63 million (2007 dollars) and is not expected to begin construction until beyond the 2027 to 2031 timeframe.

Options to Accelerate Construction: During the interviews and research, FHWA found that both the MDSHA and the WVDOH are both planning to consider and use some of the innovative project finance and contract administration options available to all States to accelerate construction on all six of the projects (or phases of large multi-phase projects) identified above. The following includes: (1) the myriad of tools available to them to accelerate construction, and (2) suggested tools that are appropriate to the six projects (or phases of large multi-phase projects) described above.

1. General Project Finance and Contract Administration Options: There are numerous Project Finance and Contract Administration tools available to States. These options are listed below.

- **Project Finance Options:** With the demand for highway improvements exceeding funding resources nationwide, State governments have adopted techniques that move the financing process from a single strategy of Federal funding on a grant reimbursement basis to a diversified approach that reduces the time to get projects underway and extends, or leverages, the value of existing resources. This approach includes Federal-aid grant management techniques that can be used separately or in conjunction with project finance tools that raise upfront dollars through the incurrence of debt.

  Decisions about project finance are sometimes combined with decisions about project procurement, such as the contract administration options shown below. In most procurement processes, the public sector retains control of – and most of the risk associated with – the project. Public-Private Partnerships (P3) offer an alternative procurement method that shifts more control and risk, together with more potential reward, to the private sector. As such, the public sponsor must assess multiple objectives when considering whether a project is suitable for a P3 approach.

  Project finance is typically used for large capital projects in cases where using "pay-as-you-go" does not make good planning and programming sense; that is, because the project's capital needs would consume most if not all available funding – and still often fall short of being fully funded. Further, given long-term benefits of transportation infrastructure, it can be economically sound to spread the project costs over the asset's life-cycle.

  However, project finance comes at a cost, because interest is paid over the long-term for the money that is borrowed today. To borrow money, of course, the creditor must identify a repayment source. This can require the development and imposition of a new revenue source to pay back bonds or loans issued to support investment.

  Potential Sources of Revenue to Support Project Financing: Non-Federal revenue sources can be categorized into several broad areas, within which can be found many options.

- **User Fees:** This fundamental tool raises revenues directly from the transportation system user. A commonly utilized user fee is a toll, collected from drivers for use of a specific facility such as a limited access highway, bridge, or tunnel. Tolls can be fixed or variable.

- **State/Local Taxes:** These are often dedicated taxes, subject to voter approval, to support specific transportation investment. Local-option sales, vehicle or property taxes are often used to fund transportation.

- **Value Capture:** This approach attempts to capture some of the increase in value due to the infrastructure improvement. Revenues can be in the form of one-time charges, or impact fees, on the new development that requires the infrastructure improvement. Tax increments capture the increase in property value resulting from the development facilitated by the infrastructure. Specific development contributions (or exactions) for land, in-kind donations, or services can be negotiated as part of the development permitting process.

Federal-aid Grants Management Techniques: Existing law affords States much flexibility in managing Federal-aid highway funds. Although State and local governments typically must provide 20 percent of the funding for projects benefiting from Federal-aid, flexibility exists to ease restrictions on the timing of obligations and reimbursements and to create a range of options for meeting matching requirements. In addition to the challenge of obtaining fund sources, States and other project sponsors have to align the flow of projects with the availability of local funding. Grant management mechanisms provide cash flow tools that help to leverage Federal funding and expedite projects.

- **Advance Construction (AC) and Partial Conversion of Advance Construction (PCAC):** AC construction and PCAC are cash flow management tools that allow States to begin projects with their own funds and only later convert these projects to Federal assistance. Advance construction allows a State to request and receive approval to construct Federal-aid projects in advance of the apportionment of authorized Federal-aid funds. Under AC, States typically "convert" projects to Federal-aid once sufficient Federal-aid funds and obligation authority are available, and do so all at once. Under PCAC, a State may obligate funds in phases, including the annual repayment of debt service in conjunction with the issuance of Grant Anticipation Revenue Vehicle (GARVEE) debt (see below).

- **Flexible Match:** A wide variety of public and private contributions can be counted toward the 20 percent State/local match for Federal-aid projects. In practice, this flexibility has been achieved primarily through use other Federal funds or third party donations as sources of the matching funds.

- **Tapered Match:** A project's Federal share can vary from year to year as long as the final amount of the Federal contribution does not exceed the project's maximum authorized share. The tapered match technique allows States to vary the required matching ratio over the life of a project. For example, the Federal share could start out at 100 percent and taper off to zero as the project nears completion.

- **Toll Credits (Soft Match):** States can substitute certain previous toll-financed investments for State matching funds on current Federal-aid projects, providing the non-Federal share of a project's cost through a "soft match" of toll credits. By allowing States

to use toll revenues when other State highway funds are not available to meet non-Federal, share-matching requirements, toll credits help States use existing resources more effectively. In most cases, the Federal share of a project can be increased effectively to 100 percent.

- **Transfers between States:** This option allows a State to transfer, without repayment, funds appropriated or allocated under Title 23 to another State to finance a project eligible for assistance with those funds under provisions in Title 23 Section 104(k)(3). The States would be required to document their concurrence in a transfer agreement.

- **Advances between States:** This option would allow one State to advance funding to another and have the funds returned in the future, similar to the process used by the Forest Highway Program (an allocated program). However, this option would require congressional action for use on ADHS-funded projects.

- **Transfers between Projects:** This option allows a State to advance a project from a program, under which the project would be eligible, and later restore these funds under provisions in SAFETEA-LU, P.L. 109-59, Section 1936. Since ADHS funds aren't included under Section 1936, this option would require congressional action for use on ADHS funded projects.

Federal Credit Programs: The FHWA can also provide direct credit assistance to project sponsors or allow State DOTs to loan Federal-aid funds for projects. These credit programs can provide critical sources of financing for projects assembling a variety of funding sources.

- **Transportation Infrastructure Finance and Innovation Act (TIFIA):** The TIFIA Credit Program provides Federal assistance in the form of direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects of national and regional significance. Eligible project costs, of which TIFIA can provide up to 33 percent of funding, must equal at least $50 million. A TIFIA borrower must pledge repayment with dedicated revenue sources such as tolls, user fees, special assessments (taxes), or other non-Federal sources.

- **State Infrastructure Banks (SIBs):** SIBs are State-run revolving funds that provide loans, credit enhancements, and other forms of non-grant assistance to surface transportation projects. The SIB Program allows States to capitalize loan funds with regularly apportioned Federal-aid highway funds.

- **Section 129 Loans:** Section 129 (a)(7) of Title 23 allows States to lend apportioned Federal-aid highway funds to toll and non-toll projects generating dedicated revenue streams. Revenue sources can include tolls, excise taxes, sales taxes, real property taxes, incremental property taxes, and motor vehicle taxes.

Bonds/Debt Financing: Federal programs also support borrowing from the capital markets, either by allowing borrowers to pledge anticipated Federal-aid funding to secure public debt GARVEEs or by providing special tax status that lowers financing costs. If permitted by State law, project sponsors can use Federal-aid funds to repay debt via contracts that may involve private entities, such as contractors.

- **Grant Anticipation Revenue Vehicles (GARVEEs)**: A GARVEE is a debt instrument—such as a bond, note, certificate, mortgage, or lease—whereby a State DOT pledges its future Federal-aid funds as a source of repayment. When implementing a GARVEE, the State uses these Federal-aid dollars to pay debt service, rather than construction costs funded with the debt proceeds. The State uses partial conversion of AC (see above) in order to obligate funds as debt service becomes due. A GARVEE is an obligation of the State, not the Federal Government.

- **Performance-based Payments:** In keeping with its transfer of risk to the private sector, a P3 transaction can feature a schedule of payments to a concessionaire that combine aspects of debt service with requirements for performance. Federal-aid funds may be used to pay the capital, or principal, portion of payment installments for:

  - **Availability Payments:** Regularly scheduled payments to a concessionaire, or private contractor, based on meeting project milestones or performance standards.

  - **Shadow Tolls:** Also known as "pass-through" tolls, these regularly scheduled payments are based on actual usage of the facility built and/or managed by the concessionaire.

- **Private Activity Bonds (PABs):** PABs are debt instruments issued by State or local governments where the proceeds are used to finance a public use project either developed by a private entity, or featuring significant private involvement. Providing private developers and operators with access to tax-exempt interest rates considerably lowers their cost of capital. The SAFETEA-LU amended the Internal Revenue Code to add highway and freight transfer facilities among eligible projects, and provided the Secretary of Transportation the authority to allocate up to $15 billion in PAB authority for such projects. Using a conduit public issuer, the private entity finances the project and is responsible for debt service on the PABs.

- **63-20 Issuance:** State and local governments can issue tax-exempt debt through nonprofit corporations created pursuant to Internal Revenue Service (IRS) Revenue Ruling 63-20. Bond proceeds issued by the nonprofit corporation can be used by private developers to finance and build transportation facilities. The 63-20 conduit issuance can be used to finance a transportation project when there is both a reasonable expectation of future user fee/toll revenues to repay the bonds and no alternative public issuer. A 63-20 credit does not count toward State or local government statutory debt limitations, providing access to debt for a project that has a dedicated revenue source, such as user fees.

- **Build America Bonds (BABs):** The February 2009 American Recovery and Reinvestment Act (ARRA) authorized these taxable bonds, which are eligible for an interest payment subsidy paid directly from the U.S. Treasury. States and local governments can issue BABs through December 2010, and proposals to extend this date appear to have legislative support. Surface transportation projects are among other public infrastructure projects (public buildings, courthouses, schools, water and sewer projects, etc.) eligible for BAB financing, which because of its direct Federal subsidy may result in net lower interest costs than a comparable tax-exempt bond.

- **Contract Administration Options:** States have at their disposal a number of contract administration tools that may be used to plan and accelerate construction on NHS routes. These include the following:

  - **Construction-Manager-at-Risk:** The vertical building industry has been using a contracting technique called construction-manager-at-risk for many years. Under this procedure, an owner selects a design and construction management consultant on the basis of qualifications, experience, fees for management services and prices for the target cost of construction as well as an estimated ceiling price. The consultant then proceeds with the preliminary design. At some point in the design process (typically at the 60 to 90 percent design completion), the owner and the consultant will agree on a guaranteed maximum price for the construction of the project. Many owners favor this contracting technique as it gives them greater control of the design process, yet it still provides for innovation and constructability recommendations in the design phase.

  - **Cost-Plus-Time Bidding:** Cost-plus-time bidding, more commonly referred to as the A+B method, involves time, with an associated cost, in the low bid determination. Under the A+B method, each bid submitted consists of two components:
    - The "A" component is the traditional bid for the contract items and is the dollar amount for all work to be performed under the contract.
    - The "B" component is a "bid" of the total number of calendar days required to complete the project by the bidder. (Calendar days are used to avoid any potential for controversy which may arise if work days were used.)

    The bid for award consideration is based on a combination of the bid for the contract items and the associated cost of the time, according to the formula: (A) + (B x Road User Cost/Day). This formula is used only to determine the lowest bid for award and is not used to determine payment to the contractor. The contractor's estimate for the completion of critical work becomes the contract time, and an Incentive/Disincentive provision is usually used to keep the bidding-playing field level.

  - **Design-Build:** The design-build concept allows the contractor maximum flexibility for innovation in the selection of design, materials and construction methods. With design-build procurement, the contracting agency identifies the end result parameters and establishes the design criteria. The prospective bidders then develop design proposals that optimize their construction abilities. The submitted proposals may be rated by the contracting agency on factors such as design quality, timeliness, management capability, and cost. These factors may be used to adjust the bids for the purpose of awarding the contract.

  - **Design-Build-Maintain (Operate):** Several States have initiated design-build-operate-maintain projects. Adding operational maintenance to the Design-Build process, this method is often incorporated into toll roads/toll agreements.

  - **Incentive/Disincentive (I/D) Provisions for Early Contract Completion:** The I/D provisions for early completion are intended to motivate the contractor to complete the work on or ahead of schedule. It allows a contracting agency to compensate a contractor a certain amount of money for each day identified that critical work is completed ahead of schedule and assess a deduction for each day the contractor overruns the I/D time. The contracting agency specifies the time required for critical work and uses this

provision for those critical projects where traffic inconvenience and delays are to be held to a minimum. The I/D amounts are based upon estimates of such items as traffic safety, traffic maintenance and road user delay costs. Some States have used a variation of the incentive/disincentive provision that provides a variable I/D amount relative to the time of early or late completion. For example, a larger incentive is provided for a 10-day early completion than for a one-day early completion.

- **Interim Completion Dates:** Interim completion dates are a means of encouraging the early completion of a specific phase of a contract such as a ramp, an interchange or another component of a larger construction contract. The particular phase or component should be selected with great caution as this will impact the scheduling of the overall project.

- **Multi-Parameter Bidding including Quality (A+B+Q Bidding):** Similar to cost-plus-time bidding, this concept envisions a contracting system where a bidder would bid the cost for completing the work -A, the time for completing critical work –B (optional), and the level of quality or performance that would be achieved over a specified period of time - Q. A warranty bond or a method of making payment in future years would be necessary to implement this system.

- **No Excuse Incentives:** "No Excuse Incentive" (NEI) clause, also known as No Excuses Bonus[16] contracts give the contractor an incentive to complete the contract work on time. The contractor is given a "drop-dead date" for completion of a phase of work or the entire project. If the work is completed in advance of this date, the contractor will receive a bonus. There are no excuses, such as weather delays, for not making the completion date. On the other hand, there are no disincentives (other than normal liquidated damages) for not meeting the completion date.

- **Stipulated Sum**: Stipulated, or lump, sum payment is commonly used for design-build contracts, but has been increasingly applied to traditional low-bid highway contracts for various bid items and more recently for contracts involving categories of work that lend themselves more to lump sum pricing. In contrast to a traditional unit-priced bid item, the DOT will not provide quantity estimates for lump sum items in the bid package. The plan sheets for a lump sum project typically will not include detailed quantity tables. The contractor is responsible for developing quantity take-offs from the plans for estimating a lump sum item or items for a project.

- **Lane Rental:** Lane rental is a contract provision that incentivizes contractors to schedule and work during non-peak periods by charging rental fees for lane and shoulder use, with higher fees during peak periods. This technique is similar to the A+B (cost-plus-time) technique in that contractors bidding on a lane rental project determine the number of days lanes will be closed during work and use this determination in their bid process. The owner will add the total lane rental bid to the standard bid to decide the award. Awarded contractors using more lane rental days than bid will be charged lane rental fees.

[16] The term incentive is preferred rather than 'bonus.' The incentive amount should be based on a public savings for opening the project early (road user cost, or other as appropriate). The term bonus implies something paid in addition to what is expected - sometimes not having a basis in cost or benefit.

- **Partnering:** The owner should include a formal partnering item in the contract documents to ensure that all parties understand the requirements of the project and to foster relationships that facilitate resolving issues that arise during the project. Discussions should include contingency plans to address potential problems such as insufficient equipment, equipment breakdowns, inclement weather, and inexperienced personnel, as well as logistical issues related to timing of materials, equipment, public notices, and multiple moves within the same window.

2. Specific Project Options to Accelerate Construction West of the NCR:

During the interviews and research, FHWA found that the MDSHA and the WVDOH both plan to consider and use some of the innovative project finance and contract administration options available to accelerate construction on all six of the projects identified above.

Maryland Projects: The MDSHA typically considers a wide range of options to accelerate large projects. Examples of specific accelerated construction techniques anticipated for the I-270/US-15 and I-70 projects at this time include:

- **Advance Construction:** I-70 Phase 4
- **Partial Conversion of Advance Construction:** I-70 Phase 4
- **Toll Credits:** I-70 Phase 4
- **Cost-Plus-Time:** I-70 Phase 4
- **Design-Build:** I-70 Phase 4
- **I/D Provisions for Early Contract Completion**: I-70 Phase 4
- **Stipulated Sum:** I-70 Phase 4
- **Project Phasing:** I-70 Phase 4
- **Partnering:** I-70 Phase 4

The MDSHA is using TIFIA financing for its Intercounty Connector (ICC) Major Project. However, those interviewed indicated that the State of Maryland would probably be reluctant to aggressively pursue additional innovative financing options, such as GARVEE Bonding, TIFIA, tolling, express toll lanes, etc., to accelerate construction on the two projects at this time due to State budget constraints, but such options would likely be considered as part of the normal project development and programming process for each project.

West Virginia Projects: Like MDSHA, WVDOH typically considers a wide range of options to accelerate construction of large projects. The WVDOH authorities and their partners participating in this study discussed other options they have considered, or will consider, to accelerate work on this portion of the NHS. Many of the suggestions reflect innovative project financing options. However, West Virginia traffic volumes, and lack of an independent revenue source, do not support strategies such as tolling, TIFIA, SIBs, and PABs. Examples of specific accelerated construction financing and contract administration techniques anticipated for Corridor H projects at this time include:

- **Advanced Construction**
- **Partial Conversion of Advance Construction**
- **Transfers between States**

- **Advances between States**
- **Transfers between Projects**
- **GARVEEs**
- **Availability Payments**
- **Design-Build**
- **I/D provisions for early Contract Completion**
- **Interim Completion Dates**
- **Project Phasing**

The table in the following section summarizes which specific project finance and contract administration options examined in this study have been, or will be, considered by the MDSHA and the WVDOH to accelerate construction, or time to construction, for the seven projects identified that would increase evacuation capacity on key NHS evacuation routes west of the NCR. Depending on where each project currently is in the project development process, will determine when such options will be considered. For example, for those projects that construction is ongoing or planned for the near term, it would be appropriate for the State DOTs to be considering many of the identified project finance and contract administration options at this time. For future projects that will not be in actual construction for many years, it would be appropriate for the State DOTs to be considering many of the identified project finance options at this time.

Summary of Findings

The summary of findings addresses both the input from the respondents from the 26 regions and a summary of the West of the NCR report that immediately precedes this section.

Summary of Top Impediments as Reported by the 26 Regions Included in the Study

Jurisdictional respondents and interviewees provided thoughtful responses and insightful dialogue. The table below categorizes the input into general and common areas that would impede an evacuation from the jurisdiction. The FHWA decided not to extrapolate further findings from these as differences in local situations make definitive findings difficult to capture. However, it is clear that several impediment areas (e.g., day-to-day congestion, infrastructure constraints, and communications) are common to many of the areas studied.

Options for Accelerating Projects to Increase Evacuation Capacity West of the National Capital Region

The second part of this study addressed how NHS projects under construction west of the NCR could increase the NCR's evacuation capacity. The FHWA conducted research and extensive interviews with FHWA Division staff and authorities from the States of West Virginia and Maryland, the Commonwealth of Virginia, and the Washington Council of Governments to discuss corridors and planned construction on the NHS and arterial routes that evacuees departing the NCR would use to evacuate the region. Through this research and interviews, FHWA (1) identified NHS roads that would qualify for this study, e.g., corridors leading west from the NCR; (2) analyzed NHS projects (or phases of large multi-phase projects) west of the NCR currently under construction that could increase evacuation capacity; and (3) provided options to accelerate NHS projects (or phases of large multi-phase projects) under construction.

Through its research and interviews, FHWA identified opportunities to accelerate construction projects on the various routes studied. Since most opportunities to accelerate construction depend on innovative means to carry out project financing, project development, and contract administration, the research team consulted with numerous FHWA, MDSHA, VDOT, and WVDOT specialists in order to identify viable options for the identified projects. The FHWA has been a leader in identifying and advocating the use of contract administration and project finance options to accelerate construction time on all highway projects, with particular focus on large and complex projects. The table below summarizes which specific project finance and contract administration options examined in this study have been, or will be, considered by the MDSHA and the WVDOH to accelerate construction, or time to construction, for the six projects (or phases of large multi-phase projects) identified that would increase evacuation capacity on key NHS evacuation routes west of the NCR.

Summary of Jurisdictional Perceptions of Impediments by Location

Location	Top Impediments/Challenges
Atlanta, GA	Contraflow Constraints; Infrastructure Limitations; Arterial Road Systems with Overpasses Cannot Accommodate Trailer Heights; Bridge Weight Restrictions Impede Movements; and Traffic Data is Scattered Throughout the Region
Baltimore, MD	Evacuation Plan Needs Updating; Infrastructure Impediments-Roadways; and Region Lacks a Coordinated Signal Timing System
Boston, MA	Contraflow Constraints; Shoulders May Not be Able to Support Additional Evacuation Traffic; and No Place for Sheltering
Charleston, SC	Infrastructure Constraint I-26; East-West Evacuation Routes; Lane Restrictions; ITS Capabilities along Evacuation Routes; and Incident Responder Coverage Along I-26, Charleston to Columbia
Chicago	Traffic Congestion; Emergency Vehicle Access; Railroad Crossing/Street Blockage; Contraflow Operations Would Impede Evacuations; and Real-Time Highway Information for Responders and Public
Dallas/Ft. Worth, TX	Infrastructure Limitations; Lack of Cameras along Key Routes; and Evacuation Plans Do Not Exist
Denver. CO	No Evacuation Plan; No Evacuation Routes Identified; No Lane Assignments for Emergency Services; Infrastructure Limitations; Traffic Flow Analysis on Evacuation Routes; and Weather Hindrances
Detroit, MI	Infrastructure Conditions Impede Responder Operations; Congestion; and Bottlenecks on Freeways, including Narrow Freeway Lanes and Limited Shoulders
Hampton Roads, VA	Traffic Signal Timing; Number of Water Crossings; Limited ITS Deployment Along Key Evacuation Routes; Flood-Prone Infrastructure; and Human Resources to Manage Evacuation Operations and Tools
Houston, TX	Bottlenecks; Communications with the Public; Number/Type of Resources to Deploy; More CCTV Cameras; and Modeling Timeliness
Jacksonville, FL	Work Zones; Limited Fueling Stations; No DMSs on westbound I-10; and No ITS Deployment on Key Interstates
Las Vegas, NV	Insufficient Lanes and Daily Congestion; Coordination with Other States on Evacuation Routes; Communications Systems Would Not Support Evacuation Operations; Deployable Traffic Signs and Evacuation Route Signage; and Traffic Flow Monitoring
Los Angeles, CA	Congestion and Evacuation Route Capacity; Communications Capabilities; and Public Outreach and Understanding Evacuation Process
Miami, FL	Insufficient Road Capacity; Damage to Critical Infrastructure; Work Zones on Major Routes; Traffic Signal Timing; and Lack of ITS Devices on Major Arterial Roads
Minneapolis-St. Paul, MN	Infrastructure Capacity and Congestion; Lack of Coordinated Plan and Universal Agreement on the Benefits of Evacuation; Disconnected Transportation and Emergency Operations Centers; Need for More Signage and Public Education; Coordination of Signal Timing Plans; Address Equipment Gaps for Pedestrian Movements; and Develop Multiple Options for River Crossing
National Capital Region (DC, MD & northern VA)	Regional GIS Database; Traffic Signal Coordination on Arterials; Limited Roadway Capacity; Institutional Coordination; Communication Interoperability and Protocols; and VIP Movements and Security
New Orleans, LA	Highway Flooding; Additional ITS Capacity; Insufficient Capacity; and Lack of Emergency Lanes
New York City, NY	Infrastructure Condition and Limitations; Need Improved Coordination between State/Local Transportation Officials and Responders; Limited Deployment of ITS Impact on Sharing Situational Awareness Data; Weather Impacts; and Need for Public Information Campaign
Philadelphia, PA	Expressway Congestion; Need for Situational Awareness; Emergency Signal Timing Coordination; Operational Coordination; and Toll Waivers
Phoenix, AZ	Communication Capabilities; Community Outreach and Education Program; Rural Evacuation Route Signing and Information (public outreach) Strategy; Mass Evacuation Regional Command and Control Center; and Evacuation Route Signing
Portland, OR	Bridge Vulnerability; Capacity and Infrastructure Limitations; Communications and Coordination with Neighboring Jurisdictions and the Public; Communications and ITS Technology for Incident Operations; Improved Traffic Management and Safety; More Robust Planning for Evacuation Operations; and Identification and Use of Resources
San Diego, CA	Communication Capabilities; Evacuation Route Capacity; and Need Public Outreach Campaign
San Francisco, CA	Communication Capabilities if Damaged; and Infrastructure (Roads, Bridges and Overpasses) along Evacuation Routes
Seattle, WA	Congestion; Limited Infrastructure; and Insufficient Responder Resources to Manage an Evacuation
St. Louis, MO	Limited Capacity; and Highway Capacity and Bridges
Tampa-St. Petersburg, FL	Highway Infrastructure Capacity; Bridge Infrastructure Capacity; Bridge Vulnerability to Damage; Highway Vulnerability to Damage; and Limited Evacuation Routes due to Geographic Limitations

Summary of Jurisdictional Perceptions of Top Impediments: General Categories [17]

General Categories	Location Reporting as Top Impediment
Communications Equipment & Frequencies, Including Interoperability	Houston, Las Vegas, Los Angeles, National Capital Region (NCR), Phoenix, San Diego, San Francisco
Communications with Responders or Public	Houston, Portland
Congestion/Capacity	Chicago (2), Detroit, Las Vegas, Los Angeles, Minneapolis-St. Paul, Miami, NCR, New Orleans, Philadelphia, Portland, San Diego, Seattle, St. Louis, Tampa (2)
Contraflow Issues	Atlanta, Boston, Chicago
Coordination, including with internal Partners, Responders & other States	Las Vegas, Minneapolis-St. Paul, NCR, New York City, Philadelphia, Portland
Evacuation Route Identification	Denver
Infrastructure-Bridges & Overpasses	Atlanta (2), Charleston, Portland, San Francisco, St. Louis, Tampa-St. Petersburg(2)
Infrastructure-Roads including Bottlenecks, Condition, Emergency Vehicle Access Lanes, etc.	Atlanta, Baltimore, Boston, Charleston(2), Chicago, Dallas/Ft. Worth, Denver(2), Detroit(5), Hampton Roads, Houston, Las Vegas, Miami(2), NCR, New Orleans(2), New York City, San Francisco, Seattle
ITS[18] Infrastructure General	Charleston, Hampton Roads, Jacksonville, Miami, New York City, Philadelphia, Portland
ITS-DMS	Jacksonville
ITS-CCTV Traffic Cameras & Detectors	Dallas/Ft. Worth, Houston, New Orleans
ITS-Ramp Metering	Hampton Roads
Plans Need Updating or Developed	Baltimore, Dallas/Ft. Worth, Denver, Minneapolis-St. Paul, Portland
Plans-Alternate Modes of Transport	Minneapolis-St. Paul
Public Outreach/Education	Los Angeles, Minneapolis-St. Paul, New York City, NCR, Philadelphia, Phoenix(2), San Diego
Real-Time Data	Chicago, New York City, Philadelphia
Resources-Equipment for Pedestrian Movements	Minneapolis-St. Paul
Resources-Fueling Stations	Jacksonville
Resources-Responder Staff	Charleston, Dallas/Ft. Worth, Hampton Roads, Houston, Portland, Seattle
Safety/Service Patrols-Increased Presence	Charleston
Sheltering	Boston, Portland
Signage-Evacuation Route or Other	Chicago, Las Vegas, Minneapolis-St. Paul, Phoenix
TMC Data Sharing & EOC Connectivity	Atlanta, Minneapolis-St. Paul, New York City, Phoenix
Toll Waivers	Philadelphia
Traffic Analysis or Modeling	Denver, Houston
Traffic Control & Monitoring	Chicago, Las Vegas
Traffic Signal Timing	Baltimore, Hampton Roads, Miami, Minneapolis-St. Paul, NCR, Philadelphia
VIP Movements & Security	NCR
Weather or Geographic Hindrances	Denver, Hampton Roads, New Orleans, NCR, New York City, Tampa-St. Petersburg
Work Zones	Jacksonville, Miami

[17] Where a parenthesis and number follow a location, e.g., Charleston (2), that indicates that two of Charleston's top impediments fall into this category.

[18] Intelligent Transportation Systems (ITS) includes Dynamic Message Signs (DMS) Closed Circuit TV (CCTV), Traffic Cameras, Traffic Management Centers (TMCs), Emergency Operations Centers (EOCs), etc.

Summary of Project Options to Accelerate Construction

Options	Projects to Consider Option
Project Finance Options:	
Potential Revenue Sources:	
• User Fees	
• State/Local Taxes	
• Value Capture	
Federal-aid Grants Management:	
• Advance Construction	I-70 Phase 4, Corridor H (All Phases)
• Partial Conversion of Advance Construction	I-70 Phase 4, Corridor H (All Phases)
• Flexible Match	
• Tapered Match	
• Toll Credits (Soft Match)	I-70 Phase 4
• Transfers Between States	Corridor H (All Phases)
• Advances Between States	Corridor H (All Phases)
• Transfers Between Projects	Corridor H (All Phases)
Federal Credit Programs:	
• Transportation Infrastructure Finance and Innovation Act (TIFIA)	
• State Infrastructure Banks (SIBs)	
• Section 129 Loans	
Bonds/Debt Financing:	
• Grant Anticipation Revenue Vehicles (GARVEEs)	Corridor H (All Phases)
• Availability Payments	Corridor H (All Phases)
• Shadow Tolls	
• Private Activity Bonds (PABs)	
• 63-20 Issuance	
• Build America Bonds (BABs)	
Contract Administration Options:	
Construction Manager At Risk	
Cost-Plus-Time	I-70 Phase 4
Design-Build	I-70 Phase 4, Corridor H (All Phases)
Design-Build-Maintain (Operate)	
Incentive/Disincentive (I/D) Provisions for Early Contract Completion	I-70 Phase 4, Corridor H (All Phases)
Interim Completion Dates	Corridor H (All Phases)
Multi-Parameter Bidding including Quality (A+B+Q Bidding)	
No Excuse Incentives	
Stipulated Sum	I-70 Phase 4
Project Phasing	I-70 Phase 4, Corridor H (All Phases)
Lane Rental	
Partnering	I-70 Phase 4

Appendix 1

Highway Evacuations in Selected Metropolitan Regions: Assessment of Impediments

Acknowledgments: Interviewees & Respondents

Atlanta, Georgia (Interview: February 26, 2010; conducted by Laurel Radow, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Representing the Atlanta Regional Commission (ARC): Tommy Griffin, Emerson Bryan, and Kofi Wakhisi

Baltimore, Maryland (Interview: February 23, 2010; conducted by Laurel Radow, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Alvin Marquess, Maryland State Highway Administration
- Information provided by the FHWA Maryland Division

Boston, Massachusetts (Interview: February 25, 2010; conducted by Laurel Radow, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Lorenzo Parra, Emergency Coordinator, Mass DOT
- Paul M. Connelly, Assistant Secretary for Homeland Security, Executive Office of Public Safety and Security

Charleston, South Carolina (Interview: February 16, 2010; conducted by Tim Lane, FHWA HQ Office of Operations)
Interview conducted by: Tim Lane, FHWA, ETO
Discussion/Interview Participants:

- Dan Hinton, FHWA, SC
- Dick Jenkins, SC DOT

Chicago, Illinois (Interview: February 11, 2010; conducted by Ray Murphy, FHWA Resource Center)
Discussion/Interview Participants:

- Robin Helmerichs, FHWA
- Tom Korty, EMC/Homeland Security – Illinois DOT
- Steve Travia, Bureau Chief of Traffic, Illinois DOT
- Earl Zuelke Jr., Special Assistant to the Director Illinois EMA
- John Plante, CTA
- Steve Brink, Illinois DOT
- Julia Fox, Illinois DOT
- Robert King, Cook County EMA

Online/Interview Responses:

- Michael McCabe Pace Suburban Bus Security Coordinator
- Ryan Rockabrand, City of Chicago Office of Emergency Management & Communications

Dallas/Ft. Worth, Texas (Interview: February 11, 2010; conducted by Paul Olson, FHWA Resource Center)
Discussion/Interview Participants:
Jimmey F. Bodiford, Director of Transportation Operations, TxDOT - Fort Worth District
Richard Schiller, Director of Maintenance, TxDOT - Fort Worth District

Denver, Colorado (Interview: February 24, 2010; conducted by Ray Murphy, FHWA Resource Center)
Discussion/Interview Participants:

- Bruce Holloman, Deputy Director, Chief of Operations - Colorado Div of EM
- Elbert Hunt, CDOT EM Preparedness Coordinator
- Lori Hodges, North Central Region Field Manager - Colorado Div of EM
- Ken DePinto, CDOT ITS Director
- Scott Kellar, Homeland Security Coordinator North Central Region
- Richard Santos, FHWA Colorado Division

Detroit, Michigan (Interview: February 12, 2010; conducted by Ray Murphy, FHWA Resource Center)
Discussion/Interview Participants:

- Eileen Phifer, Safety & Security Administration & Emergency Management, Michigan DOT
- Darryl Lundy, City of Detroit
- James Buford, Director, Wayne County EMD
- Ron Krauss, FHWA Michigan Division

Hampton Roads, Virginia (Interview: March 5, 2010; conducted by Laurel Radow, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Perry Cogburn, Emergency Manager, VDOT

Houston, Texas (Interview: February 26, 2010; conducted by Laurel Radow, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Christy Willhite, Chief Transportation Planner, Houston-Galveston Area Council of Governments
- Stuart Corder, Director, Transportation Operations, Texas DOT- Houston District

Jacksonville, Florida (Interview: February 15, 2010; conducted by Chung Tran, FHWA Resource Center)
Discussion/Interview Participants:

- Peter Vega, ITS Engineer – District 2 – Jacksonville
- Ed Ward, Emergency Coordination Officer – District 2 – Jacksonville

Las Vegas, Nevada (Interview: February 17, 2010; conducted by Chung Tran, FHWA Resource Center)
Discussion/Interview Participants:

- Christopher Joncas, Nevada DOT (NDOT)
- Information provided by the FHWA Nevada Division

Los Angeles (Interview: February 24, 2010; conducted by Tim Lane, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Sonja Brown, California Emergency Management Agency–Southern Region
- Keith Harrison, Los Angeles County
- Randy Warden, FHWA California Division

Miami (Interview: February 11, 2010; conducted by Chung Tran, FHWA Resource Center)
Discussion/Interview Participants:

- Rory Santana – FDOT District 6 (Miami) ITS Engineer

Minneapolis-St. Paul, Minnesota (Interview: February 25, 2010; conducted by Ray Murphy, FHWA Resource Center)
Discussion/Interview Participants:

- Rick Larkin, Director of Emergency Management, City of St. Paul
- Bonnie Bleskachek, City of Minneapolis
- Jon Wertjes, City of Minneapolis
- Thomas Deegan, City of Minneapolis
- David Scott, FHWA Minnesota Division
- Gerald Libbe, Statewide Planning Engineer, FHWA Minnesota Division
- Craig Strand, MnDOT Emergency Management
- Gary Fried, MnDOT
- Jim Michael, Maintenance Superintendent, MnDOT
- Lisa Dressle, City of Minneapolis
- Beverly Farraher, MnDOT

National Capital Region and for the Study of the NHS West of the NCR (Interview: various times in March 2010, conducted by Laurel Radow, FHWA Headquarters, and Sandra Jackson, FHWA DC Division)
Discussion/Interview Participants:

District of Columbia (Interview: March 11, 2010; conducted by Laurel Radow, FHWA Headquarters Office of Operations)

- Natalie Jones-Best, Emergency Preparedness Coordinator, DDOT

Maryland (Interview: March 15, 2010; conducted by Laurel Radow, FHWA Headquarters Office of Operations, & Sandra Jackson, FHWA DC Division)

- Jitesh Parikh, Team Leader, Maryland/DELMAR Division
- Jorismar Torres, Area Engineer, Maryland/DELMAR Division
- Sajid Aftab, Senior Area Engineer, Maryland/DELMAR Division
- Reena Mathews, Regional Planner, Maryland/DELMAR Division
- Kwame Arhin, Maryland/DELMAR Division
- Alvin Marquess, Emergency Manager, Maryland State Highway Administration
- Subrat Mahapatra, Planner, Maryland State Highway Administration
- Reena Mathews, Planner, Maryland State Highway Administration
- Robert Piazza, Planner, Maryland State Highway Administration

Virginia (Interview: March 4 & 23, 2010; conducted by Laurel Radow, FHWA Headquarters Office of Operations)

- Danny Jenkins, FHWA Virginia Division
- Perry Cogburn, Emergency Manager, Virginia DOT
- Ling Li, Operations Engineering Manager for the Northern Region Operations (NRO), Virginia DOT
- Virgil W. Gray, Region 7 Coordinator, Virginia Dept. of Emergency Management

New Orleans, Louisiana (Interview: February 8, 2010; conducted by Ray Murphy, FHWA Resource Center)
Discussion/Interview Participants:

- Cindy Montz, Louisiana DOTD
- Steve Strength, PTOE District 02 Traffic Operations Engineer, Louisiana DOTD
- Stephen Glascock, Louisiana DOTD – ITS Director
- Scott Boyle, Louisiana DOTD

New York, New York (Interview: February 25, 2010; conducted by Ray Murphy, FHWA Resource Center & Tim Lane, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Fred Lai, NYSDOT
- David Williams, NYSDOT
- Robert Limoges, NYSDOT
- Nelson Castillo, Office of Emergency Response, NYC-DOT
- Amy Post, NYC Office of Emergency Management
- Arthur O'Connor, NYC Office, FHWA

Philadelphia, Pennsylvania (Interview: February 4, 2010; conducted by Ray Murphy, FHWA Resource Center)
Discussion/Interview Participants:

- MaryAnn E. Tierney, Deputy Managing Director, Emergency Management, City of Philadelphia
- Stan Platt, Delaware Valley Regional Planning Commission David Brown, Montgomery County 911
- Manny Anastasiadis, PennDOT District 6-0

Online Interview Input:

- Carmine Fiscina, FHWA Pennsylvania Division
- Leo Bagley, Montgomery County Planning Commission

Phoenix, Arizona (Interview: February 10, 2010; conducted by Tim Lane, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Bill Tait, ADOT
- Bill Hahn, MCDOT
- Jennifer Brown, FHWA Arizona Division

Portland, Oregon (Interview during Regional meeting: April 9, 2010; conducted by Nathaniel T. Price, FHWA Resource Center)
Discussion/Interview Participants:

- Geoff Bowyer, ODOT
- Ted Miller, ODOT
- Greg Ek-Collins, ODOT
- Kate Freitag, ODOT
- Bill Whitson, Multnomah County Roads
- Jerry Griffin, Multnomah County Roads
- Dave Houghton, Multnomah County Emergency Management
- Lonny Welter, Columbia County Roads
- Dana Robinson, Clackamas County Emergency Management
- Todd Watkins, Washington County Roads
- John Wallace, Clark County, Washington Emergency Management

- Mike McGuire, Tri-Met (light rail & bus)
- Bob Medcraft, C-Tran (Clark County Washington Transit)
- David Harrington, Portland DOT
- Larry Stevens, Portland DOT
- Patty Rueter, Portland Office of Emergency Management
- Laureen Paulsen, Portland Office of Emergency Management

San Diego, California (Interview: February 22, 2010; conducted by Tim Lane, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Scott Marotte, California Emergency Management Agency-Headquarters
- Joanne Phillips, California Emergency Management Agency-Southern Region
- Jeff Wood, California Emergency Management Agency-Southern Region,
- Jeri Siegle, California Emergency Management Agency-Southern Region
- Stasia Place, San Diego County
- Herby Lissade, Caltrans
- Randy Warden, FHWA California Division

San Francisco, California (Interview: February 26, 2010; conducted by Tim Lane, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Cathy Wayne, Commander, California Highway Patrol
- Shawn Nozzari, CALTRANS
- Randy Warden, FHWA California Division

Seattle, Washington (Interview: February 14, 2010; conducted by Paul Olson, FHWA Resource Center)
Discussion/Interview Participants:

- John Himmel, Emergency Operations and Safety Program Manager, Washington DOT
- David Ochs, FAA, Regional Transportation Representative, Seattle, WA

St. Louis, Missouri (Interview: February 4, 2010; conducted by Ray Murphy, FHWA Resource Center)
Discussion/Interview Participants:

- Lisa Vieth, PE, Incident Response Coordinator, MoDOT
- Rick Bennett, Traffic Liaison Engineer, MoDOT
- Edward Stephen, FHWA Missouri Division

Tampa-St. Petersburg, Florida (Interview: February 23, 2010; conducted by Chung Tran, FHWA Resource Center)
Discussion/Interview Participants:
Chester Chandler, FDOT District 7

West Virginia (Interview: March 12, 2010; conducted by Laurel Radow, FHWA HQ Office of Operations)
Discussion/Interview Participants:

- Henry (Ed) Compton, West Virginia FHWA Division Office
- Chuck Runyon, Executive Assistant to the Secretary of Transportation, West Virginia & WVDOT's Emergency Manager

Appendix 2

Highway Evacuations in Selected Metropolitan Regions: Assessment of Impediments

References & Plan Summary

Citations preceded with an asterisk (*) indicate that the report has sensitive material included. Those desiring to see the referenced document must contact the owning jurisdiction or Agency for information on that report.

References

Nuclear Regulatory Commission (NRC), *"Identification & Analysis of Factors Affecting Emergency Evacuations,"* 2004

Transportation Research Board, NCHRP Synthesis 20-05/Topic 39-05 [Final Synthesis] ***Emergency Evacuation and Reentry***

Respondents provided the following plans for review during this study:

Summary of Plans Submitted for Review

Arizona - Phoenix

Mass Evacuation and Reception Plan
Emergency Evacuation Strategy Plan Final Report (July 2004)
Emergency Evacuation Strategy Phase II for Maricopa County: Final Report (December 27, 2006)
Emergency Evacuation Strategy Phase II for Maricopa County: ***Executive Summary*** (December 2006)
Emergency Evacuation Strategy Phase II for Maricopa County: Existing Conditions/ Inventory Report (December 27, 2006)

California

- San Diego

Unified San Diego County Emergency Services Organization Operational Area Emergency Plan: Annex Q – Evacuation (April 2007)

- San Francisco

Regional Catastrophic Earthquake Mass Transportation/Evacuation Plan (January 22, 2010, DRAFT)

- ***Appendix B: Maps***
- ***Appendix D: Hayward Fault Earthquake Scenario***

Colorado - Denver

North Central Region Mass Evacuation Plan (draft-June 2008)
North Central Region Mass Evacuation Plan Shelter Subcommittee Report (August 2007)

Florida

Contraflow Plan for Florida Interstate Highway System (June 13, 2005)
Reverse Lane Plan: Plan for One-Way Evacuation of Florida's Turnpike (no date) Motorist Information brochure (Florida Highway Patrol, FDOT and Florida Department of Emergency Management)

- **Miami**

Reverse Lane Plan: Plan for One-Way Evacuation of Interstate-75 (Alligator Alley South) (no date) Motorist Information brochure (Florida Highway Patrol, FDOT and Florida Department of Emergency Management)

- **Tampa-St. Petersburg**

Reverse Lane Plan: Plan for One-Way Evacuation of Interstate-4 (no date) Motorist Information brochure (Florida Highway Patrol, FDOT and Florida Department of Emergency Management)

Georgia - Atlanta

Atlanta Regional Evacuation Coordination Plan (March 2009)
Atlanta Clearance Time Tool

Illinois - Chicago

Evacuation Plan for Chicago Central Business District & Chicago Expressway System (January 2008) Produced by the Illinois Department of Transportation – Highways

Louisiana – New Orleans

Louisiana Citizen Awareness & Disaster Evacuation Guide SOUTHWEST (No date) Citizen's guide with critical information and maps

Maryland – Baltimore

Baltimore Region Contingency Transportation Emergency Management Plan Prepared by *the B*altimore Regional Operations Coordination Committee and Transportation Emergency Preparedness Task Force (January 8, 2004)

Massachusetts - Boston

Metro Boston Traffic Evacuation Plan Overview (March 18, 2009)
City of Boston Evacuation Routes Map (December 2005)

Minnesota – Minneapolis-St. Paul Metro Area

Metro Evacuation Transportation Plan (October 31, 2005
Metro Evacuation Transportation Plan Executive Summary
Metro Evacuation Traffic Management Plan Executive Summary
Citizen Evacuation Shelter in Place Capability Assessment Tool Results for Part 2 -- CESIP Capability Assessment
Citizen Evacuation Shelter in Place Gaps & Funded Proposals (12-09-09 & 01-21-10 versions

National Capital Region

NCR National Highway System Projects List
Greater Washington Events Route Map (November 26, 2002)
NCR Behavioral Survey: Behavioral Aspects of Sheltering and Evacuation Planning for the National Capital Region (December 18, 2009); Power Point Summary of subject study

- **District of Columbia**

District Response Plan-Emergency Transportation Annex (August 2006)
Transportation Tips During an Emergency Incident (February 2008); Motorist Brochure

Nevada – Las Vegas

Southern Nevada Evacuation/Emergency Planning Project (November 2008)

Executive Summary--Southern Nevada Evacuation/Emergency Planning Project (November 2008)
State Comprehensive Emergency Management Plan (SCEMP) (2005)
NDOT State Level Emergency Operations Plan
NDOT District Emergency Operations Plan
Clark County Emergency Plan (2004)

Pennsylvania - Philadelphia
Southeastern Pennsylvania Emergency Transportation Plan (June 2009)

South Carolina - Charleston
Hurricane Evacuation Plan for All Lane Reversal of I-26 from I-526 (Charleston) to I-77 (Columbia)

Texas
Hurricane Evacuation Routes: Rio Grande Valley - Pharr District (July 15, 2009); Motorist Advisory Brochure
Hurricane Evacuation Contraflow Routes: Rio Grande Valley U.S.-83 & U.S.-281 (November 3, 2008); Motorist Advisory Brochure
Hurricane Evacuation Contraflow Route: Corpus Christi to San Antonio Interstate-37 (September 1, 2009); Motorist Advisory Brochure
I-37 Hurricane Shoulder Evacuation Lane (July 15, 2009); Motorist Advisory Brochure

- **Dallas-Ft. Worth**

Hurricane Evacuation Contraflow Route: Houston to Dallas Interstate-45 (June 12, 2009); Motorist Advisory Brochure

- **Houston**

Hurricane Evacuation Contraflow Route: Houston to San Antonio Interstate-10 (November 3, 2008); Motorist Advisory Brochure
Hurricane Evacuation Contraflow Route: Houston to Dallas Interstate-45 (June 12, 2009); Motorist Advisory Brochure
Hurricane Evacuation Contraflow Route: Houston to Austin, Bryan, College Station, Waco U.S.-290 (November 3, 2008); Motorist Advisory Brochure
Hurricane Evacuation Contraflow Route: Houston to Nacogdoches U.S.-59 (June 12, 2009); Motorist Advisory Brochure

Virginia – Hampton Roads Region
Virginia Hurricane Guide (May 2009)
Tidewater Evacuation Routes Map

Washington – Seattle/Puget Sound Region
Puget Sound Regional Catastrophic Preparedness Program (Puget Sound RCPP)-Federal Grant Project Summary Sheet

Appendix 3

Highway Evacuations in Selected Metropolitan Regions: Assessment of Impediments

Acronyms & Terms

The following will aid in review and understating the acronyms and terms used throughout this document.

Acronym/Term	Description
511	National traveler information call number
911	Emergency services call number
AC	Advanced Construction
ACTT	Accelerated Construction Technology Transfer
ATMS	Advanced Transportation Management Systems
BIA	Bureau of Indian Affairs, Department of the Interior
CBRNE	Chemical, Biological, Radiological, Nuclear Explosive
CCTV	Closed Circuit Television (video monitoring of the roads—one of the ITS tools used by DOTs)
DHS	Department of Homeland Security
DHSEM	Department of Homeland Security & Emergency Management (Illinois)
DMS	Dynamic Message Signs
DOT	Department of Transportation
DPS	Department of Public Safety
EHTR	Emergency Highway Traffic Regulation
EMA	Emergency Management Agency (either a name or a generic description of the office)
EMAC	Emergency Management Assistance Compact, a State-to-State mutual aid agreement activated during a major disaster
EOC	Emergency Operations Center
ESF	Emergency Support Function, associated with the National Response System that divides response efforts into like groups, for example, ESF-2 is Communications (See ESF-1)
ESF-1	Emergency Support Function #1, or Transportation, as designated under the National Response System and used by State and local emergency management agencies to group transportation functions together.
FEMA	Federal Emergency Management Agency, a component of the Department of Homeland Security
FHWA	Federal Highway Administration, a modal Administration within the Department of Transportation with Division offices in each State /territory and which manages the highway surface transportation component of the U.S. Department of Transportation
FOUO	For Official Use Only (Sensitive, but not classified)
GARVEEs	Grant Anticipation Revenue Vehicle
GIS	Geographic Information Systems
HAR	Highway Advisory Radio
HOV	High Occupancy Vehicle (lanes)
I-	Interstate (U.S.)

Acronym/Term	Description
I/D	Incentive/Disincentive (Acceleration Technique)
INRIX®	A private-sector company that produces an annual traffic scorecard (and other studies) used in this report
IRP	Incident Response Plan
IRR	Indian Reservation Roads
ITS	Intelligent Transportation Systems
MOU(s)	Memorandum of Understanding
MPO	Metropolitan Planning Organization
NCRC	Office of the National Capital Region Coordination, FEMA, DHS
NEPA	National Environmental Policy Act
NHS	National Highway System
NIMS	National Incident Management System
NPR II	National Plan Review, Phase 2 (2006 study of response plans from around the region by the Department of Homeland Security
PCAC	Partial Conversion of Advanced Construction
RCP	Regional Catastrophic Preparedness
RCPGP	Regional Catastrophic Preparedness Grant Program (DHS program)
RCPT	Regional Catastrophic Planning Team (New York)
ROD	Record of Decision
RWIS	Road Weather Information System
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, (P.L. 109-59)
SH-	State Highway
SR-	State Road
STIP	State Transportation Improvement Plan
STRAHNET	Strategic Highway Network
TIP	Transportation Improvement Plan
TMC	Transportation or Traffic Management Center
TOC	Transportation Operations Center
TSA	Transportation Security Administration, an Administration within DHS
UASI	Urban Area Security Initiative (as identified by the Department of Homeland Security)
VE	Value Engineering
vpd	vehicles per day
WMD	Weapons of Mass Destruction

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