TRB Resilience: Key Products & Projects
September 11, 2018
The Transportation Resilience Honeycomb.

Source: Understanding Transportation Resilience: A 2016-2018 Roadmap, Fletcher and Ekern (August 2016)
Security-, Emergency Management-, and Infrastructure Protection-related Projects In Development (September 11, 2018)

1. Update of *A Pre-Event Recovery Planning Guide for Transportation*
2. Impacts of Connected/Automated Vehicles on State and Local Transportation Agencies
3. Deploying Transportation Security Practices in State DOTs
4. Emergency Management in State Transportation Agencies
Predict: Intelligence and surveillance of targets and means
Prevent: Disrupt networks, contain threats
Protect: Harden targets, immunize populations
Interdict: Frustrate attacks, manage crisis
Response & Recovery: Mitigate damage, expedite cleanup
Attribute: Identify attacker to facilitate response

Source: Downey, TRB Annual Meeting 2003
Making the Nation Safer

General Strategies and Research Needs

- Biological Research, prepare, distribute response to pathogens
- Chemical/Explosives Sensors & filters
- Info Technology Network security/ER communications
- Energy SCADA controls/adaptive grid/vulnerabilities
- Cities/Infrastructure Emergency responder support
- Transportation Layered system security
- People Trusted spokespersons
- Complex Systems Data fusion/data mining/red-teaming
- Cross-Cutting Technology Sensors/robots/SCADAs/systems analysis
- Deployment Homeland Security Institute, Partnerships among feds/states/locals/universities
- Nuclear Control weapons & materials at source

Source: Downey, TRB Annual Meeting 2003
TCRP Legal Research Digest 22

The Case for Searches on Public Transportation (2005)

1. Traditional Fourth Amendment Considerations
2. Specific Warrantless Search Categories
3. State Constitutional Issues
4. Structuring Search Policies

Photos source: Ernest R. Frazier Sr., Esq, Countermeasures Assessment & Security Experts, LLC
GAO Panel on Explosives Detection Technologies That Could Help Protect Passenger Rail, 11-12 August 2009
Table 7. Mitigation measures.

<table>
<thead>
<tr>
<th>Mitigation of intrusion</th>
<th>Mitigation of privacy concerns</th>
<th>Mitigation of claims with respect to unreasonable detention, etc.</th>
<th>Mitigation of health risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral assessment</td>
<td>Same as for intrusion</td>
<td>Enforce positive results be transmitted for suspicion, not evidence of guilt, and process according to conducting secondary screening</td>
<td>N/A</td>
</tr>
<tr>
<td>Radiation detection systems</td>
<td>Same as for intrusion</td>
<td>Enforce positive results be transmitted for suspicion, not evidence of guilt, and process according to conducting secondary screening</td>
<td>N/A</td>
</tr>
<tr>
<td>Trace detector integrated into ticket machines</td>
<td>Not a primary risk.</td>
<td>Enforce positive results be transmitted for suspicion, not evidence of guilt, and process according to conducting secondary screening</td>
<td>Scrupulously maintain radiative components.</td>
</tr>
<tr>
<td>Non-invasive desktop scanner</td>
<td>Not a primary risk.</td>
<td>Enforce positive results be transmitted for suspicion, not evidence of guilt, and process according to conducting secondary screening</td>
<td>Scrupulously maintain radiative components.</td>
</tr>
<tr>
<td>Explosive detection canine</td>
<td>Not a primary risk.</td>
<td>Enforce positive results be transmitted for suspicion, not evidence of guilt, and process according to conducting secondary screening</td>
<td>N/A</td>
</tr>
<tr>
<td>Visual/physical search</td>
<td>Directing officers non to read any material in passenger bags will minimize privacy loss and as well as intrusions from a primary risk.</td>
<td>Enforce positive results be transmitted for suspicion, not evidence of guilt, and process according to conducting secondary screening</td>
<td>N/A</td>
</tr>
<tr>
<td>Handheld trace detector</td>
<td>Not a primary risk.</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Handheld magnetometer</td>
<td>Concealed body areas or reduce image details. Also ensure that images are not displayed in a way that may be considered intrusive. Destroying images once they are acquired by security purposes should also mitigate risk.</td>
<td>Not a primary risk.</td>
<td>N/A</td>
</tr>
<tr>
<td>Backscatter X-ray</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Millimeter wave imaging scanner</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Pubic portal</td>
<td>Not a primary risk.</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Baggage X-ray</td>
<td>Not a primary risk.</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Includes measures for:
1. Mitigation of intrusion
2. Mitigation of privacy concerns
3. Mitigation of claims with respect to unreasonable detention, etc.
4. Mitigation of health risks

National Transit Institute

People who are homeless often utilize public transit vehicles or facilities as shelters for various reasons, many transit passengers do not feel comfortable when near people who manage this population and its impacts to preserve the quality of the transit environment.

This webinar, based on TCRP Synthesis Report 121: Transit Agency Practices in Interacting with People Who Are Homeless, will explore effective practices, approaches, and outcomes within the transit industry regarding homeless, through discussion of:

- Experiences of public libraries
- The trajectory of responses in how transit agencies interact with people who find themselves homeless
- Findings from a survey of transit agencies
- Detailed case examples in the video.

This session will be presented by Dan Boyle, President, Dan Boyle and Associates, and NTI uses the Adobe Connect platform for all our webinars. Prior to your participation system first by following the link below:

https://webinar.rutgers.edu/connect/launch/launchmeeting?form

A dial-in number for the audio portion will be emailed to registrants, along with one week before the date of the scheduled webinar.

<table>
<thead>
<tr>
<th>Status</th>
<th>Registration Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Code</td>
<td>906036/1173013137</td>
</tr>
<tr>
<td>Session</td>
<td>HY2017</td>
</tr>
<tr>
<td>Category</td>
<td>Webinar</td>
</tr>
<tr>
<td>Days</td>
<td>In</td>
</tr>
<tr>
<td>Dates</td>
<td>Thursday, June 8, 2017 2:00pm ET</td>
</tr>
<tr>
<td>Times</td>
<td>9:00 PM - 11:45 AM</td>
</tr>
<tr>
<td>Instructor</td>
<td>Boyle, D.</td>
</tr>
</tbody>
</table>
| Location        | Online, Adobe Connect (info)
Objective: develop a scenario-based training system compliant with federal standards (e.g., the National Incident Management System and the Homeland Security Exercise Evaluation Program) and relevant transit industry standards and regulations. It is anticipated that the training system will be delivered through an automated, functional exercise simulation system capable of providing on-demand emergency response training and exercises.
Initiate the Incident Briefing Form (ICS Form 201)

Assess

Consequences

TCRP Project A-36 / NCHRP Project 20-59(49) / ACRP Project 4-04
Command-Level Decision Making For Transportation (2017)

UPDATE IN PROGRESS
Confronting Commercial Sexual Exploitation and Sex Trafficking of Minors in the United States

This report, a joint effort between CLAJ and the Board on Children, Youth, and Families, is a comprehensive examination and synthesis of current research on commercial sexual exploitation and sex trafficking of minors in the United States.

The report finds that, even with law enforcement, policymakers, and media focusing increasingly on sex trafficking and commercial sexual exploitation of children, the U.S. is in the very early stages of recognizing, understanding, and developing solutions for these problems. Further, the report demonstrates that no one sector, discipline, or area of practice can fully understand or respond effectively to the complex problems surrounding commercial sexual exploitation and sex trafficking of minors. Therefore, participation from and cooperation among numerous individuals and entities—including victim and support service providers, health and mental health care providers, legislators, law enforcement personnel, prosecutors, public defenders, educators, and the commercial sector—is required.

The report includes recommendations to increase awareness and advance understanding, to strengthen the law’s response, and to support collaboration to prevent, identify, and respond to commercial sexual exploitation and sex trafficking of minors in the United States.

Sponsor: Office of Juvenile Justice and Delinquency Prevention, U.S. Department of Justice
Modernizing the Nation’s Crime Statistics

Project Scope

A panel of the National Research Council will assess the need for a new set of crime measures in the United States and the broad support needed on certain crime types such as against butchers. The panel will also need greater ability to associate attributes such as crime type, time, and place with crime data upon which to make recommendations in the following areas: 

- suitability of crimes to be considered in a modern crime classification system; 
- analysis of various perspectives, such as technical or legal definitions of “property” and “motive”; 
- definition of “common unacceptable actions” in common law; 
- definition of “victims” as the unit of analysis. 

The review will focus on events and their attributes, understanding what crime types are covered by existing FBI and BJS data collection systems, and international crime classification frameworks that show the optimal scope of crime statistics to serve the needs of law enforcement agencies, Congress (including corrections officials), researchers, and the general public. The review will collect the data to complete the crime classification framework, assess the appropriateness of existing instruments and methods, and the effectiveness and accuracy of their data processing methods (including data processing and the handling of missing data). The panel will also identify and measure new and emerging crime trends, the use of locally collected and existing data as well as the nature of crime reporting in current systems, and minimize underreporting, information management systems, and misleading reporting practices. 

MODERNIZING CRIME STATISTICS

Report 1—Defining and Classifying Crime
Chapter 1: Introduction
Chapter 2: Passenger Perception of Crime and Terrorism
Chapter 3: Security Measures
Chapter 4: Security Practices
Chapter 5: Conflict Mitigation Strategies
Chapter 6: Case Studies
Chapter 7: Conclusions

Figure 10 from Chapter 5: Physical Aggression Continuum
(Source: Crisis Prevention Institute’s 2007 Webinar on Workplace Violence Prevention)
FIGURE 4 The New York City Police Department posts signs on local streets indicating the presence of security cameras. This sign was across the street from a Manhattan subway station. Photo courtesy of Dorothy M. Schulz.
Objective: develop (1) a primer and (2) a briefing for transportation system owners and operators explaining the nature of cyber events and their operational and safety impacts. These products contain a list of effective practices that can be used to protect transportation systems from cyber events and to mitigate damage should an attack or breach occur.
NIMS/ICS: Perform Reliably & Effectively

- Goal of NIMS/ICS: Reliable and effective response to an event, emphasizing safety of DOT staff
- Achieved through
  - Safety
    - Check-in, check out, demobilization
  - Personnel accountability
    - Food, shelter, family contacts
  - Reimbursement
    - The job you save may be your own
    - MAP-21 changes, debris removal reimbursement

Train-the-Trainer now available
AASHTO SCOTSEm resilience resources


Fundamental Capabilities of Effective All Hazards Infrastructure Protection Resilience, and Emergency Management for State Dots (2015)


NCHRP Project Panel 20-59
Surface Transportation Security & Resilience Research

- Transportation Resilience White Papers (2017)
  - Understanding Transportation Resilience: *An Environmental Perspective*
  - Understanding Transportation Resilience: *An Economic Perspective*
  - Understanding Transportation Resilience: *A Cyber Perspective*
- CEO Primer on Transportation Resilience (2017-2019)
- CEO Engagement Forums (2017-2018)
Presentation Outline

• Definition and context for resilience
• Overview of National Academies/TRB work in resilience
• Key products for all hazards, all modes
• **Ways to get involved**
  • Introduction to TRB & hot topics
  • Catalog of completed work and work in progress
Promoting innovation and progress in transportation
TRB.org
The ability to prepare and plan for, absorb, recover from, or more successfully adapt to actual or potential adverse events.
Disaster Resilience: A National Imperative

Four major recommendations

- Manage and communicate risk
- Measure resilience in communities
- Build community partnerships and coalitions
- Share information and data to build resilient communities
Four workstreams

1. Community Pilot Program
2. Workshops, Expert Meetings, and Activities
3. Measures and Metrics of Resilience
4. Economic Supply Chain Resilience
The Hazards and Disaster Management System

Pre-Impact Interventions
- Mitigation Practices
- Emergency Preparedness Practices
- Recovery Preparedness Practices

Post-Impact Responses
- Emergency Activities (planned and improvised)
- Recovery Activities (planned and improvised)

Hazard Vulnerability
- Hazard Exposure
- Physical Vulnerability
- Social Vulnerability

EVENTS

Disaster Impacts
- Physical
- Social

Disaster Event Characteristics
- Frequency
- Predictability
- Controllability
- Magnitude of Impact
- Scope of Impact (spatial and social)
- Duration of Impact
- Length of Forewarning

CHRONOLOGICAL TIME
- Pre-Impact
- Trans-Impact
- Post-Impact

SOCIAL TIME

# Organization of federal disaster, civil defense, and defense mobilization functions, 1950-2006

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Disaster Relief</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housing and Home</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finance Administration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Independent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Civil Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Civil Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Migration (EOP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Emergency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning (1968: Renamed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Emergency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparedness)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Disaster</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assistance Administration (FDAA), in HUD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Preparedness, later Federal Civil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparedness Agency)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Emergency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management Administration (FEMA) (Independent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DHS (FEMA becomes part)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Civil Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobilization (Executive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of the President (ECP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Civil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization (EOP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DoD (Defense Civil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparedness Agency)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobilization (Executive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of the President (ECP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Civil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization (EOP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DoD (Defense Civil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparedness Agency)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobilization (Executive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of the President (ECP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Civil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization (EOP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DoD (Defense Civil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparedness Agency)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobilization (Executive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of the President (ECP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Civil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Mobilization (EOP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DoD (Defense Civil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparedness Agency)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Facing Hazards and Disasters (National Academy of Sciences, 2006)
Multidisciplinary Center for Earthquake Engineering Research (MCEER) General Framework for Quantification of Resilience: Extent of Disruption and Recovery Time

Source: Bruneau & Tierney, Resilience: Defining and Measuring What Matters (MCEER 2006)  
http://mceer.buffalo.edu/
Further elaboration: MCEER resilience domains

**Technical:** Physical Systems—Location-Based & Distributed Critical Facilities

**Organizational:** Attributes, Dynamics of Organizations & Institutions

**Social:** Attributes, Dynamics of Communities and Populations

**Economic:** Attributes, Dynamics of Local and Regional Economies & Their Constituent Units (e.g. Businesses)

Source: Bruneau & Tierney, Resilience: Defining and Measuring What Matters (MCEER 2006)
http://mceer.buffalo.edu/
<table>
<thead>
<tr>
<th>Dimension/Domain</th>
<th>Technical</th>
<th>Organizational</th>
<th>Social</th>
<th>Economic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Redundancy</strong></td>
<td>Capacity for Technical Substitutions, “Work-Arounds”</td>
<td>Alternate Sites for Managing Disaster Operations</td>
<td>Availability of Housing Options for Disaster Victims</td>
<td>Ability to Substitute, Conserve Needed Inputs</td>
</tr>
<tr>
<td><strong>Resourcefulness</strong></td>
<td>Availability of Materials for Restoration, Repair</td>
<td>Capacity to Improvise, Innovate, Expand</td>
<td>Capacity to Address Human Needs</td>
<td>Capacity to Improvise, Innovate</td>
</tr>
<tr>
<td><strong>Rapidity</strong></td>
<td>System Downtime, Restoration Time</td>
<td>Time Between Impact &amp; Early Recovery</td>
<td>Time to Restore Life-line Services</td>
<td>Time to Regain Capacity, Lost Revenue</td>
</tr>
</tbody>
</table>
Resilience quantification

\[
\bar{R} = \frac{1}{N_t} \sum_{l=1}^{N_I} \int_{t_{0E}}^{t_{0E}+T_{RE}} \left\{ 1 - L(I, T_{RE}) \left[ H(t_{0E}) - H(t_{0E} + T_{RE}) \right] \cdot \alpha_R \cdot f_{rec}(t, t_{0E}, T_{RE}) \right\} \cdot dt \cdot p_E(0, T_{LC}) \cdot P(I)
\]

Where:

\( N_E \) Number extreme events expected during the lifespan (or control period) \( T_{LC} \) of the system

\( N_I \) Number of different extreme events intensities expected during the lifespan (or control period) expected during the \( T_{LC} \) of the system

\( T_{RE} \) Recovery time from event \( E \)

\( t_{0E} \) Time of occurrence of event \( E \)

\( f_{rec}(t, t_{0E}, T_{RE}) \) Recovery function

\( H(t_{0E}) \) is a step function ( =0 for \( t< t_{0E} \); =1 otherwise)

\( \alpha_R \) Recovery factor =1 for full recovery

\( L_I(I, T_{RE}) \) Normalized loss function

\( P(I) \) Probability that an event of given intensities happens in a given time interval \( T_{LC} \)

\( p_E(0, T_{LC}) \) probability that an event happens \( E \) times in a given time interval \( T_{LC} \)

Source: Bruneau & Tierney, Resilience: Defining and Measuring What Matters (MCEER 2006)
Three key themes for resilience

- **Measure**—Figure out way/s to measure resilience
- **Communicate**—New ways to talk about risk and resilience in ways that people can understand and take action
- **Connect**—Long-term change and impact with short-term decision making
Transportation context

- Multiple modes; multiple industries
- People and freight
- Massive network – central to economy
- International in scope
- Decentralized
- Public-private mix
- No one in charge
The transportation sector is central to enabling operability in all other sectors.

Research explains how uncertainty leads to doubt

(a) Integrated Recognition-Primed Decision model

(b) Uncertainty as a barrier to action

An Infrastructure Owner’s View of a Layered, Integrated Security System

- Structural Hardening to Survive Threat (Engineered)
- Physical Denial/Barrier (Eng.)
- Facility Screening/Intrusion Detection (Operations)
- State/Local Law Enforcement
- DHS – Global Intelligence
- DHS – Immigration
- DHS – Weapons/Explosives/Bio Chemical Tracking/Control
- Facility Screening/Intrusion Detection (Operations)
- Physical Denial/Barrier (Eng.)
- Structural Hardening to Survive Threat (Engineered)

Source: Englot, PANY&NJ, 2004
Developing a Strategy to Counter Terrorism Requires a Roadmap; Each Component of the Roadmap Requires Research

**Threat Analysis**

- Why do they hate us? What makes them hate us more?

**Offensive/Foreign**
- Military Strategy and Programs
- Intelligence Strategy and Programs
- Police and Justice
- International Development
- Political Actions
- Counter- and Non-Proliferation

**Defensive/Domestic**
- Preventive Measures
- Response Measures
- Threat and Risk Analysis

Source: Riley, (2004), Reducing the Risks and Consequences of Terrorism, CREATE Conference
**Identification of R&D Gaps & Needs**

1. TRB Resilience Section shares research results from all sources & identifies research needs

2. AASHTO Committee on Transportation Systems Security & Resilience (CTSSR) identifies and refers research needs

- 70+ other technical meetings
- TRB Annual State Visits to DOTs, Universities, MPOs, Transit Agencies, Ports, Airports & other agency reps

- Federal Agencies
- Non-Government Organizations
- Private Sector
- State/Local Government
A Guide to Planning Resources on Transportation and Hazards (2009)

Chapter 1: Introduction to the Disaster Cycle
Chapter 2: Overview
Chapter 3: The Economy and Hazards
Chapter 4: People and Hazards
Chapter 5: Infrastructure: Lifelines During Disasters
Chapter 6: Land Use, Development, and Natural Systems
Chapter 7: From Theory to Practice: Case Studies
Chapter 8: Conclusion
Continuous Development of Risk Management and Emergency Response Planning Guidance

2002: Guides to Vulnerability Assessment & Emergency Response Planning
2002-2003: workshops
2004-2005: publications that anticipated NIMS, NRP/NRF, and NIPP.
2012: publications adopted by AASHTO

Published 2009:
NCHRP Report 525, Vol. 14
Security 101: A Physical Security Primer for Transportation Agencies

Published 2010:
NCHRP Report 525, Vol. 16
A Guide to Emergency Response Planning at State Transportation Agencies
Resilience has many faces,
. . . many dimensions,

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Emergencies</th>
<th>Engineering</th>
<th>Climate, Community and Societal Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mission</td>
<td>Respond, Recover</td>
<td>Resist, Adapt</td>
<td>Defend, Adapt, Relocate</td>
</tr>
<tr>
<td>Duration</td>
<td>Hours - Months</td>
<td>Years - Decades</td>
<td>Decades or longer</td>
</tr>
<tr>
<td>Potential Disruptions</td>
<td>Extreme weather events</td>
<td>New load/durability requirements</td>
<td>Climate change impacts</td>
</tr>
<tr>
<td></td>
<td>Natural disasters</td>
<td></td>
<td>Sea level rise</td>
</tr>
<tr>
<td></td>
<td>Terrorist incidents</td>
<td></td>
<td>Mass migrations</td>
</tr>
<tr>
<td>Impact</td>
<td>Local - Regional</td>
<td>Local</td>
<td>Superregional - Global</td>
</tr>
<tr>
<td>Governance</td>
<td>Varies but Public Safety</td>
<td>Varies but State DOTs generally</td>
<td>All levels of government</td>
</tr>
<tr>
<td>Transportation</td>
<td>Agencies (PSA) generally</td>
<td>provide Incident Command</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provide Project Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agency Role</td>
<td>Support evacuation and</td>
<td>Engineering and construction</td>
<td>Funding</td>
</tr>
<tr>
<td></td>
<td>emergency access activities</td>
<td>services</td>
<td>Planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Policies and Standards</td>
</tr>
</tbody>
</table>
... many scales,
. . . and many choices

Source: Caltrans
Statewide Vulnerability Assessments

Defend

Planned retreat

Adapt

Forced retreat

Sea Level Rise Adaptation Options

Source: Caltrans
AASHTO SCOTSEMs resilience resources


Fundamental Capabilities of Effective All Hazards Infrastructure Protection Resilience, and Emergency Management for State Dots (2015)


NCHRP Project 20-59(36)
NCHRP Project 20-59(14B)

Fundamental Capabilities of Effective All-Hazards Infrastructure Protection, Resilience, and Emergency Management for State Departments of Transportation (2015)
All hazards planning fundamentals

- **Prevention**: Capabilities necessary to avoid, prevent, or stop a threatened or actual act of terrorism.
- **Protection**: Capabilities necessary to secure against acts of terrorism and manmade or natural disasters.
- **Mitigation**: Capabilities necessary to reduce loss of life and property by lessening the impact of disasters.
- **Response**: Capabilities necessary to save lives, protect property and the environment, and meet basic human needs after an incident has occurred.
- **Recovery**: Capabilities necessary to assist communities affected by an incident to recover effectively.

Transportation agency resilience: fundamental capabilities

<table>
<thead>
<tr>
<th>Prevention</th>
<th>Protection</th>
<th>Mitigation</th>
<th>Response</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Public Information and Warning</td>
<td>Operational Coordination</td>
<td>Cybersecurity</td>
<td>Training and Exercises</td>
</tr>
<tr>
<td>Intelligence &amp; Information Sharing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screening, Search, &amp; Detection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Protective Measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Chain Integrity &amp; Security</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-Term Vulnerability Reduction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk &amp; Disaster Resilience Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threat &amp; Hazard Identification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Transportation Operational Communications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: AASHTO. Fundamentals of Effective All Hazards Security and Resilience for State DOTs, 2015
# Transportation agency resilience: CRP resources for fundamental capabilities

<table>
<thead>
<tr>
<th>Prevention</th>
<th>Protection</th>
<th>Mitigation</th>
<th>Response</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planning:</strong> Guide to Emergency Response Planning at State Transportation Agencies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Public Information and Warning:</strong> Communication with Vulnerable Populations</td>
<td>FloodCast</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operational Coordination:</strong> A Guide to Regional Transportation Planning for Disasters, Emergencies, and Extreme Events</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Intelligence & Information Sharing | Access Control | Long-Term Vulnerability Reduction | Critical Transportation Infrastructure Systems |
| Screening, Search, & Detection | Physical Protective Measures | Risk & Disaster Resilience Assessment | Operational Communications |
| Risk Management | Supply Chain Integrity & Security | Threat & Hazard Identification | Situational Assessment |


| Training and Exercises: Guidelines for Transportation Emergency Training Exercises | ICS Training for Field Level Transportation Supervisors and Staff | Transportation Emergency Response Application |
Objective
to develop a toolkit of communications strategies, policies, and practices for transportation agencies and emergency management agencies that focuses on communicating with vulnerable populations prior to, during, and after all-hazards emergencies.

Graphic: Cover for TCRP Report 150, Communication with Vulnerable Populations: A Transportation and Emergency Management Toolkit
NCHRP 20-59(53) FloodCast: a strategic framework and a prototype tool for enhanced flood event decision built on National Flood Interoperability Experiment (NFIE) System

Blanco River at Wimberley
Two basins and one forecast point

becomes

130 Catchments and Flowlines uniquely labelled

NFIE: 2.7 million stream reaches and catchments

Basin ~ 400 Sq Mile
Reach Catchment ~ 1 Sq Mile

A national flow network

Current: 6600 basins and 3600 forecast points

Adapting to Change in Urban Flooding

Rokstrom: Natural Systems
Snowden & Boone: Leader’s Framework for Decision-making
Milly et al: Stationarity is Dead
Types of Resilience

Resist
Complicated
Stationarity
Engineered resilience (Probabilities of failure)

Adapt
Complex (test-bed for innovation)
Stationarity is Dead
Socio-Ecological Resilience -capacity to adapt -attributes of resilience

Transform
Chaos (openness to innovation)

Source: Steve Moddemeyer, “New Ideas around the Old Problem of Urban Flooding,” ResilientAmerica Roundtable, February 17, 2017
Moving forward

“Disaster resilience is everyone’s business and is a shared responsibility among citizens, the private sector, and government. Community leaders and government officials face decisions every day that may pit short-term interests against longer-term goals. Increasing resilience to disasters will require decisions and actions that are informed and forward-looking.

“Although disasters will continue to occur, actions that move the nation from a reactive to a proactive approach will reduce many of the societal and economic burdens and impacts that disasters cause. Building the nation’s resilience is a long-term process, one that will be socially and politically challenging, but the reward for our efforts will be a safer, healthier, more secure, and more prosperous nation.”

The National Academies, 2012
Ways to get involved

- SCOTSEM & RSTS (combined into CTSSR)
- TRB Committee on Critical Infrastructure Protection (ABR10)
- NCHRP Resilience Research Road Map Needs Solicitation
- 2018 Transportation Resilience Summit and Peer Exchange
AASHTO 2016-2019 resilience research program


CEO Engagement Forums (2017-2018)

Resilience Summit and Peer Exchange (2018)


CEO Primer on Transportation Resilience (2018)

3-Transportation Resilience White Papers (2016-2018)

NCHRP 20-59(54)
NCHRP 20-59(55)
NCHRP 20-117

The National Academies of Sciences • Engineering • Medicine
TRANSPORTATION RESEARCH BOARD
NCHRP Project Panel 20-59
Surface Transportation Security & Resilience Research

- Transportation Resilience White Papers (2017)
  - Understanding Transportation Resilience: An Environmental Perspective
  - Understanding Transportation Resilience: An Economic Perspective
  - Understanding Transportation Resilience: A Cyber Perspective
- CEO Primer on Transportation Resilience (2017-2019)
- CEO Engagement Forums (2017-2018)
The objective of this research is to develop a set of implementation support tools and services to assist transportation organizations in deploying resilience-based innovations and effective practices based on the implementation recommendations contained in completed resiliency research.

The scope of these services shall encompass those activities involving (1) organizational/institutional implementation (e.g., governance, business process/data, performance measures, work plans); (2) employee learning (grounded in modern adult learning theory and centered on facilitating learning in the workplace); and (3) stakeholder outreach and engagement. A significant component of the this project will be to organize a national summit and peer exchange on transportation resiliency to be held in 2018 and co-sponsored by TRB, AASHTO (SCOTSEM, Standing Committee on the Environment, and Resilient and Sustainable Transportation Systems), FHWA, Federal Emergency Management Agency, Department of Homeland Security, and other interested parties.
TRB

Who We Are and What We Do
Promoting innovation and progress in transportation
TRB.org

This Congressionally-mandated study by the National Academies reviewed how the Department of Homeland Security (DHS) is building its capabilities in risk analysis to inform decision-making. More specifically, the study addressed the following tasks:

a) Evaluate the quality of the current DHS approach to estimating risk and applying those estimates in its many management, planning, and resource-allocation (including grant-making) activities, through review of a committee-selected sample of models and methods;

b) Assess the capability of DHS risk analysis methods to appropriately represent and analyze risks from across the Department’s spectrum of activities and responsibilities, including both terrorist threats and natural disasters;

c) Assess the capability of DHS risk analysis methods to support DHS decision-making;

d) Review the feasibility of creating integrated risk analyses covering the entire DHS program areas, including both terrorist threats and natural disasters, and make recommendations for best practices, including outreach and communications;

e) Recommend how DHS can improve its risk analyses and how those analyses can be validated and provide improved decision support.
National Academies of Sciences, Engineering, and Medicine
Transportation Policy Studies: Resilience

• **Special Report 294: The Role of Transit in Emergency Evacuation** (2008)

• **Special Report 290: The Potential Impacts of Climate Change on U.S. Transportation** (2008)
Foresight NCHRP Report 750 Series: Informing Transportation’s Future

**VOLUME 1: FREIGHT**
Economic Changes Driving Future Freight Transportation
Explore and plan for the future of freight with a scenario planning toolkit.

**VOLUME 2: CLIMATE CHANGE**
Climate Change and the Highway System: Impacts and Adaptation Approaches
How to prepare for extreme weather events.

**VOLUME 3: TECHNOLOGY**
Expediting Future Technologies for Enhancing Transportation System Performance
Select the right technology investments at the right time.

**WEBINAR:** A recorded webinar on Vol. 3 is available [here](#).

**VOLUME 4: SUSTAINABILITY**
Sustainability as an Organizing Principle for Transportation Agencies
Organize transportation agencies to support a sustainable society.

**VOLUME 5: ENERGY**
Preparing State Transportation Agencies for an Uncertain Energy Future
Identify and assess strategic responses to a variety of future energy scenarios.

**VOLUME 6: SOCIO-DEMOGRAPHICS**
The Effects of Socio-Demographics on Future Travel Demand
Envision and model the transportation impacts of shifting demographics.

The National Academies of Sciences • Engineering • Medicine

TRB
TRANSPORTATION RESEARCH BOARD
NCFRP Report 30
Making U.S. Ports Resilient as Part of Extended Intermodal Supply Chains (2014)

Figure 2.4. Agents and activities associated with a port-based supply chain disruption.
Improving the Resilience of Transit Systems Threatened by Natural Disasters

TRB's Transit Cooperative Research Program (TCRP) Web Only Document 70: Improving the Resilience of Transit Systems Threatened by Natural Disasters, Volume 1: A Guide offers practices for transit systems of all sizes to absorb the impacts of disaster, recover quickly, and return rapidly to providing the services that customers rely on to meet their travel needs. The report shows how to identify and implement appropriate resilience strategies to strengthen operations and infrastructure throughout an agency. It explores ways that agencies can become more resilient through incremental adjustments in planning and small changes in what they do every day. The guide also shows how to identify critical transit-related interdependencies and engage in broader regional resilience efforts.

The guide is accompanied by Volume 2: Research Overview and Volume 3: Literature Review and Case Studies.
Guidelines to Incorporate the Costs and Benefits of Adaptation Measures in Preparation for Extreme Weather Events and Climate Change

The objectives of this research are to develop (a) a stand-alone document providing guidance for practitioners on methods and tools, including illustrative case studies where applicable, to: (i) efficiently mine, manage, and document existing data sources; (ii) acquire and use data from new and innovative sources; and (iii) apply, and communicate the results from, a flexible and scalable framework for analyzing the costs and benefits of adaptation measures in preparation for extreme weather events and climate change conducted by various transportation organizations; (b) a final report that documents the entire research effort and includes the research team’s recommendation of research needs and priorities for additional related research; and (c) an updated PowerPoint presentation describing the research and results suitable (upon revision) for posting on the TRB website.
The objective of this research is to develop a handbook incorporating climate adaptation into airport asset, risk, and emergency management systems.

Airports need a streamlined method to address climate vulnerability and planning as a part of risk and asset management and a way to align emergency planning with major climate related events. A quantification of risk factors, including airport and regional economic impact, can help inform asset management plans, emergency plans, and capital plans. Research is needed to help airports understand how climate risks add uncertainty to maintenance and capital budgets, and how this exposure can be mitigated and addressed through changes to airport asset management and capital planning.
The objectives of this research are to: (1) identify the needed levels of precision, accuracy, and confidence for climate models to be compatible with that of the data used in current hydrologic/hydraulic analysis and design techniques, identify downscaling strategies to move climate models closer towards these levels of precision, accuracy, and confidence, and develop science-based strategies and methodologies to advance engineering in extending climate predictions when the limits of downscaling of climate models are reached; (2) identify and quantify resiliency in existing hydraulic design practices due to current safety factors and conservative assumptions/techniques; and (3) identify cost-effective adaptation solutions that extend existing infrastructure to continue to function to the end of its service life despite not having been designed for climate change. An outcome of this research will be a guidance document with a list of available and achievable hydraulic resiliency in design for retrofits.
Criteria for Selecting TRB “Hot Topics”

- Identified in TRB *Critical Issues in Transportation*
- Timely
- Sustainable
- Diverse
- Key to helping to achieve multiple TRB strategic objectives
TRB Hot Topic: Transformational Technologies

Transformational, or “disruptive” technologies, are those that can be expected to completely displace the status quo, forever changing the way we live and work.

• General examples: internet, personal computer, email, smartphone, GPS, big data

• Transportation: Connected/automated vehicles, shared vehicles, advanced versions of on-demand shared ride and micro-transit services, NextGen, cog in “internet-of-things”
Resilience is the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.

- Natural disasters: blizzards, tornadoes, floods, hurricanes, wildfires, heat waves, earthquakes, and other natural hazards
- Human-induced disasters: acts of terrorism, financial crises, social unrest, cyber attacks
TRB Hot Topic: Transportation and Public Health

All aspects of public health that affect, or are affected by, transportation

- Public health impacts on transportation: public health laws and policies, medical advances, aging population
- Transportation impacts on health: crash fatalities and injuries, access to health care, emergency response, active transportation, transportation-induced pollution, accessibility for people with transportation disabilities
TRB Annual Meeting 1920s
TRB Today

• Manage Research
• Delivering Policy Analysis & Advice
• Information Exchange: Meetings, Publications, Website, Dissemination, Outreach
TRB Sponsors

- American Public Transportation Association
- Association of American Railroads
- State Departments of Transportation (All)
- South Coast Air Quality Management District
- U.S. Army Corps of Engineers
- U.S. Air Force Civil Engineering Center
- U.S. Coast Guard
- U.S. DOT: OST, FHWA, FTA, FRA, FMCSA, FAA
Research Management
Cooperative Research Programs

- Highway
- Transit
- Airport
- Freight
- Hazardous Materials
- Rail
Characteristics of Cooperative Research Programs

- Sponsors own programs
- Practitioners select projects
- Emphasis on solving problems; short-term results
- Panels oversee each project
- Consultants, universities conduct research
- 200+ reports each year
Policy Analysis and Advice
TRB Convening Events and Standing Committees
TRB “Professional Society” Functions

- 200 Standing Technical Committees – about 4,000+ people
- Constitute communities of interest
- Identify research needs
- Sponsor sessions, conferences, and meetings – 50+ events in addition to Annual Meeting
- Review and publish papers and reports
- Share information
TRB Annual Meeting Events

• 750 workshops & sessions
• 5,000 technical papers and presentations
• 500 TRB committee meetings
• 150+ other meetings by affiliated groups
TRB NEWS

2018 TRB Annual Meeting: U.S. Department of Transportation Sessions

Several sessions at the 2018 TRB Annual Meeting will feature officials from the U.S. Department of Transportation. Use the mobile app or the interactive program to save these events to your calendar. Encouraging Innovation: The current state of innovation, industry convergence, and technological change is unprecedented and... 

Announcing the Behavioral Traffic Safety Cooperative Research Program (BTSCRP)

TRB is pleased to announce the Behavioral Traffic Safety Cooperative Research Program (BTSCRP), a new cooperative research program that will provide practical solutions to save lives, prevent injuries, and reduce costs of road traffic crashes associated with unsafe behaviors. Through funding from the National Highway Traffic Safety Administration... 

Panel Members for FY 2018 Projects in the Behavioral Traffic Safety Cooperative Research Program (BTSCRP)

The Behavioral Traffic Safety Cooperative Research Program (BTSCRP), a newly established program administered by TRB in partnership with the Governors Highway Safety Associate and the National Highway Traffic Safety Administration, is seeking panel nominations for fiscal year 2018. Nominations are due January 16, 2018, and should be submitted to... 

New Consensus Study Seeks Committee Members: Submit Nominations by December 28, 2017

At the request of the U.S. Department of Transportation, the National Academies of Sciences, Engineering, and Medicine is undertaking a new consensus study on fuel economy technologies for light-duty vehicles. Nominate or self-nominate experts in automotive technologies and production, economics, engineering systems, safety, and regulation to... 

Register for the “Alternatives to Surveys” Webinar during the ACRP’s Annual Symposium on Research in Progress

TRB’s Airport Cooperative Research Program (ACRP) is hosting a webinar in conjunction with its Annual Symposium on Research in Progress on January 7, 2018 from 12:15 to 1:15 PM ET that will feature social science experts from the Virginia Tech School of Education and the George Washington University School of Nursing who will present on...
TRB Research Databases

Resources and Databases

TRB maintains a number of databases and other resources designed to help researchers identify existing, ongoing, needed, and potential areas for funding of research in all the fields of transportation. TRB also has a physical library and produces webinars and recorded sessions that are available for download.

Research Needs Statements (RNS) database

As part of its function, the Transportation Research Board is to stimulate research that addresses concerns, issues, or problems facing the transportation community. In support of this function, TRB Technical Activities Division standing committees identify, develop, and disseminate research needs statements for use by practitioners, researchers, and others.

TRBD, the TRB and ITRD database

TRBD is a newly integrated database that combines the records from TRB’s Transportation Research Information Services (TRIS) Database and the OECD’s Joint Transport Research Centre’s International Transport Research Documentation (ITRD) Database. TRBD provides access to over 900,000 records on transportation research worldwide.

Prismatic, the AAR database

Prismatic is a database that provides access to over 2 million records on railroad research.

Transportation Research Thesaurus (TRT)

The Transportation Research Thesaurus (TRT) is a tool designed to improve the indexing and retrieval of transportation information. The thesaurus covers all modes and aspects of transportation. The TRT’s purpose is to provide a common and consistent language between producers and users of transportation information.

Online Directory

The TRB Online Directory allows you to browse or search through TRB’s committee structure to find detailed information on committees, including committee scopes, committee membership rosters, and links to committee homepages. Included in the directory are standing committees, project-based committees, and TRB governing committees.

Library

The RG Library is the primary archive for publications of the Transportation Research Board, Highway Research Board, Strategic Highway Research Program, and the Marine Board. The library was founded in 1946 to provide information services to TRB staff, sponsors, TRB committees and panels, and researchers.

Research Funding

TRB’s Funding Sources for Transportation Research: A Competitive Program is designed to help researchers identify potential organizations where they may submit research statements to obtain funding.
What is TRID?

Available for Free at trid.trb.org

The Transportation Research International Documentation (TRID) Database is the world's largest, most comprehensive bibliographic resource on published and ongoing transportation research. TRID contains more than 1.1 million records with 200,000+ links to free and fee-based full text.

Produced and maintained by TRB
What is in TRID [trid.trb.org]

- Federal and state department of transportation reports
- Ongoing, recently completed, or soon-to-start transportation research projects
- TRB publications back to 1920
- University Transportation Centers reports
- Commercial and academic journal literature
- Monographs

TRID also includes international research: the ITRD Database (Europe), the ATRI Database (Australia and New Zealand), and select records from the J-STAGE Database (Japan).
Benefits of Using TRID

• Locate solutions to problems
• Avoid duplication of work and save resources
• Encourage and facilitate cooperation and partnership
• Identify practitioners and experts in specific research areas

Please contact the TRB Library (TRBLibrary@nas.edu) with questions about using TRID.
Cooperative Research Programs
TRB Publications in 1997 & 2000 - Security and Terrorism

- Improving Transit Security (1997)

November-December 2000, TR News 211
Transportation Security: Protecting the System from Attack and Theft
2002 APTA/FTA Transit Security Workshops

January 2002 – May 2002

1. New York City
2. San Francisco, California
3. Atlanta, Georgia
4. Chicago, Illinois

APTA/FTA Transit Security Workshops

A Guide to Updating Highway Emergency Response Plans for Terrorist Incidents available May 2002

CONTRACTOR’S FINAL REPORT

A Guide to Updating Highway Emergency Response Plans for Terrorist Incidents

Emergency Transportation Operations Preparedness & Response Workshops For Statewide Applications

June – November 2003
1. New Mexico
2. Minnesota
3. Washington
4. Idaho

Bridge/Tunnel/Highway Infrastructure Vulnerability Workshop Attendees
February-March 2003
1. Sacramento, California
2. Albany, New York
3. Austin, Texas

http://security.transportation.org/sites/security/docs/guide-VA_Appendices.pdf

Table 1: Program of Commitments

COMMIT to a program that enables the public transportation system to:

⇒ PREVENT incidents within its control and responsibility, effectively protect critical assets;

⇒ RESPOND decisively to events that cannot be prevented, mitigate loss, and protect employees, passengers, and emergency responders;

⇒ SUPPORT response to events that impact local communities, integrating equipment and capabilities seamlessly into the total effort; and

⇒ RECOVER from major events, taking full advantage of available resources and programs.


“Blue Ribbon Panel on Bridge and Tunnel Security” report presented institutional, fiscal, and technical recommendations

http://www.fhwa.dot.gov/bridge/security/brpcover.htm
Identification of R&D Gaps & Needs

1. TRB Resilience Section shares research results from all sources & identifies research needs

2. AASHTO Committee on Transportation Systems Security & Resilience (CTSSR) identifies and refers research needs

- 70+ other technical meetings
- TRB Annual State Visits to DOTs, Universities, MPOs, Transit Agencies, Ports, Airports & other agency reps
- State/Local Government
- Non-Government Organizations
- Federal Agencies
- Private Sector
1 Communication of Threats
2 K9 Units
3 Robotic Devices
4 Intrusion Detection
5 Customer Communications and Training
6 Portable Explosive Detection Devices
7 Security Awareness for Employees
8 Continuity of Operations Planning
9 Emergency Drills and Exercises
10 Hazard and Security Plan Workshop
11 Security Measures for Ferry Systems
12 Tunnel Security Countermeasures
13 Passenger Security Inspections
## NCHRP Report 525 Series

**Guides on Surface Transportation Security**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Responding to Threats</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Information Sharing and Analysis</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Incorporating Security into Planning</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Terrorism-Related Risk Management</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Managing Sensitive Information</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>Emergency Operations</td>
</tr>
<tr>
<td><strong>7</strong></td>
<td>Security Awareness for Employees</td>
</tr>
<tr>
<td><strong>8</strong></td>
<td>Continuity of Operations Planning</td>
</tr>
<tr>
<td><strong>9</strong></td>
<td>Emergency Drills and Exercises</td>
</tr>
<tr>
<td><strong>10</strong></td>
<td>Public Health Disasters</td>
</tr>
<tr>
<td><strong>11</strong></td>
<td>Disruption Impact Estimation</td>
</tr>
<tr>
<td><strong>12</strong></td>
<td>Tunnel Security Countermeasures</td>
</tr>
<tr>
<td><strong>13</strong></td>
<td>Traffic Control for Agricultural Emergencies</td>
</tr>
<tr>
<td><strong>14</strong></td>
<td>Physical Security Primer</td>
</tr>
<tr>
<td><strong>15</strong></td>
<td>Costing Asset Protection</td>
</tr>
<tr>
<td><strong>16</strong></td>
<td>Emergency Response Planning</td>
</tr>
</tbody>
</table>
Risk-Informed Decision Support
Continuous Development of Risk Management and Emergency Response Planning Guidance

Published 2009:
NCHRP Report 525, Vol. 14
Security 101: A Physical Security Primer for Transportation Agencies

2002: Guides to Vulnerability Assessment & Emergency Response Planning

2002-2003: workshops

2004-2005: publications that anticipated NIMS, NRP/NRF, and NIPP.

2012: publications adopted by AASHTO

Published 2010:
NCHRP Report 525, Vol. 16
A Guide to Emergency Response Planning at State Transportation Agencies
Chapter 1: Risk Management and Risk Assessment
Chapter 2: Plans and Strategies
Chapter 3: Physical Security Measures
Chapter 4: Security Personnel and Training
Chapter 5: Infrastructure Protection
Chapter 6: Homeland Security

Update in Progress
Adopted by SCOTSEM
Objective: develop (1) a primer and (2) a briefing for transportation system owners and operators explaining the nature of cyber events and their operational and safety impacts. These products contain a list of effective practices that can be used to protect transportation systems from cyber events and to mitigate damage should an attack or breach occur.
Guide
– Summary
– Overview for state transportation agencies (authorities, etc.)
– High-level requirements based on national policies and guidelines
– High-level self-assessment with pointers

Section 6: Resource Guide
– Organizational/staffing/position guidance
– Decision-making sequences
– Detailed self-assessment and resource lists
Application Context
• Top-down, program level – to support resource allocation
• Consequence-driven – based on user-selected thresholds (“possibilistic”)
• Iterative – use to compare/refine assumptions

Model Attributes
• Objective – when possible use data rather than “best judgment”
• Transparent – avoid “weighting and rating”
• Consistent – uses simple, available data and criteria, standard data base, default values
• Replicable – identify basis of all judgments

User Features
• Convenient – uses available resources (people and software) and imbedded data model
• Scalable – support a range of user contexts, mode, hazards,
• Expandable – to accommodate new threats/hazards, asset types, and countermeasures
Costing Asset Protection: An All Hazards Guide for Transportation Agencies (CAPTA, 2009)

CAPTA Methodology Framework

User Inputs
- Asset Classes of Interest
- Threats/Hazards of Concern
- Consequence Thresholds
- Asset Attributes within Classes
- Countermeasure Selection

Risk Management Methodology
Six step methodology implemented using Microsoft Excel® spreadsheet to capture inputs and display intermediate outputs

Master Countermeasures Data Base
Description of generic countermeasures considered effective in mitigating risks by asset class, hazard or threat, and consequence.

Consolidated User Inputs

Candidate Countermeasure Configurations
- List of selected countermeasures that will reduce risks to asset classes of interest against threats/hazards of concern to avoid exceeding specified consequence threshold
- Description of selected countermeasures including rough order of magnitude costs and selected functional characteristics

Candidate Countermeasures

Countermeasure attributes

The National Academies of Sciences • Engineering • Medicine
### Basic CAPTA

<table>
<thead>
<tr>
<th>Basic CAPTA</th>
<th>Steps in Methodology</th>
<th>Expanded CAPTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identify Relevant Risks and Asset Classes</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Verify High Consequence Threats and Hazards</td>
<td>1a</td>
</tr>
<tr>
<td>2</td>
<td>Establish Consequence Thresholds</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Describe Infrastructure Assets</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Identify Critical Assets Across Modes</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Review Countermeasure Unit Costs</td>
<td>5a</td>
</tr>
<tr>
<td></td>
<td>Identify and Describe Additional Countermeasures</td>
<td>5b</td>
</tr>
<tr>
<td></td>
<td>Set Countermeasure Filters based on User Preference</td>
<td>5c</td>
</tr>
<tr>
<td>5</td>
<td>Select Candidate Countermeasures</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Summary Report</td>
<td>6</td>
</tr>
</tbody>
</table>
### Select Candidate Countermeasures

Instructions:
The following is a list of countermeasure opportunities for each critical asset. Orange indicates medium effectiveness and red indicates high effectiveness.

To analyze an asset more closely, click on the name of the asset in row 15, and then click "Analyze Asset." A new sheet will pop up that details the effectiveness of the countermeasure against every relevant threat and hazard. The sheet will also tell you how many units of countermeasure you have selected so far for the asset and the estimated cost.

To add units of countermeasure, enter the desired number of units into any cell. Alternatively, the "Analyze Asset" sheet also has a field for adding units of countermeasure. When you are satisfied with your CM allocation, click "Continue."

### Description of this step & instructions

The following is a list of countermeasure opportunities for each critical asset. Orange indicates medium effectiveness and red indicates high effectiveness.

To analyze an asset more closely, click on the name of the asset in row 15, and then click "Analyze Asset." A new sheet will pop up that details the effectiveness of the countermeasure against every relevant threat and hazard. The sheet will also tell you how many units of countermeasure you have selected so far for the asset and the estimated cost.

To add units of countermeasure, enter the desired number of units into any cell. Alternatively, the "Analyze Asset" sheet also has a field for adding units of countermeasure. When you are satisfied with your CM allocation, click "Continue."
Objective: develop a scenario-based training system compliant with federal standards (e.g., the National Incident Management System and the Homeland Security Exercise Evaluation Program) and relevant transit industry standards and regulations. It is anticipated that the training system will be delivered through an automated, functional exercise simulation system capable of providing on-demand emergency response training and exercises.
NIMS/ICS: Perform Reliably & Effectively

- Goal of NIMS/ICS: Reliable and effective response to an event, emphasizing safety of DOT staff
- Achieved through
  - Safety
    - Check-in, check out, demobilization
  - Personnel accountability
    - Food, shelter, family contacts
  - Reimbursement
    - The job you save may be your own
    - MAP-21 changes, debris removal reimbursement

Train-the-Trainer now available
TERET (Tracking Emergency Response Effects on Transportation) – Spreadsheet Layout

Sheet 1: Introduction
Provides summary instructions

Sheet 2: Basic Services
Assess criticalities that may develop from ER changes in traffic patterns.

Sheet 3: Mass Care
Assess needs during shelter-in-place, temporary shelters, or quarantine shelter.
NCHRP Report 525, Vol. 13

Incorporating Security Into the Transportation Planning Process
Quarantine Facilities for Arriving Air Travelers:
Objective to develop an all-hazards emergency evacuation guide for transportation and emergency management agencies that integrates the broad community of resources that are necessary to plan, train, exercise, and execute evacuations.
The Past Is Prologue
1. Prior to September 11, 2001
TRB Publications in 1997 & 2000 - Security and Terrorism

- Improving Transit Security (1997)

November-December 2000, TR News 211
Transportation Security: Protecting the System from Attack and Theft
2. Stage I
Immediate Aftermath of September 11, 2001:
Information Sharing
2002 APTA/FTA Transit Security Workshops

APTA/FTA Transit Security Workshops
   January 2002 – May 2002
1. New York City
2. San Francisco, California
3. Atlanta, Georgia
4. Chicago, Illinois

Notional Surface Transportation Threat Information Forum

- Open Sources
- Trans. Authorities
- Federal Authorities
- Authorized Analysts

Threat information is received via one of two mechanisms.

Content is analyzed, categorized and disseminated according to protocol and shared with relevant stakeholders.

Figure 3: Notional Surface Transportation Threat Information Forum

National Portal
Performs analysis and information sharing with other national entities (e.g., InfraGard)

Regional Portal
Local Public Transportation Authorities

FIGURE 4: DISTRIBUTED IMPLEMENTATION MODEL
NCHRP Report 525, Vol. 2
Information Sharing and Analysis Centers: Overview and Supporting Software Features (2004)
Identifying and Evaluating Implementation Options for a Highway Asset ISAC

IDENTIFYING AND EVALUATING IMPLEMENTATION OPTIONS FOR A HIGHWAY ASSET ISAC
FINAL REPORT

Prepared for
National Cooperative Highway Research Program
Transportation Research Board
National Research Council

Vicki Glenn
CACI Premier Technology, Inc.
Chantilly, Virginia
NCHRP Project 20-59(7A)

February 2006

The information contained in this report was prepared as part of NCHRP Project 20-59,
National Cooperative Highway Research Program, Transportation Research Board.
3. Stage I

Technology Assessments
Task-Order #J-10(2)B
SECURITY WHITE PAPER ON PUBLIC TRANSPORTATION SYSTEM TECHNOLOGY CLEARINGHOUSE

Performed under: Contract NAS#112 --
Task-Order Support for Surface Transportation Security Research

Submitted to:
Mr. S. A. Parker, Project Manager
Transit Cooperative Research Program
Transportation Research Board
National Research Council
2001 Wisconsin Avenue, NW
Washington, DC 20007

Submitted by:
Roger Jenkins (P.I.)
Science Applications International Corporation
1710 SAIC Drive
McLean, VA 22102
(703) 676 - 8128

Date: May 10, 2002
Anatomy of a Detection System

Source of graphic: DHS.
## TABLE 22: ACTIVITY OF DUAL PURPOSE K9 TEAM

<table>
<thead>
<tr>
<th>Activity</th>
<th>Number per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Relations and Other Demonstrations</td>
<td>10-20</td>
</tr>
<tr>
<td>Patrol Tours or Routes (two-hour shifts)</td>
<td>500-700</td>
</tr>
<tr>
<td>Narcotics Searches</td>
<td>25-50</td>
</tr>
<tr>
<td>Article Search</td>
<td>25</td>
</tr>
<tr>
<td>Building Search</td>
<td>100</td>
</tr>
<tr>
<td>Suspect Tracking</td>
<td>50</td>
</tr>
<tr>
<td>Victim or Lost Person Tracking</td>
<td>1</td>
</tr>
<tr>
<td>Police Officer Assist Calls</td>
<td>50</td>
</tr>
<tr>
<td>Local Agency Assist Calls</td>
<td>25</td>
</tr>
<tr>
<td>Arrests Made or Supported</td>
<td>12-50</td>
</tr>
<tr>
<td>Trials and Competitions</td>
<td>2</td>
</tr>
</tbody>
</table>
Checklist:

☐ Does the lighting system meet the transit agency’s established security requirement?
☐ Does the lighting system comply with the local building and safety codes?
☐ Have lighting effects on neighboring buildings or private homes been considered?
☐ Are sufficient portable lighting devices available?
☐ Is there a need for specialized spotlighting or infrared (IR) lighting?
☐ If required, is there adequate backup electrical power to support the lighting system?
☐ Is the lighting system clear of any obstructions within 6-feet (minimum) to 20-feet (ideal)?
☐ Is the lighting system properly secured to prevent removal, displacement, modification or theft?
☐ If required, are there adequate signs or language(s)?
☐ Are procedures in place for routine inspection and/or maintenance of the hardware?
☐ Have the system operators/maintainers received input to the selection of this system?
☐ Are there adequate spare parts to support the selected system?
☐ Is Point-of-Contact information readily available?
Sensitivity of the tested device: 10 nanograms (not to scale)
4. Stage I

Decontamination
Public Transportation System Nuclear, Biological, and Chemical Decontamination Procedures

Task-Order #J-10(2)A
SECURITY WHITE PAPER ON PUBLIC TRANSPORTATION SYSTEM NUCLEAR, BIOLOGICAL, AND CHEMICAL DECONTAMINATION PROCEDURES
Final

Performed under: Contract NAS#12 --
Task-Order Support for Surface Transportation
Security Research

Submitted to:
Mr. S. A. Parker, Project Manager
Transit Cooperative Research Program
Transportation Research Board
National Research Council
2001 Wisconsin Avenue, NW
Washington, DC 20007

Submitted by:
Roger Jenkins (P.I.)
Science Applications International Corporation
1716 SAIC Drive
McLean, VA 22102
(703) 676 - 8128

Date: August 23, 2002
Innovations Deserving Exploratory Analysis (IDEA)

Nine Transit IDEA projects address security.

January 6, 2006, presentation on Transit IDEA Project 45, Chemical and Biological Decontamination System for Rail Transit Facilities (completed January 2007).
5. Stage I

Training
Responding to Threats: A Field Personnel Manual

Provides a draft template that contains basic security awareness training in a workbook format that can be redesigned as a pamphlet, glove-box brochure, or other user-specific document.
An interactive CD-ROM training course; also provided as train-the-trainer and by direct delivery through the National Transit Institute.
Hazard and Security Planning Tools for Rural, Small Urban, and Community-Based Public Transportation Operations
6. Stage I

Immediate Guidance on Risk Management and Emergency Response
A Guide to Updating Highway Emergency Response Plans for Terrorist Incidents available May 2002

Emergency Transportation Operations Preparedness & Response Workshops For Statewide Applications

June – November 2003
1. New Mexico
2. Minnesota
3. Washington
4. Idaho

A Guide to Highway Vulnerability Assessment for Critical Asset Identification and Protection

Bridge/Tunnel/Highway Infrastructure Vulnerability Workshop Attendees
February-March 2003
1. Sacramento, California
2. Albany, New York
3. Austin, Texas

http://security.transportation.org/sites/security/docs/guide-VA_Appendices.pdf
<table>
<thead>
<tr>
<th>Vulnerability Issues</th>
<th>Countermeasures</th>
<th>C/E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception</td>
<td>• Demonstrated defense</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Deter Discourage attacks by visibility of countermeasures</td>
<td></td>
</tr>
<tr>
<td>Ease of Access</td>
<td>• Adjacent land-use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Road approach</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Vessel approach</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Deny Increase standoff distance from bridge substructure and tunnel entrances</td>
<td></td>
</tr>
<tr>
<td>Clear zone</td>
<td>• Adjacent vegetation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Adjacent buildings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Dynamic Threat-adjustable operational measures (inspections)</td>
<td></td>
</tr>
<tr>
<td>Exposure</td>
<td>• Lighting level</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Visibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Detect Monitor access to bridge substructure and tunnel portals to minimize</td>
<td></td>
</tr>
<tr>
<td></td>
<td>time on targets</td>
<td></td>
</tr>
<tr>
<td>Time on target</td>
<td>• Detection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Response</td>
<td></td>
</tr>
<tr>
<td>Structure</td>
<td>• Scale</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Specific features</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Defend Harden key structural elements</td>
<td></td>
</tr>
</tbody>
</table>
Security Measure Prioritization Tools:
A Guide for Transportation Decision Makers

Table 1: Program of Commitments

**COMMIT** to a program that enables the public transportation system to:

- **PREVENT** incidents within its control and responsibility, effectively protect critical assets;
- **RESPOND** decisively to events that cannot be prevented, mitigate loss, and protect employees, passengers, and emergency responders;
- **SUPPORT** response to events that impact local communities, integrating equipment and capabilities seamlessly into the total effort; and
- **RECOVER** from major events, taking full advantage of available resources and programs.


“Blue Ribbon Panel on Bridge and Tunnel Security” report presented institutional, fiscal, and technical recommendations

http://www.fhwa.dot.gov/bridge/security/hrpcover.htm
Components in Risk Assessment for a Facility

Facility Risk Score (RS)

Importance Factor (IF)
- Importance Attributes
  - Historical/symbolic
  - Replacement value
  - Evacuation route
  - Regional economy
  - Transportation network
  - Annual revenue
  - Attached utilities
  - Military route
  - Exposed population
- Weighting factors for combining attributes
- Decisionmaker consensus

Occurrence Factor (OF)
- Occurrence Attributes
  - Access for attack
  - Security against attack
  - Visibility as a target
  - Publicity if attacked
  - Past threats/attacks
- Weighting factors for combining attributes
- Security information
- Decisionmaker consensus

Vulnerability Factor (VF)
- Vulnerability Attributes
  - Expected damage
  - Expected closure
  - Expected casualties
- Weighting factors for combining attributes
- Engineering Analysis
- Decisionmaker consensus
7. Stage II

Development of Organizational Capacity to Support Security and Emergency Management Activities
Figure 3. Overview of the transportation planning process in the context of safety (adapted from FHWA, Citizen’s Guide to Transportation Decisionmaking, FHWA EP-01-013, 2001).
Figure 3. Overview of the transportation planning process in the context of safety (adapted from FHWA, Citizen’s Guide to Transportation Decisionmaking, FHWA EP-01-013, 2001).
NCHRP Report 525, Vol. 5

1. Establishing a Sensitive Information Management Policy, 1
2. Identifying Sensitive Information, 3
3. Controlling Access to Sensitive Information, 5
4. Keys for Success, 10

Appendix A  Florida DOT’s Exempt Documents and Security System Plan Request Form, A-1
Appendix B  Texas DOT’s Confidential Safety Information Memorandum, B-1
Appendix C  Examples of State Legislation to Exempt Selected Sensitive Transportation-Related Information from State “FOIA” Laws, C-1
NCHRP Report 525, Vol. 6

Incident Management Process

- Establish formal ETO policy
- Identify objectives and desired performance
- Change laws as necessary

Other Agencies

- Prepare for all hazards
- Allocate resources
- Formulate program
- Manage performance
- Deploy technology and resources
- Develop procedures

State DOT Process

- Policy and Planning (Headquarters and Other Agencies)
- Programming and Budgeting (Headquarters and Other Agencies)
- Operational Planning (Districts)

Emergency Transportations Operations (ETO)

Preparation/Mitigation

Response

Real-Time Actions
## Table 1  Emergency Events Affecting Transportation Agencies

<table>
<thead>
<tr>
<th>Naturally Occurring</th>
<th>Human-Caused</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intentional</td>
</tr>
<tr>
<td>Droughts</td>
<td>Bomb Threats and Other Threats of Violence</td>
</tr>
<tr>
<td>Dust/Wind Storms</td>
<td>Disruption of Supply Sources</td>
</tr>
<tr>
<td>Earthquakes</td>
<td>Fire/Arson</td>
</tr>
<tr>
<td>Electrical Storms</td>
<td>Fraud/Embezzlement</td>
</tr>
<tr>
<td>Floods</td>
<td>Labor Disputes/Strikes</td>
</tr>
<tr>
<td>High Winds</td>
<td>Misuse of Resources</td>
</tr>
<tr>
<td>Hurricanes</td>
<td>Riot/Civil Disorder</td>
</tr>
<tr>
<td>Ice Storms</td>
<td>Sabotage: External and Internal Actors</td>
</tr>
<tr>
<td>Landslides</td>
<td>Security Breaches</td>
</tr>
<tr>
<td>Naturally Occurring Epidemics</td>
<td>Terrorist Assaults Using Chemical, Biological, Radiological, or Nuclear Agents</td>
</tr>
<tr>
<td>Snowstorms and Blizzards</td>
<td>Terrorist Assaults Using Explosives, Firearms, or Conventional Weapons</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Theft</td>
</tr>
<tr>
<td>Tropical Storms</td>
<td>Vandalism</td>
</tr>
<tr>
<td>Tsunamis</td>
<td>War</td>
</tr>
<tr>
<td>Typhoons</td>
<td>Workplace Violence</td>
</tr>
<tr>
<td>Wildfires</td>
<td></td>
</tr>
</tbody>
</table>
Guidelines for Transportation Emergency Training Exercises

- Guidelines, resource CD-ROM and templates for developing a Progressive Exercise Program, compliant with DHS and ODP requirements
- Exercise program must address NIMS requirements and Transit Emergency Response Plan and procedures.
- Moves users through the steps necessary to develop and implement a three-year program.
- Practical emphasis on affordable exercises, cost sharing, and grant opportunities.
Survey results: Transit agency events most likely to require COOP activation
Survey results: State DOT emergencies most likely to require COOP activation.
NCHRP Legal Research Digest 49


I. Introduction—When Is Emergency Contracting Applicable?

II. The Concept of Flexibility for Contracting in Emergency Situations and How It Can Be Misused

III. Basic Conditions for Waiving Contract Requirements in Emergency Situations

IV. Range of Contracting Options

V. Specific Authority to Waive Certain Contracting Requirements

VI. Federal Statutes Applicable to State Emergency Procurements (Title 23)

VII. Limitations Imposed by FEMA for Reimbursement to the States in an Emergency

VIII. Impact of Limitations Imposed by FEMA for Reimbursement to the States for Emergency Procurements

IX. General Guidance That Has Been Issued on Federal Emergency Contracting

X. Summary and Conclusion
8. Stage II

Specialized Guidance
TCRP Report 86, Vol. 5

2. Overview (PowerPoint presentation)

CD-ROM contains all 4 items

Response

All-hazards approach
- Natural disasters (e.g., hurricanes, tornadoes, floods, storms)
- Human accidents (e.g., hazardous materials spills, fires)
- Terrorism

Communication protocols must be applicable to all emergency events
Overview of NIMS/NRP requirements.

Updated discussion regarding new threats to transportation agencies:
  - Chronology of worldwide incidents.
  - Capabilities and intentions of specified terrorist groups.

Guidance for updating Transit Emergency Response Plans.

Recommendations for establishing a Transit Incident Management Organization.

Specialized research and recommendations for mobilizing transit personnel resources to address a range of emergencies, including no-notice evacuations and terrorist events.
  - Over all incident management phases: awareness, prevention, preparedness, response and recovery.
  - Checklist for response to events indicating WMD agent release

- Highways, rail, and waterway choke points
- Key variable: Impact on commercial shipments
- Prioritize on net national economic impacts
- Excludes replacement costs & collateral damage
<table>
<thead>
<tr>
<th>GSM Categories and Sub-Categories</th>
<th># of GSMs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fencing/Barriers</strong></td>
<td></td>
</tr>
<tr>
<td>Retractable vehicle barriers/gates</td>
<td>5</td>
</tr>
<tr>
<td>Fixed vehicle deterrent with pedestrian access</td>
<td>4</td>
</tr>
<tr>
<td>Fixed, both vehicle and pedestrian deterrent</td>
<td>5</td>
</tr>
<tr>
<td><strong>Access Control</strong></td>
<td></td>
</tr>
<tr>
<td>Credentials</td>
<td>13</td>
</tr>
<tr>
<td>Locks</td>
<td>3</td>
</tr>
<tr>
<td>System Control</td>
<td>3</td>
</tr>
<tr>
<td><strong>Intruder Sensors</strong></td>
<td></td>
</tr>
<tr>
<td>Perimeter (doors &amp; windows, walls &amp; fences, and buried)</td>
<td>13</td>
</tr>
<tr>
<td>Volume sensors – motion detectors</td>
<td>9</td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>3</td>
</tr>
<tr>
<td>CCTV/video</td>
<td>7</td>
</tr>
<tr>
<td><strong>Procedural/Low Cost</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td><strong>Waterside Security</strong></td>
<td></td>
</tr>
<tr>
<td>Surface</td>
<td>4</td>
</tr>
<tr>
<td>Underwater</td>
<td>5</td>
</tr>
<tr>
<td><strong>Screening</strong></td>
<td></td>
</tr>
<tr>
<td>Passengers and Cargo</td>
<td>7</td>
</tr>
<tr>
<td>Trace Detection</td>
<td>14</td>
</tr>
<tr>
<td><strong>Human Observation</strong></td>
<td></td>
</tr>
<tr>
<td>All Areas</td>
<td>3</td>
</tr>
<tr>
<td>Waterside</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 72. How countermeasures deter, detect, and respond to hazards and threats.

<table>
<thead>
<tr>
<th>Deterrence</th>
<th>Detection</th>
<th>Response</th>
</tr>
</thead>
</table>
| Operational Tactics  
  - Roving patrols  
  - Bomb-sniffing dogs  
  - Background checks of employees and contractors  
  - Background checks of facility vendors  
  - Access control  
  - Credentialing and identification card system  
  - Guards at entry points  
  - Intelligence  
  - Hazardous material restriction  
  - Inspections  
| Operational Tactics  
  - Intelligence  
  - Security awareness training of operating and maintenance personnel  
  - Roving patrols  
  - Guards at entry points  
  - Bombing-sniffing dogs  
  - Identification card system  
  - Inspections  
| Operational Tactics  
  - Command and control (multi-tenant)  
  - Evacuation protocol  
  - Information sharing  
  - Tunnel ventilation  
  - Portable fire extinguishers  
| Technology  
  - CCTV system  
  - Intrusion detectors  
  - System integration  
| Engineering  
  - Elimination of hidden corners, alcoves, and shelves  
  - Open, unimpeded lines of sight  
  - Lighting  
  - Locked facility doors  
| Technology  
  - Intrusion detectors  
  - Identification card readers  
  - Chemical/biological/radiological detectors  
  - Seismic/stress detectors  
  - Mobile monitoring  
  - Explosive detectors  
  - System integration  
| Engineering  
  - Fire protection  
  - Lighting  
  - Ventilation  

Safety & Security in Roadway Tunnels

Final Report

Requested by:
American Association of State Highway and Transportation Officials (AASHTO)
Standing Committee on Highways

Prepared by:
Kathleen Almand
Fire Protection Research Foundation
Quincy, Massachusetts

March 2008

The information contained in this report was prepared as part of NCHRP Project 20-7, Task 230,
National Cooperative Highway Research Program, Transportation Research Board.
### Table 38: Main Design Fire Variables

<table>
<thead>
<tr>
<th>Time Dependent Design Fire Variables</th>
<th>Values Range</th>
<th>Design fire variables are a function of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Size—Maximum FhRR</td>
<td>(1.5 MW–300 MW)</td>
<td>Type of vehicle (cars, buses, HGVs, tankers; alternative fuel)</td>
</tr>
<tr>
<td>Fire Growth Rate (slow, medium, fast, ultra fast)</td>
<td>0.002–0.178 kW/s² as high as 0.331 kW/s² measured at one test</td>
<td>Type of cargo including bulk transport of fuel</td>
</tr>
<tr>
<td>Fire Decay Rate</td>
<td>0.042–0.06 (min⁻¹)</td>
<td>Fire detection system and delay in activation of FLS systems</td>
</tr>
<tr>
<td>Perimeter of Fire</td>
<td>Car–truck perimeter</td>
<td>Ventilation profile</td>
</tr>
<tr>
<td>Maximum Gas Temperature at Ceiling</td>
<td>110°C–1350°C (212°F–2462°F) (higher with FCV)</td>
<td>Fire suppression system</td>
</tr>
<tr>
<td>Fire Duration</td>
<td>10 min–2 days</td>
<td>Tunnel geometry</td>
</tr>
<tr>
<td>Smoke and Toxic Species Production Rate</td>
<td>20–300 m²/sec</td>
<td>- tunnel width, height, cross section, length</td>
</tr>
<tr>
<td>Radiation</td>
<td>From 0.25 to 0.4 of total heat flux up to 5,125 W/m² (1,625 Btu/hr/ft²)</td>
<td>- volume (available oxygen)</td>
</tr>
<tr>
<td>Flame Length</td>
<td></td>
<td>- shape of tunnel, grade</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- location of exits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunnel drainage system</td>
</tr>
</tbody>
</table>
## NCHRP Report 645

**Blast-Resistant Highway Bridges: Design and Detailing Guidelines** (2010)

---

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Function/Effectiveness</th>
<th>Costs per year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deterence</td>
<td>Detect</td>
</tr>
<tr>
<td>Countermeasure 1</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>Countermeasure 2</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Countermeasure 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Countermeasure 4</td>
<td>L</td>
<td></td>
</tr>
</tbody>
</table>

*L = Low Effectiveness  
M = Medium Effectiveness  
H = High Effectiveness  

*Figure 17. Countermeasure summary sheet (Winget and Williamson, 2003)*

- Transportation response options to an extreme event with chemical, biological, or radiological agents
- Focuses on the effect and role of transportation
- Applicable to all civilian sites (not just transportation sites)

TERET (Tracking Emergency Response Effects on Transportation) – Spreadsheet Layout

Sheet 1: Introduction
Provides summary instructions

Sheet 2: Basic Services
Assess criticalities that may develop from ER changes in traffic patterns.

Sheet 3: Mass Care
Assess needs during shelter-in-place, temporary shelters, or quarantine shelter.
The Case for Searches on Public Transportation (2005)

1. Traditional Fourth Amendment Considerations
2. Specific Warrantless Search Categories
3. State Constitutional Issues
4. Structuring Search Policies

Photos source: Ernest R. Frazier Sr., Esq, Countermeasures Assessment & Security Experts, LLC
GAO Panel on Explosives Detection Technologies That Could Help Protect Passenger Rail, 11-12 August 2009
Includes measures for:

1. Mitigation of intrusion
2. Mitigation of privacy concerns
3. Mitigation of claims with respect to unreasonable detention, etc.
4. Mitigation of health risks

Table 7. Mitigation measures.

<table>
<thead>
<tr>
<th>Mitigation of intrusion</th>
<th>Mitigation of privacy concerns</th>
<th>Mitigation of claims with respect to unreasonable detention, etc.</th>
<th>Mitigation of health risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral assessments</td>
<td>Same as for invasion</td>
<td>Same as for invasion</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Radiation detection</td>
<td>Not a primary risk</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Trace detector</td>
<td>Not a primary risk</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Scrupulously maintain radiate components.</td>
</tr>
<tr>
<td>Integrated ticket system</td>
<td>Not a primary risk</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Scrupulously maintain radiate components.</td>
</tr>
<tr>
<td>Non-integrated</td>
<td>Not a primary risk</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Scrupulously maintain radiate components.</td>
</tr>
<tr>
<td>Exploitative</td>
<td>Not a primary risk</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Vehicular and physical</td>
<td>Protocols and inspection</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handheld trace</td>
<td>Directing officers not to</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>detector</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>not to read any</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>handheld devices</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>not to read any</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>handheld devices</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>not to read any</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>handheld devices</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>not to read any</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>handheld devices</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>not to read any</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>handheld devices</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>not to read any</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
<tr>
<td>Handset</td>
<td>handheld devices</td>
<td>Enforce positive results by financial cost for suspicion, not evidence of guilt, and proceed according to conducting secondary screening.</td>
<td>Not a primary risk</td>
</tr>
</tbody>
</table>
**Table 1. Total stand-by costs.**

1. **Cost of Space in a Separate Facility if Used for Quarantine**
   - Needed: 20 square feet per person x 200 people = 4,000 square feet
   - 7 additional rooms for: recreation/leisure (3), office area, food assembly and serving, medical, and storage. Each room 500 square feet x 7 = 3,500 square feet. **Total space: 7,500 square feet**
   - Approximately $2.00 per square foot/month x $7,500 = $15,000

2. **Privacy Partitions and Space Dividers**
   - Partitions needed for sleeping areas—approximately 320 partitioned individually divided spaces and 50 other divided spaces occupied by small families. 7 other divided spaces (for recreation/leisure (3), office assembly and serving, medical, and storage—approximately 22 (2) 1/2 rooms. **Total space depending if it is on location next to walls or at end of aisles 342 dividers x $200 each = $68,400**

3. **Storage**
   - Lockers—6 tiered metal lockers (size 1 cu ft.) with 3 for each row of lockers x 12 = $325 each = $3,900

4. **Cleaning supplies**
   - Commercial mopping combo @ $26.00 x 5 = $130*
   - Mops @ $11 each x 5 = $55*
   - Trash cans: 1 44-gallon cans per 20 people plus 1 for each of 7 spaces and 3 extra = 20 cans x $45 per can = $900**
   - Cleaning liquids, approximately 25 gallons x $7.00 per gallon = $175
   - Trash can liners @ $1.50 per liner x 20 cans x 14 days = $420

---

**APPENDIX A: CDC DISEASE QUARANTINE**

<table>
<thead>
<tr>
<th>Disease / Reference</th>
<th>Susceptible Probability</th>
<th>Symptoms in Early Stage (prodromal signs)</th>
<th>Symptoms in Full Eruption (characteristic signs)</th>
<th>Duration</th>
<th>Period of Occurrence and Incubation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chickenpox</td>
<td>70%</td>
<td>High fever, cough, rash, headache</td>
<td>Blistering rash with pain lasting several days</td>
<td>7 days</td>
<td>3 days-2 weeks (incubation of 25-30 days)</td>
</tr>
<tr>
<td>Measles</td>
<td>90%</td>
<td>High fever, cough, red rash</td>
<td>Blistering rash with pain lasting several days</td>
<td>7 days</td>
<td>3 days-2 weeks (incubation of 25-30 days)</td>
</tr>
<tr>
<td>Influenza</td>
<td>80%</td>
<td>High fever, cough, sore throat, nausea</td>
<td>Blistering rash with pain lasting several days</td>
<td>7 days</td>
<td>3 days-2 weeks (incubation of 25-30 days)</td>
</tr>
<tr>
<td>Typhoid Fever</td>
<td>80%</td>
<td>High fever, headache, nausea, vomiting</td>
<td>Blistering rash with pain lasting several days</td>
<td>7 days</td>
<td>3 days-2 weeks (incubation of 25-30 days)</td>
</tr>
</tbody>
</table>

---

**Notes:**
- All calculations are based on current data and may change with future updates.
- Costs are estimated and may vary based on location and resources.
- Additional costs may include staffing, maintenance, and other utilities.
ACRP Report 12


Special Considerations for CBRNE (Chemical, Biological, Radiological, Nuclear, or Explosives)

- Command and control
- Responder communications
- Emergency public information
- Firefighting and special operations
- Law enforcement and special operations
- Emergency Medical Services (EMS)
- Quarantine
- Fatality management
- Logistics
- Continuity of Operations
- Family and customer assistance
ACRP Report 22

Helping Airport and Air Carrier Employees Cope with Traumatic Events (2009)

Five Essential Intervention Principles

Source: Hobfoll, et. al. (2007).
9. Stage II

All Hazards, All Modes

Six Goals

Five Pillars
Transportation Sector Rationale for An All Hazards Approach to Natural Hazards and Security

Safety first: build on the successful experience of the systems approach, and extend the mission of existing safety personnel

Build on DOT expertise in response: urban areas work with law enforcement, fire, rescue, and towing and recovery on traffic incident management; statewide presence with emergency contracting, equipment (e.g., communications systems), personnel, and common response to weather emergencies; trained to observe and report

Build on transit expertise in security: in urban areas parallel size and location of high-value infrastructure; invested; bring expertise on policing and security; trained to observe and report

Make interdependence an asset: transportation depends on, and is depended on, by other critical infrastructures; roads and transit are publicly owned and managed, and house public involvement experts
Six Goals for Transportation Security

1. **Social**: Involve the public—make pre-operational surveillance riskier
2. **Budget & Policy**: Make risk-informed decisions the norm
3. **Technical**: focus on countermeasures & design (instead of vulnerabilities & threats) with dual benefits
4. **Operational**: quick, layered response with effective surge capability
5. **Psychological**:
   a. for the public, peace of mind/acceptance of risk: security ≈ satisfaction
   b. for the attack planner, transportation is a difficult target, prepare more or attack something easier
6. **Intelligence**: Support police/military/intelligence by having trained transportation employees report suspicious activities and by making the bad guys stretch out their planning time
Six Goals for Transportation Security

Desired Outcome

Mainstreaming an integrated, high level, all-hazard, National Incident Management System (NIMS)-responsive, multimodal risk management process into major transportation agency programs and activities
Six Goals for Transportation Security

Desired Outcome

Five Pillars

1. A systems approach to emergency management functions focusing on a holistic approach to risk reduction: A Guide to Planning Resources on Transportation and Hazards

2. **Understanding security fundamentals:** Security 101: A Physical Security Primer for Transportation Agencies (Security 101)

3. **Organizing to be a reliable partner in emergency management:** Guide for Emergency Transportation Operations (ETO)

4. **Risk-informed decision support to buy down risk:** Costing Asset Protection: An All Hazards Guide for Transportation Agencies (CAPTA)

The Hazards and Disaster Management System

Pre-Impact Interventions
Mitigation Practices
Emergency Preparedness Practices
Recovery Preparedness Practices

Post-Impact Responses
Emergency Activities (planned and improvised)
Recovery Activities (planned and improvised)

Hazard Vulnerability
Hazard Exposure
Physical Vulnerability
Social Vulnerability

Disaster Impacts
Physical
Social

Disaster Event Characteristics
Frequency
Magnitude of Impact
Predictability
Scope of Impact (spatial and social)
Controllability
Duration of Impact
Length of Forewarning

CHRONOLOGICAL TIME
Pre-Impact
Trans-Impact
Post-Impact

SOCIAL TIME

10. Stage III

Risk-Informed Decision Support
Continuous Development of Risk Management and Emergency Response Planning Guidance

2002: Guides to Vulnerability Assessment & Emergency Response Planning
2002-2003: workshops
2004-2005: publications that anticipated NIMS, NRP/NRF, and NIPP.
2012: publications adopted by AASHTO

Published 2009:
NCHRP Report 525, Vol. 14
Security 101: A Physical Security Primer for Transportation Agencies

Published 2010:
NCHRP Report 525, Vol. 16
A Guide to Emergency Response Planning at State Transportation Agencies
Application Context
• Top-down, program level – to support resource allocation
• Consequence-driven – based on user-selected thresholds ("possibilistic")
• Iterative – use to compare/refine assumptions

Model Attributes
• Objective – when possible use data rather than "best judgment"
• Transparent – avoid "weighting and rating"
• Consistent – uses simple, available data and criteria, standard data base, default values
• Replicable – identify basis of all judgments

User Features
• Convenient – uses available resources (people and software) and imbedded data model
• Scalable – support a range of user contexts, mode, hazards,
• Expandable – to accommodate new threats/hazards, asset types, and countermeasures
CAPTA Methodology Framework

User Inputs
- Asset Classes of Interest
- Threats/Hazards of Concern
- Consequence Thresholds
- Asset Attributes within Classes
- Countermeasure Selection

Risk Management Methodology
Six step methodology implemented using Microsoft Excel® spreadsheet to capture inputs and display intermediate outputs

Consolidated User Inputs

Candidate Countermeasure Configurations
- List of selected countermeasures that will reduce risks to asset classes of interest against threats/hazards of concern to avoid exceeding specified consequence threshold
- Description of selected countermeasures including rough order of magnitude costs and selected functional characteristics

Master Countermeasures Data Base
Description of generic countermeasures considered effective in mitigating risks by asset class, hazard or threat, and consequence.

Candidate Countermeasures

Countermeasure attributes

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

TRANSPORTATION RESEARCH BOARD
### Basic CAPTA

<table>
<thead>
<tr>
<th>Basic CAPTA</th>
<th>Steps in Methodology</th>
<th>Expanded CAPTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identify Relevant Risks and Asset Classes</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Verify High Consequence Threats and Hazards</td>
<td>1a</td>
</tr>
<tr>
<td>2</td>
<td>Establish Consequence Thresholds</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Describe Infrastructure Assets</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Identify Critical Assets Across Modes</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Review Countermeasure Unit Costs</td>
<td>5a</td>
</tr>
<tr>
<td></td>
<td>Identify and Describe Additional Countermeasures</td>
<td>5b</td>
</tr>
<tr>
<td></td>
<td>Set Countermeasure Filters based on User Preference</td>
<td>5c</td>
</tr>
<tr>
<td>5</td>
<td>Select Candidate Countermeasures</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Summary Report</td>
<td>6</td>
</tr>
</tbody>
</table>

**Feedback & Iteration**

---

### Basic CAPTool

1. **Analyze Asset**
2. **Clear All Countermeasure Quantities**
3. **Next**

#### Color Key

<table>
<thead>
<tr>
<th>Medium Effectiveness</th>
<th>High Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>X</td>
</tr>
</tbody>
</table>

#### Quantity of Named Asset

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>1</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>1</th>
<th>1</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Lightening

#### Barriers & Berms

#### Fences

#### CCTV

#### Intrusion Detection Devices

#### Physical Inspection of Asset

#### ID Cards

#### Biometrics

#### Background Checks

#### Metal Detectors

#### Restricted Parking

#### Random Inspections

#### Visible Badges

#### Limited Access Points

#### Visitor Control & Escort

#### Locks

#### Explosive Detection

#### Establish Clear Zones

#### Visible Signs

#### Seismic Retrofitting

#### Fire Detection & Suppression

#### Encasement, Wrapping, Jacketing

#### Patrols

#### WX/Seismic Information

#### Intelligence Networking

#### HAZMAT Mitigation

#### Security Awareness Training

#### Emergency Response Training

#### Emergency Evacuation Planning

#### Planned Redundancy (e.g., detours)

#### Public Information and Dissemination

### Expanded CAPTool

#### Description of this step & instructions

The following is a list of countermeasure opportunities for each critical asset. Orange indicates medium effectiveness and red indicates high effectiveness.

To analyze an asset more closely, click on the name of the asset in row 15, and then click "Analyze Asset." A new sheet will pop up that details the effectiveness of the countermeasure against every relevant threat and hazard. The sheet will also tell you how many units of countermeasure you have selected so far for the asset and the estimated cost.

To add units of countermeasure, enter the desired number of units into any cell. Alternatively, the "Analyze Asset" sheet also has a field for adding units of countermeasures.

When you are satisfied with your CM allocation, click "Continue."

### Step indicators

- **Step 1:** Description of this step & instructions
- **Step 2:** Reset Buttons
- **Step 3:** Next

### Color code key

- **High Effectiveness:** Red
- **Medium Effectiveness:** Orange

### User Options

- **Buttons:** Reset

### NCHRP Report 525, Vol. 15

**Costing Asset Protection: An All Hazards Guide for Transportation Agencies (CAPTA, 2009)**
11. Stage III

Comprehensive Emergency Response Planning
Continuous Development of Risk Management and Emergency Response Planning Guidance

2002: Guides to Vulnerability Assessment & Emergency Response Planning
2002-2003: workshops
2004-2005: publications that anticipated NIMS, NRP/NRF, and NIPP.
2012: publications adopted by AASHTO

Published 2009:
NCHRP Report 525, Vol. 14
Security 101: A Physical Security Primer for Transportation Agencies

Published 2010:
NCHRP Report 525, Vol. 16
A Guide to Emergency Response Planning at State Transportation Agencies
NCHRP Report 525, Volume 16

Guide
– Summary
– Overview for state transportation agencies (authorities, etc.)
– High-level requirements based on national policies and guidelines
– High-level self-assessment with pointers

Section 6: Resource Guide
– Organizational/staffing/position guidance
– Decision-making sequences
– Detailed self-assessment and resource lists
• Appendices (A-M)
  – Applicable parts of 2002 Report (A)
  – Details of material summarized in Sections 1-5 (B-G)
  – Links to model emergency operations plans (H)
  – Links to model policy/procedural memoranda/MOUs (I)
  – Links to model exercises/training plans (J)
  – Annotated bibliography (K)*
  – White Paper: Identification and Delineation of Incident Management and Large-Scale Emergency Response Functions (L)*
  – PowerPoint presentation (M)*

• *available at www.TRB.org/SecurityPubs
12. Stage III
A Focus on Fundamentals

Homeland Security and State Departments of Transportation: Maintaining Strategic Direction for Protecting America’s Transportation System

1. State DOTs—Guardians of Transportation Infrastructure and Mobility
2. Protection of Critical Transportation Assets
3. Emergency Management Support to First Responders
4. Critical Gaps and Needs
State DOTs - Guardians of Nation’s Transportation Network

- DOTs own & operate 1.8 million lane miles & 273,200 bridges
- 5 billion daily vehicle miles (DVMT) traveled on DOTs’ roads and bridges, or 65% of total DVMT
- $92 billion/yr needed just to preserve system without extra security

State DOTs’ Major Responsibilities

- Highways
- Transit
- Freight and passenger rail
- Ports and ferries
- General and commercial aviation facilities
- Bike/pedestrian
- Motor carrier/motor vehicle services
- State patrol

U.S. Terror Incidents 1999-2004

All hazards planning fundamentals

• **Prevention**: Capabilities necessary to avoid, prevent, or stop a threatened or actual act of terrorism.

• **Protection**: Capabilities necessary to secure against acts of terrorism and manmade or natural disasters.

• **Mitigation**: Capabilities necessary to reduce loss of life and property by lessening the impact of disasters.

• **Response**: Capabilities necessary to save lives, protect property and the environment, and meet basic human needs after an incident has occurred.

• **Recovery**: Capabilities necessary to assist communities affected by an incident to recover effectively.

Transportation agency resilience: fundamental capabilities

<table>
<thead>
<tr>
<th>Prevention</th>
<th>Protection</th>
<th>Mitigation</th>
<th>Response</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Information</td>
<td></td>
<td>Operational Coordination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Warning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intelligence &amp;</td>
<td>Access Control</td>
<td>Long-Term Vulnerability Reduction</td>
<td>Critical Transportation</td>
<td>Infrastructure Systems</td>
</tr>
<tr>
<td>Information Sharing</td>
<td></td>
<td>Risk &amp; Disaster Resilience Assessment</td>
<td>Operational Communications</td>
<td></td>
</tr>
<tr>
<td>Screening, Search,</td>
<td></td>
<td>Threat &amp; Hazard Identification</td>
<td>Situational Assessment</td>
<td></td>
</tr>
<tr>
<td>&amp; Detection</td>
<td>Supply Chain Integrity &amp; Security</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cybersecurity</td>
<td>Training and Exercises</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: AASHTO. Fundamentals of Effective All Hazards Security and Resilience for State DOTs, 2015
A Guide to Planning Resources on Transportation and Hazards (2009)

Chapter 1: Introduction to the Disaster Cycle
Chapter 2: Overview
Chapter 3: The Economy and Hazards
Chapter 4: People and Hazards
Chapter 5: Infrastructure: Lifelines During Disasters
Chapter 6: Land Use, Development, and Natural Systems
Chapter 7: From Theory to Practice: Case Studies
Chapter 8: Conclusion
Chapter 1: Risk Management and Risk Assessment
Chapter 2: Plans and Strategies
Chapter 3: Physical Security Measures
Chapter 4: Security Personnel and Training
Chapter 5: Infrastructure Protection
Chapter 6: Homeland Security
NCHRP Synthesis 392

Transportation's Role in Emergency Evacuation and Reentry (2009)

Chapter 1: Introduction
Chapter 2: Background
Chapter 3: Evacuation Planning and Phasing
Chapter 4: Direction and Control on Highways
Chapter 5: Evacuee Travel Characteristics and Assisted Evacuation
Chapter 6: Communication, Data Exchange, and Public Information
Chapter 7: Reentry
Chapter 8: Current State of Practice
Chapter 9: Conclusions and Future Needs

Figure 1: Evacuation frequency based on hazard type (1990-2003)
(Source: F. Walton, Sandia National Laboratory)
Chapter 1: Introduction
Chapter 2: Passenger Perception of Crime and Terrorism
Chapter 3: Security Measures
Chapter 4: Security Practices
Chapter 5: Conflict Mitigation Strategies
Chapter 6: Case Studies
Chapter 7: Conclusions

Figure 10 from Chapter 5: Physical Aggression Continuum
(Source: Crisis Prevention Institute’s 2007 Webinar on Workplace Violence Prevention)
FIGURE 4 The New York City Police Department posts signs on local streets indicating the presence of security cameras. This sign was across the street from a Manhattan subway station. Photo courtesy of Dorothy M. Schulz.
13. Stage IV
In Progress / What’s Next

Simulation, Communication, Evacuation, Risk & Recovery: Focus on Implementation
ACRP Project 4-04

Exercising Command-Level Decision Making For Critical Incidents at Airports (2011)

- Computer-based simulation
  - A means to exercise critical decision-making at the command level
  - Accessible through a web browser
- Broad collection of scenarios
- Standards compliant
  - National Incident Management System (NIMS)
  - 14 CFR Part 139.325, Airport Emergency Plan
- Based on the National Guard Bureau’s Emergency Management Staff Trainer (EMST), a proven architecture

![EMST Logo](EMST.png)
Objective: develop a scenario-based training system compliant with federal standards (e.g., the National Incident Management System and the Homeland Security Exercise Evaluation Program) and relevant transit industry standards and regulations. It is anticipated that the training system will be delivered through an automated, functional exercise simulation system capable of providing on-demand emergency response training and exercises.
TCRP Project A-36/ NCHRP Project 20-59(49)
Command-Level Decision Making For Transportation (2017)

- **Initiate the Incident Briefing Form (ICS Form 201)**
- **Relay information from damage report**
- **Schedule a Planning Meeting**

**Assess**

**Consequences**

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Created By</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotwash</td>
<td>TRB</td>
<td>For Official Use Only</td>
</tr>
<tr>
<td>ICS Form 202</td>
<td>TRB</td>
<td>For Official Use Only</td>
</tr>
<tr>
<td>ICS Form 203</td>
<td>TRB</td>
<td>For Official Use Only</td>
</tr>
<tr>
<td>ICS Form 204</td>
<td>TRB</td>
<td>For Official Use Only</td>
</tr>
<tr>
<td>ICS Form 205</td>
<td>TRB</td>
<td>For Official Use Only</td>
</tr>
<tr>
<td>ICS Form 206</td>
<td>TRB</td>
<td>For Official Use Only</td>
</tr>
<tr>
<td>ICS Form 206A</td>
<td>TRB</td>
<td>For Official Use Only</td>
</tr>
<tr>
<td>ICS Form 207</td>
<td>TRB</td>
<td>For Official Use Only</td>
</tr>
</tbody>
</table>
Objectives: (1) identify the legislation, regulations, and executive orders in which the term “first responder” is defined; (2) briefly summarize the legislation / regulation / order to understand their scope and purpose; (3) provide the definition existing in the source documents; and (4) highlight any commonalities or inconsistencies between the definitions.
Objective: develop (1) a primer and (2) a briefing for transportation system owners and operators explaining the nature of cyber events and their operational and safety impacts. These products contain a list of effective practices that can be used to protect transportation systems from cyber events and to mitigate damage should an attack or breach occur.
Study Charge:
Evaluate the potential role of transit systems serving the 38 largest urbanized areas (UAs) (> 1 million in population) to “accommodate the evacuation, egress, and ingress of people to or from critical locations in times of emergency.”

Source: SAFETEA-LU, Section 3046(a)(1)

Graphic: Factors affecting local emergency response capacity
Objective
to develop an all-hazards emergency evacuation guide for transportation and emergency management agencies that integrates the broad community of resources that are necessary to plan, train, exercise, and execute evacuations.

Tasks
1. Literature Review
2. Roles of Modes and Other Entities in Evacuation
3. Mode Integration
4. Matching Resources to Needs
5. “Workshop in a Box”
6. Case Studies
7. Operations Plan Templates
8. Report & Draft Outline
10. Final Report
Objective
to develop a toolkit of communications strategies, policies, and practices for transportation agencies and emergency management agencies that focuses on communicating with vulnerable populations prior to, during, and after all-hazards emergencies.

Graphic: Cover for TCRP Report 150, Communication with Vulnerable Populations: A Transportation and Emergency Management Toolkit
Objective
to develop a Handbook that provides guidance to paratransit service providers, including public transportation agencies and other public and private paratransit service providers, about how to prepare for all types of emergencies, including
(a) events with notification such as floods, hurricanes, blizzards, and pandemics, as well as
(b) events with no notification, including those that may cause regional disruptions such as earthquakes, power blackouts, fires, and acts of terrorism.
Review of DHS’s Approach to Risk Analysis (2010)

This Congressionally-mandated study by the National Academies reviewed how the Department of Homeland Security (DHS) is building its capabilities in risk analysis to inform decision-making. More specifically, the study addressed the following tasks:

a) Evaluate the quality of the current DHS approach to estimating risk and applying those estimates in its many management, planning, and resource-allocation (including grant-making) activities, through review of a committee-selected sample of models and methods;

b) Assess the capability of DHS risk analysis methods to appropriately represent and analyze risks from across the Department’s spectrum of activities and responsibilities, including both terrorist threats and natural disasters;

c) Assess the capability of DHS risk analysis methods to support DHS decision-making;

d) Review the feasibility of creating integrated risk analyses covering the entire DHS program areas, including both terrorist threats and natural disasters, and make recommendations for best practices, including outreach and communications;

e) Recommend how DHS can improve its risk analyses and how those analyses can be validated and provide improved decision support.

A PowerPoint presentation that describes the entire project is available.

Project: Project Information

Project Number: HM-12

E-Newsletter Type: Recently Released TRB Publications

TRB Publication Type: HMCRP Reports
Objective: Develop a compendium of best practices that can be used by local communities to plan for recovery from disastrous hazardous materials transportation incidents.

Recovery is defined as both short- and long-term efforts to re-build and revitalize affected communities.

Recovery planning must provide for a near-seamless transition from emergency response activities to recovery operations to de-briefing lessons learned, including, but not limited to, restoration of interrupted utility services, reestablishment of transportation routes, the provision of food and shelter to displaced persons, environmental restoration, business continuity, and economic rebuilding.
Objective: to identify options for achieving the objective of a single, universally recognized credential that establishes (a) identity; (b) eligibility to access secure areas; and (c) eligibility to obtain or hold transportation-related licenses, credentials and other government certifications required of persons who transport hazardous materials by all modes in the U.S.
NCHRP Report 732
Methodologies to Estimate the Economic Impacts of Disruptions to the Goods Movement System (2012)

Commodity Characteristics
- Low/high value
- Low/high time sensitivity
- Low/high volumes

Disruption Characteristics
- Short/long duration
- Small/large geographic scale
- Small/large number of transport alternatives available
- Significant supply chain disruptions within a given industry sector

Default Values for
- Transport costs
- Inventory costs
- Lost industry productivity
- Output

Economic Impact

Figure S-1. Basic concepts in a high-level economic impact methodology.
Objective: to develop a guide that provides pre-event recovery planning principles, processes, tools, and appended resource materials for use by planners and decisionmakers in pre-event planning to support transportation infrastructure recovery.

FIGURE 2-2

Note: Declared disasters in these 10 states represent 32 percent of all disasters.
The Strategic Highway Research Program (SHRP) created a capability maturity modeling (CMM) method for organizational assessment and development of state DOTs, which is being applied through the AASHTO Guide to System Operations & Management. The application of the guide is being facilitated through numerous SHRP Implementation “CMM Workshops”, and also coordinated with SHRP multi-state “Regional Operations Forums”. The CMM Workshops generate implementation action plans, which are being utilized by state DOTs to guide incremental development of organizational capacity to develop and deliver TSM&O programs.

The objectives of the project are to:

• Coordinate incorporation of the AASHTO Guide to System Operations Management CMM methodology into the application of the TSM&O Program Planning Framework in transportation agencies of several lead states.
• Coordinate peer comparison and evaluation of these lead state application experiences.
• Summarize lessons learned and opportunities for refinement of both the CMM methodology and the Program Planning Framework, as well as the agency-specific program planning processes utilized.
• Document guidance for continued integrated application of the CMM and Framework techniques.
The objective of this research is to produce three products to be considered for use by the AASHTO Special Committee on Transportation Security and Emergency Management (SCOTSEM): (1) the National Needs Assessment for Ensuring Transportation Infrastructure Security (2016-2022); (2) the All Hazards Security and Emergency Management Research Implementation Plan (2014-2016); and (3) Fundamentals of Effective All Hazards Security Management for State DOTs (Second Edition).
Security Research Plan Reviewed at August 2007 Summit
Led to 3-year Research Plan 2008-2010 Accepted by
AASHTO Standing Committee on Research (SCOR)

Chairman Henry Hungerbeeler and Members of the Security Task Force:

In 2002, the AASHTO Transportation Security Task Force adopted twelve highway and
bridge security research priorities. After adopting the highway and bridge projects, the
Task Force initiated the development of intermodal security research projects. On
behalf of the Task Force, the Research Working Group initiated this follow-on process
to the 2002 security research priorities.

Two steps were taken to prepare these priorities. First, the Task Force cooperated with
the TRB Committee on Critical Transportation Infrastructure Protection to sponsor a
one-day workshop on intermodal security research needs. The workshop was held on
January 12, 2003. The following day, the AASHTO Transportation Security Task Force
approved a one-day working session to refine the problem statements for Task Force
consideration. The candidate projects were those intermodal projects with a highway
and bridge component. For this reason, the proposed research projects are described as
“intermodal highway and bridge” priorities. The working session was held on
February 19, 2003, in Washington, DC. The research priorities were presented at the
April 17 meeting of the Task Force, where it was recommended that they should be
forwarded to the NCHRP 20-59 panel for funding consideration.

This report presents the eleven research problem statements as supported by the
AASHTO Transportation Security Task Force. We appreciate the opportunity to support
the research mission of the AASHTO.

Mary Lou Ralls, Texas
Tom Hicks, Maryland
David Albright, New Mexico
May 30, 2003

NCHRP Project 20–59(25)
Security Research Plan
“Gap Analysis”

FINAL REPORT

Requested by:
American Association of State Highway
and Transportation Officials (AASHTO)
Special Committee on Transportation Security

Prepared by:
Mineta Transportation Institute
San Jose, California

October 2007

The information contained in this report was prepared as part of NCHRP Project 20-59, Task 25,
National Cooperative Highway Research Program, Transportation Research Board.
Promoting innovation and progress in transportation
TRB.org