Transportation Research Board

Resilience: Key Products & Projects

September 2015
Presentation Outline

• Definition and context for resilience
• Introduction to TRB & hot topics
• Overview of TRB work in resilience
• Key products
• Catalog of completed work and work in progress
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
Resilience is the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.

Disaster Resilience: A National Imperative
NRC 2012
TRB

Who We Are and
What We Do
<table>
<thead>
<tr>
<th>Year</th>
<th>Academy</th>
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<tr>
<td>1863</td>
<td>National Academy of Sciences</td>
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<td>1964</td>
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<td>1970</td>
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Making the Nation Safer: The Role of Science and Technology in Countering Terrorism

NRC Policy Study released June 25, 2002

- 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

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.

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.

WEBINAR: A recorded webinar on Vol. 3 is available [here](#)
Figure 2.4. Agents and activities associated with a port-based supply chain disruption.
Improving the Resiliency of Transit Systems
Threatened by Natural Disasters

The objectives of this research are to develop (1) a handbook with an associated suite of digital presentation materials to address planning principles, guidelines (including metrics), strategies, tools, and techniques to enable public transit systems to become more resilient to natural disasters and climatic events; and (2) a draft recommended practice for public transit resilience to natural disasters and climatic events suitable as input to the APTA Standards Program. The handbook and its associated suite of digital presentation materials should be appropriately designed for use by public transit agency executive staff to plan, budget, and institutionalize effective practices to improve resilience, addressing (a) capital project planning and asset management (including financial planning and risk assessment for natural disasters and climatic events), (b) operations and maintenance, and (c) administration. They should provide sufficient detail to allow users to adapt them to their individual entities.
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
Disaster Resilience: A National Imperative (2012)

This report by the National Research Council defines "national resilience," describes the state of knowledge about resilience to hazards and disasters, and frames the main issues related to increasing resilience in the United States.
**Resilience at The National Academies (2015)**

Individual, community, and national resilience is the ability to prepare and plan for, absorb, respond, recover from, and more successfully adapt to adverse events. No person or place is immune from disasters or disaster-related losses. Enhanced resilience allows better anticipation of disasters and better planning to reduce disaster losses — rather than waiting for an event to occur and paying for it afterward.

The National Academies of Sciences, Engineering, and Medicine have a number of activities aimed at improving individual, community, and national resilience. This website is a portal to this work.

**News & Events**

Discussion: On June 23, NOAA Administrator Kathryn Sullivan, Samuel Adams, the former mayor of Portland, Oregon, and current director of the U.S. Climate Initiative at the World Resources Institute, and NAS President Ralph Cicerone sat down to discuss building resilience through science. Joseph Witte, climate communicator at NASA Goddard, moderated the conversation.

Report: Community-based flood insurance policy that in theory would cover an entire community -- may create new opportunities to reduce flood losses and enhance the likelihood of communities paying more attention to flood risk mitigation. A new Academies report issued on July 24 discusses the pros and cons of offering collective flood insurance policies to communities, and identifies challenges that must be addressed if it were to be implemented.

Game: The Koski Science Museum was awarded a gold medal in the museums category by the Serious Games Association for Extreme Event, a role-playing game developed in collaboration with the Academies' Resilient America project. The game allows participants to simulate and build community resilience in the face of disaster.

Summary: Opportunities for the Gulf Research Program: Community Resilience and Health summarizes a workshop held last September in New Orleans to examine opportunities to improve the health, well-being, and resilience of communities in the Gulf region.
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 Today
TRB Annual Meeting Events

• 750 workshops & sessions
• 5,000 technical papers and presentations
• 500 TRB committee meetings
• 150+ other meetings by affiliated groups
2016 TRB Annual Meeting: Paper Submissions Due August 1, 2015

TRB is accepting papers for consideration as part of the program for the 95th TRB Annual Meeting, January 10–14, 2016, in Washington, D.C., and for publication in the Transportation Research Record: Journal of the Transportation Research Board (TRR). The spotlight theme for the 2016 TRB Annual Meeting is Research Convergence.

SHRP 2 Safety Data Update

TRB’s second Strategic Highway Research Program (SHRP 2) has released its latest Safety Data Update. This update provides the latest information about implementation of the SHRP 2 safety database, which is the main product of the Safety focus area of the SHRP 2 Program. New past updates:

- SHRP 2 Safety Data Update 7, July 22, 2015

TRB Short to Recording: Basics of Asphalt Modeling, Part 2: Viscelastic Models in Design andUnified Asphalt Stiffness Measure

TRB recorded presentations in July 2015 that provided an overview of applying viscoelastic models to design and unified asphalt stiffness measure. This installment is the third in a series of webinars that focused on the following goals:

- Reviewing mechanistic models for application
- Communicating the advantages of models

TRB Webinar: Mechanisms and Mitigation Strategies for Reflective Cracking in Rehabilitated Pavements

TRB will conduct a webinar on August 24, 2015, from 2:00pm to 4:00pm ET that will present the main mechanisms responsible for reflective cracking. Through the webinar, we will also introduce an evaluation of different mitigation strategies based on past research and evaluation studies. Reflective cracking is a serious challenge associated with....

TRB Webinar: Using the New Research in Progress (RIP) Project Entry Interface

TRB will conduct a webinar on August 25, 2015, from 2:00pm to 3:00pm ET that will demonstrate how to use the new Research in Progress (RIP) interface to submit and update research projects. Participants need to register in advance of the webinar, and there is no fee for attending the webinar.

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The National Academies of
SCiences • Engineering • Medicine
TRB Research Databases
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
APTA/FTA Transit Security Workshops
January 2002 – May 2002
1. New York City
2. San Francisco, California
3. Atlanta, Georgia
4. Chicago, Illinois

APTA International Transit Security Workshop September 2002 –
Leads to Transit Security Exchange Plans
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 1: Program of Commitments

<table>
<thead>
<tr>
<th>COMMIT to a program that enables the public transportation system to:</th>
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<tbody>
<tr>
<td>⇒ PREVENT incidents within its control and responsibility, effectively protect critical assets;</td>
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<tr>
<td>⇒ RESPOND decisively to events that cannot be prevented, mitigate loss, and protect employees, passengers, and emergency responders;</td>
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<td>⇒ SUPPORT response to events that impact local communities, integrating equipment and capabilities seamlessly into the total effort; and</td>
</tr>
<tr>
<td>⇒ RECOVER from major events, taking full advantage of available resources and programs.</td>
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“Blue Ribbon Panel on Bridge and Tunnel Security” report presented institutional, fiscal, and technical recommendations

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

1. TRB Committee on Critical Transportation Infrastructure Protection shares research results from all sources & identifies research needs

2. AASHTO Special Committee on Transportation Security & Emergency Management (SCOTSEM) identifies and refers research needs

50+ 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
NCHRP Project 20-59(14B)

Fundamental Capabilities of Effective All-Hazards Infrastructure Protection, Resilience, and Emergency Management for State Departments of Transportation

(2015)
# Transportation Agency Resilience: Fundamental Capabilities

<table>
<thead>
<tr>
<th>Prevention</th>
<th>Protection</th>
<th>Mitigation</th>
<th>Response</th>
<th>Recovery</th>
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<td>Planning</td>
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<td>Public Information and Warning</td>
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<td>Operational Coordination</td>
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<td>Intelligence &amp; Information Sharing</td>
<td>Access Control</td>
<td>Long-Term Vulnerability Reduction</td>
<td>Critical Transportation Infrastructure Systems</td>
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<td>Screening, Search, &amp; Detection</td>
<td>Physical Protective Measures</td>
<td>Risk &amp; Disaster Resilience Assessment</td>
<td>Operational Communications</td>
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<td>Threat &amp; Hazard Identification</td>
<td>Situational Assessment</td>
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<td>Training and Exercises</td>
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## Transportation Agency Resilience: CRP Resources for Fundamental Capabilities

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<td><strong>Guide to Emergency Response Planning at State Transportation Agencies</strong></td>
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<td><strong>FloodCast</strong></td>
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<td>Operational Coordination:</td>
<td><strong>A Guide to Regional Transportation Planning for Disasters, Emergencies, and Extreme Events</strong></td>
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<td>**ICS Training for Field Level Transportation Supervisors and Staff</td>
<td><strong>Transportation Emergency Response Application</strong></td>
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<td>Guides on Transit Security</td>
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<td>Communication of Threats</td>
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<td>Customer Communications and Training</td>
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<td>Portable Explosive Detection Devices</td>
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<td>7</td>
<td>Security Awareness for Employees</td>
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<td>Continuity of Operations Planning</td>
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<td>Emergency Drills and Exercises</td>
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<td>Hazard and Security Plan Workshop</td>
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<td>Security Measures for Ferry Systems</td>
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<td>12</td>
<td>Tunnel Security Countermeasures</td>
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<td>Passenger Security Inspections</td>
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<td>NCHRP Report 525 Series</td>
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<td>1  Responding to Threats</td>
<td>9  Emergency Drills and Exercises</td>
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<td>2  Information Sharing and Analysis</td>
<td>10  Public Health Disasters</td>
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<td>3  Incorporating Security into Planning</td>
<td>11  Disruption Impact Estimation</td>
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<td>4  Terrorism-Related Risk Management</td>
<td>12  Tunnel Security Countermeasures</td>
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<td>5  Managing Sensitive Information</td>
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<td>6  Emergency Operations</td>
<td>14  Physical Security Primer</td>
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<td>7  Security Awareness for Employees</td>
<td>15  Costing Asset Protection</td>
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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

The National Academies of Sciences • Engineering • Medicine
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
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 should 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.
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

The National Academies of Sciences • Engineering • Medicine
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

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

Consolidated User Inputs

Potential Countermeasures

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
NCHRP Report 525, Vol. 15
Costing Asset Protection: An All Hazards Guide for Transportation Agencies (CAPTA, 2009)

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

### Road Bridges
- State Line Bridge: 1
- Veteran's Bridge: 1
- Downtown Tunnel: 1

### Road Tunnels
- Uptown Tunnel: 1
- Memorial Tunnel: 4

### Transit/Train Station
- South Station: 4
- North Station: 1
- South Station: 1
- Downtown Station: 1
- Park Street Station: 1
- Government Center Station: 1
- State Street Station: 1
- College Station: 1
- Suburban Station: 1
- Airport Station: 1
- All other aboveground: 1
- All other belowground: 20

### Quantity of Named Asset

<table>
<thead>
<tr>
<th>Road Bridges</th>
<th>Road Tunnels</th>
<th>Transit/Train Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Line Bridge</td>
<td>Veteran's Bridge</td>
<td>Downtown Tunnel</td>
</tr>
<tr>
<td>State Line Bridge</td>
<td>Veteran's Bridge</td>
<td>Downtown Tunnel</td>
</tr>
<tr>
<td>State Line Bridge</td>
<td>Veteran's Bridge</td>
<td>Downtown Tunnel</td>
</tr>
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<td>Downtown Tunnel</td>
</tr>
<tr>
<td>State Line Bridge</td>
<td>Veteran's Bridge</td>
<td>Downtown Tunnel</td>
</tr>
</tbody>
</table>

### Physical Security Countermeasures

- Light: 1
- Barriers: 1
- Fences: 1
- CCTV: 1
- Intrusion Detection Devices: 1
- Physical Inspection of asset: 1

### Access Control Countermeasures

- ID Cards: 1
- Biometrics: 1
- Background Checks: 1
- Metal Detectors: 1
- Random Access: 1
- Visitor Access: 1
- Limited Access: 1
- Visitor Access: 1

### Asset Design/Engineering

- Fire Detection & Suppression: 1
- Encasement, Wrapping, Jacketing: 1
- Patrolling: 1
- WX/Seismic Information: 1
- Intelligence Networking: 1
- HAZMAT Mitigation: 1
- Security Awareness Training: 1
- Emergency Response Training: 1
- Emergency Evacuation Planning: 1
- Planned Redundancy (e.g., detours): 1
- Public Information and Dissemination: 1

### Operational Countermeasures

- Visible Badges: 1
- Limited Access Points: 1
- Visitor Control & Escort: 1
- Locks: 1
- Explosive Detection: 1
- Establish Clear Zones: 1
- Visible Signs: 1
- Seismic Retrofitting: 1
- Fire Detection & Suppression: 1
- Encasement, Wrapping, Jacketing: 1
- Patrolling: 1
- WX/Seismic Information: 1
- Intelligence Networking: 1
- HAZMAT Mitigation: 1
- Security Awareness Training: 1
- Emergency Response Training: 1
- Emergency Evacuation Planning: 1
- Planned Redundancy (e.g., detours): 1
- Public Information and Dissemination: 1

### Countermeasure Quantities

<table>
<thead>
<tr>
<th>Road Bridges</th>
<th>Road Tunnels</th>
<th>Transit/Train Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Line Bridge</td>
<td>Veteran's Bridge</td>
<td>Downtown Tunnel</td>
</tr>
<tr>
<td>State Line Bridge</td>
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</tr>
<tr>
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<td>Veteran's Bridge</td>
<td>Downtown Tunnel</td>
</tr>
<tr>
<td>State Line Bridge</td>
<td>Veteran's Bridge</td>
<td>Downtown Tunnel</td>
</tr>
<tr>
<td>State Line Bridge</td>
<td>Veteran's Bridge</td>
<td>Downtown Tunnel</td>
</tr>
</tbody>
</table>

### Countermeasure Analysis

- High Effectiveness: 1
- Medium Effectiveness: 1

### Countermeasure Selection

- Access Control Countermeasures: 1
- Physical Security Countermeasures: 1
- Asset Design/Engineering: 1
- Operational Countermeasures: 1

### User Options

- 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

- Description of this step & instructions
- Step indicators

### Reset Buttons

- Reset

### Color Code Key

- Medium Effectiveness
- High Effectiveness

### NCHRP Report 525, Vol. 15

*Costing Asset Protection: An All Hazards Guide for Transportation Agencies (CAPTA, 2009)*
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) / ACRP Project 4-04
Command-Level Decision Making For Transportation (2017)
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

- 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
- Assesses criticalities that may develop from ER changes in traffic patterns

**Sheet 3:** Mass Care
- Assesses needs during shelter-in-place, temporary shelters, or quarantine shelter
NCHRP Report 525, Vol. 3
ACRP Report 5


Table 1. Total stand-by costs.

<table>
<thead>
<tr>
<th>1. Cost of Space in a Separate Facility if Used for Quarantine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needed: 20 square feet per person x 200 people = 4,000 square feet</td>
</tr>
<tr>
<td>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</td>
</tr>
<tr>
<td>Total space: 7,500 square feet</td>
</tr>
<tr>
<td>Approximately $2.00 per square foot/month x $7,500 = $15,000 per month</td>
</tr>
</tbody>
</table>

2. Privacy Partitions and Space Dividers

Partitions needed for sleeping areas—approximately 320 partitions (based on 10 individually divided spaces and 50 other divided spaces occupied by couples or small families). 7 other divided spaces for recreation/leisure (3), office area, food assembly and serving, medical, and storage—approximately 22 (2-3 dividers per space depending if it is on location next to walls or at end of aisles): 342 dividers x $2.00 each = $68,400

3. Storage

Lockers—6 tiered metal lockers (size 1 ca ft) with 3 for each row (18 individual lockers) x $125 each = $3,750

4. Cleaning Supplies

Commercial mopping combo @ $26.00 x 5 = $130
Mops @ $11 each x 30 = $330
Trash cans: 144-gallon cans per 20 people plus 1 for each of 7 "other use" spaces and 3 extra = 30 cans x $45 per can = $1,350
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 QUARANTINES

<table>
<thead>
<tr>
<th>Disease</th>
<th>Reference</th>
<th>Symptoms in Early Stage (operative range)</th>
<th>Symptoms in Full-Morbidity Stage (admission range)</th>
<th>Incubation Period (average) in % of cases will be treated within 21-28 days</th>
<th>Duration of Quarantine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria</td>
<td>1-4</td>
<td>Malaise, sore throat, loss of appetite, headache, fever, cough</td>
<td>Adenopathy, sore throat, fever, malaise, headache, myalgia, constipation, rash, cough, hoarseness</td>
<td>3-5 days (1-3 days)</td>
<td>7 days</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disease</th>
<th>Reference</th>
<th>Symptoms in Early Stage (operative range)</th>
<th>Symptoms in Full-Morbidity Stage (admission range)</th>
<th>Incubation Period (average) in % of cases will be treated within 21-28 days</th>
<th>Duration of Quarantine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuberculosis</td>
<td>5-10</td>
<td>Prolonged recurrent cough, severe cough, shortness of breath, fatigue, low-grade fever</td>
<td>Body aches, malaise, headache, cough, chills, fever, myalgia, nausea, vomiting, diarrhea</td>
<td>3-4 weeks (1-2 weeks)</td>
<td>6 months</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disease</th>
<th>Reference</th>
<th>Symptoms in Early Stage (operative range)</th>
<th>Symptoms in Full-Morbidity Stage (admission range)</th>
<th>Incubation Period (average) in % of cases will be treated within 21-28 days</th>
<th>Duration of Quarantine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chickenpox</td>
<td>11</td>
<td>Rash, fever, rash, headache, fatigue, malaise</td>
<td>Rash, fever, rash, headache, fatigue, malaise, myalgia, cough, sore throat</td>
<td>2-3 weeks (1-2 weeks)</td>
<td>10 days</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disease</th>
<th>Reference</th>
<th>Symptoms in Early Stage (operative range)</th>
<th>Symptoms in Full-Morbidity Stage (admission range)</th>
<th>Incubation Period (average) in % of cases will be treated within 21-28 days</th>
<th>Duration of Quarantine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallpox</td>
<td>12-15</td>
<td>High fever, rash, headache, malaise, fatigue, cough, sore throat, vomiting, delirium</td>
<td>Rash, fever, rash, headache, malaise, fatigue, cough, sore throat, vomiting, delirium, delirium</td>
<td>3-4 weeks (2-3 weeks)</td>
<td>10 days</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disease</th>
<th>Reference</th>
<th>Symptoms in Early Stage (operative range)</th>
<th>Symptoms in Full-Morbidity Stage (admission range)</th>
<th>Incubation Period (average) in % of cases will be treated within 21-28 days</th>
<th>Duration of Quarantine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow Fever</td>
<td>16-18</td>
<td>Fever, headache, muscle aches, nausea, vomiting, jaundice, rash, conjunctival suffusion</td>
<td>Severe jaundice, delirium, shock, respiratory distress, liver failure, renal failure</td>
<td>3-7 days (1-2 days)</td>
<td>14 days</td>
</tr>
</tbody>
</table>

The National Academies of
SCIENCE • ENGINEERING • MEDICINE
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.
Security-, Emergency Management-, and Infrastructure Protection-related Projects In Development (September 2015)

1. Integrating Climate Resiliency into Airport Management Systems
2. Update and Field Test of Airport Scenarios in the Transportation Emergency Response Application (TERA)
3. Airport Emergency Planning Template: NIMS - Incident Command System Compliance
4. Airport Emergency Operations Centers Design Guide
6. A Guidebook for Emergency Contracting Procedures for Administration of a Regional Emergency
7. Development of Guidelines for Performance Based Seismic Design
8. Development of Live Load Distribution and Impact Factors for the Analysis of Implements of Husbandry Vehicles on Bridges
9. Applying and Adapting Climate Change Models to Hydraulic Design Procedures
10. Leveraging Big Data to Improve Traffic Incident Management
12. Update of A Pre-Event Recovery Planning Guide for Transportation
13. Voice and Data Interoperability for Transportation
15. Update of A Guide to Emergency Response Planning at State Transportation Agencies
17. Communications Worker Credentialing Requirements
18. Guidelines to Incorporate the Costs and Benefits of Adaptation Measures in Preparation for Extreme Weather Events and Climate Change
19. Impacts of Connected/Automated Vehicles on State and Local Transportation Agencies
20. Best Practices for Increasing Access to the Results of Federally Funded Scientific Research
The Past Is Prologue
1. Prior to September 11, 2001
TRB Publications in 1997 & 2000 - Security and Terrorism

- Improving Transit Security (1997)
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:

- Web (pull) via email, pager, fax, phone...
- InfraGard (push)

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

**FIGURE 3: NOTIONAL SURFACE TRANSPORTATION THREAT INFORMATION FORUM**

**FIGURE 4: DISTRIBUTED IMPLEMENTATION MODEL**
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
CAI 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
Public Transportation System Technology Clearinghouse

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

The National Academies of
SCIENCE • ENGINEERING • MEDICINE
Anatomy of a Detection System

### 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>
TCRP Report 86, Vol. 3

1 INTRODUCTION
2 OVERVIEW
2 ENVIRONMENTS
   Structures, 2
   Vehicles, 4
   Vehicle Access/Egress, 4
   Vehicle Pathways, Overheads, and Transitions, 6
   Vehicle Special Obstacles, 7
   Roadways and Terrain, 9
   Weather Conditions, 10
   Optical Navigation Environments, 10
   Radio Environments, 10
   Hazardous Environments, 10
   Other Requirements, 11
   Requirements Specification, 12

13 AVAILABLE ROBOTIC SYSTEMS
   Introduction to Robotic Systems, 13
   Robot Vehicles, 13
   Operator Control, 16
   Available Systems, 18

20 SELECTION ANALYSIS
   Selection Rationale, 21
   Operator Demands, 21

22 GLOSSARY
23 BIBLIOGRAPHY
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 maintenance of hardware?
☐ Have the system operators/maintainers been provided information on input to the selection of this system?
☐ Are there adequate spare parts to support the 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#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: August 23, 2002

The National Academies of
SCiences • Engineering • Medicine
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
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
<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><strong>Deter</strong> Discourage attacks by visibility of countermeasures</td>
<td></td>
</tr>
<tr>
<td>Ease of Access</td>
<td>• Adjacent land-use • Road approach • Vessel approach</td>
<td><strong>Deny</strong>: Increase standoff distance from bridge substructure and tunnel entrances</td>
</tr>
<tr>
<td></td>
<td><strong>Dynamic</strong>: Threat-adjustable operational measures (inspections)</td>
<td></td>
</tr>
<tr>
<td>Clear zone</td>
<td>• Adjacent vegetation • Adjacent buildings</td>
<td></td>
</tr>
<tr>
<td>Exposure</td>
<td>• Lighting level • Visibility</td>
<td><strong>Detect</strong>: Monitor access to bridge substructure and tunnel portals to minimize time on targets</td>
</tr>
<tr>
<td>Time on target</td>
<td>• Detection • Response</td>
<td></td>
</tr>
<tr>
<td>Structure</td>
<td>• Scale • Specific features</td>
<td><strong>Defend</strong>: Harden key structural elements</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

Vulnerability Factor (VF)
- Vulnerability Attributes
  - Expected damage
  - Expected closure
  - Expected casualties

  Weighting factors for combining attributes

  Engineering Analysis
  
  Decisionmaker consensus

Decisionmaker consensus

The National Academies of
SCIENCES • ENGINEERING • MEDICINE
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).
Peer Exchange Series: State & Metropolitan Transportation Planning Issues

Disaster Response in Transportation Planning (2007)

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

State DOT Process:
- Policy and Planning (Headquarters and Other Agencies)
  - Programming and Budgeting (Headquarters and Other Agencies)
  - Operational Planning (Districts)

Preparation/Mitigation:
- Prepare for all hazards
- Manage performance

Response:
- Allocate resources
- Deploy technology and resources

Emergency Transportation Operations (ETO):
- Formulate program
- Develop procedures

Real-Time Actions:
- The National Academies of
  Sciences • Engineering • Medicine
# Guidelines for Transportation Emergency Training Exercises

## 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</td>
</tr>
<tr>
<td>Dust/Wind Storms</td>
<td>Threats of Violence</td>
</tr>
<tr>
<td>Earthquakes</td>
<td>Disruption of Supply</td>
</tr>
<tr>
<td>High Winds</td>
<td>Sources</td>
</tr>
<tr>
<td>Hurricanes</td>
<td>Fire/Arson</td>
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<tr>
<td>Ice Storms</td>
<td>Fraud/Embezzlement</td>
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<tr>
<td>Landslides</td>
<td>Labor Disputes/Strikes</td>
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<tr>
<td>Naturally Occurring Epidemics</td>
<td>Mise of Resources</td>
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<tr>
<td>Snowstorms and Blizzards</td>
<td>Riot/Civil Disorder</td>
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<td>Tomatoes</td>
<td>Sabotage: External and</td>
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<td>Tropical Storms</td>
<td>Internal Actors</td>
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<tr>
<td>Tsunamis</td>
<td>Security Breaches</td>
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<tr>
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<td>Terrorist Assaults Using</td>
</tr>
<tr>
<td>Wildfires</td>
<td>Chemical, Biological,</td>
</tr>
<tr>
<td></td>
<td>Radiological, or Nuclear</td>
</tr>
<tr>
<td></td>
<td>Agents</td>
</tr>
<tr>
<td></td>
<td>Terrorist Assaults Using</td>
</tr>
<tr>
<td></td>
<td>Explosives, Firearms, or</td>
</tr>
<tr>
<td></td>
<td>Conventional Weapons</td>
</tr>
<tr>
<td></td>
<td>Theft</td>
</tr>
<tr>
<td></td>
<td>Vandalism</td>
</tr>
<tr>
<td></td>
<td>War</td>
</tr>
<tr>
<td></td>
<td>Workplace Violence</td>
</tr>
<tr>
<td></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
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.

The National Academies of Sciences • Engineering • Medicine

- Highways, rail, and waterway choke points
- Key variable: Impact on commercial shipments
- Prioritize on net national economic impacts
- Excludes replacement costs & collateral damage
Table 1. Categorization of GSMs.

<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>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>

(General Security Measures)
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>
<tbody>
<tr>
<td>• Operational Tactics</td>
<td>• Operational Tactics</td>
<td>• Operational Tactics</td>
</tr>
<tr>
<td>– Roving patrols</td>
<td>– Intelligence</td>
<td>– Command and control</td>
</tr>
<tr>
<td>– Bomb-sniffing dogs</td>
<td>– Security awareness training of operating and maintenance personnel</td>
<td>(multi-tenant)</td>
</tr>
<tr>
<td>– Background checks of</td>
<td>– Roving patrols</td>
<td>– Evacuation protocol</td>
</tr>
<tr>
<td>employees and contractors</td>
<td>– Guards at entry points</td>
<td>– Information sharing</td>
</tr>
<tr>
<td>– Background checks of</td>
<td>– Bombing-sniffing dogs</td>
<td>– Tunnel ventilation</td>
</tr>
<tr>
<td>facility vendors</td>
<td>– Identification card system</td>
<td>– Portable fire extinguishers</td>
</tr>
<tr>
<td>– Access control</td>
<td>– Inspections</td>
<td></td>
</tr>
<tr>
<td>– Credentialing and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>identification card</td>
<td></td>
<td></td>
</tr>
<tr>
<td>system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Guards at entry points</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Intelligence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Hazardous material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>restriction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Inspections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– CCTV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Intrusion detectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– System integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Blast design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Elimination of hidden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>corners, alcoves, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>shelves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Open, unimpeded lines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of sight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Lighting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Locked facility doors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Intrusion detectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Identification card</td>
<td></td>
<td></td>
</tr>
<tr>
<td>readers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Chemical/biological/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>radiological detectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Seismic/stress detectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Mobile monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Explosive detectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– System integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Fire detection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.
# Design Fires in Road Tunnels

## 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°F–135°F (60°C–74°C) (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 m³/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>

*The National Academies of Sciences • Engineering • Medicine*
### Figure 17. Countermeasure summary sheet (Winget and Williamson, 2003)

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Function/Effectiveness</th>
<th>Costs per year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deterrence</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  

- 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.
NCHRP Report 525, Vol. 13
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

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></td>
<td>Same as for intrusion.</td>
<td>N/A</td>
</tr>
<tr>
<td>Radiation detection</td>
<td></td>
<td>Same as for intrusion.</td>
<td>N/A</td>
</tr>
<tr>
<td>Trace detector</td>
<td></td>
<td>Ruin positive audits.</td>
<td>Not a primary risk.</td>
</tr>
<tr>
<td>Integrated mobile</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>ticket machine</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>Non-integrated desktop</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>scanner</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>Expedited detection</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>Weiner images</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>Fielded trace component</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>Handheld magnetometers</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>Backscatter X-ray</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>Millimeter wave</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>Imaging scanner</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>Pulverizer</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
<tr>
<td>Baggage X-ray</td>
<td></td>
<td>Require positive audits.</td>
<td></td>
</tr>
</tbody>
</table>

The National Academies of SCIENCES • ENGINEERING • MEDICINE
## Table 1. Total stand-by costs.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cost of Space in a Separate Facility if Used for Quarantine</td>
<td>Needed: 20 square feet per person x 200 people = 4,000 square feet</td>
</tr>
<tr>
<td></td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>Approximately $2.00 per square foot/month x $7,500 = $15,000 per month</td>
</tr>
</tbody>
</table>

| 2. Privacy Partitions and Space Dividers                             | 342 dividers x $200 each = $68,400* |

| 3. Storage                                                          | 3 tiers metal lockers (size 1 cu ft.) with 3 for each row: 28 lockers x $325 each = $9,000 |

| 4. Cleaning supplies                                                | Commercial mopping combo @ $26.00 x 5 = $130* |
|                                                                      | Mops @ $11 each x 5 = $55* |
|                                                                      | Trash cans: 144-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>Symptoms in Early Stage (prodromal stage)</th>
<th>Symptoms in late stage (illness-induced stage)</th>
<th>Incubation Period (range)</th>
<th>Diagnosis of Confirmed Case</th>
<th>Isolation Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza A (H1N1)</td>
<td>Malaise, sore throat, cough, headache, myalgia, nausea, vomiting</td>
<td>Headache, sore throat, cough, myalgia, and vomiting</td>
<td>24 hours</td>
<td>Diagnosis confirmed by isolation of the virus in a cell culture</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Costs are approximate and subject to change based on location and facility requirements.
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
Five Essential Intervention Principles

- Safety
- Calming
- Self-Efficacy
- Connectedness
- Hope

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 $\approx$ 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

TRANSPORTATION RESEARCH BOARD

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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)

Disaster Impacts
Physical
Social

Hazard Vulnerability
Hazard Exposure
Physical Vulnerability
Social Vulnerability

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
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

Consolidated User Inputs

Potential Countermeasures

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

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
## 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>
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<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>
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.”
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
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>
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</thead>
<tbody>
<tr>
<td>Planning</td>
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<td>Public Information and Warning</td>
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<td>Operational Coordination</td>
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<td>Intelligence &amp; Information Sharing</td>
<td>Access Control</td>
<td>Long-Term Vulnerability Reduction</td>
<td>Critical Transportation</td>
<td>Infrastructure Systems</td>
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<td>Screening, Search, &amp; Detection</td>
<td>Physical Protective Measures</td>
<td>Risk &amp; Disaster Resilience Assessment</td>
<td>Operational Communications</td>
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<td>Risk Management</td>
<td>Resilience Assessment</td>
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<td>Supply Chain Integrity &amp; Security</td>
<td>Threat &amp; Hazard Identification</td>
<td>Situational Assessment</td>
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<td>Cybersecurity</td>
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<td>Training and Exercises</td>
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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
NCHRP Report 525, Vol. 14


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
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
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.
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 should 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.
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.

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)

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.
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.
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
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).
The objective of this research is to provide guidance that enables transportation decisionmakers to integrate analysis of the costs and benefits of adaptation measures in preparation for extreme weather events and climate change.
The objectives of this research are to develop (1) a handbook with an associated suite of digital presentation materials to address planning principles, guidelines (including metrics), strategies, tools, and techniques to enable public transit systems to become more resilient to natural disasters and climatic events; and (2) a draft recommended practice for public transit resilience to natural disasters and climatic events suitable as input to the APTA Standards Program. The handbook and its associated suite of digital presentation materials should be appropriately designed for use by public transit agency executive staff to plan, budget, and institutionalize effective practices to improve resilience, addressing (a) capital project planning and asset management (including financial planning and risk assessment for natural disasters and climatic events), (b) operations and maintenance, and (c) administration. They should provide sufficient detail to allow users to adapt them to their individual entities.
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