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

Special Committee on Transportation Security and Emergency Management Webinar

December 9, 2015
Webinar Presenters

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Today’s Agenda

Introduction
Fundamental Capabilities of State DOTs
Resilience Concepts
Webinar Summary
Q&A Session
FUNDAMENTAL CAPABILITIES OF EFFECTIVE ALL-HAZARDS INFRASTRUCTURE PROTECTION, RESILIENCE, AND EMERGENCY MANAGEMENT
Fundamental Capabilities of Effective All-Hazards Infrastructure Protection, Resilience, and Emergency Management for State Departments of Transportation

Replaces 2007 Fundamentals of Effective All Hazards Security Management for State DOTs

Material derived from
• effective practices used by DOTs,
• national policy guidance,
• open-source research literature and
• team’s hands-on knowledge and experience
DOT Evolving Mission
2007 - Today
Update: Rethinking Capabilities

- Shift from protection of assets to resilience of systems
- Expansion of critical infrastructure protection to include cyber security of transportation system networks
- Integration and mainstreaming of security and all-hazards mitigation into operations
## Competencies and Capabilities

### Summary

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FUNDAMENTALS OVERVIEW

Patricia Bye
Western Management & Consulting LLC
Goal of Fundamentals Update

**REVIEW fundamental responsibilities** of state DOTs for all hazards infrastructure protection, resilience and emergency management.

**IDENTIFY technical capabilities** required of a state DOT to meet its fundamental responsibilities.

**CAPTURE** what the community has learned about the **core principles and competencies** to support an all hazards security and emergency management capacity within a DOT.
DOT Core Responsibilities

- Prevent incidents within DOT control and responsibility.
- Protect transportation users, agency personnel, and critical infrastructure.
- All hazards vulnerability reduction through risk assessment and management.
- Support regional, state, and local emergency responders with resources including facilities, equipment, and personnel.
- Recover swiftly from incidents.
- Evaluate response(s) and continually improve plans, training, skills, and protocols.

“Our focus is simple. We will provide the road to safety, we will clear the road to recovery and we will maintain the road home.” Former DOT Executive Director
Core Competencies & Capabilities

• Core competencies – agency proficiencies and collective knowledge – are the institutional “know how” that allows an agency to successfully conduct its mission.

• Each competency has key capabilities – organizational skills or processes – that are developed or improved to accomplish what needs to be done.
MISSION AREAS

- Prevention
- Protection
- Mitigation
- Response
- Recovery

FIVE ELEMENTS OF AN ALL-HAZARDS CORE COMPETENCY
Prevention

Avoiding, preventing, or stopping a threatened incident or adverse event.

- Intelligence and Information sharing
- Establishing a security mindset or awareness in all employees
- All transportation employees contribute to security.
- Security and safety is a centrally led activity.
- Focus security awareness on supporting business needs and processes.
- Establishing a reporting structure in advance - who to tell and how to describe something suspicious.
Prevention Resources

NCHRP REPORT 793: INCORPORATING TRANSPORTATION SECURITY AWARENESS INTO ROUTINE STATE DOT OPERATIONS AND TRAINING (2014)

INFORMATION-SHARING GUIDEBOOK FOR TRANSPORTATION MANAGEMENT CENTERS, EMERGENCY OPERATIONS CENTERS, AND FUSION CENTERS (2010)

NCHRP REPORT 525, VOL. 14: SECURITY 101: A PHYSICAL SECURITY PRIMER FOR TRANSPORTATION AGENCIES (2010)

INFORMATION SHARING AND ANALYSIS CENTERS (ISACS)
SURFACE TRANSPORTATION ISAC: www.surfacetransportationisac.org/
PUBLIC TRANSPORTATION INFORMATION SHARING AND ANALYSIS CENTER: www.apta.com/resources/safetyandsecurity/pages/isac.aspx
OVER THE ROAD BUS INFORMATION SHARING AND ANALYSIS CENTER (OTRB ISAC)
MULTISTATE-ISAC (MS-ISAC): http://msisac.cisecurity.org/
SUPPLY CHAIN ISAC: secure.sc-investigate.net/sc-isac/isachome.aspx
Protection

Establishing and maintaining an all hazards infrastructure protection program designed to (1) safeguard personnel; (2) prevent unauthorized access; (3) safeguard infrastructure, facilities, equipment, installations, materiel, and data.

- Includes risk management and risk assessment, plans and strategies, and countermeasures and adaptations.

- Understand sensitivity of assets, infrastructure and services to different types of events.

- Understand Interdependency of critical infrastructure.

- Integrate asset protection with broader transportation planning efforts.
Protection Resources

NCHRP REPORT 525, VOL. 14: SECURITY 101: A PHYSICAL SECURITY PRIMER FOR TRANSPORTATION AGENCIES (2010)

NCHRP REPORT 645 BLAST RESISTANT HIGHWAY BRIDGES: DESIGN AND DETAILING GUIDELINES (2010)

RECOMMENDATIONS FOR BRIDGE AND TUNNEL SECURITY (2003)

NCHRP REPORT 525, VOL. 15: COSTING ASSET PROTECTION: AN ALL HAZARDS GUIDE FOR TRANSPORTATION AGENCIES (CAPTA) (2009)
http://www.trb.org/Main/Blurbs/160337.aspx

CAPTOOL USER GUIDE: USING CAPTOOL TO IMPLEMENT THE “COSTING ASSET PROTECTION: AN ALL-HAZARDS GUIDE FOR TRANSPORTATION (CAPTA) METHODOLOGY (2013)
Mitigation

Actions taken to prevent hazards from developing into disasters, or to reduce the effects or mitigate the consequences of disasters when they occur. Mitigation efforts can occur prior to a disaster as an element of preparedness or later as a part of recovery when rebuilding following a disaster.

- Conduct vulnerability assessments to identify known and future risks.
- Identify key dependencies and interdependencies, including potential cascading effects.
- Collaborate with regional partners and stakeholders.
- Consider applicable standards and best practices for mitigation and for incorporating resilience.
- Determine adaptations to mitigate the effects of extreme weather and other natural events.
Mitigation Resources

CASE STUDY IN BRIDGE AND TUNNEL RISK ASSESSMENT, APPENDIX C OF RECOMMENDATIONS FOR BRIDGE AND TUNNEL SECURITY (2003)

ASSESSING VULNERABILITY AND RISK OF CLIMATE CHANGE EFFECTS ON TRANSPORTATION INFRASTRUCTURE: PILOT OF THE CONCEPTUAL RISK ASSESSMENT MODEL (2014)
http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/vulnerability_assessment_pilots/conceptual_model62410.cfm

COMPREHENSIVE PREPAREDNESS GUIDE 201: THREAT AND HAZARD IDENTIFICATION AND RISK ASSESSMENT GUIDE, 2ND EDITION (2013)
http://www.fema.gov/media-library-data/8ca0a9e54dc8b037a55b402b2a269e94/cpg201_htirag_2nd_edition.pdf

A GUIDE TO HIGHWAY VULNERABILITY ASSESSMENT FOR CRITICAL ASSET IDENTIFICATION AND PROTECTION (2002)
HTTP://HIGHWAYTRANSPORT.TRANSPORTATION.ORG/DOMMENTS/NCHRP_B.PDF
Response

Providing transportation (including infrastructure access and accessible transportation services) for response priority objectives, including the evacuation of people and animals, and the delivery of vital response personnel, equipment, and services to the affected areas.

• Develop skilled DOT rapid response teams equipped to handle a broad range of emergencies or event.

• Establish protocols for communications and information updates during emergency events.

• Develop Memorandums of Understanding with other Local and State Agencies.

• Ensure agency formalizes its approach including plans, policies, and procedures for evacuations with/without notice.

• Document expenses consistent with reimbursement practices of the FEMA or others required.
Response Resources

NATIONAL RESPONSE FRAMEWORK (2013)
https://www.fema.gov/national-response-framework

INFORMATION SHEET ESF #1 TRANSPORTATION

NCHRP REPORT 525 SURFACE TRANSPORTATION SECURITY VOLUME 16: A GUIDE TO EMERGENCY RESPONSE PLANNING AT STATE TRANSPORTATION AGENCIES (2010)

ROLE OF TRANSPORTATION MANAGEMENT CENTERS IN EMERGENCY OPERATIONS GUIDEBOOK (2012)

INFORMATION-SHARING GUIDEBOOK FOR TRANSPORTATION MANAGEMENT CENTERS, EMERGENCY OPERATIONS CENTERS, AND FUSION CENTERS (2010)
Recovery

Efficiently restoring transportation related infrastructure systems and services in support of maintaining a viable and sustainable community. Recovery includes an additional responsibility to improve community resilience and protect DOT assets from future hazards.

- Develop a COOP to ensure rapid recovery from incidents/events.
- Establish trained skilled teams for rapid clean up, repair, and inspection of an incident area or event.
- Conduct damage assessments, debris removal, hazardous materials disposal, and repair to restore essential services.
- Develop approaches in advance, e.g. emergency contracting, infrastructure repair and/or replacement, decontamination.
- Identify lessons learned through After-Action Reviews.
- Incorporate recommendations into existing plans and procedures.
Recovery Resources

NCHRP REPORT 753 A PRE-EVENT RECOVERY PLANNING GUIDE FOR TRANSPORTATION (2013)
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_753.pdf

TCRP REPORT 86 VOLUME 8/NCHRP REPORT 525 SURFACE TRANSPORTATION SECURITY VOLUME 8: CONTINUITY OF OPERATIONS PLANNING (COOP) GUIDELINES FOR TRANSPORTATION AGENCIES (2005)

NATIONAL DISASTER RECOVERY FRAMEWORK (2011)
TODAY

• Planning
• Public Information
• Operational Coordination

PREPARING FOR THE FUTURE AND KEEPING CUSTOMER ENGAGED
Planning
Establishing a systematic process that engages the whole regional community in the development of executable strategic, operational, and/or community-based approaches to meet defined objectives that are implementable using available resources within the time constraints set forth by the agency.

- Integrate security into planning.
- Ensure consistency with national planning programs.
- Coordinate with regional partner plans and processes.
- Support and participation from top leadership is critical.

Regular review and update plans that include:

- Infrastructure Protection and Security Plans
- All Hazards Mitigation Plans
- Emergency Operations Plans
- COOP plans
- Recovery/Resiliency Plans
- Communication Plans
Planning Resources

CONSIDERING SECURITY AND EMERGENCY MANAGEMENT IN THE PLANNING OF TRANSPORTATION PROJECTS: A GUIDE FOR PLANNERS OF NEW TRANSPORTATION PROJECTS, FHWA (MAY 2012)

INTEGRATING SECURITY INTO THE PROJECT PLANNING AND DEVELOPMENT PROCESS (2012)
http://www.planning.dot.gov/documents/integrating_security_into_project_planning.pdf

NCHRP REPORT 525 SURFACE TRANSPORTATION SECURITY VOLUME 16: A GUIDE TO EMERGENCY RESPONSE PLANNING AT STATE TRANSPORTATION AGENCIES (2010)

TCRP REPORT 86 VOLUME 8/NCHRP REPORT 525 SURFACE TRANSPORTATION SECURITY VOLUME 8: CONTINUITY OF OPERATIONS PLANNING (COOP) GUIDELINES FOR TRANSPORTATION AGENCIES (2005)
Public Information
Delivering coordinated, prompt, and reliable, information about transportation related threat or hazards, DOT agency actions being taken, and available assistance from state and regional agencies to the impacted community, through the use of clear, consistent, accessible, and culturally and linguistically appropriate methods.

- Customers require timely and accurate travel information.
- Make sure that effective communications mechanisms and people are in place.
- Communicate “regularly and often”.
- Get ahead of curve by releasing relevant and related public data.
- Leverage all appropriate communication means such as social media, web-based and mobile technology.
- Provide 24/7 travel information and timely alerts/warnings.
- Coordinate public information and establish procedures to speak with “one voice”.
Public Information Resources

TRCP REPORT 150: COMMUNICATION WITH VULNERABLE POPULATIONS: A TRANSPORTATION AND EMERGENCY MANAGEMENT TOOLKIT (2011)

NCHRP REPORT 690: A GUIDEBOOK FOR SUCCESSFUL COMMUNICATION, COOPERATION, AND COORDINATION STRATEGIES BETWEEN TRANSPORTATION AGENCIES AND TRIBAL COMMUNITIES (2011)
http://www.trb.org/main/Blurbs/165472.aspx

TCRP SYNTHESIS 99: USES OF SOCIAL MEDIA IN PUBLIC TRANSPORTATION (2012)
Operational Coordination

Establishing and maintaining a unified and coordinated operational structure that can be used to assure the efficient integration of all critical stakeholders and support functions into the agency’s execution and performance of its mission related responsibilities.

- Establish internal transportation agency communications protocols.
- Integrate and synchronize actions of participating organizations and jurisdictions to ensure unity of effort.
- Enhance and maintain NIMS-compliant command, control, and coordination structures to stabilize the incident and transition to recovery.
- Establish clear lines and modes of communication among partner organizations and jurisdictions.
- Collaborate and coordinate with appropriate local, regional, and national partners including NGOs.
Operational Coordination Resources

NCHRP REPORT 777 A GUIDE TO REGIONAL TRANSPORTATION PLANNING FOR DISASTERS, EMERGENCIES AND EXTREME EVENTS (2014)

NATIONAL INCIDENT MANAGEMENT SYSTEM (NIMS) TRAINING
http://training.fema.gov/is/nims.aspx

TRAFFIC INCIDENT MANAGEMENT (TIM) TRAINING
http://www.fhwa.dot.gov/goshrp2/solutions/all/l12_l32/national_traffic_incident_management_responder_training_program

ROLE OF TRANSPORTATION MANAGEMENT CENTERS IN EMERGENCY OPERATIONS GUIDEBOOK (2012)
THE UNSEEN RISK

TOMORROW

• Cybersecurity

• Training & Exercises

Evolving Threats to Critical Infrastructure

- Extreme Weather
- Accidents or Technical Failures
- Pandemics
- Acts of Terrorism
- Cyber Threats
Cybersecurity

Establishing a program designed to (1) safeguard transportation control systems, enterprise data systems, communications systems; (2) prevent unauthorized access (3) safeguard equipment, installations, materiel, and data and (4) minimize the consequences of an intentional or unintentional cyber incident.

- Cyber incidents - intentional and unintentional - will occur due to increasing convergence and dependence on digital components and systems.
- Parallels to physical security but significant differences.
- Integrate cybersecurity decision making into business process and investments.
- Evaluate and manage agency’s specific cyber risks.
- Implement industry standards and best practices.
- Facilitate discussion and interaction between IT, engineering and operational groups.
Cybersecurity Resources

NCHRP 20-59 (48) EFFECTIVE PRACTICES FOR THE PROTECTION OF TRANSPORTATION INFRASTRUCTURE FROM CYBER INCIDENTS

NATIONAL INSTITUTE FOR STANDARDS AND TECHNOLOGY SPECIAL PUBLICATION 80-82, GUIDE TO INDUSTRIAL CONTROL SYSTEMS (ICS) SECURITY, SECOND EDITION (FEBRUARY 2015)

APTA STANDARDS DEVELOPMENT PROGRAM RECOMMENDED PRACTICE: SECURING CONTROL AND COMMUNICATIONS SYSTEMS IN TRANSIT ENVIRONMENTS


Part IIIa and IIIb in development

NIST CYBERSECURITY FRAMEWORK
http://www.nist.gov/cyberframework/
Training and Exercises

All DOT employees require training in order to maximize their ability to perform important functions related to all-hazards planning and implementation. Employees must be able to understand and improve plans put in place, as well as to coordinate their activities with other non-agency personnel and first responders.

- Ensure DOT employees receive training to prepare for roles and are able to practice to increase the effectiveness of training.
- Incorporate security awareness into existing training including position-specific training where relevant.
- Exercises can test and validate the effectiveness of plans and processes.

- Keep training, drills, and contact lists up to date.
- Identify lessons learned through After-Action Review and incorporate recommendations into existing plans and procedures.
Training Resources

NCHRP REPORT 525, VOL. 9/ TCRP REPORT 86, VOL. 9 GUIDELINES FOR TRANSPORTATION EMERGENCY TRAINING EXERCISES (2006)

FEMA EMERGENCY MANAGEMENT INSTITUTE (EMI)
http://training.fema.gov/emi.aspx
What is Resilience

“Ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. It includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.”

“Ability to prepare and plan for, absorb, recover from and more successfully adapt to adverse events”
Disaster Resilience: A National Imperative, National Research Council 2012

“Resilient infrastructure assets, systems, and networks must also be robust, agile, and adaptable. Mitigation, response, and recovery activities contribute to strengthening critical infrastructure resilience.”
2013 National Infrastructure Protection Plan: Partnering for Critical Infrastructure Security and Resilience
Transportation Resilience Examples

• Redesign to reduce or eliminate vulnerability.
• Improve ability to improvise during an event.
• Add redundancies to improve availability.
• Have temporary options or backups available to quickly replace damages/disrupted assets or functions.
• Investigate opportunities to substitute routes or modes for another.
RESILIENCE OVERVIEW

Jeff Western
Western Management & Consulting LLC
Introduction to Resilience of Critical Infrastructure

Prepared for
AASHTO - Fundamental Capabilities of Effective All-Hazards Infrastructure Protection, Resilience, and Emergency Management for State DOTs
December 9, 2015

Presented by
Jeffrey L. Western
Argonne National Laboratory
Risk and Infrastructure Science Center (RISC)

Originally Prepared for Security Analysis and Risk Management Association Presentation
Agenda

• Resilience
  – What is Resilience
  – Components of Resilience
  – Levels of Resilience
  – Resilience Example

• Risk Analysis – Resilience
  – Resilience Index
  – Resilience Index Example
    – Owner/Operator Application
    – Combination of Risk Indices
What is Resilience?

Several Domains, Several Definitions

**In Physics**
“The work done in deforming a body to some predetermined limit, such as its elastic limit or breaking point, divided by the body's volume.”

**In Ecology**
“A measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations and state variables.”

**In Computer Science**
“The ability of a data processing system to continue to operate correctly even though one or more of its component parts is malfunctioning.”

**In Psychology**
“Dynamic process that individuals exhibit positive behavioral adaptation when they encounter significant adversity, trauma, tragedy, threats, or even significant sources of stress.”
What Are the Attributes of Resilience?

re·sil·i·ent

–adjective

1. springing back; rebounding.
2. returning to the original form or position after being bent, compressed, or stretched.
3. recovering readily from illness, depression, adversity, or the like; buoyant.
Types of Resilience

- Personal resilience
- Organizational resilience
- Community resilience
- Infrastructure resilience
- State resilience
- National resilience
- Global resilience
Infrastructure Resilience Examples

Sundberg’s House after Katrina

Kobe Earthquake
Infrastructure Resilience – National Infrastructure Advisory Council (NIAC)

Resilience: Ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event

Three key features:

- **Robustness**: Ability to maintain critical operations and functions in the face of a crisis
- **Resourcefulness**: Ability to prepare for, respond to, and manage a crisis or disruption as it unfolds
- **Recovery**: Ability to return to and/or reconstitute normal operations as quickly and efficiently as possible

Resilience – Components

1. Anticipate
2. Adapt
3. Absorb
4. Recover

Threat → Event → Consequences
Resilience – Components (Electric Power Example)

**Anticipate**

**Absorb**

**EVENT**

**Adapt**

**Recover**

**CONSEQUENCES**
## Resilience – Components

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<th>Response / Recovery</th>
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<td>Recover</td>
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<td><strong>Robustness</strong></td>
<td><strong>Resourcefulness</strong></td>
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<td><strong>Pre-event</strong></td>
<td><strong>Post-Event</strong></td>
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<td>Capability to protect or operate in the face of an event</td>
<td>Capability to prepare for the event</td>
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<td>Capability to respond to an event</td>
<td>Capability to restore after an event</td>
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**Resourcefulness**
Resilience and Risk Management

Resourcefulness

Robustness
Pre-Event
Post-Event
Recovery

Mitigation
Response
Recovery
Resilience and Risk Analysis – Bow-Tie Representation

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<td>Governance Impacts</td>
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<td>Mass evacuations</td>
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The diagram illustrates the relationship between preparation/mitigation and response/recovery in terms of resilience. It categorizes threats (manmade and natural) leading to protective measures, which in turn affect various consequences.
Bow-Tie Representation – Storage Tank Example
Bow-Tie Representation – Storage Tank Example (cont.)
Bow-Tie Representation – Storage Tank Example (cont.)
Bow-Tie Representation – Storage Tank Example (cont.)
Bow-Tie Representation – Storage Tank Example (cont.)
Bow-Tie Representation – Storage Tank Example (cont.)
Bow-Tie Representation – Storage Tank Example (cont.)
Bow-Tie Representation – Storage Tank Example (cont.)

Before explosion

After explosion (9/21/2001)

Now
## Bow-Tie Representation – Summary

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**Protective measures**

**EVENT**
Road to Resilience

Security Awareness

Critical Infrastructure & Key Asset Protection

Readiness, Response & Recovery Capability

Infrastructure Protection

Resilience

Emergency Management

2007

2014
“Paper” to Practice

AASHTO Special Committee on Transportation & Emergency Management (SCOTSEM)

scotsem.transportation.org

National Operations Center of Excellence

transportationops.org

TRB Committee on Critical Infrastructure Protection (ABR10)

https://sites.google.com/site/trbcommitteeabe40/
Thank You

For additional information please contact:

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jeffwestern@consultingtwestern.com

The Fundamentals report can be downloaded from:
Questions