NCHRP 20-59(54) 2020-2025
Resilience Research Road Map

Committee on Transportation Systems
Security and Resilience

Steering Committee Meeting
May 23, 2018

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Dave Ekern, DS Ekern Consulting
Resilience Research Roadmap: A Strategic Initiative

• Strategy 1c: Sponsor and track research related to risk assessment, resiliency and security planning and emergency management.
  – Develop priority research needs related risk assessment, resiliency, security and/or emergency management
  – Identify and develop priority research needs to address the challenges to and opportunities for integrating risk assessment, resiliency and security planning, and emergency management
  – ...

STRATEGIC PLAN FOR THE COMMITTEE ON TRANSPORTATION SYSTEM SECURITY AND RESILIENCY (May 2018)
Resilience has many faces,
... many dimensions,

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

Statewide Vulnerability Assessments

Defend

Planned retreat

Adapt

Forced retreat

Sea Level Rise Adaptation Options

Source: Caltrans
One-size won’t fit all

- Major differences in
  - Population
  - Economic activity
  - Infrastructure investment
  - Resources
Resilience Management

✓ Improve the ability to preserve or recover system value
  ✓ Defend
  ✓ Adapt
  ✓ Move

✓ Lower risk assessments

Source: https://www.researchgate.net/publication/266794121_Sea-level_rise_and_its_impact_on_wetlands_water_agriculture_fisheries_aquaculture_public_health_displacement_infrastructure_and_adaptation
Resilience Loss-Recovery

Social and economic gain achieved through resilience improvements

Acute Disturbance

Social and economic loss for all communities following an acute disturbance

Additional losses for less resilient communities

“Business as Usual” Community Function (includes impacts of chronic conditions)

Model: Dr. Mary Ellen Hynes, DHS (2001); Blair Ross, ORNL; CARRI 2008 ©
Research Roadmap

• Action plan containing road map containing prioritized research needs, potential programs and strategic initiatives encompassing the funding period 2020-2025.

• Developed cooperatively and collaboratively with government, industry and academia.

• 2 versions – pre and post-Summit
Initial Roadmap Activities

• Discover and collate existing plans, initiatives and strategies encompassing the period of interest

• Identify a representative sample of
  • agency research engineers and resilience-focused program managers,
  • researchers (academic and corporate) and
  • research sponsors (e.g., representatives from the AASHTO SCOR, AASHTO SCOTSEM, the TOPS Committee, USDOT and DHS offices)
2018 Roadmap Approach

• 2018 TRB Annual Meeting Workshop (Jan 2018)
  • The Workshop objectives were to draft a framework, propose potential research strategies and identify specific research needs for possible inclusion in the 2020-2025 Resilience Research Roadmap (RRR).
  • The RRR is intended to be a community-based consensus document

• On-line research forms submission (Jan-May 2018)
Research Needs Compilation

- NCHRP Projects
  - 54, 55, 117
  - Needs Compilation

- Foresight Series

- Committees
  - CTSSR
  - SCOTSEM
  - ABR10

- Workshops
  - 2017 Cyber Workshop
  - 2018 Resilience Workshop
  - 2018 RISE

- Resilience Round Table

- Research Synthesis 48-13

- Resilience Research Roadmap

- Background
- Objectives
- Est. Duration
- Est. Budget
- Topics

- Priority
- Status
- Timeframe
- Subject Areas
- Funding Source
# Research Roadmap Framework

<table>
<thead>
<tr>
<th>FUNCTIONS</th>
<th>ASSETS</th>
<th>NETWORKS</th>
<th>SYSTEMS</th>
<th>PEOPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The assignments, tasks, and positions in a state DOT that are critical to the performance of continued transportation activities</td>
<td>The infrastructure, equipment, resources, tools, vehicles, hardware, and facilities owned and operated by a state DOT</td>
<td>The relationships maintained by a state DOT with the private sector and other branches of government that ensure continuity of transportation activities</td>
<td>The critical technology and applications, including data, used to operate the DOT and the infrastructure and enable reliable network communication</td>
<td>The necessary personnel needed by a state DOT to ensure resilient transportation activities</td>
</tr>
<tr>
<td>CLIMATE, COMMUNITY AND SOCIETAL CHANGE</td>
<td>DESIGN ENGINEERING</td>
<td></td>
<td></td>
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</tbody>
</table>
Transportation System Resilience Research Roadmap  
Research Needs Submission

The research team invites interested parties to submit resilience research needs or problem statements in the following topical areas for inclusion in the road mapping process. Submissions may include resilience research programs, projects, plans, and other resilience initiatives encompassing the period 2020-2025.

<table>
<thead>
<tr>
<th>Working Title</th>
<th>Quantifying Surface Transportation Resilience, Risk and Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief Description</td>
<td>State DOTs increasingly are required to include discussions of resilience, risk and performance into all aspects of their business including long-range planning, improvement programs delivery and systems operations. Current state-or the practice is to use various qualitative approaches for these estimates. Unfortunately, many of these methods have difficulty estimating these parameters in a way that is understood by policy makers and practitioners. Modern practices in the risk transfer industry suggest the role for more analytic approaches.</td>
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</table>
| Scope/Objectives/Deliverables | 1. Literature review of economic, financial and risk assessment approaches  
2. Discussion of policy implications, information needs, modeling tools and governance models  
3. Implementation Guidance  
4. Effective practices case studies |
| Topical Area(s) | X_Economics of resilience  
X_Climate change/sea level rise/extreme weather risks  
X_Other human-caused or natural risks |
| Possible Sponsor (FHWA, TSA, AASHTO, APTA, TRB, Private Sector, etc.) | FHWA, FTA AASHTO and APTA |
| Estimated Cost and Duration | $250,000, 15 months |
| Submitter Name | S. Sample |
| Email/phone | Sample@someDOT.gov |

For more information
Visit the NCHRP Project 20-59(54) webpage for additional information  

Contacts
"Well, in our country," said Alice, still panting a little, "you'd generally get to somewhere else—if you run very fast for a long time, as we've been doing."

"A slow sort of country!" said the Queen. "Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!"

*Lewis Carroll, Through the Looking Glass and What Alice Found There*