

TCRP A-41: Improving the Resilience of Transit Systems Threatened by Natural Disasters

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Key Presentation Take-Aways

- Most agencies already practicing some aspects of resilience
- Many paths to resilience
- Resilience most effective when cross-cutting
- Resilience requires attention, forward thinking, may or may not require new \$

Project Team

Study Team

- » Deborah Matherly (PI)
Louis Berger staff: Jane Mobley
- » Jon Carnegie (Co-PI)
Rutgers staff: Ryan Whytlaw
- » Support:
 - Brian Wolshon, John Renne (TOD)
 - Tom Callahan (UII)
 - Jim Shaw (APA)
 - Bill Ankner
 - Eric Peterson
 - Marie Venner

Oversight

- » Panel Chair:
Dr. Cris Liban (LA Metro)
- » TCRP Senior Program Officer:
Stephan Parker



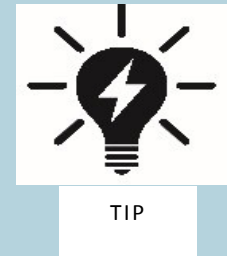
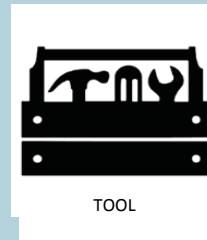
Project Outcomes

- » Guidebook
- » Final Research Report
- » Case Studies- 17 Transit Agencies' Efforts Toward Resilience
- » Transit Resilience Website- Database of Downloadable Information at resilienttransit.org



Project Outcomes

- » Aimed especially at middle managers
- » Actionable, step-wise approach
- » Designed to help transit agencies meet challenges created by climate change and impacts of extreme weather



Project's Objectives for Agencies

- » Consider definitions and domains of resilience adoption
- » Explore paths and steps to resilience
- » Understand regional and multi-sector context of interdependencies
- » Learn about tools and resources
- » APTA standards update process can integrate resilience into existing practices over time



Defining Resilience

...the ability to prepare and plan for, absorb, respond, recover from, and more successfully adapt to adverse events.

~ *The National Academies*



What definition is right for you?

“The ability to provide core functions in the face of threats, and recover quickly from major shocks or changing conditions”

~ LACMTA

Being able to “...bounce back from shocks during natural disasters or weather-related events.”

~ Kansas City Transit Authority

“Being better prepared to withstand and recover from an extreme weather event or threat.”

~ NJ TRANSIT

One definition need not fit all. It is up to you to figure out what resilience means for your agency.

Operations and Infrastructure, Restoration and Reinvention

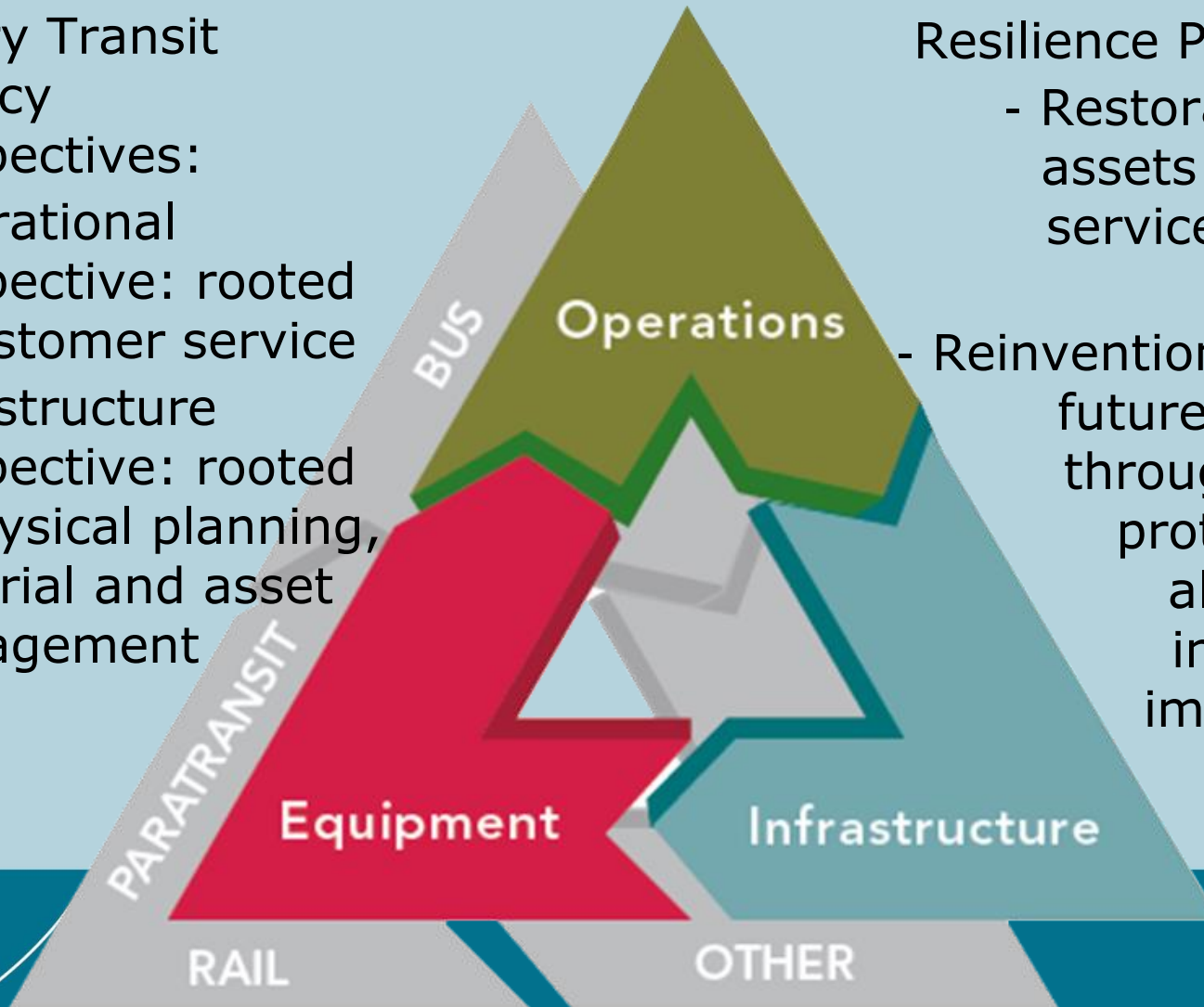
Primary Transit Agency

Perspectives:

- Operational Perspective: rooted in customer service
- Infrastructure Perspective: rooted in physical planning, material and asset management

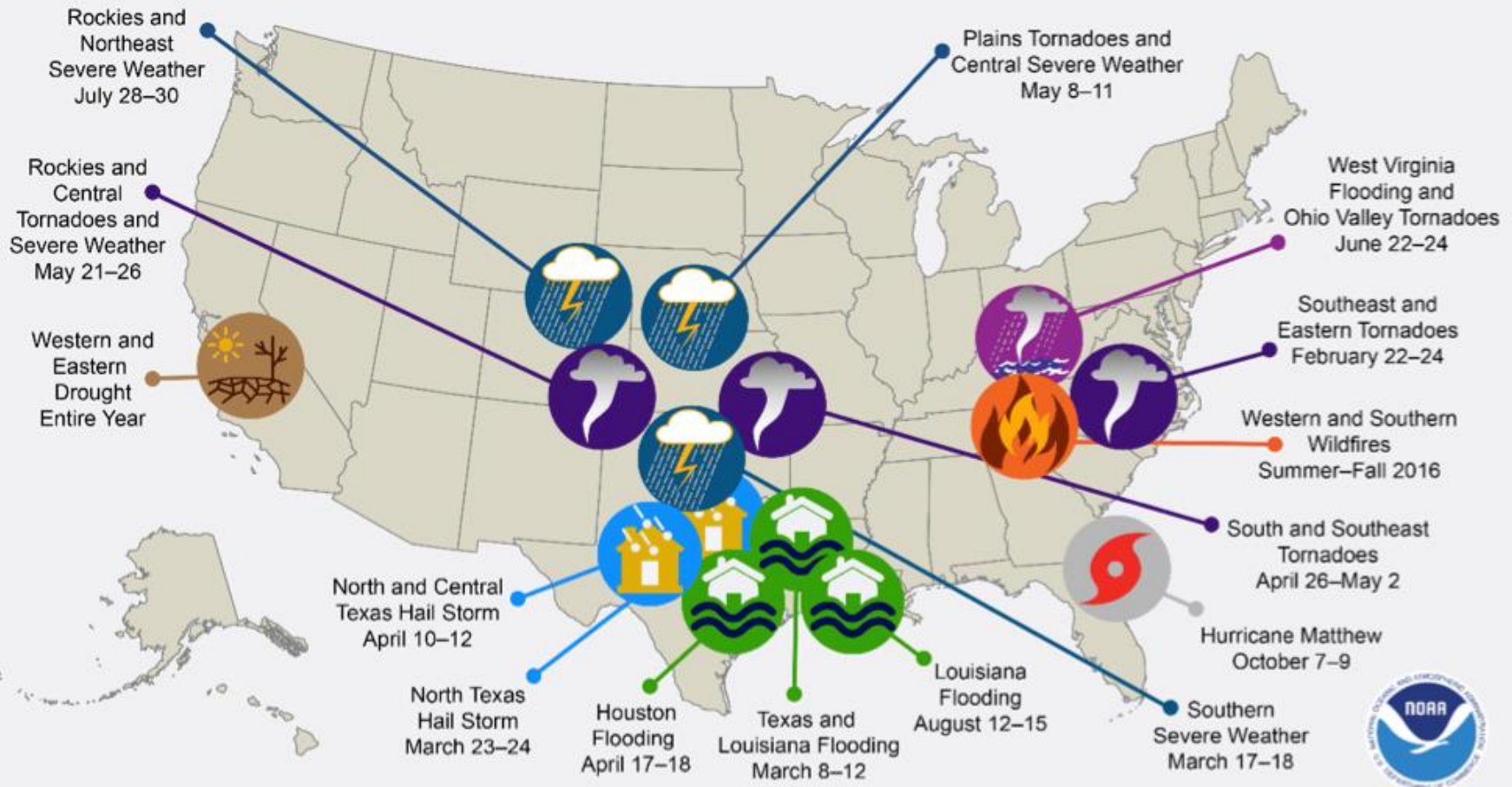
Resilience Perspectives:

- Restoration: repair assets and recover service on existing routes
- Reinvention: transform future possibilities through improved protocols, route alignments or infrastructure improvements.



Why Resilience Matters

U.S. 2016 Billion-Dollar Weather and Climate Disasters



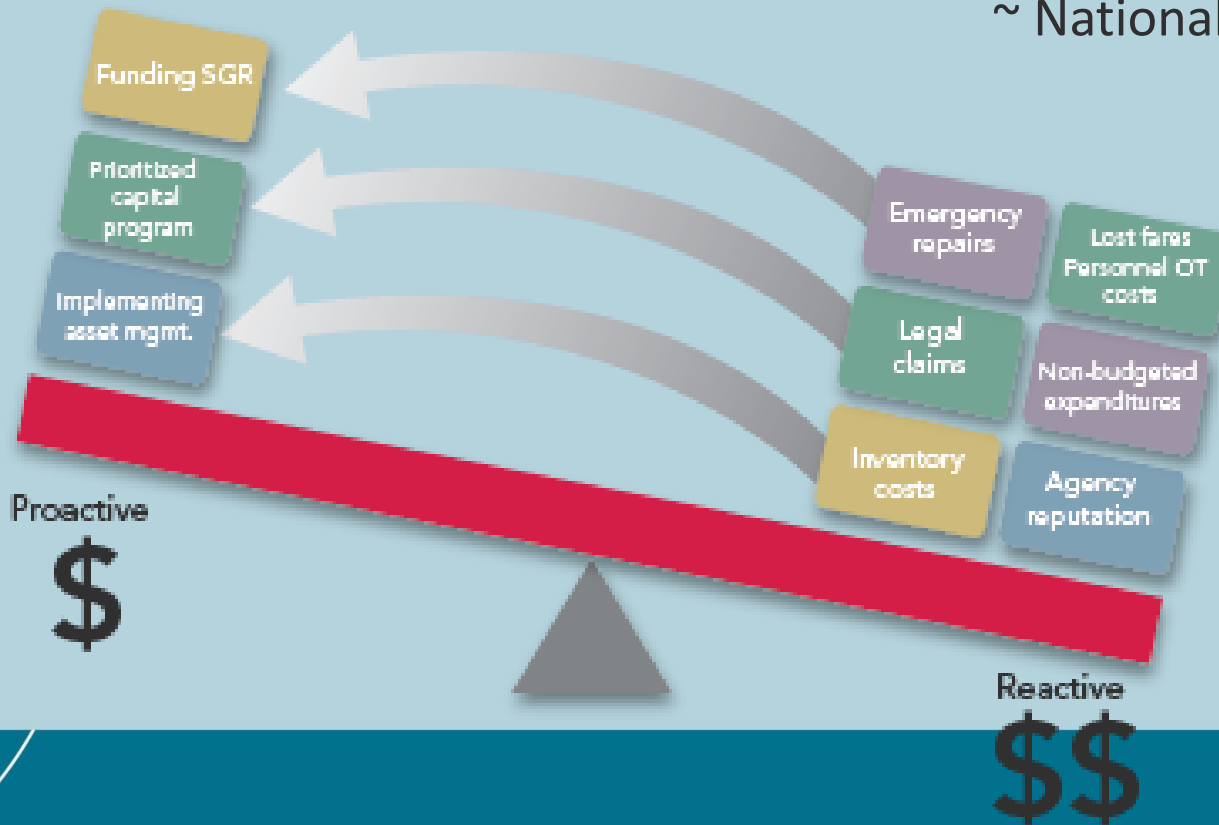
This map denotes the approximate location for each of the 15 billion-dollar weather and climate disasters that have impacted the United States during 2016.



The business case for resilience...

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.

~ National Academies



Many Paths to Resilience

**Past Disaster
Experience**

**Asset
Management
and State of
Good Repair**

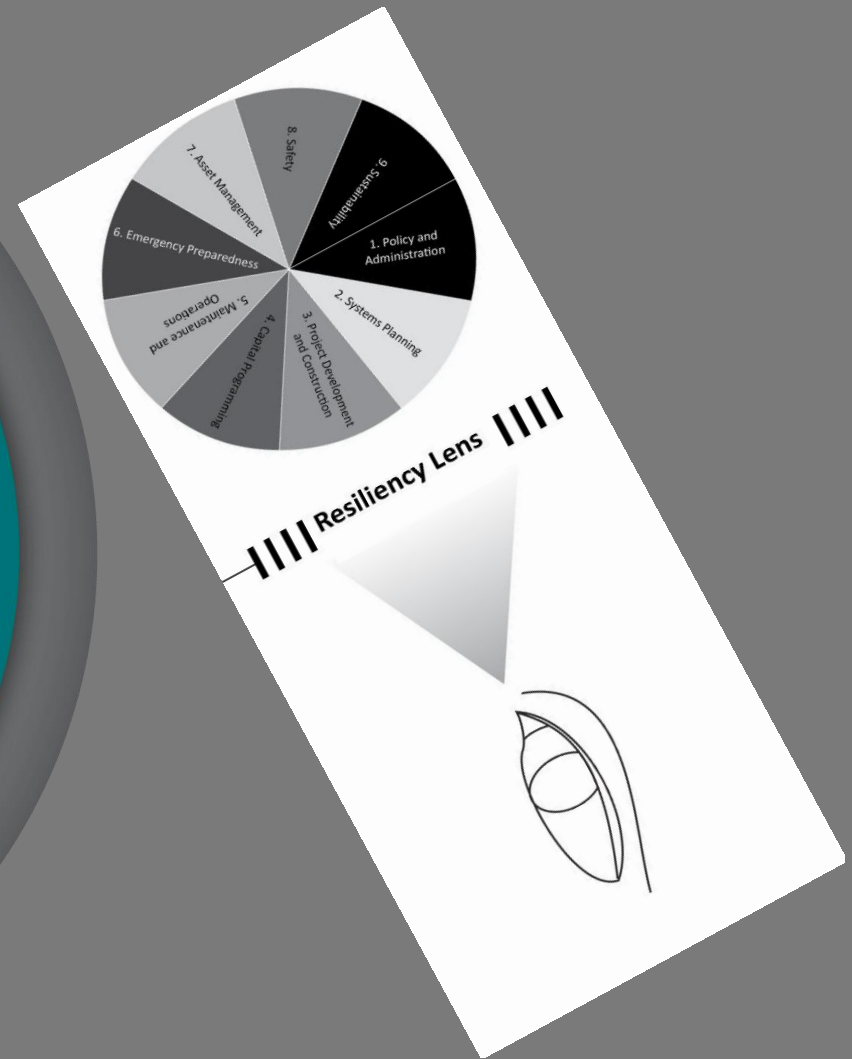
**Sustainability
and
Environmental
Programs**

**Leadership and
Organizational
Culture**

Representative examples from Case Studies show more than one way to resilience



When Domains Plan for Resilience, the System Will Be Resilient



Resilience Lenses: Overarching Practices

- Safety: Safety inspectors & O&M staff alert, report “anomalies” & weather impacts
- Asset management:
 - Risk analysis includes changing climate impacts
 - Life cycle planning addresses climate, risk trends
- Sustainability:
 - Seek co-benefits in projects (w/ regional partners)
 - Promote self-sufficiency, redundancy- critical systems

Resilience Lenses: Domains (Examples)

- System planning: Plan re-routing for emergencies, look for patterns
- Project development: Facilitate life-cycle risk-based planning thru criteria, awards
- Capital programming: CBA, prioritization factor in risks, resilience
- M&O: Promote value of front line first alert/ eyes and ears

Resilience Lenses: Supporting Processes (examples)

- Risk Management: Analyze, communicate value of mitigation/ avoidance of climate/ extreme weather impacts- insurance, self-payouts -benefits in projects
- O&M SOPs: Promote proactive procedures to reduce risk
- Procurement: Ensure that product specs & warranties support life cycle planning & that resilience aspects are included

Improving Transit Resilience Database

Guide includes overviews of database contents:

- » Case Studies
- » Resilience Planning Process Aids
- » Resilience Planning Frameworks & Guidance
- » Self-Assessment Tools, Checklists & Guidance
- » Weather & Climate-related Data Resources & Tools

Database provides online one-stop resource:
resilienttransit.org



- » Provides searchable access to articles, reports, case studies, & tools documented &/or created as part of A-41 project



Case Studies

- Hillsborough Area Regional Transit Authority (HART)- FL
- Honolulu Department of Transportation Services (DTS)-HI
- Idaho's Valley Regional Transit (VRT) - ID
- Kansas City Area Transit Authority (KCATA)- KS & MO
- Los Angeles County Metropolitan Transportation Authority (LA Metro)- CA
- Maryland Transit Administration (MTA)- MD
- Massachusetts Bay Transportation Agency (MBTA)- MA
- Metropolitan Atlanta Rapid Transit Authority (MARTA)- GA
- Nashville Metropolitan Transit Authority (MTA)- TN



Case Studies (continued)

- New Jersey Transit Corporation (NJ TRANSIT)- NJ
- New Orleans Regional Transit Authority (NORTA/RTA)-LA
- San Francisco Bay Area Rapid Transit (BART)- CA
- San Francisco Municipal Transportation Agency (SFMTA/ Muni)
- Southeastern Pennsylvania Transportation Authority (SEPTA)- PA
- Swedish Transportation Agency (STA)- Sweden
- Transport for London (TfL)- Great Britain
- Utah Transit Agency (UTA) - UT



Resilience Planning Process Aids

- » Creating a Customized Resilience Definition Activity & Worksheet
- » Resilience Lens Tool
- » Consider Agency Context Questionnaire
- » Initial Identification of Stakeholders Worksheet
- » SWOT Analysis Planning Guide
- » Making a Business Case for Resilience Worksheet
- » Preliminary Vulnerability Assessment Worksheet
- » Articulating a Resilience Vision Worksheet
- » Strategy Planning Worksheet
- » Identifying Internal & External Operational Interdependencies Worksheet



Resilience Planning Frameworks and Guidance

- › FTA Climate Change Adaptation Initiative
- › FHWA Climate Change and Extreme Weather Vulnerability Assessment Framework
- › FEMA Threat and Hazard Identification and Risk Assessment (THIRA) framework
- › NIST Community Resilience Planning Guide for Buildings and Infrastructure
- › U.S. Climate Resilience Toolkit
- › ENVISION sustainability rating system
- › ABAG Comprehensive Interdependency Assessment Framework
- › NASA Regional Multiagency, Multijurisdictional Resilience Workshops



Self-Assessment Tools, Checklists & Guidance

- » LA Metro Resilience Indicator Framework
- » FTA Office of Transit Safety and Oversight Safety Training website
- » FTA Hazard Mitigation Cost Effectiveness (HMCE) Tool
- » FHWA Infrastructure Voluntary Evaluation Sustainability Tool (INVEST)
- » Costing Asset Protection: An All Hazards (CAPTA) Guide for Transportation Agencies and the Costing Asset Protection Tool (CAPTool)



Weather and Climate-related Data Resources and Tools

- » National Weather Service's Advanced Hydrologic Prediction Service
- » NOAA's National Centers for Environmental Information Climate at a Glance website
- » The U.S. Geological Survey National Climate Change Viewer (NCCV)
- » NOAA Office of Coastal Management Coastal Flood Exposure Mapper
- » FTA Coastal Flood Recurrence Interval (RI) Calculator for Sea Level Rise
- » University of Michigan's Cities Impact and Adaptation Tool
- » Cal-Adapt



Incorporating Resilience Into APTA Standards and Guidance

APTA agreed with the premise of the A-41 project that resilience is most effective when integrated into everyday operations and asset management, and into everyday thinking about long range systems and capital planning, among other agency domains.

Currently, APTA is not working on a specific resilience standard. However, APTA is willing to propose guidance to appropriate policy committees, and its standards oversight and sustainability committees for developing resilience references and language into various standards and guidelines that will be reviewed and revised in the future. The study team provided a Resilience Lens Suggested Worksheet for APTA Working Groups.



To Provide Comments/ For Further Information

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