

TRANSPORTATION RESEARCH BOARD

# Enhancing the Capacity for Transportation System Resilience

**May 26, 2021**

**@NASEMTRB**  
**#TRBwebinar**

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- 1.5 Professional Development Hour (PDH) – see follow-up email for instructions
- You must attend the entire webinar to be eligible to receive PDH credits
- Questions? Contact Reggie Gillum at [RGillum@nas.edu](mailto:RGillum@nas.edu)

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**REGISTERED CONTINUING EDUCATION PROGRAM**

**#TRBwebinar**

# Learning Objective

Assess your agency's strategies at promoting a more resilient transportation system

**#TRBwebinar**



# **Enhancing Your Agency's Capacity to Enhance Transportation System Resilience**

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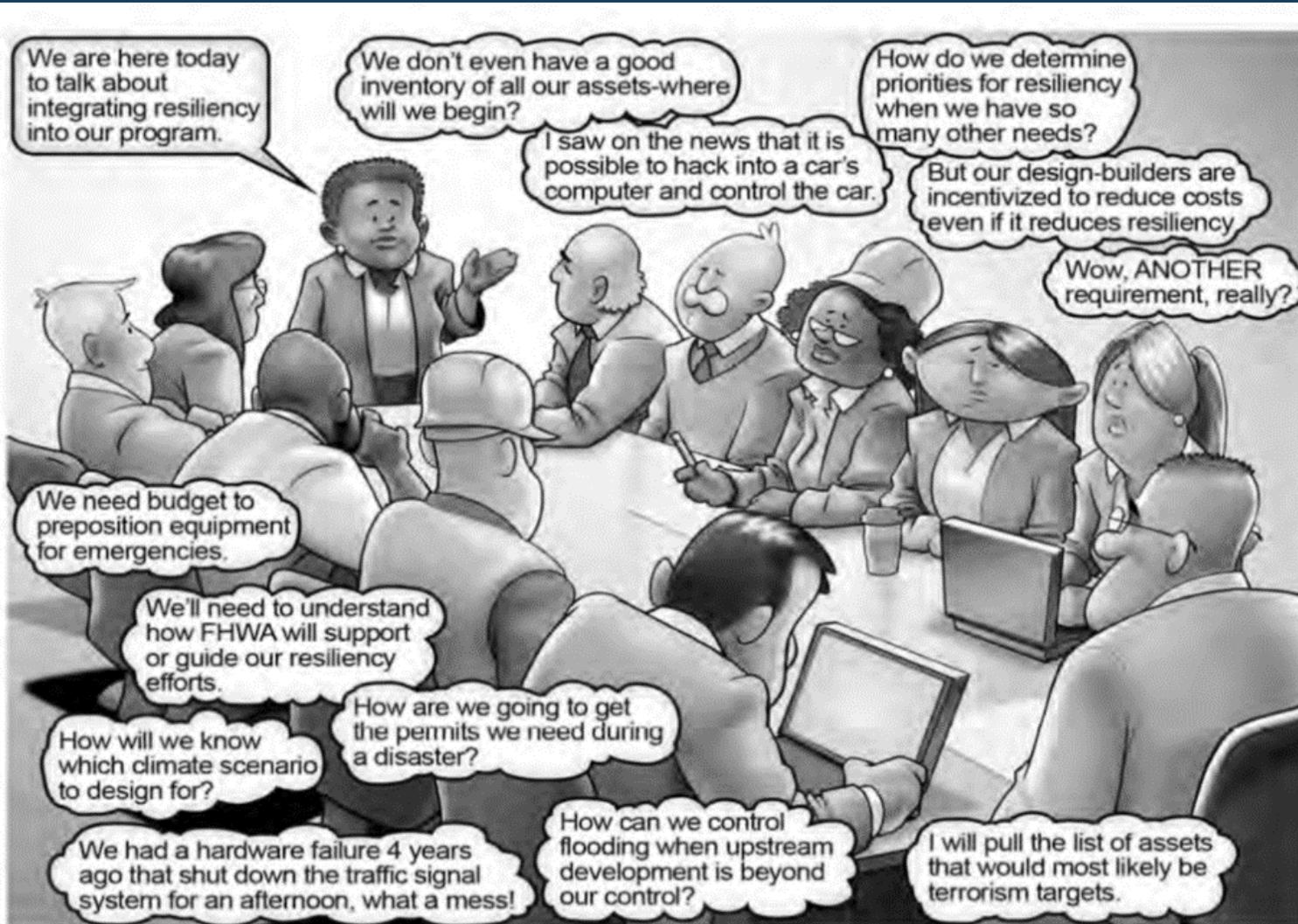
# Based on NCHRP 20-117: Deploying Transportation Resilience Practices in State DOTs

**Purpose:** Develop a set of tools and products for agencies interested in achieving a “resilience-focused” culture in their organizations → Guidebook

Products resulted from:

- Literature review
- Feedback from conference sessions on interim products
- Case studies
- Resilience Innovations and Summit Exchange (RISE)

# Many definitions of Resilience



# Overall Themes

Uncertainties/Threats  
(natural/human) need to be  
better considered in decision-  
making

Consequences are a critical  
(and missing) dialogue

Change is needed

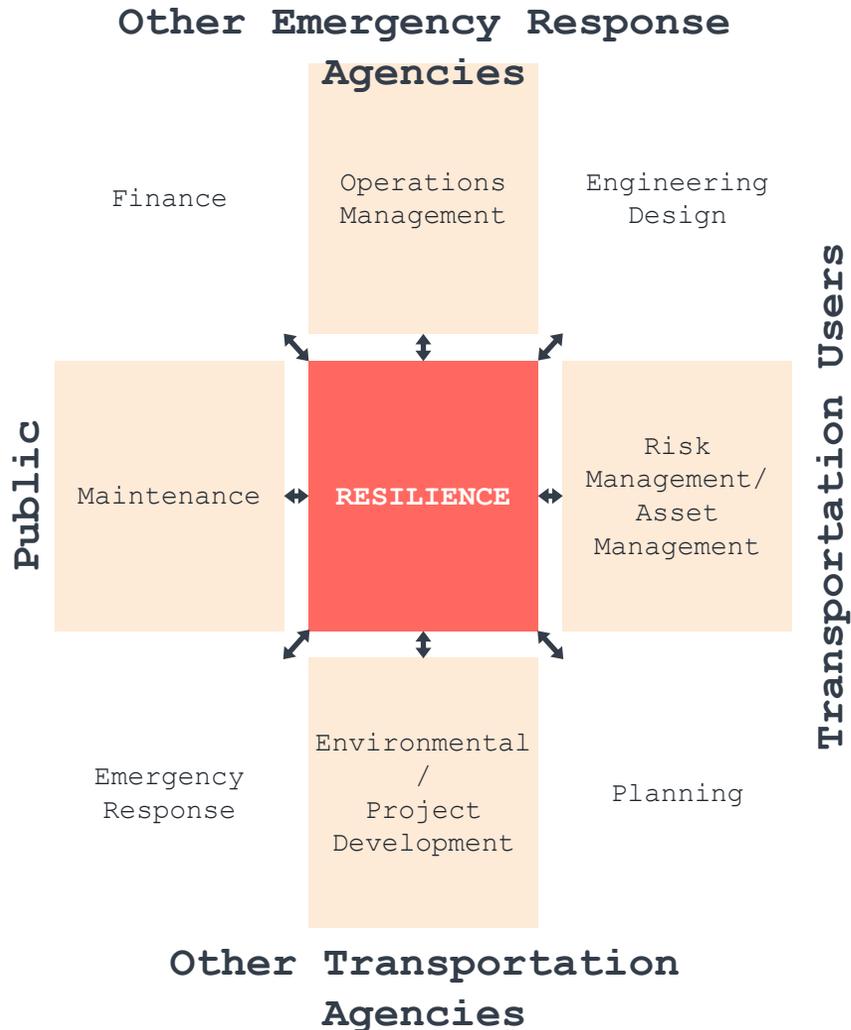


***Designing for resilient performance and behavior under adverse conditions does not imply designing for larger discharges... Resilience implies understanding what happens when events occur that are other than the design flow.***

# Organizational Perspective

"An organization that examines all **organizational functions** from the perspective of current status and that **identifies actions** to enhance organizational capacity. The concept of **risk management** has been integrated throughout all levels of the DOT such that priorities can be established to **minimize the impacts and consequences of transportation system disruption.**"

# Resilience Considerations Should be Part of All DOT Functional Areas



- Society in general
- Environmental systems
- Economic systems
- Other infrastructure support systems
- Political and governmental systems
- Equity/Social systems

# KEY LESSONS & OBSERVATIONS FROM RESILIENCE INNOVATIONS & SUMMIT EXCHANGE (RISE)

- **Key** → *Incorporating resilience concerns into decision-making processes.*
- Transportation planning is where it should start.
- **Consequences** → *greater impacts on disadvantaged populations.*
- Need for developing information, tools, and data to “make the case” for resilience.

# KEY LESSONS & OBSERVATIONS FROM RESILIENCE INNOVATIONS & SUMMIT EXCHANGE (RISE)

- Analysis frameworks exist...and are evolving.
- Sharing best practices.
- Training and professional development.
- **Focus** → what transportation systems enable.

***Transportation agencies cannot do it alone.***



## Concluding Observations

In addition to the observations from RISE —

- Considering risk and system resilience
- Funding resilience projects and/or resilience-oriented project additions
- Coordinating with other states and partners
- Finding resilience champions

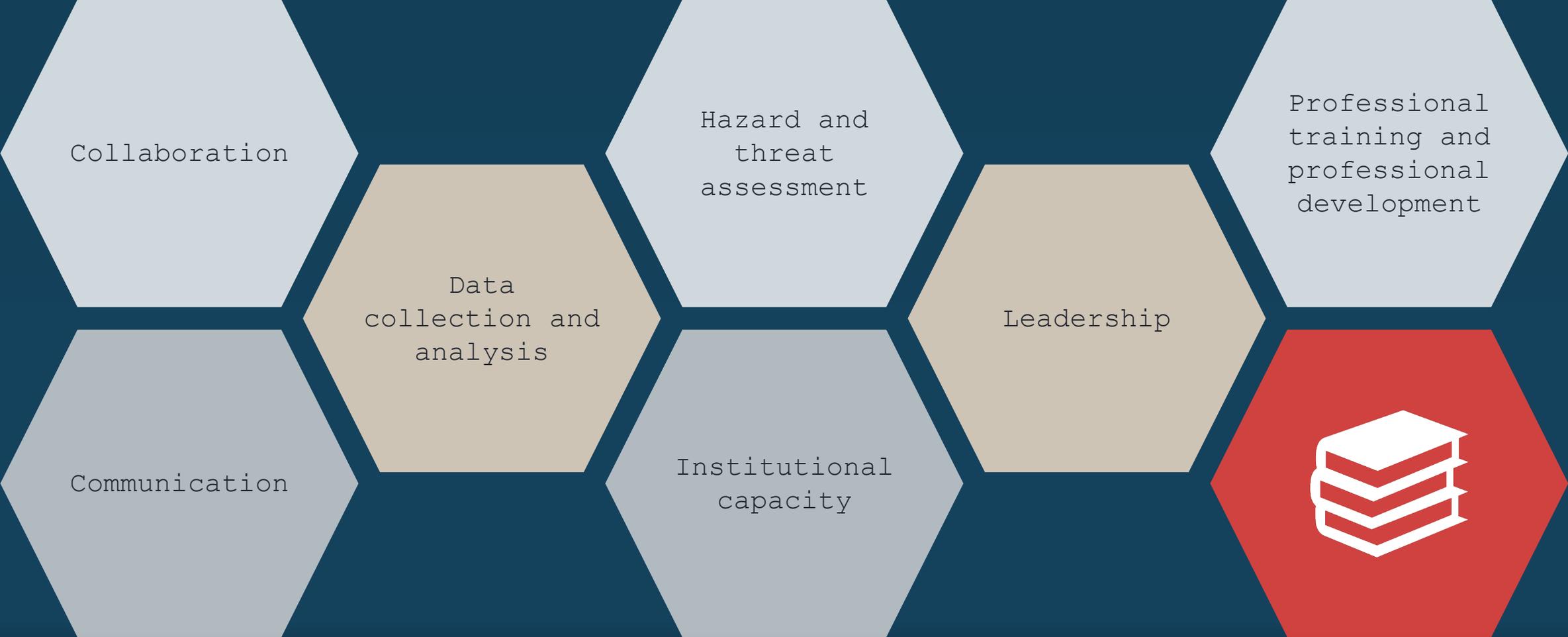
# Mainstreaming System Resilience Concepts into Transportation Agencies

Every functional area within a DOT with a role in making the transportation system more resilient.

Participation of many different agencies, organizations, communities, and groups that leads to multi-disciplinary collaborative efforts.

Broad definition of benefits, costs, and impacts > Community resilience, economic, and social impacts, and in a broad sense, quality of life.

# Guidebook: Key Themes



# Recommended Actions for:

Policy development/  
agency leadership and  
management

Planning

Project development/  
engineering

System and traffic  
operations

Construction

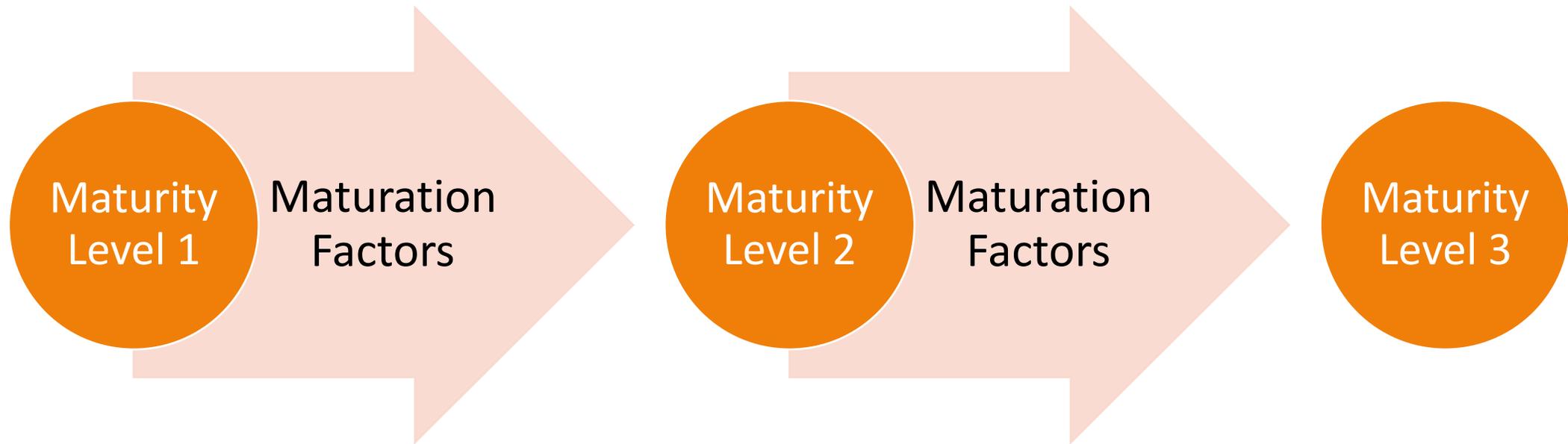
Maintenance

Asset management

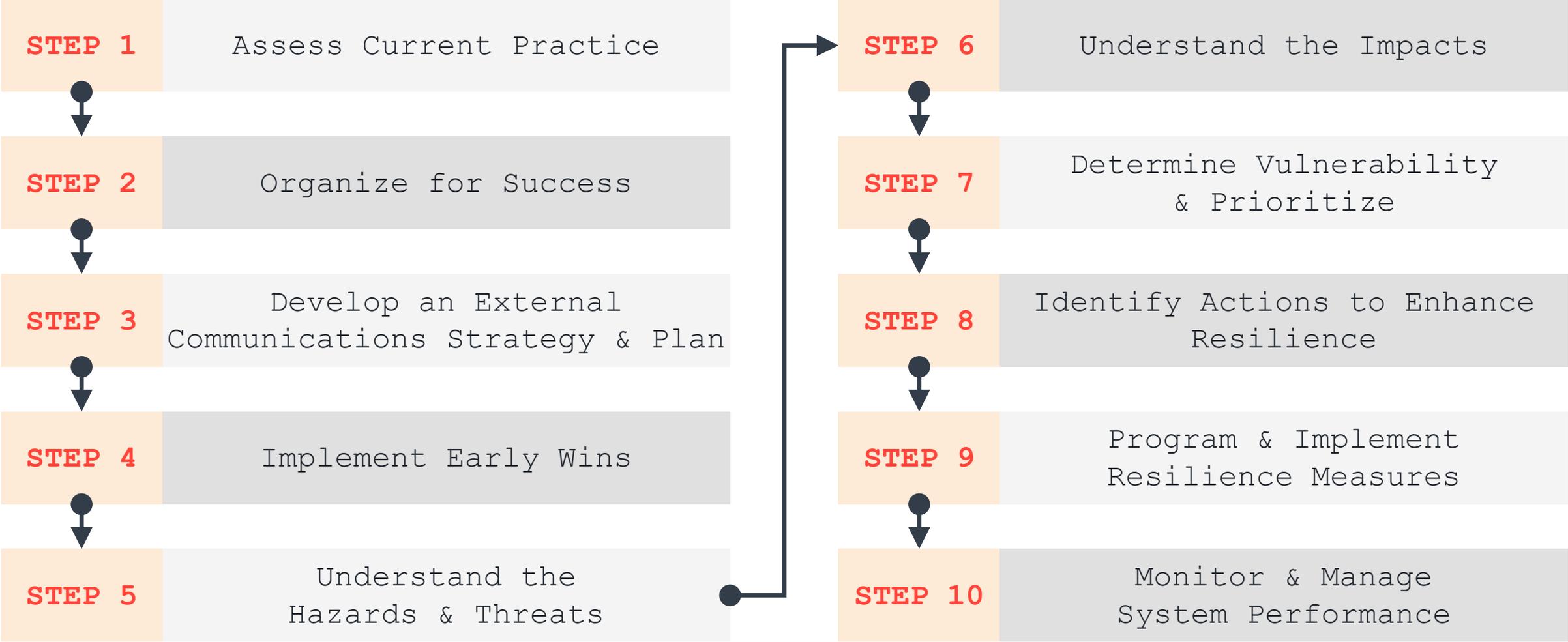
Emergency response/  
agency preparedness

Public outreach/  
communications

# Based on Capability Maturity Model Concept



# Steps in the Implementation Framework



# Self Assessment Process

Step 1	Level 1	Level 2	Level 3	Score
Factor 1				

Step 2	Level 1	Level 2	Level 3	Score
Factor 1				

Step x	Level 1	Level 2	Level 3	Score
Factor 1				

Step 10	Level 1	Level 2	Level 3	Score
Factor 1				
Factor 2				
Factor 3				
Factor x				

User rates how the agency is doing for each factor for each Step



	Score
Step 1	
Step 2	↓
Step x	
Step 10	
Total Score	

Individual step scores provide a sense of where improvements can be made

Step x	Score
Factor 1	
Factor 2	
Factor n	

Total score provides a sense of overall capability with respect to resilience efforts

Individual factor scores provide a sense of where improvements can be made in each step

Leading to.....

**Strategies and actions to enhance the organization's resilience efforts**



# EXAMPLE STEP ASSESSMENT: IDENTIFY ENHANCEMENTS TO OPERATIONS AND MAINTENANCE ACTIVITIES

Maturity Factor	Level 1 (1 point)	Level 2 (2 points)	Level 3 (3,points)
<p>8B.1 Has your agency assessed current operations &amp; maintenance (O&amp;M) strategies based on potential vulnerabilities identified in Step 7?</p>	<p>We have identified O&amp;M-related vulnerability areas. The assessment identified the likely costs of implementing O&amp;M strategies and qualitatively analyzed likely impacts.</p>	<p>We have achieved a Level 1 maturity. In addition, the assessment has examined the potential impacts of different O&amp;M options along with an assessment of implementation needs (e.g., staffing/training, equipment, and other budgetary requirements).</p>	<p>We have achieved a Level 2 maturity, plus the assessment included the use of benefit/cost analysis to determine the most appropriate O&amp;M actions. Our agency has already implemented some of the O&amp;M strategies identified in this assessment.</p>
<p>8B.2 Does your agency provide O&amp;M staff opportunities to report resilience-oriented problems and potential corrective actions?</p>	<p>We encourage O&amp;M staff to provide information on resilience-related problems to their managers (e.g., noticeable erosion near culverts or retaining walls). There are no formal requirements for doing so.</p>	<p>We have a formal report template to report resilience-related problems to O&amp;M managers. At their discretion, these managers can forward the information to other units in our agency for their use.</p>	<p>We have achieved Level 2 maturity. In addition, a formal reporting system is used to proactively request O&amp;M staff to identify actions to enhance transportation system resilience. Our O&amp;M staff provide after-event reports on the nature of disruptions, the type of response undertaken, and costs. Our maintenance-oriented asset inspection program includes information categories for potential system resilience problems at defined asset locations.</p>



# SCORING

Score Range	Description of Agency Maturity in Implementing Early Wins
0 to 12	Your agency is emerging into this area and has taken initial steps to grow awareness and understanding of the types of early wins it can implement.
13 to 23	Your agency has implemented several early win strategies, not so much as part of an agency-wide strategy but rather at the initiative of agency staff.
24 to 27	Your agency has reached significant maturity in identifying and implementing an early wins strategy. Major focus should be on maintaining and enhancing existing efforts when appropriate, and take advantage of new opportunities as they become available.

# An Example

> 80%

Your agency has made important strides in mainstreaming resilience actions in its efforts. There are still some areas where improvements can be made. Management should focus on these areas and on strategies to maintain and possibly enhance existing actions.

50 – 79%

Your agency has strength in several areas as they relate to resilience efforts, but there are many others where improvements should be made. Management should identify the priorities for making such improvements (following the recommended strategies presented in each chapter).

< 50%

There are many areas where your agency can make improvements in its overall resilience strategy. Management should identify the priorities for making such improvements (following the recommended strategies presented in each chapter).

Self-assessment Tool Step	Score	Max Score	% of Max Score
Step 1: Assess Current Practice	27	36	75%
Step 2: Organize for Success	24	33	73%
Step 3: Develop an External Communications Strategy and Plan	24	27	89%
Step 4: Implement Early Wins	18	27	67%
Step 5: Understand the Hazards and Threats	16	27	59%
Step 6: Understand the Impacts	13	24	54%
Step 7: Determine Vulnerability/Risk and Prioritize	5	12	42%
Step 8A: Assess Strategies for Enhancing Emergency Response Capabilities	37	45	82%
Step 8B: Identify Enhancements to Operations and Maintenance Activities	14	24	58%
Step 8C: Undertake Detailed Assessments of Exposed Assets and New Projects	11	24	46%
Step 8D: Integrate into Asset Management	12	30	40%
Step 9: Program and Implement Resilience Measures	10	24	42%
Step 10: Monitor and Manage System Performance	8	24	33%
<b>Total Agency Score</b>	<b>219</b>	<b>357</b>	<b>61%</b>

## **Recommended Actions for Each Step**

- Recommended actions to maintain the highest level of agency resilience capability
- Recommended actions to achieve higher levels of resilience capability

# Recommended Actions

Let's do this (check)	Action	Responsibility?	Timeframe?	Expected outcomes?
	Assess your agency's O&M strategies with respect to the vulnerabilities identified in Step 7. Emphasize the implementation requirements for additional actions that are deemed necessary.			
	Examine how O&M data collection efforts can be modified to collect resilience-related data that can be used for systems-level vulnerability analyses and asset management, in addition to O&M planning.			
	Examine how O&M data can be used to inform lifecycle costing analyses in the asset management program or in other investment evaluation efforts in your agency.			
	Investigate the extent to which your agency's vegetation management and control program reflects the likely changes in climate that your jurisdiction will face over time.			
	Update your agency's continuity of operations plan as it reflects system operations management and control to reflect the types of vulnerabilities and risks that resulted from Step 7.			



**Recommended  
Actions for  
Each Step....and**

**by Functional Areas**



# The Importance of DOT Training

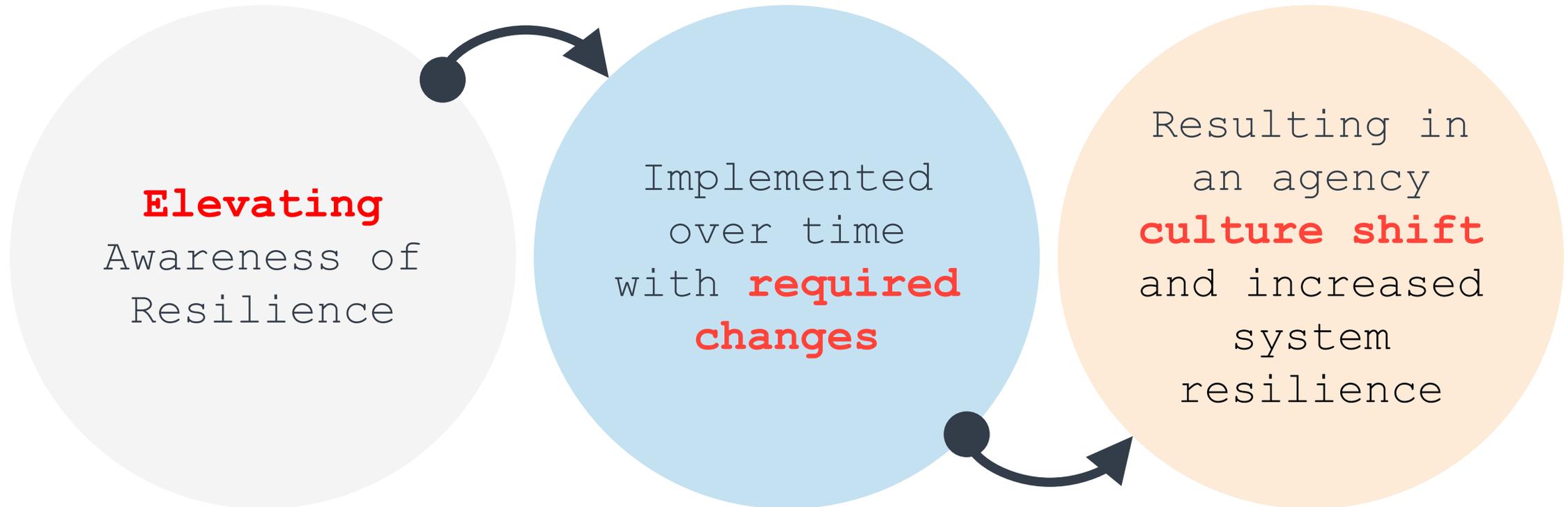
System Resilience and System Operations

System Resilience and Maintenance

System Resilience and Asset Management

Communicate Resilience Concepts to the  
Public

# Concluding Observations



# Today's Panelists

## #TRBWebinar



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**Moderated by:**  
**Paula Hammond,**  
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**Michael Flood,**  
*WSP*

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