2nd International Conference on Resilience to Natural Hazards and Extreme Weather Events

Transportation Resilience 2019

NOVEMBER 13–15, 2019
NAS Building, Washington, DC

Hosted by
Transportation Research Board

With support from
Federal Highway Administration

Organized by
Special Task Force on Climate Change
(A0020T)

The National Academies of
SCiences • Engineering • Medicine

TRANSPORTATION RESEARCH BOARD
Proud Sponsor of Transportation Resilience 2019

WSP partners with clients worldwide to create more resilient transportation systems.

Find out what we can do for you.
We are delighted to welcome all of you to the National Academies of Sciences Building for the Transportation Resilience 2019 (TR2019) conference. TRB, a division of the National Academies of Science, Engineering, and Medicine, has organized this conference with support from the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO). The conference aims to focus on proactive, transformative, and recovery practices making our transportation networks and systems resilient to extreme weather events and other nature hazards.

This international conference, entitled Transportation Resilience 2019, is the 2nd International Conference on Transportation System Resilience to Natural Hazards and Extreme Weather Events. This conference will provide transportation professionals with information on emerging best practices and state of the art research results on how to adapt surface transportation networks to the potential impacts of natural disasters and extreme weather events. The conference will examine efforts to integrate resilience in all aspects of the transportation sector, including planning and programming, capital improvements, and operations and maintenance. The conference will promote international dialogue on research, implementation, and lessons learned on this important topic, with benefits that are expected to extend beyond the transportation sector.

This conference builds on the successes of the first conference held in 2015 and the 2018 Transportation Resilience Innovations Summit and Exchange (Transportation RISE). As attendees and presenters, your contribution will help make this conference a success. This is going to be an incredible forum for an exchange of ideas and learning more about the latest thinking on transportation resiliency.

We hope you find the conference motivating, enlightening, and enjoyable.

Welcome to Washington, D.C.

Michael Culp,  
Federal Highway Administration,  
Co-Chair, TRB Planning Committee

Carol Lee G. Roalkvam,  
Washington State Department of Transportation  
Co-Chair, TRB Planning Committee

Kees van Muiswinkel,  
Rijkswaterstaat, The Netherlands  
Co-Chair, TRB Planning Committee
2019 PLANNING COMMITTEE

Mike Culp, Federal Highway Administration, Co-chair
Kees van Muiswinkel, Ministry of Infrastructure and Water Management, Rijkswaterstaat, Co-chair
Carol Lee Roalkvam, Washington State Department of Transportation, Co-chair
Mark Abkowitz, Vanderbilt University
Jeff Arnold, U.S. Army Corps of Engineers
Vicki Arroyo, Georgetown Climate Center
Brian Beucler, Federal Highway Administration
Thomas Bles, Deltares
Claire Bonham-Carter, AECOM
Anne Choate, ICF
Dave Claman, Iowa Department of Transportation
Josh DeFlorio, Port Authority of New York and New Jersey
Susanne DesRoches, NYC Mayor’s Office of Recovery and Resiliency
Brenda Dix, ICF
Scott Douglass, South Coast Engineers/University of South Alabama
Tracey Frost, CALTRANS
Julia Gold, Rhode Island Department of Transportation
Rob Graff, Delaware Valley Regional Planning Commission (DVRPC)
Elizabeth Habic, Maryland Department of Transportation State Highway Administration
Paula Hammond, WSP Inc.
Heather Holsinger, Federal Highway Administration
Jennifer Jacobs, University of New Hampshire
Tom Jacobs, Mid-America Regional Council (MARC)
Robert Kafalenos, Federal Highway Administration
Rebecca Lopes, Federal Highway Administration
Constantine (Costa) Samaras, Carnegie Mellon University
Melissa Savage, American Association of State Highway and Transportation Officials

TRB Staff

William Anderson, Senior Program Officer
Ted Jamele, Meetings Assistant
Gary A. Jenkins, Associate Program Officer

The Transportation Research Board The Transportation Research Board is one of seven major programs of the National Academies of Sciences, Engineering, and Medicine. The mission of the Transportation Research Board is to provide leadership in transportation improvements and innovation through trusted, impartial, and evidence-based information exchange, research, and advice regarding all modes of transportation. The Board’s varied activities annually engage about 8,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

www.TRB.org
## SCHEDULE AT A GLANCE

### WEDNESDAY, NOVEMBER 13

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<tr>
<th>TIME</th>
<th>EVENT</th>
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<td>7:00 AM</td>
<td>Registration Opens</td>
<td>Great Hall</td>
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<td>7:00 AM</td>
<td>Continental Breakfast and Coffee</td>
<td>West Court</td>
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<td>8:30 AM</td>
<td>Opening Plenary—Welcome Remarks (PS01)</td>
<td>Kavli Auditorium</td>
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<tr>
<td>9:00 AM</td>
<td>Plenary Session: Prioritizing Resilience at State DOTs—Progress and Challenges (PS02)</td>
<td>Kavli Auditorium</td>
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<td>10:00 AM</td>
<td>Transition Break—15 minutes</td>
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<tr>
<td>10:15 AM</td>
<td>Technical Sessions—Period One</td>
<td>NAS 120 NAS125 Member Room</td>
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<tr>
<td></td>
<td>Integrating Transportation Resilience into Asset Management (TS001)</td>
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<td>Regional and Multi-Sectoral Approaches to Resilience (TS002)</td>
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<td>Bridges and Culverts (TS003)</td>
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<td>11:45 AM</td>
<td>Lunch</td>
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<td>12:45 PM</td>
<td>Focus-Point Session: State of Play of Proactive Adaptation (FPS01)</td>
<td>Kavli Auditorium</td>
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<td>Transition Break—10 minutes</td>
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<td>1:30 PM</td>
<td>Technical Sessions—Period Two</td>
<td>NAS 120 NAS125 Member Room</td>
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<td></td>
<td>Frameworks and Methods to Address Coastal Resilience—Part A (TS004)</td>
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<td>Transforming Design for Resilience—Part A (TS005)</td>
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<td>Approaches to Addressing Multiple Hazards within a Larger Multimodal Program (TS006)</td>
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<td>3:00 PM</td>
<td>Networking Break—30 minutes</td>
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<td>3:30 PM</td>
<td>Technical Sessions—Period Three</td>
<td>NAS 120 NAS125 Member Room Board Room</td>
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<td>Integrating Resilience in Transportation Planning—Part A (TS008)</td>
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<td>Transforming Design for Resilience—Part B (TS009)</td>
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<td>Projections and Downsizing—Part A (TS010)</td>
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<td>Innovative Collaboration for Resilience to Extreme Weather Events (TS011)</td>
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<td>4:00 PM</td>
<td>Registration Closes</td>
<td>Great Hall</td>
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<tr>
<td>5:00 PM</td>
<td>Poster Session and Networking Reception</td>
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### THURSDAY, NOVEMBER 14

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<tr>
<th>TIME</th>
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<td>Continental Breakfast and Coffee</td>
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<td>8:00 AM</td>
<td>Technical Sessions—Period Four</td>
<td>NAS 120 NAS125 Member Room Board Room</td>
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<td></td>
<td>Economic Analysis to Support Resilience—Part A (TS012)</td>
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<td>Nature-Based Solutions for Coastal Highway Resilience (TS013)</td>
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<td>Geotechnical Aspects in Transportation Resilience (TS014)</td>
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<td>Causality and Surrogates: Bridge Vulnerability and Resilience (TS015)</td>
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<tr>
<td>9:30 AM</td>
<td>Plenary Session: Leading the Way to Great Resilience: Policy-Makers Talk About the Future (PS03)</td>
<td>Kavli Auditorium</td>
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<td>10:30 AM</td>
<td>Transition Break—15 minutes</td>
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### SCHEDULE AT A GLANCE, continued

#### THURSDAY, NOVEMBER 14, continued

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<tr>
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<td><strong>Technical Sessions—Period Five</strong></td>
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<td></td>
<td>Economic Analysis to Support Resilience—Part B (TS016)</td>
<td>NAS 120</td>
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<td>Pavements Resilience (TS017)</td>
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<td>Tools and Methods (TS018)</td>
<td>Member Room</td>
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<td>Assessing Coastal Impacts to Nuisance Flooding and Sea Level Rise—Part B (TS019)</td>
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<td>Managed Retreat (Part A)—Is It Even an Option? (TS020)</td>
<td>NAS 120</td>
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<td><strong>Technical Sessions—Period Five</strong></td>
<td>NAS 120</td>
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<td>Economics to Support Resilience—Part B (TS016)</td>
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<td>Assessing Coastal Impacts to Nuisance Flooding and Sea Level Rise—Part B (TS019)</td>
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<td>Managed Retreat (Part A)—Is It Even an Option? (TS020)</td>
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<td>12:15 PM</td>
<td>Lunch</td>
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<td>1:15 PM</td>
<td>Focus-Point Session: Managed Retreat—When, Whether and How? (FPS02)</td>
<td>Kavli Auditorium</td>
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<td>Transition Break—10 minutes</td>
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<td><strong>Technical Sessions—Period Six</strong></td>
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<td>Technical Solutions for Natural Disasters (TS021)</td>
<td>NAS120</td>
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<td>Communications and Making the Business Case for Resilience (TS022)</td>
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<td>Approaches to Addressing Multiple Hazards within a Large Modal Project (TS023)</td>
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<td>Networking Break—10 minutes</td>
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<td><strong>Technical Sessions—Period Seven</strong></td>
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<td>Integrating Resilience in Transportation Planning - Part B (TS024)</td>
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<td>Resilience Initiative for National Transportation Systems (TS025)</td>
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<td>Projections &amp; Downscaling —Part B (TS026)</td>
<td>Member Room</td>
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<td>Managed Retreat and Infrastructure Decision Making (Part B)—How Are the Hard Decisions Made? (TS027)</td>
<td>Board Room</td>
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<td>5:30 PM</td>
<td>Committee Meetings: TRB Special Task Force on Climate Change (A0020T)</td>
<td>NAS 120</td>
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<td>AASHTO Committee Meeting on Transportation Systems Security and Resilience</td>
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#### FRIDAY, NOVEMBER 15

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<td>7:00 AM</td>
<td>Continental Breakfast and Coffee</td>
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<td>8:30 AM</td>
<td><strong>Technical Sessions—Period Four</strong></td>
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<td>Technical Solutions for Resilience (TS028)</td>
<td>NAS 120</td>
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<td>Cascading Events (TS029)</td>
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<td>Advancing Resilience at National, State, Regional and Local Levels (TS030)</td>
<td>Member Room</td>
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<td>Recovery for More Resilient Roads (TS031)</td>
<td>Board Room</td>
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<td>10:00 AM</td>
<td>Transition Break—15 minutes</td>
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<tr>
<td>10:15 AM</td>
<td>Focus-Point Session: Lessons Learned from Post-Disaster Response (FPS03)</td>
<td>Kavli Auditorium</td>
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<tr>
<td>11:15 AM</td>
<td>Focus-Point Session: Science and Data Update (FPS04)</td>
<td>Kavli Auditorium</td>
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<tr>
<td>12:15 PM</td>
<td>Closing Plenary and Working Lunch: Collecting Your Thoughts</td>
<td>West Court</td>
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<tr>
<td>1:45 PM</td>
<td>Conference Concludes</td>
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<tr>
<td>2:00 PM</td>
<td>Committee Meetings: Standing Committee on Critical Infrastructure Protection (ABR010)</td>
<td>NAS 120</td>
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<td>Standing Committee on Emergency Evacuation (ABR30)</td>
<td>Board Room</td>
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ADVANCING THE MARINE TRANSPORTATION SYSTEM THROUGH AUTOMATION AND AUTONOMOUS TECHNOLOGIES: TRENDS, APPLICATIONS AND CHALLENGES

Sixth Biennial Marine Transportation System Innovative Science and Technology Conference

For more information contact Scott Brotemarkle at sbrotemarkle@nas.edu or Keyara Dorn at kdorn@nas.edu
COMMITEE MEETINGS

THURSDAY, NOVEMBER 14, 2019

5:30 PM–7:00 PM, NAS 120
TRB Special Task Force on Climate Change (A0020T)

5:30 PM–7:00 PM, Board Room
AASHTO Committee on Transportation Systems Security and Resilience

FRIDAY, NOVEMBER 15, 2019

2:00 PM–3:00 PM, NAS 120
Standing Committee on Critical Transportation Infrastructure Protection (ABR10)

2:00 PM–3:00 PM, Board Room
Standing Committee on Emergency Evacuation (ABR30)

WEBCAST AND RECORDING STATEMENT—CROWD RELEASE

Please be aware that sessions of the Transportation Resilience 2019 are webcast and recorded. By attending a session virtually or physically you consent to your voice and likeness being recorded for use on television and in any media now known or hereafter devised in perpetuity, and you release the National Academy of Sciences, National Academy of Engineering, and National Academy of Medicine, and the National Research Council from any liability due to such usages. If you do not wish to be subject to the foregoing, please do not participate in these sessions. The Transportation Research Board is a division of NAS. Please be aware that sessions of the Transportation Resilience 2019 are webcast and recorded. By attending a session virtually or physically you consent to your voice and likeness being recorded for use on television and in any media now known or hereafter devised in perpetuity, and you release the National Academy of Sciences, National Academy of Engineering, and National Academy of Medicine, and the National Research Council from any liability due to such usages. If you do not wish to be subject to the foregoing, please do not participate in these sessions. The Transportation Research Board is a division of NAS.

DAILY GEOSCIENCE DEMONSTRATION: STREAM TABLE

Provided daily by FHWA:

West Court

Whether confronted with acute flood damages or chronic river uncertainty, understanding the scale and type of instability is essential for long-term transportation management. This small scale stream demonstration will provide an opportunity to see river geomorphic processes in action. Attendees will gain a hands-on knowledge of morphologic response of rivers to practices like channel straightening, culvert removal, or bedload mining. A greater knowledge of river stability could result in result in reduced flood-related road damage costs and increased river and road stability.
CONFERENCE PROGRAM

WEDNESDAY, NOVEMBER 13, 2019

7:00 AM–4:00 PM, Great Hall
Registration Open

7:30 AM–8:30 AM, West Court
Continental Breakfast and Coffee

8:30 AM–9:00 AM, Kavli Auditorium
OPENING PLENARY
Opening and Welcome Remarks (PS01)
Kicking-off the conference with an overview of the program given by the leadership of the TR2019 Planning Committee:
Carol Lee Roalkvam, Washington State Department of Transportation;
Michael Culp, Federal Highway Administration (FHWA); and
Kees van Muiswinkel, Rijkswaterstaat—Ministry of Infrastructure and Water Management
Following, welcome remarks will be offered by the three convening organizations: Neil Pedersen, Transportation Research Board; Thomas Everett, U.S. Department of Transportation, Federal Highway Administration (FHWA); and Jim Tymon, American Association of State Highway Transportation Officials (AASHTO).
Moderator: Carol Lee Roalkvam, Washington State Department of Transportation
   Environmental Services Office

9:00 AM–10:00 AM, Kavli Auditorium
PLENARY SESSION
Prioritizing Resilience at State Departments of Transportation—Progress and Challenges (PS02)
State Departments of Transportation face threats to their statewide systems on a daily basis. Whether nature- or man-made, disasters can close critical facilities on a moment’s notice, disrupting the economic vitality and quality of life of communities. In this session, we’ll hear from state departments of transportation leaders about their progress and challenges in becoming more resilient agencies; in their organizational approach and through all phases of infrastructure development and operations.
Moderator: Paula J Hammond, WSP Inc.
Edwin Sniffen, Hawaii Department of Transportation
Greg Slater, Maryland State Highway Administration
Ellen Greenberg, California Department of Transportation
Mike Russo, New Jersey Department of Transportation

10:00 AM–10:15 AM
Transition Break
10:15 AM–11:45 AM, NAS 120

Integrating Transportation Resilience into Asset Management (TS001)
This session explores approaches to address the impact of current and future environmental conditions on transportation assets or highway networks. These approaches, whether focused on an entire network, a corridor, or a specific group of assets, provide a better understanding as to how to appropriately plan, design, manage, and make infrastructure investments to increase system resilience.

Moderator: Nastaran Saadatmand, Federal Highway Administration

Integrating Extreme Weather Risks into Transportation Asset Management Plans and Practices
Robert Kafalenos, Federal Highway Administration

Prioritizing Infrastructure Resilience throughout the Transportation Capital Planning Process
Jon Carnegie, Rutgers University, Voorhees Transportation Center

Southeast Michigan Flooding Study: Assessing Risk & Building Resilience
Kelly Karll, Southeast Michigan Council of Governments

Maximizing the Resiliency from Your Capital Spend: Analysis Tools to Address Resiliency Goals Management
Ister Morales, Gannett Fleming, Inc.

Development and Incorporation of Quantitative Risk and Resilience Analysis Standards into Agency Decision Making
Aimee Flannery, AEM Corporation

10:15 AM–11:45 AM, NAS 125

Regional and Multi-Sectoral Approaches to Resilience (TS002)
The transportation network is not an isolated system. Cities and regions depend on it for safety and economic vitality, other sectors rely on it for access to their infrastructure, and transportation assets can sometimes serve as the first line of defense for protecting a community. This session will explore how transportation agencies are partnering with others to more holistically plan for the resilience of a region.

Moderator: Susan Asam, IFC

Regional Resilience and Infrastructure—Opportunities for Dynamic Adaptation
Niek Verraart, Michael Baker International

Safeguarding Assets When You Can’t Get There From Here—Shared Challenges in the Nexus of Multimodal Surface Transport, Buildings and Mission
Ann Kosmal, U.S. General Services Administration, Office of Federal High-Performance Buildings

State Hazard Mitigation and Climate Adaptation Planning
Steve Miller, Massachusetts Department of Transportation (MassDOT)

Enhancing Local Climate Resilience with State-level Transportation Risk Assessment
Judy C. Gates, HNTB
Bridges and Culverts—Assessment of Resilience for Planning (TS003)

High water is a predominant climatic hazard that impacts bridges and culverts. High water can damage foundation material, structural members, and approach embankment and roadway. High water can also exceed hydraulic capacity causing overtopping and traffic interruption, as well as potentially causing problems upstream of the bridge or culvert. Resilience planning requires techniques for assessing or analyzing many locations within a jurisdiction to estimate the effects of current and future waterway flows for prioritizing mitigation. This session presents some assessment techniques that are in use or under study.

Moderator: Derek Constable, Federal Highway Administration

Resilient Bridge Planning in Mozambique: Bridge Failure Risk from Flooding and Climate Change
Sebastian Young, University of New Hampshire, Department of Civil & Environmental Engineering

Resilient Bridge Planning: Failure Risk from Flooding and Climate Change
Kyle Kwiatkowski, University of New Hampshire

Evaluating the Performance and Resilience of Major Stormwater Infrastructure Systems under Climate Change and Land Use Uncertainty
Tania Lopez-Cantu, Carnegie Mellon University

Culvert Resilience Assessment: From Pilot to Practice
Charles Hebson, Maine Department of Transportation

Lunch

FOCUS-POINT SESSION: State of Play of Proactive Adaptation (FPS01)

Proactive Adaptation is about strategies to reduce future damages caused by extreme weather and sea level rise. This focus plenary will explore the current state of proactive adaptation in the U.S. and around the globe. The aim is to highlight successes and demonstrate the clear need for proactive adaptation based on recent disasters. Questions to be addressed include:

- What is the policy advancement?
- What are barriers and ways to overcome them?
- How can we utilize science?; and
- How do you deal with uncertainty?

Moderator: Kees van Muiswinkel, Rijkswaterstaat—Ministry of Infrastructure and Water Management

Alice C. Hill, Council on Foreign Relations

Transition Break
Frameworks and Methods to Address Coastal Resilience—Part A (TS004)

*The built environment in high risk coastal areas is confronted by natural hazards such as severe storms, flooding, sea levels rising, and erosion. In this session panelist will present methods and frameworks to support decisions to reduce the ecological, structural, and economic risks of coastal hazards.*

**Moderator:** David Kriebel, United States Naval Academy

**Highways in the Coastal Environment: A U.S. Engineering Manual**
Scott Douglass, South Coast Engineers

**Strategies to Increase Resilience of Florida DOT’s Facilities**
Jennifer Carver, Florida Department of Transportation, and Carl Spirio, Jr., GHD

**A Stepwise and Flexible Adaption Framework for Coastal Road Infrastructure Resilience to a Changing Climate**
Jayne F. Knott, JFK Environmental Services LLC

**A Framework for Selecting Sea Level Rise for the Design of Resilient Infrastructure**
Roger Kilgore, Kilgore Consulting and Management

Transforming Design for Resilience—Part A (TS005)

*This session will delve into the practical world of design, exploring lessons learned from various organizations who have updated their design approaches to include nature-based solutions, as well as translate climate science into design-level guidance.*

**Moderator:** Susanne DesRoches, New York City Mayor’s Offices of Resilience and Sustainability

**Characterization of Resilience of Road Networks against Fluvial Flooding through Modelling Dynamic Evolution of Flood Control Infrastructure Networks**
Baiherula Abula, University of Texas A&M

**Flood Resiliency: The Added Benefit of Aquatic Organism Passage Using the Stream Simulation Design Methodology**
Nathaniel Gardner Gillespie, United States Forest Service, United States Department of Agriculture

**Improving Resiliency and Sustainability of Vulnerable Infrastructure by using Natural Stream Channel Design and Restoration: Three Case Studies**
Thomas A. Graupensperger, Dewberry

Approaches to Addressing Multiple Hazards within a Larger Multimodal Program (TS006)

*Public agencies are working to develop more resilient infrastructure systems to ensure access and limit disruptions to the traveling public. This session will explore various state,*
regional and national organizational approaches to address hazards within a program-wide context.

*Moderator:* Paula J. Hammond, WSP Inc.

**Arizona Department of Transportation: Designing, Funding, and Building Resilience into a $1Billion Construction Program**
Steven Olmsted, Arizona Department of Transportation

**Assessment of Incorporating Climate Adaptation into a State Department of Transportation: Caltrans Experience**
Tracy Frost, California Department of Transportation (Caltrans)

**Development of a Concept for Resilience Management for Federal Highways in Germany**
Martin Klose, Federal Highway Research Institute (BASt)

**Colorado’s Road to Resiliency**
Johnny Olson, Horrocks Engineers, and Elizabeth Kemp Herrera, Colorado Department of Transportation

**Flood Resilient Critical Infrastructure: Dutch Policy and The Role of the National Highway Network**
Kees van Muiswinkel, Rijkswaterstaat—Ministry of Infrastructure and Water Management

**3:00 PM–3:30 PM, Great Hall**

**Networking Break**

**3:30 PM–5:00 PM, NAS 120**

**Integrating Resilience in Transportation Planning—Part A (TS008)**

*Resilience touches all aspects of transportation policy, planning, design, finance, operations, and management. In these Part A and B sessions, panelists identify natural and climate mitigation and adaptation strategies that can be mainstreamed into transportation planning programs and projects.*

*Moderator:* Heather Holsinger, Federal Highway Administration

**Transportation Planning, Cultural Resources Management, and Climate Resilience**
January Tavel and Tait Elder, ICF

**Understanding the Coupled Impact of Urbanization and Climate Change on Watershed Planning**
Tom Jacobs, Mid-America Regional Council, and Stacy Hutchinson, Kansas State University

**Implementing a Risk Based Decision Tool in Long Range Transportation Planning in Federal Land Management Agencies in Alaska**
Amit Armstrong, Federal Highway Administration
Transforming Design for Resilience—Part B (TS009)
As Part 2, this session will continue to explore the practical world of design, exploring lessons learned from various organizations who have updated their design approaches to include nature-based solutions, as well as translate climate science into design-level guidance.
Moderator: Josh DeFlorio, Port Authority of New York & New Jersey

Port Decision Makers’ Barriers to Climate and Extreme Weather Adaptation;
Elizabeth L. Mclean, University of Rhode Island
Supporting Stormwater Infrastructure Decisions under Uncertainty through a Spatial and Temporal Analysis of Engineering Standards
Tania Lopez-Cantu, Carnegie Mellon University
Addressing Resilience at Road/River Intersections Using the Geomorphic Approach
Salam Murtada and Kevin Zytkovicz, Minnesota Department of Natural Resources, Ecological and Water Resources

Projections and Downscaling: Developing and Applying Precipitation and Temperature Projections—Part 1 (TS010)
This session will consist of the following:
• Panel and group discussion involving those who generate the projections and the people who actually use them.
• How to deal with uncertainty, including where do you get the projections; how to apply them; and provide examples of building taking into account climate projections.
• Highlight tools and techniques to predict storms, precipitation and flows utilizing climate projections for transportation planning, and risk based asset management.
Moderator: Jeffrey Arnold, U.S. Army Corps of Engineers

Risk Assessment & Resiliency for Design Rainfall
Allison Wood, Huitt-Zollars
Breaking the Mold: Changing the Practice of Processing Climate Projections for Transportation Planning
Rawlings Miller, WSP Inc.
Informing Neighborhood-Scale Decisions: Advances in Climate Impact Downscaling
Thomas Wall, Argonne National Laboratory
NCHRP 15-61: Incorporating Future Climate Projections into the Infrastructure Design Process
Anne Stoner, ATMOS Research & Consulting
Innovative Collaboration for Resilience to Extreme Weather Events (TS011)

This session will focus on the theme of innovative collaborations for climate action and enhanced resilience to climate change and extreme weather events in the transportation sector. Presentations will feature examples of how different agencies, local governments, and other stakeholders are working together across jurisdictional boundaries and multiple sectors and silos to improve collaborative decision-making in ways that better address climate change causes and impacts in transportation.

Moderator: Annie Bennett, Georgetown Climate Center

Innovations from Partnerships in Research and Practice—The Infrastructure & Climate Network (ICNet)

Jennifer Jacobs, University of New Hampshire

Working Towards Resilient Transportation in the Tampa Bay Region

Allison Yeh, Hillsborough County Metropolitan Planning Organization, and Sean Sullivan, Tampa Bay Regional Planning Council

Collaborating for Transportation Resilience and Recovery in the Portland-Vancouver Region

Kim Ellis, Oregon Metro

Collaborative Efforts toward Increased Agency Resiliency

Melissa Savage, American Association of State Highway and Transportation Officials (AASHTO)

Poster Session and Networking Reception

Smart Adaptive Infrastructure for Transportation Sustainability and Resiliency

Xiong (Bill) Yu, Case Western Reserve University

Compound Flood Impacts on Transportation System during Hurricane Irma

Vidya Samadi, University of Southern California

A Strategic Management Framework to Improve Resilience and Adaptivity during Transportation Planning

Yilun Xu, Alliant Engineering, Inc.

Lessons Learned from Testing Vehicular Traffic Signal Assemblies at Hurricane Level Winds

Ionnis Zisis, Florida International University

Spatial Analysis of Environmental Influence on Wet Roadway Crashes

Michael Crimmins, Villanova University

WEQUAL: A Research Project to Support Green Infrastructures

Stefano Rignanese, Maccaferri Inc.

Transportation Fuel Resilience through Diversification in Tampa Bay Florida

Caley Johnson, NREL

Seven Strategies for Climate Resilient Infrastructure

Douglas Mason, Millennium Challenge Corporation
Efficiency and Resilience in Transportation: Quantification and Tradeoffs
Igor Linkov, U.S. Army Corps of Engineers

A Pilot Project under a Transformative Resilience Framework
Anabela Simoes, Lusofona University

A Mechanistic Approach to Quantify Asphalt Pavement Resilience to Flooding
Fan Gu, National Center for Asphalt Technology at Auburn University

Using Coastal Road Failures to Improve Resiliency
Garland Pennison, HDR Engineering

Climate Change and Airport Pavement Design Approaches for Coral Atoll Islands: Experiences from Tuvalu
Asif Faiz, Faiz and Associates, LLC

Resilience Activities and Research Needs in State Departments of Transportation
Sue McNeil, University of Delaware

Dynamic Evacuation Planning Based on Traffic Micro-Simulation Modeling
Mohammad Jalayer, Rowan University

Inventories of Inland Transport Networks and Nodes Vulnerable to Climate Changes in the UNECE Region
Piet de Wildt, Rijkswaterstaat—Ministry of Infrastructure and Water Management

Resilience to Extreme Weather of Transportation Operations, Maintenance, and Emergency Management
Hunter McCracken, Battelle

Collaboration between the Community Collaborative Rain Hail and Snow Network and NM Department of Transportation for Extreme Precipitation Events
Dave DuBois, New Mexico State University

Climate Change and the Challenges of Creating a More Adaptive and Flexible Pavement Engineering Paradigm
Andrew Fried, North Carolina State University

Resilient Recovery Actions in Maritime Transportation; Dredged Hole #86, Atlantic County, New Jersey
Kimberly McKenna, Stockton University Coastal Research Center

Resiliency: A Planning Focus
Steven Humphrey, Muller Engineering Company

Infrastructure Protection Resources
Christina Miskis, SFRPC

Beyond the Weather: Enhancing Mobility with Resilience in Tulsa, Oklahoma
Paulina Baeza, INCOG

Private Sector Best Practices in Resilience Planning
Scott Middleton, EDR Group

Freight Transportation System Resiliency—Employing Strategic Asset Management Methodology in Southeast Texas
Erik Stromberg, Lamar University
Climate Resilient Tunnels Provide for Robust Storm Evacuation Routes
William Bergeson, Federal Highway Administration

Development of Advanced Technology for Slope Maintenance for Climate Change
Oil Kwon, Korea Institute of Civil Engineering and Building Technology

THURSDAY, NOVEMBER 14, 2019

7:00 AM–5:00 PM, Great Hall
Registration Open

7:00 AM–8:30 AM, West Court
Continental Breakfast and Coffee

8:00 AM–9:30 AM, NAS 120
Economic Analysis to Support Resilience—Part A (TS012)
This session explores approaches for evaluating and capitalizing on the economic value of adaptation improvements. Presenters discuss cost-benefit analysis of resilience measures from varying perspectives. A framework for cost-benefit analysis helps departments of transportation compare projects and programs impacted by extreme weather from the perspective of the agencies’ own bottom lines. A case study of a highway in California considers the often-undervalued economic impact of roadway disruptions on businesses and communities. And an asset owner seeks to capture the value of risk reduction benefits to their insurance underwriters
Moderator: Rebecca Lupes, Federal Highway Administration

Reaping the Benefits of Resilient Design to Reduce Property Insurance Premiums
Joshua DeFlorio, Port Authority of New York & New Jersey

Resilience Economics at the Facility and Program Scales
Scott Middleton, EDR Group

NCHRP 20-101: Evaluating the Costs and Benefits of Adaptation
Laurel McGinley, Dewberry

8:00 AM–9:30 AM, NAS 125
Nature-Based Solutions for Coastal Highway Resilience (TS013)
Natural and nature-based features such as wetlands, reefs, beaches, and dunes, can protect roadways from erosion and flooding while offering environmental benefits. Building on work from the US Army Corps of Engineers (USACE) and the National Oceanic and Atmospheric Administration (NOAA), the Federal Highway Administration (FHWA) conducted a research program to develop actionable information for transportation agencies to implement nature-based solutions to protect roadways. This work included a white paper, series of peer exchanges, pilot projects, and an implementation guide.
Moderator: Tina Hodges, Federal Highway Administration

Implementing Nature-Based Solutions for Coastal Highway Resilience
Bret M. Webb, University of South Alabama

Research and Pilot Projects under the USACE Engineering with Nature Initiative
Jeff King, U.S. Army Corps of Engineers
The Ecological Effects of Sea Level Rise  
Trevor Meckley, National Oceanic and Atmospheric Administration

Delaware DOT’s Analysis of Sea Level Rise and Storm Surge Vulnerability of State Route 1  
LaTonya Gilliam, Delaware Department of Transportation

8:00 AM–9:30 AM, NAS Members Room

Geotechnical Aspects in Transportation Resilience (TS014)
This session will include a discussion of:
• Geotechnical considerations in transportation resilience.
• Evaluation and management of weather elements effects on transportation geotechnical hazards (Geohazards) to maintain a resilient transportation system.
• The benefit of using GIS and data bases for the analysis of geohazards risk and development of transportation resilience approaches.
Moderator: Khalid Mohamed, Federal Highway Administration

GIS Model for Landslide Susceptibility Due to High Precipitation Rain Storm  
Hany Hassaballa, GeoDecisions, a division of Gannett Fleming Inc.

Geohazards, Extreme Weather Events and Climate Resilience—the Development of FHWA Guidance  
Brian Zelenko, WSP USA

Case Study: MD 135 Rockfall Investigation and Back Analysis  
Lijun Zhang, Maryland State Highway Administration

Resilience System to Natural Hazards in Norwegian Public Roads Administration (NPRA)  
Martine Holm Frekhaug, Norwegian Public Roads Administration

8:00 AM–9:30 AM, NAS Board Room

Causality and Surrogates: Bridge Vulnerability and Resilience (TS015)
This session focuses on the relationship between changes in precipitation and the vulnerability of bridges to these changes. When examined comprehensively and in detail, this relationship can be simultaneously “compounding” and “confounding”. We will try to step the audience through the scour processes at work and statistical relations between precipitation, flow, velocity, flow depth and ultimately scour. We will look at uncertainties and other concerns such as channel instability, watershed characteristics, and bridge site geometry and how they complicate the picture. We will examine the ways floods are changing in the US and the significance of those changes. Finally, we will run through a project that strives to account for these changes so that bridges due for replacement can be built back in a resilient manner based on sound science.
Moderator: Brian Beucler, Federal Highway Administration

Scour and Extreme Events: Focusing on the Issues  
Joe Krolak, Federal Highway Administration

Impacts of Flood Change on Bridge Scour Reliability  
Chao Huang, Genex Systems
Detection and Attribution of Flood Change across the United States
Stacy Archfield, United States Geological Survey

Development of Site-Specific Hydrologic and Hydraulic Analyses for Assessing Transportation Infrastructure Vulnerability and Risks to Climate Change
Daniel Szekeres, Michael Baker International, and Donna Newell, NTM Engineering, Inc.

9:30 AM–10:30 AM, Kavli Auditorium

ROY W. CRUM DISTINGUISHED SERVICE AWARD
Presentation of the Roy Crum Award to Dr. Sue McNeil, Professor of Civil and Environmental Engineering and Public Policy and Administration, University of Delaware.

TRB is honored to present the Roy W. Crum Distinguished Service Award to Dr. Sue McNeil for her outstanding achievements in research in the areas of infrastructure asset management processes, brownfield redevelopment, and disaster response and preparation. The Roy Crum Award is among the highest presented awards from TRB. It recognizes exceptional achievement in the field of transportation research. It is named in honor of the memory of long-time TRB Executive Director Roy Crum.

PLENARY SESSION
Leading the Way to Great Resilience: Policy-Makers Talk About the Future (PS03)
Proactive adaptation, transformative resilience, and resilient recovery require investment and policy decisions to reduce loss of live, response and recovery costs, and socioeconomic impacts of future disasters. In this plenary session policy makers will highlight strategic and operational plans for improving community and transportation resilience.

Moderator: Vicki Arroyo, Georgetown Climate Center
Andrew Wishnia, Esq., U.S. Senate Committee on Environment and Public Works
Julie Rozenberg, The World Bank
Sue McNeil, University of Delaware
April Marchese, Office of Secretary of Transportation, U.S. Department of Transportation (Invited)

10:30 AM–10:45 PM, Great Hall
Transition Break

10:45 AM–12:15 PM, NAS 120
Economic Analysis to Support Resilience—Part B (TS016)
This second session on economic analysis includes presentations and discussion underpinning the importance of economic analyses. The session starts with views from the Office of the Secretary on U.S. Department of Transportation’s current efforts to understand and incorporate the costs and benefits of resilience into long range planning and disaster recovery, followed with presentations on regionally assessing economic resiliency and making the business case for road and stormwater investments to combat sea level rise. The session ends with a review of economic tools for analyzing transportation projects incorporating resilience.

Moderator: Thomas Bles, Deltares
U.S. DOT’s Tools to Augment Transportation Resilience and Disaster Recover
Alasdair Cain, United States Department of Transportation—Office of the Assistant Secretary for Research and Technology (OST-R)

Bouncing Back: Assessing Regional Economic Resiliency
Frederick Treyz, Regional Economic Models, Inc. (REMI)

Business Case for Road and Stormwater Investments to Combat Sea Level Rise
Cassandra Bhat, ICF

A Review of Economic Tools for Analyzing Transportation Projects Incorporating Resilience
Prerna Singh, Georgia Institute of Technology

10:45 AM–12:15 PM, NAS 125

Pavement Resilience (TS017)
Design and analysis of pavement infrastructure typically include the consideration of environmental conditions. However, conventional design methods rely on the assumption of the stationery climate mainly inferred from the historical data. Nevertheless, the design of resilient and robust pavement infrastructure necessitates additional guidance on how to incorporate the effects of future climate trends and extreme weather events into the design. This session is focused on pavement design methodologies that take into consideration future environmental considerations and potential pavement adaptations targeted towards improved resilience.
Moderator: Milena Rangelov, Federal Highway Administration

Developing Time-Depth-Damage Functions for Flooded Pavements
Jo Sias, University of New Hampshire

Resiliency Enhancement of Pavement Infrastructure to Mitigate Influence of Climate Change
Vivek Tandon, University of Texas, El Paso

Boosting Pavement Resilience
Heather Dylla, Federal Highway Administration

Projected Impact of Climate Change to Asphalt Pavement Performance in the U.S.
Anne Stoner, Texas Tech University Climate Center

10:45 AM–12:15 PM, NAS Members Room

Tools and Methods (TS018)
This moderated panel discussion will explore ways to approach the assessment of climate risk as well as presenting useful tools and methods. The panel will reflect on how these approaches can be used to improve the resilience of transportation assets.
Moderator: Carol Lee Roalkvam, Washington State Department of Transportation, Environmental Services Office

City Simulator: An Innovative Tool for Transformative Resilience in Transportation Systems and Beyond
Steven Bourne, Atkins North America
Climate Risk Assessments for Transportation Assets: Lessons Learned and Recommended Practices
Donavan Jacobsen, Transport Canada

FloodCast—A Federated Data Vision for DOT Flood Resilience
Mathew Mampara, Dewberry

Improving the Resilience to Natural Hazards on Norwegian Public Roads—A Presentation of the RESPONS Project
Martine Holm Frekhaug, The Norwegian Public Roads Administration

10:45 AM–12:15 PM, Board Room
Assessing Increased Coastal Flooding Due to Relative Sea Level Rise—Part B (TS019)

Communities in almost every coastal state are experiencing problems with more frequent, and more severe, road flooding at high tide and during small storms. This increased flooding is due to relative sea level rise and has been called “nuisance flooding,” “sunny-day flooding,” “high-tide flooding,” “storm-tide flooding,” “chronic flooding,” “recurrent flooding,” and “king-tide flooding.”

The four presentations in this session show how this increased flooding due to relative sea level rise should be quantitatively assessed.

Moderator: Scott L. Douglass, South Coast Engineers

Evaluating the Impact of Recurrent Flooding on Road Network Access in a Coastal Locality
Pamela Braff, Virginia Institute of Marine Science / MARISA

Data Predictive Approach to Estimate Nuisance Flooding Impacts on Roadway Networks: A Norfolk, Virginia Case Study
Shraddha Praharaj, University of Virginia

Improved Sea Level Rise Mapping for Climate Vulnerability Assessments
Christopher Dorney, WSP Inc.

Assessment of High Tide Flooding of Coastal Roadways
David Kriebel, United States Naval Academy

2:00 PM–3:30 PM, NAS 120
Managed Retreat—Part A (TS020)

This panel will focus on control of adaptation decisions and the challenges that, in some cases, may prevent managed retreat from being considered. The panel will focus on the law and policy side of the issues, and include a case study discussion that brings to life the policy challenges of having meaningful discussion of retreat.

Moderator: Leah Dundon, Vanderbilt University

Broader Perspective on State and Local Government Actions and Challenges Related to Managed retreat, and GCC’s Forthcoming “Managed Retreat Toolkit”
Katie Spidalieri, Georgetown Climate Center
Managed Retreat and Infrastructure Planning: Long-term Challenges of Coastal Communities from a Policy and Legal Perspective
Thomas Ruppert, Florida Sea Grant Program, University of Florida Extension

Managed Retreat (Part A)—Is it Even An Option?
Jim Pappas, Delaware Department of Transportation

12:15 PM–1:15 PM, West Court
Lunch

1:15 PM–1:50 PM, Kavli Auditorium
FOCUS-POINT SESSION: Managed Retreat—When, Whether and How? (FPS02)
Sea level rise, increased frequency and intensity of flooding, and other extreme weather events have sparked a growing recognition that managed retreat must be among the solutions considered, in some locations, to protect human life, livelihoods, and public and private infrastructure investment. This plenary session will feature immediate input from the audience using smart phone survey software. Together we will create a framework for charting a path forward in this emerging area of resilience that will be of benefit to researchers and practitioners.
Moderator: Mark Abkowitz, Vanderbilt University

1:50 PM–2:00 PM, Great Hall
Transition Break

2:00 PM–3:30 PM, NAS 125
Sharable Lessons from Natural Disasters (TS021)
This session will present lessons learned for incorporating and assessing resiliency for infrastructure from extreme weather events. The presentations will provide case studies and examples for incorporating resiliency into infrastructure design/repair and for integrating/assessing resiliency into project planning/prioritization.
Moderator: Dave Claman, Iowa Department of Transportation

The Historic 2019 Missouri River Flood and Iowa DOT’s Recovery and Resiliency
Dave Claman and Tamara Nicholson, Iowa Department of Transportation

2019 Oklahoma Flooding Resilience Assessment
Rebecca Lupes, Federal Highway Administration

Highway Infrastructure Resilience and Post-Hazard Response—Bridges and Tunnels
Sissy Nikolaou, WSP Inc.

Transportation Service Plan for Disaster Survivors
Eric Plosky, Volpe National Transportation Systems Center; Matt Campbell, Federal Emergency Management Agency; and Jamie Setze, Capital Region Planning Commission
2:00 PM–3:30 PM, NAS Members Room
Communications and Making the Business Case for Resilience (TS022)
This session will include an overarching speaker to set the stage and two or more case studies.
Moderator: Elizabeth Habic, Maryland Department of Transportation

Communicating Climate Projections, Risks, and Uncertainty: Solutions to Key Challenges
Brad Hurley, ICF

Climate Communication Pilot Project
Tracey Frost, California Department of Transportation (Caltrans)

Climate and Community Engagement: A Case Study in Fresno County, California
Annika Ragsdale, WSP Inc.

2:00 PM–3:30 PM, NAS Board Room
Approaches to Addressing Multiple Hazards within a Large Modal Project (TS023)
A transportation system is exposed to multiple hazards. Innovative approaches are emerging that assess system vulnerabilities and develop resilience recommendations to cope with the changing environment. This session will explore these innovative approaches and present project-based examples.
Moderator: Rawlings Miller, WSP Inc.

Quantitative Multi-hazard Risk Assessment for Road Networks
Margreet van Marle, Deltares

Understanding Resilience through the Design and Implementation of Stress Tests for Large-scale Infrastructure Systems
Juan Carlos Lam, WSP Inc. & ETH Zurich

Frank Ricciardi, Weston & Sampson

Flood Resilience for Boston’s Blue Line Subway
Indrani Ghosh, Weston & Sampson

3:30 PM–4:00 PM, Great Hall
Networking Break

4:00 PM–5:30 PM, NAS 120
Integrating Resilience in Transportation Planning—Part B (TS024)
Resilience touches all aspects of transportation policy, planning, design, finance, operations, and management. In these Part A and B sessions, panelists identify natural and climate mitigation and adaptation strategies that can be mainstreamed into transportation planning programs and projects.
Moderator: Tom Jacobs, Mid-America Regional Council
A Resilience Measure for Prioritizing Transportation Network Recovery
Sue McNeil, University of Delaware

Incorporating Resilience into Transportation Planning and Assessment
Sarah Weilant, RAND Corporation

Integrating Natural Hazard Resilience into the Transportation Planning Process
Heather Holsinger, Federal Highway Administration

4:00 PM–5:30 PM, NAS 125
Resilience Initiative for National Transportation Systems (TS025)

Extreme weather and other effects of climate change on transportation system operations and planning can occur in damaging combinations of threats and impacts, as increased hillside precipitation and sediment runoff can follow increased wildland fire incidence and intensity. This session will present for discussion several techniques for characterizing these sorts of cascading events and for incorporating them into transportation planning and operations.

Moderator: Laurie Radow, Chair—TRB Standing Committee on Critical Infrastructure Protection [ABR10]

Transportation in the UK’s Third Climate Change Risk Assessment
David Jaroszweski, University of Birmingham

Using Dutch Highway Network Climate Stress Test Results for Performance Management, Policy Development, Planning Infrastructure and Prioritizing Renovation and Maintenance
Kees van Muiswinkel, Rijkswaterstaat—Ministry of Infrastructure and Water Management

Infrastructure Resiliency: Climate Adaptation Efforts on National Forests System Lands Enhancing Accessibility and Controlling Costs
Joseph Burns, U.S. Forest Service, U.S. Department of Agriculture

Resilience: A DOT Imperative
Deborah Matherly, WSP Inc.

4:00 PM–5:30 PM, NAS Members Room

Projections and Downscaling—Part B
Developing and Applying Precipitation and Temperature Projections, Part 2 (TS026)

This session will consist of the following:
• Panel and group discussion involving those who generate the projections and the people who actually use them.
• How to deal with uncertainty, including where do you get the projections; how to apply them; and provide examples of building taking into account climate projections.
• Highlight tools and techniques to predict storms, precipitation and flows utilizing climate projections for transportation planning, and risk based asset management.

Moderator: Brian Beucler, Federal Highway Administration
Estimating Projected Precipitation for Design of Resilient Infrastructure
Roger Kilgore, Kilgore Consulting and Management

Using Climate Model Data for Resilient Highway Planning and Design: The FHWA CMIP Tool
Rob Kafalenos, Federal Highway Administration

A Process for Efficient, Scientifically-informed Climate Data Downscaling for Large Scale Asset Class Resilience Assessments: The Arizona DOT Approach
Steven Olmsted, Arizona Department of Transportation

Introducing STAR-ESDM: High-Resolution Climate Projections for Impact Analysis
Anne Stoner, Texas Tech University Climate Center

4:00 PM–5:30 PM, NAS Board Room

Managed Retreat and Infrastructure Decision Making—How Are the Hard Decisions Made? (TS027)
This panel will focus on transportation infrastructure in high risk areas and what approaches are used now, and should be used in the future, to evaluate the option of retreat. The panel will discuss case studies of infrastructure retreat/abandonment and how we currently evaluate the costs and benefits of retreat.

Moderator: Robert Graff, Delaware Valley Regional Planning Commission

Retreat: The Case of Louisiana, Terrebone Parish, and Louisiana Strategic Adaptations for Future Environments (LA SAFE)
Mathew Sanders, Louisiana Office of Community Development

Managed Retreat and Infrastructure Decision-making
Stacy Curry, Woodbridge, New Jersey Police Department

The Case of California Coastal Communities: Moving Portions of Highway
Tracey Frost, California Department of Transportation (Caltrans)

FRIDAY, NOVEMBER 15, 2019

7:00 AM, Great Hall

Registration Open

7:00 AM–8:30 AM, West Court

Continental Breakfast and Coffee

8:30 AM–10:00 AM, NAS 120

Technical Solutions for Resilience (TS028)
Resilience transportation networks require technical solutions that go beyond traditional practice by using existing tools in novel manners and creating new methods and tools to handle new challenges. In many cases, such as low volume roads or increasing flood risks across a region, it is difficult to justify major infrastructure investments. In this session, a range of technical approaches will be discussed that focus on understanding and increasing the capacity of those systems. The focus is on practical applications that have been demonstrated to be effectively used by state departments of transportation.

Moderator: Jennifer Jacobs, University of New Hampshire
Building Climate Resilience into Low-Volume Roads
Gordon Rex Keller, Geness Geotechnical and Matt Lauffer North Carolina Department of Transportation

Increased Highway Resilience: Using Culvert Diffusers to Decrease Hydraulic Losses and Increase Capacity
Alexander W. Mann, Maine Department of Transportation

Application of 1D/2D Hydraulic Modeling for Investigation Utilizing North Carolina Department of Transportation Infrastructure to Improve Flood Resiliency
Johnny Martin, Moffatt & Nichol

8:30 AM–10:00 AM, NAS 125
Cascading Events (TS029)
Hazards are like our infrastructure, interconnected. Flooding leads to secondary effects of erosion, contaminated water, mold, clogged storm drains, downed power lines, etc. Cascading and connected events can impact local, state, regional, national, and international supply chains. The goal of this session is demonstrate methods to simulate risk in disasters and extenuate potential cascading and connected hazards.

Moderator: Jeffrey Arnold, U.S. Army Corps of Engineers

Framework for Incorporating Complex Uncertainty Systems under Post-Disaster Cascading Infrastructure
Yanfeng Ouyang, University of Illinois at Urbana-Champaign

Mesoscopic Modeling of Major Disruption Scenario in Austin, Texas to Estimate Benefits from Integrated Corridor Management
Matthew Miller, Texas A&M University

Regional-scale Simulations of Earthquake Impacts Considering Multiple Fidelity Modeling Approaches
Matt Schoettler, University of California, Berkeley

8:30 AM–10:00 AM, NAS Members Room
Advancing Resilience at National, State, Regional and Local Levels (TS030)
Panel and group discussion on a prioritization tool for transportation assets, lessons learned in indicator based vulnerability assessments, addressing climate change impacts on U.S. Forest Service Transportation assets, and approaches adopted in the Netherlands to assess the resilience of the Dutch highway network to natural hazards.

Moderator: Tracey Frost, California Department of Transportation (Caltrans)

Transportation Asset Criticality Prioritization Tool for New York State
Alaurah Moss, Dewberry

The U.S. Forest Service Transportation Resiliency Guidebook: Addressing Climate Change Impacts on U.S. Forest Service Transportation Assets
Benjamin Rasmussen, Volpe National Transportation Systems Center
Best Practices and Lessons Learned in Indicator-Based Vulnerability Assessments for Transportation
Cassandra Bhat, ICF

Stress Testing the Dutch National Highway Network
Thomas Bles, Deltares

8:30 AM–10:00 AM, NAS Board Room
Recovery for More Resilient Roads (TS031)
The best preparedness plan is a good recovery plan. Panelists discuss practical approaches to managing transportation systems to return to safe operations following a disruption caused by a disaster.
Moderator: William “Bill” Anderson, Transportation Research Board

Using Delay from a Travel Demand Model to Determine the Best Post-Disaster Bridge Repair Schedule
Mehrnaz Doustmohammadi, University of Alabama

Asphalt Pavement Resiliency: Findings of the 2019 NCAT Workshop
Benjamin Bowers, Auburn University

A Post-Disaster Decision Framework for Selection of Bridge Rehabilitation for Disrupted Transportation Networks
Eric Merschman, University of Alabama

Road Resilience at the World Road Association (PIARC)
Jürgen Krieger, Federal Highway Research Institute (BASt)

10:00 AM–10:15 AM, Great Hall
Transition Break

10:15 AM–11:15 AM, NAS Kavli Auditorium
FOCUS-POINT SESSION: Lessons Learned from Post-Disaster Response (FPS03)
Field perspectives from post-disaster recovery such as New Orleans (Katrina), New York (Sandy), Houston (Harvey), and Puerto Rico (Maria), including representatives from local and state agencies involved in specific locations.
Moderator: Anne Choate, ICF
Jane K. Brogan, Chief Policy & Research Officer, Governor’s Office of Storm Recovery (NY)
Drew Ratcliff, Regional Disaster Recovery Manager, Capital Region Planning Commission (LA)
Herby G. Lissade, P.E., Office of Maintenance Technical and Field support, California Department of Transportation (CALTRANS)
11:15 AM – 12:15 PM, Kavli Auditorium

**FOCUS-POINT SESSION: Science and Data Update (FPS04)**

This panel session will provide discussion of the current and planned immediate future for climate science and observational data which can be used for transportation resilience planning and operations. Panel members will include both data and modeling scientists as well as transportation practitioners who will present short descriptions of relevant new science products and transportation applications, and will answer questions from each other and the audience.

**Moderator:** Jeffrey Arnold, Climate Preparedness and Resilience Programs, U.S. Army Corps of Engineers
Ana Bucher, The World Bank
Stacey Archfield, United States Geological Survey
Karuna Pujara, Maryland Department of Transportation.

12:15 PM–1:45 PM, West Court

**CLOSING PLENARY AND WORKING LUNCH: Collecting Your Thoughts**

We want to hear from you. During this working lunch we ask that you talk with your lunch table partners: What did you hear that was new or challenging? Were you inspired by anyone? What are your ideas and needs that TRB, AASHTO, or FHWA may initiate as a future action?

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**PARKING FOR MEETING PARTICIPANTS**

**NAS Building**

Limited parking is available for meeting participants in the visitors parking area of the NAS building. Parking is provided on a first-come basis, and overflow is directed to public parking garages.

The public parking facilities closest to the NAS Building are Colonial Parking (20th Street, NW, between E and F Streets) and Columbia Plaza (23rd and Virginia Avenue, NW).
NAS FLOOR PLAN

1st FLOOR
The table below shows the professional development hours (PDH) that can be earned for the continuing education activities included in the Transportation Research Board Technical Sessions and Events at the Sixth International Conference on Women’s Issues in Transportation on the Insights, Inclusion, and Impact: Framing the Future of Women in Transportation, Irvine, California, September, 10-13, 2019.

Dr. Ann M. Brach
Director, Technical Activities

Transportation Resilience 2019

**Description:** The Transportation Resilience 2019: 2nd International Conference on Transportation System Resilience to Natural Hazards and Extreme Weather Events will provide transportation professionals with information on emerging best practices and state of the art research results on how to adapt surface transportation networks to the potential impacts of natural disasters and extreme weather events. The conference will examine efforts to integrate resilience in all aspects of the transportation sector, including planning and programming, capital improvements, and operations and maintenance. The conference will promote international dialogue on research, implementation, and lessons learned on this important topic, with benefits that are expected to extend beyond the transportation sector. The conference will build on the content from the 1st International Transportation Resilience Conference held in September 2015 and the Transportation RISE conference in October 2018.

**Learning Objectives:**
By the end of the conference, attendees will have:

- Greater Awareness and Understanding of state-of-the-practice information on incorporating resilience strategies into system performance activities
- Vetted Resources and Data for measureable progress and performance of transportation resilience strategies and approaches
- Identified Solutions in planning and design to advance sustainable and resilient transportation systems
- Latest Policies and Standards to advance transportation resilience to natural hazards impacts
- Exchanged Ideas with Peers from the private sector and every level of government

The Professional Development Hours (PDH) Tracking Sheet of eligible sessions and events is on the reverse side of this page.

William B. Anderson
Senior Program Officer, Transportation Research Board

Name __________________________________________ Date ________________

Signature _______________________________________________
### Professional Development Hours (PDH) Tracking Sheet

**Wednesday, November 13, 2019**

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Duration</th>
<th>PDHs</th>
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<tbody>
<tr>
<td>Welcome Remarks and Opening Plenary Session – Prioritizing Resilience as State DOTs – Progress and Challenges (PS01 &amp; PS02)</td>
<td>8:30 a.m. – 10:00 a.m.</td>
<td>1.5 hours</td>
<td>1.5 PDHs</td>
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<tr>
<td>Technical Sessions – Period One</td>
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<tr>
<td>Integrating Transportation Resilience into Asset Management (TS001)</td>
<td>10:15 a.m. – 11:45 a.m.</td>
<td>1.5 hours</td>
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<td>Regional and Multi-Sectoral Approaches to Resilience (TS002)</td>
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<td>Bridges and Culverts – Assessment of Resilience for Planning (TS003)</td>
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<td>Focus-Point Session: State of Play of Proactive Adaptation (FPS01)</td>
<td>12:45 p.m. – 1:20 p.m.</td>
<td>0.5 hours</td>
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<td>Frameworks and Methods to Address Coastal Resilience - Part A (TS004)</td>
<td>1:30 p.m. – 3:00 p.m.</td>
<td>1.5 hours</td>
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<td>Transforming Design for Resilience - Part A (TS005)</td>
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<td>Approaches to Addressing Multiple Hazards within a Larger Multimodal Program (TS006)</td>
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<td>Integrating Resilience in Transportation Planning - Part A (TS008)</td>
<td>3:30 p.m. – 5:00 p.m.</td>
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<td>Transforming Design for Resilience - Part B (TS009)</td>
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<td>Projections and Downscaling – Part A (TS010)</td>
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<td>Innovative Collaboration for Resilience to Extreme Weather Events (TS011)</td>
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<td>Focus-Point Session: Managed Retreat – When, Whether and How? (FPS02)</td>
<td>1:15 p.m. – 1:30 p.m.</td>
<td>0.5 hours</td>
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<tr>
<td>Managed Retreat (Part A) – Is it Even an Option? (TS020)</td>
<td>2:00 p.m. – 3:30 p.m.</td>
<td>1.5 hours</td>
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<td>Sharable Lessons from Natural Disasters (TS021)</td>
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<td>Communications and Making the Business Case for Resilience (TS022)</td>
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<tr>
<td>Plenary Session: Leading the Way to Great Resilience: Policy-Makers Talk About the Future (PS03)</td>
<td>9:45 a.m. – 10:30 a.m.</td>
<td>0.75 hours</td>
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<td>Technical Sessions – Period Five</td>
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<td>Economic Analysis to Support Resilience – Part B (TS016)</td>
<td>8:00 a.m. – 9:30 a.m.</td>
<td>1.5 hours</td>
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<td>Pavements Resilience (TS017)</td>
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<td>Geotechnical Aspects in Transportation Resilience (TS014)</td>
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<td>Causality and Surrogates: Bridge Vulnerability and Resilience (TS015)</td>
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<td>Integrating Resilience in Transportation Planning - Part B (TS024)</td>
<td>4:00 p.m. – 5:30 p.m.</td>
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<td>Resilience Initiative for National Transportation Systems (TS025)</td>
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<tr>
<td>Plenary Session: Science and Data Update (FPS04)</td>
<td>10:15 a.m. – 11:15 a.m.</td>
<td>1 hours</td>
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<td>Focus-Point Session: Lessons Learned from Post-Disaster Response (FPS03)</td>
<td>8:30 a.m. – 10:00 a.m.</td>
<td>1.5 hours</td>
<td>1.5 PDHs</td>
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<td>Closing Plenary and Working Lunch: Collecting Your Thoughts</td>
<td>12:15 p.m. – 1:45 p.m.</td>
<td>1.5 hours</td>
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**Total hours:**

**Thursday, November 14, 2019**

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<td>Economic Analysis to Support Resilience – Part A (TS012)</td>
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<td>Nature-Based Solutions for Coastal Highway Resilience (TS013)</td>
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<td>Tools and Methods (TS018)</td>
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<td>Assessing Increased Coastal Flooding Due to Relative Sea Level Rise - Part B (TS019)</td>
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**Friday, September 13, 2019**

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<td>Technical Sessions – Period Eight</td>
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<td>Technical Solutions for Resilience (TS028)</td>
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<td>Advancing Resilience at National, State, Regional and Local Levels (TS030)</td>
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<td>Recovery for More Resilient Roads (TS031)</td>
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**Total hours:**
SAVE THE DATE: NATIONAL CONFERENCE ON TRANSPORTATION ASSET MANAGEMENT
JULY 11-14, 2020
BOSTON, MA

VISIT OUR WEBSITE: https://trb.secure-platform.com/a/page/2020AssetManagement

The 13th National Conference on Transportation Asset Management (TAM) provides an opportunity for all practitioners involved in their agency’s asset management initiative to build core competencies and generate new ideas.

- Looking for both practical and innovative presentations.
- Selected abstracts will be featured in either poster or technical podium sessions.
- Presenters will be required to register and attend the conference to be included in the final program.

Presentation tracks and crosscutting issues:

- Track 1: Implementation
- Track 2: Data Governance/Tools
- Track 3: Managing Risk
- Track 4: Partners and Peers
- Track 5: Sustaining Asset Management in your Organization
- Crosscutting Issue 1: Transit
- Crosscutting Issue 2: Resilience
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