

## NATURAL HAZARD RISK REDUCTION: BUILDING THE RESILIENCE BUSINESS CASE – ASCE-NOAA ANNUAL WORKSHOP 2025 BRIEF

### Enhancing Infrastructure Resilience: Basis of ASCE-NOAA Relationship

The American Society of Civil Engineers (ASCE) is advancing the identification of the needs for climate and weather information as it works to incorporate the best-available science into the next generation of civil engineering codes, standards, and manuals of practice (MOPs). In turn, the National Oceanic and Atmospheric Administration (NOAA) is identifying capabilities for meeting these needs over both the near and long term. The [formal collaboration](#) between ASCE, as the world's largest civil engineering professional society, and NOAA, as the Nation's largest provider of weather and climate information, will advance understanding within engineering

practice for the design and construction of climate-resilient infrastructure, especially during the development and updating of ASCE standards and MOPs. Incorporating future climate and weather conditions into design decisions can help to reduce the long-term costs of building, maintaining, and repairing infrastructure and can lessen the impact of weather- and climate-related disasters.

### Areas for Continued Collaboration:

- Promoting efforts to characterize, probabilistically, weather- and climate-related hazards in terms of intensity and rate as they relate to civil engineering design and maintenance practices,
- Examining the economic impact of natural hazard-related disasters and the economic benefits of proactive risk reduction,
- Exploring the role of risk reduction technologies as a means of limiting economic losses and the role of civil engineering practice in risk reduction,
- Identifying opportunities and barriers to harness market forces to reduce natural hazard losses and promote resilient infrastructure,
- Promoting public and private partnerships to characterize and reduce risk, and align policy (including standards and building codes), and investment in the built environment at the asset, local, state, and national levels.

### Overview of the 2025 Annual Workshop

The third annual ASCE-NOAA workshop featured sessions and discussions on the direct impacts of weather and climate hazards on communities, with a focus on information needs and benefits of resilient design and construction. As weather and climate hazards increase and become more complex, and as federal policy continues to evolve, the need for both local and national collaboration is growing. Speakers from the insurance and finance industry, science and engineering fields, and local communities came together to discuss risks, recent research, and the costs and benefits of community adoption of hazard-based building codes. Specifically, the workshop goals were to advance the business case for resilient design and construction and to promote information flow from hazard data to engineering practice. The recording is available at: <https://youtu.be/t9Ga1ARDL7U>.

## Workshop Session Summaries

### ***Importance of Infrastructure Investment for Local, State and National Economies***

ASCE's Infrastructure Report Card highlights the economic costs to American households of aging U.S. infrastructure and the need to bridge the gap in infrastructure funding. Panelists discussed the economic benefits of natural hazard risk business incentives to adopt resilient building practices, including strong and well-enforced building standards and codes. Examples were presented from municipal and state-wide practice to address climate risks such as extreme heat and increased flooding. The recording is available at: <https://youtu.be/v69aHAFDTgY>.

### ***Losses from Natural Hazard-Related Disasters***

Losses from natural hazards are growing in the United States and globally, as shown by insurance industry data and NOAA's Billion Dollar Disasters database. Panelists explored the changing drivers of these losses, including the emergence of convective-storm related hazards. Panelists also noted the need for authoritative weather and climate data for risk assessment. Topics covered included engineering-based solutions for risk management, the importance of timeframe and beneficiaries of incentives, and the resilience incentives included in the next version of green building certifications. The recording is available at: <https://youtu.be/MjMOi2eMtoE>.

### ***Financial Risks and Economic Drivers***

Stakeholders in commercial real estate included developers, lenders, owners and investors, and insurers, each with their own set of risks and incentives. The panelists discussed how the specific financial risks that their firms and sectors face can catalyze investment in natural hazard resilience, exploring drivers of investment decisions such as market rent, length of ownership, business interruption avoidance, the cost versus benefits of specific resilience investments. The potential benefits to investors and lenders of tools to assess natural hazard risk at the individual property level, including the new American Society for Testing and Materials (ASTM) standard for property resilience assessments, were also discussed. The recording is available at: <https://youtu.be/CcBM9BbsBJk>.

### ***Products and Services for Risk Preparedness***

NOAA's Industry Proving Ground (IPG), a co-development project with members of the architecture and engineering, insurance and reinsurance, and retail sectors, presented walk-throughs of three new or improved weather and climate data products nearing release: the enhanced Storm Events Database (featuring additional datasets and a modernized interface), the new Events Footprints Catalog (which will provide spatial mapping layers of extreme events), and the improved Wind Climatology product. The panel also discussed the importance of publicly available data from NOAA, USGS, and others to inform cat (catastrophe) models used by the reinsurance sector. The recording is available at: <https://youtu.be/fR6TDP9prYE>.

### ***Dollars and Cents (Sense) of Natural Disaster Reduction***

The 2024 U.S. Chamber of Commerce study "The Preparedness Payoff" found that for every dollar invested in natural hazard mitigation and preparedness, there is a return of \$6 in direct damage reduction and \$7 in broader economic benefits. Panelists discussed the role of environmental data and engineering solutions in delivering return on investment (ROI), including areas with high ROI for lifelines (power,

water, waste management, etc.) and community resilience strategies. The panelists also considered communication strategies to bring greater awareness of economic benefits to various decision makers. The recording is available at: <https://youtu.be/SCPeiMmx5Ss>.

### ***Evolution of Building Codes and Standards: Putting Knowledge into Practice***

ASCE standards and their adoption into building codes play a significant role in natural hazard risk reduction. Panelists presented examples of performance-based seismic design (West Coast) and interim guidelines from building departments in municipalities (New York City) as options to move resilient design methods into practice at a faster pace. The discussion also served to emphasize how projections from federal partners, including NOAA, NIST, USGS, and FEMA, are being used in developing forward-looking building design standards. The recording is available at: <https://youtu.be/DxnUwZ-Y23g>.

### ***Resilience Case Studies: Real World Implementations and Proof of Concept***

This session presented various examples of resilient infrastructure performance metrics and a discussion of where engineering can best contribute to resilience efforts. Examples included “resilience curves” that conceptualize and quantify resilience, USACE’s “Prepare, Absorb, Recover, Adapt” (PARA) resilience framework, a wildland urban interface model (SWUIFT) that examines wildfire impacts on communities, including their lifelines, and the development of a detailed resilience scoring tool for highway engineering. The recording is available at: <https://youtu.be/VZZ1bJh0FXk>.

### ***Methods and Tools to Support Financial Decisions for Resilience***

The panelists explored the challenge of how to communicate the “resilience dividend” to stakeholders and bring benefit calculations into investment decisions. Barriers include lack of quantification of benefits, lengthy code adoption cycles, lack of holistic thinking among engineers and a disconnect in the bond market between who pays and who benefits from infrastructure investments. The panel discussion also focused on potential solutions, including innovative tools to quantify and optimize resilient investments, learning from asset management plans and disaster pre-and post-event planning, and strengthening communication across disciplines and through university curriculum requirements that advance knowledge of the next generation of practitioners. The recording is available at: <https://youtu.be/KMKSLwFaS6A>.

### ***Products and Services for Architecture and Engineering***

Nonstationarity in weather and climate and associated changes in the frequency and intensity of extreme events demands up-to-date and forward-looking products for risk assessment and engineering design that are not just useful, but actually used. Panelists focused on areas where NOAA’s products, science, and services are of relevance to civil engineering, including NOAA’s capabilities for high-resolution global modeling from seasonal predictions to 100-year projections, work at NOAA Laboratories on modernizing Probable Maximum Precipitation with close involvement with the dam safety community, and an engineer’s recent experience with simplified access to NOAA’s high-resolution Multi-Radar Multi-Sensor (MRMS) precipitation grids to study infrastructure failures. In addition, the challenge of differing perspectives of scientists and engineers when updating standards for future conditions were explored. The recording is available at: <https://youtu.be/8ZcpfIN8nDM>.

## ***Working Together for Resilient Infrastructure Development***

The ASCE-NOAA Task Force has facilitated efforts to identify critical user needs and promote the use of science-based hazard data in engineering standards. Participants in this session emphasized the growing economic impacts of climate-related events and the value of investing in resilient infrastructure. Clear communication of the social and financial benefits of investments in building, retrofitting, and operating infrastructure to increase resilience to weather and climate impacts remains essential, along with quantitative tools that help decision-makers justify resilient designs. The panel noted the importance of developing business cases that reflect future climate conditions and the need for policy mechanisms and partnerships—such as with real estate, insurance, and financial sectors—to align incentives.

Discussions underscored the need to integrate perspectives from additional professional societies and standards bodies, including those in transportation and building design. Better understanding is needed on how engineering practice can increase resilience, how different sectors make decisions over varying time horizons, and how to shape incentives that encourage forward-looking design. Participants called for continued collaboration and federal support to equip leaders with the knowledge and resources to advance climate resilience through infrastructure planning. The recording is available at: <https://youtu.be/g0SC5j9ryTk>.

### **Suggestions for ASCE-NOAA Task Force and Interested Partners**

Enhancing resilience in infrastructure requires measurable, economically grounded approaches that move beyond traditional risk frameworks. One recommendation for the ASCE-NOAA Task Force and associated stakeholders is to develop and adopt clear definitions and metrics for resilience that are consistent across sectors. Quantifying resilience through indicators (such as time to recovery, loss of functionality, and service reliability) enables informed decision-making, investment prioritization, and transparent evaluation of outcomes. Integrating these metrics into existing engineering practices can support benefit-cost analyses that account for system performance over time rather than focusing solely on failure probabilities.

Stakeholders were also encouraged to promote the alignment of resilience objectives with infrastructure funding mechanisms, insurance frameworks, and policy instruments. Establishing resilience-based design guidelines and encouraging the use of climate-informed decision analysis will help practitioners and agencies incorporate future conditions into project planning. Coordination among federal agencies, professional societies, and the private sector is critical to advance shared understanding and consistent application of these principles. Ultimately, building a forward-looking and performance-based approach to infrastructure resilience will strengthen national preparedness and support long-term benefits to the public and environment. The recording is available at: <https://youtu.be/t1AJ1n7kcsQ>.

**Disclaimer:** This is the third in a series of documents prepared by individuals from the ASCE, NOAA, and University of Maryland (UMD) Center for Technology and Systems Management (CTSM) as part of a partnership to integrate climate science into civil engineering codes, standards, and MOPs. Any statements expressed in this report are those of the individual authors and do not necessarily represent the views of ASCE, NOAA, UMD, and other employers, which take no responsibility for any statement made herein. No reference made in this publication to any specific method, product, process, or service constitutes or implies an endorsement, recommendation, or warranty thereof by these entities. The materials are for general information only and do not represent a standard of ASCE, nor are they intended as a reference in purchase specifications, contracts, regulations, statutes, or any other legal

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**The ASCE-NOAA Task Force on Climate Resilience in Engineering Practice (ASCE-NOAA Task Force):** The ASCE-NOAA Task Force's vision is to integrate the best available science of weather and climate into the next generation of ASCE codes, standards, and manuals of practice. To date, standards have assumed stationarity; that is, a static and unchanging climate. Extreme events have implications for the built environment of today and tomorrow. The goal of the NOAA partnership with the ASCE is an increase in the pace of climate adaptation and a reduction in design, construction, and maintenance costs, as well as the costs of climate and weather-related disasters. The ASCE-NOAA Task Force's co-chairs are Bilal Ayyub, PhD, F. ASCE, University of Maryland Center for Technology and Systems Management, Amanda McCarty, NOAA, Climate Ready Nation Director, and Dan Walker, PhD, A.M. ASCE, University of Maryland and EA Engineering, Science, and Technology, Inc. (PBC). For more information, visit <https://www.asce.org/communities/institutes-and-technical-groups/sustainability/asce-noaa-taskforce>.

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The ASCE-NOAA Task Force appreciates the panelists who contributed their expertise and insights: Willy Accame, Kevin Aswegan, Elizabeth Beardsley, Jeff Bray, Chuck Chaitovitz, Mabel Chedid, Mary Clare Maxwell, Maggie Coates, Allison Crimmins, Tom Delworth, Ron Eguchi, Negar Elhami-Khorasani, Natalie Enclade, David Frost, Louis Gritzo, Daniel Kaniewski, Maria Lehman, Abbie Liel, Kelly Mahoney, Sissy Nikolaou, Darren Olson, Jia-Dzwan (Jerry) Shen, Constadino (Gus) Sirakis, Terry Smith, Kristina Swallow, Will Veatch, Jim Waller, and Erik Zuker. Some of the workshop attendees are photographed below. The appendix has the workshop program for more information.

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The poster features a night-time cityscape background with illuminated buildings and a highway. A green diagonal banner across the middle contains the text: "ASCE-NOAA WORKSHOP" in large green letters, "Hazard Risk Reduction:" in white, and "Building the Resilience Business Case" in white. Below this, a green banner contains the date "JUNE 2025" and the two-day period "24-25". To the right, the address "ASCE Headquarters 1801 Alexander Bell Drive Reston, VA 20191" is listed. The bottom section contains two columns of text: "This two-day workshop features sessions and discussions on the direct impacts of weather hazards on communities, as well as on national and regional security. As weather hazards increase and become more complex, and as federal policy continues to evolve, the need for both local and national collaboration is growing." and "Speakers from the insurance/finance industry, science and engineering fields, and local communities, will come together to discuss risks, recent research and the costs/benefits of community adoption of hazard-based building codes." Logos for ASCE, University of Maryland, NOAA, AEI, CSS, and Riverside are at the bottom.

**ASCE-NOAA WORKSHOP**

**Hazard Risk Reduction:**  
Building the Resilience Business Case

**JUNE 2025**  
**24-25**

ASCE Headquarters  
1801 Alexander Bell  
Drive Reston, VA 20191

This two-day workshop features sessions and discussions on the direct impacts of weather hazards on communities, as well as on national and regional security. As weather hazards increase and become more complex, and as federal policy continues to evolve, the need for both local and national collaboration is growing.

Speakers from the insurance/finance industry, science and engineering fields, and local communities, will come together to discuss risks, recent research and the costs/benefits of community adoption of hazard-based building codes.

**ASCE**  
AMERICAN SOCIETY OF CIVIL ENGINEERS

**UNIVERSITY OF MARYLAND**

**NOAA**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
U.S. DEPARTMENT OF COMMERCE

**AEI**

**CSS**

**RIVERSIDE**



# ASCE-NOAA WORKSHOP

## Hazard Risk Reduction: Building the Resilience Business Case

Agenda/Session Themes		Speaker(s)
<b>DAY 1</b>	<b>8:30 AM</b>   Registration & Networking	
	<b>9:00 AM</b>   Welcome & Introductions	Bilal Ayyub, UMD Tom Smith, ASCE
	<b>9:15 AM</b>   Opening Remarks & Facilitated Discussion	Feniosky Pena-Mora, ASCE
	<b>10:00 AM</b>   Overview of Workshop Goals Building on ASCE-NOAA Task Force Efforts	Amanda McCarty, NOAA Daniel Walker, EA Engineering & UMD
	<b>10:30 AM</b>   Networking Break	
<b>1a</b>	<b>11:00 AM</b>   Importance of Infrastructure Investment for Local, State, and National Economies Moderator: Maria Lehman, ASCE	Darren Olson, ASCE Committee on America's Infrastructure Kristina Swallow, ASCE & City of Tucson, AZ Natalie Enclade, BuildStrong America
<b>1b</b>	<b>11:45 AM</b>   Losses from Natural Hazard Related Disasters Moderator: David Easterling	Louis A. Gritzo, FM Global Elizabeth Beardsley, USGBC
	<b>12:30 PM</b>   Networking Luncheon	
	<b>1:15 PM</b>   Group Photo	
<b>2a</b>	<b>1:30 PM</b>   Financial Risks and Economic Drivers Moderator: Holly Neber, AEI Consultants	Willy Accame, Hamilton Development Mary Clare Maxwell, Northern Trust Bank Jeff Bray, Prologis
<b>2b</b>	<b>2:15 PM</b>   Products and Services for Risk Preparedness Moderator: Ellen Mecray	Allison Crimmins, NOAA, IPG Maggie Coates, Cadmus Jim Waller, Guy Carp
<b>3a</b>	<b>3:15 PM</b>   Dollars and Cents (Sense) of Natural Disaster Reduction Moderator: David Butry, NIST	Chuck Chaitowitz, Chamber of Commerce Daniel Kaniewski, Marsh McLennan Ron Eguchi, ImageCat
<b>3b</b>	<b>4:00 PM</b>   Evolution of Building Codes and Standards (Putting Knowledge into Practice) Moderator: Jennifer Coupil, ASCE	Kevin Aswegan, Magnusson Klemencic Constadino Sirakis, NYC Department of Building

# ASCE-NOAA WORKSHOP

## Hazard Risk Reduction: Building the Resilience Business Case

### Agenda/Session Themes

### Speaker(s)

**DAY 2**

**8:30 AM** | Networking & Registration

**9:00 AM** | Welcome to Day 2

**4a**

**9:15 AM** | Resilience Case Studies: Real World Implementations and Proof of Concept  
Moderator: Alice Hill, CFR

David Frost, GEER/Georgia Tech  
Will Veatch, USACE  
Negar Elhami-Khorasani, University at Buffalo  
Mabel Chedid, WSP

**4b**

**10:30 AM** | Methods & Tools to Support Financial Decisions For Resilience  
Moderator: Chris Clavin, NIST

Maria Lehman, GHD/ASCE  
Jia-Dzwan "Jerry" Shen, FHWA  
Sissy Nikolaou, NIST  
Terry Smith, Smith's Research & Gratings

**11:45 AM** | Networking Luncheon

**4c**

**12:30 PM** | Products and Services for Architecture and Engineering  
Moderator: Maria Honeycutt, AtkinsRéalis

Tom Delworth, NOAA, GFDL  
Kelly Mahoney, NOAA, PSL  
Abbie Liel, University of Colorado, Boulder

**5**

**1:30 PM** | Synthesis - Working Together for Resilient Infrastructure Development  
Moderators: Norma Jean Mattei, University of New Orleans

ASCE-NOAA Task Force Co-chairs:  
Bilal Ayyub, UMD  
Amanda McCarty, NOAA  
Dan Walker, EA Engineering & UMD

**2:30 PM** | Key Takeaways

Bilal Ayyub, UMD

**3:00 PM** | Workshop Adjourns

**Virtual Attendance Link:**

<https://asce-org.zoom.us/j/82666047850>

**Full Online Program**

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