

FINAL PROGRAM

**ASCE**  
FORENSIC  
ENGINEERING

# 9th FORENSIC ENGINEERING CONGRESS

Denver, Colorado | November 4–7, 2022

Elevating Forensic Engineering



PROFESSIONAL  
★ EARN UP TO  
**21**  
★ DEVELOPMENT HOURS



Hilton Denver City Center

[www.forensiccongress.org](http://www.forensiccongress.org)





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## Schedule-at-a-Glance

*(Subject to Change)*

### Friday, November 4

- 7:00 a.m. – 6:00 p.m. Registration
- 8:00 a.m. – 5:00 p.m. Short Courses
- 5:30 p.m. – 7:00 p.m. Welcome Reception at the Brown Palace Hotel

### Saturday, November 5

- 7:00 a.m. – 6:00 p.m. Registration
- 7:30 a.m. – 8:30 a.m. Continental Breakfast
- 8:30 a.m. – 10:00 a.m. Opening Plenary Session
- 10:00 a.m. – 10:30 a.m. Networking Break
- 10:30 a.m. – 12:00 p.m. Concurrent Technical Sessions
- 12:00 p.m. – 2:00 p.m. Lunch and Committee Meetings
- 2:00 p.m. – 3:00 p.m. Concurrent Technical Sessions
- 3:00 p.m. – 3:30 p.m. Networking Break
- 3:30 p.m. – 5:00 p.m. Concurrent Technical Sessions
- 5:30 p.m. – 7:30 p.m. Reception

### Sunday, November 6

- 7:00 a.m. – 5:00 p.m. Registration
- 7:30 a.m. – 8:30 a.m. Continental Breakfast
- 8:30 a.m. – 10:00 a.m. Plenary Session
- 10:00 a.m. – 10:30 a.m. Networking Break
- 10:30 a.m. – 12:00 p.m. Concurrent Technical Sessions
- 12:00 p.m. – 1:30 p.m. Awards Luncheon
- 1:30 p.m. – 3:00 p.m. Concurrent Technical Sessions
- 3:00 p.m. – 3:30 p.m. Networking Break
- 3:30 p.m. – 5:00 p.m. Concurrent Technical Sessions

### Monday, November 7

- 7:00 a.m. – 10:00 a.m. Registration
- 7:30 a.m. – 8:30 a.m. Continental Breakfast
- 8:30 a.m. – 10:00 a.m. Concurrent Technical Sessions
- 10:00 a.m. – 10:30 a.m. Networking Break
- 10:30 a.m. – 11:40 a.m. Concurrent Technical Sessions
- 11:40 a.m. – 1:30 p.m. Lunch and Closing Plenary Session
- 2:00 p.m. – 4:00 p.m. FED ExCom and Chairs Fall Meeting

## Organizing Committee Members

### Forensic Engineering Division Executive Committee Chair

Stewart M. Verhulst, P.E., M.ASCE, Vice President and Executive Technical Director, Nelson Forensics

### Forensics Congress Steering Committee

#### Congress Chair

Carmen Mulea, P.E., M.ASCE, Principal, Engineered Building Solutions, Inc.

### Congress Steering Committee

Ronald W. Anthony, Aff.M.ASCE, Principal, Anthony & Associates Inc.

Hossein Ataei, Ph.D., P.E., P.Eng, F.ASCE, Civil Engineering Faculty and Director of Construction Engineering and Management Program, University of Illinois at Chicago

Paul A. Bosela Jr., P.E., LEED AP, Forensic Engineer, Bosela Forensic Engineering Consultants, LLC

Tara Cavalline, Ph.D., M.ASCE, Associate Professor, UNC Charlotte

Alicia E. Diaz de Leon, P.E., R.A., S.E., M.ASCE, Principal, Drerup Building Performance Engineering, PLLC

Stephen Andrew Dlugos, P.E., M.ASCE, Principal, Thomas Downey, LTD

Michael J. Drerup, P.E., F.ASCE, Principal Engineer, Drerup Building Performance Engineering, PLLC

Anthony M. Dolhon, P.E., M.ASCE, Principal, Dolhon Forensics

Travis Gregory Ebisch, P.E., M.ASCE, Project Director, Nelson Forensics, LLC

Joshua B. Kardon, Ph.D., P.E., F.ASCE, Principal, Joshua B. Kardon and Co.

Michael P. Lester, P.E., M.ASCE, Principal, Element Analytical, PLLC

Rui Liu, Ph.D., P.E., M.ASCE, Associate Professor, Kent State University

Navid Nastar, Ph.D., P.E., S.E., F.ASCE, Principal, Brandow & Nastar, Inc

M. Kevin Parfitt, P.E., F. AEI, M. ASCE, Department of Architectural Engineering, The Pennsylvania State University

Kevin L. Rens, Ph.D., P.E., M.ASCE, Chair and Professor, Civil Engineering, University of Colorado Denver

Ziad Mohammad Salameh, P.E., M.ASCE, Principal, ZS, LLC

Maria Mirian Velay-Lizancos, Ph.D., A.M.ASCE, Assistant Professor, Lyles School of Civil Engineering, Purdue University

Wael A. Zatar, M.ASCE, Dean and Professor of Civil Engineering, Marshall University

### ASCE Staff

Kelly Frere, Senior Manager, Contracts & Event Services

Lindsay O'Leary, Director, Technical Advancement

Jay Snyder, Senior Manager, Technical Advancement

Sean Scully, Senior Manager, Senior Manager, Media and Event Sales

Abigail Zarfoss, Exhibit Services Coordinator, Conference & Event Services



## On behalf of the technical and organizing committees, it is my pleasure to welcome you to Denver, Colorado for the 9th Forensic Engineering Congress.

Organized by ASCE's Forensic Engineering Division (FED), the Congress brings together practicing engineers, academics, and forensic experts from various disciplines to share their knowledge and experience. After a one-year postponement due to the Covid-19 pandemic, this Congress is a long-awaited, in-person opportunity to network, build relationships, share information, and learn from others. Our focus for the 9th Congress is Elevating Forensic Engineering through Collaboration. To that end, we are pleased to have participation from committees within the Forensic Engineering Division as well as other divisions of ASCE, and we look forward to participation from individuals with diverse expertise and varied career paths. It is through these collaborations, that the Forensic Engineering Division continuously strives to disseminate information on failures and their causes, develop practices to reduce failures, provide guidelines for conducting failure investigations, and provide guidance on the professional practice of forensic engineering, in an ongoing effort to elevate forensic engineering.

The program includes:

- 34 technical sessions and 3 moderated panel discussions, in five parallel tracks
- The keynote address by Ashraf Habibullah, the founder, President, and CEO of Computers and Structures, Inc., a globally recognized leader in the development of software tools for structural and earthquake engineering
- A plenary session and concurrent technical session presented by various members of the CROSS (Confidential Reporting for Structural Safety) international community
- A plenary session on ASCE's Infrastructure Report Card
- Three preconference short courses on the following topics:
  - Guidelines for Failure Investigations, Volume 2
  - Resources for Practitioners to Reduce Claims
  - Machine Learning and Emerging Technologies for Forensic Engineering
- FED Committee meetings which all registrants are welcome and encouraged to attend
- Dedicated networking events
- Presentation of Forensic Engineering Awards
- An opportunity to earn Professional Development Hours (PDHs)

25 years after the first Forensic Engineering Congress, we look forward to continuing the tradition of another successful Congress. We are grateful to our sponsors, participants, and the many volunteers who helped make this Congress possible.

Again, welcome to Denver!

**Carmen C. Mulea, P.E., M.ASCE**  
Congress Chair  
Engineered Building Solutions, Inc., Upper Marlboro, Maryland

## Proceedings of the 9th Forensic Engineering Congress

As an exclusive benefit for conference registrants, eligible attendees can claim the complete collection of proceedings papers through ASCE Library for 60 days, beginning the day the conference opens. Once you have claimed the proceedings, you can access the papers whenever you want.

**Go to: <https://ascelibrary.org/forensic22-token> for full instructions**



# Short Courses & Congress Agenda

## Friday, November 4

### Guidelines for Failure Investigations, Volume 2

8:00 a.m. – 12:00 p.m., [Penrose 2](#)

**PDHs: 4**

**Instructors:** **Randall P. Bernhardt, P.E., S.E., F.SEI, F.ASCE;** **Richard S. Barrow, P.E., S.I.;** **Chase Anderson, P.E., M.ASCE**

“Guidelines for Failure Investigation” Volume 1, written by the Committee on Forensic Investigation of the Forensic Engineering Division, American Society of Civil Engineers, provides an overview of the planning, analysis, and reporting components of a successful civil engineering failure investigation. This workshop will address the content in Volume 2 of the “Guidelines” which is currently being written. Volume 2 will provide guidance for conducting a forensic investigation based upon the type of construction materials or structures involved in the failure. This workshop will provide a description of unique material properties, construction and fabrication techniques, common failure modes, means of deterioration, inspection techniques and laboratory tests for common construction materials. Additionally, the workshop will address building envelopes and construction practices as they relate to failure investigations.

### Resources for Practitioners to Reduce Claims

1:00 p.m. – 5:00 p.m., [Penrose 2](#)

**PDHs: 4**

**Instructors:** **Ronald Anthony**, President, Anthony & Associates; **Daniel Becker**, President, DBecker Consulting, LLC; **Daniel Harpstead**, Senior Vice President, Kleinfelder; **James Robert Harris**, Principal, J.R. Harris & Company

This workshop will involve participants in discussions for reducing the frequency of claims through education and managing those claims that do occur through the claims resolution process. Organized by the ASCE Committee on Claims Reduction and Management (CCRM), case studies of claims against engineers on several subjects, including examples of retaining walls, expansive soils, thermal break connectors for concrete slabs, stormwater detention products, corrosion and other forms of deterioration of structural materials, bracing for temporary construction loads, excessive deflections, and differential volume changes, will be used to illustrate the lessons and to generate participation among the workshop attendees. Cryptically, it is less costly for the practicing engineer to learn from the mistakes of others than to learn by making the same mistake on their own. Recent activities of CCRM, such as the Agreement Basics guide will be included in the discussion.

### Machine Learning and Emerging Technologies for Forensic Engineering

8:00 a.m. – 5:00 p.m., [Penrose 1](#)

**PDHs: 8**

**Instructors:** **Rui Liu, Ph.D, P.E., M.ASCE**, Kent State University; **Mirian Velay-Lizancos, Ph.D., M.ASCE**, Purdue University; **Glenn Katz, M.ASCE**, Stanford University; **Nina Anani-Manyo**, Ballinger; **Pengkun Liu**, Carnegie Mellon University

Machine learning, deep learning, and other emerging technologies, e.g., virtual reality (VR), augmented reality (AR), and mixed reality (MR), have been reported to boost architects, engineers, construction managers, and builders’ decision-making capacities. For example, artificial intelligence systems, i.e., computer vision algorithms, have been developed to analyze drone images taken after earthquakes or hurricanes to evaluate damages and identify critical areas quickly. Inspection images could be processed to detect defects in civil infrastructure. Natural disasters could be simulated and experienced in a virtual environment. Mixed realities have the potentials to enable inspectors to “visualize” hidden construction components. The workshop offers an opportunity for participants to learn fundamental concepts of machine learning, deep learning, mixed reality, and their potential applications in forensic engineering. Workshop participants are expected to receive hands-on training on coding with algorithms of machine learning and deep learning to process various data, including material properties tested in the lab, and inspection images. The workshop will engage participants to discuss the impacts on the future practices of forensic engineering and how to be prepared for the potentially dramatic changes. The one-day short course is composed of three parts:

1. Machine learning and deep learning for forensic engineering (4 hrs.)
2. VR, AR and MR for forensic engineering (2.5 hrs.)
3. Discussions on future practices of forensic engineering driven by emerging technologies (1.5 hrs.)

### Learning Outcomes

- Fundamentals of machine learning, deep learning, and artificial intelligence
- Hand-on coding using Tensorflow to build a convolutional neural network for image processing
- Understanding of VR, AR, and MR technologies
- Learning the workflow to deploy virtual models onto VR, AR and/or MR devices
- Interpreting impacts of emerging technologies on future practices of forensic engineering

### Welcome Reception

5:30 – 7:00 p.m., [Brown Palace Hotel](#)

What a terrific way to kick off the Congress! Enjoy hors d’oeuvres, meet old and new colleagues, and make plans to enjoy the nightlife that Denver has to offer.

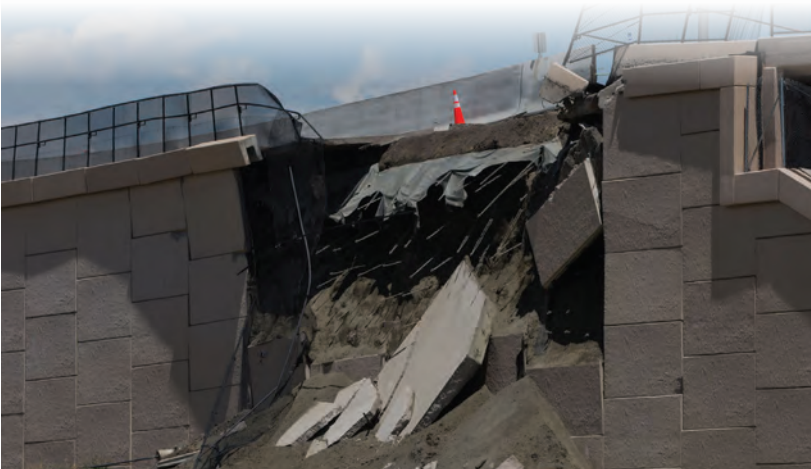
**Sponsored by University of Colorado, Denver**

## Saturday, November 5

### Continental Breakfast

7:30 – 8:30 a.m., [Colorado Pre-Function](#)

**Sponsored by Dolhon Forensics**



## Opening Plenary Session

8:30 – 10:00 a.m., *Colorado E-F*

## Keynote Address

**Ashraf Habibullah**, President and CEO of Computers and Structures, Inc.

Ashraf Habibullah founded CSI in 1975. Today, CSI is recognized globally as the pioneering leader in the development of software tools for structural and earthquake engineering. The software is used by thousands of engineering firms in over 160 countries for the design of landmark projects such as the Freedom Tower in New York City, the Burj Khalifa Tower in Dubai and the Bird's Nest Stadium in Beijing. Today the skyline of every major modern city in the world is defined by structures that have been designed using CSI software.

## Morning Networking Break

10:00 – 10:30 a.m., *Colorado Pre-Function*

## Technical Sessions

10:30 a.m. – 12:00 p.m.. | See page 6 for a list of presentations and rooms.

## Networking Lunch

12:00 – 2:00 p.m., *Colorado E-F*

**Sponsored by Simpson, Gumpertz & Heger Inc.**

## Technical Sessions

2:00 – 3:00 p.m. | See page 6 for a list of presentations and rooms.

## Afternoon Networking Break

3:00 – 3:30 p.m., *Colorado Pre-Function*

## Technical Sessions

3:30 – 5:00 p.m.. | See page 7 for a list of presentations and rooms.

## Reception

5:30 – 7:30 p.m., *Colorado Pre-Function*

**Sponsored by CSI**

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## Sunday, November 6

### Continental Breakfast

7:30 – 8:30 a.m., *Colorado Pre-Function*

**Sponsored by Applied Building Sciences**

### Plenary Session

8:30 – 10:00 a.m., *Colorado E-F*

### Confidential Reporting on Structural Safety (CROSS) PDHs: 1.5

CROSS helps to make structures safer for the public and those who build and operate them. They do this by publishing safety information based on the confidential reports received and information in the public domain. There will be two sessions at the congress reviewing the work and ambitions of CROSS.

**Moderator: Glenn Bell**

## Topics & Speakers:

**The Formation, Development, and Future of CROSS:** *Alastair Soane*  
**Enhanced and Expanded CROSS:** *Paul McNulty, Paul Livesey*  
**Development of CROSS in Australasia:** *Michael W. Fordyce, Peter Ho*  
**Development of CROSS in the United States:** *Andrew W. Herrmann*

## Morning Networking Break

10:00 – 10:30 a.m., *Colorado Pre-Function*

## Technical Sessions

10:30 a.m. – 12:00 p.m.. | See page 7 for a list of presentations and rooms.

## Awards Luncheon

12:00 – 1:30 p.m., *Colorado E-F*

**Sponsored by Envista Forensics**

## Technical Sessions

1:30 – 3:00 p.m. | See page 8 for a list of presentations and rooms.

## Afternoon Networking Break

3:00 – 3:30 p.m., *Colorado Pre-Function*

## Technical Sessions

3:30 – 5:00 p.m. | See page 8 for a list of presentations and rooms.

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## Monday, November 7

### Continental Breakfast

7:30 – 8:30 a.m., *Colorado Pre-Function*

**Sponsored by ZS LLC**

### Technical Sessions

8:30 a.m. – 10:00 a.m. . | See page 9 for a list of presentations and rooms.

### Morning Networking Break

10:00 – 10:30 a.m., *Colorado Pre-Function*

### Technical Sessions

10:30 a.m. – 11:40 a.m. | See page 9 for a list of presentations and rooms.

### Lunch and Closing Plenary

11:40 a.m. – 1:30 p.m., *Colorado E-F*

### Anna Denecke, ASCE

Anna Denecke is the Director of Infrastructure Initiatives at the American Society of Civil Engineers (ASCE). In that role she oversees ASCE's Infrastructure Report Card program, including the development of national and state grades. She also produces reports that examine best practices in infrastructure policy and the impacts of underinvestment in our roads, bridges, airports and more.

**Thank you to our Anchor Sponsor  
Computers & Structures, Inc.**



# Technical Program

## Saturday November 5

Track A:   Columbia G-H	Track B:   Columbia I-J	Track C:   Columbia A-B	Track D:   Columbia C	Track E:   Columbia D
<b>Natural Disasters and Extreme Conditions</b> <i>Track Chair: Mike Drerup</i>	<b>Building Enclosures and Technologies for Forensic Investigation</b> <i>Track Chair: Alicia Diaz de Leon</i>	<b>Professional Practice in Forensic Engineering and Analysis, Design, Repairs, and Remediation</b> <i>Track Chair: Anthony M. Dolhon</i>	<b>Construction Performance and Safety and Infrastructure Performance</b> <i>Track Chair: Mike Lester</i>	<b>Forensic Engineering Education and Material Performance</b> <i>Track Chair: Carmen Mulea</i>
10:30 a.m. – 12:00 p.m. <b>Concurrent Technical Sessions, PDHs 1.5</b>				
<b>Water and Hurricane Damages</b> <i>Moderator: Ziad Salameh</i>	<b>Hail and Ice Damming</b> <i>Moderator: Paul Bosela Jr.</i>	<b>Care, Responsibilities and Ethics</b> <i>Moderator: Anthony M. Dolhon</i>	<b>Construction Inspection and Monitoring</b> <i>Moderator: Juan Carlos Araiza</i>	<b>Learning From Failure Case Studies</b> <i>Moderator: Casey K. Hemmatyar</i>
<p><b>Impact of 2021 Western European Flooding on Geo-Structures</b>, Elliot Nichols, Anne Lemnitzer, Nina Stark, Michael Gardner, Jeremias Mueller</p> <p><b>Determining Water Damage from Storm-Created Openings after Hurricane Florence</b>, Richard Vose, Cliff D. Bishop, David Peraza</p> <p><b>Analysis of Damage Patterns from Hurricane Michael</b>, Steven Klepac, John Cleary</p> <p><b>Forensic Investigations into the Performance of Large-Volume, Low-Rise Buildings Affected by Hurricane Michael (2018)</b>, Justin D. Marshall, David B. Roueche, Jeffrey W. Berman, Jonathan Roberts, Charner Blue</p>	<p><b>Dating Hail: Investigation and Determination of the Date of Occurrence of Hail Impact Damage</b>, Stewart Verhulst, J. Daniel Bosley, Justin Donaldson</p> <p><b>Benefits of Evaluating Interply Bitumen in Bituminous Roofing Membrane Samples in Assessments of Hail Impact Distress</b>, Justin Donaldson, Marco DeLeon, Garrett Simpson</p> <p><b>Assessing Hail Damage to Concrete Tile Shingles, an Analytical Method and a Case Study</b>, Nathan P. Mayercsik, Paul J. Bennett</p> <p><b>Water Intrusion Ice Damming Assessments</b>, Lokman "Luke" M. Sharara, James W. Jordan</p>	<p><b>Defining Structural Collapse</b>, Kip Gatto, Richard Dethlefs, Patrick Staron, Zeno Martin</p> <p><b>Why Care About the Standard of Care?</b> Joshua B. Kardon</p> <p><b>Responsibilities of The Testifying Expert</b>, John Nelson, Daniel D. Overton, Erik J. Nelson</p> <p><b>The Fine Line Between Ethical and Unethical: Ten Strategies for Making Ethical Decisions</b>, Terence Kadlec, Donna Friis, Frank S. Griffin Jr.</p>	<p><b>Failure Reduction Through Construction Inspections</b>, Richard S. Barrow</p> <p><b>Monitoring Strategies for Construction and Operation of Facilities</b>, Ilias Ortega</p> <p><b>Case studies of Construction Vibration Monitoring and Evaluation Through Soil-Structure Interaction</b>, Antonio De Luca, Zhi Zhang, Reyhaneh, Liling Cao</p> <p><b>Remote Ground and Building Vibration Monitoring of a Multi-Family Residential Complex During Neighboring Construction Activities</b>, R. "Bobby" Funcik</p>	<p><b>Failure Case Studies of Concrete Structures</b>, Tara L. Cavalline, Rui Liu, Laura Sullivan-Green, Phil Hailes, Norbert J. Delatte, Kenneth L. Carper, Paul Bosela Sr., Kevin Rens, Simon Adamtey, Jonathan G.M. Wood</p> <p><b>A Practical Application of Code of Ethics in Failure Case Studies</b>, Rui Liu, Hossein Ataei, Kevin Rens, Tara L. Cavalline, Phil Hailes, Laura Sullivan-Green, Paul Bosela Sr., Norb Delatte, Jacelyn Rice-Boayue, Simon Adamtey, Lameck Onsarigo</p> <p><b>Manufactured Metal Building Roof Collapse: What Actually Happened?</b> John Cocca, Conrad Paulson, Hannah Rakowski</p> <p><b>Identifying Procedural Non-Compliance and Latent Causes of Repeated Machinery Failures</b>, Phil Hailes</p>
2:00 p.m. – 3:00 p.m. <b>Concurrent Technical Sessions, PDHs 1.0</b>				
<b>Fire</b> <i>Moderator: Ron Anthony</i>	<b>Foundation</b> <i>Moderator: Jim Harris</i>	<b>Assessment and Responsibility</b> <i>Moderator: Ben Cornelius</i>	<b>Panel Discussion</b> <i>Moderator: John C. Wylie</i>	<b>Academic and Industry Education Profiles</b> <i>Moderator: Kevin Parfitt</i>
<p><b>Technical and Code Aspects of Investigation of Fire Impact on Buildings and their Occupants</b>, Ali Ashrafi, Jenny Sideri, Luciana Balsamo</p> <p><b>Challenges of Repairing Wildfire Damaged</b>, Hillside Structures in California, C. Can Simsir, Anurag Jain, Mohammad Moravej, Behnam Arya</p> <p><b>Methodology for Assessing the Thermal Effects of a Wildfire on a Structure</b>, Kyle T. Wieghaus, Stanley C. Stoll</p>	<p><b>Foundation Damage Assessments and Structural Repairs</b>, Stanley C. Stoll, Samuel R. Henning, Aaron D. Bagley, Kyle T. Wieghaus</p> <p><b>On the Move: Case Studies of Expansive Soils and Foundation Movement</b>, Amanda K. Ramirez, Amanda R. Nogay</p> <p><b>Evaluation Methods for Localized Differential Foundation Movement in Post-Tensioned Concrete Foundations</b>, Ryan Kalina, Kerry S. Lee</p>	<p><b>Listening to the Structure – Signs of Impending Collapse</b>, Norb Delatte</p> <p><b>Assessing the Root Cause of Observed Distress</b>, Charles Hammond, Al Bustamante</p> <p><b>Differing Site Conditions: Who is Responsible for the Risks of Additional Costs?</b> Ibrahim Osman, Hossein Ataei, Abolfazl Seyrfar</p>	<p><b>Preconstruction Surveys of Adjoining Structures – Development of Practice Guidelines</b>, John C. Wylie and Committee on Forensic Investigation</p>	<p><b>Failure Prediction, Testing and Retrofit of Open Web Steel Joists in an Undergraduate Curriculum</b>, David W. Dinehart</p> <p><b>Applications of Acoustic Technologies: A Multidisciplinary Forensic Engineering Freshman Project</b>, David W. Dinehart, Sridhar Santhanam, Yimin D. Zhang</p> <p><b>Cracking the Code for Wind Distress at Tile Roofs, A Regional Assessment</b>, Todd E. Jorgenson, Bart B. Barrett</p>



## Saturday November 5 *(continued)*

Track A:   Columbia G-H	Track B:   Columbia I-J	Track C:   Columbia A-B	Track D:   Columbia C	Track E:   Columbia D
3:30 p.m. – 5:00 p.m. <b>Concurrent Technical Sessions, PDHs 1.5</b>				
<b>Panel Discussion</b> <b>Moderator: Jason Gregorie</b>	<b>Performance and Evaluation</b> <b>Moderator: Stewart Verhulst</b>	<b>Professional Practice Considerations</b> <b>Moderator: Leonard Morse-Fortier</b>	<b>Adjacent Construction</b> <b>Moderator: Dave Peraza</b>	<b>Concrete</b> <b>Moderator: Travis Ebisch</b>
<b>Investigation of Constructed Facilities: Sampling Methodologies</b> , Juan Carlos Araiza, Benjamin Cornelius, Jason Gregorie, Roberto Marte, Weijin Wang	<b>Performance of Building Envelope Systems in South Florida: Case Studies</b> , Antonio De Luca, Lauren Millman, Matthew Olender, Khushroo Daruwalla <b>Evaluation of Existing Buildings for Feasibility of Photovoltaic Array Installation</b> , Sebastian B. Mendes, Jonathan C. Ellowitz, Han Xu <b>Deflecting Issues</b> , Ryan A. Grabow <b>Analysis and Testing of Reset Finned Windows</b> , Paul J. Bennett, Richard W. Vose	<b>Forensic Engineering and the Standard of Care</b> , Dale Statler, Steven Altstadt, Jerry Maly, Andrew Stam <b>“Willful and Wanton” Conduct Opinion Testimony By Forensic Engineering Experts</b> , Serena L. Hendon <b>10 Tips for Mining Fact Witness Deposition Transcripts in Forensic Investigations</b> , Anthony M. Dolhon, Juliana Held, Keighly Butler <b>Why You Should Not Tell an Owner that “All Concrete Cracks,”</b> Charles Hammond	<b>Soil Settlement and Water Damage due to Adjacent Pile Installations</b> , Ibrahim Erdem <b>Risk Factors During Underpinning of Historic Structures</b> , Jenna R. Halpern, James W. Feuerborn Jr., Jason Wu <b>A Tale of Two Clients: Case Studies in Adjacent Construction Risk Management</b> , David E. Kosnik, Dennis M. McCann <b>Why Did these Historic Masonry Buildings Fail?</b> Nabi Goudarzi, Yasser Korany	<b>Which Shear Test for Bonded Concrete?</b> James M. Summers, Fredrick R. Rutz <b>Structural Performance of Concrete Corners Reinforced with Different Steel Reinforced Details Under Static Loading</b> , Fouad T. Al Rikabi, Husam Hussein, Issam Khoury, Waleed Hamid, Ali Abdulmohsin khamees <b>Behavior of Internally Cured Concrete Under Severe Conditions</b> , Waleed Hamid, Eric P. Steinberg, Issam Khoury, Kenneth Walsh, Safiya Ahmed, Fouad Al Rikabi <b>Aluminum Interaction with Cementitious Materials in a Coastal Environment</b> , Lauren Millman, Chase Anderson, Antonio De Luca

## Sunday November 6

10:30 a.m. – 12:00 p.m., <b>Concurrent Technical Sessions, PDHs 1.5</b>				
<b>Cross Session</b> <b>Moderator: Andrew Herrmann</b>	<b>Facades</b> <b>Moderator: Alicia Diaz de Leon</b>	<b>Legal, Risk and Resolution</b> <b>Moderator: Sakshi Singh</b>	<b>Temporary Bracing and Loading</b> <b>Moderator: Wael Zatar</b>	<b>Durability</b> <b>Moderator: Tara Cavalline</b>
<b>The Decade of Disaster</b> <b>Glenn R. Bell</b> <b>Structural Safety and Failure Case Studies in Germany</b> , Robert Hertle, Thomas Hertle <b>Confidential Reporting for Fire Safety</b> , Neil Gibbins <b>The Need for Fire Safety Performance-Based Design in an Increasingly Prescriptive Environment</b> , Nathan B. Wittasek <b>CROSS Influence on Codes and Standards of Practice</b> , James R. Harris	<b>Exposing Exposed Concrete – Design, Construction and Maintenance Considerations for Success</b> , Erin Regan, Sean O’Brien <b>Hidden from View: Investigating Masonry Veneer Anchorage</b> , Stewart J. Verhulst, J. Daniel Bosley, Alan Pettingale <b>Masonry Veneer Investigation in Transitional Construction Restoration</b> , Michel D. Thompson, Julia E. Mathias Manglitz, Vance Kelley <b>Reviving a Historic Landmark: Assessment and Monitoring of “Detroit’s Largest Art Object,” the Iconic Fisher Building</b> , Ziad Salameh	<b>Beyond Silo Failures: Legal Implications and Lessons Learned</b> , Jesus Chavez Sagarnaga, John W. Carson <b>Bulkhead Failure During Construction – A Builder’s Risk Dispute</b> , Dennis M. McCann, David P. Drengenberg <b>Learning from Design-Build Busts: Thoughts on Risk Mitigation for the Design-Build Arena</b> , Thanh Do, David Ojala <b>Optimizing the More Effective Dispute Techniques in the Contract Phase to Find the Best Dispute Resolution</b> , Paola Provenzano, Giuseppe Iddas	<b>Philadelphia Building Collapse During Demolition</b> , David B. Peraza <b>Silo Discharge Design and Construction Influences on Wall Pressures</b> , Daniel A. Wojnowski Sr., Liling Cao, Meeok Kim <b>Long-Span Wood Trusses-Temporary Bracing and the Requirements to Prevent Catastrophic Collapse under Construction</b> , David A. VanDerostyne <b>Bearing Capacity Failure of an Excavated Footing Prior to Building Moving Operations</b> , Bryan P. Strohman, Zachary T. Chabot	<b>Concrete Distress Resulting from Embedded Waterstop</b> , James Triano, Terrence Paret, F. Dirk Heidbrink <b>ASR-Related Distress in Floor Finishes</b> , Terry McGovern, Todd Nelson, Xiaoqiang Hou <b>Investigation of Alkali Silica Reaction Induced Blowups in an Airfield Runway Pavement</b> , Benjamin F. Birch <b>Duration of Exposure (Part 3): Plumbing and Construction Materials</b> , Nolan Wells, Donald Nehrig, Ralph E. Moon

# Technical Program *(continued)*

## Sunday November 6 *(continued)*

Track A:   Columbia G-H	Track B:   Columbia I-J	Track C:   Columbia A-B	Track D:   Columbia C	Track E:   Columbia D
1:30 p.m. – 3:00 p.m. <b>Concurrent Technical Sessions, PDHs 1.5</b>				
<b>Wind</b> <b>Moderator: Mike Drerup</b>	<b>Roofing and Drainage</b> <b>Moderator: Randy Bernhardt</b>	<b>Wood Trusses and Beams</b> <b>Moderator: Robert Gunter</b>	<b>Foundation and Slope Failure</b> <b>Moderator: Paul Bosela Sr.</b>	<b>Panel Discussion</b> <b>Moderator: Joshua B. Kardon</b>
<b>Load Paths in Fabric Membrane Structures Informed by Failure Analysis and Monitoring of an In-Service Structure</b> , David B. Roueche, Justin D. Marshall, John W. Stiles, Dan T. Jackson, Brian Anderson, James S. Davidson  <b>Wind-Induced Failures of Flexible Structures</b> , Sumanth Cheruku  <b>Assessment of wind-induced damages to pedestrian bridges due to Hurricane Maria</b> , Gustavo E. Pacheco-Crosetti, Hector J. Cruzado  <b>Impact of Non-Synoptic Winds on Building Components</b> , Anurag Jain, C. Can Simsir, Behnam Arya, Mohammadtaghi Moravej	<b>The Rain Must Drain: An Engineering Perspective on a Common Pitfall of Overlay Reroofing</b> , Travis Ebisch, Ryan Chancey  <b>The Unforeseen Impact of Building Modifications to a Roofing Assembly</b> , Kevin Dunham, Michael Schulz  <b>Foreseeable Failure: Roof Collapses and Roof Drainage Deficiencies</b> , Stewart M. Verhulst, Travis G. Ebisch  <b>Evaluation of Single Ply Roofing Blisters - How Big is Too Big?</b> J. Eric Peterson, Patricia M. Aguirre, Byoung-Jun Lee	<b>Hanging Load Failures in Wood Beams</b> , Jeffrey Hunt, Aaron Freidenberg  <b>Metal Plate Connection Failures in Wood Trusses Lessons Learned from Damage Investigations</b> , Paul Parfitt, Josh Jaskowiak, Zeno Martin  <b>Wood Bowstring Trusses Evaluating Distress through Structural Analysis</b> , Gloriana A. Martinez, Alexander D. Stephani, Filippo Masetti  <b>Permanent Bracing for Wood Trusses: Why a Building in Snow Country Cannot Survive Without It</b> , Alice Roache, Theresa Ahlborn	<b>Evaluation of Shoring Wall Failure, Irving, Texas</b> , Erik J. Nelson  <b>Drilled Pier Failure Investigations</b> , Frank S. Griffin Jr., Donna Friis, Terence D. Kadlec  <b>Analyses of Slope Failure and Development of a Reclamation Plan, Pikeview Quarry, Colorado Springs, Colorado</b> , Daniel D. Overton, Robert Schaut, Denise Garcia, John D. Nelson  <b>Analyses of Slope Failures Resulting During and After Construction of a Natural Gas Pipeline, South Eastern, Ohio</b> , Jason S. Andrews, Denise Garcia, Erik J. Nelson	<b>Standard of Care</b> , Joshua B. Kardon, Sean Hanlon, William McConnell, Patrick Casey, Ed Fronapfel
3:30 p.m. – 5:00 p.m. <b>Concurrent Technical Sessions, PDHs 1.5</b>				
<b>Wind Damages</b> <b>Moderator: Wes Jordan</b>	<b>New Technologies</b> <b>Moderator: Jason Gregorie</b>	<b>Investigation and Repair</b> <b>Moderator: Chantell J. Cornett</b>	<b>Parking and Storage Facilities</b> <b>Moderator: Nate Smith</b>	<b>Panel Discussion</b> <b>Moderator: Debi Denny</b>
<b>Case Study Evaluation of Farm and Commercial Grain Bins During the August 2020 Iowa, Derecho Windstorm</b> , Christine E. Wittich, Ben Praeuner  <b>Performance of Exterior Sliding Glass Doors Subjected to Extreme Wind Pressures</b> , Behnam Arya, Mohammad Maravedi, C. Can Simsir, Anurag Jain  <b>2020 Tennessee-Arkansas Tornado Outbreak Structural Assessments</b> , Lokman "Luke" M. Sharara, Kurt A. Bergman  <b>A Textbook Case: Wind Failure of an Insulated Tank on Alaska's North Slope and Review of Recent Changes to ASCE 7</b> , David R. Ojala, Jason Andrew	<b>A Critical Assessment of Unmanned Aerial System Usage and Data Analysis in Forensic Assessment</b> , Melissa S. Beauregard, Nathan P. Mayercsik, Randall A. Pietersen  <b>Computer Vision and Forensic Investigation</b> , Nina Anani-Manyo, Rui Liu  <b>Use of Unmanned Aerial Vehicles for Inspection of Bridges and Viaducts in Northeast Brazil</b> , Renan Gustavo Pacheco Soares, Romilde Almeida de Oliveira, Arnaldo Manoel Pereira Carneiro  <b>Using Models in Forensic Engineering – All Models are Wrong, but Some are Useful</b> , Norb Delatte	<b>Mitigating Wood-Framed Egress Stair Stringer Failures</b> , Scott D. Coffman, Joseph D. Gaskin  <b>Evaluation of Screw Connections in Aluminum Members</b> , Edward R. Stimpson, Nathaniel B. Smith, Scott N. Bondi  <b>Investigation and Methodology Approach – Forensic Study of Deteriorating Fin Fan Columns</b> , Justin C. Salgado, Nicholas Triandafilou  <b>Investigation and Repair of a Leaking Travertine-Faced Precast Concrete Façade</b> , Carmen C. Mulea	<b>Typical Parking Structure Problems, Repairs, and Cost Assessment</b> , Ravi Mullapudi  <b>Service Life Prediction of Concrete Parking Structures: Case Studies</b> , Antonio De Luca, Zhi Zhang, Liling Cao  <b>Steel Framed Parking Structures - 40 Years of Figuring Out What Went Wrong and How to Avoid It</b> , Andrea E. Shear, Andrew Osborn, George Taylor  <b>Seepage Investigation at a Tailings Storage Facility in San Luis Potosí, Mexico – Case Study No 1 of Rationalizing the Unusual and Unexpected</b> , John O. Ejezie	<b>Sustainability and Resilience Roundtable Discussion Committee on Sustainability Committee on Adaptation to a Changing Climate Infrastructure Resilience Division</b>



## Monday November 7

Track A:   Columbia G-H	Track B:   Columbia I-J	Track C:   Columbia A-B	Track D:   Columbia C
8:30 a.m. – 10:00 a.m. <b>Concurrent Technical Sessions, PDHs 1.5</b>			
<b>Earthquake, Impact and Data Collection</b> <b>Moderator: Chase Anderson</b>	<b>Case Studies</b> <b>Moderator: John Wylie</b>	<b>Concrete and Materials</b> <b>Moderator: Chad Williams</b>	<b>Case Study Assessments</b> <b>Moderator: Mike Lester</b>
<b>Database of damages caused by earthquakes in Puebla City</b> , Cristhian Rivera Valdez, Hugo Ferrer-Toledo, Norb Delatte  <b>Investigation of Damage to School Buildings from Induced Earthquakes</b> , C. Can Simsir, Behnam Arya, Mohammad Moravej, Anurag Jain  <b>Evaluation of Structural and Consequential Damage Resulting from Vehicle Impacts to Residential Structures</b> , Aaron J. Trenshaw, James N. Pyatt  <b>Data Collection in Incidents in Dense Urban Areas</b> , Dan Eschenasy	<b>Cloud-Based GIS Mapping Software as an Evaluation Tool for Condition Assessments</b> , R. Michael Cousins, Austin Doezema, Alice Roache, Mark R. Muszynski  <b>Analysis of Local News Articles in Digital (Virtual) Reconnaissance of Buildings and Other Structures after Natural Hazards</b> , Arman Mousavi, Christine E. Wittich  <b>BIM and Building Emergency Response Management: Review of Applications</b> , Abolfazl Seyrfar, Ibrahim Osman, Hossein Ataei	<b>Evaluation and Repair of Existing Post Tensioned Concrete Slab Without Original Construction Drawings</b> , Byoung-Jun Lee, Gerald A. Dalrymple  <b>Concrete Damage Attributable to the Oxidation of Pyrrhotite</b> , Leonard J. Morse-Fortier  <b>Structural Evaluation of Coconut (Coir) Fiber Reinforced Gypsum Plaster Dome</b> , Akshay Beniwal, Byoung-Jun Lee, Jodi Knorowski, Rex Cyphers  <b>Fungal Ecology: Application in a Forensic Water Loss Assessment</b> , Jeremy D. Beagle	<b>Structural Review of Historic Perry Memorial Arch</b> , Tim Ariosto, Hannah Rakowski  <b>Port Terminal Anchored Bulkhead Failure: A Forensic Case Study</b> , Jason D. Gregorie  <b>The Impacts of Aging Infrastructure and Evolving Load Conditions: Case Study of an Earth Retaining Wall Failure</b> , Alomir H. Favero Neto, Patricia D.G. Orlando, Ronaldo Rocha  <b>Structural Assessment of In-Service Bridge-Mount-Truss Overhead Ancillary Structures in West Virginia</b> , Wael Zatar, Hai Nguyen, Hien Nghiem
10:30 a.m. – 12:00 p.m., <b>Concurrent Technical Sessions, PDHs 1.5</b>			
<b>Geotechnical Failures</b> <b>Moderator: Sumanth Cheruku</b>	<b>Non-destructive Testing</b> <b>Moderator: Rebecca Bowman</b>	<b>Analysis and Repair</b> <b>Moderator: Travis Ebisch</b>	<b>Light Rail and Bridges</b> <b>Moderator: Randy Bernhardt</b>
<b>Geotechnical Risk Management During Design and Construction</b> , Theodore von Rosenvinge  <b>Emergency Damage Assessment – Guajataca Dam in Puerto Rico</b> , Tom Caldwell  <b>Evolution and Mitigation of the Mandaree, North Dakota, Rural Water Intake Landslide</b> , Charles D. Hubbard	<b>Influence of Frequencies of Ground-Penetrating Radar Antennas on Detectability of Defects and Image Reconstructability of Concrete Structures</b> , Wael Zatar, Hai Nguyen, Hien Nghiem  <b>Influence of Concrete Subsurface Voids on Elastic Structural Behavior of Moment Resisting Frame: A Preliminary Study with the Use of Concrete Ultrasonic Echo Tomography</b> , Zhengqi Li  <b>Using Non-Destructive Test Methods to Determine Voiding in Grouted Post Tensioned (PT) Tendons</b> , William Horne, Brian J. Pailes	<b>Testing and repair of concrete in the context of post-fire forensic investigation and structural assessment</b> , Luciana Balsamo, Ali Ashrafi, Kevin Mueller, Stephen Pessiki  <b>Repair Recommendations After a Forensic Investigation</b> , Carl J. Schoenberger, Sean M. McGrath  <b>Analysis of a Fire Riser Failure below a Concrete Slab-on-Grade Foundation</b> , Trevor Greenberg, Travis Ebisch	<b>Investigation of Restraining Rail Assembly Bolt Failure for Light Rail Track</b> , Nicholas D. Catella  <b>Long-Term Thermal Effects on a Turn-Back Wingwall in a Semi-Integral Abutment Bridge</b> , Safiya Ahmed, Issam Khoury, Shad Sargand, Jamal Nusairat, Waleed K. Hamid

# Awards

## Forensic Engineering Award Winners

The ASCE Forensic Engineering Division (FED) has announced the recipients of the 2018, 2019, 2020, and 2021 Forensic Engineering Awards. The Forensic Engineering Award recognizes individuals for outstanding contributions to the field of forensic engineering.



2018 RECIPIENT

**Peter J. Maranian, P.E., S.E., M.ASCE, F.SEAOC**

Peter Maranian, from 1970 through to 1981 in England, worked on the design and construction of bridges, buildings and aircraft hangar.

After moving to California in 1981, he has worked with Brandow & Johnston on a variety of projects from small to major structures, including office buildings, schools, hospitals, medical centers, studios, convention centers, and parking structures. One of his most recent major projects was as the SEOR for the 73 Story Wilshire Grand building in downtown Los Angeles. He was also involved in the investigation and repair of several steel moment frame buildings following the 1994 Northridge Earthquake. This led to him becoming a member of ASCE's Forensic Engineering Division's Committee on Practice to Reduce failures (ASCE FED CPRF) which he has been for about 25 years and which he chaired for several years.



2019 RECIPIENT

**James R. Harris, P.E., Ph.D., DistM.ASCE, NAE**

Dr. Harris is founder and principal of J. R. Harris & Company, Structural Engineers, located in Denver, Colorado. Jim is well versed in structural engineering practice and research. He has designed or evaluated thousands of structures ranging from dwellings to high-rise building, industrial facilities, buildings in the highest seismic zones, excavation bracing, renovations of historic buildings, and many others. This background spans nearly all types of construction and structural materials and includes responsibility for management of all design disciplines. He is an active member of several committees that produce national standards for structural engineering practice, and his expertise there was recognized by his election to the National Academy of Engineering.



2020 RECIPIENT

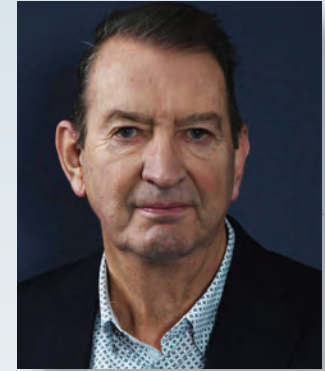
**Robert T. Ratay, Ph.D., P.E., F.ASCE, (1936-2020)**

Robert Ratay's professional experience in structural engineering included full-time design practice, teaching, and expert consulting.

He was very active in ASCE and other engineering societies. He is the originator of the ASCE/SEI 37-02, *Design Loads on Structures During Construction Standard*, and he participated regularly in the work of the Forensic Engineering Division.

During his career he taught engineering courses at several universities, including Columbia University, where he developed graduate courses on forensic structural engineering.

Dr. Ratay was a prolific writer on engineering failures. Besides numerous published papers, Dr. Ratay spearheaded the preparation of highly regarded reference books, such as *Handbook of Temporary Structures in Construction and Forensic Structural Engineering Handbook*.



2021 RECIPIENT

**Alastair Soane, B.Sc., Ph.D., C.Eng, FICE, FIStructE**

A founder of, and currently Principal Consultant to CROSS - Collaborative Reporting for Safer Structures). Responsible for leading on developments for this voluntary reporting system for structural safety. Since 2021 he has been part of an enhanced CROSS team on fire safety.

Previously MD of a firm of consulting engineers he was engaged on major projects within the UK and Internationally. Former member of Building Regulations Advisory Committee and chair of Part A Structures. Member of the Advisory Group on Temporary Structures, and until 2022 Visiting Professor of civil engineering at Liverpool University.

Honors from the Institution of Structural Engineers (UK) include the Sir Arnold Waters Medal, a Lewis Kent Award, and a President's Award.

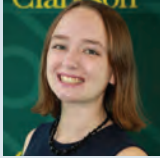
## Forensic Engineering Awards Committee

- **Navid Nastar**, Ph.D., P.E., S.E., F.ASCE, *Principal, Brandow & Nastar, Inc, Division First Past Chair*
- **Clemens Rossell**, P.E., M.ASCE, *Facilities Structural Engineer, Boeing, Division Second Past Chair*
- **Alicia E. Diaz de Leon**, P.E., R.A., S.E., M.ASCE, *Principal, Drerup Building Performance Engineering, PLLC, Division Third Past Chair*

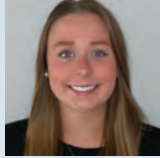


## Forensic Division Student Failure Case Studies Competition

### FINALISTS



Williams



Boyle



Zwack



Jonna

**Hanna Williams**, Clarkson University, Potsdam, NY

**Julia Boyle**, Widener University, Chester, PA

**Molly Zwack**, Kent State University, Kent, OH

**Rohan Reddy Jonna**, The University of North Carolina at Charlotte, Charlotte, NC

### HONORABLE MENTIONS

**Chancho Mainson**, B.Tech and A P J Abdul Kalam Technological University

**Siddarth S**, Anna University

**Sindi Krasta**, Drexel University, Philadelphia, PA

**Kammila Naga Priyanka**, Velagapudi Ramakrishna Siddhartha Engineering College

### Forensic Student Competition Subcommittee

- **M. Kevin Parfitt**, Professor Emeritus, Pennsylvania State University
- **Paul Bosela, Sr.**, Professor Emeritus, Cleveland State University; Principle, Bosela Forensic Engineering, LLC
- **Jose P. Gomez III**, Former Director of Research for the Virginia Transportation Research Council; Lecturer, University of Virginia
- **Alicia Diaz de Leon**, Former ASCE FED EXCOM Chair, Principle, Drerup Building Performance Engineering, PLLC
- **Tara Cavalline**, Associate Professor, University of North Carolina at Charlotte
- **Mike Drerup**, Former ASCE FED EXCOM Chair, Principle, Drerup, PLLC

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## General Information

### ADA Compliance

The Hilton Denver Center City is fully accessible to the disabled. While ASCE will make every effort to meet the needs of the disabled, accommodations cannot be guaranteed without prior notification.

### Attendee Packets

The packet you received at the on-site Registration Desk includes your name badge, the tickets for events you have ordered, PDH information and general announcements.

### Badge Policy and Ribbons

Your name and badge is your admission to the Congress. Please wear your badge at all time! Texts while in the hotel. ASCE recommends you remove your badge when leaving the hotel. Where tickets are required, please bring them with you as you will not be admitted without one. Ribbons will be available at the Congress registration desk.

### Congress Attire

The dress code for the Congress is business casual (i.e. slacks, casual dresses). Meeting room temperatures will vary, so wear layered clothing to ensure your personal comfort. We also recommend attendees wear comfortable shoes.

### Congress Proceedings

The conference proceedings will be available online. One copy is included with each full registration.

### City Information

For more information on Denver or the surrounding area, please contact Visit Denver Convention & Visitors Bureau directly or visit the destination page at [www.denver.org](http://www.denver.org).

### Medical Emergencies

ASCE hopes that your visit to Denver and the 9th Forensic Engineering Congress will be free of medical incident. However, if you become ill at the Hilton Denver Center City, please contact the front desk and tell them you have a medical emergency that requires immediate attention.

### No Smoking Policy

ASCE supports a "No Smoking" policy. Smoking is prohibited at the Hilton Denver Center City and all venues hosting ASCE events.

### Post-Congress Evaluations

An electronic evaluation will be sent out to all attendees immediately following the Congress.

### Professional Development Hours (PDH)

You may earn up to 21.0 PDHs, which are nationally recognized units of record, by attending Congress concurrent sessions and short courses. Please note there are differences from state to state in continuing education requirements for professional engineering licensure. ASCE follows NCEES guidelines on continuing professional competency. Since continuing education requirements for P.E. license renewal vary from state to state, ASCE strongly recommends that individuals regularly check with their state registration board(s) on their specific continuing education requirements that affect P.E. licensure and the ability to renew licensure. For details on your state's requirements, please go to [www.ncees.org/licensure/licensing-boards](http://www.ncees.org/licensure/licensing-boards).

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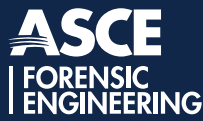
**Assumption of Risk:** All ASCE events and activities are purely voluntary activities; and attendees are fully responsible for their own conduct and well-being, including without limitation, determining their level of fitness to take part in any such event or activity. In participating in any event or activities, attendees shall be deemed to understand and accept all risk of possible physical injury might occur as a result of such participation.

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Please help ASCE & Pipelines stay "green" by leaving your name badge holder in the registration area when you leave the conference. If you are concerned about privacy, you are welcome to remove your name from the holder and take that with you.

### Registration Hours

Friday, November 4	7:00 a.m. – 6:00 p.m.
Saturday, November 5	7:00 a.m. – 6:00 p.m.
Sunday, November 6	7:00 a.m. – 5:00 p.m.
Monday, November 7	7:00 a.m. – 10:00 a.m.



# 9th FORENSIC ENGINEERING CONGRESS

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November 1-4, 2024

