# NAFE Saturday Schedule (July 12, 2025)


## Ziad Azzi, PhD, PE (NAFE #1343M)

Director of Engineering, DDA Forensics


**Time:** 8 to 9 AM

**Title:** Discerning Wind-Related Damage to Residential Roofs: A Case Study of Shingle and Tile Roofs


**Abstract:** Hurricane season brings a significant rise in wind-related insurance claims, as powerful storms lead to property damage (particularly to roofs). The surge in claims places pressure on insurance carriers, leading to delays in processing or disputes over claim validity. Distinguishing between wind- and nonwind-related damage as well as pre-existing issues to roofing components becomes critical in ensuring fair, efficient, and timely resolutions. This study presents an in-depth analysis of wind-related damage to two common roof covering materials: asphalt composition shingles and clay/concrete tiles. Utilizing a series of detailed case studies coupled with data from field inspections, this paper aims to differentiate wind-induced damage to roofs from issues stemming from wear and tear, material aging, and installation deficiencies, among other environmental and mechanical factors. By examining damage patterns, damage location, and material behavior from field observations — coupled with wind flow around bluff-bodies such as residential structures — this paper highlights how the unique properties of each roof (including its location, height, shape, and slope) influence its response to wind-induced pressures during extreme wind events. The insights aim to enhance damage identification, including cause, origin, and duration of roof covering failures as well as support informed decision making for roof inspectors.


Ziad Azzi, PhD, MBA, PE, DFE, CGC, CCC, PMP, is the Director of Engineering at DDA Forensics. He is a dedicated and innovative civil and structural engineer with more than 10 years of experience, and he brings extensive wind engineering and building enclosure expertise to the team. Due to his extensive work and educational background, Dr. Azzi's expertise encompasses an exceptional mix of capabilities in structural and geotechnical engineering, structural analysis, structural dynamics, earthquake and wind analysis of structures, aeroelasticity, vibration and inspection, as well as evaluation of existing residential and commercial structures. As Director of Engineering at DDA Forensics, Dr. Azzi oversees all aspects of the engineering department. He has published numerous articles and conference papers in prestigious journals as well as delivered lectures and presentations on the wind flow and wind effects on structures. He currently is a lecturer at the University of Miami (UM), teaching undergraduate and graduate-level design courses. Prior to that, Dr. Azzi also taught as an adjunct professor at Florida International University (FIU) in the Department of Civil and Environmental Engineering. He also serves as an expert consultant for Windtech Consultants, certifying their wind engineering reports pertaining to wind loads on tall buildings and facades obtained from wind tunnel testing.

## Tonja Koob Marking, PhD, PE (NAFE #1152S)

Owner and President, Gaea Consultants, LLC

**Time:** 9 to 10 AM

**Title:** Forensic Hydraulic Analysis of a Tow and Barge Vessel Allision with a Lock and Dam

**Abstract:** During record-high water on a major river, a tow pushing 14 barges allided with a lock and dam structure. Detached barges allided with gates, making two inoperable and damaging three others. Multiple structures in the adjacent town flooded as the earthen levee overtopped when the pool level rose in response to the inoperable and damaged gates. Recreation of river conditions utilizing hydraulic gages revealed gate opening and closing operations counter to the official incident report. As-built drawings reconciled with real-time photographs demonstrated actual gate openings were not as testified by lock personnel or reported in the official inquiry. Cell phone logs, videos, and vessel tracking and voice data were instrumental in recreating navigational instructions and responses during the vessel transit. The opposing expert's computer modeling illustrated the velocity field prior to the allision, further supporting the forensic hydraulic analysis and questioning official claims regarding the root cause of the incident.

Dr. Tonja Koob Marking, PE, BC.NE, BC.WRE, DFE, MBA, PMP, CFM, is the owner and president of Gaea Consultants, LLC. She has been the technically responsible party for Gaea Consultants' hydraulics projects for the past 25 years. She is a licensed Professional Engineer in seven states. Dr. Koob Marking has worked her entire 30+-year career in hydraulic and navigation engineering. While employed with the U.S. Army Corps of Engineers, she created hydraulic models and designed projects on large rivers and small bayous. She reviewed plans for dredged material disposal sites, sedimentation studies, and coastal restoration sediment diversion projects. As a visiting assistant professor, she taught graduate classes in river engineering and sediment transport at two universities. As a consultant, much of her navigational work has been as a forensic hydraulic engineer, recreating navigational conditions for allisions resulting in significant property damage and loss of life. She has served as an expert witness in state and federal courts in the areas of hydraulics, forensic hydraulics, sediment transport, and river engineering. She has published her work in peer-reviewed journals and conference proceedings, and has received multiple awards from technical societies recognizing her work and contributions to the engineering profession.

## Michael Stall, PE (NAFE #955M)

President, Managed Response, Inc.

**Time:** 10:15 to 11:15 AM

**Title:** Forensic Engineering Evaluation and Quantification of Fire Damage to a Home Under Construction

**Abstract:** When construction of an 8,000-square-foot custom home was close to completion, a fire started when a torch-down type of modified roof was being installed. The fire started at the west end of the 150-foot-long building, and the heat damage and smoke contamination traveled to the east end through the attic, the second floor, and the first floor ceiling cavity. Detailed forensic evaluation found heat damage and smoke residue throughout the building in exposed and hidden areas. Since the smoke residue can leave behind contaminants that have negative health effects on occupants — and this was a new home under construction — it was imperative to identify all contaminated building components. This paper examines the forensic engineering evaluation processes and techniques that were utilized to identify the structural damage caused by the fire, the heat-damaged components such as the spray poly foam insulation, the asphaltic waterproofing membranes and plastic trim, and the smoke-contaminated building materials and other components that must be removed to provide a new home condition.

Michael Stall is a registered professional engineer (#65893) in Texas and is a National Academy of Forensic Engineers board-certified forensic engineer (DFE). Stall earned a master's of science in civil engineering from Stanford University and a bachelor's of science in architectural engineering from the University of Texas at Austin. He has worked as an expert witness in resolution of design, construction, and property insurance settlement disputes over the past 15 years. Stall is also a certified property appraiser and umpire. He has more than 45 years of construction experience as a carpenter, ironworker, foreman, supervisor, engineer, scheduler, and construction manager for construction of shopping centers, single-family homes, multi-family buildings, manufacturing plants, power plants, and medical facilities. He has evaluated hundreds of buildings during the past 30 years that have suffered damage from fires, explosions, hurricanes, earthquakes, tornados, hail storms, design defects, and construction defects. He has published peer-reviewed articles in the *Journal of the National Academy of Forensic Engineers* about construction defects and resolution of schedule delay claims and has made numerous presentations to industry and university groups about construction management and disaster recovery. Stall is founder and president of Managed Response, Inc. (MRI), a Texas-registered professional engineering firm (#00546) and a general contracting company that specializes in evaluation and repair of distressed and damaged properties. MRI is a licensed general contractor in Florida and California and has been in business since 1998. MRI performs construction, renovation, disaster reconstruction, and forensic engineering.

## Stephen Batzer, PhD, PE (NAFE #677F)

President, Batzer Engineering

**Time:** 11:15 to 12:15 PM

**Title:** Unreliable at the Boundary: The Analysis of Two Sub-Optimum Crossbow Trigger Designs

**Abstract:** It is a fundamental principle that any weapon activated by a trigger — whether a crossbow, pistol, rifle, or shotgun — should only fire when the safety is set to the FIRE position, and the trigger is significantly pulled. This study examines two distinct crossbow trigger designs associated with injuries. In the first crossbow, the trigger safety can be unintentionally or intentionally moved to an "intermediate" position — a point on the edge between SAFE and FIRE. This setting creates uncertainty, leading to instances where the crossbow has discharged unexpectedly, either through arrow handling or simply after sitting idle without any user action. In the second crossbow design, if the bowstring is not drawn with enough force, the safety fails to fully lock in place, resulting in the sear providing inadequate support to the corresponding release component. This, too, creates a hazardous situation, observed to cause unintended discharge and injury to the user without any trigger activation. In both cases, the injuries did not stem from deliberate misuse; rather, the archer was operating the crossbow in a way that slightly deviated from the manufacturer's intended use.

Steve Batzer is a mechanical forensic engineer who consults with clients regarding patent infringement, firearms, and the forensic analysis of accidents and product failures. He has taught at five universities, served as a commissioned officer of the U.S. Army, and has worked as a manufacturing engineer in the Michigan automotive industry. He has testified at more than 50 trials and published more than 70 peer-reviewed engineering papers. Dr. Batzer is also a member the Society of Automotive Engineers, the American Society of Mechanical Engineers, and is a fellow of the National Academy of Forensic Engineers. He is a Vice President of the Michigan Society of Professional Engineers and encourages all engineers to be licensed. He earned his BS in mechanical engineering from Michigan Tech, an MS degree in manufacturing systems engineering from the GMI Engineering and Management Institute in Flint, Michigan, and a Ph.D. in Mechanical Engineering, again from Michigan Tech. Dr. Batzer lives with his wife in a log cabin in the Pere Marquette forest near Fife Lake, Michigan.

**Henry Mowry, PE (NAFE #1195M)**
Vice President of Engineering, Knott Laboratory

**David Ridder**
Forensic Visualization Expert, Knott Laboratory

**Time:** 1:15 to 2:15 PM

**Title:** The Importance of Human Perception in Incident Reconstruction and the Potential for Misleading Interactive Reconstructions

**Abstract:** A common and key component to forensic engineering and incident investigations is the "reconstruction" component of the investigation. Reconstructions allow the investigator to build and analyze the incident based upon objective information, such as video cameras (including dash cameras, surveillance cameras, and more), post-incident photographs (such as from first responders, eyewitnesses, etc.), physical data, including things such as skid marks in a roadway, damage patterns to involved objects (e.g., vehicles, buildings, etc.), and even physical injuries. As reconstructions, software, and technology advance, "interactive" reconstructions are becoming more and more popular, allowing the reconstructionist to control and adjust the reconstruction as it is shown. Interactive reconstructions allow the controlling individual to move cameras, start and stop the reconstruction, adjust parameters or variables, and allow analysis of the incident from static and omniscient perspectives. However, such interactive reconstructions also have the potential to be misleading. This paper will discuss the often disregarded or misrepresented portion of a reconstruction — that is, what the individual(s) in question "saw" or "perceived" during the incident as well as demonstrate the potential for harm or misleading interactive reconstructions.

Henry "Hank" Mowry, PE graduated from the Colorado School of Mines with a bachelor of science in Mechanical Engineering in 2008. Since graduating, he has worked in the nuclear power industry, chemical production industry in mid-stream oil and gas, and began work as a forensic engineer in 2015. During this time, he has focused on numerous product liability investigations, premise liability investigations (including slips-and-falls, trips-and-falls, and workplace safety incidents), mechanical failure analyses, and other personal injury matters.

As a visualization Expert for Knott Laboratory, David employs his techniques and experience in collaboration with the rest of the team to bring clarity to uncertain events. Using state-of-the-art technologies and software, David creates realistic reconstructions of accident scenes based on scientifically sound principles for use in court. David works with engineers and other visualization experts to verify the graphics and visualizations are accurate. He has expertise in 3D modeling, texturing, animation, motion capture, photogrammetry, matchmoving, and compositing.

## Robert Peruzzi, PhD, PE (NAFE #967M)

President and Founder, R. Peruzzi Consulting, Inc.

**Time:** 2:15 to 3:15 PM

**Title:** Forensic Investigation of Bitcoin Mining, Power Transmission, and Vegetation Mismanagement Causing Electrical Faults and Railroad Control System Failures

**Abstract:** This paper analyzes the engineering failures that led to a legal dispute involving Bitcoin mining, electric power transmission, and railway safety. To support their high-energy operations, Bitcoin entrepreneurs purchased an idle power plant, its 135kV transmission line, and a right-of-way along railroad tracks. However, their failure to maintain vegetation along the transmission corridor — despite regulatory obligations — led to a severe electrical fault. A tree branch made contact with the transmission line, causing fault current to travel through the tree, into the ground, and along adjacent railroad tracks. This surge disrupted a microprocessor-controlled railroad crossing system, which activated its failsafe mode and closed the crossing, disrupting both freight and passenger rail services. The railroad operator, responding to municipal complaints, held the transmission line owners accountable and demanded corrective action. However, vegetation management efforts were insufficient, leading to recurring outages and legal action. This article presents a forensic engineering analysis of the event, examining fault current propagation, compliance with NFPA 70 (the *National Electrical Code*), and industry standards for vegetation management. Additionally, it highlights the forensic engineer's role in investigating failures, preparing expert reports, and testifying in legal proceedings. The case underscores the risks of inadequate infrastructure maintenance and the cascading failures it can trigger.

Robert Peruzzi is a licensed professional electrical engineer (PE) and expert witness practicing forensic and technical consulting. He is president and sole employee of R. Peruzzi Consulting, Inc. Robert moved to Pennsylvania's Lehigh Valley in 1990 to work as an Automated Test Equipment (ATE) test developer for AT&T Bell Labs, where he took advantage of their tuition assistance plan and earned his Ph.D. in 2005 after what seemed like an eternity of part-time study. He stayed on as that company evolved through Lucent, Agere, LSI, and Infineon. As opportunities arose, he crossed between departments and product lines, working in analog and mixed signal design for hard disk drive and mobile phone electronics. He has been an independent consultant since Infineon's late 2008 layoffs and has expanded his practice from design and verification to include forensic and expert witness practice. Robert served as Chair of IEEE Philadelphia Consultants Network (CONET) and serves on the Board of IEEE Consultants Committee. He is the founder and past Chair of the IEEE Lehigh Valley Chapter Solid-State Circuits Society (SSCS). He is a member of National Academy of Forensic Engineers (NAFE), where he serves as an Associate Editor of the *NAFE Journal*, and is a past NAFE Director at Large. Robert lives in Bethlehem, Pennsylvania with his wife, Esther. They are the parents of two adult children and grandparents of three.

## Stephen Batzer, PhD, PE (NAFE #677F)

President, Batzer Engineering

**Time:** 3:30 to 4:30 PM

**Title:** Barrel Failure in an Over and Under Shotgun

**Abstract:** A 12-gauge over-and-under shotgun experienced a rupture in its lower barrel when firing standard factory ammunition. This incident marked the shotgun's first use in the field, as it had only been test-fired at the factory with regular-pressure shells (not proof loads) prior to this event. The barrel steel split axially ahead of the reinforced chamber, under the polymer fore-end, causing hot gases and plastic debris to violently strike the shooter's left hand, resulting in serious injury. A detailed metallurgical and geometric evaluation of the affected barrel was conducted at an independent third-party laboratory. Chemical analysis confirmed the steel matched SAE 1045 alloy with appropriate hardness for the barrel's intended thickness. Performance testing on a new, identical shotgun using intentionally overloaded shells was also carried out, despite the spent hulls from the incident showing no signs of excessive pressure. The assessment uncovered a distinct manufacturing flaw in the lower barrel that had created a localized weak spot in the barrel wall.

Steve Batzer is a mechanical forensic engineer who consults with clients regarding patent infringement, firearms, and the forensic analysis of accidents and product failures. He has taught at five universities, served as a commissioned officer of the U.S. Army, and has worked as a manufacturing engineer in the Michigan automotive industry. He has testified at more than 50 trials and published more than 70 peer-reviewed engineering papers. Dr. Batzer is also a member the Society of Automotive Engineers, the American Society of Mechanical Engineers, and is a fellow of the National Academy of Forensic Engineers. He is a Vice President of the Michigan Society of Professional Engineers and encourages all engineers to be licensed. He earned his BS in mechanical engineering from Michigan Tech, an MS degree in manufacturing systems engineering from the GMI Engineering and Management Institute in Flint, Michigan, and a Ph.D. in Mechanical Engineering, again from Michigan Tech. Dr. Batzer lives with his wife in a log cabin in the Pere Marquette forest near Fife Lake, Michigan.

## Rebecca Bowman, Esq, PE (NAFE #1153M), Brian Eubanks, PE (NAFE #962S), and Lauren Kelley, PE (NAFE #1358M)

**Time:** 4:30 to 5:30 PM **Title:** Beyond the Building Code: Expansive Soils

**Abstract:** As defined by ASTM, soils that are susceptible to significant volumetric changes from the addition and/or removal of external elements are deemed expansive soils. Expansive soils, typically associated with clay soil compositions, are predominantly encountered throughout the central portion of the United States as well as portions of the southeast and west regions. Although it is not well documented, expansive soils are also encountered adjacent to coal deposits throughout the Appalachian coal region in the eastern United States. Depending on the mineralogy, clay soils comprised of expansive minerals can bond with moisture, causing the volume of the soil to increase with the addition of moisture, and conversely, decrease with the withdrawal of moisture. This paper will explore tools for the identification of expansive soils and factors to consider in the design and construction of ground-supported structures to mitigate risk associated with post-construction differential foundation movement from expansive soils. It will also explore consequences to ground-supported structures not adequately designed and/or constructed for expansive soils as well as potential remedial measures to address adverse foundation performance.

Rebecca Bowman served four years as the Senior Director of Ethics and Professional Practice with the National Society of Professional Engineers. She is the principal of a woman-owned business in civil engineering, dispute resolution, and legal services. She is experienced in boundary law issues, engineering design and forensic analysis, and construction/project management. She is a registered professional engineer, a certified arbitrator, mediator, and Christian conciliator, and a Diplomate of Forensic Engineering. She received her B.S. degree in civil engineering from the University of North Dakota, her M.B.A. degree from Oklahoma University, her J.D. degree from Duquesne University, and she recently completed her certificate in Sustainability Policy from Penn State.

Brian Eubanks is the founder and principal structural engineer of Paragon Structural Engineering, a structural design, forensic investigation, and consulting firm based in Plano, Texas. Eubanks is licensed in 15 states and has extensive experience designing structural systems for a wide range of residences and ancillary structures. He has conducted thousands of forensic investigations, authored an equal number of expert reports, and frequently serves as an expert witness in mediations, arbitrations, and courtroom proceedings. He received his B.S. and M.S. degrees in Civil Engineering from the Georgia Institute of Technology, is a Senior Diplomate of Forensic Engineering, and a Diplomate of the International Board of Forensic Engineering Services.

Lauren Kelley is a senior staff structural engineer at Paragon Structural Engineering. She holds B.S. and M.S. degrees in Civil Engineering from Texas A&M University and is a Licensed Professional Engineer in two states. Kelley is Building Envelope Trained and Certified by the Building Envelope Science Institute, Haag Certified, a Model Law Engineer with the National Council of Examiners for Engineering and Surveying. She is also a Member of the National Academy of Forensic Engineers. With over seven years of experience, she leads technical teams in structural design and forensic investigations of both new and existing structures.