ASCE | CONTINUING EDUCATION

Structural Engineering with Unconventional Materials

Purpose and Background

Structural engineers use the principles of mathematics, physics, material science, and other disciplines to create structures that resist the forces of nature to protect those who occupy them and to limit the amount of damage sustained from a major environmental event, such as an earthquake or a hurricane. Engineers are mostly accustomed to common materials (wood, steel, masonry, concrete) and basic configurations, but changing needs of society require a more in-depth evaluation of unconventional materials and configurations. Sustainability, resilience, and attention to local needs and conditions can be important factors that influence discovery of innovative solutions and can lead to improvement of an engineer's problem-solving abilities.

The purpose of this 2-day seminar is to illustrate methods of structural design for alternative building materials and identify resources to assist in defining loads and material resistance values. Additionally, attention will be given to coordination with a state's adopted building code and resources will be identified for defining compliance with accepted standards that may not have been formally adopted by a code-writing agency. Methods and strategies learned in this seminar will enhance the ability of attendees to defend alternative designs and to help their clients understand the uses and limitations of unconventional materials. Numerical example problems, question/answer sessions, and a post-test will be used to illustrate concepts and to assess learning of attendees.

Seminar Instructor

DAVE K. ADAMS, P.E., S.E., M.ASCE has been practicing structural engineering since graduation from the University of California, San Diego in 1990. He is currently a Principal Associate with BWE in San Diego, CA, and continues to serve as a subject matter expert for the California engineer's licensing board (BPELSG). He regularly designs and details structures of various materials and collaborates with other engineers and draftspersons. Dave also investigates structural failures or damage for a variety of building types and has written comprehensive reports to summarize findings and retrofit recommendations. Mr. Adams is actively involved in the engineering community through committee membership, paper publication, and student mentoring.

- **For group training, contact John Wyrick (JWyrick@asce.org) or Stephanie Tomlinson (STomlinson@asce.org)**

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Summary Outline (1.4 CEUs)

Session 1: Researching and Evaluating Alternative Designs
- Why alternatives?
- Structural design methods
- Understanding the intent of building codes
- Justification of designs

Session 2: Sustainable, Resilient, and Reliable Construction
- What is sustainability?
- Structural LEED credits
- Smart buildings
- Assessing reliability of alternative structures
- Global programs and perspectives

Session 3: Straw-Type Materials
- Material characteristics and strength
- Straw bale construction
- Bamboo
- Hybrid construction
- Testing and inspection

Session 4: Rammed Earth and Partially Buried Structures
- Structural loading characteristics of retained soil
- Simplified plate and shell design
- Material characteristics and strength
- Resisting lateral forces
- Testing and inspection

Session 5: Shipping Containers and Modular Construction
- Availability and manufacturing
- Load requirements and combinations
- Materials and load path
- Testing and inspection

Session 6: Log Buildings
- Characteristics and geometrical arrangements
- Material strengths
- Beams, columns, and connections
- Resisting lateral forces
- Testing and inspection

Session 7: Alternative Concretes
- Using pozzolans
- Recycled products
- Performance characteristics
- Resisting lateral forces
- 3-D printable concrete buildings
- Testing and inspection

Session 8: Clay, Cob, and Adobe
- Material characteristics and loading requirements
- Supporting gravity loads
- Resisting lateral forces
- Hybrid structures
- Inspections and testing

Seminar Benefits

1. Instruction on the evaluation and defense of alternative designs
2. Summary of available design resources for alternative materials
3. Coordination of structural requirements for unconventional materials with building codes
4. Example problems

Learning Outcomes

1. Calculate the resistance of alternative materials to loading
2. Understand the environmental benefits of unconventional materials
3. Learn how to identify relevant code requirements with unconventional materials
4. Define a suitable load path for lateral forces with unconventional materials
5. Organize requirements for testing and inspection

Who Should Attend?

- Structural engineers
- Civil engineers
- Industrial engineers
- Architects
- Building officials
- Educators
- Students
- Manufacturers

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