

NCCS White Paper

Introducing and Embedding Safety Culture Concepts in Undergraduate Education

**School of Engineering, University of Kansas
The National Center for Construction Safety**

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August 18, 2022 | Spahr Library 2300, KU

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Emergency Procedures: Spahr Library

Date: 08.18.2022

An emergency is a situation that poses an immediate risk to health, life, property, or the environment. Emergencies catapult us out of our routine operations.

In the event of an emergency that requires an evacuation from the library, you will hear the fire alarms ring. This indicates that you must leave the building. The following evacuation procedures will help us react in an organized manner.

Things to remember:

- In the event of a fire, do not use the elevators.
- Fire extinguishers and fire alarm pulls are located throughout the library; see the maps below for their exact locations.
- In the maps below, red arrows indicate emergency exits.
- Use the first route for evacuation. If the first route is blocked, use the second route.
- Emergency exits, fire extinguishers, and fire alarm pulls in the Archives are accessible.
- After evacuating the library, report to the designated assembly area (South Plaza, Northwest Parking Lot)
- Stay in your designated outdoor assembly area for a head count.
- Report any missing individuals and last known locations to emergency responders.
- Notify emergency responders about sensitive research, operating equipment, animals left in buildings, etc.
- Wait for instructions from emergency responders.

MEDICAL EMERGENCY

Lawrence Memorial Hospital is the premiere health care provider for the residents of Douglas County. It is located approximately 2.5 miles from LEEP2 via Iowa St. at the following address:

325 Maine Street, Lawrence, Kansas 66044

The hospital has an emergency room and can be reached at **(785) 505-5000**

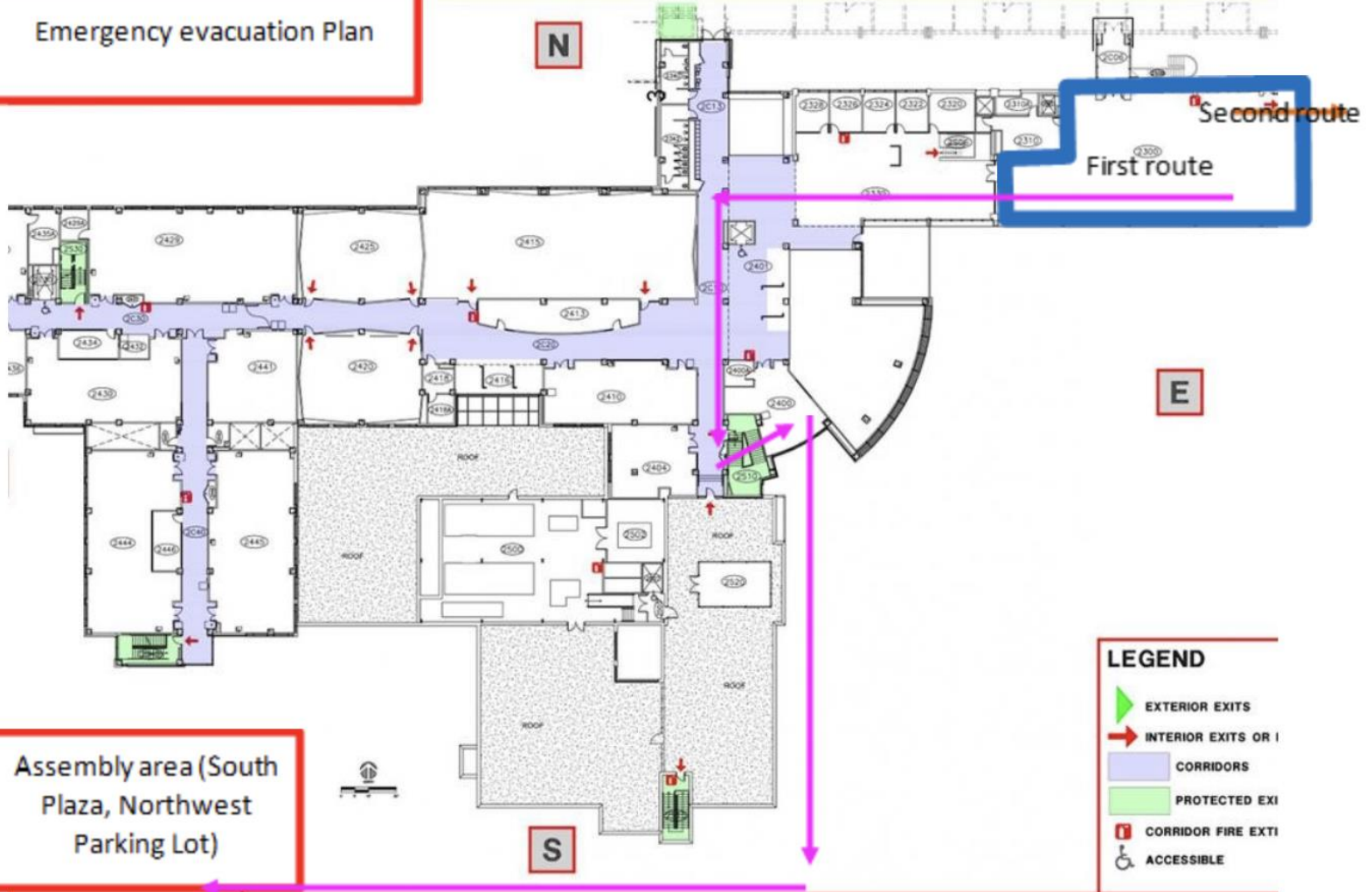
KU'S POLICE DEPARTMENT

The KU patrol unit delivers most of the required police services to the KU community. Police Officers are on duty 24 hours a day, seven days a week.

Public Safety Bldg., 1501 Crestline Dr, Lawrence, KS 66045

The department can be contacted at (785) 864-5900 for non-emergency questions, services, and information. For police, fire, or medical emergency response, call **911**.

Emergency evacuation Plan



Parking and Map

Please register your car using the following link **before** you park it in the designated parking garage:

<https://rockcha.lk/National-Academy-of-Construction-Symposium-2022>

We have arranged parking for this event. Please park your car in the **Allen Fieldhouse Parking Garage**, Lawrence, KS 66044 (Clearance is 7 feet). Your parking fee will be automatically covered if you sign up your car before parking it in the Allen Fieldhouse Parking Garage. Please enter your license plate numbers without any spaces, dashes, or county codes.

Parking violations will be issued a ticket. Need assistance? Please call (785) 864-0215.



Understanding Safety Culture in the Construction Industries

Adapted from NAC Executive Insight

By Emmitt Nelson

January 14, 2022

OSHA rates the construction industry as one of the most hazardous to its workers. Research by the Construction Industries Institute (CII) confirms that just complying with OSHA's safety rules and working

conditions helps but does not assure adequate safety outcomes. What is needed is a commitment to zero injuries and accidents and the development of a safety culture which believes “all accidents can be prevented.”

While the safety records of leading companies who follow CII guidelines in their safety programs is excellent, the industry’s record as a whole is not. The National Academy of Construction (NAC) believes overall safety performance will be enhanced if more construction companies and owners adopted CII guidelines, make a conscious commitment to zero injuries and accidents, and establish and maintain an adequate “Safety Culture” in their operations.

Definition of Safety Culture

A **safety culture** can be defined as the system of shared beliefs, practices, and attitudes that exists in an organization which shapes behavior and drives the way in which all work is performed. A safety culture is created by a well-designed **safety management system** and the development of a **safety climate** which defines the manner in which an operation actually behaves.

Elements of a Safety Management System

A well-designed safety management system is an essential but not sufficient pre-requisite to establishing a safety culture. Elements of a proper safety management system include:

1. Demonstrated management commitment (at all levels) to the belief that “all accidents can be prevented;”
2. Staffing with safety professionals;
3. Establishing safe work practices for common activities;
4. Job safety planning before undertaking specific activities;
5. Safety training and education;
6. Worker participation and involvement in defining the elements of the safety management system and making necessary adjustments;
7. Subcontractor management;
8. Recognition and rewards;
9. Incident/Accident/ Near Miss reporting and investigations focused on root causes;
10. Disseminating learnings from Incidents/Accidents/ Near Misses;
11. Drug and alcohol testing;
12. Periodic audits and worker surveys to assure the safety management system is working as defined.

There is much available in the literature as to how to address each of these elements. One of the keys is top level corporate commitment that permeates the organization which includes worker involvement in defining each element of the safety management system.

Establishing a Safety Climate

A safety culture requires a proper **safety climate** as well as a working safety management system. In a proper safety climate, leaders are unified in purpose, approach, and message so that there is a harmony in human relationships. That is, both employer-employee and employee-employee relationships occur with mutual respect. Experience has shown an appropriate climate where all supervisors at every level work at establishing a careful, caring, and nurturing approach can provide excellent safety results. The desired safety culture can only occur when leader-to-worker communications demonstrate by their actions:

1. There is a sincere concern for worker welfare.
2. All leaders are friendly.
3. All leaders are respectful.
4. The organization is merciful and not “quick to punish.”

In a proper safety culture, all workers must feel that everyone in the organization is committed to safety and to learning from mistakes and incidents. They must feel free to bring observations to management without fear of reprisals, and the climate must encourage them to take personal responsibility for their own safety.

A zero-injury safety-culture based program differs noticeably from a traditional safety program because it emphasizes that leaders to show a deep-seated “caring demeanor” for those supervised. It does not threaten the employees with punishment if they fail. Instead, it offers appreciation and recognition when they succeed.

Achieving a zero-injury climate requires “winning” the hearts and minds of all employees to become co-owners of the quest for zero. The NAC Executive Insight by Emmet Nelson dated January 14, 2022 provides further guidance on how to create a safety climate.

The Bottom Line of Safety Culture

CII data shows clearly that those organizations which adopt a corporate value that recognizes the benefits of a safety culture and believe all accidents are preventable both for themselves and for their onsite sub-contractors, have significantly better safety outcomes than those that do not.

In addition, when the desired safety culture is in place, the entire project team becomes significantly more productive. CII research shows that projects achieving zero injury had close to five percent productivity improvement each for both contractor and owner. Some successful contractors have estimated at least a 10 percent improvement in productivity on projects that reach near one million-hour zero recordable safety record.



NCCS
The Craig and Diane Martin
 NATIONAL CENTER FOR
 CONSTRUCTION SAFETY



**NATIONAL
 ACADEMIES** Sciences
 Engineering
 Medicine

National Academy of Construction Symposium

**Introducing and Embedding Safety Culture Concepts in
 Undergraduate Education**

**School of Engineering, University of Kansas
 The National Center for Construction Safety**

Date: August 18, 2022

Venue: Spahr Library 2300, KU (Address: 1532 West 15th Street, Lawrence, KS 66045)

Agenda:

- | | |
|---------------|--|
| 8:30 to 9:30 | Light Breakfast/Optional Tours

Tour Moderator: Robert L. Parsons, Professor, University of Kansas |
| 9:30 to 10:00 | Welcome/Introducing the Opportunity

Moderator: Craig Martin, Senior Advisor, NCCS

Speaker: Wayne Crew, President/CEO, National Academy of Construction |
1. Safety moment
 2. Symposium structure
 3. Construction industry safety statistics

- 4. Critical need to implement safety concepts and safety culture throughout the construction industry
 - 5. Role/contribution of undergraduate education
- 10:00 to 10:30 First Keynote Address – A construction company perspective
- Speaker: Mike Heitmann, CEO, Garney Construction
- 1. Benefits of a Safety Culture.
 - 2. Industry’s expectation of recent graduates
- 10:30 to 11:15 Panel 1 – Safety culture and the new graduate
- Panel Moderator: Craig Martin
- Speakers:
- 1. Burt Morey, State Transportation Engineer, Kansas DoT
 - 2. Chris Turnbull, President, Kiewit Power Constructors
 - 3. Jack Brazil, Vice President, JE Dunn Construction
 - 4. John Smith, Vice President, Alberici Constructors
 - 5. Mike Schneider, Vice President, Baker Concrete Construction
- Four or five industry representatives describe their culture of safety and what they need in new graduates.
- 11:15 to 11:30 Break
- 11:30 to 12:00 Second Keynote Address – A Dean’s perspective
- Speaker: Arvin Agah, Dean, School of Engineering, University of Kansas
- 1. Understanding of industry needs
 - 2. Curriculum and staff constraints
 - 3. Ability to meet industry’s requirements
- 12:00 to 12:45 Panel 2 – Including safety culture concepts in existing course structures.
- Panel Moderator: Dave Darwin, Distinguished Professor, University of Kansas

Speakers:

1. Georgi Popov, Chair, Occupational Risk and Safety Sciences Department, University of Central Missouri
2. Kelli R. Kopocis, Chair, Construction Programs Curriculum Committee, University of Nebraska
3. James F. Goddard, Professor, Department of Architectural Engineering and Construction Science, Kansas State University
4. Aaron M. Scurto, Professor, Department of Chemical and Petroleum Engineering, University of Kansas
5. C. Allan Guymon, Chair, Department of Chemical and Biochemical Engineering, University of Iowa

Four or five academic representatives describe how they have incorporated and integrated safety concepts into their course material or how they might do so.

12:45 to 1:45	Lunch/Introduction to the National Center for Construction Safety
1:45 to 3:15	Breakout Discussions <ol style="list-style-type: none">1. Teaching culture vs. procedure2. Providing help to educators3. Leveraging the results of this workshop
3:15 to 3:30	Break
3:30 to 4:30	Report Out – Open Discussion
4:30 to 4:45	Next Steps, Wayne Crew, President/CEO, NAC <ol style="list-style-type: none">1. Publicizing/leveraging the results of the workshop2. Value of this program3. Gratitude and appreciation
4:45 to 5:30	Social Hour/Networking
Contact	Chien-Ho Ko, Ph.D., P.E. chko@ku.edu (785) 864-0215

Breakout Exercise:

Teaching culture vs. procedure, providing help to educators, and leveraging the results of this workshop.

1:45 to 3:15: Discussion

3:30 to 4:30: Report out.

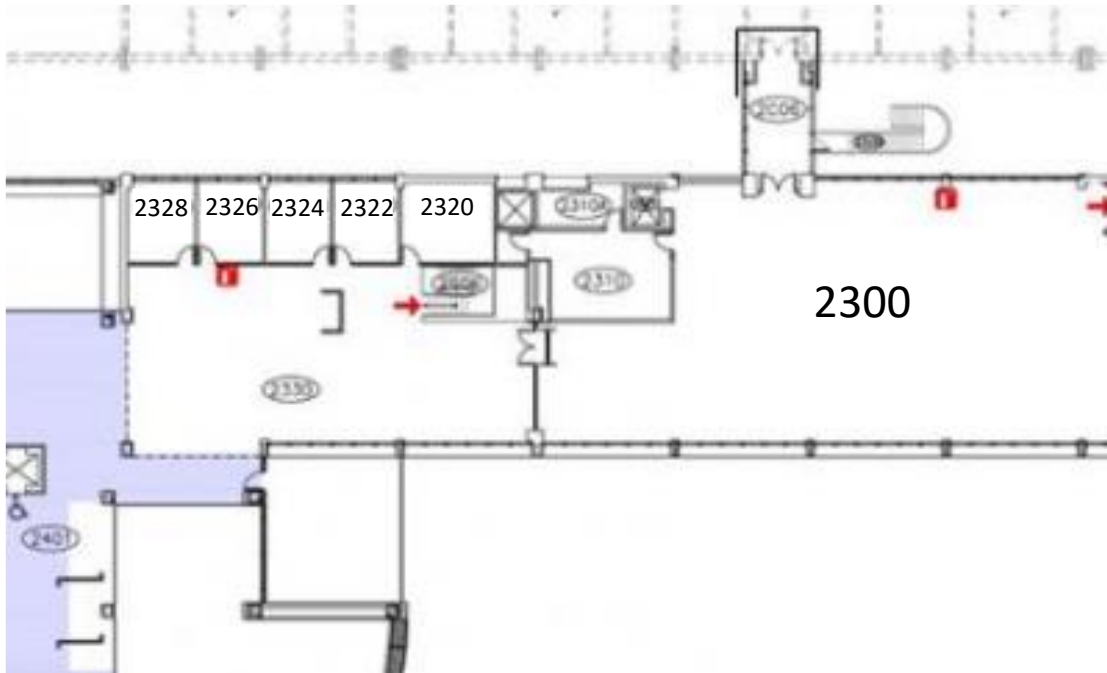
The leader and recorder are selected in advance.

Given the background provided earlier about the industry and academia perspectives concerning the benefits of a Safety Culture focus in the Academic preparation of new graduates, work through the following within your group based on your experience.

1. Briefly (15-30 seconds per participant) introduce yourself to others in your group.
2. Explain the breakout exercise to the group (1-2 minutes).
3. Discuss **opportunities** for creating synergies and leveraging efforts between industry, academia, and others to enhance safety culture education in the academic preparation of students (20-25 minutes), including strategies or developments needed; recorder captures these thoughts.
4. Discuss **challenges** to implement a safety culture in the academic preparation of students (20-25 minutes); the recorder captures these thoughts.
5. Prioritize your group's top three or four opportunities and top three or four challenges; briefly discuss **strategies** to strengthen opportunities and to overcome challenges with paths forward, including key organizations to leverage (20-25 minutes).
6. Prepare to share your results with others.
7. Present at the Report Out session (6-8 minutes) (3:30 to 4:30).

*Each breakout group presents its top three **opportunities**, **challenges**, and **strategies** when they reconvene at the Report Out session. (1 hr. for all breakout groups)*

Breakout Sessions



Room: Spahr 2300

Company	Name
Washburn University Institute of Technology	Charles "Chaz" Havens (Leader)
Jacobs Engineering Group	Stephanie DeWitt (Recorder)
University of Delaware	Mohsin Siddiqui
University of Central Missouri	Georgi Popov
University of Kansas	Sumon Mojumder
University of Kansas	Mohammad Abu El Rub
Terracon	Michael O'Grady
National Academy of Construction	Wayne Crew

Kiewit Power Constructors	Chris Turnbull
Gaylor Electric, Inc.	Justin Baker

Room: Spahr 2320

Company	Name
University of Central Missouri	Joe Long (Leader)
University of Northern Iowa	Gil Schultz (Recorder)
Tennessee State University	Kang Du
University of Nebraska	Kelli R. Kopocis
University of Kansas	Wayne Yeye
International Crane & Construction Safety Solutions	Kevin Cunningham
Great Lakes Dredge & Dock Company	Dave E. Simonelli
Terracon	Craig Martin
JE Dunn Construction	Jack Brazil
University of Kansas	David Darwin

Room: Spahr 2322

Company	Name
University of Kansas	Brian Lines (Leader)
Mark One Electric Co.	Dave Ezell (Recorder)
Cleveland State University	Richard Schoephoerster
University of Central Missouri	Curtis Bradford
University of Kansas	Fahmid Tousif
University of Evansville	Hyunsoung Park

Garney Construction	Mike Heitmann
Baker University	Ran Sivron
Gaylor Electric, Inc.	Bryan Feller

Room: Spahr 2324

Company	Name
K Arnold Consulting	Kenneth E. (Ken) Arnold (Leader)
Brigham young University - Idaho	Ron Kinville (Recorder)
University of Northern Iowa	Randy Sharp
Burns & McDonnell	Ryan Spangler
Lawrence Technological University	Ahmed Al-Bayati
Eli Lilly and Company	Krishan Thakkar
Kansas DoT	Burt Morey
University of Kansas	Arvin Agah
Kansas State University	James F. Goddard
Clemson University	(TBD)

Room: Spahr 2326

Company	Name
Alberici Constructors	John C. Smith III (Leader)
Lawrence Technological University	Elin Jensen (Recorder)
University of Kansas	Aaron M. Scurto
Garney Construction	Paul Kerstiens

Peter Kiewit and Sons'	Tom Shelby
Washburn University Institute of Technology	Cody Beauclair
University of Kansas	Rebecca Kassa
University of Missouri-Kansas City	Ceki Halmen
Clark Construction	(TBD)

Room: Spahr 2328

Company	Name
Missouri University of Science and Technology	Eric Showalter (Leader)
PLOT Comms	Chris Callen (Recorder)
Massman Construction Co.	Flint Howard
University of Kansas	Lola Ogundare
University of Northern Iowa	Lisa Riedle
Baker Concrete Construction	Mike Schneider
Kansas State University	Steve Schaffner
University of Iowa	C. Allan Guymon
University of Maine	Shaleen Jain

Contact:

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(785) 864-0215

For police, fire, or medical emergency response, call **911**.

Symposium Recap and Take-aways:

Content/Activities:

- Final symposium agenda ([final symposium agenda.pdf](#))
- Brief description of who attended and participated in the symposium, including their name, organization, and role (participant/attendee) ([participants_attendees.pdf](#))
- Slides from presentations given during the symposium ([NAC-NCCS Safety Symposium.pdf](#))
- Available transcripts of discussions during panel sessions, presentation Q&A sessions, symposium breakout sessions, and any other formal symposium activities ([breakout_transcripts.pdf](#))

Outcomes:

- Summary description of the present safety culture in the universities represented at the symposium based on input from the academic participants/attendees
 1. Construction safety programs at universities focus on creating graduates who have a rich understanding of the value of safety.
 2. Students might be more interested in taking safety courses if the courses are bundled with a certificate.
 3. It is difficult to add a specific safety and safety culture course to existing engineering curricula since the credit hours are already full.
 4. Some faculty members may not be aware of the concepts necessary to create and maintain a safety culture.
 5. Safety is not regarded as mainstream in academics since research dollar is not largely available for construction safety.
- Brief answers to the following questions based on the presentations/discussions:

1. What is the current status of safety education in the universities represented at the symposium (e.g., in what classes is safety taught, what programmatic efforts related to safety are present, in what academic units is safety covered)?
 - 1) Safety classes: Current safety courses are mainly provided in construction programs, not so much in engineering classes. Classes that safety is taught include (but not limited to): Construction safety, construction management, safety management, process safety, risk analysis, risk management, risk assessment, environmental safety, occupational safety and health, industrial hygiene, scheduling (safety activity), cost estimating (budget for safety consideration), statistics (injury analysis), incident analysis, and human factors.
 - 2) Programmatic efforts: Efforts toward building a safety culture include (but not limited to): Developing safety certificates, developing construction programs, developing safety programs based on the requirements of safety professional qualifications, developing curriculum embedding safety elements, recruiting safety instructors, embedding safety culture in the curriculum, shifting safety courses in the junior year before students start their core courses, developing a safety lab, developing criteria for evaluating process safety according to ABET's safety requirements (chemical engineering), and developing course maps based on safety professional exams.
 - 3) Academic units: Construction departments and programs (such as construction engineering, construction management, and construction sciences) frequently involve courses with construction safety subjects. For other safety fields not explicitly focusing on construction safety, academic units may include (but not limited to): Occupational Risk and Safety Sciences Department (BS, MS, University of Central Missouri), Aerospace and Occupational Safety (BS, Embry-Riddle Aeronautical University), Occupational Safety and Health (BS, Murray State University), Occupational Safety and Health (BS, Illinois State University), Safety Management (BS, Indiana State University), Safety Technology (BS, Marshall University), Occupational Safety (MS, East Carolina University), Safety Management (MS, Oakland University), Safety Management (MS, West Virginia University), Safety Engineering

(Graduate Certificate, Texas A&M), and Safety Engineering (Graduate Certificate, University of Pittsburgh).

2. What are examples of how safety is included in classes, and in out-of-class student activities?
 - 1) In class student activities: Traditional lecture, case study, incident analysis, sharing experience, sharing personal reasons, assignments, test, role plays, and quiz.
 - 2) Out-of-class student activities: Lab work, field trips, capstone projects, course projects, and field demonstrations.
3. What barriers to increasing safety content in undergraduate education are present?
 - 1) Recruiting instructors for safety courses and programs may need additional budgets.
 - 2) Safety is not the core course in architecture, civil, and construction engineering.
 - 3) Instructors need to spend more time and effort revising the curricula.
 - 4) Students need to spend more time learning additional course content.
4. What are expected benefits of increasing safety content in undergraduate education?
 - 1) Students who understand the value of safety can protect themselves and their workers from getting an injury.
 - 2) Students will be more competitive when looking for a job, especially for those companies that focus on safety.
5. What resources are needed to incorporate safety topics into undergraduate programs?
 - 1) Proper pedagogy, such as active learning, case study, experiments, hands-on approach, capstone projects, course projects, and role plays.
 - 2) Instructors who are enthusiastic about safety subjects.
 - 3) Department Chair's and Dean's support.
 - 4) Budgets for hiring instructors for safety courses.
6. How can industry assist with enhancing safety within undergraduate programs?
 - 1) To provide opportunities for students to participate in their "safety week" activities.

- 2) To offer internship opportunities both for students and faculty.
 - 3) To provide cases for discussion and analysis.
 - 4) To help with site visits.
 - 5) To introduce the company's safety value and measures.
 - 6) To co-mentor students, e.g., provide suggestions for student course projects.
 - 7) To demonstrate hazardous situations, e.g., high voltage and cutting torch.
 - 8) To give a lecture introducing practical safety issues.
 - 9) To co-teach safety subjects with the instructor.
7. What are industry's (constructors, engineering firms, owner organizations) expectation/requests to educators with respect to safety?
- 1) To replicate the job site in a lab setting, such as falls and electrocution.
 - 2) To analyze injury and fatal cases in the class.
 - 3) To hire instructors with practical experience.
 - 4) To team up with industry leaders to develop curricula.
 - 5) To add safety components to capstone projects.
 - 6) To schedule specific industry lectures or presentations in courses where the industry representative can discuss safety culture.
 - 7) To incorporate OSHA 10 or OSHA 30 in the curriculum or degree requirements.
 - 8) To introduce confined spaces, fall protection, and hazard recognition.
 - 9) To improve students' communication skills, integrity, confidence, empathy, human psychology, ethics, and passion.
 - 10) To introduce safety culture in all engineering classes.
8. What was learned about a way forward to encourage learning about safety in undergraduate education?
- 1) To promote advantages of understating safety values, e.g., it can protect ourselves and our workers so that we can return home safely. Also, understanding safety values may be easier for students to have an internship in a company that focuses on safety.
 - 2) To promote advantages of earning a construction safety certificate, e.g., it can increase employment opportunities.
 - 3) To organize a safety summer camp that simulates how incidents could occur to increase students' learning incentives.

- 4) To establish a construction safety program that incorporates industry partners to increase employment opportunities.
9. What are three (or more) recommendations for integrating safety into undergraduate education?
 - 1) To engage with industry via Internships to learn management and supervision (rather than just filing paperwork), so students will get to know what management and supervision look like.
 - 2) To acquire support from Department Chair and Dean.
 - 3) To include discussing elements of a good safety culture where it fits in the existing course.
 - 4) To engage the advisory board to push bringing a safety culture into undergraduate education.
 - 5) To include information on workplace safety in the engineering curriculum:
 - a. People: Focuses on the behavior and culture needed to effectively manage risks and make real, measurable, and lasting improvements that can best be achieved through communication, competency, and accountability.
 - b. Process: Considers the life-cycle fundamentals of the built environment and involves efforts to enhance standards, licensing, and training, especially in terms of logistics, the environment, continuous improvement, and a safety management system.
 - c. Product: Includes the key elements that need to be considered in the planning, design, construction, operation, maintenance, and decommissioning phases of a project, especially in terms of suitability, constructability, and sustainability.
 - 6) To collaborate with Industry:
 - a. Co-teach with safety professionals.
 - b. Develop new courses with input from industry.
 - c. Accreditation agencies emphasizing safety.
 - d. Changes to curricula.
 - 7) To relocate safety courses in the first years before students take core courses.
 - 8) To treat safety courses as important as physics.

