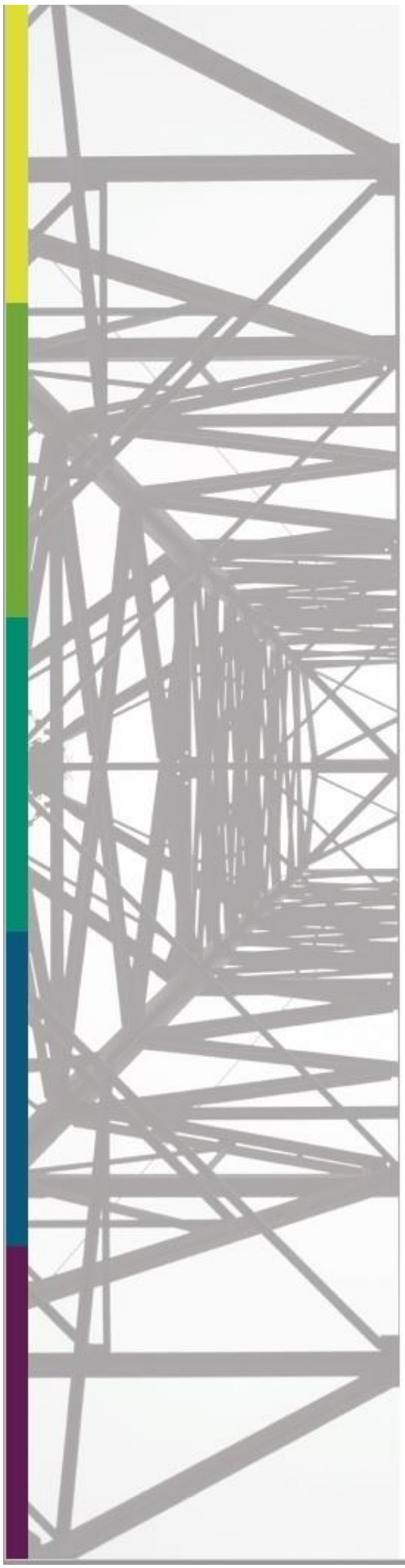

Civil Engineering Education Summit

Action Plan

ASCE Civil Engineering Education Summit Working Group

August 2021

ASCE Civil Engineering Education Summit Working Group Members

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CE Education Summit Action Plan

EXECUTIVE SUMMARY

The ASCE Civil Engineering Education Summit, held in Dallas, Texas in May 2019, brought together over 200 educators, practitioners, and other professionals to consider the future and opportunities and challenges related to preparing civil engineers to address and meet society's needs. A complete description of the activities and findings for the Summit is given in the report *Civil Engineering Education Summit: Mapping the Future of Civil Engineering Education*[1].

Vision

Participants at the Summit proposed a vision for civil engineering with a focus on people:

> *Civil Engineering is a global, holistic profession that serves the needs of all people.*

Goals

Goals that emerged from the Summit exhibit the vision:

1. A *Profession* that **serves** people;
2. A *Culture* that **includes** people;
3. An *Education* that **prepares** people.

[1] ISBN: 9780784483251

Objectives

Summit discussions and workshops identified four major objectives as initial pathways toward achieving the goals:

Objective 1: Reexamine, and potentially redefine, the domain of Civil Engineering.

Objective 2: Elevate professional skills to a truly equal footing with technical skills.

Objective 3: Develop a diverse, inclusive, equitable, and engaging culture within the civil engineering profession.

Objective 4: Foster an ongoing commitment to transformative education.

Education Summit Working Group

The ASCE Committee on Education (COE), working with the Department Heads Coordinating Council (DHCC), formed the **ASCE Civil Engineering Education Summit Working Group (SWG)** in April 2020.

The Summit Working Group was charged with the following tasks and activities:

- Disseminate the Summit report and communicate recommendations to all relevant stakeholders.
- Draft a plan of short- and long-term actions.
- Solicit input on recommendations and the action plan from relevant stakeholders.
- Execute short- and long-term actions as appropriate.

Development of Action Items

The SWG reviewed all findings from the Summit, including the top 20 and the 156 total "Opportunity Statements" generated by Summit participants and the four major objectives presented in the Summit report. From this

review the SWG developed lists of recommended actions and related them to the four objectives identified from the Summit.

The organizing principle of the Summit was "**Empowered to Innovate**." As such, the Summit Working Group believes it to be vital that **all members** of the profession, working collaboratively to achieve a shared vision, are empowered to advance and participate in the education and preparation of civil engineers.[2]

The overarching strategy adopted by the SWG is to empower each person and organization to innovate – tapping into the creativity and unique opportunities present throughout the civil engineering community – to forge a global, holistic profession that serves the needs of all people. Innovation, then, is a key driving force in the preparation of future engineers.

Actions identified in this report are proposed for each of two target audiences:

(1) **Directed, Specific Actions** are linked to organizations and other entities who could sponsor and lead the specified action(s);

(2) **Grassroots Actions** include activities that should be accomplished by any/all stakeholders, on a variety of scales (local, regional, national, etc.) highlighting the opportunity – and critical importance – for all members of the profession to participate.

In general, the actions proposed here support the four objectives identified at the Summit, as demonstrated in Figure 1.

[2] This perspective aligns with ASCE Policy Statement 140, "Civil Engineering Education – A Shared Responsibility".

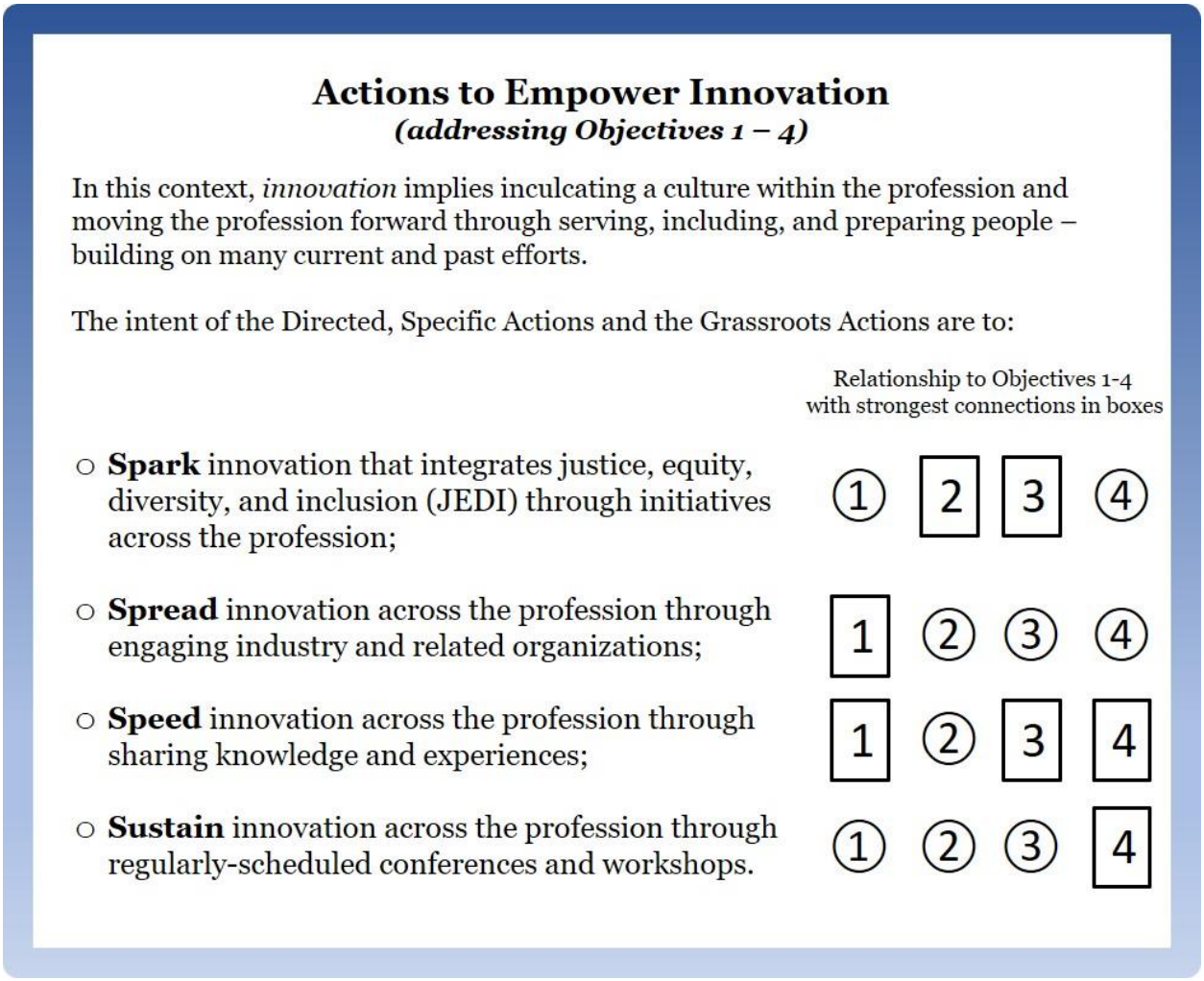

Figure 1. Framework for Actions to Empower Innovation

CE EDUCATION ACTION PLAN

A complete description of the activities and findings for the Civil Engineering Education Summit is given in the report *Civil Engineering Education Summit: Mapping the Future of Civil Engineering Education*[3]. Participants in the ASCE Civil Engineering Education Summit produced 156 *Opportunity Statements* – actions and ideas that would help prepare future engineers for the opportunities and challenges related to addressing and meeting society's needs. This report describes the development of an action plan based on these statements, and recommends specific actions for all members of the profession.

1.0 Action Plan Development

In April 2020, the ASCE Committee on Education appointed a Summit Working Group (SWG) to develop a plan for dissemination of the Summit report and findings, and to create an action plan for implementation of the ideas identified in the Opportunity Statements. The charge to the SWG was as follows:

- Disseminate the Summit report and communicate recommendations to all relevant stakeholders.
- Draft a plan of short- and long-term actions:
    - Consider recommendations presented in the Summit report.
    - Consider other sources of relevant input, including ASCE's Strategic Goals and Future World Vision.
    - Develop a plan for convening future CE Education Summits.
    - Establish a timeline for actions.
    - Identify responsible entities for actions and resource needs.
- Solicit input on recommendations and the action plan from relevant stakeholders.
- Execute short- and long-term actions as appropriate.

[3] ISBN: 9780784483251

The SWG reviewed all findings from the Summit, including the complete list of 156 Opportunity Statements and the list of the Top 20. The SWG concluded that the Top 20 Opportunity Statements, presented in Appendix A, captured nearly all of the ideas represented in the complete list of 156 statements.

The four principal objectives identified at the Summit are presented in Figure 2. The SWG worked in sub-groups to develop lists of potential short- and long-term ***actions*** associated with the four major objectives and the 156 Opportunity Statements.

The ASCE Civil Engineering Education Summit

The ASCE Civil Engineering Education Summit, held May 28-30, 2019, was organized to engage civil engineering educators from across the United States in a series of interactive, facilitated sessions to identify opportunities and challenges related to preparing civil engineers to address and meet society's needs. The Summit program included an opening session that examined the past and present of civil engineering education, two sessions presenting different visions for the future of civil engineering education, and two concluding sessions focused on moving from a collective vision to action. Through facilitated group discussions in a specified format, 156 "Opportunity Statements" were developed by assembled groups. In the final session, 20 of the Opportunity Statements, or consolidated versions of several Opportunity Statements, were selected by the Summit participants as being of highest priority (see Appendix A). Summaries of the sessions, primary themes that emerged from the sessions, and the complete list of Opportunity Statements are presented in the Summit report.

1.1 The Overarching Strategy: *Empowered to Innovate*

The pathway to achieving the four Summit objectives is built on the recognition of shared responsibility in which everyone has a role. Thus, the overarching strategy adopted by the SWG is to empower each person and organization to innovate – tapping into the creativity and unique opportunities present throughout the civil engineering community. Through collaboration and systematic communications, we can facilitate and accelerate the adoption of innovations throughout the profession and embrace innovation as a key driving force – inculcating a culture of innovation in the profession.

Developing opportunities and addressing challenges facing society at the global and local scales requires engineers to be prepared to lead change and advance the profession. Innovative approaches in education, research, and engineering practice devised with sustainability, equity, and justice in mind; collaborations forged within – and beyond – the civil engineering community; and open communication of needs and ideas are all necessary

to prepare future engineers for a profession that serves the needs of all people. Success is possible if all members of the profession engage in this effort.

Figure 2. Four major objectives identified at the ASCE Civil Engineering Education Summit 2019

2.0 Actions to Empower Innovation

Collectively, actions to empower innovation in relation to the four Summit objectives (Figure 1) seek to:

- **Spark** innovation that integrates justice, equity, diversity, and inclusion (JEDI) through initiatives across the profession;

  These actions directly address Objective 3, while also strongly supporting Objective 2. Meeting Objectives 2 and 3 will require a long-term commitment and as such, including these actions into ongoing education efforts (Objective 4) is vital.

- **Spread** innovation through engaging industry and related organizations;

  The shared nature of the task to *empower all to innovate* requires us to collaboratively consider the civil engineering domain; actions here directly address Objective 1. There are also strong ties to the culture of the profession (Objective 3), and to pursuit of these actions on an ongoing basis (Objective 4).

- **Speed** innovation through sharing knowledge and experiences;

  The best resource(s) for innovation and innovative practices in civil engineering are the members of the profession and their diverse experiences and insights. Actions to share our collective knowledge and experiences are directly tied to Objectives 1, 3, and 4, and strongly related to Objective 2.

- **Sustain** innovation through regularly scheduled conferences and workshops.

  These actions directly address Objective 4. Continuous engagement will sustain and strengthen innovation in civil engineering education. Additionally, content and activities at education-related events will address Objectives 1, 2, and 3.

2.1 Recommended Actions

This section contains examples of *directed, specific actions* and *grassroots actions* that Spark, Spread, Speed, and Sustain innovation.

(1) **Directed, Specific Actions**, aimed at organizations and other entities who could sponsor and lead the specified action(s). The actions suggested here serve as **examples** of activities that can be accomplished by organizations and other entities who could sponsor and lead the specified action.

(2) **Grassroots Actions**, that can be accomplished by any/all stakeholders on a variety of scales (individual, local, regional, national, etc.). The actions suggested here serve as **examples** of activities that can be accomplished by a variety of individuals and groups. All members of the education and practitioner communities are encouraged to engage in direct actions, and with organizations supporting innovation in the profession.

2.1.1 **Spark** innovation that integrates JEDI principles across the profession.

Table 1 presents examples of Directed, Specific Actions related to sparking innovation. Table 2 presents examples of Grassroots Actions related to sparking innovation.

Table 1. Example Directed, Specific Actions for Sparking Innovation

Support individuals and organizations endeavoring to innovate and promote educational excellence.	○ Department administrators recognize and reward education excellence and innovation as part of promotion, tenure, and/or faculty reviews. ○ Department heads provide course release time or seed funds for education innovation development and support activities. ○ Faculty prioritize discussing education innovation challenges and successes during faculty meetings and/or retreats. ○ Department heads and industry managers incentivize practitioners to participate in academia and for academics to engage with industry. ○ Industry/funding agencies increase funding related to innovation in education and research.
Adopt innovative approaches.	○ Integrate research activities into education and vice versa. Measure and disseminate outcomes and best practices. ○ Leverage ASCE initiatives in academia, e.g., develop innovative designs for Future World Vision scenarios, use Envision, and encourage students to participate in the ASCE Blue Sky Innovation Contest.
Promote JEDI through student activities.	○ ASCE Educational Activities and department heads advocate for a student competition focused on JEDI and/or incorporating JEDI into existing competitions. ○ Leverage ASCE Committee on Student Conferences and Competitions to introduce JEDI components in competitions and Student Chapter activities.
Employ best practices to assure equitable and inclusive community/stakeholder engagement.	○ Incorporate principles of universal design for learning and/or other inclusive pedagogy in ExCEEd and/or other faculty development workshops. ○ Disseminate and promote the use of the ASCE MOSAIC Best Practices Guide across the education community to support implementation of strategies that foster equity, inclusion, and justice in training and communications, leadership and engagement, partnerships, and

	events as well as strategies for assessment and accountability. ○ Include JEDI as an Outcome in CEBOK4 and/or integrate JEDI throughout the CEBOK4 Outcomes.

Table 2. Example Grassroots Actions by *All* Stakeholders for Sparking Innovation.

Integrate and promote JEDI principles across all facets of the academic enterprise.	○ Integrate JEDI principles into the academic and research enterprise – both in conduct and content. ○ Adopt, implement, promote and reward strategies that foster equity, inclusion, and justice in policies and practices, communications, leadership and engagement, partnerships, and events to assure the recruitment, retention, advancement, and success of faculty and students from all backgrounds and identities.
Develop assessment and continuous improvement systems.	○ Develop and implement plans for assessment, accountability, and continuous improvement with respect to strategies implemented to foster equity, inclusion, and justice. ○ Identify and revise or replace policies and practices that have created and/or perpetuated inequities.
Promote and recognize efforts to serve as role models.	○ Make representation and equity efforts in education more visible to the practitioner community as a means for encouraging such practices across the industry. ○ Reward and recognize exemplars for equitable and inclusive planning and design.

2.1.2 **Spread** innovation through engaging industry and related organizations.

Table 3 presents examples of Directed, Specific Actions related to spreading innovation. Table 4 presents examples of Grassroots Actions related to spreading innovation.

Table 3. Example Directed, Specific Actions for Spreading Innovation.

Establish and promote industry-academia collaboration.	○ ASCE forms an industry/academia task force, with appropriate representation of stakeholder groups, and charges it to prepare recommendations to achieve Objectives (1) through (4), ○ ASCE Industry Leaders Council (ILC) expands use of the Charles Pankow Foundation and Water Research Foundation research funding and support models to engage and increase collective industry funding and expertise to identify and support their research needs. ○ ASCE forms an ad hoc committee to inventory current sources and funding levels for civil engineering-related research, using existing data from the National Science Foundation and other sources. The committee will be charged with developing a system for continuous tracking and sharing of data on civil engineering research expenditures, sources, topics and impact.
Promote innovation in academia.	○ University programs actively promote and support the Blue Sky Innovation Contest and develop innovation-oriented activities at ASCE Student Conferences. ○ University programs institute a culture of innovation in research, curricular, and extracurricular activities, e.g., through collaboration with other disciplines, and bringing in entrepreneurs outside of traditional civil engineering employment organizations.
Form strategic parnterships across academia and organizations to promote innovation.	○ University programs organize university consortia to engage with industry/government on important regional infrastructure-environment challenges. The universities strive to incorporate aspects of the regional projects on an ongoing basis in senior design and other courses. ○ University programs work collaboratively and with industry partners to develop professional skills tools for use in formal and self-directed civil engineering education. ○ ASCE and university programs collectively work to partner with institutions and existing programs and support initiatives (e.g., career fair, mentoring

	networks, webinars/info sessions) to attract students from historically marginalized identities to pursue careers as civil engineering faculty or practitioners (NSF AGEP, SREB, FFF, GEM, ASCE ILC, ASCE sections). *See appendix D for guide to acronyms.*

Table 4. Grassroots Actions by *All* Stakeholders for Spreading Innovation.

Adopt, promote and value a culture of innovation.	○ Civil Engineering academic departments, Industry/Alumni Advisory Committees, ASCE Sections/Branches and Younger Member groups modify their governing documents and activities to explicitly address Objectives (1)-(4). ○ ASCE Department Heads Coordinating Council (DHCC), ASCE Industry Leaders Council (ILC), and Department Industry/Alumni Advisory Committees identify academia/industry innovation success stories, share results and identify opportunties for innovations.
Identify needs and practices to promote professional skills and innovation in practice.	○ ASCE DHCC and ILC and Department Industry/Alumni Advisory Committees promote understanding of industry needs and opportunities to collaborate within academic curricula and research. ○ Work with local ASCE communities to expand and enhance professional skills training and education.

2.1.3 **Speed** innovation through sharing knowledge and experiences.

Table 5 presents examples of Directed, Specific Actions related to speeding innovation. Table 6 presents examples of Grassroots Actions related to speeding innovation.

Table 5. Directed, Specific Actions for Speeding Innovation.

Utilize the Civil Engineering Education Hub (CEEH) repository to collaborate and share information.	○ ASCE Committee on Education collaborates with other organizations and develops a repository of global teaching best practices (content and pedagogy) related to development of an innovation mindset in civil engineering practice. ○ ASCE curates a repository of course modules that incorporate JEDI principles and practices (including principles of universal design, user-centered design) in civil engineering problem solving and decision making. ○ Civil engineering faculty contribute to the CEEH for sharing innovations in civil engineering education. ○ ASCE education community promotes sharing of best practices. ○ Share tools and strategies to help civil engineering programs address and assess JEDI principles and practices in ABET EAC Student Outcomes.
Share knowledge, examples, and practices consistently across the civil engineering education community.	○ Civil engineering faculty integrate creativity and innovation into the curriculum and share examples with the education and practitioner communities. ○ Civil engineering educators share examples of successfully implemented systems-oriented modules, courses, facilities, and experiences in their programs. For example, educators can leverage the systems-oriented Envision design framework in civil engineering education.
Regular communication through ASCE venues and publications.	○ ASCE develops and implements short communication vehicles (e.g., “Education Notes”) in the Journal of Civil Engineering Education for sharing and discussing educational practices and innovations. ○ ASCE implements a public forum for persons to share ideas, examples, practices, and products relating to innovation in the education and development of civil engineers. This could include a variety of events and use of different platforms (e.g., regular virtual gatherings, online discussion boards, PechaKucha sessions). ○ ASCE-led JEDI-focused events and publications including:

	• A yearly issue of the ASCE *Journal of Civil Engineering Education* (JCEE) focused on JEDI and JEDI incorporated into regular JCEE issues. • *Civil Engineering* magazine emphasizes JEDI in feature articles and adds a monthly section dedicated to JEDI. • ASCE organizes and holds a regularly scheduled JEDI-focused conference (with possible tie to sustainability) and includes JEDI in technical sessions at every Institute's feature conference.

Table 6. Example Grassroots Actions by *All* Stakeholders for Speeding Innovation.

Share ideas, examples, practices, and products on innovation.	Share ideas, examples, practices, and products related to innovation through: • Special Issues and articles in journals and other publications • Dissemination via social media • Special sessions, committee activities, and presentations at conferences • Presentations at universities, companies, industry organizations, ASCE regional and section meetings • Regular participation in, and submittal of material to the Civil Engineering Education Hub repository, including examples to support collaborations among faculty and faculty-practitioner collaborations aimed at advancing innovation, creativity, and JEDI • Formal and/or informal virtual or in-person sessions
Promote acceptance and use of innovative approaches.	Advance use of innovative approaches by: • Faculty organizing and empowering education innovation committees charged with implementing curricular and pedagogical innovations in their programs. • Faculty integrating updates on education innovation in reports to Industrial/Alumni Advisory Committees and providing examples on innovation at regularly scheduled meetings/events. • Including disruptors, provocateurs – domain experts (e.g., pedagogy) – in curriculum planning. • Implementing an innovative technology in a design project.

	• Faculty seeking ways to eliminate barriers to collaboration between engineering and other disciplines (e.g., arts, social science, policy, behavioral science) and normalize convergent problem solving.

2.1.4 **Sustain** innovation through regularly-scheduled conferences and workshops.

Table 7 presents examples of Directed, Specific Actions related to sustaining innovation. Table 8 presents examples of Grassroots Actions related to sustaining innovation.

Table 7. Directed, Specific Actions for Sustaining Innovation.

ASCE convenes a regularly scheduled Education Forum.	○ Incorporate the Civil Engineering and Technology Education Forum into the current 8-year ASCE CEBOK-CEPC cycle. Convene the Education Forum on a 3-year cycle, as shown in Table 9. ○ Form a standing Committee for Education Forum Planning and Action under the ASCE Committee on Education.
Advance JEDI, professional skills, and innovation through all ASCE channels.	○ Include an Education Innovation track at the annual ASCE Department Heads Conference. ○ Partner with ASCE Sections and Branches to host regularly scheduled education events for targeted topics (e.g, innovation, JEDI). Examples of events include webinars, in-person conferences, etc. ○ ASCE Institutes and ASCE Sections organize and hold JEDI-focused meetings , conferences, and JEDI-related sessions at other conferences; incorporate JEDI-focused presentations into technical sessions.

Table 8. Example Grassroots Actions by *All* Stakeholders for Sustaining Innovation.

Support and promote collaboration and participation at local, regional, national, and global levels.	○ Host education-related events on a local and/or regional basis. Support faculty and student participation in conferences, workshops, and other events. ○ Sponsor events; provide sponsorships to allow educators and practitioners to attend events. ○ Individuals contribute to and use the Civil Engineering Education Hub.

Sustaining efforts on innovation in civil engineering undergraduate curricula will require integration of the Education forum into the Civil Engineering curriculum planning cycle. As shown in **Table 9**, ASCE has established an eight-year cycle for systematic review and revision of the Civil Engineering Body of Knowledge (CEBOK) and the ABET Civil Engineering Program Criteria. The SWG proposes convening the Education Forum on a 3-year cycle that is integrated into the existing eight-year cycle, as shown in **Table 9**. A

regular schedule for convening the Education Forum allows for a robust discussion at key points in development of the CEBOK and the ABET Civil Engineering Program Criteria.

Table 9. ASCE's long-term schedule for CEBOK and Civil Engineering Program Criteria development

Event	CEBOK 3rd Edition	CEBOK 4th Edition
CEBOK committee organized	October 2016	October 2024
Education Forum Convened		***June 2025***
CEBOK finalized	December 2018	December 2026
CEBOK published	March 2019	March 2027
Education Forum Convened	***June 2019 (Summit)***	***June 2028***
Accreditation task committee organized	October 2020	October 2028
Draft CE Program Criteria published	March 2022	March 2030
Education Forum Convened	***June 2022***	
CE Program Criteria approved by ABET EAC (1st reading)	July 2022	July 2030
CE Program Criteria approved by ABET Board of Directors (1st reading)	October 2022	October 2030
Public review of CE Program Criteria initiated	November 2022	November 2030
Education Forum Convened		***June 2031***
CE Program Criteria approved by ABET EAC (2nd reading)	July 2023	July 2031
CE Program Criteria approved by ABET Board of Directors (2nd reading)	October 2023	October 2031
First reviews under new CE Program Criteria	September 2024	September 2032

3.0 ADVANCING THE PROFESSION: A Call to Action

The ASCE Civil Engineering Education Summit 2019, building on the organizing principle of *Empowered to Innovate*, revealed remarkable unity about the opportunity areas to advance and strengthen Civil Engineering education and prepare graduates to address the challenges of the 21st Century. From analysis of the Top 20 Opportunity Statements and the four major objectives developed at the Summit, the SWG developed proposed specific actions in four thematic areas.

- **Spark** innovation that integrates JEDI (justice, equity, diversity, and inclusion) principles across the profession.
- **Spread** innovation through engaging industry and related organizations.
- **Speed** innovation through sharing knowledge and experiences.
- **Sustain** innovation through regularly-scheduled conferences and workshops.

The Summit Working Group believes it to be vital that all members of the profession, working collaboratively to achieve a shared vision, are empowered to advance, and participate in the education and preparation of civil engineers. The actions suggested in this document are intended to help stimulate new initiatives and actions by academic leaders, educators, and students; industry leaders and practitioners; ASCE and other professional organizations; government entities, and others. These action lists are intended to stimulate thought and promote action and are neither exhaustive nor intended to be restrictive. The entire Civil Engineering community is called to a collective pursuit of new ideas and activities in collaboration, innovation, commitment, and JEDI, and toward achieving the Summit objectives.

Achieving progress will require a structure and leadership for sustained efforts on implementation of the actions proposed herein, including a timeline for action with related accountability. Critical recommended actions for sustaining efforts are:

- Initiate an ASCE Education Forum to be conducted regularly, i.e., at least at 2-4 year intervals (Table 9), to exchange ideas, collaborate on advancing actions, and to keep the civil engineering education community focused on progress. Based on the schedule proposed in Table 9, the first Education Forum is slated for June 2022.
- Form a standing Committee on Education Forum Planning and Action under the ASCE Committee on Education. This committee should have representation from the Department Heads Coordinating Council, MOSAIC, and other ASCE groups as deemed appropriate by the Committee on Education.
- Report on progress and hold an open forum on ideas for priority actions at each annual meeting of the Civil Engineering Department Heads.

The Education Forum is envisioned to be a nimble vehicle for convening meetings of educators, practicing engineers, and industry organizations on topics pertaining to civil engineering education, in all its forms including research and professional service. The Forum could be held in conjunction with meetings of ASCE Institutes or as stand-alone events. The Committee on Education Forum Planning and Action should be charged to engage broadly across ASCE in making plans for events that will support advancement of the 2019 Summit objectives and the categories of actions outlined in this report.

Advancing education and preparing graduates to meet these challenges will need the commitment and support of all members of our profession. The need for the service, commitment, and creativity of civil engineers in communities across the world has never been greater. With technology advances, climate change, and growing awareness of the need for socially-just infrastructure solutions, the nature and focus of civil engineering education must continue to adapt to our changing world. All civil engineers, and especially civil engineering educators, are encouraged to be proactive: **identify at least one type of action discussed in this report and start working on it today.**

Appendix A

Top 20 Opportunity Statements from Civil Engineering Education Summit 2019

1. Students need to learn systems thinking so that they are prepared for current and future societal challenges.

2. Students need to develop people-focused skills so that they can design infrastructure that is relevant to society.

3. Faculty need to emphasize systems thinking so that sustainable, socially-just infrastructure can be designed.

4. Civil Engineering faculty need to integrate creativity into the curriculum to build thought leaders and innovators.

5. Faculty need to adopt evidence-based instructional methods so that students can develop critical thinking skills in order to evaluate alternative approaches of civil engineering like sustainability and equity.

6. K-12 students need to be exposed to the challenges of the future so that as future civil engineers they are equipped to solve them.

7. Faculty need to provide learning opportunities inside and outside the classroom so that students can build portfolios of life experiences.

8. Civil Engineering students need to exhibit the attitudes and behaviors of innovation so that they can respond to future challenges.

9. University administrators need to be adaptable and offer resources so that new curricular approaches are encouraged.

10. Faculty need to equip students to understand equity and diversity so that they can work inclusively in a global environment.

11. Under-prepared students need access to supplementary education so that they can be successful in Civil Engineering and careers.

12. Universities need to develop a culture of equity and inclusion so that we produce a more diverse future workforce.

13. Civil Engineering faculty need to develop more flexible assessment criteria so that curricula can respond to worldwide challenges and opportunities.

14. Accrediting bodies need to foster adaptive programs so that curricula can rapidly address current and future societal needs.

15. ASCE needs to provide a repository of global teaching best practices so that the rate of innovation is increased.

16. Civil Engineering departments need to communicate better the application of a CEBS degree so that students see its value in any career path.

17. Faculty need to identify new metrics for scholarly productivity so that promotions are awarded to those addressing society's future needs.

18. Decision-makers need to remove regulatory roadblocks so that innovation can flourish.

19. Industry-University consortia need to provide startup opportunities with funding so that students can be energized (sparkle) by an entrepreneurial pipeline.

20. Higher Education institutions need to form consortia so that emergent topics can be team taught with virtual technology.

Appendix B

Civil Engineering Education Summit 2019 Action Matrix

The Summit Working Group compiled, grouped, and condensed related goals, thoughts, and actions identified by Summit participants, and developed lists of possible actions that were grouped into four thematic areas. The actions were then mapped to a list of Civil Engineering stakeholders, and primary (P) or secondary (s) responsibility for implementation was assigned to certain stakeholders for each action. The resulting Civil Engineering Education Summit 2019 Action Matrix – separated by Objective – is presented in this Appendix.

Spark innovation that integrates JEDI principles across the profession.

Spark innovation that integrates JEDI principles across the profession	DSA/ GR[1]		Academic Leaders[2]	Educators[2]	Students[2]	Industry Leaders[2]	Engineering Practitioners[2]	ASCE[2]	Other Professional Orgs[2]	Goverment[2]	Accrediting & Licensing[2]
Support individuals and organizations											
Department administrators recognize excellence and innovation	DSA	**P**	s								
Department heads provide course release time or seed funds	DSA	**P**	s								
Faculty prioritize discussing innovation sucesses and challenges	DSA	s	**P**	s							
Department heads and industry managers incentivize practitioners	DSA	**P**	s	s	**P**	s			**P**		
Industry funding agencies increase funding for innovation	DSA				**P**		s	s	s		
Adopt innovative JEDI Approaches											
Integrate research activities into education and vice versa	DSA	**P**	**P**		s	s			s		
Leverage ASCE initiatives into academia	DSA	s	s	s	s	s	**P**		s		
Promote JEDI through student activities	DSA										
ASCE Educ Activities and dept heads advocate for JEDI student competitions	DSA	s	s	s	s	s	**P**	**P**			
Disseminate and promote ASCE MOSAIC Best Practices Guide	DSA	s	s	s	s	s	**P**	**P**			
Include JEDI as Outcome in CEBOK$_4$ and/or integrate throughout CEBOK$_4$	DSA	s	s	s	s	s	**P**	**P**			
Employ JEDI best practices											
Incorporate universal design in ExCEEd and faculty development	DSA	**P**	**P**		s	s	**P**	s			
Disseminate and promote use of MOSAIC best practices	DSA	**P**	s	s	**P**	s	**P**	s	s	s	
Include JEDI as CEBoK$_4$ Outcome	DSA	**P**	s		**P**	s	**P**	s			
Integrate and promote JEDI principles across academic enterprise											
Integrate JEDI principles into academic and research enterprise	GR	**P**	s	s	**P**	s	s	s	**P**	**P**	
JEDI strategies for recruitment, retention, and advancement of diverse faculty & students	GR	**P**	s	s	**P**	s	s	s	**P**	**P**	
Develop JEDI assessment and continuous improvement systems											
Develop and implement plans for assessment and improvement of JEDI strategies	GR	**P**	s	s	**P**	s	s	s	**P**	**P**	
Revise/replace policies and practices that have created or perpetuated inequities	GR	**P**	s	s	**P**	s	s	s	**P**	**P**	
Promote and recognize efforts to serve as JEDI role models											
Make JEDI education efforts more visible to practitioner community	GR				**P**	s	s	s	**P**		
Reward/recognize exemplars for equitible and inclusive planning and design	GR				**P**	s	s	s	**P**		

Notes:

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Description of Stakeholer Groups:

Educators:	University educators such as professors, adjuncts, and instructors.
Students:	Undergrad and graduate students.
Industry Leaders:	Current or former heads of engineering companies.
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Spread innovation through engaging industry and related organizations.

	DSA/ GR[1]		Academic Leaders[2]	Educators[2]	Students[2]	Industry Leaders[2]	Engineering Practitioners[2]	ASCE[2]	Other Professional Orgs[2]	Government[2]	Accrediting & Licensing[2]
Spread innovation through engaging industry and related organizations											
Establish and promote industry-academia collaboration											
ASCE industry/academia task force for Objectives (1) through (4)	DSA	**P**	s	s	**P**	s	**P**		s	s	
ASCE ILC expands industry funding and participation in research	DSA	**P**	s		**P**	s	**P**		s		
ASCE ad-hoc committee to inventory and track CE research funding data	DSA	s	s		s	s	**P**		s		
Promote innovation in academia											
Universities promote ASCE Innovation Contest/innovation at ASCE Student Conferences	DSA	**P**	s	**P**	s	s	**P**				
Universities promote innovation in research, curricular, and extracurricular activites	DSA	**P**	s	s	**P**	s			**P**		
Form strategic partnerships across academia and organizations											
University consortia engage w/ industry/gov't on infrastructure-environment challenges	DSA	**P**	s		**P**	s			**P**		
Universities work with industry partners to develop professional skill tools	DSA	**P**	s	s	**P**	s			**P**	s	
Partner w/ institutions/programs to attract students from marginalized identities to CE	DSA	**P**	s	s	**P**	s		**P**	**P**	s	
Adopt, promote, and value a culture of innovation											
CE depts and ASCE groups modify governing documents to address Objectives (1) - (4)	GR										
ASCE DHCC, ILC, and advisory committees share academia/industry success stories	GR	**P**	s		**P**	s	**P**	s	**P**		
Identify needs and practices to promote professional skills and innovation in practice											
ASCE DHCC, ILC, and advis comms promote understanding of collaboration opportunities	GR										
Work with local ASCE comms to expand/enhance professional skills training and educ	GR	**P**	s	s	**P**	s	**P**	s	**P**	s	

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Speed innovation through sharing knowledge and experiences.

	DSA/ GR[1]	Academic Leaders[2]	Educators[2]	Students[2]	Industry Leaders[2]	Engineering Practitioners[2]	ASCE[2]	Other Professional Orgs[2]	Goverment[2]	Accrediting & Licensing[2]
Speed innovation through sharing knowledge and experiences										
Utilize CEEH repository to collaborate and share information										
ASCE COE collaborates with others to develop repository of best global teaching practices	DSA	**P**	s	s	**P**	s	**P**	s	**P**	s
ASCE curates repository of course modules for JEDI practices	DSA	s	s	s	s	s	**P**	s	s	s
CE faculty contribute to CEEH	DSA	P	P				**s**			
ASCE COE promotes sharing of best practices	DSA	s	s				**P**			
Share tools/strategies for CE programs for incorporating JEDI into ABET EAC outcomes	DSA	s					**P**			**P**
Share knowledge, examples, and practices across the CE education community										
Faculty integrate creativity and innovation into curriculum and share	DSA	P	P				**s**	s		
CE educators share examples of systems-oriented modules, courses, etc.	DSA	P	P		s		**s**	s		
Regular communication through ASCE venues and publications										
ASCE develops short communication vehicles for ASCE Journal of CE Education	DSA	s	s	s	s	s	**P**	s	s	s
ASCE implements public forum for persons to share ideas and experiences	DSA	s	s	s	s	s	**P**	s	s	s
ASCE-led JEDI-focused events and publications:	DSA	s	s	s	s	s	**P**	s	s	s
ASCE Journal of CE Education	DSA	s	s	s	s	s	**P**	s	s	s
CE Magazine	DSA	s	s	s	s	s	**P**	s	s	s
ASCE conferences	DSA	s	s	s	s	s	**P**	s	s	s
Share ideas, examples, practices, and products on innovation										
Special issues in journals	GR	**P**	**P**	s	**P**	**P**	s	**P**	**P**	**P**
Social media	GR	**P**	**P**	s	**P**	**P**	s	**P**	**P**	**P**
Special sessions, committee activites, and presentations at conferences	GR	**P**	**P**	s	**P**	**P**	s	**P**	**P**	**P**
Presentations at univerisities, companies, industry orgs & ASCE regional/section activies	GR	**P**	**P**	s	**P**	**P**	s	**P**	**P**	**P**
Regular participation in and submission of reports to CEEH	GR	**P**	**P**	s	**P**	**P**	s	**P**	**P**	**P**
Formal and/or informal virtual or in person sessions	GR	**P**	**P**	s	**P**	**P**	s	**P**	**P**	**P**
Promote acceptanance and use of innovative approaches										
Faculty organize and empower innovation committees	GR	P	P							
Faculty include innovation updates in reports to Industrial/Alumni Advisory Commmittee	GR	P	s		P					
Include disruptors, provocatures, and domain experts in curriculm planning	GR	P	s				s	s		
Implement innovative technology in a design project	GR	s	P			s				
Faculty seek to eliminate barriers to collaboration between engineering/other disciplines	GR	P	P		s	s	s	s		

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Sustain innovation through regularly-scheduled conferences and workshops.

	DSA/ GR[1]	Academic Leaders[2]	Educators[2]	Students[2]	Industry Leaders[2]	Engineering Practitioners[2]	ASCE[2]	Other Professional Orgs[2]	Government[2]	Accrediting & Licensing[2]	
Sustain innovation through regularly-scheduled conferences and workshops											
ASCE convenes regularly scheduled education forum											
CE&T Educ Summit in 8 yr CEBoK-CEPC cycle/Educ Summit on 4 yr cycle (Table 1)	DSA	**P**	s		s	s	**P**		**P**		
Standing Committee for Education Forum Planning & Action under COE	DSA	s			s		P				
Advance JEDI, professional skills, and innovation through all ASCE channels											
Include Education Innovation track at annual ASCE Div Hds Conf	DSA	P	s								
Partner w/sections and branches for regular education events	DSA	**P**	s		**P**	**P**	**P**		**P**		
ASCE institutes and sections hold JEDI conferences or conference sessions	DSA	**P**	s		**P**	**P**	**P**		**P**		
Support/promote collaboration & participation at local, regional, national, and global events											
Host educ events at local/regional venues & support faculty & students in confs etc	GR	s	**P**	s	s	**P**	s	s	**P**		
Sponsor events; provide sponsorships for educators and practitioners	GR	s	**P**	s	s	**P**	s	s	**P**		
Individuals contribute to and use the CEEH	GR	s	**P**	s	s	**P**	s	s	**P**		

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Appendix C

Useful Resources

50K Coalition: https://50kcoalition.org/

ABET Engineering Accreditation Commission (EAC) Outcomes

ASCE (1995) "Summary Report: 1995 Civil Engineering Education Conference (CEEC '95)." American Society of Civil Engineers, Denver, CO, June 8-11, 1995.

ASCE (2019) "Civil Engineering Body of Knowledge: Preparing the Future Civil Engineer," 3rd Edition, American Society of Civil Engineers, Reston, VA, 2019.

ASCE (2006) "The Vision for Civil Engineering in 2025," American Society of Civil Engineers, Reston, VA, 2006.

ASCE, *Education Summit: Mapping the Future of Civil Engineering Education*, ISBN: 9780784483251

ASCE Policy Statement 140, "Civil Engineering Education – A Shared Responsibility"

ASCE ExCEEd Teaching Workshops https://www.asce.org/exceed/

ASCE Future World Vision: https://www.futureworldvision.org/

ASCE Justice, Equity, Diversity, and Inclusion Resources

ASEE (1955) "Summary of the Report on Evaluation of Engineering Education," Journal of Engineering Education, American Society for Engineering Education, Washington, DC, September 1955, pp. 25-60.

Black in Engineering Action Steps toward becoming an Antiracist University

Engineering Change Podcast https://engineeringchangepodcast.com/

MIT (2018) "The Global State of the Art of Engineering Education." Graham, Ruth, Massachusetts Institute of Technology, Cambridge, MA, 2018, pp. ii-iv.

NAE (2005) "Educating the Engineer of 2020: Adapting Engineering Education to the New Century." National Academy of Engineering, Washington, DC, 2005, pp. 1-5.

NAE Grand Challenges for Engineering

United Nations Sustainable Development Goals

Appendix D

Acronyms

ABET	Accreditation Board for Engineering and Technology, Inc.
AGEP	Alliances for Graduate Education and the Professoriate
AHEAD	Association on Higher Education and Disability
AISES	American Indian Science and Engineering Society
ASCE	American Society of Civil Engineers
CBOK	ASCE Civil Engineering Body of Knowledge
CEPC	Criteria for Civil Engineering Programs
COE	ASCE Committee on Education
DHCC	ASCE Civil Engineering Department Heads Coordinating Council
ExCEEd	Excellence in Civil Engineering Education
FFF	Ford Foundation Fellows
GEM	National GEM Consortium
IAC	Industry/Alumni Advisory Committee
ILC	ASCE Industry Leaders Council
JEDI	Justice Equity Diversity and Inclusion
MOSAIC	Members of Society Advancing an Inclusive Culture
NSBE	National Society of Black Engineers
NSF	National Science Foundation
SHPE	Society of Hispanic Professional Engineers
SREB	Southern Regional Education Board
SWE	Society of Women Engineers
SWG	ASCE Civil Engineering Education Summit Working Group