# CIVIL ENGINEERING EDUCATION WITH STRAIGHT A'S— ASCE, ABET & AUBURN

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AUBURN UNIVERSITY
Samuel Ginn College of Engineering

# CEE UNDERGRADUATE PROGRAM

## BACHELOR OF CIVIL ENGINEERING PROGRAM

- Enrollment steady at approximately 550 students
- 120 graduates per year (25th in US)
- Eight specialization options
- 1st Place—2022 ASCE National Innovation Contest
- Hosted 2022 Gulf Coast ASCE Symposium—1st Place Overall (out of 15 universities)
- 2nd Place—2023 Traffic Control Device Student Challenge (national competition)
- 2023 Gulf Coast ASCE Symposium—1st Place in structural engineering, coastal engineering, and environmental engineering events
- At top of SGCOE in *Employment Success* and *Continuing Education Success*


# CHOICE OF SPECIALIZATION AREA

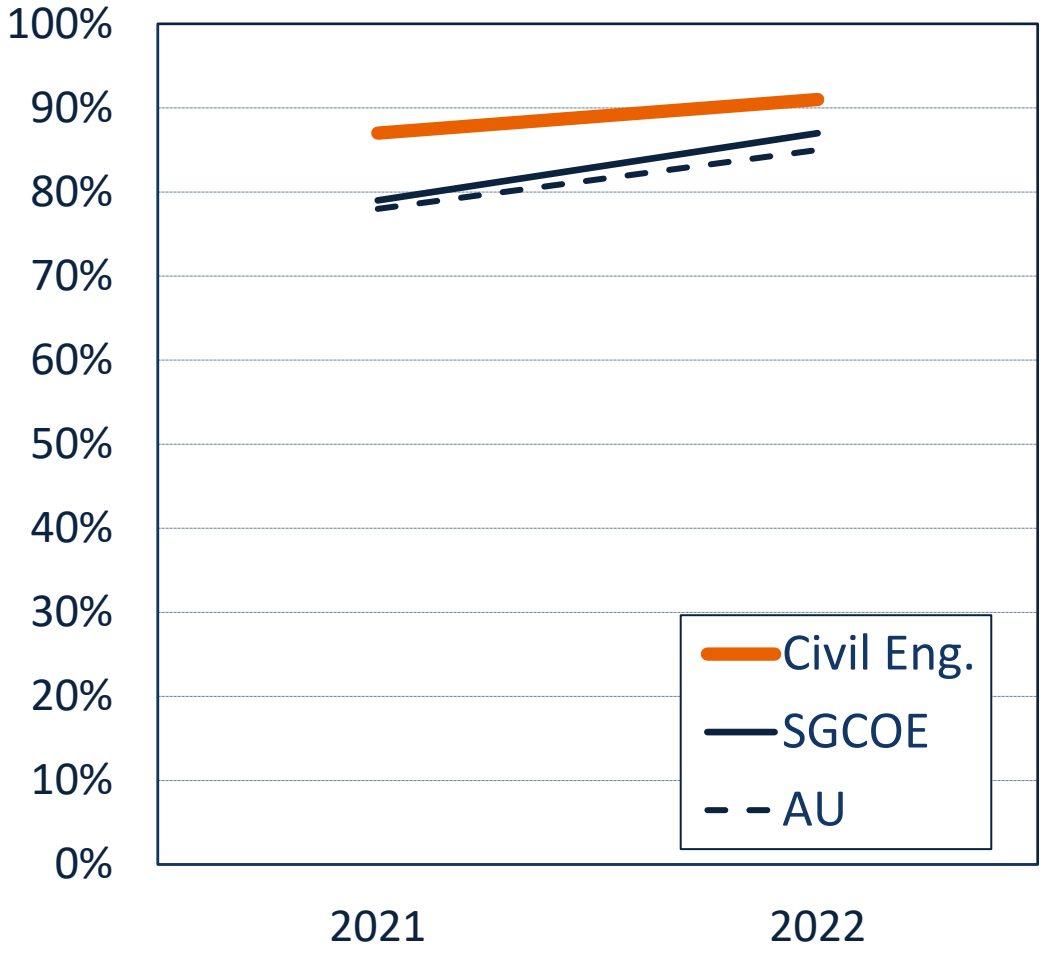
## AUBURN UNIVERSITY ALUMNI VERSUS FIRST-YEAR STUDENTS

| | Alumni Survey (%) n=220 | ENGR 1110 (%) n=62 |
|---|---|---|
| Construction | 28 | 28 |
| Transportation | 20 | 13 |
| Structural | 17 | 31 |
| Site Eng & Land Devel. | 11 | 10 |
| Water Resources | 6 | 5 |
| Environmental | 4 | 5 |
| Pavements & Matl | 3 | 5 |
| Geotechnical | 3 | 3 |
| Other | 8 | NA |

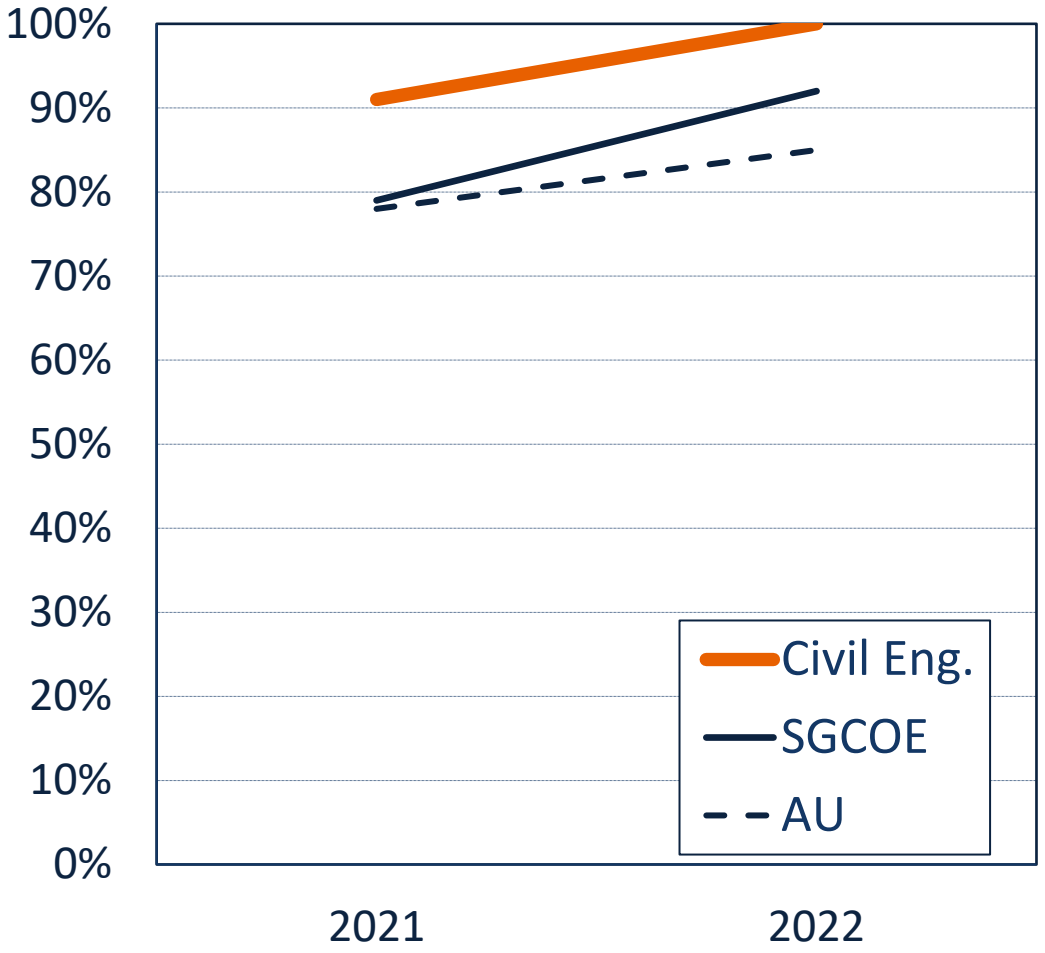
# CEE UNDERGRADUATE PROGRAM

## BACHELOR OF CIVIL ENGINEERING OUTCOMES

### Employment Success




### Continuing Education Success



# HOW DOES ASCE INFLUENCE CE EDUCATION?

## A FEW THINGS COME TO MIND

- Standards
- Guidance and Inspiration
- Support
  - Mentorship
  - Activities and competitions
  - Sponsorship
- Growth
  - Visibility and recruiting

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# STANDARDS

# AU STUDENT OUTCOMES

(MANDATED BY ABET FOR ALL ENGINEERING DISCIPLINES)

Auburn University Bachelor of Civil Engineering graduates will have

1. an ability to **identify, formulate, and solve complex engineering problems** by applying principles of engineering, science, and mathematics;
2. an ability to **apply engineering design** to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3. an ability to **communicate effectively** with a range of audiences;
4. an ability to **recognize ethical and professional responsibilities** in engineering situations and **make informed judgments**, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts;
5. an ability to **function effectively on a team** whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;
6. an ability to **develop and conduct appropriate experimentation**, **analyze and interpret data**, and **use engineering judgment to draw conclusions**; and
7. an ability to **acquire and apply new knowledge** as needed, using appropriate learning strategies.

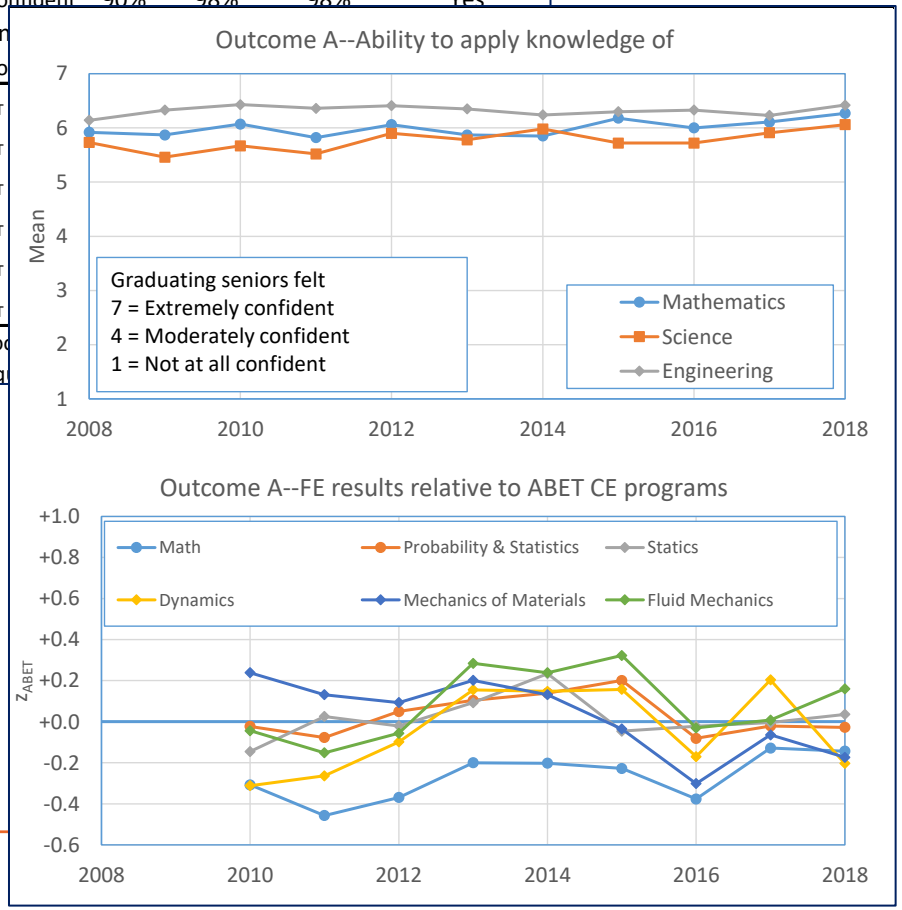
# PROGRAM ASSESSMENT—STUDENT OUTCOMES

1. Course-embedded measures
2. FE Exam scores
3. Graduating senior exit surveys
4. Alumni survey

- Annual Process
- Action Plan if needed

Outcome A--2019 Assessment Results

| Instrument | Scale | n | Metric | Goal | Previous | Current | Goal Met? |
|---|---|---|---|---|---|---|---|
| C_A1 (CIVL 3010) | 0-7 | 40 | % ≥ 5 | 70% | 77% | 65% | No |
| C_A2 (CIVL 3110) | 0-7 | 52 | % ≥ 5 | 70% | 67% | 46% | No |
| C_A3 (CIVL 3310) | 0-4 | 57 | % ≥ 3 | 70% | 71% | 84% | Yes |
| GS_A1 (Math) | 1-7 | 94 | Mean | 5 | 6.11 | 6.27 | Yes |
| | | | % ≥ Mod. Confident | 90% | 98% | 99% | Yes |
| GS_A2 (Science) | 1-7 | 94 | Mean | 5 | 5.91 | 6.06 | Yes |
| | | | % ≥ Mod. Confident | 90% | 98% | 98% | Yes |
| GS_A3 (Engineering) | 1-7 | 94 | Mean | | | | |
| | | | % ≥ Mod. Co | | | | |
| FE_Math | | 65 | $z_{ABET}$ | | | | |
| FE_Prob&Stat | | 65 | $z_{ABET}$ | | | | |
| FE_Statics | | 65 | $z_{ABET}$ | | | | |
| FE_Dynamics | | 65 | $z_{ABET}$ | | | | |
| FE_MechMatls | | 65 | $z_{ABET}$ | | | | |
| FE_FluidMech | | 65 | $z_{ABET}$ | | | | |
| AS_A (2010-14 grads) | 0-4 | 32 | % ≥ Goo | | | | |
| | | | % ≥ Adeq | | | | |



# DRAFT ABET *CIVIL ENGINEERING* PROGRAM CRITERIA

## CIVIL ENGINEERING **FACULTY** REQUIREMENTS (DEVELOPED BY ASCE)

- The program must demonstrate that **faculty teaching courses that are primarily design in content** are qualified to teach the subject matter by virtue of **professional licensure, or by education and design experience**.
- The program must demonstrate that it is **not critically dependent on one individual**.

# DRAFT ABET *CIVIL ENGINEERING* PROGRAM CRITERIA

## CIVIL ENGINEERING **CURRICULUM** REQUIREMENTS (DEVELOPED BY ASCE)

The curriculum must include:

a) Application of:

i) mathematics through differential equations, probability and statistics, calculus-based physics, chemistry, and either computer science, data science, or an additional area of basic science

ii) engineering mechanics, materials science, and numerical methods relevant to civil engineering

iii) principles of sustainability, risk, resilience, diversity, equity, and inclusion to civil engineering problems

iv) the engineering design process in at least two civil engineering contexts

v) an engineering code of ethics to ethical dilemmas

b) Solution of complex engineering problems in at least four specialty areas appropriate to civil engineering

c) Conduct of experiments in at least two civil engineering contexts and reporting of results

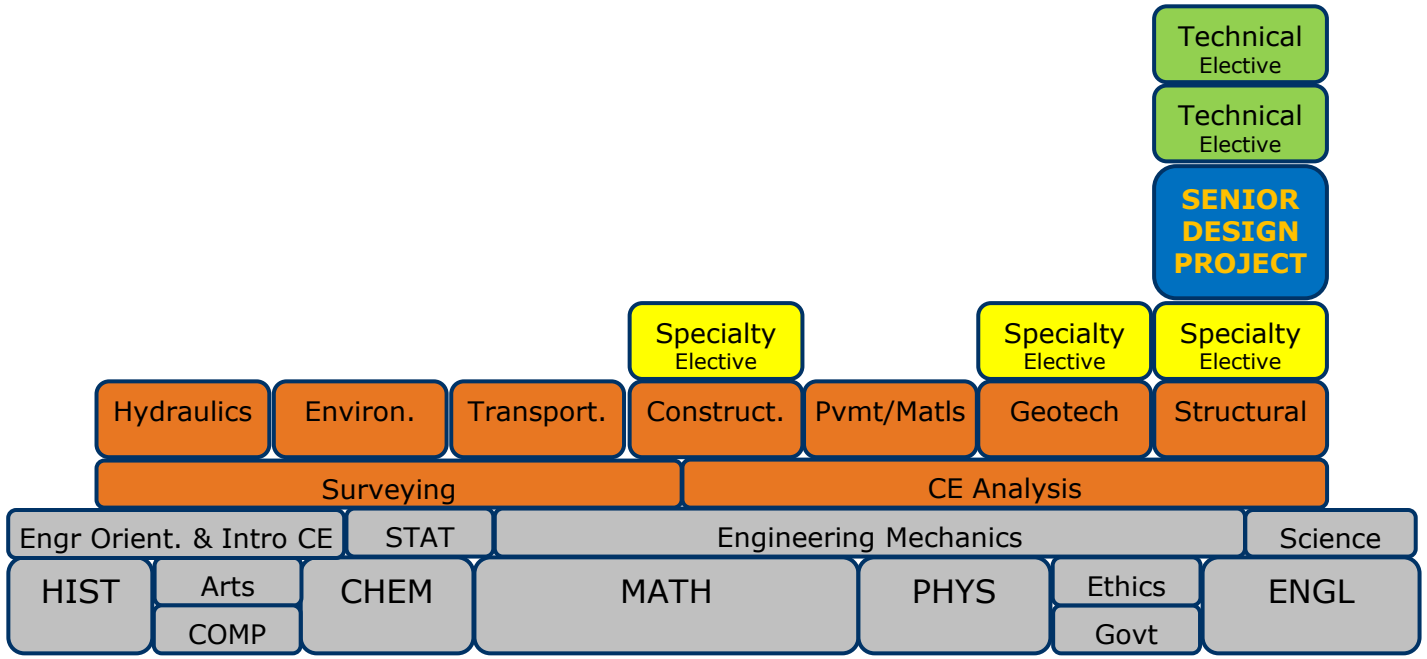
d) Explanation of:

i) concepts and principles in project management and engineering economics

ii) professional attitudes and responsibilities of a civil engineer, including licensure and safety

# AUBURN BCE CURRICULUM STRUCTURE (128 CREDIT HOURS)

## SPECIALIZATION EXAMPLE—STRUCTURAL ENGINEERING




CIVL Electives

Required CIVL

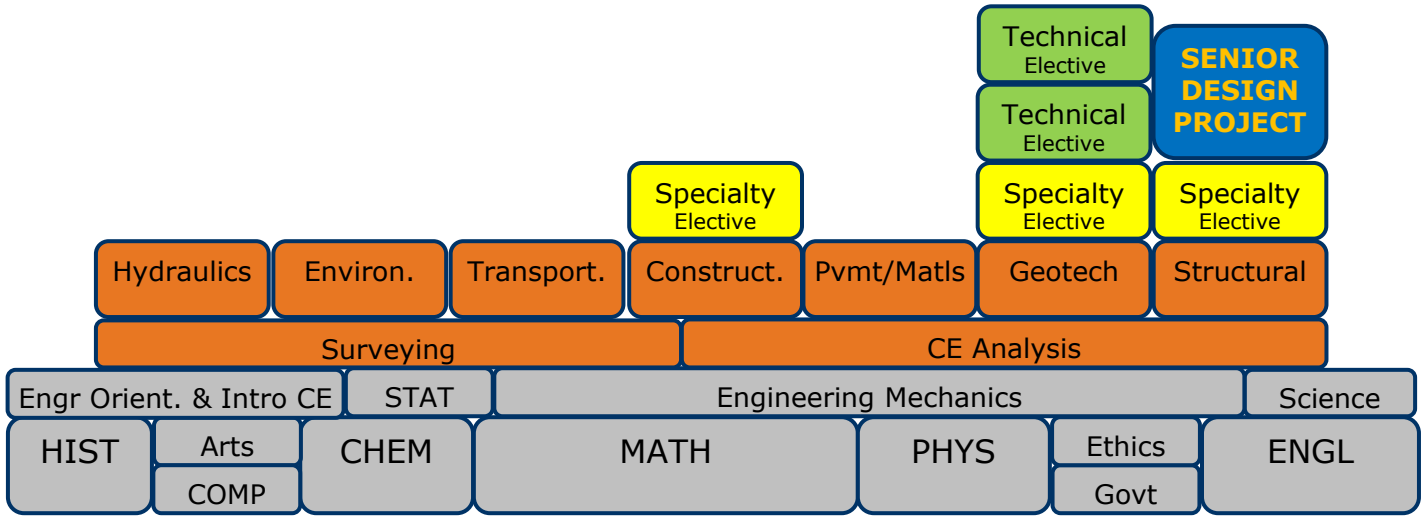
Core and Pre-Engineering

*DEPTH*

*BREADTH*

# AUBURN BCE CURRICULUM STRUCTURE (128 CREDIT HOURS)

## SPECIALIZATION EXAMPLE—GEOTECHNICAL ENGINEERING




CIVL Electives

Required CIVL

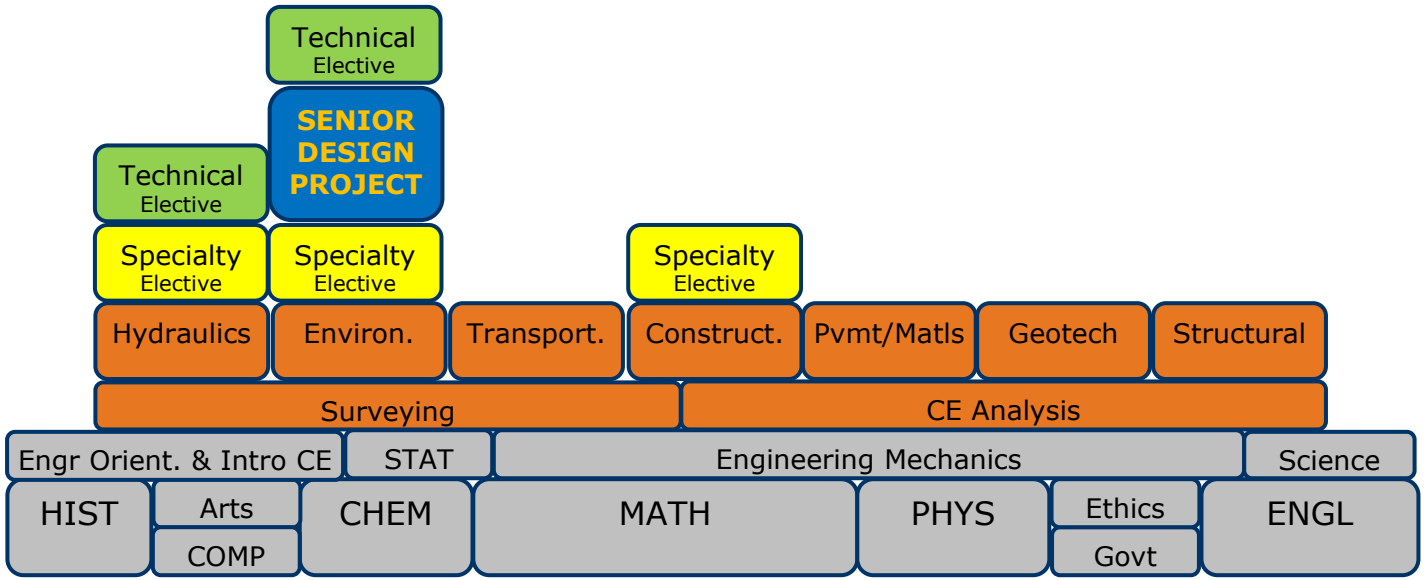
Core and Pre-Engineering

*DEPTH*

*BREADTH*

# AUBURN BCE CURRICULUM STRUCTURE (128 CREDIT HOURS)

## SPECIALIZATION EXAMPLE—ENVIRONMENTAL OR WATER RESOURCES ENGINEERING




CIVL Electives

Required CIVL

Core and Pre-Engineering

*DEPTH*

*BREADTH*

# BREADTH VERSUS DEPTH

## THE PERENNIAL ISSUE

- How much breadth should be required?
  - AU→first course in all areas, second course (with design aspects) in three areas
  - Is this too much?
  - If so, what should we drop or free up?
- Can we achieve the appropriate level of depth for an undergraduate degree?
  - AU→typically 4-5 courses within specialization plus one or two in closely aligned areas (e.g., Structures and Geotech; Environmental & Water Resources
  - If not, how much more depth is needed at the undergraduate level?
- How do we balance flexibility with meaningful course selection (by students)?
  - AU→most students choose expediency (effort, GPA considerations) over specialization.

# STANDARDS—ENFORCEMENT

## BECOME AN ASCE/ABET PROGRAM EVALUATOR (PEV)

- PEVs evaluate Civil Engineering programs for compliance with ABET criteria
- You don't have to be an "academic"!
- Qualifications
  - ASCE Member (or higher) grade
  - PE with 10 years experience
- Applications (www.abet.org) typically reviewed January-February
- Training (online) follows your selection by ASCE
- Review activities begin report review late summer and conclude with campus visit in the fall
- Travel expenses are covered
- Campus visit travel typically spans Saturday to Tuesday
- You set your availability each year
- Great way to travel, interact with other engineers, and learn new things!

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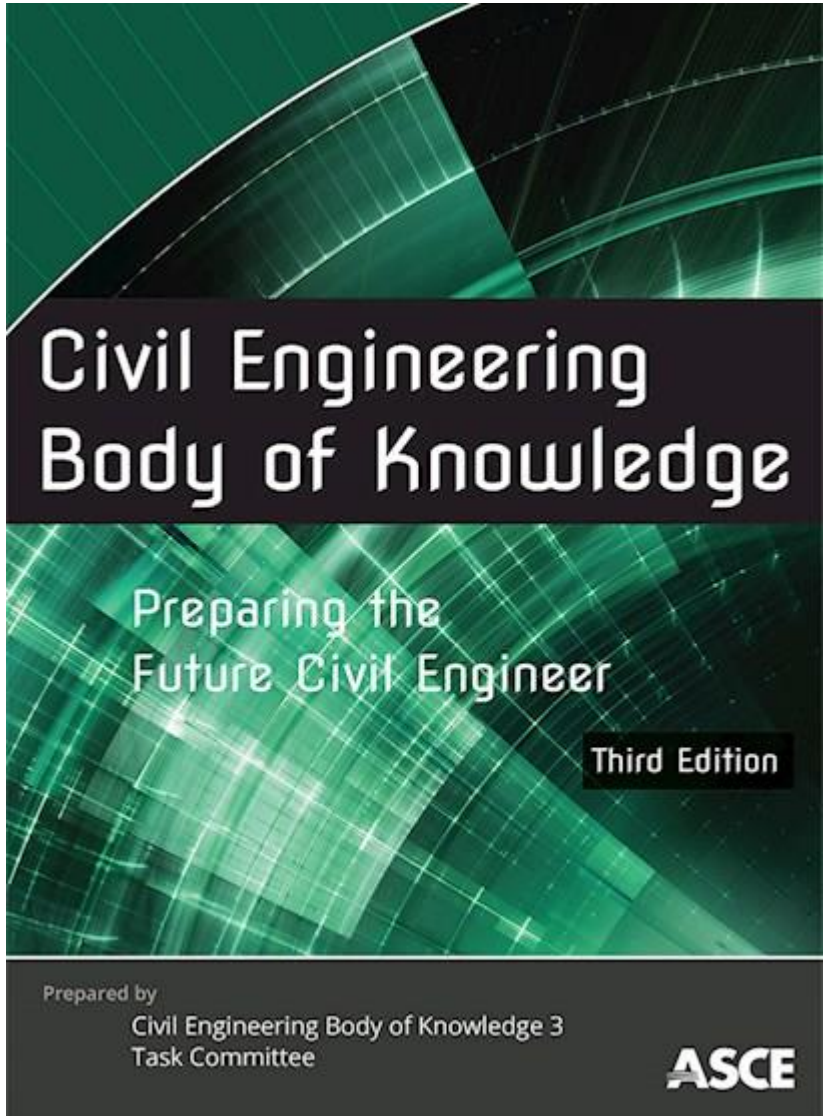
# GUIDANCE

# FORWARD-THINKING KNOWLEDGE BUILDING

## ASCE CIVIL ENGINEERING BODY OF KNOWLEDGE





- Specific levels of outcome achievement are assigned to four types of education:
  - Undergraduate
  - Postgraduate
  - Mentored experience
  - Self-developed

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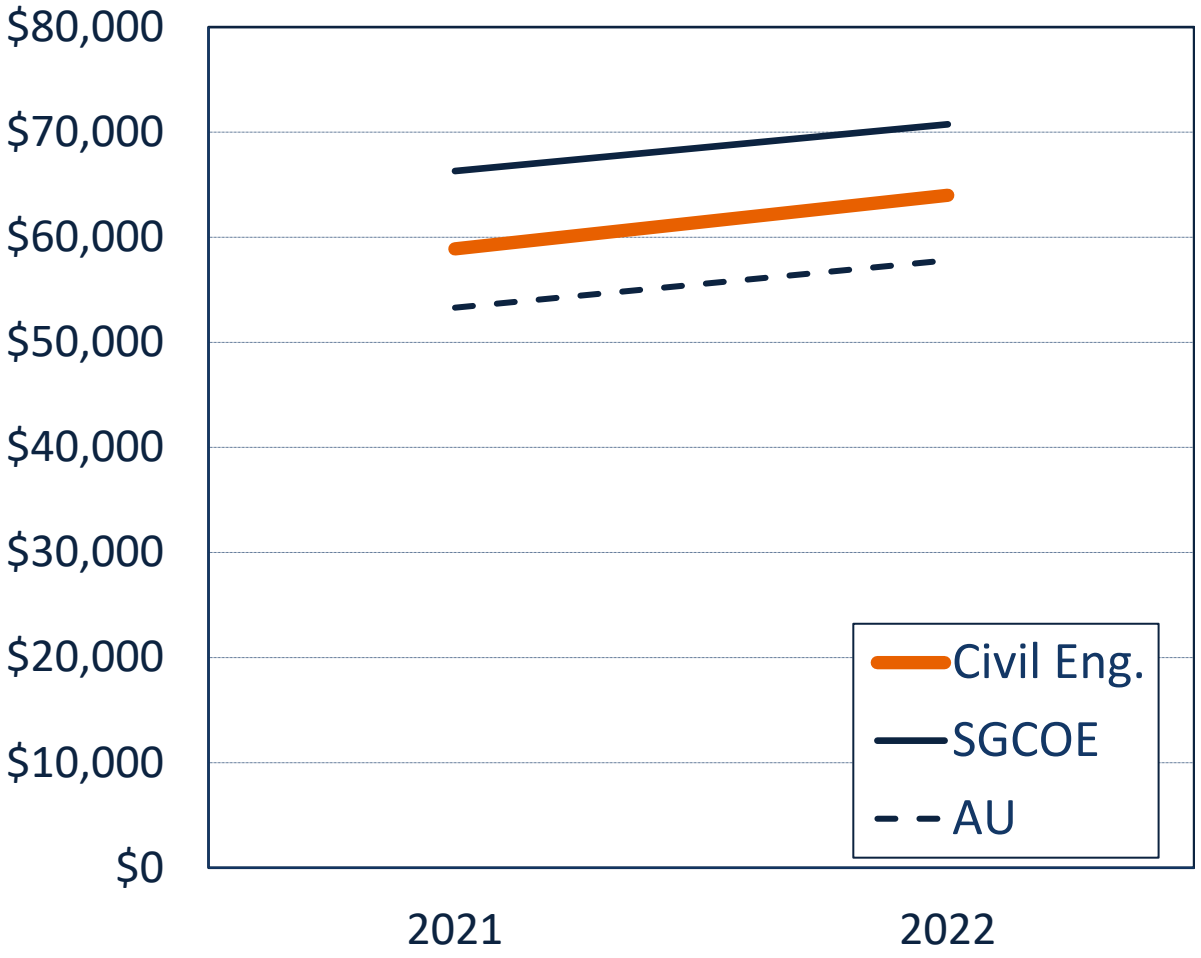
# GROWTH OF OUR PROFESSION

# DEMAND FOR CIVIL ENGINEERS

SOME STATISTICS—2022

## Avg. Starting Salary—AU Bachelors




- Alabama has approx. 1.5% of CE jobs in US (*BLS*)
- IIJA will **create** 82,000 engineering/design jobs (*ASCE*)
- 21,200 CE job **openings** per year over next decade in US (*BLS*)
- 15,700 Bachelor of CE or EnvE graduates per year in US (*ASEE*)—not growing
- 2022 average CE salary in Alabama—$92,500 (*BLS*)
- Average **starting** salary for Auburn BCE graduate in 2022 ($64,000) was **above** the 20$^{th}$ percentile salary for all CEs in (state of) Alabama. (*BLS*)
- We need more young people interested in civil and environmental engineering!
- Else (offshoring, AI)?

# RECRUITING YOUTH TO CIVIL ENGINEERING

## ASCE'S MOST URGENT TASK?

- None of this is new, but more urgent than ever (peacetime)?
- Must capture the attention of young people and school programs—not engineering, **civil engineering!**
- Universities are doing a better job than ever, but **CE** recruiting is not simple.
- How do we get into schools?
- How do we get to underrepresented population? How do we get them up to speed?
- ASCE recruiting programs/resources
  - Future World Vision (futureworldvision.org)
  - *Cities of the Future*—IMAX film (early 2024?)
- What can ASCE Montgomery do (with or without AU)?






2020 2030 2040 2050 2060 2070

Flexible Batteries
Graphene
Construction Drones
Liquid Battery
GMO Food Disaster
3D Printing
Sustainable Desalination
15% of New Construction is 3D Printed
Autonomous Vehicles
Nanotech
Ubiquitous Connected Infrastructure
Mars Manned Mission
Ubiquitous "Human Scale" AIs in Cities
3D Printed Graphene Used in Construction
Quantum Computing
Level 6 AVs
Megastorms
Ubiquitous Graphene Construction
Commercial Quantum Computing
General AI
Sea Levels Rise by 1' Worldwide
143 Million People Displaced by Climate Change
Rogue Asteroid or Planet Hits Earth
25 Million to 1 Billion Environmental Immigrants
Most Cargo is Shipped via Hyperloop & AV

CATEGORIES: Innovation Disruptors Informed Speculation

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# THANK YOU!

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