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

Robert Barnes, PhD, PE
Professor
Chair, Undergraduate Program Committee
Department of Civil & Environmental Engineering

AUBURN UNIVERSITY
Samuel Ginn College of Engineering
CEE UNDERGRADUATE PROGRAM

BACHELOR OF CIVIL ENGINEERING PROGRAM

- Enrollment steady at approximately 550 students (127 women this year)
- 120 graduates per year (20\textsuperscript{th}-25\textsuperscript{th} in US)
- Eight specialization tracks
<table>
<thead>
<tr>
<th>Specialty</th>
<th>Alumni Survey (%)</th>
<th>ENGR 1110 (%)</th>
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</thead>
<tbody>
<tr>
<td>Construction</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Transportation</td>
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<td>13</td>
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<tr>
<td>Structural</td>
<td>17</td>
<td>31</td>
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<tr>
<td>Site Eng &amp; Land Devel.</td>
<td>11</td>
<td>10</td>
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<td>Water Resources</td>
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<tr>
<td>Environmental</td>
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<td>Pavements &amp; Matl</td>
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<td>5</td>
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<tr>
<td>Geotechnical</td>
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<tr>
<td>Other</td>
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</table>
CEE UNDERGRADUATE PROGRAM

BACHELOR OF CIVIL ENGINEERING PROGRAM

- Enrollment steady at approximately 550 students (127 women this year)
- 120 graduates per year (20th-25th in US)
- Eight specialization tracks
- 1st Place—2022 ASCE National Innovation Contest
- Hosted 2022 Gulf Coast ASCE Symposium—1st Place Overall
- 2023 Gulf Coast ASCE Symposium—1st Place in structural engineering, coastal engineering, and environmental engineering events
- 2024 Gulf Coast ASCE Symposium—1st Place in steel bridge and sustainable solutions; 2nd place surveying and geotechnical engineering
- At top of SGCOE in Employment Success and Continuing Education Success
HOW DOES ASCE INFLUENCE CE EDUCATION?
A FEW THINGS COME TO MIND

- Standards
- Guidance
- Support
- Growth
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.
1. Course-embedded measures
2. FE Exam scores
3. Graduating senior exit surveys
4. Alumni surveys

- Annual Process
- Action Plan if needed
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 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
The curriculum must include:

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:
   
   b) i) concepts and principles in project management and engineering economics
   
   c) ii) professional attitudes and responsibilities of a civil engineer, including licensure and safety
AUBURN BCE CURRICULUM STRUCTURE (128 CREDIT HOURS)

SPECIALIZATION EXAMPLE—STRUCTURAL ENGINEERING

BREADTH
AUBURN BCE CURRICULUM STRUCTURE (128 CREDIT HOURS)

SPECIALIZATION EXAMPLE—STRUCTURAL ENGINEERING

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<th>DEPTH</th>
<th>Required CIVL</th>
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<td>Core and Pre-Engineering</td>
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BREADTH
AUBURN BCE CURRICULUM STRUCTURE (128 CREDIT HOURS)

SPECIALIZATION EXAMPLE—STRUCTURAL ENGINEERING

BREADTH

DEPTH

CIVL Electives

Required CIVL

Core and Pre-Engineering
AUBURN BCE CURRICULUM STRUCTURE (128 CREDIT HOURS)

SPECIALIZATION EXAMPLE—ENVIRONMENTAL OR WATER RESOURCES ENGINEERING

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

BREADTH

CIVL Electives

Required CIVL

Core and Pre-Engineering
How much **breadth** should be required?

- AU → first course in all areas, second course (with design aspects) in three areas

Can we achieve the appropriate level of **depth** for an undergraduate degree?

- AU → typically 4-5 courses within specialization area plus one or two in closely aligned areas (e.g., Structures and Geotech; Environmental and Water Resources)

How do we balance flexibility with meaningful course selection?

- AU → Many students still choose expediency (effort, GPA considerations) over specialization/focus.
STANDARDS—ENFORCEMENT

BECOME AN ASCE/ABET PROGRAM EVALUATOR (PEV)

- PEVs evaluate Civil Engineering programs for compliance with ABET criteria
- Qualifications
  - ASCE Member (or higher) grade
  - PE with 10 years experience
- Training (online) follows your selection by ASCE
- Review activities begin with report review in summer and conclude with campus visit in fall
- Travel expenses are covered
- You set your availability each year
- Great way to travel, interact with other engineers, and learn new things!
The CEBOK identifies 21 interrelated outcomes in four categories that prepare you to assume responsible charge.

- 1. Foundational outcomes provide the knowledge on which all other outcomes are built.
- 2. Engineering Fundamentals outcomes form the bridge between foundational and technical outcomes for civil engineering practice.
- 3. Technical outcomes specify knowledge and skills more specific to civil engineering.
- 4. Professional outcomes focus on interpersonal and leadership skills needed.

Specific levels of outcome achievement are assigned to four types of education:

- Undergraduate
- Postgraduate
- Mentored experience
- Self-developed
EDUCATIONAL SUPPORT

ASCE AND AUBURN

- Mentorship
- Activities and Competitions
- Sponsorship, Scholarships, and Awards
GROWTH OF OUR PROFESSION
DEMAND FOR CIVIL ENGINEERS

SOME STATISTICS—2022

- 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 Bach. of CE or EnvE graduates per year in US (ASEE)—not growing in US or at Auburn
- 2022 mean CE salary in Alabama—$92,500 (BLS)
- Average starting salary for Auburn BCE graduate in 2022 ($64,000) equaled the 25th percentile salary for all CEs in Alabama! (BLS)
- We need more young people interested in civil and environmental engineering!
- Else (offshoring, AI)?

![Graph showing average starting salary for AU Bachelors in various fields over 2021-2023.](image-url)
RECRUITING YOUTH TO CIVIL ENGINEERING

ASCE’S MOST URGENT TASK?

▪ None of this is new, but more urgent than ever?
▪ Must capture the attention of young people and school programs
▪ Universities are doing a better job than ever, but CE recruiting is not simple.
▪ What can ASCE sections, branches, or groups do?
  – Does your branch have a group focused on K-12 outreach/inspiration?
  – How do we get into civil engineering exposure into schools, youth organizations?
  – How do we get to underrepresented groups?
What can ASCE sections, branches, or groups do?

- **Future World Vision**
- Competitions
- Site visits

futureworldvision.org
Cities of the Future

- IMAX film (McWane Center, now; Fernbank, TBD)
- $1500 grants to take groups to the film: application deadline April 19!
THANK YOU!

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