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
- 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
<table>
<thead>
<tr>
<th>Choice of Specialization</th>
<th>Alumni Survey (%)</th>
<th>ENGR 1110 (%)</th>
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<tbody>
<tr>
<td>Construction</td>
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<tr>
<td>Transportation</td>
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<tr>
<td>Structural</td>
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<td>Site Eng &amp; Land Devel.</td>
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<td>Water Resources</td>
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<td>5</td>
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<tr>
<td>Environmental</td>
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<td>5</td>
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<td>Pavements &amp; Matl</td>
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<td>5</td>
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<td>Geotechnical</td>
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<td>Other</td>
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Employment Success

Continuing Education Success

2021 2022

Civil Eng.
SGCOE
AU

Civil Eng.
SGCOE
AU

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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
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 survey

- 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 program must demonstrate that it is not critically dependent on one individual.
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

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

BREADTH

CIVL Electives

Required CIVL
Core and
Pre-Engineering

DEPTH
AUBURN BCE CURRICULUM STRUCTURE (128 CREDIT HOURS)

SPECIALIZATION EXAMPLE—GEOTECHNICAL ENGINEERING

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**DEPTCH**

CIVL Electives

Required CIVL

Core and Pre-Engineering

**BREADTH**
AUBURN BCE CURRICULUM STRUCTURE (128 CREDIT HOURS)

SPECIALIZATION EXAMPLE—ENVIRONMENTAL OR WATER RESOURCES ENGINEERING

**DEPT**
- CIVL Electives
- Required CIVL
- Core and Pre-Engineering

**BREADTH**

**DEPT**
- Core and Pre-Engineering

** breadth**

** DEPT **
- CIVL Electives
- Required CIVL
- Core and Pre-Engineering

**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](http://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!
Specific levels of outcome achievement are assigned to four types of education:

- Undergraduate
- Postgraduate
- Mentored experience
- Self-developed
GROWTH OF OUR PROFESSION
Demand for Civil Engineers

- 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 20th percentile salary for all CEs in (state of) Alabama. (BLS)
- We need more young people interested in civil and environmental engineering!
- Else (offshoring, AI)?

**Some Statistics—2022**

### Avg. Starting Salary—AU Bachelors

<table>
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<tr>
<th>Year</th>
<th>Civil Eng.</th>
<th>SGCOE</th>
<th>AU</th>
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<tr>
<td>2021</td>
<td>$60,000</td>
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<tr>
<td>2022</td>
<td>$64,000</td>
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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)?