Oregon TECH

2017-18
Assessment Report
Bachelor of Science in Civil Engineering Degree Program

The Civil Engineering Department at Oregon Institute of Technology administers a Bachelor of Science in Civil Engineering (BSCE) degree. This degree is accredited by the Engineering Accreditation Commission of ABET, Inc.

Section 1 – Program Mission

The mission of the Bachelor of Science in Civil Engineering (BSCE) program at Oregon Institute of Technology is to prepare students for professional practice. To be prepared to practice as professionals, engineers must be able to act responsibly and ethically, understand their limits and the limits of the tools they use, communicate effectively, work well in teams, and, amid the changing landscape of the field of civil engineering, be able to pursue graduate level education.

The mission, objectives, and student learning outcomes for the BSCE program are reviewed annually by the department at the fall retreat during convocation. They are also reviewed annually by the department's Industrial Advisory Council (IAC).

Section 2 – Program Educational Objectives

The following objectives are what the faculty expects graduates from the program to be able to accomplish a few years after the commencement of their careers and stem directly from the program mission. In the annual review of the objectives with the IAC in the spring of 2017, the words "or continuing" were added to Objective 2. The other objectives remained unchanged and are as follows. The alumni from the BSCE program at Oregon Tech should:

1. practice in civil engineering or a related field
2. pursue advanced or continuing education in civil engineering or a related field
3. act as responsible, effective, and ethical citizens
4. communicate effectively
5. collaborate effectively

Section 3 – Program Description and History

This section will describe the BSCE program history, locations, enrollment, graduation rate, employment rates and salaries, industry relationships, showcase learning experiences, and supportive graduating student comments about the program.

Program History

The Bachelor of Science in Civil Engineering (BSCE) program at Oregon Institute of Technology (Oregon Tech) was first accredited by the Engineering Accreditation Commission (EAC) of ABET in 1998. A number of curricular and process changes followed that initial visit, the most significant of which was the implementation of an interdisciplinary senior design capstone project. The program received continued accreditation after visits from ABET in 2004, 2010, and 2016. A major program revision was implemented fall 2013 that aligned the BSCE with the outcomes outlined in the ASCE Body of Knowledge.

Program Locations

The BSCE is offered exclusively on the Klamath Falls campus. No program courses are taught online.

Program Enrollment

Fall 2018 – 124
Fall 2017 – 116
Fall 2016 – 118
Fall 2015 – 119
Fall 2014 – 110

Program Graduates
2018 – 23
2017 – 25
2016 – 25
2015 – 15
2014 – 17

Employment Rates and Salaries

The 2017-2018 Senior Exit Survey results indicated that 12 of the 12 students who completed the survey were employed, a 100% employment rate. This is consistent with conversations with each of the graduates who were either pursuing graduate education or heading to work with a position secured prior to graduation. Annual salaries provided by these graduates ranged from $50,000 to $65,000.

Industry Relationships
The department maintains relationships with industry primarily through its industrial advisory committee (IAC) and student chapters of various professional societies and associations including the American Society of Civil Engineers (ASCE), Associated General Contractors (AGC), Institute of Transportation Engineers (ITE), and Engineers Without Borders (EWB).

Showcase Learning Experiences
Showcase learning experiences include rich laboratory experiences in each of the civil engineering sub disciplines (structural, geotechnical, transportation, and water resources engineering) as well as student chapter events like the ITE Traffic Bowl, ASCE Student Conference concrete canoe and steel bridge competitions, and EWB project travel to Tanzania. The student chapters host trips to leadership conferences, active construction sites, and competitions. The senior design project (CE401/402) is the capstone experience for civil engineering students in which they develop designs for local and regional civil engineering projects. They work with clients that include municipal and state agency representatives and professional practitioners.

Supportive Student Comments

In the 2017-2018 Senior Exit Survey, graduates had very good things to say about the strengths of the program and its faculty:

“The greatest strength of the Oregon Tech Civil Engineering department is the professors that care intensely about the success of each individual student. The professors go above and beyond on a weekly basis to ensure concepts are not only clear as they are taught, but are highly applicable in the engineering field. Another strength of the program is the community the students build. The students actively engage in each other’s success and failures in an effort to provide a better experience for all.”

“The professors genuinely care about student success and provide the tools needed for the professional setting. Professors are here to teach not to do research for personal needs. Within the first two weeks at OIT, I can personally say that all my teachers knew my name. For all professors that read this, I can’t emphasize enough how important it is to make all students feel welcomed.”

Section 4 – Program Student Learning Outcomes

From the program educational objectives stem a number of specific and measurable outcomes. In addition to being more specific, the outcomes state what students should be able to demonstrate while in the program and provide evidence that the objectives are also likely being met.

During the 2017-2018 academic year, the faculty and industry advisory council members engaged in discussions to transition the program student learning outcomes from those based on ABET a-k to the updated ABET Criterion 3 outcomes, commonly referred to as 1-7. The program's current outcomes are defined here:

Upon graduating from the BSCE program at Oregon Tech, students should possess:

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility as well as the importance of professional licensure
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use the techniques, skill, and modern engineering tools necessary for engineering practice
l. an ability to explain basic concepts in management, business, public policy, and leadership
m. an ability to evaluate concepts and ideas from alternative perspectives

In an effort to transition in time to allow for a complete assessment based on new outcomes before our next accreditation visit, ABET outcomes 1-7 were presented and discussed at the Spring IAC meeting and at the final department meeting of the academic year. Table 4-1 summarizes the old (a-k) and new (1-7) outcomes and provides a mapping to current and future target courses and Essential Student Learning Outcomes (ESLOs). After deliberation at the department meeting, the department faculty arrived at a consensus to assess outcomes 1-7 and discard the proposed outcomes 8-10 in Table 4-1. In general, it was felt that adjustments to the assessment criteria in each outcome rubric would allow for consideration of the items in the proposed outcomes 8-10. Basic concepts in management, business, public policy, and leadership (proposed outcome 8 and formerly a departmentally added outcome l) is included in outcomes 2 and 5. Evaluate concepts and ideas from alternative perspectives (proposed outcome 9) is captured by outcomes 2 and 4, as well as the institutional Diverse Perspectives ESLO. Explain the importance of professional licensure (proposed outcome 10) is included in ABET Criterion 5, program criteria, and does not require assessment. An indirect assessment of this outcome will still be collected via senior exit surveys and included in future ABET self-studies.

While an assessment of outcome a was conducted in this academic year, it will ultimately not be included in our future ABET assessment given the more rigorous nature of outcome 1. During the department retreat in September 2018, outcomes 8-10 were discussed in detail. The department faculty arrive at a consensus that outcomes 8-10 were sufficiently addressed in the existing ABET outcomes 1-7 that additional outcomes were not necessary. A review of publications related to the transition to ABET 1-7 also indicated that other institutions are not commonly supplementing ABET 1-7 with additional outcomes. The updated program outcomes will be discussed and approved at our next IAC meeting in Spring 2019 and new rubrics are being drafted and piloted in the fall of 2018 that couple related institutional outcomes with ABET 1-7.

Table 4-1. Mapping of old programmatic outcomes a-m to new ABET 1-7, including target courses and related ESLOs

Previous Courses Assessed	**OLD: ABET a-k + l and m Students will demonstrate an ability to**	**NEW: 1-7 + 8, 9, 10 Students will demonstrate an ability to**	**Courses Assessed**	**ESLO**
ENGR211/213, CIV328	a. Apply knowledge of mathematics, science, and engineering.	1) Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	CE331 ENGR213	QL
CIV361, CIV344, CE212	e. Identify, formulate, and solve engineering problems.			
CIV416, CIV402	c. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	2) 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, in at least two civil engineering contexts.	CE402 CE442 or 444? CE374?	IA QL DP
CIV315, CE351	h. Understand the impact of engineering solutions in global, economic, environmental, and societal context.			
CE402, CE312	k. Use the techniques, skills, and modern engineering tools necessary for engineering practice.			
CIV402	g. Communicate effectively.	3) Communicate effectively with a range of audiences.	CE405 CE371	**COM CE371, CE308**
CE208, Sr. Exit Survey	f. Understand professional and ethical responsibility as well as the importance of professional licensure.	4) Recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, environmental, and social contexts.	CE308 Sr. Exit Survey	**ER CE308**
ENGR101, CE402	d. Function in multidisciplinary teams	5) Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	ENGR318 CE402	**TW ENGR318**
ENGR231, ENGR213	b. Design and conduct experiments as well as analyze and interpret data.	6) Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions, in two technical areas.	CE311 ENGR213	IA, **QL CE311**
ENGR101, CIV402	i. Recognize the need for, and engage in, lifelong learning.	7) Acquire and apply new knowledge as needed, using appropriate learning strategies.	CE354 CE401	**IA CE354**
CE402, CE208	l. Explain basic concepts in management, business, public policy, and leadership	8) Explain basic concepts in management, business, public policy, and leadership.	CE308 CE402	TW
ENGR102, CE354	m. Evaluate concepts and ideas from alternative perspectives	9) Evaluate concepts and ideas from alternative perspectives.	CE354?, CE405	**DP – CE405**
CE208, Sr. Exit Survey	f. Understand professional and ethical responsibility as well as the importance of professional licensure.	10) Explain the importance of professional licensure.	CE308 Sr. Exit Survey	
CE539, CE354	j. Knowledge of contemporary issues.	Eliminated in new Criterion 3 Outcomes 1-7	----	----

Section 5 – Curriculum Map

The updated curriculum map with ABET 1-7 outcomes represented is in progress and will be complete for the next program assessment report. Outcome mapping for outcomes a-m that are being retired is included here (Table 5-1 through 5-5). Upon review of these tables it is clear that, in general, most outcomes are introduced in general education and foundational coursework and reinforced throughout civil engineering core courses and electives. Mapping to ABET outcomes 1-7 will be conducted in the next academic year.

Table 5-1. Mapping of Program Outcomes to Math and Science Courses

		BSCE Program Outcomes												
	Math and Science Courses	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
CHE 221/222	General Chemistry	I	I											
GEOL 201	Physical Geology	I	I		I		R	R	I					
PHY 221/222	General Physics with Calculus	I	I											
Math 251	Differential Calculus	I												
Math 252	Integral Calculus	R												
Math 254N	Vector Calculus I	R												
Math 321	Applied Differential Equations I	R												
Math 361	Statistical Methods	R												
	Math/Science Elective	R												

I: Introduced, R: Reinforced

Table 5-2. Mapping of Program Outcomes to Communication, Humanities, and Social Science Courses

		BSCE Program Outcomes												
	General Education Courses	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
SPE 111	Fundamentals of Speech				I			I						
WRI 121/122	English Composition						I	I						
WRI 227	Technical Report Writing						I	R						I
COM 401/402	Civil Engineering Project				R			R	R	I				I
ANTH 452	Globalization						R		R		R			R
*ANTH 335	The Built Environment						I		I		I			I
*HIST 335	The Engineering Profession						I		I		I			I
	Social Science Electives								I					
	Humanities Electives								I					

I: Introduced, R: Reinforced

*Students must take *either* ANTH 335 or HIST 335

Table 5-3. Mapping of Program Outcomes to Introductory and Core Engineering Courses

		BSCE Program Outcomes												
Introductory and Core Engineering Courses		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
ENGR 101/102	Introduction to Engineering	I	I	I	I	I	I	I	I	I		I		I
CE 203	Engineering Graphics							I				I		
CE 205	Computational Methods	R				I						I		
CE 212	Civil Engineering Materials	I	I					I				I		
GME 134	Geographical Information Systems	I					I				I	I		
GME 161	Plane Surveying I	I				I						I		
ENGR 211	Engineering Mechanics: Statics	R				I						I		
ENGR 213	Engineering Mechanics: Strength of Materials	R	R			R		R				I		I
ENGR318	Engineering Mechanics: Fluids	R	R		I	R		I						

I: Introduced, R: Reinforced

Table 5-4. Mapping of Program Outcomes to Civil Engineering Core Courses

		BSCE Program Outcomes												
	Civil Engineering Core Courses	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
CE 208	Principles of Professional Practice	R				R	R	R	I	R	I	R	I	I
CE 311	Introduction to Geotechnical Engineering	R	R			R	R	R	R		I	R		I
CE 312	Earth Pressures and Foundations	R	R			R	R	R	R		I	R		I
CE 331	Structural Analysis	R				R						R		
CE 341	Elementary Structural Design	R		I		R						R		
CE 351	Introduction to Transportation Engineering	R	R			R	I	I	I		I	R		I
CE 354	Traffic Engineering	R	R	R		R	I	I			I	R		I
CE 371	Closed Conduit Design	R		I		R		R				R		I
CE 374	Hydrology	R	I		I	R		R	I		I	R		I
CE 401/402	Civil Engineering Project	R		R	R	R	R			I				
CE 405	Sustainability and Infrastructure	R		R		R	R		R	R	R	R	R	R

I: Introduced, R: Reinforced

Table 5-5. Mapping of Program Outcomes to Civil Engineering Elective Courses

		BSCE Program Outcomes												
	Senior Elective Courses	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
*GME 351	Construction and Engineering Surveying	R				R		R				R		
*GME 372	Subdivision Planning and Platting	R				R		R				R		
GME 425	Remote Sensing	R				R						R		
ENV 435	Atmospheric Physics	R	R			R			R		R			
MATH 341	Linear Algebra I	R				R								
MATH 425	Vector Analysis	R				R								
MATH 451	Numerical Methods I	R				R		R						
MATH 465	Mathematical Statistics	R				R								
CE 411	Engineering Geology	R	R	R		R		R		R		R		
CE 413	Advanced Soils	R	R			R								
CE 432	Structural Loading and Lateral Forces	R		R		R				R	R	R		
**CE 442	Advanced Reinforced Concrete Design	R		R		R						R		
**CE 444	Intermediate Steel Design	R		R		R				R	R	R		
CE 447	Masonry Design	R		R		R						R		
CE 448	Timber Design	R		R		R						R		
CE 456	Pavement Engineering	R	R	R		R	R				R	R		I
CE 457	Transportation and Land Development	R	R			R	R	R			R	R		I
CE 473	Groundwater	R	I	I		R	I	R				R		I
CE 481	Environmental Engineering I	R		I	I	R	I	R	I	I	R	R		I
CE 489	Treatment Wetlands	R	I	I	R	I	I	R	R		I	R		R
CE 511	Seepage and Earth Structures	R	R	R		R		R		R		R		
CE 512	Earthquake Engineering	R	R	R		R		R		R		R		
CE 513	Deep Foundations	R	R	R		R		R		R		R		
CE 522	Advanced Shear Strength of Soils	R	R			R		R			R	R		R
CE 533	Structural Matrix Analysis	R				R						R		
CE 534	Advanced Solid Mechanics	R				R						R		
CE 535	Structural Dynamics	R				R						R		
CE 539	Highway Bridge Rating	R				R	R	I		R	R	R		R
CE 542	Prestressed Concrete Design	R		R		R					R	R		R
CE 544	Advanced Steel Design	R		R		R				R	R	R		
CE 549	Bridge Design	R		R		R	R	I		R	R	R		R
CE 550	Transportation Structures	R		R		R	R	I		R	R	R		R
CE 551	Geometric Design of Roadways	R	R	R		R	R				R	R		I
CE 554	Advanced Traffic Engineering	R	R	R		R	R	I			R	R		I
CE 558	Transportation Safety	R			R	R	R	I	I		R	R	I	I
CE 568	Traffic Demand Modeling	R				R	R				R	R		
CE 571	Open-Channel Hydraulics	R		R		R	R	R				R		
CE 572	Hydrometry	R		R	R	I	I	R		I		R		
CE 574	Environmental River Mechanics	R		R	R	R	R	R	I		I	R		I
CE 576	Applied Hydraulic Design	R		R	I	R	R	R				R		I
CE 586	Water and Wastewater Treatment	R		R	I	R	R	R	I			R		
CE 587	Environmental Remediation Technologies			I	I	I	I	R	I	I	R	I	I	I

I: Introduced, R: Reinforced

500-level electives may be used toward the BSCE Degree

* Only one of these courses can be counted toward the BSCE Degree

**Students must complete either CE 442 or CE 444 for BSCE Degree

Section 6 – Assessment Cycle

Traditionally, the Civil Engineering Department has followed a three-year assessment cycle during which the faculty members conduct two direct assessments of each program outcome to ensure the quality of the program. The 2017-2018 academic year was the first year in this three-year cycle. Rather than conduct many assessments that might not align with updated ABET outcomes, the department focused on discussion and revision of the outcomes as described in Section 4 – Program Student Learning Outcomes.

During the 2017 fall retreat, the civil engineering department renewed a plan for targeted assessments. This plan called for a cycle in which each outcome is directly assessed at least twice in specific, targeted courses in the curriculum—courses where the outcome is normally taught, reinforced, or otherwise addressed.

This cycle was a work in progress during the 2017-2018 academic year and is still evolving as the department revises rubrics for the updated outcomes. The department faculty generally meet at the beginning of each term to discuss outcomes that were scheduled to be assessed during that term. At the fall retreat, performance criteria for each outcome were developed, or reviewed if they had been used previously. After deciding on appropriate performance criteria, the faculty members discussed whether the targeted course was still an appropriate course in which to conduct the assessment or decided upon a new setting. Sometimes the newly-targeted course was during the same term and sometimes it was in a different term and so the outcome was moved to a new time in the cycle. As such, the assessment cycle was slightly changed from year to year. Table 6-1 summarizes the latest cycle as well as the courses that were targeted for assessments.

Table 6-1. Outcomes with Targeted Courses

Outcome	Courses proposed for assessment			
PSLO 1 - Problem Solving	ENGR213	CE331		
PSLO 2 - Design	CE402	CE444		
PSLO 3 - Communication	CE401	CE401		
PSLO 4 - Ethical/Professional Responsibility	ENGR101	CE308	CE405	Sr Exit Survey
PSLO 5 - Teamwork	ENGR318	CE402		
PSLO 6 - Experimentation	CE311	ENGR213		
PSLO 7 - New Knowledge	CE354	CE402		
ESLO 1 - Communication	CE371	CE401		
ESLO 2 - Inquiry & Analysis	CE354	CE401		
ELSO 3 - Ethical Reasoning	ENGR101	CE401		
ESLO 4 - Quantitative Literacy	CE311	CE402		
ESLO 5 - Teamwork	ENGR318	CE401		
ESLO 6 - Diverse Perspectives	CE405	CE401		

Table 6-2 provides a correlation between the updated ABET 1-7 and Oregon Tech ESLOs. Revised rubrics that take advantage of Oregon Tech ESLO rubrics with additions to support ABET assessment are being developed and will be available for next year's assessment report. Table 6-3 outlines a three-year assessment cycle according to the updated ABET 1-7 outcomes.

Table 6-2. Program (PSLO) and institutional (ESLO) outcome correlation

	ESLO 1 – Comm-unication	**ESLO 2 - Inquiry & Analysis**	**ELSO 3 - Ethical Reasoning**	**ESLO 4 - Quantitative Literacy**	**ESLO 5 - Teamwork**	**ESLO 6 - Diverse Perspectives**
PSLO 1 - Problem Solving						
PSLO 2 - Design						
PSLO 3 - Communication						
PSLO 4 - Ethical/Professional Responsibility						
PSLO 5 - Teamwork						
PSLO 6 - Experimentation						
PSLO 7 - New Knowledge						

Table 6-3. Three-year outcome assessment schedule

	Term					
Outcome	**F18**	**W19**	**S19**	**F19**	**W20**	**S20**
PSLO 1 - Problem Solving			ENGR213	CE331		
PSLO 2 - Design			CE444	CE401	CE402	
PSLO 3 - Communication	CE401			CE401		
PSLO 4 - Ethical/Professional Responsibility	ENGR101, CE401	CE308	Trans Safety			
PSLO 5 - Teamwork					CE308, CE402	
PSLO 6 - Experimentation	CE311		ENGR213			
PSLO 7 - New Knowledge			CE354		CE402	
ESLO 1 - Communication						
ESLO 2 - Inquiry & Analysis						
ELSO 3 - Ethical Reasoning	ENGR101, CE401					
ESLO 4 - Quantitative Literacy				CE311		
ESLO 5 - Teamwork						
ESLO 6 - Diverse Perspectives						

Section 7 – Assessments Conducted this Year

Two assessments were conducted during the 2017-2018 academic year: an ESLO assessment of Inquiry and Analysis and a PSLO assessment of Outcome a – a knowledge of math, science, and engineering. The results of these assessments are provided here.

ESLO Assessment: Inquiry & Analysis

The ESLO assessment of Inquiry and Analysis was conducted CE 354 Traffic Engineering. Student work was scored and uploaded via the assessment software that is no longer available at the time of this writing. Results are available through the Office of Academic Excellence.

PSLO Assessment: Outcome a – knowledge of math, science, and engineering

Nineteen students enrolled in CIV 331-Structural Analysis were given a number of different problems for which they were required to apply a knowledge of math, science, and engineering. These problems appeared on quizzes or exams administered either in class or in another proctored setting on campus. The questions ranged in difficulty from entry-level to advanced, and students were required to get the problems completely correct with no room for error. Table 7-1 summarizes the performance criteria, question-types asked, and results from this assessment. As can be determined from the table, all benchmarks were met for this assessment except one. A few of the students in this particular offering of the course had an unusual aversion to trusses. This attitude is unlike any the instructor has ever seen in his 15 years of teaching truss analysis. As such, this is considered to be a random occurrence and no further action is needed.

Table 7-1. Outcome a performance criteria and results.

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Solve entry-level structural mechanics problem	force equilibrium problem on quiz or exam	right or wrong	90% of students getting at least one problem correct & 80% of students getting two problems correct	100% of students got two problems right
Solve entry-level structural mechanics problem	truss analysis problem on quiz or exam			90% got one right 68% got two right
Solve entry-level structural mechanics problem	shear and moment problem on quiz or exam			100% got one right 95% got two right
Solve mid-level structural mechanics problem	influence line problem on quiz or exam		80% of students getting at least one problem correct	100% got one right 95% got two right
Solve advanced structural mechanics problem	beam deflection problem on quiz or exam			90% got one right 68% got two right
Solve advanced structural mechanics problem	indeterminate beam problem on quiz or exam			84% got one right 58% got two right