Annual Assessment Report
2011-2012 Academic Year

BACHELOR OF SCIENCE IN CIVIL ENGINEERING DEGREE PROGRAM

administered by the

Civil Engineering Department
Oregon Institute of Technology

1. INTRODUCTION

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. The program has maintained an average enrollment of 110 students with an average one-year retention of 85%. Approximately 23 BSCE degrees are awarded each year.

2. MISSION, OBJECTIVES, AND OUTCOMES

The mission, objectives, and student learning outcomes for the BSCE program are reviewed annually by the department at the fall retreat during convocation. Based upon feedback received from ABET evaluators during a Fall 2010 visit, minor changes were made to the objectives and outcomes. A revised set of objectives and outcomes were discussed at a department retreat in Fall 2011 and then discussed with the department's Industrial Advisory Council (IAC) during the same term. The department and IAC approved the revised outcomes and objectives below. No changes have been made to the mission of the department.

2.1 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.

2.2 Program 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. The alumni from the BSCE program at Oregon Tech should:

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

2.3 Program Outcomes

From these 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 being met. 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

3 ASSESSMENT CYCLE

The Civil Engineering Department follows a three-year assessment cycle during which the faculty members conduct numerous assessments to ensure the quality of the program. The 2011-2012 academic year is the first year in the current cycle.

During the 2011 fall retreat, the civil engineering department developed 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 is a work in progress and is constantly evolving. The department faculty meets at the beginning of each term to discuss outcomes that are scheduled to be assessed during that term. Performance criteria for each outcome are either developed, or reviewed if they had been used previously. After deciding on appropriate performance criteria, the faculty members discuss whether the targeted course is still an appropriate course in which to conduct the assessment or decide upon a new setting. Sometimes the newly-targeted course is during the same term and sometimes it is in a different term and so the outcome is moved to a new time in the cycle. As such, the assessment cycle may be slightly changed from year to year. Table 1 summarizes the most up-to-date cycle as well as the courses that have been targeted for assessments.

Table 1 Assessment Cycle with Targeted Courses

Outcome	Winter 12	Spring 12	Fall 12	Winter 13	Spring 13	Fall 13	Winter 14	Spring 14
a. fundamentals	CIV 328	ENGR 212						
b. experimentation			ENGR 231	ENGR 213				
c. design			CIV 416	CIV 402				
d. teamwork						ENGR 213	CIV 402	
e. problem solving	CIV 361	CIV 344						
f. professionalism						CIV 358		CIV 317
g. communication	*CIV 402							
h. broad education			CIV 315		CIV 202			
i. life-long learning			CIV 358	CIV 402				
j. contemporary issues						CIV 315	CIV 371	
k. tools							CIV 402	CIV 374
l. leadership			CIV 358/402					
m. alternative perspectives						CIV 358		CIV 202

*Multiple assessments will be done for this outcome in this course during this term

4. 2011-2012 TARGETED ASSESSMENT ACTIVITIES

Each of the program outcomes are taught or reinforced in several classes. The tables in Appendix A illustrate the relationships between the program outcomes and each course in the curriculum. Courses with a predetermined relationship to a particular outcome were possible targets for direct assessments. As shown in Table 1, three outcomes were assessed in five different targeted courses during the 2011-2012 academic year. Each of these assessments is detailed below.

4.1 Outcome (a): *an ability to apply knowledge of mathematics, science, and engineering*

The students' abilities to apply math, science, and engineering were assessed twice: once in a structural analysis course and again in dynamics.

4.1.1 First Assessment

Nine students enrolled in CIV 328-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 2 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 and no further action is required at this time.

Table 2 Summary of First Assessment of Outcome (a): Fundamentals

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			91% got one right 82% got two right
Solve entry-level structural mechanics problem	shear and moment problem on quiz or exam			100% got one right 91% 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	91% got one right 73% got two right
Solve advanced structural mechanics problem	beam deflection OR indeterminate beam problem on quiz or exam			82% got one right 55% got two right

4.1.2 Second Assessment

Nineteen civil engineering students were enrolled in ENGR 212-Dynamics in the spring term of 2012. The final exam for this course was used as the assessment instrument. Students' abilities to apply knowledge of science (Newtonian physics), mathematics (algebra and differential calculus), and engineering (relating science and mathematics to physical phenomena) were assessed. As shown in Table 3, students met benchmarks in all but one area. Students did not meet the performance criterion of dynamics of pulley systems, a common shortcoming in the instructor's experience even though students indicate they understand this material in class discussion and based on homework results.

The department will meet to discuss the one substandard result during the 2012-2013 academic year to determine what, if any, action needs to be taken on this outcome.

Table 3 Summary of Second Assessment of Outcome (a): Fundamentals

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Apply relationships between position, velocity and acceleration to draw position-versus-time and acceleration-versus-time curves given a velocity-versus-time curve.	Final examination	1-4 According to attached criteria	75% of students scoring >= 3	84% of students scored >=3
Apply particle kinetics and kinematics concepts to solve for the force required to bring a train up to speed.	Final examination	1-4 According to attached criteria	75% of students scoring >= 3	95% of students scored >=3
Calculate the speed of a point in a pulley system given the geometry of the system and the speed of another point.	Final examination	1-4 According to attached criteria	75% of students scoring >= 3	42% of students scored >=3

4.2 Outcome (e): *an ability to identify, formulate, and solve engineering problems*

This outcome was assessed twice during the 2011-2012 academic year: the first time in a water resources course and the second time in a structural steel design course.

4.2.1 First Assessment

Twenty-seven students were enrolled in CIV 361-Closed Conduit Design in the winter term of 2012. The problem solving skills of these students were assessed on an exam question using

performance criteria and a rubric developed by the civil engineering faculty. The results of this assessment are summarized in Table 4.

Table 4 Summary of First Assessment of Outcome (e): Problem Solving

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Identification of knowns	Sharp-crested weir equivalency exam problem	1-4 according to attached rubric/criteria	85% scoring ≥ 3.0	100% ≥ 3 48% = 4
Identification of unknowns				56% ≥ 3 19% = 4
Identification of solution method				93% ≥ 3 41% = 4
Application of solution method				44% ≥ 3 18% = 4
Correct/defendable result				70% ≥ 3 30% = 4

The results of the assessment summarized above indicate that students have the abilities to identify, formulate, and solve engineering problems. The results also suggest that students do not consistently and completely document the problem before commencing the solution process.

These results will be discussed in a future department meeting to determine what action needs to be taken in the future. The course instructor plans to place additional emphasis on problem documentation in future offerings of both the assessed course and other courses in the same technical area.

4.3.2 Second Assessment

The students' abilities to identify, formulate, and solve engineering problems were assessed again in the spring term offering of CIV 344-Structural Steel Design by evaluating a take-home examination problem. The particular problem, submitted by a total of 22 students, was evaluated by the instructing civil engineering professor using the same criteria and scale.

The results presented in Table 5 suggest that students do have the ability to identify, formulate, and solve engineering problems as well as document their solutions.

Table 5 Summary of Second Assessment of Outcome (e): Problem Solving

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Identification of knowns	Take-home examination	1-4 According to attached criteria	70% of students scoring >= 3	100% of students scored >=3
Identification of unknowns	Take-home examination	1-4 According to attached criteria	70% of students scoring >= 3	100% of students scored >=3
Identification of solution method(s)	Take-home examination	1-4 According to attached criteria	70% of students scoring >= 3	91% of students scored >=3
Application of solution method	Take-home examination	1-4 According to attached criteria	70% of students scoring >= 3	82% of students scored >=3
Correct/defendable result	Take-home examination	1-4 According to attached criteria	70% of students scoring >= 3	73% of students scored >=3

4.4 Outcome (g): *an ability to communicate effectively*
In Winter 2012, 15 students were enrolled in CIV 402, which is the second and final term of the senior design project sequence. Students were assessed twice to determine their ability to communicate: once assessing oral skills and once assessing their written skills.

4.4.1 First Assessment
Students in CIV 402 worked together as a single design firm with different individuals working on different aspects of the design project. The entire group gave one final presentation to faculty members, government officials, and interested parties. This presentation was assessed using performance criteria and a rubric developed by the department in conjunction with the Communication Department. The results of this assessment are presented in Table 6.

Table 6 Summary of Assessment of Outcome (g): Communication-Oral

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Structure	instructor evaluation of group final presentation	1-4 according to attached rubric	85% of instructors scored the students 3.0 or higher	100%
Delivery	instructor evaluation of group final presentation	1-4 according to attached rubric	85% of instructors scored the students 3.0 or higher	85%
Visuals	instructor evaluation of group final presentation	1-4 according to attached rubric	85% of instructors scored the students 3.0 or higher	100%
Content	instructor evaluation of group final presentation	1-4 according to attached rubric	85% of instructors scored the students 3.0 or higher	100%
Response to questions	instructor evaluation of group final presentation	1-4 according to attached rubric	85% of instructors scored the students 3.0 or higher	100%

As can be determined from Table 6, minimum acceptable performance was met in all categories, though the course instructors were a little disappointed by the performance in the Delivery category. In the future, the faculty plans on prescribing more practice sessions for oral presentations with the goal of improving student delivery.

4.4.2 Second Assessment
Students in CIV 402 were required to write an individual Self Assessment document where they judged their own performance and participation in relation to the senior project group. These documents were assessed using the university's official Technical Writing performance criteria and rubric. The results from these assessments are summarized in Table 7.

Unfortunately, as can be seen from the information in Table 7, a large number of students did not perform as expected in the Organization, Style, and Conventions criteria. The department takes these deficiencies very seriously and has had a number of discussions with Communication faculty, both the group at large as well as the professor involved directly in the CIV 402 course, to determine how to improve students' writing abilities. A few different actions are being taken immediately. The first is to provide more direct instruction to the senior project students in various topics related to written communication. The second is to require more individual written assignments, accompanied with appropriate feedback provided to students, in the senior project

courses. The third is a comprehensive redesign of the technical writing course administered by the Communication Department. The faculty who teach technical writing accepted constructive feedback from the civil engineering faculty and decided, as a group, that the course needed to be updated to provide all students, not just those in the BSCE program, the skills they need to be effective writers.

Table 7 Summary of Assessment of Outcome (g): Communication-Written

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Audience	instructor evaluation of written "self-assessment"	1-4 according to attached rubric	85% of students scoring 3.0 or higher	97%
Development	instructor evaluation of written "self-assessment"	1-4 according to attached rubric	85% of students scoring 3.0 or higher	87%
Organization	instructor evaluation of written "self-assessment"	1-4 according to attached rubric	85% of students scoring 3.0 or higher	70%
Writing style and/or voice	instructor evaluation of written "self-assessment"	1-4 according to attached rubric	85% of students scoring 3.0 or higher	70%
Format	instructor evaluation of written "self-assessment"	1-4 according to attached rubric	85% of students scoring 3.0 or higher	87%
Conventions	instructor evaluation of written "self-assessment"	1-4 according to attached rubric	85% of students scoring 3.0 or higher	50%

The civil engineering faculty will reassess written communication in the Winter 2013 offering of CIV 402, after some of these changes have been implemented.

5 OTHER ASSESSMENT ACTIVITIES

The department participated in the university-wide assessments of the Institutional Student Learning Outcomes, specifically providing feedback on the Mathematics assessment. Information on these activities can be obtained from the university's Director of Assessment.

6 DATA STORAGE AND MANAGEMENT

All of the paperwork associated with the assessments described herein is kept with the department's assessment coordinator, Sean St.Clair. This paperwork includes assessment reports, summary sheets, raw data, student work, and assessment/evaluation instruments.

7 OPEN ISSUES

As this year was the first in the assessment cycle, there were no open issues that needed to be addressed.

8 CONCLUSION

The 2011-2012 academic year was the first year in a three-year assessment cycle. This year, three outcomes were assessed in five different targeted courses. Shortcomings were revealed in the areas of Written Communication, Problem Documentation, and Advanced Dynamics Problems. The civil engineering faculty has already discussed courses of action to correct the issues in Written Communication and will meet in the fall term of 2012 to determine what, if any, actions need to be taken.

Appendix
Mapping of Program Outcomes to Courses

		BSCE Program Outcomes												
Math and Science Courses		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
CHE 201/202/204/205	General Chemistry	I	I											
PHY 221/222/223	General Physics with Calculus	I	I											
Math 221	Introduction to Computational Software	R				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

		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						
COM 401/402	Civil Engineering Project				R			R	R	I				
PHIL 331	Ethics in the Professions				R		I	R	I					
*ANTH 335	The Built Environment						I		I		I			
*HIST 335	The Engineering Profession						I		I		I			
	Social Science Electives								I					
	Humanities Electives								I					

I: Introduced, R: Reinforced

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

		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				
CIV 112	Engineering Graphics							I				I		
CIV 201/202	Sustainable Civil Engineering													
CIV 223	Elementary Properties of Materials	I	R			I								
GME 161	Plane Surveying I	I				I								
ENGR 211	Statics	R				I								
ENGR 212	Dynamics	R				I								
ENGR 213	Strength of Materials	R	R			R		I						I
ENGR 231	Fluid Mechanics	R	R		I	R								
*ENGR 236	Fundamentals of Electrical Circuits	R				I								
*ENGR 355	Thermodynamics	R				I								
CIV 317	Economics for Civil Engineers	R				I	R					I	I	I

I: Introduced, R: Reinforced

*Students take *either* ENGR 236 *or* ENGR 355

		BSCE Program Outcomes												
	Civil Engineering Core Courses	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
CIV 315	Principles of Environmental Engineering	R				R			I		I			
CIV 321	Soil Mechanics and Foundations	R	R			R						R		
CIV 328	Structural Analysis	R				R						R		
CIV 331	Reinforced Concrete Design	R	R	I		R						R		
CIV 344	Structural Steel Design	R		I		R				R	R	R		I
CIV 358	Project Management				R		I	R	R		I		R	
CIV 361	Closed Conduit Design	R		I		R						R		I
CIV 362	Hydrology and Surface Water Management	R	I		I	R						R		I
CIV 364	Introduction to Water and Wastewater Treatment Systems													
CIV 371	Introduction to Transportation Engineering	R	R			R					I	R		I
CIV 375	Highway Engineering	R		R		R						R		I
CIV 401/402	Civil Engineering Project	R		R		R	R		R	R	R	R	R	R
CIV 415	Civil Design Software Applications	R				R		R				R		I

I: Introduced, R: Reinforced

		BSCE Program Outcomes												
	Senior Elective Courses	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
CIV 410	Basic Dynamics of Structures	R				R						R		
CIV 416	Structural Design for Lateral Loads	R		R		R				R	R	R		
CIV 418	Structural Matrix Analysis	R				R						R		
CIV 435	Timber Design	R		R		R						R		
CIV 445	Design of Reinforced Masonry Structures	R		R		R						R		
CIV 464	Water and Wastewater Treatment Plant Design	R		R		R						R		R
CIV 466	Solid and Hazardous Waste Management				R	R					R	R		
CIV 467	Groundwater	R				R						R		
CIV 468	Environmental River Mecanics													
CIV 469	Treatment of Wetlands													
CIV 475	Traffic Engineering	R	R	R		R					R	R		R
CIV 476	Environmental Remediation Technologies					R						R		
CIV 531	Open-Channel Hydraulics													
CIV 551	Bridge Design													
CIV 573	Transportation and Land Development													
CIV 574	Advanced Pavement Design													

I: Introduced, R: Reinforced