

# **Annual Assessment Report 2007-08**

## **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 (OIT) administers a Bachelor of Science in Civil Engineering (BSCE) degree. This degree has been accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology since 1998. 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. The BSCE program is only offered on the Klamath Falls campus.

#### **2. MISSION, OBJECTIVES, AND OUTCOMES**

The mission, objectives, and student learning outcomes for the BSCE program underwent slight revisions in the fall of 2007. These revisions were discussed among and decided upon by the entire civil engineering faculty at their fall retreat. The revisions were also presented to the industrial advisory board (IAB), the members of which supported the revisions. The mission, objectives, and outcomes are given below.

##### **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 if necessary.

##### **2.2 Program Objectives**

The following objectives are what the faculty expects graduates from the program to be able to accomplish upon commencement of their careers and stem directly from the program mission.

1. be able to practice civil engineering
2. be able to pursue advanced education in civil engineering or a related field
3. act as responsible, effective, and ethical citizens
4. understand and effectively communicate the realistic constraints of civil engineering
5. be able to perform effectively in a multi-disciplinary environment

## 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.

- 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
- 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 perform realistic and practical civil engineering design

## 3 ASSESSMENT CYCLE

During the 2007 fall retreat, the civil engineering faculty decided to implement a plan for targeted assessment. This plan calls for a three-year assessment cycle in which each outcome is directly assessed at least twice at specific targeted courses in the curriculum where the outcome is normally addressed. Table 1 below summarizes this cycle as well as the courses that have been targeted for assessments.

**Table 1 Assessment Cycle with Targeted Courses**

Outcome	Fall 07	Winter 08	Spring 08	Fall 08	Winter 09	Spring 09	Fall 09	Winter 10	Spring 10
a. fundamentals				Engr 211	Engr 213				
b. experimentation					CIV 321		Engr 231		
c. design					CIV 402			CIV 464	
d. teamwork		CIV 412	CIV 413						
e. problem solving							CIV 315	CIV 328	
f. professionalism						PHIL 331		CIV 402	
g. communication			*CIV 413						
h. broad education			CIV 221	CIV 315					
i. life-long learning			CIV 413				CIV 101		
j. contemporary issues		CIV 371				CIV 315			
k. tools			CIV 112		CIV 321				
l. leadership				CIV 371			CIV 358		
m. practicality				CIV 416		CIV 322			

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

#### 4. 2007-08 TARGETED ASSESSMENT ACTIVITIES

As shown in Table 1, six outcomes were scheduled to be assessed during the 2007-08 academic year. Each of these assessments, except *Outcome i: life-long learning*, were successfully executed and in the following sections. The assessment schedule will be reviewed and adjusted at the civil engineering retreat in the fall of 2008 to determine when *Outcome i* will be assessed.

##### 4.1 Outcome d: *an ability to function on multi-disciplinary teams*

This outcome was directly assessed twice during the academic year: once in the second term of the three term senior project sequence using peer reviews and again during third term of senior project using a process that the civil engineering faculty employ to improve group dynamics.

##### 4.1.1 First Assessment: *peer reviews*

Outcome d was first assessed in CIV 412: the second term course in a three-course senior project sequence. Twenty-three students were assessed using a peer review process developed by civil engineering students and faculty under the guidance of a communications faculty member with expertise in group dynamics. Table 2 below contains the performance criteria that were used in the assessment as well as the assessment methods used, the acceptable levels of performance, and the results of the assessment.

**Table 2 Summary of First Assessment of Outcome d**

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Reliability and Responsibility	Peer reviews from senior project group members using developed form.	1 - 5 according to form criteria	Average of 3.5 with 90% scoring at or above 3.0	Average = 4.1 93.1% $\geq$ 3.0 69.0% $\geq$ 4.0
Accountability	Peer reviews.	1 - 5 according to form criteria	Average of 3.5 with 90% scoring at or above 3.0	Average = 4.1 96.6% $\geq$ 3.0 75.9% $\geq$ 4.0
Professionalism	Peer reviews.	1 - 5 according to form criteria	Average of 3.5 with 90% scoring at or above 3.0	Average = 4.2 100% $\geq$ 3.0 69.0% $\geq$ 4.0
Form Completion	Evaluation by writing and group dynamics expert according to developed criteria	1 - 5 according to form criteria	Average of 3.5 with 90% scoring at or above 3.0	Average = 4.0 93.1% $\geq$ 3.0 69.0% $\geq$ 4.0

Minimum acceptable performance levels were met for each criterion, suggesting that teamwork is a strength for senior civil engineering students. No additional action is required on this outcome at this time.

##### 4.1.2 Second Assessment: *tracking student progress on group dynamics*

A second assessment was conducting in the following term of senior project: CIV 413. The same 23 students, which had been separated into three different design teams, were assessed as they went through a process to improve group dynamics within their design teams. The assessment was conducted by three civil engineering faculty members and the communications/group dynamics professor. The process involved meeting as a group with the faculty, developing a plan to improve group relations, and following through to see if the plans were implemented and

effective. At each stage of the process, professors assessed the students using the methods shown in Table 3 which also contains the results.

**Table 3 Summary of Second Assessment of Outcome d**

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Participate effectively in a group meeting	Evaluation (using attached criteria) by 2-3 faculty members sitting in on a group meeting	1 - 5 according to form criteria	85% of students scoring at least 3.0	Average = 3.8 87.0% ≥ 3.0
Write a plan for improving group dynamics	Evaluation of paper (using attached rubric) by 2-3 faculty members	1 - 4 according to form criteria	85% of students achieving an average of at least 3.0	Average = 3.4 91.3% ≥ 3.0
Follow through with written plan	Evaluation (using attached rubric) by 2-3 faculty members of plan implementation and results	1-4 according to form criteria	85% of students achieving an average of at least 3.0	Average = 3.6 90.5% ≥ 3.0

The results of this assessment also met expectations, once again revealing that students could demonstrate an ability to function on multi-disciplinary teams. No additional direct action is required on this outcome until the next assessment cycle.

**4.2 Outcome g: *an ability to communicate effectively***

This outcome was also directly assessed twice in the 2007-08 academic year. Both of these assessments took place during the third term of senior project.

4.2.1 First Assessment: *written communication*

The students' abilities to communicate were assessed once by evaluating their final engineering reports which represented written summaries of the design work that 23 students had completed throughout the year. These reports were evaluated by four civil engineering professors and two communications professors using the criteria and methods in Table 4.

The results given in Table 4 provide evidence to suggest that students are able to effectively communicate in writing. One of the performance criteria, however, was only just met and so the faculty will be closely monitoring students' use of graphics in future writing assignments. Other than that, no other action is required on this learning outcome at this time.

4.2.2 Second Assessment: *oral communication*

The performance criteria and assessment methods contained in Table 5 were used to assess the ability of 23 students to effectively use oral communication to summarize their senior designs.

Students met, and in some cases greatly exceeded (approaching perfect scores on the first and last performance criteria), faculty expectations in each of the performance areas suggesting that students possess the ability to effectively communicate through speech. No action relating to this outcome is required.

**Table 4 Summary of Assessment of Outcome g: Written Communication**

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Identifies a clear purpose	Evaluation of group final reports by 6 faculty members	1-4 according to attached rubric	75% of reports scoring 3.0 or higher	Average = 3.7 100% ≥ 3.0
Targets a specific audience	Evaluation of group final reports by 6 faculty members	1-4 according to attached rubric	75% of reports scoring 3.0 or higher	Average = 3.9 100% ≥ 3.0
Employs effective organization and content	Evaluation of group final reports by 6 faculty members	1-4 according to attached rubric	75% of reports scoring 3.0 or higher	Average = 3.3 83% ≥ 3.0
Effective use of graphics	Evaluation of group final reports by 6 faculty members	1-4 according to attached rubric	75% of reports scoring 3.0 or higher	Average = 3.2 75% ≥ 3.0
Presents technically accurate material	Evaluation of group final reports by 6 faculty members	1-4 according to attached rubric	75% of reports scoring 3.0 or higher	Average = 3.6 100% ≥ 3.0
Meets professional writing standards	Evaluation of group final reports by 6 faculty members	1-4 according to attached rubric	75% of reports scoring 3.0 or higher	Average = 3.2 92% ≥ 3.0

**Table 5 Summary of Assessment of Outcome g: Oral Communication**

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Structure	Evaluation of group oral presentations by 6 faculty members and 7 invited constituents	1-4 according to attached rubric	Average of 3.0 or higher	Average = 3.9
Delivery	Evaluation by 6 faculty members and 7 invited constituents	1-4 according to attached rubric	Average of 3.0 or higher	Average = 3.2
Visuals	Evaluation by 6 faculty members and 7 invited constituents	1-4 according to attached rubric	Average of 3.0 or higher	Average = 3.5
Content	Evaluation by 6 faculty members and 7 invited constituents	1-4 according to attached rubric	Average of 3.0 or higher	Average = 3.6
Responses to questions	Evaluation by 6 faculty members and 7 invited constituents	1-4 according to attached rubric	Average of 3.0 or higher	Average = 3.9

**4.3 Outcome h: *the broad education necessary to understand the impact of engineering solutions in a global and societal context***

In Spring 2008, 29 students were enrolled in a sophomore-level engineering geology. The instructor of this course assigned a research paper wherein the students were to discuss the global and societal impacts of geology and civil engineering. The performance criteria given in Table 6

were developed by the civil engineering faculty to assess these papers. The results of this assessment are also presented in Table 6.

The results of this assessment reveal a weakness in the program. Specifically, students were generally not inclusive nor expansive in their collective vision of wider population impacts of geologic phenomena nor engineering approaches they reviewed, as evidenced by the scoring on the metric for this assignment. The results of this assessment will be discussed during the fall retreat in 2008 to consider course or curriculum modifications as a mechanism to increase exposure to global and societal concepts. Future reports will describe the actions and additional assessments resulting from these discussions in the fall.

**Table 6 Summary of Assessment of Outcome h**

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Appropriate use of references	Engineering Geology Research Report	1 -- 4 according to attached criteria	75% of students scoring > or = 3.0	44.4% of students scored > or = 3.0
Research and sythesis of information	Engineering Geology Research Report	1 -- 4 according to attached criteria	75% of students scoring > or = 3.0	81.5% of students scored > or = 3.0
Topic relevance	Engineering Geology Research Report	1 -- 4 according to attached criteria	75% of students scoring > or = 3.0	74.1% of students scored > or = 3.0
Explanation of impacts on society	Engineering Geology Research Report	1 -- 4 according to attached criteria	75% of students scoring > or = 3.0	22.2% of students scored > or = 3.0

#### **4.4 Outcome j: *a knowledge of contemporary issues***

This outcome was assessed just once this academic year. The assessment took place in CIV 371, a junior-level introduction to transportation engineering course, during the winter term. In this activity, 17 students wrote papers on current issues in transportation. These papers were evaluated by the course instructor using performance criteria agreed upon by the entire department. Table 7 summarizes the assessment and the results.

The assessment reveals that students are able to effectively research, evaluate, and summarize current issues in civil engineering. Not only were the averages above the minimum levels of acceptable performance, but all 17 students exceeded expectations on all three criteria suggesting that this is a strength in the program. Not action is required at this time but this outcome is scheduled to be assessed again in Winter, 2009.

**Table 7 Summary of Assessment of Outcome j**

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Evaluate content with respect to relevance to current challenges in transportation engineering	"Current Challenges in Transportation" Paper	1-4 According to attached criteria	Average >3.0	Average = 3.29
Effectively Summarize content of technical reports	"Current Challenges in Transportation" Paper	1-4 According to attached criteria	Average >3.0	Average = 3.76
Utilize and correctly cite multiple sources	"Current Challenges in Transportation" Paper	1-4 According to attached criteria	Average >3.5	Average = 3.53

**4.5 Outcome k:** *an ability to use the techniques, skill, and modern engineering tools necessary for engineering practice*

This outcome was assessed once during the spring term of 2008 in CIV 112, Computer Aided Design. Seventeen students were enrolled and completed a project in the course using AutoCAD. The project submissions, as well as the final exam, were evaluated using performance criteria developed by the civil engineering faculty. The results of this assessment are shown in Table 8.

These results reveal another program weakness: students struggle with the concept of plot-scaling, especially under the time constraints present in an exam setting. The results of this assessment will be discussed during the fall retreat in 2008 to consider course or curriculum modifications as a mechanism to increase exposure to these important engineering tools. Future reports will describe the actions and additional assessments resulting from these discussions in the fall.

**Table 8 Summary of Assessment of Outcome k**

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable	Results
Generate accurate CAD drawing file from sketch with appropriate internal structure and external file management practice.	Project 3	1 -- 4 according to attached criteria	75% or more meet > or = 3.0	94% of students met this standard
Generate accurate, scaled plots from an CAD drawing file, selecting appropriate standard engineering scales and methods.	Project 3	1 -- 4 according to attached criteria	75% or more meet > or = 3.0	71% of students met this standard
Produce visually attractive and clear, readable plots meeting ANSI standards for lettering height, dimensioning and annotation.	Project 3	1 -- 4 according to attached criteria	75% or more meet > or = 3.0	82.% of students met this standard
Produce moderately complex 2D CAD drawing file and plot to appropriate standard scale under time constraint.	Final Exam	1 -- 4 according to attached criteria	75% or more meet > or = 3.0	22% of students met this standard

**5 OTHER ASSESSMENT ACTIVITIES**

Indirect assessments in the form of online surveys were completed by 22 students enrolled in CIV 413, Senior Project, in Spring of 2008. These surveys asked students how they felt that both the curriculum in general and senior project in particular helped them to enhance their skills in the program outcome areas. The results of these surveys are summarized in Table 9. The civil engineering faculty determined that a median score above 3.0 suggests that the outcome is being achieved. Furthermore, achievement in either the general curriculum *or* the senior project sequence is sufficient to indicate success. This is because responses were provided on a single survey and students may have responded to one area *relative* to the other. For example, students may have felt that they had significantly more experience working in groups in the senior project sequence than in the rest of the curriculum and may have rated the senior project sequence accordingly higher than the general curriculum.

With this evaluation strategy in mind, there is only one outcome that did not score above a three in either the curriculum or the senior project sequence: Outcome l: an ability to explain basic concepts in management, business, public policy, and leadership. This is a weakness that the department is aware of and plans to address when two new faculty members join the department in Fall 2008.

Two open ended questions were also asked of the students and these responses are reproduced in Appendix A.

## **6 DATA STORAGE AND MANAGEMENT**

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

## **7 SUMMARY AND OPEN ISSUES**

The assessments conducted during the 2007-08 revealed strengths in many areas, and weakness in three:

- Outcome h: the broad education necessary to understand the impact of engineering solutions in a global and societal context
- Outcome k: an ability to use the techniques, skill, and modern engineering tools necessary for engineering practice
- Outcome l: an ability to explain basic concepts in management, business, public policy, and leadership

At the departmental retreat in Fall 2008, course and/or curriculum improvements will be discussed and decided upon to address these weaknesses. Decisions will also be made then about when to reassess these outcomes to ensure that the quality of the program is not only maintained but also improved. Future assessment reports will describe how these open issues have been addressed.

**Table 9 Summary of Exit Survey Results**

**To what extent has the civil engineering curriculum and the senior project sequence allowed you to enhance your skills in the following core areas?**

	CIVIL ENGINEERING CURRICULUM						SENIOR PROJECT SEQUENCE					
	A great deal	Quite a bit	Some what	Very little	Not at all	Median	A great deal	Quite a bit	Some what	Very little	Not at all	Median
a. an ability to apply knowledge of mathematics, science, and engineering	16	6	0	0	0	5.0	2	8	9	3	0	3.0
b. an ability to design and conduct experiments, as well as to analyze and interpret data	9	12	1	0	0	4.0	2	10	9	1	0	4.0
c. an ability to design a system, component, or process to meet desired needs	5	15	2	0	0	4.0	3	10	7	2	0	4.0
d. an ability to function on multi-disciplinary teams	5	5	10	2	0	3.0	9	6	5	1	1	5.0
e. an ability to identify, formulate, and solve engineering problems	13	7	2	0	0	5.0	3	12	6	1	0	4.0
f. an understanding of professional and ethical responsibility as well as the importance of professional licensure	13	4	5	0	0	5.0	4	3	9	5	1	3.0
g. an ability to communicate effectively	5	10	6	1	0	4.0	8	5	7	2	0	5.0
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context	8	8	5	1	0	4.5	4	5	10	2	1	3.0
i. a recognition of the need for, and an ability to engage in life-long learning	8	8	6	0	0	4.5	7	4	4	6	1	5.0
j. a knowledge of contemporary issues	3	8	7	4	0	4.0	2	3	8	8	1	2.5
k. an ability to use the techniques, skill, and modern engineering tools necessary for engineering practice	7	8	7	0	0	4.0	3	7	7	5	0	3.5
l. an ability to explain basic concepts in management, business, public policy, and leadership	2	7	10	3	0	3.0	0	7	11	3	1	3.0
m. an ability to perform realistic and practical civil engineering design	6	9	6	1	0	4.0	6	6	8	1	1	3.0

## APPENDIX A

### RESPONSES TO OPEN-ENDED QUESTIONS ON SENIOR-PROJECT EXIT SURVEYS

**Please include any other comments you may have regarding the senior project sequence.**

Would be nice to know how to use more programs and software before senior project to be able to use a variety and to a good extent.

Too much communication and not enough design. Although, I do feel like I'm much better at communication skills.

Less fluff. The process was more concerned about peer evals and progress reports. It would have been nice to spend more time actually doing the engineering of the project instead of the fluff.

FUN!!!

I could be much more effective if it were more realistic. Inclusion of things like entitlement of projects takes a lot of time and effort but was not involved in the project.

I didn't feel that it was very realistic. We have been told all term that this models the 'real world', but in my experience and that of my peers, it doesn't. I especially didn't like that our project manager was not very involved, in my experience a project manager is always wanting to know where you're at with your work.

I honestly feel that senior project could be more realistically based. Forcing the students to police themselves and try to make them fire someone when they are not producing is highly unrealistic. That is the job of a superior or supervisor, who would fire the person for poor work. Also, peer reviews did not seem to serve the purpose that they should have. I know that members of my group recieved poor peer reviews and nothing happened. That should also be the job of the supervisor/project manager to take care of this situation. There was also many times where no direction was given to the students. In the real world you would be given an example to work from or told how to start, I did not feel this was the case in senior project, especially in the fall term with the RFP. I also feel that teachers should be held to the same standards as the students, as this did not seem to be the case many times, and there is nothing the students can do about this. The thing that I wish I could see the most out of senior project is an experience that will be realistic and prepare students for the working world.

Senior Project was not a realistic project. I did not get much out of it. There were other students in Senior Project that were not qualified to be in the class. In a real job setting, these people would have been fired by managment. You asked the students to do the dismissing, once again, this was not realistic.

I think the course was good, but it is hard to be on a team where some of the members don't carry their weight when it is crunch time. It was a good project to work on, but there were

several things that were unrealistic about it. And also there is a lot of things that had to be done that I looked at like there is no point to this and I just need to get it done to do it. I enjoyed the term, it helped me bond more with my fellow students. Another thing that I liked was that the city is actually going to employ some of our ideas in the future, that made me feel good about what we had accomplished.

-Garrett Paul

I liked senior project. The bi-weekly presentations seemed like buisy work. I think that the managers should have have tried to be a little more involved in the process, because of my low experience I felt lost sometimes.

I think the SR. Project sequence should be a smaller project that goes into more depth on the design details and project politics.

**Please include any other comments you may have regarding the civil engineering curriculum.**

More time using programs that are used in the field.

I absolutely love the instruction I received at OIT. Now that I'm working, I realize how well I was prepared for real world engineering.

Less social and humanities and more civil electives, something that we will actually use.

FUN!!!

Most of the civil engineering curriculum is fine. I only wish there had been more choices for senior level classes.

I feel that I have acquired the skills that I need in order to preform in the work place.

It is good, more computer programs that are used in the field in the structures side of it would be nice besides RISA, but overall it was a good experience.

-Garrett Paul

I really liked Oit's civil engineering program. I feel prepared to go out into the work force. I like all of the teachers (most of the time), and I like the class sizes.

More use of software would be nice in all areas.

With the limited number of students at OIT I think the curriculum has quite a few options. I would like to see a few more electives offered in modern structural design and water/sewer.