Annual Assessment Report
2009-2010 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 (OIT) administers a Bachelor of Science in Civil Engineering (BSCE) degree. This degree has been accredited by the Engineering Accreditation Commission of ABET, Inc. 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.

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. By unanimous vote, these elements remained unchanged from the previous year. The mission, objectives, and outcomes were then presented to the Industrial Advisory Board. This body recommended a very slight change in the wording to the first objective from "practice civil engineering" to "practice as a professional civil engineer". A slight change was also suggested to the mission statement: the words "if necessary" were removed from the end of the last sentence. These changes were welcomed by the department faculty. The mission, objectives and outcomes are presented herein.

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 OIT should:

1. be able to practice as a professional civil engineer
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 2009 fall retreat, the civil engineering department reviewed the plan for targeted assessments. This plan calls for a three-year assessment 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 then developed, if they had been used previously, or reviewed. 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 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 the 2008-2009 academic 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	Fall 07	Winter 08	Spring 08	Fall 08	Winter 09	Spring 09	Fall 09	Winter 10	Spring 10
a. fundamentals				Engr 211	CIV 328				
b. experimentation					CIV 321		Engr 231		
c. design					CIV 371		CIV 416		
d. teamwork		CIV 412	CIV 413						
e. problem solving							CIV 328	CIV 361	
f. professionalism						CIV 317		CIV 574	
g. communication			*CIV 413						
h. broad education			CIV 221	CIV 315					
i. life-long learning					CIV 402			CIV 402	
j. contemporary issues		CIV 371					CIV 315		
k. tools			CIV 112		CIV 402				
l. leadership							CIV 358	CIV 402	
m. practicality				CIV 416				CIV 371	

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

4. 2009-2010 TARGETED ASSESSMENT ACTIVITIES

Each of the program outcomes are taught or reinforced in several classes at least. 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, ten outcomes were assessed in eight different targeted courses during the 2009-20010 academic year. Each of these assessments is detailed below.

4.1 Outcome (b): *an ability to design and conduct experiments, as well as to analyze and interpret data*

The students' abilities to design and conduct experiments, and to analyze and interpret the resulting data, were assessed once by evaluating a selected laboratory exercise and associated report. The laboratory actions and subsequent written reports by 6 student teams, a total of 24 students, were evaluated by the instructing civil engineering professor using the criteria and methods in Table 2. One team only completed a cursory inspection of the laboratory assignment and equipment, returning at a later date to complete the work without informing the instructor of their rescheduled time; the observational components of that particular team's work were thus largely gleaned from their submitted report.

The results given in Table 2 indicate that students have the abilities to design and conduct experiments, as well as to analyze and interpret data. Based on other assessments of this outcome, students continue to demonstrate a relative weakness in real-time assessment of data and preliminary results.

The results of this assessment were discussed in a department meeting. It was recommended that future introductory laboratory courses more specifically include discussion of, and required activities in, preliminary data and results assessment.

Table 2 Summary of Assessment of Outcome (b): Experimentation

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Correctly identified all applicable variables	Observation of laboratory exercise and evaluation of associated hydraulic report by course instructor	1 - 4 according to form criteria	90% scoring ≥ 3.0	100.0% ≥ 3.0
Identified appropriate test standards / methodologies				100.0% ≥ 3.0
Chose / assembled appropriate test equipment / apparatus				100.0% ≥ 3.0
Chose appropriate test sample				100.0% ≥ 3.0
Followed appropriate standards / methodologies				100.0% ≥ 3.0
Accurately assessed and responded to preliminary results				83.3% ≥ 3.0
Performed appropriate analysis and interpretation of data				100.0% ≥ 3.0
Arrived at reasonable and defendable result				100.0% ≥ 3.0

4.2 Outcome (c): *an ability to design a system, component, or process to meet desired needs*
The students' ability to design a system was assessed in CIV 416, Structural Design for Lateral Loads, in the fall term of 2009. Seventeen students, divided into four groups, designed a lateral force resisting system for a structure. The students designed wood diaphragms with appropriate connections, chords, and struts as well as wood structural panel shear walls with appropriate connections, hold-downs, and anchors. Each group produced a set of earthquake force, wind force, and design calculations and a set of framing plans show the appropriate elemental parts of the lateral force resisting system. Using performance criteria and a rubric designed by the entire civil engineering faculty, and used in a previous assessment in the 2008-2009 academic year, the course instructor assessed the students' work.

The data from this assessment are summarized in Table 3, where the performance criteria are also presented. All students performed competently on the project and met the minimum acceptable performance level for each performance criteria on this outcome. These data suggest that students can perform the outcome and no further action is required at this time.

Table 3 Summary of Assessment of Outcome (c): Design

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Identifies all relevant needs	Final project: lateral design of a wood framed structure	1-4 according to attached rubric/criteria	75% of students scoring at or above a 3	100% ≥ 3
Demonstrates knowledge of applicable standards, codes, methodologies, or theories of practice				100% ≥ 3
Uses appropriate design methods				100% ≥ 3
Addresses all previously stated criteria (needs and standards)				100% ≥ 3
Effectively documents design process and results				76.5% ≥ 3

4.3 Outcome (e): *an ability to identify, formulate, and solve engineering problems*
As can be seen in Table 1, Outcome (e) was not assessed until this year, wherein it was assessed twice. During the civil engineering department retreat, the faculty developed the following set of performance criteria: identification of knowns, identification of unknowns, identification of solution method, application of solution methods, and arrival at correct/defendable result. The faculty felt that if the students accomplished these performance criteria, then they would have identified, formulated, and solved an engineering problem. They designed a rubric to measure these performance criteria and then used the rubric to assess problems that students had solved in two different courses. Each of these two assessments will be described below.

4.3.1 First Assessment
Outcome (e) was first assessed in CIV 328, Structural Analysis. Though it was originally scheduled to be completed in the fall term, scheduling conflicts required it to be pushed back to winter. For this assessment, nine students were asked to solve for the external reactions on a compound beam. Nine students completed the quiz without any assistance in the form of books or notes. Using the rubric and performance criteria designed by the faculty, the course instructor graded the students' quizzes.

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

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Identification of knowns	Compound beam force equilibrium quiz	1-4 according to attached rubric/criteria	85% of students scoring at or above a 3	100% ≥ 3 89% = 4
Identification of unknowns				100% ≥ 3 78% = 4
Identification of solution method				100% ≥ 3 89% = 4
Application of solution method				89% ≥ 3 67% = 4
Correct/defendable result				89% ≥ 3 56% = 4

The results of this assessment are presented in Table 4. All students performed at the minimum acceptable level for all criteria. These results suggest that students can performed at the desired level and are thus achieving the outcome.

4.3.2 Second Assessment

The students' abilities to identify, formulate, and solve engineering problems were assessed once by evaluating an assigned homework problem. The particular problem, submitted by a total of 20 students, was evaluated by the instructing civil engineering professor using the criteria and methods in Table 5.

The results given in Table 5 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.

The results of this assessment were discussed in a department meeting. The course instructor plans to place additional emphasis on problem documentation in future offerings of both the assessed course and other courses in the assigned workload.

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

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Identification of knowns	Multiple reservoir hydraulic balance homework problem	1-4 according to attached rubric/criteria	85% scoring ≥ 3.0	100% ≥ 3 55% = 4
Identification of unknowns				100% ≥ 3 50% = 4
Identification of solution method				100% ≥ 3 100% = 4
Application of solution method				85% ≥ 3 35% = 4
Correct/defendable result				95% ≥ 3 25% = 4

4.4 Outcome f: *an understanding of professional and ethical responsibility as well as the importance of professional licensure*

In Spring, 2010, 13 students enrolled in CIV 574, Advanced Pavement Design, completed the ethics component of this outcome using the performance criteria and rubric—which the course instructor altered slightly—that were developed by the university's Executive Committee on Assessment. The committee also developed an assignment that was linked to the performance criteria. The assessment coordinator chose an ethical case study within the civil engineering discipline to use with the assignment and the course instructor scored the returned assignments according to the rubric. The resulting data are summarized in Table 6.

Table 6 Summary of Assessment of Outcome f

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Using code of ethics, describes ethical issue(s).	Ethics case study.	1-4 according to attached rubric	85% of responses scoring 3.0 or higher	100%≥3.0 Avg=3.08
Describes stakholders and discusses their points of veiw.	Ethics case study.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	85%≥3.0 Avg=3.08
Describes and analyzes alternative approaches.	Ethics case study.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	92%≥3.0 Avg=3.00
Chooses and approach and explains the benefits and risks.	Ethics case study.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	92%≥3.0 Avg=3.31
Code Location	Ethics case study.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	100%≥3.0 Avg=3.77
Provisions	Ethics case study.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	92%≥3.0 Avg=3.38

All results met or exceeded the minimum acceptable performance levels although the ability to identify stakeholders and discuss their points of view was the weakest. The course instructor suggested that the concept of multiple stakeholders should be introduced in freshmen courses and emphasized throughout the BCE curriculum. Because this was the second successful assessment of ethics, no further action on this portion of the outcome is required until the next assessment cycle.

The professional licensure component of this outcome was assessed via a survey in CIV 402 which was completed by 26 students enrolled in the course. The department felt that if students understood the importance of professional licensure, they would desire to become professionals. As such, students were simply asked if they intended to pursue licensure and 21 out of 26 (or 80.8%) stated that this was their intention. While this is lower than what the faculty would desire, there are a number of seniors graduating in 2010 who do not intend to pursue a career in engineering at all, so it is understandable. Two follow-on questions asked students why they thought licensure was important and what the steps toward licensure were. All 26 students who responded were able to correctly identify the steps toward licensure. All students also provided a valid reason for why licensure what important: sixteen responses involved responsibility (e.g. "To hold professionals accountable" or "makes sure that engineers have a minimum level of competence"), thirteen responses involved business and career advancement (e.g. "Increases marketability," "Get paid more," "Professional advancement," or "increased freedom"), and three responses (some student provided more than one response) stated that professionals were required to maintain a continual stream of professionals. The faculty felt that each of these responses were valid and suggest, along with the other data presented above, that students do, in fact, understand the importance of licensure.

4.5 Outcome (i): *a recognition of the need for, and an ability to engage in, life-long learning*
This outcome was assessed during the winter term of 2010 in CIV 402, the second term of the senior project sequence, via a survey about licensure and continuing education. Twenty-eight students were enrolled in the course, 26 of these completed portions of the survey, and 25 of them completed the entire questionnaire.

Students were asked about ways to obtain continuing education, how they felt about continuing education, and similar questions. The results, summarized in Table 7, reveal that minimum acceptable performance was met on all criteria, achievement of which suggests that students do, in fact, recognize the need for life-long learning and also have an ability to engage in such activities. In addition to the data given above, students were also asked in the survey to explain why they thought that continuing education was important. All 25 students who completed the survey gave very valid reasons for continuing education. Examples include "Staying up to date with new products and procedures," "To keep…informed on new regulations and techniques," and "So one does not become obsolete." The faculty considers this outcome to be met and no further action is required at this time.

Table 7 Summary of Assessment of Outcome (i): Life-long Learning

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Students are aware of continuing education requirements for licensure	survey question	either aware of requirements or not aware	80% of students responding that they are aware that most states require continuing education	83.3% of students said that they were aware
Students have a positive outlook towards continuing education	survey question	students either responded that they saw continuing education as a way to grow professionally or as another hoop to jump through	80% of students responding that continuing education is a way to grow professionally	87% of students responded correctly
Students know where to go to continue their education or to find information on continuing education	survey question	students listed three sources, coordinator judged responses as valid sources of information	80% of students listing at least two valid sources	92% of students listed at least 2 valid sources of information on continuing education
Students identify at least one method of continuing education	survey question	students response to open-ended question was evaluated by coordinator	80% of students listing at least one way to continue their education	96% of students listed at least one way to continue their education
Students identify methods least likely to count towards continuing education credits	survey questions	students were given four multiple choice questions and asked on each to identify which choice was least like to count towards continuing education credits	80% of students correctly identifying at least two correct answers	87.5% of students correctly answered at least two questions

4.6 Outcome (j): *a knowledge of contemporary issues*
The students' knowledge of contemporary issues, as related particularly to the subdiscipline of environmental engineering, was assessed once by evaluating their environmental engineering term papers and poster session presentations. The written and verbal components of 28 students were evaluated by the instructing civil engineering professor and visiting faculty, as well as peer-evaluated by the entire class, using the criteria and methods in Table 8.

The results given in Table 8 indicate that students are able to identify problems related to environmental engineering and relate those problems to contemporary issues. As with related outcome assessments, the measurements suggest that students are slightly more able to articulate these concepts and effects in personal discussion than in a written report.

The results of this assessment were discussed in a department meeting. It was determined that no further actions are required at this time.

Table 8 Summary of Assessment of Outcome (i): Contemporary Issues

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Identify environmental engineering problem & propose current solution	Poster session (including discussion) & written paper	1 - 4 according to form criteria	90% of students scoring at or above 3	100% ≥ 3.0 91.1% = 4.0
Relate problem to contemporary issues	Poster session (including discussion) & written paper	1 - 4 according to form criteria	90% of students scoring at or above 3	100% ≥ 3.0 91.1% = 4.0

4.7 Outcome (l): *an ability to explain basic concepts in management, business, public policy, and leadership*

This outcome was assessed twice during this academic year. In both assessments, students were asked to complete an essay assignment which asked them to describe the role of a manager in civil engineering, explain what is involved in running an engineering business, explain what public policy is and how it relates to civil engineering, and list the qualities of effective and ineffective leaders.

4.7.1 First Assessment

Fifteen students enrolled in CIV 358, Project Management, completed the assignment in fall term. The course instructor coded their essays according to performance criteria and a coding rubric developed by the civil engineering faculty. The results of this assessment are presented in Table 9.

Table 9 Summary of First Assessment of Outcome (l): Management, Business, Public Policy, & Leadership

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Explain Basic Concepts in Management	Essay examination	1-4 According to attached criteria	75% of students scoring >= 3	20% of students scored >=3
Explain Basic Concepts in Business	Essay examination	1-4 According to attached criteria	75% of students scoring >= 3	87% of students scored >=3
Explain Basic Concepts in Public Policy	Essay examination	1-4 According to attached criteria	75% of students scoring >= 3	100% of students scored >=3
Explain Basic Concepts in Leadership	Essay examination	1-4 According to attached criteria	75% of students scoring >= 3	100% of students scored >=3

The results indicate that students were able to explain basic concepts in all areas except management. While the students were asked to "be specific" in their answer regarding

management practices, very few provided sufficient detail to meet the performance criterion. The list of terms/concepts developed by the faculty to demonstrate knowledge of management principles was long and few students provided a sufficiently long and detailed answer to succeed in mentioning even a third of the terms on the list. The course instructor felt that there was a mismatch between the information requested and the information desired and that the students in fact do have a reasonably good understanding of management principles as they pertain to civil engineering. This suggests that the assessment instrument was faulty. Another assessment was conducted, however, using the same instrument.

4.7.2 Second Assessment

Juniors in the BSCE program were asked in an email to complete the essay assignment. Eighteen students responded and their responses were coded according to same rubric as used in Section 4.7.1.

Table 10 Summary of Second Assessment of Outcome (l): Management, Business, Public Policy, & Leadership

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Describe the role of a manager in civil engineering	Essay examination	1-4 According to attached criteria	75% of students scoring >= 3	11% of students scored >=3
Explain what is involved in running an engineering business	Essay examination	1-4 According to attached criteria	75% of students scoring >= 3	72% of students scored >=3
Explain what public policy is and how it relates to civil engineering	Essay examination	1-4 According to attached criteria	75% of students scoring >= 3	72% of students scored >=3
List qualities of effective and ineffective leaders	Essay examination	1-4 According to attached criteria	75% of students scoring >= 3	94% of students scored >=3

As can be seen from the results summarized in Table 10, students were successful with the leadership component, struggled with the public policy and business components, and performed very poorly in the management component. Reasons for this may be that 1) over half of the students had not yet completed engineering economics and project management—two courses that are integral to this outcome; 2) while the faculty interpret the term "management" to refer to the management of *projects*, students interpreted it as managing over *people* (which the faculty considered to be leadership when developing the criteria and rubric); 3) the assessment method is poorly formed and does not accurately reflect the students' abilities. As a result, the faculty decided that these four topics will continue to be emphasized in CIV 317, Economics for Civil Engineers, and CIV 358, Project Management. Future assessments will be done at the senior-level, once students have completed these two courses. The assessment piece will be redesigned so as to more accurately assess these abilities. Also, asking students to "describe the role of a project manager" as opposed to just a “manager” will likely eliminate some of the student confusion between manager and leader. This outcome will be assessed in future senior project settings as well as end the end of the project management course.

4.8 Outcome m: *an ability to perform realistic and practical civil engineering design*

Outcome m was assessed in CIV 371, Introduction to Transportation Engineering. Twenty-one students were enrolled in the course. These students formed pairs and each partnership

performed a highway design. The practicality of their designs was assessed using a rubric based on the performance criteria developed by the civil engineering faculty.

The performance criteria, along with the summarized results, are shown in Table 11. All students scored 3 or 4 out of 4 on every performance criteria. As such, the results suggest that students are able to perform realistic and practical civil engineering design. No further action is required on this outcome at this time.

Table 11 Summary of Assessment of Outcome (m)

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Design is cost effective	Evaluation of a highway design project	1-4 according to attached rubric	90% of designs scoring 3.0 or higher	100% ≥ 3 Avg=3.48
Design is safe	Evaluation of a highway design project	1-4 according to attached rubric	90% of designs scoring 3.0 or higher	100% ≥ 3 Avg=4.00
Realistic design materials	Evaluation of a highway design project	1-4 according to attached rubric	90% of designs scoring 3.0 or higher	100% ≥ 3 Avg=4.00
Design completed using practical techniques and tools	Evaluation of a highway design project	1-4 according to attached rubric	90% of designs scoring 3.0 or higher	100% ≥ 3 Avg=3.43
Design completed on time	Evaluation of a highway design project	1-4 according to attached rubric	90% of designs scoring 3.0 or higher	100% ≥ 3 Avg=4.00
Design fulfills intended need	Evaluation of a highway design project	1-4 according to attached rubric	90% of designs scoring 3.0 or higher	100% ≥ 3 Avg=3.62
Designed according to realistic assumptions	Evaluation of a highway design project	1-4 according to attached rubric	90% of designs scoring 3.0 or higher	100% ≥ 3 Avg=3.52
Design is constructable	Evaluation of a highway design project	1-4 according to attached rubric	90% of designs scoring 3.0 or higher	100% ≥ 3 Avg=3.52

5 OTHER ASSESSMENT ACTIVITIES

Indirect assessments, in the form of online surveys, were conducted with employers and alumni in the spring of 2010. The results are presented in Appendix B for Program Objectives and Appendix C for Program Outcomes. Most of the results from these surveys were very positive, especially regarding alumni and employers: graduates (who may not have a good understanding of just how much they know when they graduate from the program) tended to be a little harsher in their responses. While data strongly support achievement of the program objectives, some of the program outcomes had responses that were low enough to be of some concern. An in-depth discussion of these survey results and their relationship to the targeted assessment results is outside of the scope of this annual report and can be found elsewhere in the three-year cycle summary report which summarizes all assessments from the entire assessment cycle.

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

The assessments conducted during the 2007-08 and 2008-2009 revealed strengths in many areas, and a handful of shortcomings, some of which have been addressed, thus having closed the loop, in previous annual reports. Others remain unresolved. The unresolved issues from previous academic years are

- Outcome (b): an ability to design and conduct experiments as well as to analyze and interpret the data
- Outcome (c): an ability to design a system, component, or process to meet desired needs
- Outcome (h): the broad education necessary to understand the impact of engineering solutions in a global and societal context
- Outcome (l): an ability to explain basic concepts in management, business, public policy, and leadership

In departmental meetings throughout 2009, including the department retreat in the fall, course and/or curriculum improvements were discussed and decided upon to address these unresolved issues. Also, assessments, to be conducted during the 2009-2010 academic year, were developed to determine if these changes had any effects.

7.1 Outcome (b):

This outcome was assessed in a sophomore level materials course in the winter of 2009. This original assessment revealed that students were not performing at acceptable levels for all performance criteria. As such, plans were put into place to improve their performance in the areas of data analysis and interpretation and obtaining reasonable and defendable results. Specifically, lab instructors emphasized the "real-time" analysis of experimental data as the experiment was being conducted to determine if the data were reasonable, thus reinforcing the notion that the test was being conducted correctly.

After these changes were implemented, a reassessment took place in CIV 574, Advanced Pavement Design, wherein 14 students completed pavement experiments and wrote reports on their research. The course instructor used the departmental rubric to evaluate the reports. The data are summarized in Table 12 and reveal that the changes led to a significant increase in performance in the last two criteria. These results suggest that students are able to achieve the outcome, thus closing the loop on Outcome (b).

Table 12 Summary of Assessment of Outcome (b)

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Variable Identification	Pavement experiment project report.	1-4 according to attached rubric	85% of responses scoring 3.0 or higher	100%≥3.0 Avg=3.21
Standards Identification	Pavement experiment project report.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	100%≥3.0 Avg=3.79
Experiment Preparation	Pavement experiment project report.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	100%≥3.0 Avg=4.00
Appropriate Sampling	Pavement experiment project report.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	100%≥3.0 Avg=4.00
Experimentation Methods	Pavement experiment project report.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	100%≥3.0 Avg=3.79
Analysis of Preliminary Results	Pavement experiment project report.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	100%≥3.0 Avg=3.29
Data Analysis and Interpretation	Pavement experiment project report.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	100%≥3.0 Avg=3.50
Arrives at Defendable Result	Pavement experiment project report.	1-4 according to attached rubric	85% of designs scoring 3.0 or higher	100%≥3.0 Avg=3.71

7.2 Outcome (c):

This outcome was first assessed in the 2008-2009 academic year in a junior-level transportation class. In that initial assessment, students did not meet the minimum acceptable performance levels in last two criteria. The faculty members agreed to emphasize the following in all design courses: 1) Designs must address all of the needs and standards and 2) designs must be effectively documented.

After the implementation of these changes, a follow up assessment was conducted in CIV 402, the final term of the capstone senior design project course sequence. Twenty-eight students were enrolled in the course and were divided into four design groups. These groups each designed a mixed use development with individuals or smaller groups each taking on different portions of the design such as geotechnical report and design; stormwater, sanitary sewer, and water conveyance design; structural design; and transportation and land development design. Four faculty members evaluated portions of the design according the previously developed rubric and performance criteria.

The results, summarized in Table 13, reveal significant improvement in the last two performance criteria. These data suggest that students are able to perform this outcome. These successful results reveal that the department's changes mentioned above were successful and thus close the loop on this outcome.

Table 13 Summary of Assessment of Outcome (c)

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Identifies all relevant needs	Faculty Evaluation of Senior Project Final Submittals	1-4 according to attached rubric/criteria	90% of students scoring at or above a 3	100% ≥ 3
Demonstrates knowledge of applicable standards, codes, methodologies, or theories of practice			90% of students scoring at or above a 3	96% ≥ 3
Uses appropriate design methods			75% of students scoring at or above a 3	100% ≥ 3
Addresses all previously stated criteria (needs and standards)			75% of students scoring at or above a 3	96% ≥ 3
Effectively documents design process and results			75% of students scoring at or above a 3	89% ≥ 3

7.3 Outcome (l):

This outcome was originally assessed indirectly, via a survey asking graduating students to rate their level of preparedness on this outcome, in the spring of 2008. Responses on that survey did not meet the benchmarks established by the faculty for successful achievement. Unfortunately, the direct assessments described in Section 4.7 of this document reveal that this is still an area in which the department could improve. The faculty will continue to work on this outcome over the next few years, even outside of the normal three-year assessment cycle, in an effort to improve

student performance regarding their ability to explain basic principles in management, business, public policy, and leadership.

7.4 Open Issues from the 2008-2009 Academic Year

The assessments conducted during the 2008-2009 academic year revealed deficiencies in three areas associated with the following outcomes:

- Outcome b: an ability to design and conduct experiments as well as to analyze and interpret the data
- Outcome c: an ability to design a system, component, or process to meet desired needs
- Outcome h: the broad education necessary to understand the impact of engineering solutions in a global and societal context

Ways to address these weaknesses have already been determined and are presented in the various respective sections of this document.

8 CONCLUSION

The 2009-2010 academic year was the third and final year in the three-year cycle.
The efforts of the Civil Engineering Department to institute new targeted, direct assessments have become streamlined and easier to implement. The results described herein reveal weaknesses that are not surprising to the faculty. Civil engineering students at OIT are consistently excellent in technical areas. It is with the softer skills, this time in the areas of business, leadership, public policy and management, that the students struggle. The faculty members have determined ways to address these issues and look forward to reassessing these outcomes in the future to determine if the interventions were successful.

Appendix A
Mapping of Program Outcomes to Courses

Table A-1. Correlation between Outcomes and 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 201/202/204/205	General Chemistry	I	I											
PHY 221/222/223	General Physics with Calculus	I	I											
*CHE 231	Streamwater Chemistry	R	R		I				I					
*CHE 232	Streamwater Sampling	R	R		I				I					
*CHE 455	Water Quality Technology	R	R		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 Electives	R												

I: Introduced, R: Reinforced

*Students must take either CHE 231/232 or CHE 455.

Table A-2. Correlation between Outcomes and General Education 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						
WRI 121/122	English Composition							I						
WRI 227	Technical Report Writing							R						
COM 401/402	Civil Engineering Project				R			R	R					
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

Table A-3. Correlation between Outcomes 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)
CIV 101	Orientation to Engineering				I		I							
CIV 102	Basic Techniques in Engineering				I			I		I				
CIV 103	Freshman Design Experience			I	I			I						I
CIV 112	Graphical Communication Techniques in Civil Engineering							I				I		
CIV 221	Engineering Geology	I												
CIV 223	Elementary Properties of Materials	I	R	I		I								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	I		R		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: Introduced, R: Reinforced

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

Table A-4. Correlation between Outcomes and Core Civil Engineering Courses

		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	R	R			R						R		
CIV 322	Foundation Engineering	R		I		R						R		I
CIV 328	Structural Analysis	R				R						R		
CIV 331	Reinforced Concrete Design	R	R	R		R						R		I
CIV 344	Structural Steel Design	R		R		R				R	R	R		I
CIV 358	Project Management				R		I	R	R		I		R	
CIV 361	Water and Sewer Systems Design	R		I		R						R		I
CIV 362	Hydrology and Surface Water Management	R	I	I	I	R						R		I
CIV 371	Introduction to Transportation Engineering	R	R	I		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		I		R		R				R		I

I: Introduced, R: Reinforced

Table A-5. Correlation between Outcomes and Civil Engineering Elective Courses

		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		R
CIV 418	Structural Matrix Analysis	R				R						R		
CIV 435	Timber Design	R		R		R					R	R		R
CIV 445	Design of Reinforced Masonry Structures	R		R		R						R		R
CIV 451	Cost Analysis and Estimating					R						R	R	
CIV 455	Construction Equipment					R								
CIV 464	Water and Wastewater Treatment Systems Design	R		R		R						R		R
CIV 466	Solid and Hazardous Waste Management				R	R					R	R		
CIV 467	Groundwater	R				R						R		
CIV 475	Traffic Engineering	R	R	R		R					R	R		R
CIV 476	Methods in Site Investigation					R						R		

I: Introduced, R: Reinforced

Students are required to take at least three of these courses.

Appendix B
Indirect Assessments (Survey Results) of Program Educational Objectives

Table B-1. Results of Alumni Survey on BSCE Objectives.

BSCE Program Objectives	Degree of Preparation		Count	Percent
Be able to practice as a professional civil engineer	Highly prepared		34	57%
	Prepared		23	38%
	Somewhat prepared		2	3%
	Not at all prepared		0	0%
	Not Applicable	NA	1	2%
Be able to pursue advanced education in civil engineering or a related field	Highly prepared		22	37%
	Prepared		33	55%
	Somewhat prepared		4	7%
	Not at all prepared		0	0%
	Not Applicable	NA	1	2%
Act as a responsible, effective, and ethical citizen	Highly prepared		42	70%
	Prepared		14	23%
	Somewhat prepared		4	7%
	Not at all prepared		0	0%
	Not Applicable	NA	0	0%
Understand and effectively communicate the realistic constraints of civil engineering	Highly prepared		33	55%
	Prepared		23	38%
	Somewhat prepared		4	7%
	Not at all prepared		0	0%
	Not Applicable	NA	0	0%
Be able to perform effectively in a multi-disciplinary environment	Highly prepared		34	57%
	Prepared		21	35%
	Somewhat prepared		5	8%
	Not at all prepared		0	0%
	Not Applicable	NA	0	0%

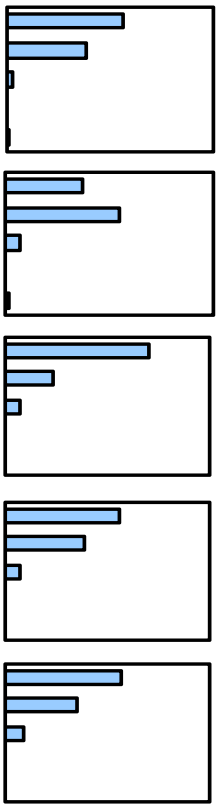
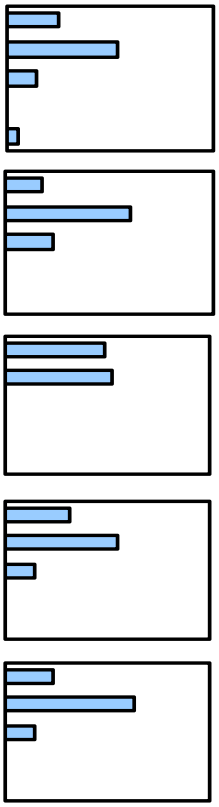


Table B-2. Results of Employer Survey on BSCE Objectives

BSCE Program Objectives	Degree of Preparation		Count	Percent
Be able to practice as a professional civil engineer	Highly prepared		9	26%
	Prepared		19	54%
	Somewhat prepared		5	14%
	Not at all prepared		0	0%
	Not Applicable	NA	2	6%
Be able to pursue advanced education in civil engineering or a related field	Highly prepared		6	17%
	Prepared		21	60%
	Somewhat prepared		8	23%
	Not at all prepared		0	0%
	Not Applicable	NA	0	0%
Act as a responsible, effective, and ethical citizen	Highly prepared		17	49%
	Prepared		18	51%
	Somewhat prepared		0	0%
	Not at all prepared		0	0%
	Not Applicable	NA	0	0%
Understand and effectively communicate the realistic constraints of civil engineering	Highly prepared		11	31%
	Prepared		19	54%
	Somewhat prepared		5	14%
	Not at all prepared		0	0%
	Not Applicable	NA	0	0%
Be able to perform effectively in a multi-disciplinary environment	Highly prepared		8	23%
	Prepared		22	63%
	Somewhat prepared		5	14%
	Not at all prepared		0	0%
	Not Applicable	NA	0	0%



Appendix C
Indirect Assessments (Survey Results) of Program Outcomes

Table C-1. Survey Results for Outcome (a)-Fundamentals

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	16	73%
	Prepared	6	27%
	Somewhat prepared	0	0%
	Not at all prepared	0	0%
Alumni	Highly prepared	60	57%
	Prepared	45	42%
	Somewhat prepared	1	1%
	Not at all prepared	0	0%
Employers	Highly prepared	8	24%
	Prepared	24	71%
	Somewhat prepared	2	6%
	Not at all prepared	0	0%

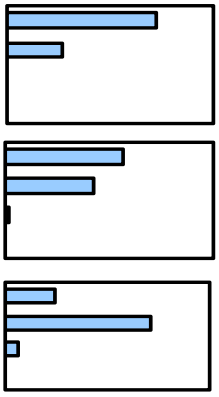


Table C-2. Survey Results for Outcome (b)-Experimentation

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	9	41%
	Prepared	12	55%
	Somewhat prepared	1	5%
	Not at all prepared	0	0%
Alumni	Highly prepared	40	38%
	Prepared	53	50%
	Somewhat prepared	13	12%
	Not at all prepared	0	0%
Employers	Highly prepared	6	18%
	Prepared	20	59%
	Somewhat prepared	8	24%
	Not at all prepared	0	0%

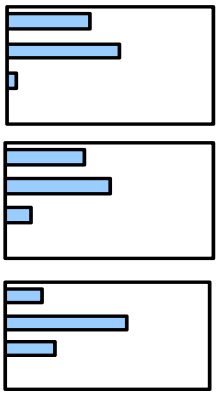


Table C-3. Survey Results for Outcome (c)-Design

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	5	23%
	Prepared	15	68%
	Somewhat prepared	2	9%
	Not at all prepared	0	0%
Alumni	Highly prepared	47	44%
	Prepared	46	43%
	Somewhat prepared	13	12%
	Not at all prepared	0	0%
Employers	Highly prepared	8	24%
	Prepared	23	70%
	Somewhat prepared	2	6%
	Not at all prepared	0	0%

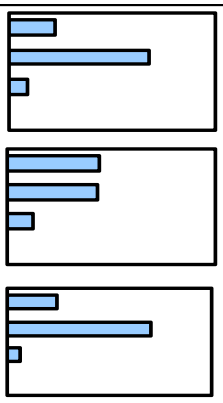


Table C-4. Survey Results for Outcome (d)-Teamwork

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	5	23%
	Prepared	5	23%
	Somewhat prepared	10	45%
	Not at all prepared	2	9%
Alumni	Highly prepared	59	56%
	Prepared	40	38%
	Somewhat prepared	7	7%
	Not at all prepared	0	0%
Employers	Highly prepared	13	38%
	Prepared	20	59%
	Somewhat prepared	1	3%
	Not at all prepared	0	0%

Table C-5. Survey Results for Outcome (e)-Problem Solving

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	13	59%
	Prepared	7	32%
	Somewhat prepared	2	9%
	Not at all prepared	0	0%
Alumni	Highly prepared	66	62%
	Prepared	38	36%
	Somewhat prepared	2	2%
	Not at all prepared	0	0%
Employers	Highly prepared	10	29%
	Prepared	20	59%
	Somewhat prepared	4	12%
	Not at all prepared	0	0%

Table C-6. Survey Results for Outcome (f)-Professionalism

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	13	59%
	Prepared	4	18%
	Somewhat prepared	5	23%
	Not at all prepared	0	0%
Alumni	Highly prepared	61	58%
	Prepared	40	38%
	Somewhat prepared	5	5%
	Not at all prepared	0	0%
Employers	Highly prepared	15	44%
	Prepared	15	44%
	Somewhat prepared	4	12%
	Not at all prepared	0	0%

Table C-7. Survey Results for Outcome (g)-Communication

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	5	23%
	Prepared	10	45%
	Somewhat prepared	6	27%
	Not at all prepared	1	5%
Alumni	Highly prepared	49	46%
	Prepared	42	40%
	Somewhat prepared	15	14%
	Not at all prepared	0	0%
Employers	Highly prepared	12	35%
	Prepared	19	56%
	Somewhat prepared	3	9%
	Not at all prepared	0	0%

Table C-8. Survey Results for Outcome (h)-Broad Education

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	8	36%
	Prepared	8	36%
	Somewhat prepared	5	23%
	Not at all prepared	1	5%
Alumni	Highly prepared	37	35%
	Prepared	49	46%
	Somewhat prepared	20	19%
	Not at all prepared	0	0%
Employers	Highly prepared	5	15%
	Prepared	22	67%
	Somewhat prepared	6	18%
	Not at all prepared	0	0%

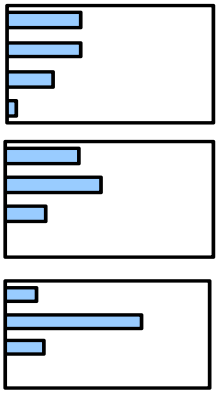


Table C-9. Survey Results for Outcome (i)-Life-Long Learning

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	8	36%
	Prepared	8	36%
	Somewhat prepared	6	27%
	Not at all prepared	0	0%
Alumni	Highly prepared	49	46%
	Prepared	48	45%
	Somewhat prepared	8	8%
	Not at all prepared	1	1%
Employers	Highly prepared	8	24%
	Prepared	23	68%
	Somewhat prepared	3	9%
	Not at all prepared	0	0%

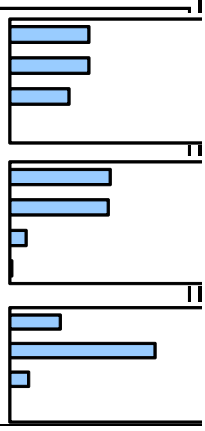


Table C-10. Survey Results for Outcome (j)-Contemporary Issues

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	3	14%
	Prepared	8	36%
	Somewhat prepared	7	32%
	Not at all prepared	4	18%
Alumni	Highly prepared	28	26%
	Prepared	59	56%
	Somewhat prepared	17	16%
	Not at all prepared	2	2%
Employers	Highly prepared	4	12%
	Prepared	22	67%
	Somewhat prepared	7	21%
	Not at all prepared	0	0%

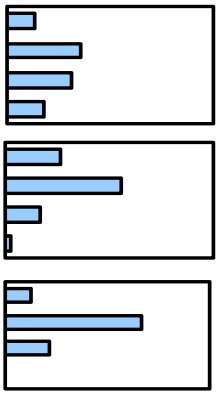


Table C-11. Survey Results for Outcome (k)-Tools and Techniques

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	7	32%
	Prepared	8	36%
	Somewhat prepared	7	32%
	Not at all prepared	0	0%
Alumni	Highly prepared	51	48%
	Prepared	47	44%
	Somewhat prepared	8	8%
	Not at all prepared	0	0%
Employers	Highly prepared	11	33%
	Prepared	18	55%
	Somewhat prepared	4	12%
	Not at all prepared	0	0%

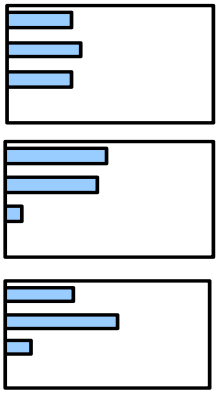


Table C-12. Survey Results for Outcome (l)-Leadership

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	2	9%
	Prepared	7	32%
	Somewhat prepared	10	45%
	Not at all prepared	3	14%
Alumni	Highly prepared	33	31%
	Prepared	46	43%
	Somewhat prepared	25	24%
	Not at all prepared	2	2%
Employers	Highly prepared	3	9%
	Prepared	19	58%
	Somewhat prepared	10	30%
	Not at all prepared	1	3%

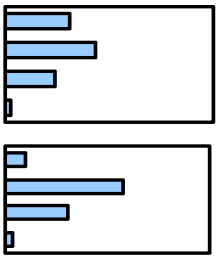


Table C-13. Survey Results for Outcome (m)-Practicality

Survey Group	Degree of Preparation	Count	Percent
Graduates	Highly prepared	6	27%
	Prepared	9	41%
	Somewhat prepared	6	27%
	Not at all prepared	1	5%
Alumni	Highly prepared	62	58%
	Prepared	38	36%
	Somewhat prepared	6	6%
	Not at all prepared	0	0%
Employers	Highly prepared	11	33%
	Prepared	18	55%
	Somewhat prepared	4	12%
	Not at all prepared	0	0%