Civil and Environmental Engineering

Prepared by Gregory G. Wilber

Degree Program(s) Assessed	Assessment Methods	Number of Individuals Assessed
BS - Civil Engineering	Exit Interviews	29
	Fundamentals of Engineering Exam	24
	Board of Visitors	*
	Student Advisory Committee	8
	Faculty and Professional Evaluations	26
	ABET Evaluation	§
MS - Civil Engineering	Exit Interviews	23
	Theses/Report Defense (Committee Evaluation	23
	Board of Visitors	*
MS - Environmental Engineering	Exit Interviews	7
	Theses/Report Defense (Committee Evaluation)	7
	Board of Visitors	*
PhD - Civil and Environmental Engineering	Exit Interviews	0
	Theses/Report Defense (Committee Evaluation)	0

* The Board of Visitors evaluates program components (curriculum, students, faculty, facilities, etc.) While they do speak to individual students, they do not formally assess specific individuals.

§ The visiting team from the Accrediting Board for Engineering and Technology did not evaluate individual student achievements. However, they provided a very thorough review of our School's Self Study and met with many students and faculty. In doing so, they identified program strengths and weaknesses. As such, this periodic external review is another valuable assessment for our undergraduate program.

Summary of Assessment Process

A variety of assessment tools are in use by the School of Civil and Environmental Engineering, for the purpose of monitoring and improving the program. The School also uses these tools as part of the assessment process required for maintaining accreditation by the Accrediting Board for Engineering and Technology. For example, Table 1 below displays the primary ABET educational outcomes for the Bachelor of Science in Civil Engineering degree, along with the various assessment tools used to assess our achievement of these outcomes. The assessment tools are also used as the primary input to program improvement. Note that not all assessment tools are used every year. Some are on a two- or three-year cycle.

Table 1. Matrix of Outcomes Assessment Measures for the School of Civil and Environmental Engineering

	Surveys					External			Capstone Course		Course Level Assessment					
Program Outcome	Graduation Exit Interviews	Employer Survey	OUA Graduate Survey	Board of Visitors	Faculty Input	Fundamentals of Engineering	FE Exam Computers/Num. Methods	FE Exam Ethics Section	Capstone Course Grade	Capstone Course Evaluations	Laboratory Course GPA	Professional School GPA	Pre-Engineering GPA	STAT 4910 grade	Humanities/Social Science GPA	ENGL and SPCH GPA
a) Knowledge of math, science and engineering		x				x						x	x			
b) Design/conduct experiments, analyze/interpret data		x									x			x		
c) Design to meet desired needs	x	x	x	x					x	x		x				
d) Multi-discliplinary teams	x	x	x	x	x					x						
e) Engineering problem solving	x	x	x						x	x		x				
f) Professionalism and ethics		x	x					x		x						
g) Effective communication	x	x	x		x				x	x	x					x
h) Broad education/global and societal context	x	x	x												x	
i) Life-long learning	x	x	x							x						
j) Contemporary issues	x	x	x						x	x						
k) Modern engineering tools	x	x					x		x	x	x	x				

Analysis and Findings

ABET Evaluation: The most significant exercise in assessment of our undergraduate program this academic year was the visit by the accrediting team from ABET in the Fall of 2003. Preparation for this evaluation visit required a thorough analysis of our assessment activities for the past few years. The draft of the program evaluation issued by the team listed as strengths of our program the dedicated and well-qualified faculty, the strong design component of the curriculum, the breadth of the program (incorporating six areas of specialization in the undergraduate curriculum), and the quality of student/faculty interaction. The report cited one weakness, the lack of two distinct civil engineering laboratory experiences in the undergraduate

curriculum (for those students not in the environmental emphasis area). The report also cites three areas of concern. The first two address the fact that the faculty has only one member each specializing in two of the areas covered by the curriculum (construction management and geotechnical engineering). This may make it difficult to always deliver all six areas in the undergraduate courses and may make the program too dependent on one individual. Lastly, while plans for improving the laboratory facilities are underway, the current situation is still not ideal. The final report from the ABET evaluation is not expected until the middle of the summer. How the School is using the results of the report for program improvement is described below.

Exit Interviews: Graduating seniors are given a survey and interviewed, in an attempt to learn their opinions on the program. Questions aimed at determining if the students felt they had achieved the program objectives and outcomes are included. In the previous academic year, students expressed a high level of satisfaction with the program. Their responses indicated that they felt well prepared for their entry-level positions. Furthermore, with few exceptions, in their own self-assessments they felt they had achieved all of the key educational objectives and outcomes specified by the program.

Fundamentals of Engineering Exam: This is a national, standardized exam administered twice each year. It is the first step to professional registration and passing it is necessary for most entry-level jobs in civil and environmental engineering. All CIVE students are encouraged to take the exam, and approximately 80% of all CIVE graduates have done so before graduation. The vast majority of those students who do not take it are international students who plan to return to their home countries. Data detailing the performance of CIVE students on the exam are made available to the Associate Dean of Engineering each semester. These data do not give results for individual students but rather composite scores for groups of students, categorized according to the discipline listed on their application. All examinees take the same morning 'general' exam. Students then have a choice of taking either another 'general' exam in the afternoon, or a discipline specific afternoon exam. The vast majority of CIVE students elect to take the 'civil engineering' afternoon section. Results are sent to the Dean's office categorized by the specific exam taken by a given group of examinees. A detailed statistical analysis of these results is prepared twice each year by an assessment specialist in the College of Engineering, Architecture, and Technology.

Results for the Spring 2004 examinees were not yet available. However, results from the Fall 2003 group showed significant improvement from the previous year. In that group, 12 of the 13 CIVE students who took the test passed. This 92% passing rate was an improvement over the previous three semesters. Furthermore, this group performed significantly better than the national averages in three areas: electrical circuits, thermodynamics, and structural analysis. They performed significantly below the national average in only one area, the mathematics section of the morning (general) exam. This deficiency has been consistent for years and, due to the nature of the exam, is not considered by the faculty or the School's Board of Visitors to be a major concern. In previous years, our students have generally performed significantly below the national average on the 'computational and numerical methods' section of the afternoon exam, but the Fall 2003 group was just slightly above the national average. Lastly, the students performed at the national average on the 'engineering ethics' section, indicating achievement of the professionalism and ethics educational outcome.

In summary, these FE results indicate that the changes made to the curriculum to improve spreadsheeting skills like those tested in the 'computational and numerical methods' section, as well as the efforts by faculty to better inform students about proper timing and preparation for the exam have been successful. Continued monitoring is called for, and these efforts will continue into the coming year.

Board of Visitors: The Board of Visitors, which consists of eight civil and environmental engineering professionals, many of whom are alumni of our programs and/or employers of our graduates, met once this past year. They met with faculty, students, and administrators and reviewed curricula, programs, and departmental resources. In general, they expressed a high level of satisfaction with the program and the direction it is moving. In particular, they are enthusiastic about the capital campaign underway that will eventually lead to great improvements in the department's labs. They again expressed concern about the enrollment in the program. They encouraged the department to maintain the curriculum as it is, covering a broad range of CIVE topic areas and not allowing excessive specialization. They supported the addition to the curriculum of the engineering materials lab course (described below) and also urged the Dean of CEAT to authorize the hiring of at least one new faculty member in both construction and geotechnical engineering.

Student Advisory Committee: This committee consists of eight student leaders who represent student concerns to the departmental leadership. They meet with the department head periodically. In general, this group expresses satisfaction with the program. Concerns that do arise routinely include the sub-standard educational technology in Engineering South classrooms and the sub-standard lab facilities for the department.

Faculty and Professional Evaluations: Each student takes at least one "capstone" design course. This generally occurs in the student's final year. In these courses, group design projects are completed, the products of which (reports, design work, and presentations) are presented to faculty (in addition to the course instructor) and to participating professionals. These individuals evaluate these products and present the evaluation to the students and course instructor. In all cases available for review, the practitioners reported satisfaction with the work performed. They offered suggestions for the improving the projects themselves but felt the curriculum had prepared the students adequately for the work. In addition, the faculty members who teach these courses are surveyed with respect to the extent to which the students in their course exhibited achievement of the program educational outcomes. Overall, faculty expressed significant concern regarding only one outcome, that dealing with written and oral communication. For those students who performed least well in the class, written and oral communication skills did not always meet the faculty members' standards. Achievement of all other outcomes, even by the lowest achieving students, was reported.

Graduate Theses Defenses: The examination committee for each graduate degree candidate assesses the candidate's academic record as well as the product of his/her graduate research (creative component report, thesis or dissertation). As required, the examining committee found all students who passed this examination satisfactory.

Uses of Assessment Results

The following program changes have been implemented as a result of the various assessment results.

Permanent Addition of CIVE 3623 - Engineering Materials Lab: In response to both student demand, discussions with alumni and employers, and results of the ABET evaluation, CIVE 3623 - Engineering Materials Laboratory was added to the curriculum. It was previously available as an elective, but it has now been added in place of ENSC 3313 – Materials Science. The course addresses basic construction materials including Portland cement concrete, asphalt concrete, aggregates, metals and composite materials. It also includes behavioral characteristics, use and quality control of these materials, as well as basic statistical procedures used for material specifications. Laboratory sessions will provide "hands on" experience in performing standard tests. This change to the curriculum will easily satisfy the weakness cited by the ABET evaluation team.

Curriculum Review: A review of the CIVE curriculum is currently underway. Results of this and other recent years' assessments will be incorporated, as well as input from the Board of Visitors, Student Advisory Board, and faculty. For example, the remaining weakness in some students' oral and written communications skills, cited above, will have to be addressed. No results are available at this time, but it is anticipated that by this time next year, a thorough evaluation of the curriculum will have been made.

Non-Curricular Improvements: One of this previous academic year's non-curricular areas of focus was on the student chapter of the American Society of Civil Engineers. This organization functions as the primary undergraduate student organization for the department and, as such, also serves as a key resource for disseminating information to the students. Several steps were taken to improve the effectiveness of this organization. A survey of CIVE students performed last spring indicated that the monthly Thursday at 7:30pm meeting was not ideal for many students. In addition, it was determined that students also were interested in more social activities in addition to the monthly professional meeting. Based on these survey results, beginning in the Fall 2003, ASCE meetings were moved to the second and fourth Tuesday of each month at 7:00pm. One meeting per month was a traditional professional meeting, with a guest speaker discussing a project or some other aspect of their profession. The other meeting was a more social event, such as a pizza party, a field trip, or a bowling tournament. An effort was also made to ensure that the professional meetings were all of high quality, with a high level of student engagement. This was achieved primarily by being very selective about invited speakers. An informal survey of active ASCE participants found a high level of satisfaction with this year's speakers.

After one year of these changes, it appears that the level of participation by CIVE students in ASCE has definitely increased, though not by as much as hoped. An additional study was conducted in late Spring 2004 to determine how well students felt informed about ASCE activities. The results of this study indicated that many sophomore and junior level students are not always reached by the standard means of publicizing ASCE activities. As such, plans are underway for Fall 2004 to try new avenues of promoting awareness among that group of CIVE students, with the aim of increasing ASCE participation (measured in terms of the percent of all CIVE students who routinely attend ASCE functions) by at least 20%.