

AC 2010-1729: ASSESSING PROGRAM EDUCATIONAL OBJECTIVES USING A WEB-BASED ALUMNI SURVEY SYSTEM

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Assessing Program Educational Objectives Using a Web-Based Alumni Survey System

Abstract

ABET's *Criteria for Accrediting Engineering Programs for 2009-2010* defines Program Educational Objectives (PEOs) as "broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve." The criteria further states that "each program for which an institution seeks accreditation or reaccreditation must have in place an assessment and evaluation process that periodically documents and demonstrates the degree to which these objectives are attained."¹ For EAC-ABET visits in 2007-2008, 36.7% of the engineering programs visited received a PEO related weakness at the conclusion of the visit.²

In 2001, the Civil Engineering Program at the University of Evansville began surveying alumni electronically using a web-based system. Surveys were conducted bi-annually from 2001-2009, and response rates ranged from 67% to 78%. Survey questions were developed to assess the program's educational objectives (PEO) as required by EAC-ABET. The alumni survey provided the program with valuable direct assessment data such as the percentage of graduates working in specific civil engineering specialty areas, the percentage of graduates that are members of ASCE, the percentage that are registered professional engineers, and the number that have attended continuing education courses in the past 24 months, obtained a graduate degree, traveled outside the country, and are working for organizations that consider sustainable development in the design of public and private projects.

The bi-annual alumni survey is administered by the faculty and staff in the program and conducted over a 60 day period during February and March of odd numbered years. The electronic survey is targeted to alumni within 1 to 10 years of graduation and a link to the web-based survey is sent via electronic mail. At the conclusion of the survey period, the data is assembled anonymously, tabulated, statistically analyzed, and shared with the Civil Engineering Advisory Council (CEAC), a body that includes all four of the program's constituencies. The CEAC evaluates the data and provides input to the civil engineering faculty. The alumni survey results have been used to assess the program's PEOs and to drive curricular change, influence budget expenditures, and guide the content of senior design projects.

Introduction

One of the major challenges facing EAC-ABET accredited engineering programs is the assessment of program educational objectives (PEOs). PEOs are defined as "broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve."¹ Institutional representatives attending the July 2009 Engineering Accreditation Commission (EAC-ABET) meeting were presented with statistics from the 2007-2008 visits showing that Criterion 2 shortcomings were cited more than any other criterion.² At the end of the 2007 EAC-ABET campus visits, 192 of 469 programs were cited as having Criterion 2 weaknesses. After the due process period, the number was reduced to 92, but

Criterion 2 shortcomings were still more common than shortcomings in any of the other eight EAC-ABET criterion. This has been a trend for several years.

In a published report card on the status of institutional and program assessment, the development of PEOs was given a grade of B+, but assessment of PEOs was given a grade of D.³ Clearly, institutions are doing a better job of defining their PEOs than they are assessing them. The EAC-ABET Criterion 2 includes requirements for developing PEOs and an assessment process that documents and demonstrates the extent to which the PEOs are met.²

Assessing PEOs requires institutions to gather data about their graduates rather than their students. Access to graduates is not easily available, and there is difficulty in obtaining both direct and indirect assessment data from them. ABET defines direct and indirect methods as follows.

A direct method is one that is based on the direct observation or examination of student performance. This method could be testing, observation, review of student work, etc. Indirect methods can be used to supplement direct methods. Indirect methods are those that are opinion or self-report and ascertain the perceived degree of knowledge or skill related to an outcome. The most common indirect method is a survey or questionnaire that asks students to report on their own knowledge or skill.⁴

Alumni surveys can be difficult to implement and the resulting data are challenging to interpret.⁵ Too often alumni surveys are limited to obtaining indirect survey data with questions that begin, “Do you believe,” “How do you feel,” or “In your opinion.” Indirect methods that use responses to survey questions are useful but frequently are insufficient to show that PEOs are being met. Direct assessment methods provide institutions with quantitative, qualitative, and demographic data that can be used to effect change. Thus, the question facing many institutions is, “what assessment instruments and methodology can be used to demonstrate to EAC-ABET that the Criterion 2 requirements are being met?”

This paper will provide a case study of the use of a web-based survey system at the University of Evansville. The paper describes the assessment infrastructure in the civil engineering program and successes experienced in using the data gathered to assess the program PEOs.

University of Evansville’s Civil Engineering Program Educational Objectives (PEOs)

The University of Evansville (UE) is a liberal arts university located in southwestern Indiana. The full time enrollment is 2707 students.⁶ UE is committed to the liberal arts and sciences as a basis for intellectual and personal growth. It endeavors to prepare women and men for lives of personal and professional service and leadership. It emphasizes undergraduate education and supports an array of liberal arts and sciences and professional programs.⁷ UE is aware of the challenges of living in an international community and therefore adopts a global view in its programs and its vision. The University owns Harlaxton College in Grantham, England, and many of its students spend a semester studying abroad.

Civil engineering (CE) is one of four EAC-ABET accredited programs at UE. There are currently 60 civil engineering majors and the average number of graduates during the period 2006-2009 was 13.⁶

PEOs for the civil engineering program were developed by the faculty in 1997. They were modified in 2002 and 2009, based on input from the Civil Engineering Advisory Council (CEAC) and EAC-ABET teams. The CEAC was formed in 2002 and represents all four constituencies: students, alumni, employers, and faculty.

The 2010 PEOs are listed in Table 1. The faculty and the CEAC review the program objectives on an annual basis. Because educational objectives apply to recent graduates, alumni survey data have been the primary component of the assessment process. Alumni surveys have been conducted every two years since 2001 and the results are used to assess and review the PEOs.

Table 1. UE Civil Engineering Program Education Objectives

Civil Engineering Program Educational Objectives (PEO)	
“Graduates” are defined as civil engineering alumni within 3-5 years of graduation	
Objective 1:	Graduates will be actively engaged in a professional career as a civil engineer or pursuing advanced study.
Objective 2:	Graduates will understand professional practice issues and demonstrate a commitment to professional licensure and continuing education.
Objective 3:	Graduates, guided by the principles of sustainable development and global interconnectedness, will understand how civil engineering projects affect society and the environment.

Web-based Alumni Surveys

Paper-based alumni surveys were conducted by the University of Evansville alumni office prior to 2001, but the number of responses was typically less than ten percent (< 10%). The low number of responses did not provide a sufficient amount of data for the program to assess the PEOs. Because the PEOs apply to graduates in their first few years after graduation, it became apparent to the faculty that the university was attempting to use outdated paper surveys for individuals who were accustomed to using the internet to stay connected to their families, their peers, and their business colleagues. This is typical for members of Generation X and Generation Y.⁸

Confronted with an impending EAC-ABET visit, the civil engineering program faculty embarked on a project to develop a web-based alumni survey in January 2001. During meetings, the faculty decided that individual e-mail messages would be sent to each graduating class, beginning with the 1996 class, the first year the program was accredited by EAC-ABET. The e-mail messages were personalized, first names were used in the salutation, and messages were signed by a faculty member who knew all of the graduates from that class. The message included a brief update on activities in the program and concluded with a link to a web page containing an alumni survey that could be completed in less than ten minutes. The first

electronic survey was conducted in February 2001. By the end of the 60-day survey period, the response rate was 71% (30 of 42).

Beginning with the 2001 graduating class, seniors were encouraged to maintain contact with the civil engineering program after graduation. Because their UE email address expired shortly after graduation, graduates were asked to provide faculty members with either their business e-mail address or a personal email address.

The alumni survey is conducted using a website developed by the civil engineering program. Results are assembled in EXCEL and tabulated by the department administrative assistant. Data is reported anonymously, but responses are monitored to ensure that each graduate responds only once to the survey.

Prior to each alumni survey, questions are reviewed by the CEAC and the survey web page is updated. The most recent bi-annual civil engineering alumni survey was conducted in March, 2009. An email message containing a web link was sent to 118 alumni in early March. A total of 78 civil engineering alumni responded to the web-based survey during the 60-day survey period. Accounting for e-mail addresses that were found to be invalid (13 or 11%), the final response rate was 74% (78 of 105).

Bi-annual alumni surveys were conducted in 2003, 2005, 2007, and 2009. During this period, the alumni survey response rate was consistently over 65%. The alumni survey has provided the program with both direct and indirect assessment data to assess the PEOs and Direct Data to characterize the alumni. Some of the survey questions request alumni to provide comments. During the 2007 and 2009 surveys, a majority of alumni responding to the survey submitted written comments pertaining to the PEOs, the civil engineering curriculum, the program's website, program activities, and career accomplishments.

Multiple Measures

Performance measures (PM) were established for the three civil engineering PEOs in 2001 after the first alumni survey was conducted. The performance measures included quantifiable benchmarks that could be assessed using alumni survey data. The benchmarks were established by the civil engineering faculty in consultation with the CEAC. The 50% benchmark for all performance measures was selected to ensure that a majority of graduates met the criteria, except for the measure related to graduate study.

Direct Data are not linked to performance measures, yet they provide valuable information for the program. Performance Measures have benchmarks associated with them; Direct Data do not.

The first PEO describes employment and academic conditions for graduates within the first few years after graduation. To assess the PEO, data is required to determine if graduates are working as a civil engineer or pursuing a graduate degree full time. In some cases, they are doing both. In other cases, civil engineering graduates are pursuing careers in other disciplines. Four performance measures were developed for the first PEO.

- PM 1-1. [50% or more](#) of CE graduates will respond “agree or strongly agree” to the statement “The civil engineering courses I took at UE adequately prepared me for my current job”
- PM 1-2. [50% or more](#) of CE graduates will respond “agree or strongly agree” to the statement, “the design projects that I worked on as a civil engineering student at UE prepared me to work on multidisciplinary teams”
- PM 1-3. [50% or more](#) of CE graduates are working in a professional career position as a civil engineer
- PM 1-4. [10% or more](#) of CE graduates will respond that they have enrolled in graduate school or have completed a graduate degree.

The first two performance measures were assessed using indirect assessment data from the alumni survey. The survey questions were developed to account for graduates who were working in careers outside of civil engineering and to determine how graduates value the design experiences they had as undergraduates. A five-point Likert scale accompanied the survey questions with five possible responses: strongly agree, agree, neutral, disagree, and strongly disagree.

To assess the third and fourth performance measures, direct assessment data was used. Graduates were asked to list their primary civil engineering discipline area and their primary employer. The goal was to determine the percentage of graduates working in the civil engineering profession and their type of employment (federal, state and local government, private consulting firms, design-build firms, contractors, utility companies, non-profits, and positions outside of engineering). Responses to a fourth question provided the program with the number of alumni who were currently taking graduate courses or had obtained a graduate degree.

The second PEO focuses on the practice of civil engineering. It states that graduates will understand professional practice issues and demonstrate a commitment to becoming registered professional engineers and continuing their education. Six performance measures were developed for the second PEO. The first three are indirect measures and the last three are direct measures of a graduate’s performance.

- PM 2-1. [50% or more](#) of CE graduates will respond “agree or strongly agree” to the statement, “When compared to my colleagues, my immediate supervisor generally believes that I have good communication skills.”
- PM 2-2. [50% or more](#) of CE graduates will respond “agree or strongly agree” to the statement, “My engineering education at UE prepared me for the ethical situations I have encountered in my career as an engineer”
- PM 2-3. [50% or more](#) of CE graduates will respond “agree or strongly agree” to the statement “I stay abreast of current issues in civil engineering by reading professional publications on a monthly basis.”
- PM 2-4. [50% or more](#) of CE graduates will respond that they have active memberships in ASCE.
- PM 2-5. [50% or more](#) of CE graduates will answer in the affirmative to the statement “I have participated in short courses, workshops or conferences during the past year.”
- PM 2-6. [50% or more](#) of CE graduates eligible to take the professional engineers exam will respond that they have passed the exam.

The first performance measure applies to graduates regardless of whether they are working as a civil engineer or working in another field. The purpose of this performance measure is to determine if a majority of civil engineering alumni perceive that their writing skills are adequate to perform in their present position. The second and third performance measures apply to graduates working as engineers and were developed to assess professional ethics and how graduates keep up with current events in civil engineering. The last three performance measures were established to provide a direct measure of a graduate's commitment to professional practice issues. Membership in the American Society of Civil Engineers (ASCE), participation in continuing education, and taking and passing the professional engineer's exam were viewed as evidence of this commitment.

The third PEO focuses on the graduate's understanding of how civil engineering projects affect society and the environment. Terms such as "sustainable development" and "global interconnectedness" were added in 2008 to link the PEOs to the objectives in the new ASCE Civil Engineering Body of Knowledge for the 21st Century.⁹ Six performance measures were developed to assess the third PEO. All six are indirect measures, tied to questions on the alumni survey.

- PM 3-1. 50% or more of CE graduates will respond "agree or strongly agree" to the statement, "The company I work for considers 'sustainable development' in the design of public and private projects."
- PM 3-2. 50% or more of CE graduates will respond "agree or strongly agree" to the statement, "My UE experience prepared me to work with other cultures."
- PM 3-3. 50% or more of CE graduates will respond "agree or strongly agree" to the statement, "When I compare the liberal arts education I received at UE with the education that my colleagues received, I believe the liberal arts education provided me with distinct advantages."
- PM 3-4. 50% or more of CE graduates will respond "agree or strongly agree" to the statement, "My engineering and analysis work has been influenced by public comments over the past two years."
- PM 3-5. 50% or more of CE graduates will respond "agree or strongly agree" to the statement, "The company (agency) I work for considers 'green design' as an important component of a project."
- PM 3-6. 50% or more of CE graduates will respond "agree or strongly agree" to the statement, "I have made a presentation or comments at a public hearing in the past two years"

All six performance measures seek to determine the graduate's experience with sustainable development, the interaction between projects and the environment, and their interaction with the public.

Evaluation of the sixteen performance measures is the primary means of assessing the three PEOs. Direct Data from four other alumni survey questions are used in the assessment process. Alumni are asked to list codes that they use in design, categorize their employer, list design software they use, and state whether they have traveled outside the United States (other than Mexico, the Caribbean, and Canada) over the past two years for business or pleasure. A historical comparison of the data allows the faculty and the CEAC to track trends, obtain a profile of recent graduates, and periodically evaluate the civil engineering design courses.

Alumni Survey Results

EAC-ABET requires engineering programs to have an assessment and evaluation process that periodically documents and demonstrates the degree to which the PEOs are met.² This requires the collection and analysis of assessment data, frequent reviews, and updates. Alumni survey data for the time period 2001-2009 are summarized in Table 2. This data is used to assess the PEOs.

Table 2. Alumni Survey Results for UE Civil Engineering Graduates

PEO 1	Alumni Survey Years					
Performance Measure	Assessment Standard	2001 N=30	2003 N=47	2005 N=42	2007 N=73	2009 N=78
PM1-1 CE courses	≥ 50%	87%	92%	90%	92%	90%
PM1-2_Design projects	≥ 50%	93%	85%	82%	86%	84%
PM1-3 Prof CE position	≥ 50%	97%	98%	96%	94%	97%
PM1-4 Graduate School	≥ 10%	30%	23%	31%	16%	25%
PEO 2						
PM2-1 Communication skills	≥ 50%		75%	69%	87%	88%
PM2-2 Ethics education	≥ 50%	97%	96%	98%	94%	87%
PM2-3 Read professional pubs	≥ 50%	87%	47%	52%	53%	55%
PM2-4 Membership ASCE	≥ 50%	63%	49%	55%	41%	47%
PM2-5 Continuing education	≥ 50%	80%	75%	71%	74%	65%
PM2-6 PE exam	≥ 50%			68%	66%	78%
PEO 3						
PM3-1 Sustainable Develop	≥ 50%	70%		64%	69%	72%
PM3-2 Work with other cultures	≥ 50%		70%	67%	69%	75%
PM3-3 Liberal arts education	≥ 50%	57%	57%	71%	91%	
PM3-4 Public comments	≥ 50%					53%
PM3-5 Green design	≥ 50%					54%
PM3-6 Public hearings	≥ 50%					53%

The alumni survey results in Table 2 seem to indicate that all Performance Measures are being met, with the exception of PM2-4, membership in ASCE. However, it is in the Direct Performance Measure questions and the Direct Data questions that a more complex picture of civil engineering alumni emerges, shedding some light on the question of professional membership

Since 2003, data has been collected to determine the civil engineering area in which graduates are primarily engaged. Most UE civil engineering graduates work for companies, agencies, and organizations that are involved in transportation engineering, construction engineering, or water resources engineering. These results have affected course offerings, faculty hires, and the selection of senior design projects.

The primary civil engineering specialty results are summarized in Table 3.

Table 3. Primary Civil Engineering Specialties of UE Civil Engineering Graduates

Civil Engineering Specialty Area	Alumni Survey Year				
	2001 N=30	2003 N=47	2005 N=42	2007 N=73	2009 N=78
Structural Engineering	7%	15%	2%	6%	5%
Geotechnical Engineering	9%	6%	2%	0%	3%
Construction Engineering	14%	19%	24%	21%	19%
Water Resources Engineering	28%	24%	21%	26%	22%
Transportation Engineering	16%	26%	33%	20%	33%
Environmental Engineering	13%	2%	2%	7%	3%
Surveying and Site Development	13%	6%	7%	9%	8%
Construction Materials	0%	0%	5%	3%	4%
Other than civil engineering	0%	2%	4%	6%	3%

The ASCE membership results have been surprising. The data has not consistently met the performance standard of 50% alumni membership in ASCE. During the period 1996-2009, the ASCE student chapter at UE won national awards and had very active membership among civil engineering students. However, forty one (41) of the 78 respondents to the 2009 alumni survey were not members of ASCE. For the 2009 survey, alumni were asked if they belonged to other professional organizations. Thirty (30) percent of the alumni who are not members of ASCE are members of other professional organizations such as AWWA, SWE, AISC, ACI, and ACEC.

Figure 1 summarizes the ASCE membership of civil engineering graduates.

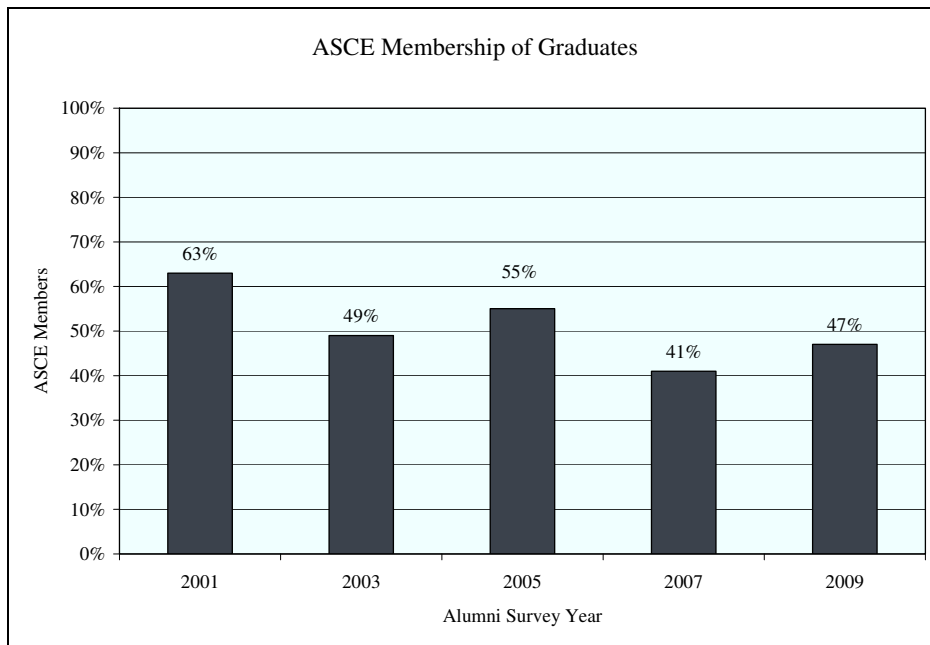


Figure 1. ASCE Membership of UE Civil Engineering Graduates

Over the past ten years, all civil engineering faculty members at UE have been ASCE members and have attended student chapter meetings. The faculty members share with students the

benefits of ASCE membership (both personal and professional). The development of lab spaces for concrete canoe and steel bridge are prompted in part by the commitment of the program to encourage students to be active in a professional society. Although the alumni survey data indicates that many graduates do not maintain their ASCE memberships after leaving UE, the majority of graduates are members of either ASCE or another professional organization.

Direct Data regarding design codes, employers, design software, and travel outside the United States have been collected since 2001. The design code data is summarized in Figure 2. This data is used by faculty to select design codes and standards to use in undergraduate civil engineering design courses as well as support expenditures for software contracts in the program. By making sure that students are familiar with codes, standards, and design software at the time of graduation, the program enables graduates to transition quickly to a professional career as a civil engineer.

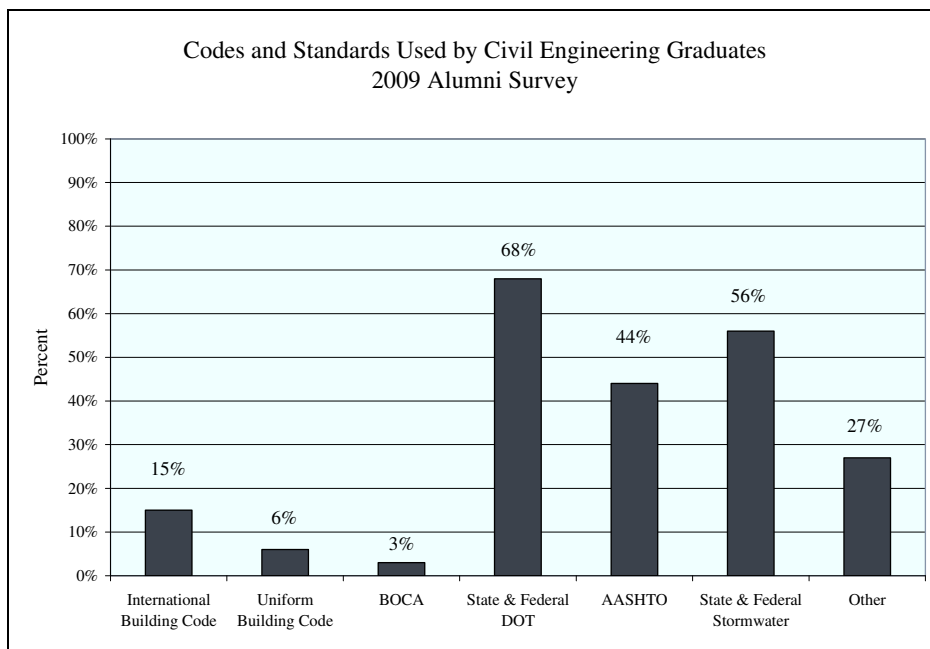


Figure 2. Codes and Standards used by Civil Engineering Graduates-2009 Alumni Survey

In 2009, the University of Evansville ranked ninth in the United States among Master's granting institutions with 58.3% of all undergraduates participating in a study abroad experience.¹ The 2009 alumni survey results revealed that 40% of graduates had traveled outside the United States in the previous two years for either business or pleasure. Travel to Mexico, the Caribbean, and Canada was not included in the percentage because they are convenient vacation destinations. International travel contributes to graduates global minded perspective and helps them understand issues associated with designing civil engineering projects in an interconnected world.

Assessing Program Educational Objectives

The civil engineering program uses a four column assessment report to document and evaluate its ability to meet the three program educational objectives. The faculty and the CEAC review

the program objectives on an annual basis. Because PEOs apply to recent graduates, the bi-annual alumni survey data has been a critical component of the assessment process. The PEO assessment process involves comparing data with performance measure standards, reviewing performance measure standards, assessing PEOs, and determining if changes are needed within the program.

The review procedure is summarized in Figure 3.

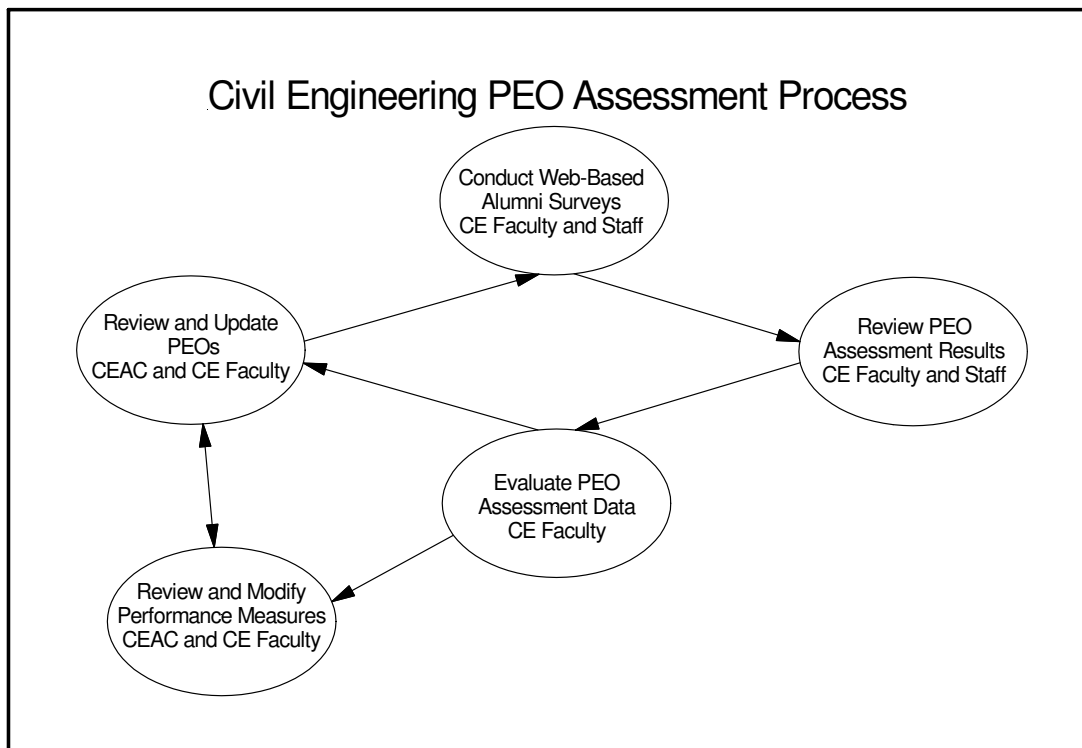


Figure 3. Civil Engineering PEO Assessment Process

Several assessment driven changes have been made to the civil engineering program since the first web-based alumni survey in 2001. These changes include the following.

- An advanced transportation engineering course and an environmental geology course were created and offered to civil engineering students
- Additional laboratory space was obtained for civil engineering student teams to construct a concrete canoe and a steel bridge for the ASCE competitions.
- The writing requirements for civil engineering students were increased in 2005. All civil engineering seniors are required to write a paper for the annual ASCE Daniel Mead paper competition.
- Capstone design teams prepare posters for their project presentations.
- The civil engineering curriculum was modified in 2008 and a science elective was added.
- Co-op and intern opportunities in the area of transportation engineering have increased significantly.
- Codes and standards are an integral part of the senior capstone design project.

Fiscal and policy changes have been made as a direct result of data obtained from the alumni survey. The civil engineering program obtained a dedicated funding source for maintaining licenses for professional engineering design and analysis software, such as those suggested specifically by alumni. Alumni survey responses have consistently indicated that graduates use design software in their jobs. Furthermore, graduates travel outside the United States and work on international projects. In order to provide students with additional international design experiences, in 2008-2009 civil engineering seniors participated in two senior design projects in the Dominican Republic. Members of both design teams spent a week in the Dominican Republic in August 2008 to meet with the client, visit the site, complete an engineering survey of the site, obtain soil samples, and develop a scope of work for the design of a church and a sports complex. Developing a sustainable design solution was an important component of these two projects, and based on both CEAC and alumni survey input, sustainability was included as a component of the 2009-2010 senior design projects.

The civil engineering faculty and the CEAC review all alumni survey data and assessment-driven changes are documented in the CEAC minutes. Civil engineering students are represented on the CEAC. The ASCE student chapter president and the Chi Epsilon president have been members of the CEAC since it was formed in 2002, and many graduates who respond to the alumni survey are former CEAC members who understand the value of providing input that can be used to assess the PEOs.

Conclusion

The civil engineering alumni survey at the University of Evansville is conducted at a website developed by the department. Results are submitted in EXCEL format, tabulated, analyzed, and reported anonymously. During the period 2001-2009, the bi-annual alumni survey response rate was consistently over 65%.

The alumni survey has provided the program with both direct and indirect assessment data that has been used to assess the Program Educational Objectives as required by EAC-ABET. Direct assessment data that has been provided to the civil engineering program includes the primary employers of graduates, the civil engineering specialty areas in which graduates are working, the percentage of graduates that are members of ASCE, the percentage of graduates that have obtained a professional engineer's license, the number of graduates who have obtained advanced degrees, the number of graduates who have traveled outside the United States, and a list of software and design codes that graduates are using in their design work. Alumni survey data have been used to provide the faculty, the CEAC, and the university with valuable information to drive curricular change, influence budget expenditures, and guide the content of senior design projects.

Using a personalized e-mail message and a user-friendly web-based system has resulted in high alumni survey response rates, the acquisition of valuable direct assessment data, an effective PEO assessment process, and a reduction in the amount of time that faculty spend gathering PEO assessment data. This case study provides insight into how EAC-ABET accredited programs can meet the challenges of assessing their PEOs. The use of multiple performance measures, direct and indirect assessment data to assess the PEO's, and Direct Data to characterize the alumni

resulted in an effective assessment process and one that can be implemented by other EAC-ABET programs.

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