

B.4.2 Actions to Improve the Program

Comparisons of the assessment results with the established benchmark show that the Outcomes have been achieved with no major concerns identified, hence no action plan was warranted. However, the regular reviews of various assessments results by the Department ABET advisory committee and an in-depth review by the CEE faculty resulted in several actions to improve upon the program. These are described below.

B.4.2.1 Actions Taken to Improve on Communication Skills

The results of Graduating Senior Surveys, One-Year alumni Surveys, and Six-Year Alumni Surveys revealed a concern with communication skills. The CEE Department therefore took action to improve upon the program in this area. The remedial actions were drawn recognizing that the curriculum, through the required courses, already provides for development of written and oral communication skills. More specifically, all Civil Engineering students are required to take two semesters of English composition, one semester of literature, and an additional semester of speaking/communication. Opportunities to improve written and oral communication skills are also available in various CEE courses requiring laboratory, project, or term paper reports. Additionally, Senior Design Project, CEE 4950, extensively emphasizes personal (teamwork), as well as written and oral communication skills.

The first action taken in order to (1) emphasize the importance of communication skills and (2) strengthen communication skills of the students was the adoption of uniform guidelines for effective written and oral presentations, and for the evaluation of non-technical content of the laboratory or project reports in Fall 2002. The CEE departmental faculty developed the guidelines for effective written and oral presentations (shown in Appendix E.7), which require students to prepare written reports and presentations in a professional manner. The second action was the promotion of utilizing available university resources such as the University Writing Center in Fall 2007. The University Writing Center is hosted by the Department of English and Communications and is open to all students at Tennessee Technological University. Students can take a draft of particular assignments they are working on and get help with their writing. The center is open four to five hours per day on Monday through Thursday.

Additionally, the university has included a three-hour course in English oral presentational communication PC 2500/SPCH 2410 as a required general education course effective Fall Semester 2004. The new addition helps students improve their oral communication skills.

In the meetings with CEE graduating seniors post-implementation of these actions, the students felt that the significance of written and oral communication skills is emphasized throughout the curriculum. Further, the various survey results for Outcome 5 shown in Figures 4.2 and 4.3 also demonstrate that there has been improvement in students' communication skills.

B.4.2.2 Actions Taken on the Knowledge of Contemporary Issues

Although the satisfactory ratings on knowledge of research and contemporary issues are obviously higher than the established benchmark, it was observed that the students and alumni have rated this item relatively lower than the other statements in the survey. Presently, all Civil Engineering students are required to take a minimum of six credit hours in a selected list of social science and behavioral science courses and a minimum of six credit hours on humanity and fine art. There are many seminars and presentations on campus that are open to all students. Students do have opportunities to learn the impact of various societal, professional, and global concerns and

issues. However, it appears that not all students easily make the linkage of the content of these courses and seminars with the terminology “knowledge of contemporary issues in the world”. The general consensus among CEE faculty was that the Department should emphasize the importance of contemporary issues, especially in the engineering profession. During the faculty retreat in August 2007, the faculty decided to address the problem by requiring student attendance at least 1 or 2 seminars in CEE 1020 – Connections to Civil Engineering, CEE 4920 – Professionalism and Ethics, and CEE 4950 - Senior Design. In addition, the faculty suggested changing question #13 on the alumni survey and the senior exit questionnaire to read “contemporary issues in engineering”. Both of these suggestions have been incorporated in the above-mentioned courses starting in the fall 2007 semester as well as the new surveys.

B.4.2.3 Action Taken on the Concepts of Leadership, Management, and Public Policy

To address the recent ABET changes, the faculty voted during the faculty retreat meeting in August 2007 to include a twelfth objective to the CEE departmental Educational Objectives. This objective addressed the issue of ‘broad understanding of fundamental principles and key concepts in engineering management, business, public policy, and leadership’. Implementation of Objective 12 has been accomplished primarily through CEE 4950 (Senior Design Project) and CEE 4920 (Professionalisms and Ethics) by inviting well-qualified speakers to come to campus and give seminars on those topics. In the spring semester of CEE 4950, the invited speakers were: Mr. Phil Wilbourn, a former general manager of Texaco's International Offshore Engineering Department who gave the lectures on Leadership; Mr. Kevin Young, Senior Vice President of J.R. Wauford & Co. who gave the lectures on Management; and Mr. Jay West, former Vice Mayor of Nashville who gave the lecture on Public Policy. In CEE 4920, Mr. Edward Wilson gave a lecture on entrepreneurship on April 14, 2008.

On account of implementing this action, CEE students understand and are able to explain basic concepts in leadership, management, and public policy respectively. Their written submissions on these subjects are included in the display material for CEE 4920 and CEE 4950.

B.4.2.4 Actions Taken on Improving Laboratory Facilities

The results of assessment on quality of course work and effectiveness of the training in various areas are very positive. The overall percentage of favorable responses (percent agree or strongly agree) were significantly higher than the negative responses (percent disagree or strongly disagree), and well above the established benchmark. However, there were a few areas that needed to be addressed to improve upon students' experience. Improving laboratory facilities was one of them.

The upgrade of CEE 3120 (Mechanics of Materials laboratory) began in summer 2006 after necessary funds became available. The improvement included a new tension testing machine, new torsion testing machine, new Instron universal testing machine, new computer software for experiments, a newly manufactured test specimen for stress concentration, and room renovation for lab security. The survey ratings for lab facilities are clearly improved after the lab renovation. A new laboratory named "Cement and Concrete Composites Laboratory" was set up in 2007. The centerpiece of this lab is an Instron 100-kN universal testing machine (UTM) with closed loop controls and assorted accessories including tension grips, 3/4-point flexure fixtures, and extensometers for tensile and flexure testing. This new state of the art laboratory is expected to further enrich and enhance senior level elective classes and help with undergraduate student research experience in the Materials/Transportation area of specialization.

B.4.2.5 Actions Taken on Use of CAD and Other Engineering Software

As noted above, the survey results show that the students were not fully satisfied with use of CAD and engineering software in the curriculum. In response to this concern, the CEE Department has taken steps to increase exposure to AutoCAD in ENGR 1110 (Engineering Graphics) and, to the extent possible, in some CEE design courses. The faculty have continually introduced AutoCAD in selected CEE course homework since the last ABET visit. The measure was reemphasized at the Faculty Retreat in August 2007. Currently, the courses that require homework assignments to be undertaken with AutoCAD are CEE 3110, 3610, 4320, 4350, 4360, 4640, and 4950.

The CEE Department Advisory Board and computer advisory committee were asked to identify the most relevant engineering design software in four areas; namely, structures, structural mechanics, transportation, and environmental engineering. A list was compiled by the Department computer advisory committee and made available to the Department Chairperson for review and purchase as funds become available. To date, the CEE Department, with support from the university and the college of engineering, has purchased AutoCAD, Micro station, GIS, STAAD.Pro, Visual Analysis, RISA 2D, HEC-HMS (Hydrology), HCST, Synchro + SimTraffic, MathCAD, MAPLE, MS Excel, and other application programs used in Civil Engineering practice. Faculty have been actively integrating these software packages into various CEE classes since 2003. The classes that currently require students to use engineering software beyond basic spreadsheet applications are: CEE 3020, 3320, 3610, 4350, 4380, 4440, 4420, 4610, and 4630.

B.4.2.6 Actions Taken on Improving Computer Programming

Another relatively low satisfactory rating was obtained on the quality of the engineering programming course. The Department ABET committee and faculty discussed possible remedial measures in several meetings. During the faculty retreat in August 2007, the faculty decided that the departmental Curriculum Committee should examine the programming course taken in Basic Engineering and submit a report. At the same time, CEE faculty suggested a modification to the syllabus of CEE 3100 (Computers in Civil Engineering) to help address some of the concerns with the existing course in programming. Thus, the modified CEE 3100 (Computers in Civil Engineering) was reincarnated in the spring 2008 semester. It is an elective course that is designed to address the need to improve on student's computer programming skills for the Civil Engineering workplace. The new syllabus imparts an independent 'thinking' ability to students to become more rational users of software (rather than blind users). Students learn to develop algorithms as an important step in the development of analytical skills for independent programming. Each problem topic is revisited using two different tools (a spreadsheet tool and a tool in any programming language) to highlight the merits and demerits of using each tool to solve a typical CEE problem. Also, students are required to turn in a complete project report addressing a design or analysis problem assigned to them. The report itself has to be written appropriately with sections on introduction, algorithm formulation, theory, code implementation, results and discussion.

B.4.2.7 Actions Taken Based on Course Evaluations

As indicated in section B.4.1.6, each semester, CEE courses are surveyed to examine the extent to which the course learning outcomes are attained. At the end of the semester, each instructor submits a document to indicate the findings, the deficiencies, and the plan of action for improving the course when it is taught the next time. Then, before the beginning of each semester, the course instructors evaluate the written document and respond accordingly when preparing the course syllabus. Samples of course evaluations and plans of action for course level outcome assessment are included in the display material that will be available to reviewers during the site visit in fall 2008.

B.4.2.8 Actions Taken Based on Suggestions from Students and CEE Advisory Board

Assessments of the curriculum effectiveness are not limited to the above-mentioned surveys, but also discussed in Department advisory committee meetings, faculty meetings, Department ABET retreats, and meetings and contacts with students. In addition to the analysis of survey results and discussion of remedial actions, concerns brought up by students are discussed in the faculty meetings for action. For example, students expressed concerns about outdated equipment in classrooms and lack of a study space for CEE students only. In consultation with Department Advisory Board and CEE faculty, a fundraising campaign was initiated to generate funds for renovating a new classroom and creating a student study room. As a result of joint efforts of CEE alumni, college of engineering, and the Department, a new 40-seat classroom with state-of-the-art technology was opened for use in the fall 2007 semester. A new student study room with new furnishing also became available to CEE students in the spring 2008 semester.

Survey results have also been shared with Civil Engineering Advisory Board members in the annual meetings, and their feedback and counsel have been incorporated on a continual basis. Moreover, their suggestions on matters related to curriculum, instruction, and fund raising as well as present and future industry needs have been sought on a regular basis. For the purpose of Program Outcomes assessment, the Civil Engineering Advisory Board meets with student representatives to discuss concerns and issues of mutual interest. Their input is then relayed to the Department ABET advisory committee for review and recommendation for possible actions. A sample of the above-mentioned process can be found in the minutes of the October 2007 civil engineering Advisory Board meeting, which is included in Appendix E.4.