

### *3.3.2 Assessment Tools and Target Performance Levels*

#### **Course Evaluations**

Course evaluations are performed during the last two weeks of each semester that a course is taught. The questions are specifically selected to assess a number of outcomes. For each course, questions 1-4 (c.f. Table 6) are common to all courses on a university-wide basis. Questions 5-10 are common for all CoE courses. Questions 11-21 are also common for all CoE courses and correspond to outcomes a – k of ABET EC 2000 criterion 3. The remaining questions are selected by the cognizant faculty member for each course to assess specific course outcomes. The results of course evaluation are reported in two ways. Each instructor receives a statistical analysis of the responses for his/her course. In addition, the assessment committee receives a report on all questions and courses of the program together with the percentile of a target performance level. The report level is set to 4 (on a scale of 1-5) by the CoE. Individual programs select the percentile of responses with a score higher than 4 that they consider as desirable. The CEE department considers 80% the target level for questions with a double mark in the course outcome matrix (Table 3.1) and 60% the target level for courses with a single mark. Reports for courses taught in recent semesters will be available for examination during the ABET visit.

#### **Prerequisite Course Competency and Student Performance**

Instructors and cognizant faculty report to the assessment committee, by means of their annual report, the student performance on an absolute basis and in relation to previous years. They also report to the committee whether or not expectations of competency based on courses designated as prerequisite for any given course are met at a satisfactory level. The assessment committee in turn reports the cumulative results of individual reports to the department and takes measures to correct any problems or to modify the program course and outcome matrix.

#### **Senior Surveys and Exit Interviews**

For over 10 years, the department of Civil and Environmental Engineering has maintained the practice of conducting an exit interview of all graduating seniors. The interview is conducted by the chair and, when the number of graduating students is large, the associate chair and members of the executive committee. A questionnaire was also completed at the same time in past years, which was replaced in 1998 by the more comprehensive questionnaire currently in use. The latter consists of several parts addressing various aspects of the students' experiences at the University of Michigan. Program outcomes are assessed by several direct and indirect questions. Table 3.3 shows an example taken from the Fall 1998 senior survey. The survey was repeated in Winter 1999 and the results indicate only minor changes from the 1998 survey. A change detection mechanism has been established so that significant jumps in student responses can be automatically sensed and processed for immediate action.

	EXTREMELY WELL	VERY WELL	ADEQUATELY	NOT WELL	POORLY	NOT APPLICABLE	PROG WT. AVG.	CoE WT. AVG.
FRESHMAN MATH	2.3%	25.0%	43.2%	13.6%	2.3%	13.6%	2.87	2.88
SOPHOMORE MATH	2.3%	32.6%	39.5%	18.6%		7.0%	3.20	3.12
CHEMISTRY		25.0%	50.0%	13.6%		11.4%	3.13	2.98
PHYSICS	9.1%	43.2%	29.5%	9.1%	2.3%	6.8%	3.51	3.23
COMPUTING	6.8%	27.3%	34.1%	13.6%	11.4%	6.8%	3.05	3.06
FRESHMAN COMPOSITION	2.3%	15.9%	40.9%	15.9%	4.5%	20.5%	2.94	2.82

**Table 3.3. 1998 Senior Survey**

### Alumni Surveys

Alumni surveys are conducted at 2, 5 and 10 years after graduation from the program. Responses are collected by the CoE, and the processed data are distributed to the individual departments. Specific questions are asked on the ABET EC 2000 outcomes a-k, which are common to all programs. The data are reported in two categories. First, the alumni are asked to rate the importance of each competency and attitude to their professional experience. Then, they are asked to rate how the undergraduate program has prepared them in these areas. Therefore each alumni group can help identify the discrepancies between importance and preparation of the various program outcomes. In addition, the time scale of the survey reveals any potential trends in both the professional expectations and the program effectiveness. Tables 3.4, 3.5, and 3.6 show the results of the 1998 survey of the classes of 1988, 1993 and 1996, respectively. Figure 3.2 shows an example of this for two of the outcomes, specifically, engineering problem solving and technical communication. The data have been weighted on a scale 1-5. It is evident that the problem solving outcome is satisfied very well, both in absolute terms and relative to the importance assigned by the alumni. On the other hand, the technical communication outcome is not satisfied well. Notice that the major changes of MC 2000, which affect the technical communication outcome significantly, are not shown in the data, as the new curriculum was initiated in the 1997-98 academic year. However, the changes were precisely introduced to address, among other issues, the technical communication outcome.

Considerable effort has gone into the development and evolution of the survey process. Questionnaire development has been the duty of a subcommittee within the ABET working group of the College of Engineering. Table 3.7 shows a schematic of the historical development and deployment of the survey, which continues to evolve. It is planned that the survey will be conducted through the internet for the academic year 1999-2000.

	Always Necessary	Often Useful	Useful	Rarely Useful	Never Used	Excellent Preparation	Good Preparation	Some Preparation	Slight Preparation	No Preparation
Math, science and engineering skills	25.0%	75.0%	0.0%	0.0%	0.0%	0.0%	75.0%	25.0%	0.0%	0.0%
Ability to design and conduct experiments	0.0%	12.5%	50.0%	25.0%	12.5%	12.5%	12.5%	62.5%	0.0%	12.5%
Ability to design a system, component or process	0.0%	37.5%	25.0%	37.5%	0.0%	0.0%	12.5%	62.5%	12.5%	12.5%
Ability to function on a team	62.5%	37.5%	0.0%	0.0%	0.0%	0.0%	37.5%	37.5%	12.5%	12.5%
Engineering problem-solving skills	87.5%	12.5%	0.0%	0.0%	0.0%	37.5%	37.5%	25.0%	0.0%	0.0%
Appreciation for the ethical values of being a professional	25.0%	62.5%	12.5%	0.0%	0.0%	12.5%	25.0%	37.5%	25.0%	0.0%
Communication skills	87.5%	12.5%	0.0%	0.0%	0.0%	0.0%	25.0%	25.0%	50.0%	0.0%
Understanding of the social, economic and environmental impact of my work	25.0%	37.5%	25.0%	12.5%	0.0%	0.0%	25.0%	12.5%	62.5%	0.0%
Interest and ability to keep up-to-date through continuing education (formal or informal)	37.5%	25.0%	37.5%	0.0%	0.0%	0.0%	25.0%	12.5%	50.0%	12.5%
Knowledge of contemporary issues that affect my work	37.5%	25.0%	37.5%	0.0%	0.0%	12.5%	12.5%	12.5%	37.5%	25.0%
Ability to use modern engineering techniques, skills & tools	25.0%	50.0%	12.5%	12.5%	0.0%	12.5%	25.0%	25.0%	37.5%	0.0%

**Table 3.4. Class of 1988 Survey Results**

	Always Necessary	Often Useful	Useful	Rarely Useful	Never Used	Excellent Preparation	Good Preparation	Some Preparation	Slight Preparation	No Preparation
Math, science and engineering skills	45.0%	30.0%	20.0%	5.0%	0.0%	50.0%	50.0%	0.0%	0.0%	0.0%
Ability to design and conduct experiments	15.0%	5.0%	30.0%	30.0%	20.0%	5.0%	30.0%	60.0%	5.0%	0.0%
Ability to design a system, component or process	35.0%	20.0%	10.0%	25.0%	10.0%	0.0%	45.0%	40.0%	15.0%	0.0%
Ability to function on a team	55.0%	40.0%	5.0%	0.0%	0.0%	30.0%	25.0%	40.0%	5.0%	0.0%
Engineering problem-solving skills	70.0%	25.0%	0.0%	5.0%	0.0%	40.0%	40.0%	20.0%	0.0%	0.0%
Appreciation for the ethical values of being a professional	30.0%	55.0%	15.0%	0.0%	0.0%	15.0%	35.0%	45.0%	5.0%	0.0%
Communication skills	85.0%	15.0%	0.0%	0.0%	0.0%	5.0%	40.0%	35.0%	20.0%	0.0%
Understanding of the social, economic and environmental impact of my work	45.0%	20.0%	25.0%	10.0%	0.0%	5.0%	20.0%	50.0%	25.0%	0.0%
Interest and ability to keep up-to-date through continuing education (formal or informal)	10.5%	52.6%	26.3%	10.5%	0.0%	0.0%	40.0%	55.0%	5.0%	0.0%
Knowledge of contemporary issues that affect my work	30.0%	50.0%	15.0%	5.0%	0.0%	5.0%	10.0%	65.0%	20.0%	0.0%
Ability to use modern engineering techniques, skills & tools	35.0%	35.0%	25.0%	5.0%	0.0%	10.0%	55.0%	25.0%	10.0%	0.0%

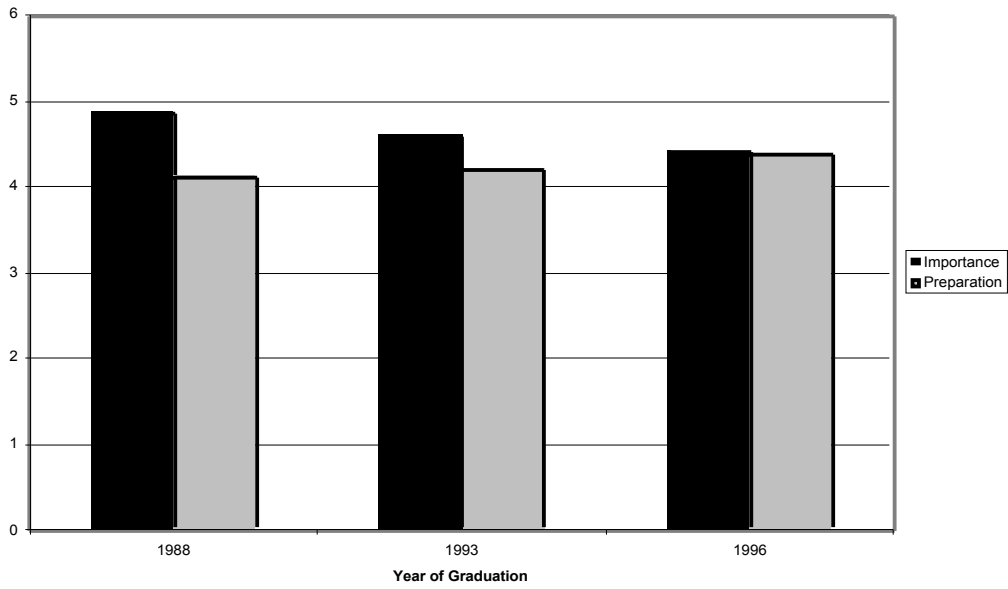
**Table 3.5. Class of 1993 Survey Results**

	Always Necessary	Often Useful	Useful	Rarely Useful	Never Used	Excellent Preparation	Good Preparation	Some Preparation	Slight Preparation	No Preparation
Math, science and engineering skills	27.3%	51.5%	21.2%	0.0%	0.0%	48.5%	39.4%	12.1%	0.0%	0.0%
Ability to design and conduct experiments	24.2%	21.2%	12.1%	30.3%	12.1%	15.2%	36.4%	45.5%	3.0%	0.0%
Ability to design a system, component or process	21.2%	21.2%	30.3%	21.2%	6.1%	15.2%	33.3%	39.4%	12.1%	0.0%
Ability to function on a team	63.6%	30.3%	6.1%	0.0%	0.0%	33.3%	27.3%	27.3%	12.1%	0.0%
Engineering problem-solving skills	57.6%	27.3%	12.1%	3.0%	0.0%	51.5%	39.4%	6.1%		3.0%
Appreciation for the ethical values of being a professional	45.5%	39.4%	15.2%	0.0%	0.0%	15.2%	27.3%	24.2%	27.3%	6.1%
Communication skills	78.8%	21.2%	0.0%	0.0%	0.0%	18.2%	15.2%	42.4%	21.2%	3.0%
Understanding of the social, economic and environmental impact of my work	18.2%	33.3%	48.5%	0.0%	0.0%	6.1%	18.2%	51.5%	18.2%	6.1%
Interest and ability to keep up-to-date through continuing education (formal or informal)	30.3%	42.4%	27.3%	0.0%	0.0%	24.2%	27.3%	24.2%	24.2%	0.0%
Knowledge of contemporary issues that affect my work	45.5%	33.3%	21.2%	0.0%	0.0%	6.1%	33.3%	30.3%	24.2%	6.1%
Ability to use modern engineering techniques, skills & tools	27.3%	36.4%	24.2%	6.1%	6.1%	21.2%	51.5%	24.2%	3.0%	0.0%

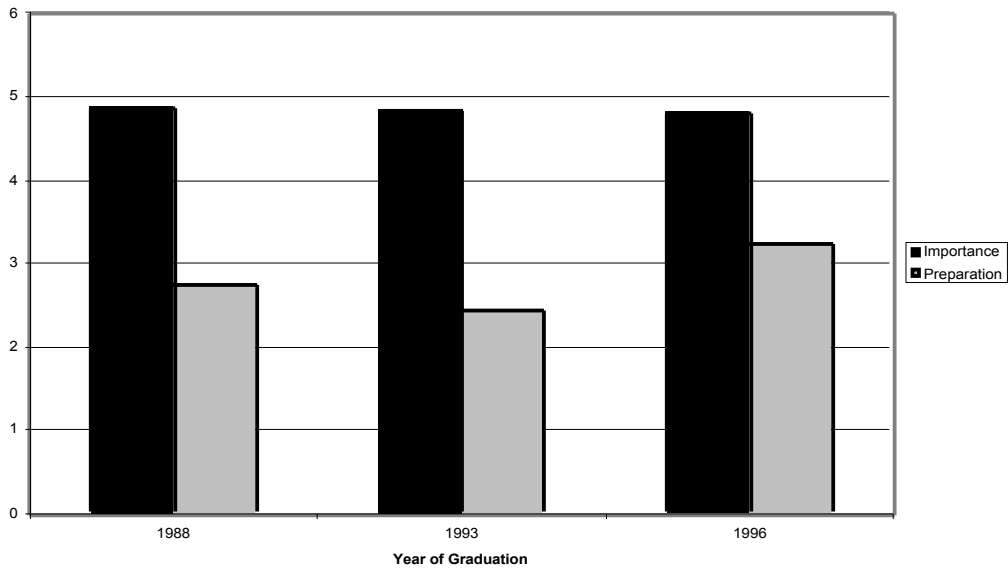
**Table 3.6. Class of 1996 Survey Results**

**Figure 3.2. Alumni Survey of Program Outcomes**

**Problem Solving**



**Technical Communication**



### **Employer Surveys**

Employer surveys were recently instituted by the CoE and were distributed for the first time in 1999 during campus recruiting events. Additional surveys were mailed to major employers of CoE graduates. The basic data that are gathered are directed again towards ABET EC 2000 outcomes a-k. The results follow closely those of the alumni surveys. Almost 96% of employers are satisfied with CoE graduates, the remaining 4% are neutral. On a scale of 1-5, employers rate program graduates at 4.61.

### **Fundamentals of Engineering Examination Results**

Civil and Environmental Engineering students are encouraged to take the Fundamentals of Engineering Examination during their senior year. The program receives feedback regarding the students' success and statistical information of similar data at the State of Michigan and the National levels. Michigan student success is considered an indicator of program outcome satisfaction, so the CEE department monitors the results of the examination in the Civil and Environmental fields. Figure 3.3 shows the results of the last four years, which indicate improvement in both absolute and relative terms.