RESPONSE TO PROGRAM WEAKNESS AND CONCERNS EXPRESSED IN ABET DRAFT STATEMENT (MARCH 8, 2007)

CIVIL ENGINEERING UNDERGRADUATE PROGRAM

CLEVELAND STATE UNIVERSITY

April 6, 2007

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Introduction

A Draft Statement presenting the findings of the Engineering Accreditation Commission of ABET, regarding the CSU report submitted July 31, 2006, was received. This document constitutes the 30-Day Response of the Department of Civil and Environmental Engineering to the Department Specific Weakness and Concerns identified in the Draft Statement.

Program Weakness

1. Criterion 2 Program Educational Objectives

"The eight new program educational objectives are not statements that describe the expected accomplishments of graduates during the first several years following graduation, and do not comply with Criterion 2 requirements. The assessment process identified and used to collect data on the inappropriate educational objectives appears to be applicable for assessing achievement of an appropriate set of education objectives."

Actions Taken:

The Department, with input from the Department Visiting Committee, has adopted the following revised Program Educational Objectives:

To provide an attractive avenue for students interested in Civil Engineering which

* Utilize practical engineering skills for productive, gainful, and ethical careers in civil engineering and related industries and organizations .
* Engage in life-long learning through professional activities and/or the pursuit of higher educational degrees.

The Department also has adopted the suggestion (April 25, 2005 Observation of the ABET Review) encouraging the adoption of Performance Indicators, and will use the following performance indicators to measure how well our civil engineering graduates are meeting the Program Objectives, two to five years after graduation. They are included in Alumni and Employer Surveys.

1. Communicate effectively with clients and constituents.
2. Demonstrate progressive technical competency.
3. Acquire and maintain professional registration.
4. Participate and/or lead as an engineering team member.
5. Meet realistic deadlines consistently
6. Continue professional growth through activities such as continuing education, graduate school and activities in professional societies..
7. Make decisions that include ethical and societal considerations.
8. Demonstrate critical thinking skills.

Performance indicators 1 through 5, 7 and 8 provide quantitative information with respect to the first Program Objective, "productive, gainful, and ethical careers in civil engineering and related industries and organizations". Performance indicator 6 provides a measure of Program Objective 2, the commitment to "lifelong learning". (These will be re-numbered in the 2007 survey, so that the "commitment to life-long learning" is listed last.) The Performance Indicators are also related as a secondary measure to the Program Outcomes, as later described under Criterion 3.

Survey of Alumni. A survey is taken every year to solicit feedback from program alumni regarding their preparation at CSU for the profession, as well as their progress as professionals.
The survey is done electronically, starting in Spring 2006, and the data statistically analyzed and used as a metric for the Program Objectives and Outcomes. The electronic forms, using an automated web-based survey technique, were very easy to use and distribute, and provided automated statistical analysis of the response

For the Spring Semester Alumni Survey, there were 21 respondents. The numerical designation for responses is 1=unacceptable, 2=poor, 3=average, 4=good, and 5=excellent. The questions and mean score of the responses were as follows:

1a.	Communicate effectively with clients and constituents in written form:	3.857
1b.	Communicate effectively with clients and constituents verbally:	3.762
2.	Demonstrate progressive technical competency:	4.000
3a.	Acquire and maintain Fundamentals of Engineering professional registration:	4.524
3b.	Progress towards Professional Engineering (PE) registration:	4.286
4a.	Participate effectively as an engineering team member:	4.238
4b.	Lead effectively as an engineering team member:	4.238
5.	Meet realistic deadlines consistently:	4.286
6a.	Continue professional growth through continuing education:	4.048
6b.	Continue professional growth through graduate school:	3.952
6c.	Continue professional growth through professional societies:	4.190
7.	Make decisions that include ethical and societal considerations:	4.000
8.	Demonstrate critical thinking skills:	4.381

Survey of Employers of Graduates. A survey is taken every year to solicit feedback from the employers of our graduates to review their preparation at CSU for the profession. The electronic forms, using an automated web-based survey technique, were very easy to use and distribute, and provided automated statistical analysis of the response. The 2006 Survey included five employer respondents, who employ 34+ alumni. Their mean responses regarding the same questions for their employees were as follows:

1a.	Communicate effectively with clients and constituents in written form:	3.800
1b.	Communicate effectively with clients and constituents verbally:	3.800
2.	Demonstrate progressive technical competency:	3.800
3a.	Acquire and maintain Fundamentals of Engineering professional registration:	4.400
3b.	Progress towards Professional Engineering (PE) registration:	3.800
4a.	Participate effectively as an engineering team member:	3.800
4b.	Lead effectively as an engineering team member:	4.000
5.	Meet realistic deadlines consistently:	3.800
6a.	Continue professional growth through continuing education:	3.800
6b.	Continue professional growth through graduate school:	3.600
6c.	Continue professional growth through professional societies:	3.400
7.	Make decisions that include ethical and societal considerations:	3.800
8.	Demonstrate critical thinking skills:	3.600

CSU Department of Civil and Environmental Engineering
2006 Alumni and Employer Survey Results

Objective 1	**"productive, gainful and ethical careers"**	**Alumni**	**Employers**
1a.	Communicate effectively with clients and constituents in written form:	3.857	3.8
1b.	Communicate effectively with clients and constituents verbally:	3.762	3.8
2.	Demonstrate progressive technical competency:	4.000	3.8
3a.	Acquire and maintain Fundamentals of Engineering professional registration:	4.524	4.4
3b.	Progress towards Professional Engineering (PE) registration:	4.286	3.8
4a.	Participate effectively as an engineering team member:	4.238	3.8
4b.	Lead effectively as an engineering team member:	4.238	4.0
5.	Meet realistic deadlines consistently:	4.286	3.8
7.	Make decisions that include ethical and societal considerations:	4.000	3.8
8.	Demonstrate critical thinking skills:	4.381	3.6
	Mean =	4.158	3.86

Objective 2	**commitment to "lifelong learning"**		
6a.	Continue professional growth through continuing education:	4.048	3.8
6b.	Continue professional growth through graduate school:	3.952	3.6
6c.	Continue professional growth through professional societies:	4.190	3.4
	Mean =	4.063	3.6

Thus, the mean resultant score for the performance indicators for Objective 1 is rated GOOD in the Alumni Survey, and AVERAGE-GOOD in the Employer Survey. The difference is somewhat expected in that individuals may tend to overrate their own performance compared to how they rate others.

Program Concerns

2. Criterion 3 Program Outcomes and Assessment

"The Self-Assessment Manual for the Civil Engineering Program indicates multiple outcomes assessment tools such as the Course Reflection Form, Senior Exit Survey, and Senior Capstone Design Performance. The only data presented was a sample of the Course Reflection Form. This form was judged non-responsive for evaluation of outcomes achievement. The outcomes assessment methods of surveys of alumni and External Advisory Committee input previously not completed were reported as complete, however, no data or results from these methods were provided. It appears that outcomes assessment is limited. It is the program's responsibility to clearly demonstrate the assessment of outcomes, to define requirements that indicate achievement of an outcome, and to make program changes based on the assessments."

Actions taken:

The "Outcomes" are statements that describe what students are expected to know and are able to do by the time of graduation. These outcomes should also support the achievement of the stated program objectives. The Program Outcomes are:

(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 civil engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of civil and environmental engineering solutions in a global and social 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, skills, and modern engineering tools necessary for civil and environmental engineering practice

The Assessment tools have been modified, and now consists of the following:

1. Senior Exit Survey – once per year near the end of the Spring Semester
2. Faculty Course Reflections and Evaluations
3. Student Survey in Key Courses – once per year per course, near the end of the semester for each Key Course
4. Senior Capstone Design Performance – evaluated by project advisors once per year near the end of the Spring Semester
5. FE Performance – scores become available 1 per year during the summer
6. Alumni Surveys – conducted once per year, during the month of April.
7. Employers Surveys – conducted once per year, during the month of April.
8. Visiting Committee input – meetings conducted a minimum of once per year. The Committee reviews the results of the other assessment tools and provides feedback on

any changes to the program, based upon the results of the other tools.

Senior Exit Survey. The seniors are interviewed by the department chairperson shortly before they graduate, and they complete a survey to document their opinions. Questions 8-18 correspond directly with the a-k Program Outcomes. The response scale ranges from 1 (strongly disagree) to 5 (strongly agree). The survey also includes a section for them to offer suggestions regarding the program. The Department Chair discusses any of the suggestions with the student, and relevant suggestions are then reported and discussed with the appropriate constituents (individual faculty, department faculty, visiting committee). The survey questions are statistically evaluated and used as a metric for closing the loop in the annual ABET review.

CSU Department of Civil and Environmental Engineering
2006 Senior Exit Survey Results

Outcome	In my studies of Civil Engineering at Cleveland State University I have	Mean
(a)	Gained the ability to apply knowledge of mathematics, science and engineering	4.82
(b)	Gained the ability to design and conduct experiments, as well as to analyze and interpret data	4.35
©)	Gained the ability to design a system, component, or process to meet desired needs	4.18
(d)	Gained the ability to function on multi-disciplinary teams	4.35
(e)	Gained the ability to identify, formulate, and solve civil engineering problems	4.59
(f)	Gained the understanding of professional and ethical responsibility	4.53
(g)	Gained the ability to communicate effectively	4.35
(h)	Gained a broad education necessary to understand the impact of civil and environmental engineering solutions in a global and social context	4.41
(I)	Gained a recognition of the need for, and an ability to engage in life-long learning	4.65
(j)	Gained a knowledge of contemporary issues	4.12
(k)	Gained the ability to use the techniques, skills, and modern engineering tools necessary for civil and environmental engineering practice	4.29
		4.42

The mean score for each outcome is from 4.12-4.82, corresponding to AGREE to STRONGLY AGREE. The average mean for all outcomes is 4.42, which is near the midpoint of that range. A score of 4 or higher is considered acceptable. Thus, this tool indicates that all outcomes have been met.

Faculty Course Reflections & Evaluations. Faculty self-evaluate each course taught at the end of the semester, rating the level of contribution for each of the outcomes and objectives stated for that course. The rating scale varies from 5 (very strong contribution) to N/A (no contribution).

The following table includes the faculty self-evaluation scores for the Civil Engineering and Engineering Science Courses required and taught by the Department. Cumulative for each outcome, rather than average scores, are presented, since individual outcomes are not expected to be covered to the same extent in each individual course. Civil Engineering Technical Electives Courses are not included. The 14 Basic Math, Science and Engineering Science Courses (MSE) taught outside the Department heavily support outcome (a), but course reflection forms are not used outside of the engineering college. General Education courses, also not included in the table, strongly support outcomes (f),(g), (h) and(j).

CSU Department of Civil and Environmental Engineering
2006 Summary of Faculty Reflection Scores

course #	ABET Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**I**	**j**	**k**
MSE*	*70*	-	-	-	-	-	-	-	-	-	-
CVE 211	5	1	3	1	4	4	5	3	3	3	3
CVE 212	4	5	1	5	4	5	4	4	1	2	5
CVE 310	5	4	N/A	5	4	N/A	5	N/A	N/A	N/A	4
CVE 312	5	N/A	N/A	N/A	5	4	N/A	N/A	3	N/A	4
CVE 322	5	2	5	2	5	4	4	2	4	1	5
CVE 331	5	N/A	4	N/A	4	4	4	4	3	4	4
CVE 332	5	5	N/A	N/A	4	4	4	3	3	4	4
CVE 361	N/A	N/A	4	N/A	4	N/A	4	N/A	N/A	N/A	N/A
CVE 362	N/A	4	N/A	5	N/A	N/A	4	N/A	N/A	N/A	N/A
CVE 371	N/A	N/A	4	N/A	3	4	N/A	4	N/A	3	4
CVE 403	3	N/A	4	N/A	4	4	4	3	4	3	4
CVE 412	4	N/A	N/A	N/A	4	N/A	N/A	N/A	4	N/A	4
CVE 422	5	N/A	5	N/A	4	4	N/A	N/A	4	1	5
CVE 426	N/A	N/A	4	4	4.5	2	4.5	2.5	2.5	4	4.5
CVE 429	5	N/A	5	N/A	4	3	4	3	4	4	4
CVE 446	5	4	4	N/A	4	4	4	5	4	5	4
CVE 473	N/A	N/A	4	N/A	3	N/A	N/A	4	N/A	4	4
CVE 474	N/A	4	N/A	3	N/A	N/A	4	N/A	N/A	N/A	N/A
ESC 201	5	N/A	4	N/A	4	4	3	N/A	4	4	N/A
ESC 202	4	N/A	N/A	N/A	4	N/A	N/A	N/A	N/A	N/A	3
ESC 211	4	4	4	N/A	4	3	3	3	3	3	4
Total	139	33	55	25	76.5	53	60.5	40.5	46.5	45	69.5

A score of 20 had been established as the minimum acceptable for each outcome. As the table indicates, that has been exceeded for all outcomes. Thus, using this tool, all outcomes have been met.

Student Surveys in Key Courses. Students taking a key course, which is the last course in a sequence (Hydraulic Engineering, Transportation, Reinforced Concrete Design, Environmental Engineering Lab, Foundations, plus Construction Planning and Estimating) complete a survey. The survey questions are related to the Outcomes and Objectives, but the questions are paraphrased in a manner to be more understandable by the students. The key courses represent a cumulative body of knowledge at the end of a course sequence, and also include significant design content. The students are asked to evaluate the level to which they believe each outcome was met by the course, using the scale of (1) no contribution; (2) weak contribution; (3) moderate contribution; (4) strong contribution; (5) very strong contribution. The results of those surveys for Spring 2006 are as follows:

CSU Department of Civil and Environmental Engineering
2006 Summary of Student Surveys in Key Courses

		CVE Course #					
	Outcome	**361** Hydraulic Engr.	**473** Environ. Lab	**446** Transport Engr.	**403** Construct	**422** Concrete Design	**Average**
a)	ability to apply knowledge of mathematics, science and engineering	3.93	N/A	3.78	3.78	N/A	3.83
b)	ability to design and conduct experiments, as well as to analyze and interpret data	N/A	3.67	4.00	4.00	N/A	3.89
c)	ability to design a system, component, or process to meet desired needs	3.53	3.82	4.41	4.41	4.50	4.13
e)	ability to identify, formulate, and solve civil engineering problems	4.38	4.17	4.53	4.08	4.60	4.35
f)	understanding of professional and ethical responsibility and education necessary to understand the impact of civil and environmental engineering solutions In a global and social context	N/A	3.92	4.24	4.32	N/A	4.16
g)	ability to communicate effectively	4.19	3.42	4.24	4.03	N/A	3.97
h)	the broad education necessary to understand the impact of civil and environmental engineering solutions in a global and social context	N/A	N/A	4.47	N/A	N/A	4.47
I)	a recognition of the need for, and an ability to engage in life-long learning	N/A	N/A	4.12	4.00	N/A	4.06
j)	knowledge of contemporary issues	N/A	3.58	4.50	4.16	4.30	4.14
k)	ability to use the techniques, skills, and modern engineering tools necessary for civil and environmental engineering practice	N/A	4.08	4.59	3.92	4.40	4.25
						Average of mean scores =	4.125

All outcomes except (d) are measured by this assessment tool. The average of all mean scores was 4.125, which corresponds to STRONG CONTRIBUTION - VERY STRONG CONTRIBUTION. All of the individual outcome mean scores are in the range of MODERATE CONTRIBUTION - STRONG CONTRIBUTION or STRONG CONTRIBUTION - VERY STRONG CONTRIBUTION. Moderate Contribution or above is considered the minimum for each of these courses. Thus, this tool indicates that the outcomes a-k have been met (except for outcome d, which is not measured by this assessment tool)..

Senior Capstone Design Performance. All students must complete the capstone course to graduate, and all students must participate in preparing the written report and well as in the formal presentation to their peers, faculty and invited guests. Following completion of senior design, the faculty who are advising each group perform an assessment survey.

Outcomes a-k are all measured in the survey. The scores for outcomes in the 2005-2006 Senior Design Group surveys ranged from 3.5 - 4.5, with an average score of 4.14. Moderate contribution (3.0) or above is considered acceptable. Hence, this tool indicates that all of the Outcomes have been achieved. A summary of the outcome scores is included in the following table:

The results of those surveys for the 2005-2006 Senior Design Groups are included in the following table:

CSU Department of Civil and Environmental Engineering
Senior Design Group Assessment Survey by Faculty Instructor

Course: CVE 426 Instructor: All Group: Groups 1 – 4 Term: Spring 2006

Please rate the following with respect to your overall perception of the senior design group.

	The design group showed:	1	2	3	4	Average
1	ability to apply knowledge of mathematics, science and engineering	4	5	5	4	4.5
2	ability to design and conduct experiments, as well as to analyze and interpret data	4	4	4	4	4
3	ability to ability to design a system, component, or process to meet desired needs.	4	4	4	5	4.25
4	ability to function on multi-disciplinary teams	4	5	4	4	4.25
5	ability to identify, formulate, and solve civil engineering problems;	4	5	4	4	4.25
6	understanding of professional and ethical responsibility;	4	5	4	5	4.5
7	ability to communicate effectively;	4	4	4	5	4.25
8	understanding of the impact of civil and environmental engineering solutions in a global and social context.	3	5	4	4	4
9	recognition of the need for, and an ability to engage in life-long learning	3	4	3	4	3.5
10	knowledge of contemporary issues;	3	5	3	4	3.75
11	ability to use the techniques, skills, and modern engineering tools necessary for civil and environmental engineering practice	4	5	3	5	4.25
A	Pre-requisite courses adequately prepared the group to take the course.	4	5	2	5	4

If you marked "disagree" or "strongly disagree" on any of the above, please identify as specifically as possible what you perceive as problems and ways of correcting the problems. Also, please provide any other comments related to the class and your preparedness to complete it successfully. (use reverse side if needed)

FE Performance by Seniors. Seniors are strongly encourage to take the Fundamentals of Engineering (FE) Exam prior to graduation. The percentage of students passing the FE exam (compared to the number of students taking the exam) is used as a merit.

The passing rate on the FE EXAM for our students was 80 %. It exceeds the minimum acceptable criteria of 50 %.

Survey of Alumni. A survey is taken every year to solicit feedback from program alumni regarding their preparation at CSU for the profession, as well as their progress as professionals. The survey is done electronically, starting in Spring 2006, and the data statistically analyzed and used as a metric for the Program Objectives and Outcomes. The electronic forms, using an automated web-based survey technique, were very easy to use and distribute, and provided automated statistical analysis of the response.

The Civil Engineering program adopted the following Performance Indicators, which are also used in revised Alumni and Employer Surveys as a measurement of both the Program Objectives and Program Outcomes.:

1. communicate effectively with clients and constituencies
2. demonstrate progressive technical competency
3. acquire and maintain professional registration
4. participate and/or lead as an engineering team member
5. meet realistic deadlines consistently
6. continue professional growth through activities such as continuing education, graduate school and activities in professional societies
7. make decisions that include ethical and societal considerations
8. demonstrate critical thinking skills

Although these Performance Indicators are used to measure Objectives, as discussed previously in this report, they also serve as a Secondary Assessment Tool for the Outcomes. For the Spring Semester 2006 Alumni Survey, there were 21 respondents. The Department is working to increase the number of respondents in future surveys. The numerical designation for responses is 1=unacceptable, 2=poor, 3=average, 4=good, and 5=excellent. The questions and mean score of the responses were as follows. The following table provides the scores, and the relationship between the performance indicator and respective outcomes for the Spring Semester 2006 Alumni Survey.

Results of 2006 Alumni Survey

Outcome a	**Apply knowledge of math, science and engineering**	
Performance indicator 2.	Demonstrate progressive technical competency:	4.000
Outcome b	**Design and conduct experiments. Analyze date.**	
Performance indicator 2.	Demonstrate progressive technical competency:	4.000
Outcome c	**Design a system, process or component**	
Performance indicator 2.	Demonstrate progressive technical competency:	4.000
Outcome d	**Function on multi-disciplinary teams**	
4a.	Participate effectively as an engineering team member:	4.238
4b.	Lead effectively as an engineering team member:	4.238
Outcome e	**Identify, formulate and solve civil engineering problems**	
Performance indicator 2.	Demonstrate progressive technical competency:	4.000
Performance indicator 8.	Demonstrate critical thinking skills:	4.381
Outcome f	**Understanding of Professional and Ethical Responsibility**	
Performance indicator 3a.	Acquire and maintain Fundamentals of Engineering professional registration:	4.524
Performance indicator 3b.	Progress towards Professional Engineering (PE) registration:	4.286
Performance indicator 5.	Meet realistic deadlines consistently:	4.286
Performance indicator 7.	Make decisions that include ethical and societal considerations:	4.000
Outcome g	**Ability to Communicate Effectively**	
Performance indicator 1a.	Communicate effectively with clients and constituents in written form:	3.857
Performance indicator 1b.	Communicate effectively with clients and constituents verbally:	3.762
Outcome h	**Understand impact of CE solutions in Global and Social Context**	
Performance indicator 7.	Make decisions that include ethical and societal considerations:	4.000
Outcome I	**Lifelong Learning**	
Performance indicator 6a.	Continue professional growth through continuing education:	4.048
Performance indicator 6b.	Continue professional growth through graduate school:	3.952
Performance indicator 6c.	Continue professional growth through professional societies:	4.190
Outcome j	**Knowledge of Contemporary Issues**	
Performance indicator 7.	Make decisions that include ethical and societal considerations:	4.000
Performance indicator 8.	Demonstrate critical thinking skills:	4.381
Outcome k	**Use Techniques, Skills, Modern Engineering Tools necessary for Practice**	
Performance indicator 2.	Demonstrate progressive technical competency:	4.000
Performance indicator 3a.	Acquire and maintain Fundamentals of Engineering professional registration:	4.524
Performance indicator 3b.	Progress towards Professional Engineering (PE) registration:	4.286
Performance 8.	Demonstrate critical thinking skills:	4.381

Thus, the mean response met or exceeded acceptable levels for all questions.

Survey of Employers of Graduates. A survey is taken every year to solicit feedback from the employers of our graduates to review their preparation at CSU for the profession. Starting in 2006, electronic forms, using an automated web-based survey technique, were used. They provided automated statistical analysis of the response. The 2006 Survey included five employer respondents, who employ 34+ alumni. The results of that survey are summarized below:

Results of 2006 Employer Survey

Outcome a	**Apply knowledge of math, science and engineering**	
Performance indicator 2.	Demonstrate progressive technical competency:	3.800
Outcome b	**Design and conduct experiments. Analyze date.**	
Performance indicator 2.	Demonstrate progressive technical competency:	3.800
Outcome c	**Design a system, process or component**	
Performance indicator 2.	Demonstrate progressive technical competency:	3.800
Outcome d	**Function on multi-disciplinary teams**	
4a.	Participate effectively as an engineering team member:	3.800
4b.	Lead effectively as an engineering team member:	4.000
Outcome e	**Identify, formulate and solve civil engineering problems**	
Performance indicator 2.	Demonstrate progressive technical competency:	3.800
Performance indicator 8.	Demonstrate critical thinking skills:	3.600
Outcome f	**Understanding of Professional and Ethical Responsibility**	
Performance indicator 3a.	Acquire and maintain Fundamentals of Engineering professional registration:	4.400
Performance indicator 3b.	Progress towards Professional Engineering (PE) registration:	3.800
Performance indicator 5.	Meet realistic deadlines consistently:	3.800
Performance indicator 7.	Make decisions that include ethical and societal considerations:	3.800
Outcome g	**Ability to Communicate Effectively**	
Performance indicator 1a.	Communicate effectively with clients and constituents in written form:	3.800
Performance indicator 1b.	Communicate effectively with clients and constituents verbally:	3.800
Outcome h	**Understand impact of CE solutions in Global and Social Context**	
Performance indicator 7.	Make decisions that include ethical and societal considerations:	3.800
Outcome I	**Lifelong Learning**	
Performance indicator 6a.	Continue professional growth through continuing education:	3.800
Performance indicator 6b.	Continue professional growth through graduate school:	3.600
Performance indicator 6c.	Continue professional growth through professional societies:	3.400
Outcome j	**Knowledge of Contemporary Issues**	
Performance indicator 7.	Make decisions that include ethical and societal considerations:	3.800
Performance indicator 8.	Demonstrate critical thinking skills:	3.600
Outcome k	**Use Techniques, Skills, Modern Engineering Tools necessary for Practice**	
Performance indicator 2.	Demonstrate progressive technical competency:	3.800

Performance indicator 3a. Acquire and maintain Fundamentals of Engineering professional registration:	4.400
Performance indicator 3b. Progress towards Professional Engineering (PE) registration:	3.800
Performance 8. Demonstrate critical thinking skills:	3.600

Thus, the mean response met or exceeded acceptable levels for all questions. The Department is working with the Visiting Committee to increase the number of respondents to the 2007 Employer Survey.

Visiting Committee. This committee is comprised of approximately 20 professionals from all aspects of the civil engineering discipline. They meet annually, and they have met and discussed the ABET outcomes and objectives and the CSU program. Their input is in the form of comments and recommendations recorded as meeting notes. This input will be discussed for each of the relevant outcomes and objectives individually.

Committee meetings were held on December 16, 2005, May 4, 2006, and April 4, 2007. A website for the advisory committee was also established. The December 16 meeting included an update on the department, and proposed changes in the ABET Program Outcomes, Objectives, Constituents and Assessment tools and an assessment process was developed and adopted by the department faculty and advisory committee. At the April 4, 2007 Visiting Committee meeting, the ABET Draft Statement was reviewed, and Department Response was reviewed and adopted. It also established that a regular Advisory Committee Meeting would be held every Fall and Spring Semester. The May 4, 2006 meeting further discussed assessment methods, results of alumni and employer surveys, selective course surveys, and also provided an opportunity for Advisory Committee members to participate in the review of senior design student presentations.

A website for the External Advisory Committee (http://www.csuohio.edu/civileng/Advisory%20Comm/Advisory.htm) with a link from the civil engineering department webpage was established. The website includes committee members and their email addresses, meeting minutes, and upcoming meeting agendas. As per the desire of the committee members, the site is password protected so that the email addresses of the members do not become available to the general public. ABET reviewer's can log on to the site using a password of CIVILVC.

3. Criterion 4. Professional Component

"The list of standards and constraints for the specific senior design projects for 2005-2006 meets the requirement for incorporating engineering standards and realistic constraints into the major design experience. However, there is no indication of a programmatic change that would ensure that future senior design projects incorporate engineering standards and realistic constraints."

Actions taken:

It should be noted that almost the entire Civil Engineering Department, most of whom are registered professional engineers, participate jointly in Senior Design, with respect to their areas of expertise, and the projects have always incorporated engineering standards and realistic constraints, similar to the list of standards and constraints for the 2005-2006 senior design projects. However, the Department acknowledges that evidence of such may have been difficult to quantify during the reviewer's visit. In addition to the change in course syllabus emphasizing the need to incorporate engineering standards and realistic constrains, the following programmatic changes have been made:

1. The Department has approved the following revised catalog description of CVE 426 Senior Design:

CVE 426 Senior Design (0-3-2). *Prerequisite: Senior Standing.* A capstone course which applies and extends previously developed principles of civil engineering. Students will be placed on teams and work on design projects under the supervision of civil engineering faculty, in the various areas offered by the faculty. The design must incorporate appropriate engineering standards and realistic constraints. Computer-aided analysis, cost estimation, planning, and management should be included in the design. Registration must be for two consecutive semesters of 2 credits each. *Writing.*

2. The Department faculty, rather than the students, brainstorm on potential senior design, projects, and select the projects assuring that each individual project incorporate sufficient engineering standards and realistic constraints. The students are then presented with the list of projects, and are asked to rate them on their interest. The faculty then attempt to assign students to the various teams according to their interests, as well as to balance teams based upon academic ability. The faculty advisors discuss with each team the appropriate engineering standards and constraints, and assure that they are being properly considered. A representative list of appropriate engineering standards and constraints, based on project type, is included in the syllabus.

3. The faculty review sheets (included previously in the 30-Day Response - April 24, 2005) now used by all faculty during the preliminary (Fall Semester) and final (Spring Semester) student senior design presentations indicate whether the appropriate engineering standards and constraints were used. These completed forms are given to the primary advisor for each group, who notifies his group of any deficiencies in that area. It is the Department's opinion that the revised forms and how they are used constitutes an additional Programmatic Change to assure that appropriate engineering standards and realistic constraints are being incorporated in all senior design projects.

The following list is now given to the senior design students:

Typical engineering standards and constraints for senior design projects.

(Note: this is a representative sample, and does not necessary include all engineering standards and constraints which might apply for a specific project) :

1. Bridge Design Project

AASHTO 2002 Bridge Design Manual

Ohio 2004 BDM (Bridge Design Manual)

AISC 9th Edition

ODOT Location and Design Manual, Volume 2 Drainage

ACI 3-18

2. Building Design Project

ASTM Soil Testing Procedures

Foundations, Bearing - General Bearing Equation

Foundation, Settlement - strain influence factor of Schmertmann and Hartman (1978)

Steel, AISC Allowable Stress Design Method

Open Web Joists - Steel Joist Institute (Vulcraft Catalog)

Roof and Floor Decks - Steel Deck Institute and American Concrete Institute (Vulcraft Catalog)

Loads: Live, Roof, Wind, Earthquake - ASCE 7, as adopted in the Uniform Building Code and the 2005 Ohio Building Code (We gave access to the full text of ASCE 7-98)

Building Code Requirements for Structural Concrete (ACI 318-05) and Commentary (ACI 318R-05)

Loads: Snow - Cleveland Building Code

Masonry Design code used was published by The Masonry Standards Joint Committee and included:

Building Code Requirements for Masonry Structures
ACI 530-05/ASCE 5-05/TMS 402-05

Specifications for Masonry Structures
ACI 530.1-05/ASCE 6-05/TMS 602-05

Commentary on Building Code Requirements for Masonry Structures
ACI 530-05/ASCE 5-05/TMS 402-05

Commentary on Specification for Masonry Structures
ACI 530.1-05/ASCE 6-05/TMS 602-05

3. Pervious Pavement Design Project

Bruce K. Ferguson, “Porous Pavements,” CRC Press, 2005

ACI Committee 522, "Pervious Concrete," final draft approved for publication, 2006

Master Builders Degussa Admixtures Inc., "Project Information: Pervious Concrete," Master Builders, 2005

Pervious Concrete Pavements, Southeast Cement Association, http://www.pervious.info, 2006

Paul D. Tennis, Michael L. Lerning, David J. Akers, 'Pervious Concrete Pavements," PCA Engineering Bulletin EB 302, Portland Cement Association, 2004

ACI Committee 330, "Guide for Design and Construction of Concrete Parking Lots," ACI 330.1R-01, American Concrete Institute, 2001

StreetPave software, American Concrete Pavement Association, 2006

Portland Cement Association (PCA), "Thickness Design for Concrete Highway and Street Pavements," PCA Engineering Bulletin EB109P, PCA, 1984

Mallela, J., Larson, G., Wyatt, T., Hall, J., and Barker, ;W., "User's Guide for Drainage Requirements in Pavements - DRIP 2.0 Microcomputer Program,: Washington, D.C.: Federal Highway Administration, United States Department of Transportation, 2002, http://www.fhwa.dot.gov/pavements/software.cfm

Vernon R. Schaefer, Keijin Wang, Muhannad T. Suleiman, and John T. Kevern, "Mix Design Development for Pervious Concrete in Cold Weather Climates," Report Number 2006-01, National Concrete Pavement Technology Center, Iowa State University, February 2006. Http://pccenter.iastate.edu/projects/reports.cfm

ACI Committee 211, "Guide for Selecting Proportions for No-Slump Concrete", ACI 211.3 R-02, American Concrete Institute, 2002

Sidney Mindess, J. Francis Young, and David Darwin, "Concrete," p. 317, Prentice-Hall, 2003

NRMCA, "Freeze Thaw Resistance of Pervious Concrete", National Ready Mixed Concrete Association, May 2004

ACI Committee 325 (2002) Guide for Design of Jointed Concrete Pavements for Streets and Local Roads, ACI 325.12 R-02, Farmington Hills, MI: American Concrete Institute

4. Hydrology Projects

G.M. Bonnin, D. Todd, B. Lin, T. Parzybok, M.Yekta, and D. Riley. 2004. Precipitation-Frequency Atlas of the United States, NOAA Atlas 14, Volume 2, Version 2.
National Oceanic and Atmospheric Administration, National Weather Service, Silver Spring, Maryland, 2004. (Utilized to estimate rainfall depths for average return periods of 2 years through 1000 years and rainfall temporal patterns for average return periods of 1 year to 10 years.)

Goettemoeller, Robert L. December 1981. Ohio Stormwater Control Guidebook, second edition. Ohio Department of Natural Resources, Division of Soil and Water Conservation. (Contains the description of the criteria for the Ohio Critical Storm Method)

Huff, Floyd A. and James R. Angel. 1992. Rainfall frequency atlas of the Midwest. National Oceanic and Atmospheric Administration, National Weather Service, Midwestern Climate Center, Research Report 9203 and the Illinois Department of Energy and Natural Resources, the Illinois State Water Survey Bulletin 71. (Utilized to estimate rainfall depths for average return periods of 1 year and less.)

Ohio Environmental Protection Agency. Effective date April 21, 2003. Expiration date April 20, 2008. Authorization for storm water discharges associated with construction under the National Pollutant Discharge Elimination System. Ohio EPA Permit Number OHC000002. (This document specifies the storm water management practices which must be implemented on construction sites during and after construction.)

United States Department of Agriculture, Soil Conservation Service. 1985. National Engineering Handbook, Section 16, Hydrology. (This document provides the background and development for the SCS curve number method and the SCS time of concentration method.)

United States Department of Agriculture, Soil Conservation Service. 1983. Project formulation: hydrology. Technical Release 20. (This document was the original computer program to implement the SCS methods of hydrologic analysis. The algorithms contained in this program are found in numerous commercial software products.)

4. Criterion 7 Institutional Support and Financial Resources

"The establishment of the University Transportation Center (UTC) and the funding allocated for the next four years will represent a significant increase in support staff for the department. The current plans for the future of UTC indicate that the support will continue. However, the recent reduction in the operating budget for the college and the fact that the establishment of the UTC is still a plan leaves institutional support for the program as an open issue.

Actions taken:

The Strategic Plan for the UTC has been approved by the U. S. Department of Transportation and the UTC is now fully functional.