Self-Assessment Manual


Civil Engineering Program

Cleveland State University

Prepared by Walter M. Kocher, Ph.D.

Revised May, 2006
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Prepared by Walt Kocher 5/30/06
Self-Assessment Manual

Civil Engineering Program

SELF-ASSESSMENT REQUIREMENTS

The Civil Engineering Program must conduct self-assessment procedures for two accreditation bodies, the NCA (North Central Association of Colleges and Schools) accreditation of the entire university, and the ABET accreditation of the Civil Engineering Program.

NCA Accreditation

The Civil and Environmental Engineering Department must submit annual assessment reports on all undergraduate and graduate programs within the department.

The relevant assessment activities identified for all programs within the university include:

- Surveys (exit interviews, alumni survey, employers survey, best students, student survey, and entrance survey)
- Performance measures (internal exam, external exam, presentation/project, student portfolio, and program portfolio)
- Judgment assessments (faculty judgments, external judgments of students, external judgment of program, and student self-assessment)
- Courses (course grade, program grade analysis, GPA required, and special courses)
- Other (pre/post test and teaching evaluation)

The report (Figure 1) must also include:

- A listing of salient findings from the recent academic year
- A listing of persons who received those findings and could make informed program decisions based at least in part on the findings
- A listing of any program/curricular modifications in any way connected to the assessment data

The ABET assessment requirements for the undergraduate (Civil Engineering) program more than satisfy the NCA requirements. Therefore, the ABET assessment process, described in detail within this manual, will also be used to meet the NCA assessment requirements.

However, the graduate programs within the department must conduct separate assessment activities, although the survey and other assessment forms are similar to the forms outlined for the ABET assessment. Faculty evaluations, student exit surveys, plus feedback from several areas including alumni, employers and visiting committees.
members, are used in a similar manner described for the ABET assessment analysis and development of continual improvement activities.

**ABET EC 2000 Accreditation**

The new ABET accreditation criteria has moved away from “bean counting” – counting credit hours for designated categories – and now seeks to evaluate engineering programs based upon the particular goals and objectives of each university, college and department. The new Basic Level Accreditation Criteria are:

1. Students (student quality and performance)
2. Program Educational Objectives
3. Program Outcomes and Assessment
4. Professional Component (ethics, economics, environmental, social, political, etc.)
5. Faculty (sufficient numbers & competencies to cover program areas, qualifications)
6. Facilities (classrooms, labs & associated equipment, a “learning environment”)
7. Institutional Support & Financial Resources (funding, leadership, support functions)
8. Program Criteria (curriculum requirements & faculty qualifications, criticality)

The “Objectives” have been defined by ABET as statements that describe the expected accomplishments of graduates during the first few (??) years after graduation. Objectives may include expectations that might apply to all graduates as well as expectations that only some graduates might accomplish.

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. These outcomes must embrace the ABET required a-k outcomes:

(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 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 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 engineering practice

There must be a “system of ongoing evaluation” of the Objectives that demonstrates achievement of these Objectives and uses the results to improve the effectiveness of the
program. There must also be in place an “assessment process” to document and demonstrate that the graduates have met the stated Outcomes. The tools used for the “Objectives evaluation” may overlap with the tools used for “Outcomes assessment”, depending upon the constituents (students, faculty, alumni, employers, etc.) involved.

The evaluation/assessment tools that have already been specified by the NCA (North Central Association of Colleges and Schools) self-assessment process and are in use include:

(a) senior exit survey
(b) student performance on FE Exam
(c) student performance in Senior Capstone Design Course
(d) Survey of employers of graduates
(e) Survey of alumni

Other tools suggested by ABET include student portfolios, other nationally-normed subject content examinations (GRE, etc.) and documentation of placement data of graduates.

The following process refers specifically to the ABET assessment requirements – the assessment tools used for the graduate programs to meet the NCA requirements are modeled after the ABET process described below.

OVERVIEW OF THE ABET SELF-ASSESSMENT PROCESS

Several assessment methods have been adopted to provide indicators of every program outcome (Table 1) and objective (Table 2) for the Civil Engineering Program. The correlation between assessment methods, outcomes and objectives is summarized in Table 3.

A set of criteria (Table 4) have been established to provide more objective indictors so that each assessment tool either indicates that the program has met that outcome or objective, or reveals an issue that must be addressed by the department to continually improve the program.

The constituents for our program are faculty, students, alumni, our Visiting Committee and employers of our graduates.

The assessment process is administered, and results are collected, by the Department ABET Representative. The results are compiled and an annual report is produced. The department faculty discuss the ABET issues during faculty meetings throughout the year, and the annual report is presented and discussed at the first faculty meeting of each year. Recommendations that involve making curriculum changes are given to the departmental Undergraduate Affairs Committee to investigate possible modifications and recommend improvements to the faculty.
Senior Exit Survey. The seniors are interviewed by the department chairperson shortly before they graduate, and they complete a survey (see appendix) to document their opinions. The response scale ranges from 5 (excellent) to 1 (poor).

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 1 (no contribution).

FE Exam Performance by Seniors. Seniors are strongly encouraged 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 metric.

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.

Student Surveys in Key Courses. Students taking a key course (Transportation, Steel Design, Reinforced Concrete Design, Environmental Engineering II, 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.

Survey of Employers of Graduates. A survey (see appendix) is taken every other year to solicit feedback from the employers of our graduates to review their preparation at CSU for the profession.

Survey of Alumni. A survey (see appendix) is taken every other year to solicit feedback from program alumni regarding their preparation at CSU for the profession, as well as their progress as professionals.

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.

The schedule for conducting each of these assessment measurements is outlined in Table 7.
SELF-ASSESSMENT OF OUTCOMES

The self-assessment of outcomes from the most recent ABET Annual Report is included in Appendix A. This appendix details the analysis procedure for the measured data. The values of the collected data may change annually.

The annual report for the upcoming year will reflect the changes described in the body of this manual.

SELF-ASSESSMENT OF OBJECTIVES

The self-assessment of objectives from the most recent ABET Annual Report is included in Appendix B. This appendix details the analysis procedure for the measured data. The values of the collected data may change annually.

The annual report for the upcoming year will reflect the changes described in the body of this manual.

CLOSING THE LOOP

ABET Annual Reports

The purpose of the ABET Annual Reports, initially, was analyze (and later develop a quantitative evaluation tool) the ABET data to determine where we met the ABET criteria, and where we did not.

However, this leaves a gap between meeting the threshold criteria for an accredited program, and the ongoing effort for continual improvement of the program. Therefore, these reports have been expanded to include sections that describe the status of continual improvement efforts over the past year and also identification of the continual improvement efforts that will be pursued during the coming year. This will close the loop to bridge the gap between assessing if the program meets the threshold criteria and planning for continual improvement.

The faculty discuss opportunities and approaches for improvement of the program at every ABET faculty meeting – and at many other faculty meetings as well. These ideas are frequently addressed by a faculty or a faculty sub-committee during the year. When there is a solid plan for action, then it is brought before the faculty for discussion, modification and approval. The ABET report may provide some insight as to where improvements might be made, although there is not an existing deficiency in the program.

Input from our constituents for our program (including faculty, students, alumni, our Visiting Committee and employers of our graduates) will be incorporated into all program discussions.

Prepared by Walt Kocher 5/30/06
Appendix A

SELF-ASSESSMENT OF OUTCOMES in AY 2005 - 06

Each program outcome has a specific set of assessment tools used to measure the level of success meeting that outcome. Based upon the metric scales of each assessment tool, a set of threshold criteria (Table 4) has been established to determine the level of success meeting each of the outcomes. The assessment results, discussion and conclusions will be presented for each outcome in the annual report.

A sample summary table of the outcomes scores resulting from the faculty course reflections and evaluation process is provided in Table 5.

Outcome a. An ability to apply knowledge of mathematics, science, and engineering.

Prior to students taking relevant courses within the civil engineering program, several courses are taken from other departments (ESC courses) and colleges (mathematics, chemistry, physics) which are important prerequisites. Later in their studies, their performance in the relevant CVE courses (particularly ESC courses) reflects ability to apply that acquired knowledge. The effectiveness of this foundation is well tested by the engineering courses taken early in their engineering curriculum. The courses and activities that contribute significantly to meeting Outcome a include:

- Calculus I
- General Chemistry I
- General Chemistry Lab I
- FORTRAN or ASSI C
- Calculus II
- University Physics I
- Surveying
- Multi. Calc. for Engineers
- University Physics II
- Statics
- Differential Eq. for Engineers
- Surveying Lab
- Strength of Materials
- Fluid Mechanics
- Eng. Statistics & Probability
- Electrical Eng. Concepts
- Linear Algebra & Num. Methods
- Materials Science
- Dynamics
- Thermodynamics
- Engineering Economy
- Co-op experience
- Engineering design contests

<table>
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<th>Minimum Criteria</th>
<th>Score</th>
<th>Met Criteria</th>
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<td>4.8</td>
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The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome a.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Outcome a:

| Strength of Materials | Exam Problems |

**Outcome b.** An ability to design and conduct experiments, as well as to analyze and interpret data

The sciences departments provide the fundamental background to engineering students during their first two years in the program. The effectiveness of this foundation is well tested by the engineering courses taken early in their engineering curriculum. More advanced lab courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome b include:

- General Chemistry Lab I
- University Physics I
- Surveying
- University Physics II
- Surveying Lab
- Eng. Statistics & Probability
- Hydraulic Engineering Lab
- Geotechnical Eng. lab
- Environmental Eng. Lab
- Engineering design contests

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<th>Met Criteria</th>
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<td>50% pass</td>
<td>80</td>
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<tr>
<td>Curriculum / Student Records</td>
<td>95% met all requirements</td>
<td>100</td>
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</tr>
<tr>
<td>Engineering Design Contests</td>
<td>1 contest participation</td>
<td>1</td>
<td>Yes</td>
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The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome b.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Outcome b:

Prepared by Walt Kocher  
5/30/06
Outcome c. An ability to design a system, component, or process to meet desired needs

Several engineering courses provide the design background to engineering students, primarily during their last two years in the program. More advanced design courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome c include:

- Fluid Mechanics
- Structural Analysis I
- Hydraulic Engineering
- Environmental Engineering
- Structural Steel Design
- Geotechnical Engineering
- Structural Analysis II
- Environmental Eng. II
- Reinforced Concrete Design
- Senior Design
- Foundation Engineering
- Transportation Eng.
- Co-op experience
- Engineering design contests

<table>
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<tr>
<td>Fundamentals of Engineering Exam</td>
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<td>80</td>
<td>Yes</td>
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<tr>
<td>Curriculum / Student Records</td>
<td>95% met all requirements</td>
<td>100</td>
<td>Yes</td>
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<tr>
<td>Senior Capstone Design Performance</td>
<td>3</td>
<td>4.75</td>
<td>Yes</td>
</tr>
<tr>
<td>Engineering Design Contests</td>
<td>1 contest participation</td>
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<td>Yes</td>
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The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome c.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Outcome c:

- Hydraulic Engineering: Homework and exam problems
- Structural Analysis I: Exam problems

Outcome d. An ability to function on multi-disciplinary teams

A few advanced engineering courses provide the multi-disciplinary experience to engineering students, primarily during their last two years in the program. The capstone design course provides the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome d include:
Career Orientation
Senior Design
Co-op experience
Engineering design contests

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<th>Score</th>
<th>Met Criteria</th>
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<td>Engineering Design Contests</td>
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The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome d.

**Outcome e.** An ability to identify, formulate, and solve civil engineering problems

Several engineering courses provide the problem-solving background to engineering students. More advanced problem-solving and design courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome e include:

- FORTRAN or ASSI C
- Multi. Calc. for Engineers
- Statics
- Differential Eq. for Engineers
- Strength of Materials
- Fluid Mechanics
- Electrical Eng. Concepts
- Linear Algebra & Num. Methods
- Structural Analysis I
- Hydraulic Engineering
- Environmental Engineering
- Materials Science
- Structural Steel Design
- Geotechnical Engineering
- Dynamics
- Structural Analysis II
- Thermodynamics
- Environmental Eng. II
- Reinforced Concrete Design
- Senior Design
- Technical elective
- Foundation Engineering
- Transportation Eng.
- Co-op experience
- Engineering design contests

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<th>Assessment Method</th>
<th>Minimum Criteria</th>
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<td>Senior Exit Survey</td>
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<td>4.6</td>
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Faculty Course Evaluations | 8 | 62 | Yes
---|---|---|---
Fundamentals of Engineering Exam | 50% pass | 80 | Yes
Curriculum / Student Records | 95% met all requirements | 100 | Yes
Senior Capstone Design Performance | 3 | 4.75 | Yes
Engineering Design Contests | 1 contest participation | 1 | Yes

The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome e.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Outcome e:

- Hydraulic Engineering: Homework and exam problems
- Ground Water Hydrology: Homework and exam problems
- Open Channel Hydraulics: Homework and exam problems

**Outcome f.** An understanding of professional and ethical responsibility

A few engineering courses provide the ethics background to engineering students, primarily during their last two years in the program. The capstone design course provides the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome f include:

- Student Orientation
- Career Orientation
- Environmental Engineering
- Engineering Ethics
- Environmental Eng. II
- Senior Design
- Co-op experience
- ESEP & student organizations
- Engineering design contests
- Order of the Engineer

<table>
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<th>Minimum Criteria</th>
<th>Score</th>
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<tr>
<td>ESEP &amp; other student organizations</td>
<td>2 active organizations</td>
<td>4</td>
<td>Yes</td>
</tr>
<tr>
<td>Order of the Engineer</td>
<td>50% join</td>
<td>60</td>
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<tr>
<td>Engineering Design Contests</td>
<td>1 contest participation</td>
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<td>Yes</td>
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</tbody>
</table>

The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome f.

**Outcome g.** An ability to communicate effectively

Prepared by Walt Kocher 5/30/06
As part of their graduation requirements, students must satisfy the Writing-across-the-Curriculum requirements. Many of these requirements are met by courses offered by the program, and provide significant training in technical writing and presentations. Both the engineering and other colleges provide the communications background for engineering students. Several civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome g include:

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<th>Score</th>
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<td>Curriculum / Student Records</td>
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<td>Yes</td>
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<tr>
<td>Senior Capstone Design Performance</td>
<td>3</td>
<td>4.75</td>
<td>Yes</td>
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<tr>
<td>Engineering Design Contests</td>
<td>1 contest participation</td>
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<td>Yes</td>
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</table>

The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome g.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Outcome g:

- Hydraulic Engineering Lab
  - Lab reports

**Outcome h.** The broad education necessary to understand the impact of civil and environmental engineering solutions in a global and social context

The CVE students must complete a substantial General Education requirement to graduate. The courses include requirements for the categories of Arts/Humanities, Social Sciences, Western Culture, Nonwestern Culture, African-American Experience and Human Diversity. Both the engineering and other colleges contribute to a broad educational background to engineering students. Several civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome h include:

- Gen Ed Elective
Career Orientation
Environmental Engineering
Engineering Ethics
Environmental Eng. II
Senior Design
Engineering Economy
Construction Plan. & Est.
ESEP & student organizations
Engineering design contests
Order of the Engineer

<table>
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<th>Assessment Method</th>
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<th>Score</th>
<th>Met Criteria</th>
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<td>Faculty Course Evaluations</td>
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<td>Curriculum / Student Records</td>
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<td>100</td>
<td>Yes</td>
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<tr>
<td>Senior Capstone Design Performance</td>
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<td>4.75</td>
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<tr>
<td>Engineering Design Contests</td>
<td>1 contest participation</td>
<td>1</td>
<td>Yes</td>
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</table>

* a single semester score

The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome h.

**Outcome i.** A recognition of the need for, and an ability to engage in life-long learning

Both the engineering and other colleges contribute to a recognition of the need for life-long learning to engineering students. Several civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome i include:

Gen Ed Elective
Career Orientation
Engineering Ethics
Senior Design
Co-op experience
ESEP & student organizations
Engineering design contests

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<td>Senior Exit Survey</td>
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<td>4.6</td>
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<td>Faculty Course Evaluations</td>
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<td>Yes</td>
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<td>ESEP &amp; other student organizations</td>
<td>2 active organizations</td>
<td>4</td>
<td>Yes</td>
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<tr>
<td>Engineering Design Contests</td>
<td>1 contest participation</td>
<td>1</td>
<td>Yes</td>
</tr>
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The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome i.

**Outcome j.** A knowledge of contemporary issues

Prepared by Walt Kocher 5/30/06
Both the engineering and other colleges contribute to a knowledge of contemporary issues for engineering students. Several civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome j include:

- Career Orientation
- Environmental Engineering
- Engineering Ethics
- Structural Steel Design
- Environmental Eng. II
- Reinforced Concrete Design
- Senior Design
- Technical elective
- Foundation Engineering
- Transportation Eng.
- ESEP & student organizations
- Engineering design contests

<table>
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<td>Engineering Design Contests</td>
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* a single semester score

The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome j.

**Outcome k.** An ability to use the techniques, skills, and modern engineering tools necessary for civil and environmental engineering practice

Several engineering courses provide the technical skills to engineering students, primarily during their last two years in the program. More advanced design courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome k include:

- FORTRAN or ASSI C
- Environmental Engineering
- Structural Steel Design
- Environmental Eng. II
- Reinforced Concrete Design
- Senior Design
- Engineering Economy
- Technical elective
- Foundation Engineering
- Transportation Eng.
- Construction Plan. & Est.
- Co-op experience
- Engineering design contests

Prepared by Walt Kocher  5/30/06
The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome k.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Outcome k:

- Strength of Materials
- Ground Water Hydrology
- Open Channel Hydraulics
- Structural Analysis I

Outcome l. An ability to complete a comprehensive design problem related to at least four recognized major civil engineering areas

Engineering courses provide comprehensive design experience for engineering students, primarily during their last two years in the program. More advanced design courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome l include:

- Senior Design
- Technical elective
- Construction Plan. & Est.
- Engineering design contests

The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome l.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Outcome l:

- Ground Water Hydrology
- Open Channel Hydraulics

Prepared by Walt Kocher 5/30/06
Outcome m. A commitment to succeed personally, assure employer success, and serve the greater good of society as an engineer

Both the engineering and other colleges encourage success to engineering students. Several civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome m include:

- English
- English II
- Gen Ed Elective
- Surveying Lab
- Hydraulic Engineering Lab
- Engineering Ethics
- Geotechnical Eng. lab
- Strength of Materials Lab
- Environmental Eng. Lab
- ESEP & student organizations
- Engineering design contests

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The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome m.

Outcome n. An understanding of the expectations of a civil/environmental engineer who practices in an industrial, governmental or engineering consulting organization

Primarily engineering courses contribute to an understanding of expectations from engineers. Several civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome n include:

- Career Orientation
- Technical elective
- Construction Plan. & Est.
- Co-op experience
- ESEP & student organizations
- Engineering design contests

<table>
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Prepared by Walt Kocher  5/30/06
The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to outcome n.

**Outcomes Summary.**

The assessment scores indicate that the Civil Engineering Program is meeting all of the stated objectives. For all Outcomes, one course cannot meet the minimum criteria for a Faculty reflection score – at least two courses must contribute significantly to meet the minimum criteria. Other student activities – and their relevant criteria – are used as indicators of meeting Outcome m.

These outcomes and assessment tools will continue to be reviewed and discussed by faculty and the visiting committee in an effort to seek improvement.
Appendix B

SELF-ASSESSMENT OF OBJECTIVES in AY 2004-05

Each program objective has a specific set of assessment tools used to measure the level of success meeting that outcome. Based upon the metric scales of each assessment tool, a set of threshold criteria (Table 4) has been established to determine the level of success meeting each of the objectives. The assessment results, discussion and conclusions will be presented for each outcome.

A summary table of the scores resulting from the faculty course reflections and evaluation process is provided in Table 6.

Objective 1. Have demonstrated proficiency in written, graphical and oral engineering communication

Both the engineering and other colleges provide the communication background to engineering students. Several civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Objective 1 include:

- English II
- Surveying Lab
- Hydraulic Engineering Lab
- Geotechnical Eng. lab
- Senior Design
- Engineering design contests

<table>
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<td>3</td>
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</table>

Meeting relevant Outcomes criteria, as specified, also provides evidence of meeting this Objective. The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to Objective 1.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Objective 1:

- Hydraulic Engineering Lab: Lab reports
- Hydraulic Engineering: Homework and exam problems
- Ground Water Hydrology: Homework and exam problems
- Open Channel Hydraulics: Homework and exam problems

Objective 2. Are prepared to help meet regional needs of business, industry, government and the engineering profession
Primarily engineering courses contribute to the preparation of engineering students to meet regional needs. Several civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Objective 2 include:

Surveying
Career Orientation
Hydraulic Engineering
Environmental Engineering
Engineering Ethics
Structural Steel Design
Geotechnical Engineering
Environmental Eng. II
Reinforced Concrete Design
Senior Design
Technical elective
Foundation Engineering
Transportation Eng.
Construction Plan. & Est.
Co-op experience
ESEP & student organizations
Engineering design contests
Order of the Engineer

<table>
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<td>3</td>
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<td>Yes</td>
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</table>

Meeting relevant Outcomes criteria, as specified, also provides evidence of meeting this Objective. The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to Objective 2.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Objective 2:

- Strength of Materials
- Open Channel Hydraulics
- Structural Analysis I
- Exam Problems
- Homework problems
- Exam problems

**Objective 3.** Are prepared to apply the principles of civil engineering
Primarily engineering courses contribute to the preparation of engineering students to apply the principles of civil engineering. Several civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Objective 3 include:

- FORTRAN or ASSI C
- Surveying
- Multi. Calc. for Engineers
- Differential Eq. for Engineers
- Surveying Lab
- Structural Analysis I
- Hydraulic Engineering
- Hydraulic Engineering Lab
- Environmental Engineering
- Engineering Ethics
- Structural Steel Design
- Geotechnical Engineering
- Geotechnical Eng. lab
- Strength of Materials Lab
- Structural Analysis II
- Environmental Eng. II
- Environmental Eng. Lab
- Reinforced Concrete Design
- Senior Design
- Technical elective
- Foundation Engineering
- Transportation Eng.
- Construction Plan. & Est.
- Co-op experience
- Engineering design contests

<table>
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</table>

Meeting relevant Outcomes criteria, as specified, also provides evidence of meeting this Objective. The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to Objective 3.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Objective 3:

- Hydraulic Engineering Lab Exam

Prepared by Walt Kocher  5/30/06
Hydraulic Engineering  Exams
Ground Water Hydrology  Homework and exam problems
Open Channel Hydraulics  Homework and exam problems
Strength of Materials  Exam Problems
Structural Analysis I  Exam problems

**Objective 4.** Understand the principles of ethical behavior and the society-serving role of practicing civil engineers

Both engineering and non-engineering courses provide the ethics background to engineering students. The capstone design course provides the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Objective 4 include:

Gen Ed Elective  
Career Orientation  
Engineering Ethics  
Senior Design  
ESEP & student organizations  
Engineering design contests  
Order of the Engineer

<table>
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<th>Assessment Method</th>
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<th>Score</th>
<th>Met Criteria</th>
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</table>

Meeting relevant Outcomes criteria, as specified, also provides evidence of meeting this Objective. The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to Objective 4.

**Objective 5.** Are capable of identifying, formulating and solving a wide range of civil engineering problems

Several engineering courses contribute to the preparation of engineering students to solve engineering problems. Many civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Objective 5 include:

FORTRAN or ASSI C  
Surveying  
Structural Analysis I

Prepared by Walt Kocher  5/30/06
Meeting relevant Outcomes criteria, as specified, also provides evidence of meeting this Objective. The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to Objective 5.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Objective 5:

- Hydraulic Engineering Lab: Lab reports
- Hydraulic Engineering: Homework and exam problems
- Ground Water Hydrology: Homework and exam problems
- Open Channel Hydraulics: Homework and exam problems

**Objective 6.** Are capable of designing and conducting experiments, plus analyzing and interpreting data related to civil engineering

Primarily engineering courses contribute to the preparation of engineering students to conduct and analyze experiments. Many civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Objective 6 include:

- General Chemistry Lab I
- Surveying Lab
- Eng. Statistics & Probability
- Hydraulic Engineering Lab
- Geotechnical Eng. Lab
- Strength of Materials Lab
- Environmental Eng. Lab
- Engineering design contests

Prepared by Walt Kocher

5/30/06
Meeting relevant Outcomes criteria, as specified, also provides evidence of meeting this Objective. The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to Objective 6.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Objective 6:

- Hydraulic Engineering Lab: Lab reports
- Ground Water Hydrology: Homework and exam problems
- Open Channel Hydraulics: Homework and exam problems

**Objective 7.** Are capable of designing a system, component or process to meet desired specifications related to at least four recognized major civil engineering areas.

Several engineering courses provide the design background to engineering students, primarily during their last two years in the program. More advanced design courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Objective 7 include:

- Hydraulic Engineering
- Environmental Engineering
- Structural Steel Design
- Environmental Eng. II
- Reinforced Concrete Design
- Senior Design
- Technical elective
- Foundation Engineering
- Transportation Eng.
- Co-op experience
- Engineering design contests

Meeting relevant Outcomes criteria, as specified, also provides evidence of meeting this Objective. The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to Objective 7.

Prepared by Walt Kocher 5/30/06
Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Objective 7:

- Hydraulic Engineering Lab
- Exam
- Hydraulic Engineering
- Homework and exam problems
- Ground Water Hydrology
- Homework and exam problems
- Open Channel Hydraulics
- Homework and exam problems

**Objective 8.** Are capable of functioning as part of a multi-disciplinary group

A few advanced engineering courses provide the multi-disciplinary experience to engineering students, primarily during their last two years in the program. The capstone design course provides the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Objective 8 include:

- Student Orientation
- Gen Ed Elective
- Career Orientation
- Engineering Ethics
- Senior Design
- Co-op experience
- ESEP & student organizations
- Engineering design contests

<table>
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<th>Assessment Method</th>
<th>Minimum Criteria</th>
<th>Score</th>
<th>Met Criteria</th>
</tr>
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</table>

Meeting relevant Outcomes criteria, as specified, also provides evidence of meeting this Objective. The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to Objective 8.

Documented evidence of contributions from specific courses within the curriculum is included in the course binders. The following lists the course binders and materials that have been identified by the faculty as making significant contributions to meeting Objective 7:

- Hydraulic Engineering Lab
- Lab reports

**Objective 9.** Are motivated to continue their professional growth through graduate education and/or professional development

Primarily engineering courses contribute to a recognition of the need to continue professional growth by engineering students. Several civil engineering courses provide the experience most pertinent to the civil engineering profession. The courses and activities that contribute significantly to meeting Outcome i include:
Career Orientation  
Engineering Ethics  
Senior Design  
Technical elective  
Co-op experience  
ESEP & student organizations  
Engineering design contests  
Order of the Engineer

<table>
<thead>
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</tr>
</tbody>
</table>

Meeting relevant Outcomes criteria, as specified, also provides evidence of meeting this Objective. The assessment scores are used to indicate strengths and weaknesses of the program as it pertains to Objective 9.

**Objectives Summary.**

All of the assessment scores are used to indicate if the Civil Engineering Program is meeting all of the stated objectives. However, these objects and assessment tools will continue to be reviewed and discussed by faculty and the visiting committee in an effort to seek improvement.
Appendix C

CLOSING THE LOOP in AY 2005-06

ABET Annual Reports

The purpose of the ABET Annual Reports, initially, was analyze (and later develop a quantitative evaluation tool) the ABET data to determine where we met the ABET criteria, and where we did not.

However, this leaves a gap between meeting the threshold criteria for an accredited program, and the ongoing effort for continual improvement of the program. Therefore, these reports have been expanded to include sections that describe the status of continual improvement efforts over the past year, and also identification of the continual improvement efforts that will be pursued during the coming year. This will close the loop to bridge the gap between assessing if the program meets the threshold criteria and planning for continual improvement.

Several comments were submitted by students regarding the program. One comment referred to the CSU Civil Engineering Program as an excellent program. Another comment suggested less emphasis on structures and more flexibility for other specializations. The growth of the transportation specialization will help to meet those requests. Several students requested more construction related courses. All of these comments will be taken into consideration.

The faculty discuss opportunities and approaches for improvement of the program at every ABET faculty meeting – and at many other faculty meetings as well. These ideas are frequently addressed by a faculty or a faculty sub-committee during the year. When there is a solid plan for action, then it is brought before the faculty for discussion, modification and approval. The ABET report may provide some insight as to where improvements might be made, although there is not an existing deficiency in the program.

The faculty will continue to study ways of improving our curriculum and providing the students with an even better educational opportunity. Faculty are expected to make a conscious effort to address any weaknesses that might be identified through the ABET accreditation process, by means of course modifications and other activity adjustments. These specific issues have been identified and changes have been implemented to address the ABET findings. These changes have been discussed in appropriate sections of this report.

During AY 2005-06, the self-assessment manual was modified, and both the alumni and student employer surveys were developed and implemented. The Senior Design capstone course was further developed, including more-defined course objectives and additional evaluation tools (more direct measures of cumulative student capabilities just prior to graduation).

Prepared by Walt Kocher 5/30/06
The self-assessment program is also developed and implemented a student course reflection and evaluation form, to be used in key courses. This will also reflect the departmental outcomes and objectives, and provide a student perspective similar to the faculty course reflections. The results and ramifications of those results are currently under review.
**Table 1. Civil Engineering Program Outcomes**

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. These outcomes must embrace the ABET required a-k outcomes:

(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
(l) an ability to complete a comprehensive design problem related to at least four recognized major civil engineering areas
(m) a commitment to succeed personally, assure employer success, and serve the greater good of society as an engineer
(n) an understanding of the expectations of a civil/environmental engineer who practices in an industrial, governmental or engineering consulting organization

**Table 2. Civil Engineering Program Objectives**

The objectives of the Civil Engineering program are consistent with the mission statements and guiding principles of the college and the university. The objectives are to produce graduates who:

1. have demonstrated proficiency in written, graphical and oral engineering communication
2. are prepared to help meet regional needs of business, industry, government and the engineering profession
3. are prepared to apply the principles of civil engineering
4. understand the principles of ethical behavior and the society-serving role of practicing civil engineers
5. are capable of identifying, formulating and solving a wide range of civil engineering problems
6. are capable of designing and conducting experiments, plus analyzing and interpreting data related to civil engineering
7. are capable of designing a system, component or process to meet desired specifications related to at least four recognized major civil engineering areas
8. are capable of functioning as part of a multi-disciplinary group
9. are motivated to continue their professional growth through graduate education and/or professional development

Prepared by Walt Kocher 5/30/06
Figure 1. Academic Assessment Report, 1999-2000

<table>
<thead>
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<th>Form completed by:</th>
<th>Date:</th>
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Below is a checklist of common assessment activities. Mark with an X the items carried out in 1999-2000.

**SURVEYS**
- Exit interview
- Alumni survey
- Employer survey
- Best students
- Student survey
- Entrance survey

**PERFORMANCE MEASURES**
- Internal exam
- External exam
- Presentation/project
- Student portfolio
- Program portfolio

**JUDGEMENT ASSESSMENTS**
- Faculty judgments
- External judgments of
- External judgment of
- Student self assessment

**COURSES**
- Course grade
- Program grade analysis
- GPA required
- Special course

**OTHER**
- Pre/post test
- Teaching evaluation

Please type below three short paragraphs for inclusion in our annual report. Please limit your comments to a single page. The needed paragraphs are:

1. A listing of salient findings from the 1999-2000 academic year;
2. A listing of persons who received those findings and could make informed program decisions based at least in part on the findings;
3. A listing of any program/curricular modifications in any way connected to the assessment data.

Prepared by Walt Kocher

5/30/06
Table 3. Schedule of Assessment Measurements

1) Senior Exit Survey – 1 per year near the end of the Spring Semester
2) FE Performance – scores become available 1 per year during the summer
3) Senior Capstone Design Performance – evaluated by project advisors 1 per year near the end of the Spring Semester
4) Student Survey in Key Courses – 1 per year near the end of the semester for each offering of a Key Course
5) Alumni Surveys – conducted every odd-numbered year during the Fall Semester
6) Employers Surveys – conducted every even-numbered year during the Fall Semester
7) Visiting Committee input – meetings conducted 1 per year during the Spring Semester, meeting minutes documented
Figure 2  Senior Exit Survey Form

FENN COLLEGE OF ENGINEERING
Senior Questionnaire
for the Department of Civil & Environmental Engineering
May 2002

1. Indicate your overall rating of each of the faculty as a professor based on your experience in class.

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Poor</th>
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<th>3</th>
<th>4</th>
<th>5</th>
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<td>no experience</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>no experience</td>
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</tbody>
</table>

2. In general, the Civil Engineering Department has provided a _________ quality academic program?

   High     Moderate     Low

3. The College (ESC) courses are of _________ academic quality?

   High     Moderate     Low

4. The Civil Engineering courses are of _________ academic quality?

   High     Moderate     Low

5. Compared to the rest of the University faculty, the Civil Engineering faculty are:

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<th>5</th>
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<td>Superior</td>
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<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
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6. What one engineering course that you took was of least value to you in the program and appeared to be of no future professional value?  __________________________ or none 

7. Who was the most outstanding engineering professor you had at Fenn College of Engineering?  __________________________
(Please see reverse side. Questionnaire Begins on Opposite Side.)

In my studies of Civil Engineering at Cleveland State University I have:

<table>
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<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
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<tbody>
<tr>
<td>1. gained the ability to apply knowledge of mathematics, science, and engineering principles</td>
<td>1 2 3 4 5</td>
<td>5</td>
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<tr>
<td>2. gained the ability to design and conduct experiments, as well as to analyze and interpret data</td>
<td>1 2 3 4 5</td>
<td>5</td>
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<tr>
<td>3. gained the ability to design a system, component, or process to meet desired needs</td>
<td>1 2 3 4 5</td>
<td>5</td>
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<td>4. gained the ability to function on multi-disciplinary teams</td>
<td>1 2 3 4 5</td>
<td>5</td>
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<td>5. gained the ability to identify, formulate, and solve civil engineering problems</td>
<td>1 2 3 4 5</td>
<td>5</td>
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<td>6. gained an understanding of professional and ethical responsibility</td>
<td>1 2 3 4 5</td>
<td>5</td>
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<td>7. gained the ability to communicate effectively</td>
<td>1 2 3 4 5</td>
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<tr>
<td>8. gained a broad education necessary to understand the impacts of civil and environmental engineering solutions in a global and social context</td>
<td>1 2 3 4 5</td>
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<tr>
<td>9. gained a recognition of the need for, and an ability to engage in life-long learning</td>
<td>1 2 3 4 5</td>
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<tr>
<td>10. gained a knowledge of contemporary issues</td>
<td>1 2 3 4 5</td>
<td>5</td>
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<tr>
<td>11. gained the ability to use the techniques, skills, and modern engineering tools necessary for civil and environmental engineering practice</td>
<td>1 2 3 4 5</td>
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<tr>
<td>12. gained the ability to complete a comprehensive design problem related to at least four recognized major civil engineering areas</td>
<td>1 2 3 4 5</td>
<td>5</td>
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<tr>
<td>13. became committed to succeed personally, assure employer success, and serve the greater good of society as an engineer</td>
<td>1 2 3 4 5</td>
<td>5</td>
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<tr>
<td>14. gained an understanding of the expectations of a civil/environmental engineer who practices in an industrial, governmental or engineering consulting organization</td>
<td>1 2 3 4 5</td>
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<tr>
<td>15. Comments on how the Civil And Environmental Engineering Department could be improved.</td>
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</table>
### ABET Course Evaluations by Instructor

**ESC 211 Strength of Materials**  
**Instructor:**  

Please evaluate the level to which you believe each objective & outcome was met by this course during this semester, using the following scale:

1. no contribution;
2. weak contribution;
3. moderate contribution;
4. strong contribution;
5. very strong contribution

#### Objective

1. have demonstrated proficiency in written, graphical and oral engineering communication

2. are prepared to help meet regional needs of business, industry, government and the engineering profession

3. are prepared to apply the principles of civil engineering

4. understand the principles of ethical behavior and the society-serving role of practicing civil engineers

5. are capable of identifying, formulating and solving a wide range of civil engineering problems

6. are capable of designing and conducting experiments, plus analyzing and interpreting data related to civil engineering

7. are capable of designing a system, component or process to meet desired specifications related to civil engineering

8. are capable of functioning as part of a multi-disciplinary group

9. are motivated to continue their professional growth through graduate education and/or professional development

#### Outcome

a) ability to apply knowledge of mathematics, science and engineering to solving problems

b) Ability to identify, formulate, and solve civil engineering problems

c) Others?

#### Comments: please comment on objectives, outcomes, recommendations for changes, preparation of students by prerequisite topics, etc. on the back of this form.

Signature: ___________________________ Date: ____________
ABET Course Evaluations by Students  
CVE 426 Senior Design  Instructor:  
Fall 2004

Please evaluate the level to which you believe each objective & outcome was met by this course during this semester, using the following scale:

(1) no contribution; (2) weak contribution; (3) moderate contribution; (4) strong contribution; (5) very strong contribution

Objective

1. Have demonstrated proficiency in written, graphical and oral engineering communication

2. Are prepared to help meet regional needs of business, industry, government and the engineering profession

3. Are prepared to apply the principles of civil engineering

4. Understand the principles of ethical behavior and the society-serving role of practicing civil engineers

5. Are capable of identifying, formulating and solving a wide range of civil engineering problems

6. Are capable of designing and conducting experiments, plus analyzing and interpreting data related to civil engineering

7. Are capable of designing a system, component or process to meet desired specifications related to civil engineering

8. Are capable of functioning as part of a multi-disciplinary group

9. Are motivated to continue their professional growth through graduate education and/or professional development

Outcome

c) ability to design a system, component, or process to meet desired needs

d) ability to function on multi-disciplinary teams

e) ability to identify, formulate and solve civil engineering problems

f) an understanding of professional and ethical responsibilities

g) ability to communicate effectively

h) an understanding of engineering solutions in a global and social context

i) recognition of the need for, and an ability to engage in, lifelong learning

j) knowledge of contemporary issues

k) ability to use techniques, skills and modern engineering tools in engineering practice

l) ability to complete a comprehensive design problem

n) an understanding of the expectations of a practicing civil/environmental engineer

Please complete the other side of this form
Please evaluate the level that each desired project experience has been satisfied by this course, using the following scale:

(1) no contribution; (2) weak contribution; (3) moderate contribution; (4) strong contribution; (5) very strong contribution

**Desired Project Experiences**

1) Integrate the sub-disciplines of civil engineering

2) Develop criteria for design and performance trade-off and alternatives analyzes to produce cost-effective solutions

3) Gather relevant data, have discussions with the client, identify and use applicable regulations codes and other information

4) Communicate site analyses, work programs and engineering design detail to both technical and non-technical customers

5) Do integrated project planning, scheduling, and cost analysis for a moderately-sized civil engineering project

6) Perform a reasonably detailed design to meet customer requirements using, where appropriate, software and computer techniques to satisfy design objectives and to prepare requested construction documentation

7) Work more effectively on a multi-disciplinary team

**Comments:** please comment on objectives, outcomes, recommendations for changes, recommended prerequisite topics, etc.

Signature: ___________________________ Date: ___________________________
From which engineering program did you receive your bachelor degree at CSU?

Year of graduation with bachelor degree:  ☐ 1997  ☐ 1998  ☐ 1999  ☐ 2000  ☐ 2001  ☐ 2002

How well did your undergraduate studies at Cleveland State University prepare you in the following areas?

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<tr>
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<th>Poor</th>
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<th>Very Well</th>
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19. Since graduation, have you (check all that apply):
☐ Enrolled in graduate course(s)
☐ Attended workshops or short courses
☐ Joined a professional association
☐ Subscribed to or regularly read a technical or professional journal

20. Your current position is (select only one):
☐ Within the engineering field corresponding to your degree
☐ Outside engineering
☐ Within another engineering field
☐ Unemployed

21. Your type of position (select only one):
☐ Consulting
☐ Customer Service/Support
☐ Research or Development
☐ Management
☐ Product Design
☐ Manufacturing/Production
☐ Marketing/Sales
☐ Testing
☐ Product Support
☐ Software Development
☐ Operations/Maintenance
☐ Other

22. Overall, the education that you received at Cleveland State was of:
☐ Low quality  ☐ Moderate quality  ☐ High quality

Please Turn To Other Side 

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Prepared by Walt Kocher  
5/30/06
Civil Engineering and Mechanical Engineering Alumni: Please answer the following questions.

---

**Civil Engineering**

Since graduation, have you (check all that apply):
- ☐ Made formal presentations to your peers? If yes, how many?  
- ☐ Authored or co-authored a paper in a refereed journal? If yes, how many?  
- ☐ Authored or co-authored a paper in a trade journal?  
- ☐ Earned an advanced degree or certificate?

With regards to the Professional Engineers (PE) license, have you (check all that apply):
- ☐ Passed the FE exam  
- ☐ Passed the PE exam  
- ☐ Taken, but not passed, the FE exam  
- ☐ Plan on taking the PE exam  
- ☐ Have not taken the FE exam  
- ☐ Do not plan on taking the PE exam  
- ☐ Taken PE exam, awaiting results  
- ☐ Taken PE exam, awaiting results

---

**Mechanical Engineering**

In your current employment, are you involved with (check all that apply):
- ☐ Fluid/thermal systems  
- ☐ Machine elements  
- ☐ Other

As a student in the mechanical engineering program, did you find the equipment in the mechanical engineering laboratories to be (check only one):
- ☐ Modern and up-to-date  
- ☐ Adequate  
- ☐ Inadequate or out-of-date

What **three** courses from the mechanical engineering program were **most useful** for your career?

_________________________________________  _________________________________________

What **one** course from the mechanical engineering program was **least useful** for your career?

_________________________________________

---

Please write additional comments about your educational experience at Cleveland State University here, or attach another sheet of paper.

---

Thank you for your participation in this survey. Your feedback is greatly appreciated.
Survey of Employers of Civil Engineering from Cleveland State University

Please rate the abilities of our graduates, using the following scale:
(1) strongly disagree; (2) disagree; (3) neither agree or disagree; (4) agree (5) strongly agree

Do our Civil Engineering graduates have:

- technical skills necessary to practice civil engineering
- adequate written communication skills
- adequate oral communication skills
- background to deal with ethical and professional issues as they arise
- engage in life-long learning to keep your technical and professional skills current
- ability to design a system, component or process to meet a need
- ability to work on a multi-disciplinary team
- analyze global and societal impacts of engineering decisions
Alumni Survey
Civil Engineering Program
Cleveland State University

Please rate your abilities, using the following scale:
(1) strongly disagree; (2) disagree; (3) neither agree or disagree; (4) agree (5) strongly agree

Do you believe that our program prepared you for, or provided you with, the following:

- technical skills necessary to practice civil engineering
  
- adequate written communication skills
  
- adequate oral communication skills
  
- background to deal with ethical and professional issues as they arise
  
- engage in life-long learning to keep your technical and professional skills current
  
- ability to design a system, component or process to meet a need
  
- ability to work on a multi-disciplinary team
  
- analyze global and societal impacts of engineering decisions

Please check all of the following that apply:

I have my FE registration.

I am a registered Professional Engineer (PE).

I have my FS registration.

I am a registered professional land surveyor (PS)
<table>
<thead>
<tr>
<th>Current Assessment Methods</th>
<th>Program Outcomes</th>
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<tbody>
<tr>
<td>Senior Exit Survey</td>
<td>a</td>
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<tr>
<td>Faculty Course Reflection</td>
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<td>FE performance by seniors</td>
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<td>Performance</td>
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<td>Induction</td>
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<td>ESEP &amp; student group</td>
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<td>activities</td>
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<td>contests</td>
<td>o</td>
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<tr>
<td>Survey of employers</td>
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<td>of graduates</td>
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Prepared by Walt Kocher  5/30/06
## Table 5. Assessment Criteria for Meeting Outcomes and Objectives

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<td>the mean score for each question must meet or exceed 3.25</td>
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<tr>
<td>Faculty Course Reflection &amp; Evaluations</td>
<td>at least 95% of the evaluations per year must indicate met outcomes</td>
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<tr>
<td>FE performance by seniors</td>
<td>at least 50% of students taking the exam pass it</td>
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<td>Senior Capstone Design performance</td>
<td>at least 80% of projects are rated satisfactory or better by evaluators</td>
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<tr>
<td>Curriculum / Students' academic records</td>
<td>at least 95% of graduates meet the &quot;writing-across-the-curriculum&quot; requirements</td>
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<td>Order of the Engineer induction</td>
<td>at least 95% of graduates satisfied the CVE curriculum requirements</td>
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<td>ESEP &amp; student group activities</td>
<td>at least 95% of graduates earned a &quot;C&quot; or better in the ESC and CVE courses</td>
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<td>Engineering design contests</td>
<td>At least 30% of the graduating class join the Order of the Engineer</td>
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<td>Survey of employers of graduates</td>
<td>at least 2 student groups are active during the year</td>
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<td>student participation in at least 1 engineering contest per year</td>
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Civil Engineering Program AY 2003 - 2004

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Total: 56  71  85  66  74  58  71  54  57
### Table 7: ABET EC 2000 Curriculum to Meet Outcomes

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### Program Outcomes

- a. Apply math. sci., & eng data
- b. Experiment & analyze data
- c. Design system, processes & sys.
- d. Multidisciplinary teams
- e. Civil engineering problems
- f. Ethical responsibility
- g. Communicate effectively
- h. Global and social context
- i. Life-long learning
- j. Contemporary issues
- k. Comprehensive design
- l. Serve the greater good
- m. Understand's expectations
Table 7. ABET EC 2000 Curriculum Designed to Meet Outcomes

Civil Engineering Program

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Prepared by Walt Kocher 11/12/04
Appendix D

ABET review responses

2. **Professional Component**  Criterion 4 requires a major design experience, based on earlier course work, that incorporates engineering standards and realistic constraints. The capstone design course, CVE 426, Senior Design, addressed standards and constraints only to a very limited extent.

The capstone senior design course has always emphasized standards and constraints, and the faculty who team teach the course are “exceptionally well qualified in engineering practice, by virtue of the fact that eight of ten tenured faculty are licensed professional engineers, a commendable percentage,” as noted as a program strength by the reviewer earlier in the ABET DRAFT STATEMENT. However, the CVE 426 course syllabus was weak in identifying the importance of standards and constraints in the capstone design project. Hence, the syllabus for the CVE 426 was revised and the new syllabus distributed to the students in November 2004. In addition, course performance indicator self-review forms for CVE 426 were also developed, and used by the students, and a revised form for the review of student/group performance was developed and used by the faculty. Both forms are included at the end of this section. As further documentation, the senior design presentations are now videotaped. Preliminary presentations are videotaped, critiqued and returned to each student, so that they may improve upon their oral presentation skills before their final presentation. (The final senior design presentations, to the faculty and visiting committee, will be made on April 28, 2005. They will also be videotaped.) Copies of preliminary and final presentations are also being retained by the Department for future ABET reviews.
CVE 426 - Senior Design

Catalog Description: Senior Design (0-3-2). Prerequisite: Senior Standing. A capstone course which applies and extends previously developed principles of civil engineering. Students work in multi-disciplinary teams on the planning, design and analysis of a civil project, involving as much as possible all major aspects of the civil engineering profession. Computer-aided analysis, cost estimation, planning and management should be included in the design. Registration must be for two consecutive semesters of two credits each.

Textbook: None

References: Material used in previous courses, including textbooks, building codes, software, etc.

Coordinator: Paul A. Bosela, Ph.D., P.E., Professor
Civil and Environmental Engineering Department

Course Objectives: To provide the student with the opportunity to apply the concepts and procedures used in their previous courses to a comprehensive design project, which encompasses the various sub-disciplines within civil engineering

Expected Outcomes: To use and gain experience in the design methodologies and codes which are applicable to the various areas of civil engineering.

To gain experience in how design interrelates with planning, analysis, cost estimation, construction, etc. in order for a project to come to fruition.

To get experience in working on multi-disciplinary teams

Partial Fulfillment of the Following Civil Engineering Program Objectives and Outcomes:

Objectives:

1) have demonstrated proficiency in written, graphical and oral engineering communications
2) are prepared to help meet regional needs of business, industry, government and the engineering profession
3) are prepared to apply the principles of civil engineering
4) understand the principles of ethical behavior and the society-serving role of practicing civil engineers
5) are capable of identifying, formulating and solving a wide range of civil engineering problems
6) are capable of designing and conducting experiments, plus analyzing and interpreting data related to civil engineering
7) are capable of designing a system, component or process to meet desired specifications related to civil engineering
8) are capable of functioning as part of a multi-disciplinary group
9) are motivated to continue their professional growth through graduate education and/or professional development
Outcomes:

  c) ability to design a system, component, or process to meet desired needs
  d) ability to function on multi-disciplinary teams
  e) ability to identify, formulate, and solve civil engineering problems
  f) an understanding of professional and ethical responsibilities
  g) ability to communicate effectively
  h) an understanding of engineering solutions in a global and social context
  i) recognition of the need for, and an ability to engage in life-long learning
  j) knowledge of contemporary issues
  k) ability to use techniques, skills and modern engineering tools in engineering practice
  l) ability to complete a comprehensive design problem
  n) an understanding of the expectations of a practicing civil/environmental engineer

Prerequisites:

  Senior standing in Civil Engineering

Laboratory Projects:

  As required by the individual project. Typically includes field surveying and geotechnical sampling and testing

Computer Usage:

  As required by the individual project. Typically includes AutoCAD, Hydraulics software, structural analysis software, Richardson’s Estimating software, etc.

Contribution of the Course to Meeting the Professional Component:

This course provides a major design experience based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and realistic constraints that include most of the following considerations: economic; environmental; sustainability; constructability; ethical; health and safety; social; and political.

- Site Investigation
  - Pre-design inspection
  - Environmental assessment
  - Utility location
  - Soil sampling (Geo-probe or drilling rig)
  - Site access, safety and constructability issues

- Discussion with client and architectural students

- Review applicable building codes, zoning, soil maps, flood maps, etc.

- Soil testing

- Prepare alternate designs using appropriate building codes and constraints

- Selection of design based upon various constraints

- Project schedule

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Instructional Staff:

$ Dr. Paul Bosela, P.E.  Project Management

$ Dr. Paul Bellini, P.E.  Computer Analysis

$ Dr. Norbert Delatte, P.E.  Structural Design (Concrete, Pavement, Reinforced Masonry, Timber), Transportation

$ Dr. Steve Duffy, P.E.  Structural Design (Steel, Reinforced Masonry), Surveying, CAD

$ Dr. Phil DeGroot, P.E.  Water Resources, Hydraulics

$ Dr. Lutful Khan, P.E.  Geotechnical Testing and Analysis, Foundation Design, Environmental Remediation

$ Dr. Yung-tse Hung, P.E.  Water and Wastewater Treatment

$ Dr. Walter Kocher, EIT  Environmental Impact, Sustainability

$ Dr. Nilufer Dural  Environmental/Chemical Engineering

$ Dr. John Tomko, P.E.  Structural Design (Concrete, Steel, Timber)

$ Professor Greg Tkachyk, P.E.  Architecture, Structural Engineering (Kent State University)


References:

Minimum Design Loads for Buildings and Other Structures, ASCE 7-02

Quality in the Constructed Project, Second Edition, ASCE No. 73.

How to Work Effectively with Consulting Engineers

Getting the Best Project at the Right Price for your Public Constituents
ASCE Manual 45

Ohio Building Code (OBC/IBC)

Highway Capacity Manual

AASHTO Manuals

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By the end of the course, students should be able to:

1. Integrate the sub-disciplines of civil engineering, develop criteria for design and perform trade off and alternatives analyses to produce cost-effective solutions.

2. Gather relevant data, have discussions with the client, identify and use applicable regulations, codes and other information.

3. Communicate site analyses, work programs and engineering design detail to both technical and non-technical customers.

4. Do integrated project planning, scheduling, and cost analysis for a moderately-sized, civil engineering project.

5. Perform a reasonably detailed design to meet customer requirements using, where appropriate, software and computer techniques to satisfy design objectives and to prepare requested construction documentation.

ABET Course Evaluations by Students
CVE 426 Senior Design  Instructor:  Fall 2004

Please evaluate the level to which you believe each objective & outcome was met by this course during this semester, using the following scale:

(1) no contribution; (2) weak contribution; (3) moderate contribution; (4) strong contribution; (5) very strong contribution

Objective

1. Have demonstrated proficiency in written, graphical and oral engineering communication

2. Are prepared to help meet regional needs of business, industry, government and the engineering profession

3. Are prepared to apply the principles of civil engineering

4. Understand the principles of ethical behavior and the society-serving role of practicing civil engineers

5. Are capable of identifying, formulating and solving a wide range of civil engineering problems

6. Are capable of designing and conducting experiments, plus analyzing and interpreting data related to civil engineering

7. Are capable of designing a system, component or process to meet desired specifications related to civil engineering

8. Are capable of functioning as part of a multi-disciplinary group

9. Are motivated to continue their professional growth through graduate education and/or professional development

Outcome

c) ability to design a system, component, or process to meet desired needs

d) ability to function on multi-disciplinary teams

e) ability to identify, formulate and solve civil engineering problems

f) an understanding of professional and ethical responsibilities

g) ability to communicate effectively

h) an understanding of engineering solutions in a global and social context

i) recognition of the need for, and an ability to engage in, lifelong learning

j) knowledge of contemporary issues

k) ability to use techniques, skills and modern engineering tools in engineering practice

l) ability to complete a comprehensive design problem

m) an understanding of the expectations of a practicing civil/environmental engineer

Please complete the other side of this form

Prepared by Walt Kocher

5/30/06
Please evaluate the level that each desired project experience has been satisfied by this course, using the following scale:

(1) no contribution; (2) weak contribution; (3) moderate contribution; (4) strong contribution; (5) very strong contribution

**Desired Project Experiences**

1) Integrate the sub-disciplines of civil engineering

2) Develop criteria for design and performance trade-off and alternatives analyzes to produce cost-effective solutions

3) Gather relevant data, have discussions with the client, identify and use applicable regulations codes and other information

4) Communicate site analyses, work programs and engineering design detail to both technical and non-technical customers

5) Do integrated project planning, scheduling, and cost analysis for a moderately-sized civil engineering project

6) Perform a reasonably detailed design to meet customer requirements using, where appropriate, software and computer techniques to satisfy design objectives and to prepare requested construction documentation

7) Work more effectively on a multi-disciplinary team

**Comments:** please comment on objectives, outcomes, recommendations for changes, recommended prerequisite topics, etc.

Signature: _________________________     Date: _______________
Prepared by Walt Kocher 5/30/06
### CVE 426 Senior Design  
#### Project Presentation Evaluation by faculty  
**Fall 2004**

**Project title:** 

**Student Design Team Members:**

Please indicate your initial rating of performance to date in these areas. (U=unsatisfactory, P=Progress, S=satisfactory)

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<td>Use of Standards</td>
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**Comments:**

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

Prepared by Walt Kocher  

5/30/06
Project Concerns: (Ex. Behind schedule, lack of adequate participation by some members, crucial topics not being covered, etc. Please be specific.)

Completed by: ____________________     Date: ____________________

Prepared by Walt Kocher  5/30/06
**Program Concerns**

1. **Criterion 3. Program Outcomes and Assessment**

Two intended assessment methods, i.e., surveys of alumni & External Advisory Committee input, were not accomplished.

As mentioned previously, the assessment manual formally established assessment processes and procedures to be followed by all faculty. The Alumni and Employer surveys have been specifically addressed to obtain good quality input from those two constituent groups.

The procedure for providing formal documentation of the input from the External Advisory Committee has also been addressed by this manual.

In addition to the survey from the alumni office, we will be doing the following:

$ Surveying our employers and alumni every year at the OTEC Breakfast and visiting committee meeting. (Based upon past attendance, we anticipate approximately 20 alumni at the OTEC Breakfasts, many of whom are employers of our students as well.)

$ Perform an alumni survey by mail from the Department or Engineering Dean’s Office every two years
Survey of Employers of Civil Engineering
from Cleveland State University

Please rate the abilities of our graduates, using the following scale:
(1) strongly disagree; (2) disagree; (3) neither agree or disagree; (4) agree (5) strongly agree

Do our Civil Engineering graduates have:

$ technical skills necessary to practice civil engineering 

$ adequate written communication skills

$ adequate oral communication skills

$ background to deal with ethical and professional issues as they arise

$ engage in life-long learning to keep your technical and professional skills current

$ ability to design a system, component or process to meet a need

$ ability to work on a multi-disciplinary team

$ analyze global and societal impacts of engineering decisions

Prepared by Walt Kocher 5/30/06
Alumni Survey
Civil Engineering Program
Cleveland State University

Please rate your abilities, using the following scale:
(1) strongly disagree; (2) disagree; (3) neither agree or disagree; (4) agree (5) strongly agree

Do you believe that our program prepared you for, or provided you with, the following:

$ technical skills necessary to practice civil engineering

$ adequate written communication skills

$ adequate oral communication skills

$ background to deal with ethical and professional issues as they arise

$ engage in life-long learning to keep your technical and professional skills current

$ ability to design a system, component or process to meet a need

$ ability to work on a multi-disciplinary team

$ analyze global and societal impacts of engineering decisions

Please check all of the following that apply:

I have my FE registration.

I am a registered Professional Engineer (PE).

Prepared by Walt Kocher

5/30/06
I have my FS registration.

I am a registered professional land surveyor (PS)