This document describes the evaluation of ABET Program Educational Objectives (PEOs) and Student Outcomes for the Civil Engineering undergraduate program for 2016-17. Data were collected throughout the year and evaluated by the CEE Assessment Committee (Drs. Barr, Dupont, McNeill, and Tullis) in June 2017.

**Program Educational Objectives**

The Civil Engineering (CE) Program Educational Objectives (PEOs) are reviewed by each of the program’s three constituencies (Table 1).

### Table 1: PEO Review Process and Schedule for CE Program Constituency

<table>
<thead>
<tr>
<th>Constituency</th>
<th>Review opportunity</th>
<th>Frequency</th>
<th>Most recent reviews</th>
<th>Date of next review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>Freshman Orient. (CEE 1880)</td>
<td>Every freshman class (Fall and Spring)</td>
<td>Spring semester 2017</td>
<td>Fall semester 2017</td>
</tr>
<tr>
<td></td>
<td>Junior design course (CEE 3880)</td>
<td>Every junior class (Spring)</td>
<td>Spring 2017</td>
<td>Spring 2018</td>
</tr>
<tr>
<td></td>
<td>Senior exit interview</td>
<td>Every graduating class (Spring)</td>
<td>April 2017</td>
<td>April 2018</td>
</tr>
<tr>
<td>Employers</td>
<td>Advisory Board meeting</td>
<td>Annually (typically late Fall)</td>
<td>November 2016</td>
<td>November 2017</td>
</tr>
<tr>
<td>Faculty</td>
<td>CEE Faculty Retreat</td>
<td>Annually (August)</td>
<td>August 2016</td>
<td>August 2017</td>
</tr>
</tbody>
</table>

**Students:** The PEOs are introduced to the freshman class in CEE 1880 as part of a lecture on the accreditation and licensing processes (see the slides in Appendix A). PEOs are again shown to the juniors in CEE 3880. This reminds continuing students about the PEOs and allows transfer students (who typically do not take CEE 1880) to see the PEOs. Finally, as part of the senior exit interview process, graduating seniors are given an opportunity to review the PEOs in an effort to establish some big picture career goals. Student comments related to the PEOs (Appendix B) were very positive.

**CEE Advisory Board:** The CEE Advisory Board met on November 8, 2016 (see Appendix C for meeting minutes). The PEOs were reviewed and discussion included the desire for the program to encourage students to improve their communication skills (PEO1) and support for including “sustainability considerations” in PEO2. The Advisory Board unanimously approved keeping the current PEOs. The PEOs will continue to be reviewed and discussed at all future annual Advisory Board Meetings.
**Program Faculty:** The PEOs are reviewed and discussed with the program faculty at the annual faculty retreat, which takes place every August just prior to the Fall semester. The faculty unanimously approved keeping the current PEOs during the 2016 faculty retreat (see Appendix D for meeting minutes). The PEOs will continue to be reviewed and discussed at all future annual faculty retreats.

**Student Outcomes**
Assessment of the Student Outcome attainment is conducted by the CEE Assessment Committee on a specified schedule with approximately one-third of the Student Outcomes assessed every year (Table 2). When deficiencies are identified, recommendations are made to fix specific problems and support continuous improvement. For example, Outcomes b and f were re-assessed this year because the program did not meet the performance goals in 2015-16.

**Table 2: Evaluation Schedule for Student Outcomes**

<table>
<thead>
<tr>
<th>Evaluation Date</th>
<th>School Year</th>
<th>Outcomes evaluated</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2015</td>
<td>2014-15</td>
<td>a, b, c, d</td>
</tr>
<tr>
<td>May 2016</td>
<td>2015-16</td>
<td>b, e, f, g</td>
</tr>
<tr>
<td><strong>May 2017</strong></td>
<td><strong>2016-17</strong></td>
<td><strong>b, f, h, i, j, k</strong></td>
</tr>
<tr>
<td>May 2018</td>
<td>2017-18</td>
<td>a, b, c, d</td>
</tr>
<tr>
<td>May 2019</td>
<td>2018-19</td>
<td>e, f, g</td>
</tr>
<tr>
<td>May 2020</td>
<td>2019-20</td>
<td>h, i, j, k</td>
</tr>
</tbody>
</table>

The assessment process uses data from three sources: student coursework, FE Exam results, and senior exit interviews. The 2016-17 Assessment of Student Outcomes includes data from Fall 2016 and Spring 2017.

**Student Coursework:** Outcomes b, f, h, i, j, and k were reviewed in 2016-17 (Table 2). Assessment data are summarized in Table 3 and Figure 1; detailed evaluation of each outcome is presented in Appendix E. Student assignments are evaluated on a 0-1-2 scale, which corresponds to the student’s performance not meeting, partially meeting, and meeting the Outcome Objective, respectively. The CE program has two goals for student performance:

- **Goal 1:** a minimum of 70% of the students will perform at a 2 level
- **Goal 2:** a minimum of 80% of the students will perform at the 1 or 2 level.

Note the “sample size” in Table 3 refers to the number of individual examples of student work that were assessed for each outcome, not the number of students.
### Table 3: Aggregated Assessment Results for CE Classes, Fall 2016 and Spring 2017

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Sample size</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>Sum of 1&amp;2 ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>244</td>
<td>80%</td>
<td>18%</td>
<td>2%</td>
<td>98%</td>
</tr>
<tr>
<td>f</td>
<td>298</td>
<td>72%</td>
<td>22%</td>
<td>6%</td>
<td>94%</td>
</tr>
<tr>
<td>h</td>
<td>459</td>
<td>80%</td>
<td>16%</td>
<td>4%</td>
<td>96%</td>
</tr>
<tr>
<td>i</td>
<td>291</td>
<td>85%</td>
<td>8%</td>
<td>7%</td>
<td>93%</td>
</tr>
<tr>
<td>j</td>
<td>485</td>
<td>72%</td>
<td>22%</td>
<td>6%</td>
<td>94%</td>
</tr>
<tr>
<td>k</td>
<td>525</td>
<td>86%</td>
<td>12%</td>
<td>2%</td>
<td>98%</td>
</tr>
</tbody>
</table>

### Figure 1: Aggregated Assessment Results for CE Classes for Fall 2016 and Spring 2017

Figure 1: Aggregated Assessment Results for CE Classes for Fall 2016 and Spring 2017
Both goals were met for all Outcomes b, f, h, i, j, and k. Continuing from previous years, assessment for Outcome b is looking at students’ ability to design experiments, as well as to conduct experiments and analyze/interpret data. The introduction of assignments requiring students to design (not just conduct) experiments to the CEE 3160 (Material Science) and CEE 3500 (Fluid Mechanics) classes has been very successful. We have also been able to successfully demonstrate student achievement on outcome f (ethics) after failing to meet our goals the past two years. It’s not that our students were unethical in the past; rather, we were not properly assessing ethics. That has now been rectified.

**Fe Exam:** Our goal is to have 100% pass rate on the FE exam; our minimum acceptable level of performance is a pass rate at or above the national average. Table 4 summarizes the FE results for the past six years, including the percentage of students who had passed the FE exam by the time of graduation. The USU CE pass rate has been between 90% and 100%, well above the national average.

Table 4: CE Graduates Passing FE Exam vs. National Pass Rate

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total CE degrees</td>
<td>50</td>
<td>43</td>
<td>56</td>
<td>61</td>
<td>53</td>
<td>55</td>
</tr>
<tr>
<td>% graduates passing FE</td>
<td>90%</td>
<td>95%</td>
<td>93%</td>
<td>100%</td>
<td>98%</td>
<td>100%</td>
</tr>
<tr>
<td>National CE pass rate</td>
<td>74%</td>
<td>74%</td>
<td>72%</td>
<td>70%</td>
<td>69%</td>
<td>69%</td>
</tr>
</tbody>
</table>

FE Exam performance by first-time test takers for various engineering topics is summarized in Figures 2, 3, 4, and 5. During the Fall 2016 and Spring 2017 testing periods, USU CE students performed at or above the national average (including the uncertainty range) on all engineering topics, with the exception of Dynamics (Fall 2016, Figure 2) and Fluid Mechanics (Spring 2017, Figure 4). The low scores on these topics seems to be an outlier, as performance was improved in subsequent semesters. Overall, the fact that nearly all CE students continue to pass the FE exam is a strong, independent, external indicator for meeting Student Outcomes b, f, and k. It is also an indication of a good foundation for life-long (independent) learning skills.
Figure 2: Scaled FE Exam results (statics, dynamics, mechanics, and materials). Error bars represent uncertainty range for scaled scores.

Figure 3: Scaled FE Exam results (structural analysis and design, geotechnical engineering, transportation engineering). Error bars represent uncertainty range for scaled scores.
Figure 4: Scaled Fe Exam results (fluids, hydraulics, environmental engineering). Error bars represent uncertainty range for scaled scores.

Figure 5: Scaled Fe Exam results (ethics and professional practice, economics, construction, surveying). Error bars represent uncertainty range for scaled scores.
**Senior exit interview**: Graduating seniors complete an anonymous online exit interview to provide feedback about the CE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met (2)” or “partly met (1)”, which was achieved for all six outcomes (Figure 6). Acknowledging that this is a subjective self-evaluation, these exit interview results are taken as a general indication that students feel they are meeting the outcome.

![Figure 6: Student exit interview ratings of progress on Outcomes b, e, f, and g](image)

**Summary**: The CEE Assessment Committee met in June 2017 and evaluated all of the assessment data presented herein.

The evaluation of student work, FE Exam results, and senior exit interviews indicates that all Outcomes b, f, h, i, j, and k are being met. Outcomes b and f were re-assessed due to not meeting our performance goals last year, and student performance this year (2016-17) is satisfactory.

**Recommendations**
Evaluate Outcomes a, b, c, and d as planned during the 2017-18 school year.
Appendix A

Slides from CEE 1880

(introducing freshmen students to ABET PEOs and outcomes)
ABET is a non-profit, non-governmental organization that accredits college and university programs in the disciplines of applied science, computing, engineering, and engineering technology. The criteria for accreditation include the following:

- A program must be in a college or school of engineering.
- The department must have a clear mission and goals.
- The program must provide a high-quality education that leads to a degree in engineering.
- The program must have a process for evaluating student performance.
- The program must have a process for assessing the effectiveness of the program.
- The program must maintain high standards for curriculum, instruction, and faculty.

ABET accreditation, which is voluntary, and achieved through a peer review process. It is a mark of excellence in the field of engineering.

Program Educational Objectives:

- Graduates of the Civil Engineering and Environmental Engineering program will be prepared to be effective professionals in a variety of positions, including:
  - Designers and engineers for private and public sector organizations.
  - Consulting engineers.
  - Research engineers.
  - Government officials.
  - Educators.

Program Educational Outcomes:

- Graduates will be prepared to:
  - Apply the principles of engineering to solve problems.
  - Use the methods of engineering analysis and design.
  - Make informed engineering judgments.
  - Work effectively as a member of a team.

Market Outcomes:

The Civil Engineering and Environmental Engineering Program prepares students to be effective professionals in a variety of positions. The program emphasizes the following outcomes:

- Application of knowledge to solve engineering problems.
- Design and analysis of complex engineering systems.
- Use of contemporary techniques and tools.
- Communication of technical ideas.
- Engineering ethics and professional responsibility.

ABET Accreditation at Utah State University leads to proficiency in at least 4 areas of Civil and Environmental Engineering:

- Structural Engineering
- Geotechnical Engineering
- Water Resources
- Environmental Engineering
Appendix B
Student Comments on PEOs from Exit Interviews

• I agree with all of the PEO's.
• I agree with all of these and plan to pursue the four options listed after graduation.
• I think it would be beneficial to have a class on ethics and responsibility, maybe in tandem with the business college. To help prepare students for the world of business and for working with businesses.
• I think that the courses taken here allow us to get a very big picture of what gets done all around the world. However, I don't think that it is possible to get our feet wet enough in all aspects of design to fully prepare us for the real world.
• I think these objectives are realistic and what makes a professional engineer.
• I think they are great.
• No. They all look great!
• Not sure the curriculum can meet all these objectives. PEO 3 involve conferences and professional societies that are not introduced by professors. I did not have any idea about group like the young member forum in the ASCE until this semester. I am sure introductory course to CEE can also focus on groups and opportunities that are available. The word "continue" implies that I have already been involved with conferences and societies during my education, which is not fully true.
• PEO 3 was not particularly met. USU did not set me up well for graduate study, and professors rarely, if ever, discussed graduate-level research.
• Sound good. How will they be tracked?
• The objectives are well defined.
• There needs to be way more focus on learning how to used software more effectively to solve problems (Excel, Smath Studio, etc.) and practical design/problem solving after the fundamentals classes. Also, most professors cover theory in class then assign math problems for homework and exams. So students have to spend time learning how to work engineering problems they weren't taught how to solve. Theory should be assigned outside of class, and problems should be worked in class.
• These all sound like great objectives!
• These PEO's are great goals and have been helped.
• They sound like great objectives, but I literally was not aware that they existed until I took this survey.
• I think those are excellent goals, but I also don't see them displayed anywhere else but here. If they became a part of the classes, even if just for a day, you'd probably be more likely to actually achieve them. If that's the goal here. If they just exist for show, then yeah, they sound great! I hope to follow those things, for the record.
• Don't really have any comment. Really hoping I can accomplish all of these in 5 years, though finding a job is beginning to be increasingly difficult.
• USU should provide more training in standard programs used in the Civil field. Programs such as CAD, Microstations, etc.
Appendix C
Minutes of the CEE Advisory Board Meeting Nov 8, 2016

Intro
- Fall 2016
  - Passing FE exam is now a requirement
  - FE exam now has more civil based updates
  - Civil pass rate: 95%
  - CEE 1880 is taught both spring and fall
    ♣ Freshman class is the same size as sophomore class
 ♣ Our department is growing
    • Worried about maintaining quality of one on one connection
 ♣ This is why we are meeting with CEE 1880 classes
    • Gives the students an opportunity to meet and ask questions
 ♣ Questions for the students
    • Why did you decide to study CEE?
    • What is your biggest difficulty being a CEE student so far?
    • What has been your best experience so far as a CEE student?
    • What improvements to the program can you suggest?

ABET-Laurie
- Review of PEOs
  - Program educational objectives
  - What our students will be able to do 5 years out
  - Feedback from advisory board?
    ♣ Professional licensure?
      • Yes/no-we get aggregate stats on our students; just a number who passed the PE and FE exams
      • EnvE students are tracked since there are so few
    ♣ No additional comments
  - Student outcome ratings
    ♣ rated from 0-2
      • 0-didn’t understood
      • 1-kind of understood
      • 2-completety understood
    ♣ Goal to have more than 70% at the “2” level
    ♣ Is there a better time to evaluate different outcomes?
      • We’re looking at evaluating different classes
    ♣ EnvE was successful with all student outcomes measured
  - Fe exam pass rate
    ♣ Goal is to have 100% pass rate
    ♣ CEE is above the national average
  - Outcomes B&F are being reevaluated along with H,I,J, & K

Note: non-ABET related items have been removed from these minutes
Questions/Comments

工程师们对伦理的观察能与其它专业人士不同

- 它将有助于知道并非所有的专业人士都如此强烈的伦理观
  - 律师们对客户有忠诚，工程师们更诚实，等等。
  - 信息可以被轻易地获取，扭曲和利用。
- 你不能“反其道而行之”，伦理教育。我赞赏你为确保我们的学生留下一个坚实道德原则的努力。

什么发生在那些通过FE考试的学生上?

- 我们提供资源和帮助确保学生通过。即使不是第一次，甚至第二次。
- “我永远不会改变通过FE考试的要求”
Note: non-ABET related items have been removed from these minutes

**Appendix D**

**CEE Annual Faculty/Staff Retreat Minutes**

August 22, 2016

Laurie-ABET

- Review program (PEO)
- To-do list for this year

PEO handout

- Changes?
  - What are students doing 5 years after graduation?
- Criteria 4
  - Student coursework
  - FE exam
  - Exit interview results

- Outcome of student schedule
  - Each year we review a subset of the outcomes
  - Subsets B,E,F,G

- Student course work rating scale
  - 0,1,2 rating scale
  - We need at least 70% at the 2 level
  - 80% at performing level (1-2)
  - Summary
    - ♠ E outcome met
    - ♠ G outcome met
    - ♠ B goal was not met (design and conduct)
    - ♠ F goal not met (ethics)
    - ♠ Environmental met all goals =]

- FE Exam
  - 100% pass rate
  - Minimum goal is to be at or above national pass rate
  - CE 98% pass rate
    - ♠ 69% nationally
  - Environmental
    - ♠ 78% pass rate
      - 76% nationally
  - Last year, we were above, or within, the error bar of national average for performance
  - Bottom line:
    - ♠ All students scored at or above on all FE exam topics

- Senior exit interviews
  - Self assessment for students
  - We would like to see that 80% are understanding curriculum
    - ♠ All students feel they met expectations

- Evaluation
  - Student course work: goals met for outcomes E,G but not for B, F
  - Outcomes B,F need to be redone
We didn’t assess enough classes

- Evaluation schedule
  - H,I,J,K plus B,F
  - Assess two outcomes in all required UG classes

- Outcome B
  - Design and conduct experiments
    - Materials
    - Fluids
    - Soils
    - Hydraulics
    - Others?
  - We’ve failed the last two years with outcome B

- Outcome F
  - Ethics
    - This can be done in any and all of our classes
    - The challenge is assessing….
      - www.asce.org/ethics
      - Case studies and ethically considered column
      - Ideas for classes

- Outcomes H,I,J
  - Outcome H
    - Anything beyond the textbook
  - Outcome I
    - CEE orientation
    - EnvE sophomore seminar
    - Junior/senior design
    - Others?
  - Outcome J
    - Knowledge of contemporary issues
      - Everyone!

- Outcome K
  - Ability to use techniques and skills for modern engineering
    - Anyone using software, design codes
    - May have to rely on elective classes
    - CEE 4870/4880?

- Program criteria for CE
  - Probability and statistics
  - Include principles of sustainability in design
  - Explain basic concepts in project management, business, public policy, and leadership

- These don’t need to be formally assessed, but we do have to discuss where the students are getting these concepts in our curriculum.
Appendix E
Detailed Evaluation for Outcomes b, f, h, i, j, and k

See following pages
Civil Engineering
ABET Outcome Summary
2016-2017

Outcome b: an ability to design and conduct experiments, as well as to analyze and interpret data

Student Course Work Assessment

Student work is rated on a 0 – 1 – 2 scale:

- 0 = student did not understand the fundamental principle or component
- 1 = student applied some but not all of the fundamental principles in their solution
- 2 = student applied the correct fundamental principles in their solution

The CE program has two goals for student performance for student course work assessment:

- Goal 1: a minimum of 70% of the students will perform at a 2 level
- Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

This outcome was assessed in three lab- and lecture-based courses (see Table B-1 on the next page), using 244 samples of student work. Based on the Assessment Committee’s recommendation, during Fall 2015 we intentionally introduced assignments requiring students to design (not just conduct) experiments to the CEE 3160 (Material Science) and CEE 3500 (Fluid Mechanics) classes. Last year (2015-2016), we met Goal 2 but did not meet Goal 1, with just under 70% of students rating a 2. This year, instructors refined their ‘design an experiment’ exercises and student performance improved. Goal 1 was met with 80% of student work rating a 2 and Goal 2 was met with 98% of student work rating a 1 or 2 (Figure B-1). In fact, these exercises are popular with students and we are pleased with their incorporation into the curriculum.

Figure B-1: Summary of ratings of student work on Outcome b
Table B-1: List of student work assessed for Outcome b

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Instructor</th>
<th>Term</th>
<th>Enrol.</th>
<th>Method</th>
<th>Description</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE</td>
<td>Surveying</td>
<td>Caliendo</td>
<td>F 2016</td>
<td>121</td>
<td>lab</td>
<td>surveying traverse special problem</td>
<td>70%</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE</td>
<td>Civil Engineering Materials</td>
<td>Sorensen</td>
<td>F 2016</td>
<td>52</td>
<td>lab exercise</td>
<td>design expt to test diff materials under loading</td>
<td>90%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE</td>
<td>Hydraulics</td>
<td>Urroz</td>
<td>Sp 2017</td>
<td>71</td>
<td>lab exercise</td>
<td>expt on pipeline losses and pump curves</td>
<td>87%</td>
<td>6%</td>
<td>7%</td>
</tr>
</tbody>
</table>
**FE Exam Results**
Not applicable to this outcome.

**Senior Exit Interviews**
Graduating seniors complete an anonymous online exit interview to provide feedback about the CE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met” or “partly met”, which was achieved in 2016-2017 with 73% of students rating Outcome b as “met” and 25% as “partly met” for a total of 98% (Figure B-2). Acknowledging that this is a subjective self-evaluation, these exit interview results are taken as a general indication that students feel they are meeting the outcome.

**Figure B-2: Student exit interview ratings of progress on Outcome b**

**Summary**
The evaluation of student work indicates that goals related to Outcome b are being met. We are pleased that students are prepared to ‘design experiments’ as well as to ‘conduct experiments’ and ‘analyze and interpret data.’

**Recommendations**
Continue to revise experimental design activities in CEE 3160 and CEE 3500. Add an exercise in CEE 3510. Re-evaluate Outcome b as planned during the 2017-18 school year.
Outcome f: an understanding of professional and ethical responsibility

Student Course Work Assessment

Student work is rated on a 0 – 1 – 2 scale:

0 = student did not understand the fundamental principle or component
1 = student applied some but not all of the fundamental principles in their solution
2 = student applied the correct fundamental principles in their solution

The CE program has two goals for student performance for student course work assessment:

Goal 1: a minimum of 70% of the students will perform at a 2 level
Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

Last year (2015-2016) this outcome was not assessed in as many classes as originally planned, so we renewed our efforts for this year. Student attainment was assessed in the introductory seminar class (CEE 1880) through a group writing assignment on the ethics associated with an engineering failure, homework exercises in CEE 3640 and CEE 3780, and a quiz about the code of ethics in CEE 4870 (298 samples of student work; see Table F-1). Both goals were met with 72% of student work rating a 2 and 98% of student work rating a 1 or 2.

Figure F-1: Summary of ratings of student work on Outcome f
Table F-1: List of student work assessed for Outcome f

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Instructor</th>
<th>Term</th>
<th>Enrol.</th>
<th>Method</th>
<th>Description</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 1880</td>
<td>CEE Orientation</td>
<td>Rahmeyer</td>
<td>F 2016</td>
<td>73</td>
<td>group report</td>
<td>summarize ethics of an eng failure</td>
<td>67</td>
<td>33</td>
<td>0</td>
</tr>
<tr>
<td>CEE 1880</td>
<td>CEE Orientation</td>
<td>Rahmeyer</td>
<td>Sp 2017</td>
<td>65</td>
<td>group report</td>
<td>summarize ethics of an eng failure</td>
<td>72</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>CEE 3640</td>
<td>Water Treatment</td>
<td>McNeill</td>
<td>Sp 2017</td>
<td>32</td>
<td>HW</td>
<td>essay on Flint, MI drinking water scandal</td>
<td>91</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>CEE 3780</td>
<td>Solid and Haz Waste Mgmt</td>
<td>Dupont</td>
<td>F 2016</td>
<td>53</td>
<td>HW</td>
<td>ethics of LEED design</td>
<td>64</td>
<td>26</td>
<td>9</td>
</tr>
<tr>
<td>CEE 4870</td>
<td>Civil Engineering Design II</td>
<td>Peralta</td>
<td>F 2016</td>
<td>75</td>
<td>quiz</td>
<td>ethics and professional responsibility</td>
<td>75</td>
<td>17</td>
<td>8</td>
</tr>
</tbody>
</table>
**FE Exam Results**

Our goal is to have 100% pass rate on the FE exam; our minimum acceptable level of performance is a pass rate at or above the national average. Table F-2 summarizes the FE results for the past six years, including the percentage of students who had passed the FE exam by the time of graduation. The USU CE pass rate has been between 90% and 100%, well above the national average.

<table>
<thead>
<tr>
<th>Table F-2: CE Graduates Passing FE Exam vs. National Annual Pass Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total CE degrees</td>
</tr>
<tr>
<td>% graduates passing FE</td>
</tr>
<tr>
<td>National CE pass rate</td>
</tr>
</tbody>
</table>

FE Exam performance by first-time test takers on the ethics and professional practice section is summarized in Figure F-2. Students performed equivalent to the national average, considering the uncertainty range (error bars). Overall, the fact that nearly all CE students continue to pass the FE exam is a strong independent external indicator for meeting Student Outcome f. It is also a strong indication of a good foundation for life-long (independent) learning skills.

![Scaled Fe Exam results for ethics and professional practice. Error bars represent uncertainty range for scaled scores.](image-url)
**Senior Exit Interviews**
Graduating seniors complete an anonymous online exit interview to provide feedback about the CE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met” or “partly met”, which was achieved with 77% of students rating Outcome f as “met” and 23% as “partly met” for a total of 100% (Figure F-3). Acknowledging that this is a subjective self-evaluation, these exit interview results are taken as a general indication that students feel they are meeting the outcome.

![Outcome f](image)

**Figure F-3:** Student exit interview ratings of progress on Outcome f

**Summary**
Evaluation of course assessment data, FE exam results, and senior exit interviews indicate that Outcome f goals are being met.

**Recommendations**
Evaluate Outcome f as scheduled during the 2018-2019 school year.
Civil Engineering
ABET Outcome Summary
2016-2017

Outcome h: the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

Student Course Work Assessment

Student work is rated on a 0 – 1 – 2 scale:

0 = student did not understand the fundamental principle or component
1 = student applied some but not all of the fundamental principles in their solution
2 = student applied the correct fundamental principles in their solution

The CE program has two goals for student performance for student course work assessment:

Goal 1: a minimum of 70% of the students will perform at a 2 level
Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

As recommended by the Assessment Committee the last time this outcome was evaluated (2013-2014), the number of assessments for this outcome has increased. Student performance on this outcome has been assessed through seven assignments in four different courses (459 samples of student work; see Table H-1), and student performance satisfactorily meets both Goal 1 and Goal 2 (Figure H-1).

Figure H-1: Summary of ratings of student work on Outcome h
Table H-1: List of student work assessed for Outcome h

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Instructor</th>
<th>Term</th>
<th>Enrol.</th>
<th>Method</th>
<th>Description</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 3080</td>
<td>Reinforced Concrete Design</td>
<td>Barr</td>
<td>Sp 2017</td>
<td>59</td>
<td>HW</td>
<td>cost/economics in column design</td>
<td>82%</td>
<td>5%</td>
<td>13%</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>essay HW</td>
<td>summarize EIS - env, econ, societal</td>
<td>76%</td>
<td>22%</td>
<td>3%</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>essay HW</td>
<td>summarize TMDL - env, econ, societal</td>
<td>92%</td>
<td>8%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>essay HW</td>
<td>summarize Superfund site - env, econ, societ al</td>
<td>67%</td>
<td>30%</td>
<td>3%</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>field trip report</td>
<td>env, econ, societal consid of WWTP</td>
<td>78%</td>
<td>16%</td>
<td>5%</td>
</tr>
<tr>
<td>CEE 3650</td>
<td>Wastewater Treatment</td>
<td>Dupont</td>
<td>Sp 2017</td>
<td>7</td>
<td>mini-design</td>
<td>Env and cost impacts of TMDL</td>
<td>57%</td>
<td>29%</td>
<td>14%</td>
</tr>
<tr>
<td>CEE 4200</td>
<td>Engineering Economics</td>
<td>Alminagorta</td>
<td>F 2016</td>
<td>76</td>
<td>exam</td>
<td>economic impact of eng solutions</td>
<td>89%</td>
<td>11%</td>
<td>0%</td>
</tr>
</tbody>
</table>
**FE Exam Results**
Not applicable to this outcome.

**Senior Exit Interviews**
Graduating seniors complete an anonymous online exit interview to provide feedback about the CE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met” or “partly met”, which was achieved with 79% of students rating Outcome f as “met” and 19% as “partly met” for a total of 98% (Figure H-2). Acknowledging that this is a subjective self-evaluation, these exit interview results are taken as a general indication that students feel they are meeting the outcome.

![Outcome h](image)

**Figure H-2**: Student exit interview ratings of progress on Outcome h

**Summary**
The evaluation of student work and senior exit interviews indicates that Outcome h is being met.

**Recommendations**
Evaluate Outcome h as planned during the 2019-20 school year.
Outcome i: a recognition of the need for, and an ability to engage in life-long learning

Student Course Work Assessment

Student work is rated on a 0 – 1 – 2 scale:

0 = student did not understand the fundamental principle or component
1 = student applied some but not all of the fundamental principles in their solution
2 = student applied the correct fundamental principles in their solution

The CE program has two goals for student performance for student course work assessment:

Goal 1: a minimum of 70% of the students will perform at a 2 level
Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

This outcome is assessed in the freshman orientation class and the second and third classes of the capstone design sequence (291 samples of student work; see Table I-1 on the next page). Student attainment is demonstrated through a memo on the importance of life-long learning, a quiz on professional registration requirements (including associated continuing education requirements), and an essay on a guest speaker’s discussion of this topic. Student performance is satisfactory and meets both Goal 1 and Goal 2 (Figure I-1). To additionally reinforce this idea in the capstone design sequence, since the 2014-2015 academic year, all guest speakers who are professional engineers are requested to include the topic of life-long learning in their presentation.

![Figure I-1: Summary of ratings of student work on Outcome i](image-url)
### Table I-1: List of student work assessed for Outcome i

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Instructor</th>
<th>Term</th>
<th>Enrol.</th>
<th>Method</th>
<th>Description</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 1880</td>
<td>CEE Orientation</td>
<td>Rahmeyer</td>
<td>F 2016</td>
<td>73</td>
<td>group HW</td>
<td>rules for professional licensure</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CEE 1880</td>
<td>CEE Orientation</td>
<td>Rahmeyer</td>
<td>Sp 2017</td>
<td>65</td>
<td>group HW</td>
<td>rules for professional licensure</td>
<td>83</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>CEE 4870</td>
<td>Civil Engineering Design II</td>
<td>Peralta</td>
<td>F 2016</td>
<td>75</td>
<td>quiz</td>
<td>quiz on continuing ed requirements</td>
<td>75</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td>CEE 4880</td>
<td>Civil Engineering Design III</td>
<td>Peralta</td>
<td>Sp 2017</td>
<td>75</td>
<td>quiz</td>
<td>quiz on lifelong learning in Code of Ethics</td>
<td>83</td>
<td>0</td>
<td>17</td>
</tr>
</tbody>
</table>
**FE Exam Results**
Not applicable to this outcome.

**Senior Exit Interviews**
Graduating seniors complete an anonymous online exit interview to provide feedback about the CE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met” or “partly met”, which was achieved with 83% of students rating Outcome f as “met” and 13% as “partly met” for a total of 96% (Figure I-2). Acknowledging that this is a subjective self-evaluation, these exit interview results are taken as a general indication that students feel they are meeting the outcome.

![Outcome i graph](image)

Figure I-2: Student exit interview ratings of progress on Outcome i

**Summary**
The evaluation of student work and senior exit interviews indicates that Outcome i is being met.

**Recommendations**
Evaluate Outcome i as planned during the 2019-20 school year.
Outcome j: a knowledge of contemporary issues

Student Course Work Assessment

Student work is rated on a 0 – 1 – 2 scale:

0 = student did not understand the fundamental principle or component
1 = student applied some but not all of the fundamental principles in their solution
2 = student applied the correct fundamental principles in their solution

The CE program has two goals for student performance for student course work assessment:

Goal 1: a minimum of 70% of the students will perform at a 2 level
Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

This outcome was assessed in multiple classes by having students demonstrate knowledge of contemporary issues through HW, writing assignment, or exam (485 samples of student work; see Table J-1 on the next page). Student performance is satisfactory and meets both Goal 1 and Goal 2 (Figure J-1).

Figure J-1: Summary of ratings of student work on Outcome j
Table J-1: List of student work assessed for Outcome j

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Instructor</th>
<th>Term</th>
<th>Enrol.</th>
<th>Method</th>
<th>Description</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE</td>
<td>1880 CEE Orientation</td>
<td>Rahmeyer</td>
<td>F 2016</td>
<td>73</td>
<td>group HW</td>
<td>group essay on contemporary issues</td>
<td>89</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>CEE</td>
<td>1880 CEE Orientation</td>
<td>Rahmeyer</td>
<td>Sp 2017</td>
<td>65</td>
<td>group HW</td>
<td>group essay on contemporary issues</td>
<td>91</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>CEE</td>
<td>3020 Structural Analysis</td>
<td>Halling</td>
<td>Sp 2017</td>
<td>71</td>
<td>quiz</td>
<td>role of structural codes in modern building</td>
<td>11</td>
<td>59</td>
<td>30</td>
</tr>
<tr>
<td>CEE</td>
<td>3610 Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>HW</td>
<td>Cache Valley PM2.5 issue</td>
<td>89</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>CEE</td>
<td>3610 Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>field trip report</td>
<td>solid waste mgmt current issues in CV</td>
<td>73</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>CEE</td>
<td>3610 Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>field trip report</td>
<td>current issues in Logan City drinking water</td>
<td>73</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>CEE</td>
<td>3640 Water Treatment</td>
<td>McNeill</td>
<td>Sp 2017</td>
<td>32</td>
<td>HW</td>
<td>ethical issues in Flint, MI drinking water scandal</td>
<td>91</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>CEE</td>
<td>3650 Wastewater Treatment</td>
<td>Dupont</td>
<td>Sp 2017</td>
<td>7</td>
<td>group project</td>
<td>contemp issues for WWTP</td>
<td>57</td>
<td>43</td>
<td>0</td>
</tr>
</tbody>
</table>
**FE Exam Results**
Not applicable to this outcome.

**Senior Exit Interviews**
Graduating seniors complete an anonymous online exit interview to provide feedback about the CE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met” or “partly met”, which was achieved with 60% of students rating Outcome f as “met” and 35% as “partly met” for a total of 95% (Figure J-2). Acknowledging that this is a subjective self-evaluation, these exit interview results are taken as a general indication that students feel they are meeting the outcome. It is interesting to note that while student performance in coursework is very good (see previous section), more students are rating their own attainment as only “partly met” here in the exit interview. Perhaps they do not understand what is meant by “contemporary issues” when asked in this context.

![Outcome j](image)

Figure J-2: Student exit interview ratings of progress on Outcome j

**Summary**
The evaluation of student work and senior exit interviews indicate that Outcome j is being met.

**Recommendations**
Evaluate Outcome j as planned during the 2019-20 school year.
Outcome k: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

**Student Course Work Assessment**

Student work is rated on a 0 – 1 – 2 scale:

- 0 = student did not understand the fundamental principle or component
- 1 = student applied some but not all of the fundamental principles in their solution
- 2 = student applied the correct fundamental principles in their solution

The CE program has two goals for student performance for student course work assessment:

- Goal 1: a minimum of 70% of the students will perform at a 2 level
- Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

Multiple classes across the curriculum assess students’ ability to use modern tools including surveying equipment and various software programs like excel/VBA, HEC-HMS, SAP2000, and EPANET (525 samples of student work; see Table K-1 on the next page). Overall, student performance is satisfactory and meets both Goal 1 and Goal 2 (Figure K-1).

**Figure K-1: Summary of ratings of student work on Outcome k**
Table K-1: List of student work assessed for Outcome k

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Instructor</th>
<th>Term</th>
<th>Enrol.</th>
<th>Method</th>
<th>Description</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE</td>
<td>2240 Surveying</td>
<td>Caliendo</td>
<td>F 2016</td>
<td>121</td>
<td>lab</td>
<td>surveying traverse special problem</td>
<td>70</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>CEE</td>
<td>2870 Intro to Programming</td>
<td>Urroz</td>
<td>F 2016</td>
<td>102</td>
<td>HW</td>
<td>use VBA and spreadsheet to calc flow in open channel</td>
<td>93</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>CEE</td>
<td>3430 Engineering Hydrology</td>
<td>Urroz</td>
<td>Sp 2017</td>
<td>81</td>
<td>HW</td>
<td>use excel and HEC-HMS to find hydrograph</td>
<td>89</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>CEE</td>
<td>3510 Hydraulics</td>
<td>Urroz</td>
<td>Sp 2016</td>
<td>69</td>
<td>exam</td>
<td>EPANET 2.0 for analysis of pipe network</td>
<td>86</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>CEE</td>
<td>3510 Hydraulics</td>
<td>Urroz</td>
<td>Sp 2017</td>
<td>71</td>
<td>exam</td>
<td>EPANET 2.0 for analysis of pipe network</td>
<td>97</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CEE</td>
<td>3780 Solid and Haz Waste Mgmt</td>
<td>Dupont</td>
<td>F 2016</td>
<td>53</td>
<td>exam</td>
<td>spreadsheet: effect of recycling on landfill</td>
<td>89</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>CEE</td>
<td>5001 Field Irrigation Systems</td>
<td>Torres-Rua</td>
<td>F 2016</td>
<td>7</td>
<td>exam</td>
<td>remote sensing applications</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CEE</td>
<td>5010 Matrix Analysis of...</td>
<td>Barr</td>
<td>F 2016</td>
<td>22</td>
<td>exam question</td>
<td>use SAP2000 to solve truss, beam, frame and 2-D elements</td>
<td>80</td>
<td>20</td>
<td>0</td>
</tr>
</tbody>
</table>
**FE Exam Results**

Our goal is to have 100% pass rate on the FE exam; our minimum acceptable level of performance is a pass rate at or above the national average. Table K-2 summarizes the FE results for the past six years, including the percentage of students who had passed the FE exam by the time of graduation. The USU CE pass rate has been between 90% and 100%, with the exception of 2009-10 when we were just above the national average.

The fact that nearly all of the CE students pass the FE exam is a strong, independent, external indicator for meeting Student Outcomes a, e, f, and k. It is also a strong indication of a good foundation for life-long (independent) learning skills.

<table>
<thead>
<tr>
<th>Table K-2: CE Graduates Passing FE Exam vs. National Annual Pass Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>% graduates passing FE</td>
</tr>
<tr>
<td>National CE pass rate</td>
</tr>
</tbody>
</table>

**Senior Exit Interviews**

Graduating seniors complete an anonymous online exit interview to provide feedback about the CE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met” or “partly met”, which was achieved with 67% of students rating Outcome f as “met” and 33% as “partly met” for a total of 100% (Figure K-2). Acknowledging that this is a subjective self-evaluation, these exit interview results are taken as a general indication that students feel they are meeting the outcome. Several students commented on the exit interview that they wanted to learn additional software tools such as Civil 3D and other programming languages (R, Matlab). We will investigate the possibility of adding these topics into the curriculum.

![Outcome k](image)

Figure K-2: Student exit interview ratings of progress on Outcome k
Summary
The evaluation of student work, FE Exam results, and senior exit interviews indicates that Outcome k is being met.

Recommendations
Evaluate Outcome k as planned during the 2019-20 school year. Evaluate opportunities to add additional software tools and programming languages into the curriculum.