Assessment Plan and Assessment Report
Bachelor of Science in Civil Engineering
Montana State University
2016 - 2017 Academic Year

Department: Civil Engineering

Department Head: Jerry Stephens

Assessment Coordinators: Joel Cahoon and Jerry Stephens

Date: Fall 2017, Reporting Period Academic Year 2016 - 2017

Programs: BS Civil Engineering, BS Civil Engineering - Bioresources Option

Background

In Summer 2017, the department decided to combine the Assessment Plan document and the annual Assessment of Objectives and Outcomes into one document – this document is our first attempt at this combination. This approach allows a more seamless reporting of the annual assessment process, establishes that the Assessment Plan, itself, is a fluid document allowing easy refinements through time, and will streamline the compilation of multiple year activities when preparing ABET® reports.

Civil Engineering's annual performance assessments are prepared in the context of the program Assessment Plan (updated annually) and the Assessment Report (prepared annually) by the CE Department. The Bachelor of Science in Civil Engineering program at Montana State University has approximately 460 undergraduate students, and is accredited by the Accreditation Board for Engineering and Technology (ABET®). ABET® accreditation is cyclic, and the Civil Engineering program was most recently accredited in 2015 for a 6-year duration (the next review is scheduled for 2021). In the most recent ABET® review, the only concern related to the way our bioresources option was referred to on our website, references that have been adjusted for clarity. The final statement of ABET®'s accreditation action for the Civil Engineering program was received in August 2016, and no concerns were expressed.

Assessment Plan

Mission - Foremost, we will provide undergraduate education founded on a rigorous treatment of engineering fundamentals coupled with modern engineering tools. We see competency in mathematics, physical science, and engineering mechanics as crucial to our mission. We will provide graduate education opportunities in a majority of traditional civil engineering areas. The department will maintain sufficient breadth to provide post-baccalaureate education focused on professional practice. The department will provide graduate opportunities in a subset of focus areas coupled to vibrant research programs with sound external funding.

Vision - Montana State University's Department of Civil Engineering anticipates that the engineering and construction community will evolve quickly with several very fundamental precepts for success. Among these is the premise that the engineers and constructors of the future will continue to rely on fundamental engineering science and contemporary computational tools to guide their choices. We therefore choose to focus on fundamental engineering basics and the application of modern engineering tools. Our civil and environmental engineering programs will be acknowledged for their strong emphasis and rigor in engineering science, design, and applications. Our construction programs will be acknowledged for their emphasis on engineering and management skills and the application of those skills to the construction industry. The emphasis of these programs will continue to be preparation of students for professional practice in the engineering and construction industries.

Program Educational Objectives

The Bachelor of Science degree in Civil Engineering is a traditionally structured program that provides graduates with a strong background in math, basic sciences and engineering mechanics, and prepares graduates to become registered Professional Engineers (PE's) capable of practicing civil engineering in the areas of environmental, geotechnical, structural, transportation or water resources engineering. The background of graduates who select the bioresources option (a pathway to the same diploma) is focused on soil, water resources and environmental concerns. The educational objectives of the Civil Engineering Bachelor of Science program describe what graduates can expect to accomplish during the first years after graduation.

The contemporary civil engineering baccalaureate educational program objectives were adopted in 2003. Program constituents reconsidered these objectives in 2006 and re-adopted them without revision at that time. Further assessment activities in 2011 and 2014 resulted in modifications to the program educational objectives, and these modifications are reflected in the current objectives as stated herein.

All graduates can expect to be able to:

1. Enter the profession of Civil Engineering and advance in the profession to become registered professional engineers and leaders in the field of Civil Engineering.
2. Work on multi-disciplinary teams and effectively communicate with Civil Engineers of various sub-disciplines, architects, contractors, the public and public agents, scientists and others to design and construct Civil Engineering projects.
3. Begin to develop expertise in one of the sub-disciplines of Civil Engineering and engage in the life-long learning necessary to advance in the Civil Engineering profession.
4. Contribute to society and the Civil Engineering profession through involvement in professional related and/or other service activity.
5. Conduct their affairs in a highly ethical manner holding paramount the safety, health and welfare of the public and striving to comply with the principles of sustainable development.

Some graduates can expect to be able to:

6. Earn advanced degrees in Civil Engineering or other fields.

Courses in the first two years of the program develop a student's mathematical skills and understanding of the physical principles that underlie the practice of civil engineering. Engineering science courses in the second, third, and fourth years develop the student's ability to apply mathematics and basic scientific principles to the solution of practical engineering problems. The third-year student develops a broad perspective of the field and establishes the foundation for professional practice and further study. The student completes at least one course in each subarea of civil engineering by the end of this year. Most of these courses are combinations of engineering science and design experiences. The fourth year includes a capstone professional practice and design experience, elective courses in a subarea (or subareas) of civil engineering--most of which are combinations of engineering science and design experiences--and elective courses that help the student develop an appreciation for the role of the professional engineer in society. Contemporary engineering aids are introduced in the first year and used in assignments throughout the rest of the program. Courses and assignments that develop oral and written communication skills are distributed throughout the curriculum and are components of the capstone professional practice and design experience in the fourth year.

Bio-Resources is an option within Civil Engineering - the degree and diploma are the same with or without the option and as such are assessed as one program. The curriculum of this option is identical to the standard Civil Engineering curriculum except for two required courses and the courses available for professional electives. The Bio-Resources option students are not required to take transportation engineering (ECIV 350) or the second course in structural engineering (ECIV 315). Instead, the Bio-Resources students take a second course in hydrology (EENV 432) and a course in natural water treatment systems (EENV 441). The professional electives the Bio-Resources students chose from allow them to build on the basic Civil Engineering curriculum with courses that focus on soil, water, and environmental concerns.

During the senior-year, our students are required to take the Fundamentals of Engineering exam administered by the Montana Board of Professional Engineers and Land Surveyors as the first step toward professional registration. EGEN 488 (Engineering Program Assessment), a zero-credit course, is used to enforce this curriculum requirement. This examination is administered by the National Council of Engineering Examining Boards and is accepted nationwide through reciprocity with the Montana Board of Professional Engineers and Land Surveyors.

Consistency of the Program Educational Objectives with the Mission of the Institution

In this context, the *Institution* is perceived to be the College of Engineering. The mission of the College of Engineering maps to the Civil Engineering Department's educational objectives as demonstrated in Table 1. It is no surprise that the college vision and mission statements do not map to CE department educational objectives with a higher correlation than shown in the table above. The College has a mandate to achieve at a very high level in all three of the traditional land-grant charges: teaching, research and service. The College serves a much broader constituency than does the department. The department does indeed support vigorous research and outreach components, but these tend to not be the focus of our educational objectives that are primarily tailored to our undergraduate programs.

Table 1. Map of COE mission to MSU CE educational objectives.

Key: 3 = highly related 2 = moderately related 1 = somewhat related	M (a) fostering lifelong learning	M (b) integrating learning and discovery	M (c) developing and sharing technical expertise	M (d) empowering students to be tomorrow's leaders
All Graduates:				
1. … enter the profession and advance to become registered professional engineers …	2		2	2
2. work on multi-disciplinary teams …		1		
3. … develop expertise in one of the sub-disciplines … engage in the life-long learning …	3	2	1	
4. contribute to society and the … profession …	1		1	2
5. conduct affairs in a highly ethical manner … safety, health and welfare of the public … principles of sustainable development.			1	2

Process for Assessing CE Program Educational Objectives

Each August prior to the start of the new academic year, the department holds a one-day retreat. One of the agenda items at the retreat is the review of assessment data and the evaluation of program outcomes and objectives. At these retreats, the department head and/or program coordinator distributes recent and historical assessment data and a comparison of assessment results with metric goals. Annually the departmental External Advisory Committee evaluates the extent to which they believe MSU Civil Engineering graduates meet the program objectives on a scale of 0 (not at all) to 10 (completely), and the extent to which they believe each of them is suitable, similarly scaled from 0 (not at all suitable) to 10 (completely suitable).

If assessment results fall below metric goals, the faculty are responsible for developing a strategy or strategies for improving these levels of achievement. A drop below metric goal levels for one survey will not necessarily require action. However, several occurrences of scores below metric goal levels will trigger corrective action. If all scores exceed metric goal levels, the faculty may use assessment data to identify weaker areas of student performance and choose to develop strategies for improvement. The faculty strive to continually improve the program. While the whole faculty participates in strategy development, implementation of these strategies is assigned to the curriculum committee, the program coordinator, the department head or department staff as appropriate for implementation.

Note that the program educational objectives assessment process outlined herein is adaptable. As the education and engineering field evolve, our assessment procedure should be just as fluid. In the current Assessment Plan, the department head and/or program coordinator presents assessment data at the annual retreat, and prepares the annual Assessment Report thereafter, including proposed activities for continuous improvement for the next year.

Program Outcomes

Program outcomes are more focused statements that describe what students are expected to know and can do at the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire in their matriculation through the program. Assessment under this criterion is one or more processes that identify, collect, and prepare data to evaluate the achievement of program outcomes. Evaluation under this criterion is one or more processes for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which program outcomes are being achieved, and results in decisions and actions to improve the program.

The CE baccalaureate program Outcomes were approved by the CE faculty in August of 2006. At that time, the department adopted ABET® Criterion 3 Outcomes (a-k) listed sequentially as Outcomes (1-11) below, and four additional outcomes, based on the ASCE Body of Knowledge, which are listed as Outcomes (12-15) below:

To satisfy the academic prerequisites for the professional practice of civil engineering, MSU civil engineering graduates will be able to:

1. apply knowledge of mathematics, science, and engineering
2. design and conduct experiments and analyze and interpret experimental data
3. design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. function as a member of a multidisciplinary team
5. identify, formulate and solve engineering problems
6. explain professional and ethical responsibility
7. compose and present effective written, verbal and graphical communications
8. draw upon a broad education to explain the impact of engineering solutions in a global, economic, environmental and societal context
9. explain the need for, and demonstrate the capacity for, life-long learning
10. explain contemporary issues as they relate to the solution of engineering practice
11. apply the techniques, skills and modern tools necessary for engineering practice
12. [MS Programs Only] synthesize/evaluate knowledge in specialized areas related to CE
13. explain the elements of project management, construction and asset management
14. explain the fundamentals of business, public policy and administration
15. explain the role of the leader, leadership principle, and attitudes conducive to effective professional practice of civil engineering.

These Outcomes are reviewed with the faculty every year, although they have not changed since their initial adoption. These Outcomes are mapped on our Program Educational Objectives in Table 2.

Table 2 Map of Civil Engineering objectives and outcomes.

Key: 3 = highly related 2 = moderately related 1 = somewhat related	1. … math, science, and engineering …	2. … experiments … interpret data…	3. … design a system, component …	4. … multi-disciplinary teams …	5. … solve engineering problems …	6. … professional and ethical responsibility.	7. … communicate effectively.	8. … impact … global and societal …	9. … life-long learning.	10. … contemporary issues.	11. … modern engineering tools …	12. … knowledge in specialized area …	13. … project management, construction …	14. … business, public policy, admin …	15. … leadership principles …
All Graduates:															
1. … enter the profession and advance to become registered professional engineers …	3	3	3	2	3	2	3	3	3	2	3	3	1	2	3
2. work on multi-disciplinary teams …	1	1	2	3	2	2	2	3	2	3	1	3	3	2	2
3. … develop expertise in one of the sub-disciplines … engage in the life-long learning …	3	3	2	2	3	2	3	2	2	2	3	2	2	2	1
4. contribute to society and the … profession …	1	1	2	2	2	3	2	2	2	3	1	2	1	2	2
5. conduct affairs in a highly ethical manner … safety, health and welfare of the public … principles of sustainable development.	2	1	2	3	3	3	2	3	2	2	1	1	2	2	1

Processes for Assessing CE Program Outcomes

The following are the primary instruments used to assess the extent to which student outcomes are met:

Fundamentals of Engineering Exam

- All CE students are required to take (not pass) the FE exam to graduate.
- The assessment process documents program performance in each topic area of the Civil Engineering discipline specific exam.
- Student performance in each topic area is compared to metric goals. Our goal is to exceed the national pass rate for civil engineering students taking the civil exam and for the MSU student performance to exceed 96% of the national performance in each subject area of the exam. Three consecutive cycles below the national pass rate overall, or three consecutive cycles of less than the national pass rate on a per-topic basis, identify concerns requiring discussion, comment, and appropriate action by the department.

Review of Student Work

- Representative student work from selected classes is collected. Faculty representatives and the External Advisory Board review this work and assess student performance relative to program outcomes.

- Results are documented and summarized in the Annual Assessment Report.

Student Interviews

- Students exit interviews are a tool that the department head, as discretion warrants, may choose to use. This usually occurs only as a secondary investigation of a concern that has emerged during routine operations. When applicable, results are documented, shared with faculty, and summarized in the Annual Assessment Report.

Departmental External Advisory Board

- The Department's External Advisory Board provides heuristic assessment of students' achievement of program outcomes. Further, Board members independently complete an evaluation of the extent to which they believe MSU Civil Engineering graduates meet Program Outcomes on a scale of 1-very poor to 6-excellent. The goal for this evaluation is that 80 percent of the responses are 4-good or better.
- The EAB provides input concerning department commendations and recommendations for improvement.
- The EAB evaluates student performance relative to each program outcome.
- Results are documented and summarized in the Annual Report.

CE Faculty/Curriculum Committee

- Due to the high degree of interest in student success and the high degree of interaction between MSU CE faculty and program constituents, the CE faculty is well-informed about constituent issues/concerns with CE programs. The CE faculty also are charged with keeping current with the state-of-the-practice in their technical sub-disciplines. Therefore, CE faculty input is invaluable in the continuous quality improvement efforts of the department.
- The department Curriculum Committee includes a representative from each of the sub-disciplines of civil engineering and construction engineering technology, the senior capstone class instructors, and the program coordinators. The department head and department academic advisor are ex-officio members of the committee.

PE Exam

- New in 2017, the pass/fail and topic specific results of the PE (Professional Engineer) exam were made available to the department. Results are available for all examinees that earned a CE degree from MSU, and then attempted the PE exam during the academic year. This is a very attractive assessment instrument, but it should be noted that the examinees in 2016-2017 graduated at least 4 years prior, and perhaps much before that.

Program Educational Objectives Assessment – Academic Year 2016 - 2017

As stated above, program objectives are evaluated each year by the department's External Advisory Board and its faculty. The External Advisory Board, composed of representatives from the engineering consulting and construction industries, are asked as part of their annual meeting to assess a) the extent to which they believe MSU Civil Engineering graduates meet the Program Objectives (on a scale of 0 to 10), b) the extent to which they believe the Objectives are suitable for the program (again on a scale of 0 to 10), and c) if the Objectives need to be revised. On the quantitative assessment, the metric goal for this evaluation is an average score of 7 for each objective. The Civil Engineering faculty review the program objectives at the August retreat, and with due consideration of any recommendations from the External Advisory Board, revise them as appropriate.

The numerical results of the External Advisory Board review of the Civil Engineering Program Educational Objectives over the three-year duration ending in the 2016-2017 academic year are presented in Table 3. The average External Advisory Board assessments rendered in spring of 2017 all exceeded a score of 7. All the program educational objectives continued to be judged as suitable, but a lower level of attainment was assessed for the objectives related to multidisciplinary team work (7.6 out of 10). At the CE Department retreat in August 2017, the faculty reviewed the Program Educational Objectives and the External Advisory Board assessment of them. The Program Educational Objectives were re-affirmed by the faculty with no changes.

Table 3. Results of the External Advisory Board review of the Civil Engineering Program Objectives during the most recent three years.

	Suitability			Met		
	2015	2016	2017	2015	2016	2017
1. Enter the profession of Civil Engineering and advance in the profession to become registered professional engineers and leaders in the field of Civil Engineering.	9.4	10.0	9.9	9.1	9.2	9.0
2. Work on multi-disciplinary teams and effectively communicate with Civil Engineers of various sub-disciplines, architects, contractors, the public and public agents, scientists and others to design and construct Civil Engineering projects.	9.6	9.5	9.9	8.6	7.6	7.6
3. Begin to develop expertise in one of the sub-disciplines of Civil Engineering and engage in the life-long learning necessary to advance in the Civil Engineering profession.	9.0	9.8	9.9	8.6	9.4	8.9
4. Contribute to society and the Civil Engineering profession through involvement in professional related and/or other service activity.	8.8	8.7	9.1	8.5	7.6	8.6
5. Conduct their affairs in a highly ethical manner holding paramount the safety, health and welfare of the public and striving to comply with the principles of sustainable development.	9.9	9.7	10.0	9.3	9.0	8.7

Program Outcomes Assessment – Academic Year 2016 - 2017

As summarized above, program Outcomes each year are assessed using the following instruments:

1. Fundamentals of Engineering Exam
2. Review of Student Work
3. Student Interviews (ad hoc)
4. Department External Advisory Board
5. CE Faculty/Curriculum Committee
6. PE Exam

Assessment data and analysis from each of these instruments is presented below. This assessment data is presented to the faculty at the Department's annual retreat in August each year, at which time it is thoroughly discussed and action items established for the following academic year.

1. Fundamentals of Engineering Exam

Pass rates for students from the MSU Civil Engineering Department on the FE Exam over the past several years are presented in Figure 1. Pass rates for MSU CE students consistently exceed the national average pass rate. Topic area results are presented in Table 4. Overall and by topic areas CE students almost without exception performed better on the exam compared to the national average. Three consecutive cycles below the national pass rate overall, or three consecutive cycles of less than the national pass rate on a per-topic basis, trigger action. Looking more closely at student performance on the overall exam (see Figure 1), the cross-hatched areas of the bars for June 2016 and June 2017 represent an issue that has resulted from the maturity of the Gazi-MSU Dual Degree Program. The cross-hatched bars in this figure indicate the change in aggregate student performance when the Gazi cohort is removed from those two test cycles. Each June, a sizable portion of the graduating class is made up of Turkish students that alternate years between Gazi University (Freshman and Junior) in Ankara, Turkey and MSU (Sophomore and Senior). These students generally perform poorly on the FE exam. This level of performance is attributable not only to the language challenge they confront, but also to the absence of a strong incentive for them to do well on the exam. The Turkish students know the exam is a gateway to professional licensure in the U.S., but has less pertinence to their engineering career in Turkey. The department is working on ways to resolve this issue.

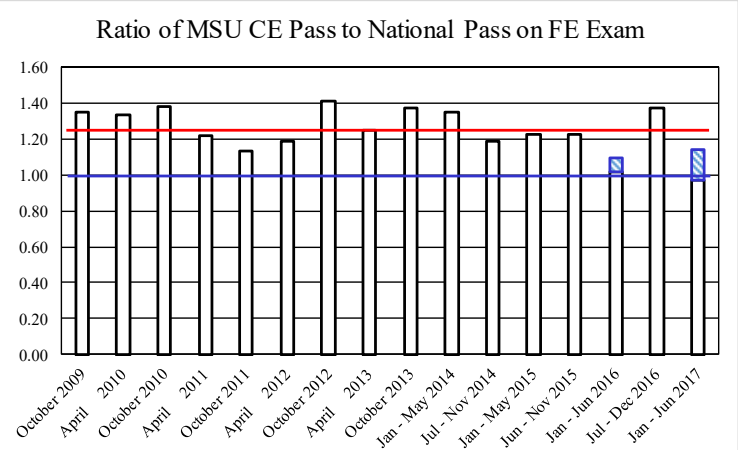

Figure 1. Overall pass rate results of the FE Exam

Table 4. Topic specific results for the FE exam.

	Oct 2009	April 2010	Oct 2010	April 2011	Oct 2011	April 2012	Oct 2012	April 2013	Oct 2013	Spr 2014	Fall 2014	Spr 2015	Fall 2015	Spr 2016	Fall 2016	Spr 2017	Avg
Math	1.22	1.09	1.16	1.11	1.07	1.01	1.14	1.09	1.15	1.10	0.95	1.00	1.04	1.06	0.98	1.01	1.07
Statistics	1.25	1.13	1.11	1.06	1.03	0.94	1.17	1.15	1.19	1.08	1.02	1.02	1.07	0.90	1.01	0.99	1.07
Computer	1.04	1.03	1.10	1.00	0.73	0.96	0.96	0.99	1.06	0.92	1.08	0.95	0.89	0.96	1.05	0.98	0.98
Ethics/Business	1.14	1.01	1.04	1.05	1.04	0.98	1.11	1.02	1.03	1.10	1.04	0.98	0.84	1.05	0.98	1.04	1.03
Economics	1.19	1.15	1.07	1.08	1.03	0.99	1.11	1.09	1.25	1.35	1.17	1.02	1.04	1.15	1.21	1.12	1.13
Statics	1.31	1.20	1.15	1.19	1.04	1.03	1.12	1.03	1.25	1.09	0.99	0.98	1.03	1.06	0.96	1.05	1.09
Dynamics	1.26	1.24	1.12	1.11	1.21	1.12	1.13	1.07	1.29	1.10	0.98	1.04	1.13	1.03	1.08	1.03	1.12
Strength	1.20	1.21	1.16	1.15	1.20	1.13	1.19	1.03	1.24	1.02	0.97	1.02	1.00	1.05	0.99	0.96	1.10
Materials Prop	1.28	1.10	1.18	1.22	0.96	0.89	1.19	0.92	1.16	0.96	1.10	1.05	0.92	0.99	1.02	1.01	1.06
Fluid Mechanics	1.20	1.27	1.09	1.16	1.18	1.06	1.13	1.10	1.19	1.14	0.93	1.03	0.97	1.07	1.10	1.04	1.10
Surveying	1.37	1.24	1.07	1.20	1.09	1.05	1.18	1.18	1.04	1.36	1.07	1.10	1.21	0.95	1.15	1.05	1.14
Hydraul/Hydrolog	1.37	1.19	1.28	1.13	1.17	1.27	1.33	1.14	1.41	1.11	1.04	1.08	1.03	1.07	1.19	1.10	1.18
Soil Mechanics	1.18	1.27	1.12	1.10	1.15	1.17	1.21	1.10	1.25	1.23	1.07	1.03	1.09	1.04	1.01	1.03	1.13
Environmental	1.18	1.09	1.17	1.05	1.07	1.07	1.18	1.18	1.16	1.06	0.99	1.02	1.04	1.05	1.03	1.10	1.09
Transportation	1.14	1.12	1.07	1.31	1.23	1.06	1.11	1.24	1.17	1.10	0.96	1.03	1.04	0.93	1.10	1.03	1.10
Struct Analysis	1.11	1.21	1.09	1.22	1.07	1.07	1.26	1.06	1.18	1.04	0.99	1.05	1.00	1.02	1.03	1.02	1.09
Struct Design	1.15	1.11	1.02	1.11	1.16	1.04	1.14	1.13	1.25	0.99	1.07	0.96	1.10	1.07	1.05	0.98	1.08
Const Mgmt	1.13	1.27	1.07	1.15	1.15	1.13	1.21	1.11	1.11	1.21	0.93	1.00	1.02	0.94	1.03	1.04	1.09
Chemistry	1.14	1.08	0.92	1.09	1.03	0.97	1.04	1.00	1.10								
Elect/Mag	0.91	0.98	0.77	0.93	0.98	0.91	1.04	0.81	1.15								
Thermodynamics	1.02	1.36	1.08	1.19	1.11	1.05	1.27	1.10	1.30								
Materials	1.09	1.11	1.11	1.11	1.00	1.07	1.23	1.14	0.95								
	Compared to National Average									ABET							

Relative to student performance on a per topic basis, no topic area scores were below the action trigger of 96% of the national comparator in the 2016-2017 academic year,

2. Review of Student Work

The Civil Engineering program assessment plan calls for review of a portfolio of student work by the CE Department Curriculum Committee and by members of the CE Department External Advisory Board. Course materials and student work associated with the following classes were provided to the Board this assessment cycle:

Posted on secure EAB website

EGEN 202 - Dynamics
ECIV 401 - Professional Practice and Ethics
ECIV 416 - Timber Design

The Board was positively impressed with the content and organization of these classes, the nature of the attendant assignments/projects/exams, and the expectations on student performance (as evidenced by the way they were graded).

Additionally, the External Advisory Board heard presentations from students documenting their experiences and products in the ECIV 499 Senior Design II (Capstone) and ECIV 492 ASC Competition Prep courses. The students were complemented on these activities and the quality of their presentations on them.

3. Student Interviews (ad hoc)

In 2016 – 2017, student interviews were conducted by the External Advisory Board at their annual meeting in February. The External Advisory Board was divided into two groups, each of which met independently for approximately ½-hour with the same group of students. The students that participated in these interviews were informally selected by the various student organizations housed within the department. The only charge given to the students was that their representatives should be able to accurately speak to their collective perspective on their program. No particular format was set for these interviews. The External Advisory Board came back together after the interviews to discuss their findings, with these findings and their attendant discussion being shared with the department head and program coordinators. These findings were further shared with the faculty at the August retreat.

Relative to what the External Advisory Board heard (as reported by them):

Program Weaknesses

- EGEN 310, the required college wide interdisciplinary design class, is not meeting its objectives – the quality of the experience varies between sections, and the design projects are more appropriate for mechanical, electrical and computer engineering students.
- The availability of the department's computer lab (Tait Lab) to work on course assignments/projects is becoming increasingly compromised by its use for course instruction.
- The work load for some courses is disproportionate to their credit assignment (notably, ECIV 489/499, two credit capstone; ECIV 315, 2 credit lecture, 1 credit lab, structures class).
- Some valued professional electives are only offered every other year.
- CADD should be exercised across the curriculum, not just taught in the freshman year and only used again in the senior year. More CADD classes are needed.
- Many cultural CORE classes are of questionable value.
- Class activities need to be structured not to interfere with Career Fair.

Program Strengths

- The faculty are very knowledgeable, very accessible and very helpful.
- The department academic coordinator is awesome.

The post interview discussion primarily focused on the issue of EGEN 310, the junior interdisciplinary design class required across all the curriculums in the College of Engineering. This class has been problematic for a few years, relative to offering an experience of equal value/quality across all engineering disciplines in a single common junior-level design course. The suggestion was made to work with the EGEN 310 coordinator to make sure a credible civil/construction element was part of their design projects, or more ideally, that the overall focus of the interdisciplinary project could be civil/construction related (e.g., commercial building design/construction project). If this kind of change cannot be made, the Board recommendation was to consider pulling our students from the class.

4. Department External Advisory Board

The Department's External Advisory Board meets annually to review from a professional practice perspective almost all aspects of the Department's programs. Some of their roles in outcome assessment have already been described above, as the results from various assessment instruments have been presented and discussed. Most of the Board's input is obtained at the annual Board meeting by the CE Department Head and CE Program Coordinator. This information is then disseminated as appropriate to Department faculty and committees.

Program Outcomes are directly evaluated each year by the Department's External Advisory Board. The External Advisory Board is asked to assess the extent to which they believe MSU Civil Engineering graduates meet the program outcomes (on a scale of 1–very poor, to 6 - excellent). The goal for this evaluation is that 80 percent of the responses are 4 – good or better.

The numerical results of the External Advisory Board review of the Civil Engineering program outcomes over the last three years are presented in Table 5 below. All scores in this assessment period were above 4.0.

Table 5. Assessment of program outcomes by the EAC.

	2015	2016	2017
1. apply knowledge of mathematics, science, and engineering	5.6	6.0	5.5
2. design and conduct experiments and analyze and interpret experimental data	5.3	4.8	5.0
3. design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	5.1	4.7	5.1
4. function as a member of a multidisciplinary team	5.3	4.8	5.0
5. identify, formulate and solve engineering problems	5.8	5.3	5.5
6. explain professional and ethical responsibility	5.4	4.8	5.4
7. compose and present effective written, verbal and graphical communications	4.3	4.0	4.4
8. draw upon a broad education to explain the impact of engineering solutions in a global, economic, environmental and societal context	5.0	4.8	4.4
9. explain the need for, and demonstrate the capacity for, life-long learning	5.1	5.0	5.0
10. explain contemporary issues as they relate to the solution of engineering practice	4.9	5.0	4.6
11. apply the techniques, skills and modern tools necessary for engineering practice	5.3	5.5	5.5
12. [MS Programs Only] synthesize/evaluate knowledge in specialized areas related to CE	5.6	4.7	5.3
13. explain the elements of project management, construction and asset management	4.6	4.5	4.8
14. explain the fundamentals of business, public policy and administration	4.0	3.7	4.4
15. explain the role of the leader, leadership principle, and attitudes conducive to effective professional practice of civil engineering.	4.8	4.0	4.6
Average	5.1	4.8	5.0

5. CE Faculty/Curriculum Committee

Department curriculum committee discussions/actions during the 2016-2017 academic year that resulted from the action items generated in the 2015-2016 assessment cycle included:

- Review the department's environmental engineering course offerings in the context of our new hires in environmental engineering and the possibility of a new degree program. The department has decided to phase out the Bioresources Option in the civil engineering program and replacing it with an ABET® accredited undergraduate environmental engineering degree. A considerable portion of the Curriculum Committee's activities in 2016-2017 were devoted to developing the curriculum for

the proposed Environmental Engineering degree and preparing the request to establish the new program. The formal proposal for this program was submitted for review in July 2017. The review process has 12 steps, starting at the Department level and culminating with the Board of Regents. If approved, this program will be assessed separately from the Civil Engineering program in future assessment and accreditation activities.

- Continue to review our graphics course offerings.
  Our two-course (3 credits total) graphics sequence was replaced with a three-credit hour course with a single instructor beginning in Fall 2017.

- Continue to review the significant revision of the College of Engineering's interdisciplinary engineering design course, EGEN 310, relative to achievement of course objectives and student satisfaction with course conduct.
  The Department continues to communicate its concerns with EGEN 310 with the course coordinator(s). In Fall of 2017, a new design project is to be instituted, in which a small remote-control vehicle is to be designed and driven on a test track that offers specific traction and other challenges. The civil/construction element of the project is the design and construction of the test track.

- Consider streamlining the hydraulic-hydrology courses.
  Mostly because it helps with flow through the junior-level course sequence, but also to aid in teaching assignments and classroom availability, it is being proposed to combine ECIV 331 (hydrology) and ECIV 332 (Hydraulics) into one 4 credit-hour course (3 lecture, 1 lab) beginning in Fall 2018.

- Add courses based on unique instructor/resource availability.
  Two new courses will be pursued for Spring 2018: a senior level course dealing with snow mechanics and a sophomore level Contemporary Science core course dealing with infrastructure development. Both courses are offered in response to temporary availability of suitable instructors, and will be evaluated as permanent courses in 2018.

  In 2016 – 2017, using resources made available by a Washington Foundation endowment, a new course was taught in sustainable construction practices (ECIV 406), which is a professional elective in the civil engineering program. Funded by the same mechanism, work began on a new course, ECIV 311, Construction Contracts, to be first taught in Fall 2017. This class will be a professional elective for CE students.

6. <u>PE Exam Results</u>

New to this assessment cycle is the availability of PE exam results. These are sparse, and will require several years accumulation before they become truly telling. The results for 2016-2017 are included here to begin that data accumulation.

Table 4. PE Exam results.

	MSU			National			Pass
	Pass	Take	Rate	Pass	Take	Rate	Ratio
Fall 2016							
Water Resources and Environmental	6	8	75	765	1037	74	1.02
Transportation	1	1	100	858	1234	70	1.44
Geotechnical	3	3	100	216	340	64	1.57
Civil-Construction	3	3	100	308	535	58	1.74
Structural							
Overall	**13**	**15**	**87**	**2147**	**3146**	**68**	**1.27**
Spring 2017							
Water Resources and Environmental	5	6	83	859	1214	71	1.18
Transportation	6	7	86	1083	1555	70	1.23
Geotechnical	1	2	50	252	374	67	0.74
Civil-Construction	1	1	100	389	632	62	1.62
Structural	2	2	100	787	1147	69	1.46
Overall	**15**	**18**	**83**	**3370**	**4922**	**68**	**1.22**
Totals Since Fall 2016							
Water Resources and Environmental	11	14	79	1624	2251	72	1.09
Transportation	7	8	88	1941	2789	70	1.26
Geotechnical	4	5	80	468	714	66	1.22
Civil-Construction	4	4	100	697	1167	60	1.67
Structural	2	2	100	787	1147	69	1.46
Overall	**28**	**33**	**85**	**5517**	**8068**	**68**	**1.24**

Action Items for Academic Year 2016-2017

Department curriculum committee discussions that merit consideration as action items in the 2017-2018 academic year (as discussed with the faculty at the August 2017 retreat) include:

- Examine the intern class credit assignment with the goal of possibly adjusting this credit assignment to reflect the importance of internships and to incentivize student participation in them.
- Consider reinstating senior exit interviews for the civil engineering curriculum, or retain this assessment tool as ad hoc.
- Continue to monitor progress of the proposal for an accredited environmental engineering undergraduate program as it moves through the University review process.
- Consider some form of formal ABET based outcome survey of our graduating seniors (conducted inhouse) to replace the outcomes survey historically conducted across the entire COE.
- Consider starting to formally use the PE exam results as assessment tool.
- Continue to monitor the conduct of EGEN 310.
- Review and revise our program assessment plan.
- Continue to exam the impact of Gazi Dual-Degree students on the FE exam results as an assessment tool.