SAINT LOUIS UNIVERSITY.

Program-Level Assessment: Annual Report

Program: Civil Engineering	Department: School of Engineering
Degree or Certificate Level: Bachelor of Science	College/School: Parks College of Engineering, Aviation & Technology
Date (Month/Year): October/2021	Primary Assessment Contact: Dr. Chris Carroll

In what year was the data upon which this report is based collected? 2020/2021

In what year was the program's assessment plan most recently reviewed/updated? 2019/2020

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle?

1) An ability to identify, formulate, and solve complex civil engineering problems by applying principles of engineering, science, and mathematics in more than one context (e.g. construction, environmental, geotechnical, structural, transportation, water resources).

4) An ability to recognize ethical and professional responsibilities in civil engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

2. Assessment Methods: Artifacts of Student Learning

Which artifacts of student learning were used to determine if students achieved the outcome(s)? Please identify the course(s) in which these artifacts were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

1) An ability to identify, formulate, and solve complex civil engineering problems by applying principles of engineering, science, and mathematics in more than one context (e.g. construction, environmental, geotechnical, structural, transportation, water resources).

CVNG 3010 – Exam Question on Virtual Work

CVNG 3010 – Exam Question on the Force Method

CVNG 3040 – Graded Assignment on Water Treatment Plant Clarifier Design

CVNG 3110 – Graded Assignment on Geometric Roadway Design

CVNG 3130 – Final Exam Question on Backwater Modeling

4) An ability to recognize ethical and professional responsibilities in civil engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

CVNG 3040 – Final Exam Question on Climate Change

CVNG 3120 – Project on Transportation News

CVNG 3140 – Social Justice Presentation

PHIL 3400 – Final Overall Grade

7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

CVNG 4500 – Assignment on Design Criteria

3. Assessment Methods: Evaluation Process

What process was used to evaluate the artifacts of student learning, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and include them in/with this report.

The Faculty Review process includes a self-assessment at the course level followed by an independent review of specific outcomes by a faculty member who did not contribute to that respective outcome. Each independent reviewer was asked to answer the following questions:

1) What are the critical program strengths identified in this outcome?
2) What are the critical program weaknesses identified in this outcome?
3) Are there suggested plans of action to improve the results of this outcome? If so, are they adequate?
4) To what extent is the outcome met by the assessment measures on a scale of 1-5?
   (1 = Not at all, 2 = Slightly, 3 = Moderately, 4 = Mostly, 5 = Completely)

Following the independent review of the outcomes, the faculty meet for an assessment retreat as a group to develop a collective plan of action to address any weaknesses.

Note: All rubrics are included at the end of this report.

1) An ability to identify, formulate, and solve complex civil engineering problems by applying principles of engineering, science, and mathematics in more than one context (e.g. construction, environmental, geotechnical, structural, transportation, water resources).

Outcome 1 was assessed using five different assignments/exams in four different courses that cover four respective sub-disciplines within civil engineering that rely heavily on the application of pre-requisite concepts from engineering, the sciences, and math. Those four courses are CVNG 3010—Structural Analysis, CVNG 3040—Sustainability and Environmental Engineering, CVNG 3110—Transportation Engineering, and CVNG 3130—Hydraulic Engineering.

4) An ability to recognize ethical and professional responsibilities in civil engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Outcome 4 was assessed using three different assignments in three different courses along with the overall letter grade in a fourth. Three courses cover three respective sub-disciplines, while the fourth is a core course for all engineering majors. Those four courses are CVNG 3040—Sustainability and Environmental Engineering, CVNG 3120—Transportation Engineering Lab CVNG 3140—Hydraulics Engineering Lab, and PHIL 3400—Engineering Ethics.

7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Outcome 7 was assessed using two different assignments in two different courses. The two courses are the culminating capstone experiences: CVNG 4500—Capstone Design I and CVNG 4510—Capstone Design II.

4. Data/Results

What were the results of the assessment of the learning outcome(s)? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

1) An ability to identify, formulate, and solve complex civil engineering problems by applying principles of engineering, science, and mathematics in more than one context (e.g. construction, environmental, geotechnical, structural, transportation, water resources).

Only one of the five assessment measures successfully met the benchmark of 80% for rubric score and raw score for the 2020-2021 academic year. In the 2019-2020 assessment two of four met the benchmark and one was not assessed because of the COVID-19 Pandemic. Thus, there was a slight decline in student performance. While the various social distancing protocols and use of Zoom may have impacted student performance, the commonality across three of the measures that did not meet the benchmark in the 2020-2021 academic year was small mistakes that cascaded through the problems used to assess the outcome. The exam questions seem to be too comprehensive and the most likely solution is to revise the problems to not rely so much on other knowledge outside of Outcome 1's scope.

Outcome 1 Assessment Results Summary for 2020-2021 (Current)

Course	CVNG 3010		CVNG 3010		CVNG 3040		CVNG 3110		CVNG 3150	
Assess. Measure	Exam Question on Virtual Work		Exam Question on the Force Method		Graded Assignment on Water Treatment Plant Clarifier Design		Graded Assignment on Geometric Roadway Design		Final Exam Question on Backwater Modeling	
Scoring	Raw Score	Rubric Score	Raw Score	Rubric Score	Raw Score	Rubric Score	Raw Score	Rubric Score	Raw Score	Rubric Score
Average	15.14	1.67	30.56	1.88	13.69	2.56	7.18	1.45	11.00	1.67
SD	8.16	0.84	13.83	0.93	1.74	0.63	2.79	0.52	3.88	0.98
High	25.00	3.00	45.00	3.00	15.00	3.00	10.00	2.00	15.00	3.00
Median	16.25	1.00	32.00	2.00	15.00	3.00	6.00	1.00	12.50	1.00
Low	0.00	1.00	0.00	1.00	10.00	1.00	4.00	1.00	3.00	1.00
Total Pts	25		45		15		10		15	
≥ 70%	9		9		15		5		8	
< 70%	9		8		1		6		4	
% ≥ 70%	**50**		**52.9**		**93.8**		**45.5**		**66.7**	
Target		2		2		2		2		2
≥ 2		8		9		15		5		4
< 2		10		8		1		6		8
% ≥ 2		**44.4**		**52.9**		**93.8**		**45.5**		**33.3**
Status	**Not Met**	**Not Met**	**Not Met**	**Not Met**	**Met**	**Met**	**Not Met**	**Not Met**	**Not Met**	**Not Met**

Outcome 1 Assessment Results Summary for 2019-2020 (Previous)

Course	CVNG 3010		CVNG 3010		CVNG 3040		CVNG 3110		CVNG 3150	
Assess. Measure	Exam Question on Virtual Work		Exam Question on the Force Method		Graded Assignment on Water Treatment Plant Clarifier Design		Graded Assignment on Geometric Roadway Design		*Final Exam Question on Backwater Modeling	
Scoring	Raw Score	Rubric Score	Raw Score	Rubric Score	Raw Score	Rubric Score	Raw Score	Rubric Score	Raw Score	Rubric Score
Average	26.28	2.05	33.15	1.75	9.76	2.21	37.74	1.89		
SD	5.47	0.60	11.74	0.85	4.44	0.85	3.00	0.32		
High	30.00	3.00	44.00	3.00	15.00	3.00	40.00	2.00		
Median	28.00	2.00	35.00	1.50	10.00	2.00	40.00	2.00		
Low	10.50	1.00	0.00	1.00	4.00	1.00	30.00	1.00		
Total Pts	30		45		15		40			
≥ 70%	17		12		8		19			
< 70%	3		8		11		0			
% ≥ 70%	**85**		**60**		**42.1**		**100**			
Target		2		2		2		2		
≥ 2		17		10		14		17		
< 2		3		10		5		2		
% ≥ 2		**85**		**50**		**73.7**		**89.5**		
Status	**Met**	**Met**	**Not Met**	**Not Met**	**Not Met**	**Not Met**	**Met**	**Met**	**N/A**	**N/A**

4) An ability to recognize ethical and professional responsibilities in civil engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Two of the three assessment measures successfully met the benchmark for raw score and rubric score and in the case of the philosophy course, the overall equivalent grade. One assessment failed to meet the benchmark values, but included suggestions for improvement. In comparison, all of the assessment measures successfully met the benchmark values in the 2019-2020 assessment. Concern still exists regarding the rigor of the ethics course and the program has begun implementing planned changes to address the concern.

Outcome 4 Assessment Results Summary for 2020-2021 (Current)

Course	CVNG 3040		CVNG 3120		CVNG 3140		PHIL 3400
Assess. Tool	Final Exam Question on Climate Change		Project on Transportation News		Social Justice Presentation		Final Overall Grade
Scoring	Raw Score	Rubric Score	Raw Score	Rubric Score	Raw Score	Rubric Score	Numerical Equivalent
Average	11.67	2.17	27.91	2.09	92.00	2.60	4.00
SD	3.36	0.86	1.51	0.70	3.06	0.52	0.00
High	15.00	3.00	30.00	3.00	96.00	3.00	4.00
Median	11.00	2.00	28.00	2.00	92.00	3.00	4.00
Low	6.00	1.00	25.00	1.00	89.00	2.00	4.00
Total Pts	15		30		100		
≥ 70%	11		11		10		
< 70%	7		0		1		
% ≥ 70%	**61.1**		**100**		**90.9**		
Target		2		2		2	2
≥ 2		13		9		10	22
< 2		5		2		1	0
% ≥ 2		**72.2**		**81.8**		**90.9**	**100**
Status	**Not Met**	**Not Met**	**Met**	**Met**	**Met**	**Met**	**Met**

Outcome 4 Assessment Results Summary for 2019-2020 (Previous)

Course	CVNG 3040		CVNG 3120		CVNG 3140		PHIL 3400	
Assess. Tool	Final Exam Question on Climate Change		Project on Transportation News		Social Justice Presentation		Final Overall Grade	
Scoring	Raw Score	Rubric Score	Raw Score	Rubric Score	Raw Score	Rubric Score	Numerical Equivalent	
Average	9.32	2.79	17.47	1.95	89.43	2.24	3.96	
SD	1.62	0.54	1.35	0.52	2.09	0.44	0.11	
High	10.00	3.00	20.00	3.00	92.00	3.00	4.00	
Median	10.00	3.00	18.00	2.00	88.00	2.00	4.00	
Low	3.00	1.00	15.00	1.00	87.00	2.00	3.70	
Total Pts	10		20		100			
≥ 70%	18		19		21			
< 70%	1		0		1			
% ≥ 70%	**94.7**		**100**		**95.5**			
Target		2		2		2	2.00	
≥ 2		18		16		21	15	
< 2		1		3		1	0	
% ≥ 2		**94.7**		**84.2**		**95.5**	**100**	
Status	**Met**	**Met**	**Met**	**Met**	**Met**	**Met**	**Met**	**Met**

7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Both of the assessment measures successfully met the benchmark of 80% percent for both raw score and rubric score. Both assessment measures also met the benchmark values in the 2019-2020 assessment.

Outcome 7 Assessment Results Summary for 2020-2021 (Current)

Course	CVNG 4500		CVNG 4510	
Assess. Tool	Assignment on Design Criteria		Assignment on Pursuit of External Resources not Typically Taught in Classes	
Scoring	Raw Score	Rubric Score	Raw Score	Rubric Score
Average	92.50	2.75	86.10	2.40
SD	4.44	0.44	11.67	0.68
High	95.00	3.00	98.00	3.00
Median	95.00	3.00	90.00	2.50
Low	85.00	2.00	60.00	1.00
Total Pts	100		100	
≥ 70%	20		18	
< 70%	0		2	
% ≥ 70%	**100**		**90**	
Target		2		2
≥ 2		20		18
< 2		0		2
% ≥ 2		**100**		**90**
Status	**Met**	**Met**	**Met**	**Met**

Outcome 7 Assessment Results Summary for 2019-2020 (Previous)

Course	CVNG 4500		CVNG 4510	
Assess. Tool	Assignment on Design Criteria		Assignment on Pursuit of External Resources not Typically Taught in Classes	
Scoring	Raw Score	Rubric Score	Raw Score	Rubric Score
Average	95.00	2.71	91.62	2.43
SD	3.46	0.46	5.27	0.60
High	98.00	3.00	98.00	3.00
Median	95.00	3.00	92.00	2.00
Low	90.00	2.00	80.00	1.00
Total Pts	100		100	
≥ 70%	21		21	
< 70%	0		0	
% ≥ 70%	**100**		**100**	
Target		2		2
≥ 2		21		20
< 2		0		1
% ≥ 2		**100**		**95.2**
Status	**Met**	**Met**	**Met**	**Met**

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

1) An ability to identify, formulate, and solve complex civil engineering problems by applying principles of engineering, science, and mathematics in more than one context (e.g. construction, environmental, geotechnical, structural, transportation, water resources).

Independent Faculty Review

1. Outcome 1 is assessed in four courses across the civil engineering curriculum during the third year using five assignments evaluated by rigorous rubrics. Unfortunately, student performance related to this outcome appeared to decline compared to the 2019-2020 assessment. Despite modifications for the 2020-2021 academic year, the students did not show significant strength. The faculty may need to revise their activities or approach to assess it as it seems difficult to satisfy.
2. It is concerning that this outcome was not met given that much emphasis is on the engineering analysis skills in junior years. It is critical to improve student performance related to Outcome 1.
3. The commonality among three of the assessment measures is the comprehensive level of the exam questions currently being used. The exam questions may be too difficult because students consistently make early mistakes that cascade through the problem resulting in additional mistakes related to Outcome 1. It is imperative that this outcome improve and that it does not keep declining and the problems should focus more on the topic at hand and less on previous knowledge for better assessment. Furthermore, the instructors of courses in which the same three assessment measures are used have also noted concerns regarding students' prerequisite knowledge.
4. The average rating for this outcome was a 2.0. The outcome was only **slightly** met and has room for improvement.

4) An ability to recognize ethical and professional responsibilities in civil engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Independent Faculty Review

1. The Civil Engineering Program is particularly strong in the social, ethical, global, and cultural aspects. Outcome 4 is assessed in multiple civil engineering courses and sub-disciplines. There is an apparent connection between extracurricular activities and programs with the curriculum in the context of Outcome 4. The strength of the program towards global and cultural aspects remains strong.
2. The interaction among students in the 2020-2021 academic year was impacted because of COVID-19 social distancing protocols, which may have impacted student performance to some extent.
3. In the 2021-2022 academic year, having the students back in person to promote these types of discussion will improve awareness. The assignment in CVNG 3040 will be revised. PHIL 3400 is being phased out as it is not being well received by students and faculty, although it did meet the set criteria.
4. The average rating for this outcome was a 4.0. The outcome was **mostly** met, but has some room for improvement.

7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Independent Faculty Review

1. Both assessment measures used for this outcome clearly met the established benchmark of 80% on both raw score and rubric score. Most of the teams were successful in identifying several of the required codes and constraints and were able to acquire new knowledge as needed for the Capstone course to some extent.
2. Students were still lacking a complete list of design specifications; two of the four groups were missing critical design specification information and/or lacked references to properly document their sources for information. Furthermore, there was no documentation of communication with external contacts, which was mainly attributed to the fact that students had very limited options for meetings because of the COVID-19 pandemic.

3. One option to improve on this outcome is to allow students to revise their submissions based on instructor feedback and it is recommended that students should keep records of their external communications/meetings in the form of meeting minutes including contact names, dates, and minimal descriptions of topics discussed.
4. The average rating for this outcome was a 3.0. The outcome was **moderately** met and may have some room for improvement.

6. Closing the Loop: Dissemination and Use of Current Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of assessment?

Civil Engineering Program Meeting—ABET/HLC

Meeting Minutes

October 6, 2020, 3:10 pm - 4:00 pm, MDD 1001

Attendance:
Present: Craig Adams, Chris Carroll, Amanda Cox, Riyadh Hindi, Jalil Kianfar, Ronaldo Luna
Absent: None
Visitors: None

1. **Meeting topic:** The topic of this meeting was focused on the Assessment Retreat portion of the Annual ABET/HLC Student Outcomes Assessment Process. The specific purpose was to evaluate the Faculty Review of Outcomes 1, 4, and 7 and Develop a Plan of Action that addresses any weaknesses that were identified during the assessment and review processes for this cycle.

2. **Review of Student Outcomes and Rubrics:** The Faculty Review process includes a self-assessment at the course level followed by an independent review of specific outcomes by a faculty member who did not contribute to that respective outcome. For the 2021 review, Drs. Hindi and Luna were the independent reviewers for Outcome 1 and 4 and Drs. Carroll and Cox were independent reviewers for Outcome 7. Each independent reviewer was asked to answer the following questions:

   5) What are the critical program strengths identified in this outcome?
   6) What are the critical program weaknesses identified in this outcome?
   7) Are there suggested plans of action to improve the results of this outcome? If so, are they adequate?
   8) To what extent is the outcome met by the assessment measures on a scale of 1-5?
      (1 = Not at all, 2 = Slightly, 3 = Moderately, 4 = Mostly, 5 = Completely)

   The following sections summarize brief discussions and activities related to each outcome during the meeting.

   Outcome 1: Dr. Carroll began the discussion by reviewing the data from the last assessment period for Outcome 1, which occurred in the 2019-2020 academic year because the Civil Engineering Program revised their assessment process for that year. Two of four assessment measures in 2019-2020 met the benchmark values: CVNG 3010 and CVNG 3110, while two did not: CVNG 3010 and CVNG 3040. The assessment measure in CVNG 3130 was not assessed in 2019-2020 due to the COVID-19 Pandemic.

   The 2019-2020 Plan of Action for Continuous Improvement included changes in CVNG 3010 and CVNG 3040 to address the weaknesses. Dr. Carroll noted that changes in CVNG 3010 in the fall of 2020 included more emphasis on writing shear and moment equations through in-class examples and homework problems and Dr. Adams provided more in-depth examples in class and had students do more active learning activities where they worked through problems during class. There were no improvements made in CVNG 3110 or CVNG 3130 for the 2020-2021 academic year.

   Only one assessment measure met the benchmark values for the 2020-2021 academic year: CVNG 3040. Dr. Adams noted that the students did very well on the assignment given the changes he made from the 2019-2020 academic year. The other assessment measures in CVNG 3010, 3110, and 3130 did not meet the benchmark values for the 2020-2021 academic year. Dr. Carroll noted that COVID protocols may have contributed to the decline as a result of students attending class on Zoom along with other indirect impacts on student learning associated with the pandemic. He also mentioned that some students in CVNG 3010 specifically made a D in statics and/or mechanics or took one of the courses outside of the university, both of which may be affecting their levels of prerequisite knowledge. Dr. Cox noted that the problem used for assessment in CVNG 3130 included a lot of

information and if a student made a mistake early on, it also impacted the portion of the problem directly related to the assessment of Outcome 1. Dr. Carroll concurred that his problems may have similar issues in CVNG 3010. Dr. Kianfer used a quiz for the 2020-2021 assessment measure in place of a homework assignment used for the 2019-2020 assessment measure, which could have affected the assessment results given that the rubric was tailored more toward the homework assignment. Furthermore, Drs. Hindi and Luna, the independent reviewers for Outcome 1, also suggested that the assessment measures may need revision to accurately capture student performance. Dr. Carroll and Dr. Cox both plan to revise their exam questions to better assess Outcome 1 and minimize the impact of simple mistakes made early on by the students. Dr. Kianfar plans to revert back to using the homework assignment as the assessment tool in lieu of the quiz. Furthermore, the Civil Engineering Program will implement a C- or better requirement for prerequisite statics, mechanics, and fluid dynamics courses taking affect with the freshmen in the fall of 2022.

Dr. Luna also pointed out that all of the courses used to assess Outcome 1 were at the junior level and Dr. Hindi mentioned assessing other required courses, perhaps at the sophomore level. Dr. Carroll suggested statics and mechanics since Dr. Kianfar typically teaches statics in the fall and Dr. Hindi typically teaches mechanics in the spring. Several of the students in those courses are civil engineering majors and would provide an adequate sample size to assess Outcome 1 at the sophomore level. Dr. Kianfar and Dr. Hindi agreed to pull data from the two courses for assessment purposes and will look at what assessment measures to use during each semester.

Outcome 4: Dr. Carroll began the discussion by reviewing the data from the last assessment period for Outcome 4, which occurred in the 2019-2020 academic year because the Civil Engineering Program revised their assessment process for that year. All four assessment measures met the benchmark values. Although the benchmark values were all met, there were some continuous improvement actions proposed for the 2020-2021 academic year. Dr. Kianfar confirmed that he increased the presentation time to 8 minutes giving students more time to elaborate on the content. Likewise, Dr. Cox confirmed that she revised her assignment with more focus on societal needs and economic and environmental factors. PHIL 3400 is still required and embedding ethics content into other courses is in progress.

Three of the four assessment measures met the benchmark values for the 2020-2021 academic year; the only one that did not meet the benchmark values was in CVNG 3040. Dr. Adams said he spent sufficient time on the topic last year and that students created a flyer to inform the general public about the content and that students should be ok this year without any significant changes. The ethics course remains a concern because all civil engineering students made an A in the course. This suggest that the course does not provide enough rigor.

The only major change echoes that from the 2019-2020 academic year: PHIL 3400 will be removed from the curriculum and ethics will be embedded throughout other civil engineering courses at all levels. Beginning with the freshmen who begin in the fall of 2022, students will no longer be required to take PHIL 3400. Some additional suggested courses for embedding ethics into the curriculum included CVNG 3040, CVNG 3070, CVNG 3130, and CVNG 3150. The faculty as a whole noted they are not familiar with the best practices to teach ethics, but are willing to include such content. Dr. Carroll plans to look for best practices for incorporating ethics content into engineering courses.

Outcome 7: Dr. Carroll began the discussion by reviewing the data from the last assessment period for Outcome 7, which occurred in the 2019-2020 academic year because the Civil Engineering Program revised their assessment process for that year. Both assessment tools met the benchmark values. The Plan of Action called for more specificity by the students regarding what is a law, codes, design guideline, constraint, or specification with regard to design criteria and documenting meetings with external entities in the form of a memo or meeting minutes. External meetings were difficult with COVID protocols in place for the 2020-2021 academic year.

Drs. Carroll and Cox, the independent reviewers for Outcome 7, recommended that students should keep records of their external communications/meetings in the form of meeting minutes including contact names, dates, and minimal description of topics discussed. They also suggested more detail regarding design criteria and to allow students the opportunity to revise their submissions if they were missing references.

Dr. Luna mentioned that the design criteria assignment is completed in the second half of the first semester (CVNG 4500). At that time, students are still completing their conceptual designs and still working to determine what will drive their design criteria. The students improve throughout the year and the other reports (e.g. 60% and 90% progress reports) could be used to further assess Outcome 7. Dr. Cox suggested the possibility of giving the students an opportunity to revise their work based on feedback as subsequent assignments, which could be as simple as adding assessment of existing assignments from CVNG 4510. Dr. Carroll noted that the 2019-2020 assessment concluded that students should include meeting minutes or memos. However, the COVID protocols prohibited students from conducting such meetings. Dr. Luna mentioned that students claim to take notes, but agreed that there should be a graded assignment, specifically when students meet with individuals off campus. Meeting documentation will be added in the 2021-2022 academic year.

B. How specifically have you decided to use these findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies	• Course content • Teaching techniques • Improvements in technology • Prerequisites	• Course sequence • New courses • Deletion of courses • Changes in frequency or scheduling of course offerings
Changes to the Assessment Plan	• Student learning outcomes • Artifacts of student learning • Evaluation process	• Evaluation tools (e.g., rubrics) • Data collection methods • Frequency of data collection

Please describe the actions you are taking as a result of these findings.

1) An ability to identify, formulate, and solve complex civil engineering problems by applying principles of engineering, science, and mathematics in more than one context (e.g. construction, environmental, geotechnical, structural, transportation, water resources).

Listed below are the detailed plans of action associated with each course for continuous improvement related to Outcome 1.

CVNG 3010—Structural Analysis: Consistent with the 2019-2020 assessment results, students appear to focus on other parts of the problem and brush off the importance of previous information when preparing for the exam. The common mistakes on the virtual work problem made by students include minor mistakes writing moment equations, using incorrect limits for the integration, and in the case of this year's problem, not recognizing the symmetry of the problem. Similarly, students consistently missed the reactions on the force method problem, which resulted in further accumulating errors. There were some mistakes related to the moment equations as well. The student appeared to understand the process, but the problem itself may be too complex for an exam problem. It is also worth noting that the course logistics were affected by COVID protocols with at least four students who attended class via Zoom; all of those students had low scores on this question and struggled throughout the semester. During the fall semester of 2021, the instructor will continue to emphasize the importance of writing moment equations, but will also adjust the exam questions to focus more on the topic at hand and stray away from requiring students to recall as much previous information.

CVNG 3040—Sustainability and Environmental Engineering: There is no continuous improvement planned for the 2021-2022 academic year in this course with respect to Outcome 1.

CVNG 3110—Transportation Engineering: A quiz was used in place of a homework assignment for assessment of Outcome 1 in the 2020-2021 academic year, which could have affected the assessment results given that the rubric was tailored more toward the homework assignment. The instructor will revert to the homework assignment used in the 2019-2020 academic year. Furthermore, the instructor will elaborate more on the importance of consistency of the distance units and slopes in the spring of 2022 to address students' struggles with "stations" and distances.

CVNG 3130—Hydraulic Engineering: A number of students failed to select the correct flow depth to evaluate for the problem early on. Students must first classify and sketch the water surface profile to determine which flow depth should be used for the analysis. In short, students were required to complete several steps on the problem before the actual calculations used for the assessment of Outcome 1. During the spring semester of 2022, the instructor will modify the problem used for assessment to isolate the different analysis components, so that the calculations used for assessment can be evaluated independent from the other concepts.

Other Suggested Improvements: The instructors in CVNG 3010 and 3130 have expressed concerns regarding students' prerequisite knowledge from ESCI 3100—Mechanics and ESCI 3200—Fluid Dynamics over the past three years. Currently, students must simply pass those courses to advance to CVNG 3010 and CVNG 3130, respectively. The students who have struggled with the material in CVNG 3010 and CVNG 3130 have made D's in those courses and in the case of ESCI 3100, sometimes taken the course at a community college. Beginning with the freshmen students who

enter the program in the fall of 2022, a C- or better requirement will be in place for ESCI 3100 and ESCI 3200 to potentially address the inadequate prerequisite knowledge issues.

4) An ability to recognize ethical and professional responsibilities in civil engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Listed below are the detailed plans of action associated with each course for continuous improvement related to Outcome 4.

CVNG 3040— Sustainability and Environmental Engineering: Students did not appear to understand the principles of climate change as a whole, although they were approaching the benchmark value with regard to rubric scores. The instructor created a new homework for the fall semester of 2021 in which each student has to prepare a flyer that demonstrates all the key points related to climate change and global warming.

CVNG 3120—Transportation Engineering Lab: There is no continuous improvement planned for the 2021-2022 academic year in this course with respect to Outcome 4.

CVNG 3140—Hydraulic Engineering Lab: There is no continuous improvement planned for the 2021-2022 academic year in this course with respect to Outcome 4.

PHIIL 3400—Ethics and Engineering: This course will be officially removed from the curriculum beginning in the fall of 2022. Students who entered the university prior to the fall of 2022 will still be required to take the course.

Other Suggested Improvements: The civil engineering faculty have discussed where to gradually embed and assess ethics at each level of the curriculum beginning at the freshmen level. The most likely courses for that implementation are CVNG 1010—Freshman Engineering (i.e. Intro to Civil Engineering), CVNG 3070—Engineering Project Management, CVNG 3040—Sustainability and Environmental Engineering, CVNG 3150—Intro to Structural Design, CVNG 4500—Capstone Design I, and CVNG 4510—Capstone Design II. The civil engineering faculty will begin embedding ethics content into various courses during the 2021-2022 academic year.

7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Listed below are the detailed plans of action associated with each course for continuous improvement related to Outcome 7.

CVNG 4500—Capstone Design I: There is no continuous improvement planned for the 2021-2022 academic year in this course with respect to Outcome 7.

CVNG 4510—Capstone Design II: Students will be required to document external communications/meetings in the form of meeting minutes including contact names, dates, and minimal descriptions of the topics discussed.

Other Suggested Improvements: Given that students' knowledge regarding design criteria improves with time in CVNG 4500 and CVNG 4510, 60% and 90% progress reports may also be added to the assessment process.

If no changes are being made, please explain why.

7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

One particular change made during the fall 2020 semester with regard to CVNG 3040 for Outcome 1:

"The students struggled with relatively straight-forward design calculations. Beginning in the Fall 2020 semester, the instructor will adjust the amount of time devoted to the topic of water treatment plant and wastewater treatment plant design (noting many calculations are similar). The instructor will present more examples in class on design calculations in general, and process sizing (e.g., basin sizing, filter sizing, chlorine dosing, etc.) specifically. Less assumptions regarding students' prior knowledge regarding calculations will be made, and more in-depth discussion around the topic of treatment plant design will be conducted. Additional homework problems will be assigned that require open-ended problem solving by the students."

B. How has this change/have these changes been assessed?

The changes were assessed in the 2020-2021 academic year through normal assessment activities.

C. What were the findings of the assessment?

In the 2019-2020 academic year, 42.1% of students scored at least a 70% on the design problem and 73.7% scored at least a 2 (satisfactory) on the corresponding rubric, both of which were below the 80% benchmark. In the 2020-2021 academic year, 93.8% of students scored at least 70% on the design problem and scored at least a 2 (satisfactory) on the corresponding rubric.

D. How do you plan to (continue to) use this information moving forward?

Future assessment data will provide continued information regarding these changes and will allow for further enhancements.

IMPORTANT: Please submit any assessment tools and/or revised/updated assessment plans along with this report.

1) An ability to identify, formulate, and solve complex civil engineering problems by applying principles of engineering, science, and mathematics in more than one context (e.g. construction, environmental, geotechnical, structural, transportation, water resources).

Course: CVNG 3010 – Structural Analysis
Performance Measure: Exam Question on Virtual Work

1 – Does not meet expectations	2 – Meets expectations	3 – Exceeds expectations
The virtual load is applied at the wrong location or the moment equations are incorrect due to a major error or multiple minor errors (e.g. omitted the distributed load, sums the moments about the wrong point) **OR** The integration calculation is grossly incorrect (e.g. integration method is wrong, limits are wrong)	The virtual load is applied at the correct location. The moment equations for the real and virtual loads are mostly correct with no more than two minor errors (e.g. wrong sign, wrong moment arm). **AND** The integration calculation is correct with no more than one minor math error (e.g. wrong sign, forgot to divide by the added exponent)	The virtual load is applied at the correct location. The moment equations are correct, and symmetry is used to solve the problem. **AND** The integration calculation is correct with no math errors.

Course: CVNG 3010 – Structural Analysis
Performance Measure: Exam Question on the Force Method

1 – Does not meet expectations	2 – Meets expectations	3 – Exceeds expectations
The virtual load calculations are incorrect on "Structure 1" (e.g. the virtual load is applied at the wrong location, the moment equations or integration are incorrect due to a major error or multiple minor errors). **OR** The virtual load calculations are incorrect on "Structure 2" (e.g. the virtual load is applied at the wrong location, the moment equations or integration are incorrect due to a major error or multiple minor errors).	The virtual work calculations are mostly correct on "Structure 1." Specifically, the moment equations for the real and virtual loads and the integration calculation are mostly correct with only minor errors (e.g. wrong sign, wrong moment arm, forgot to divide by the added exponent). **AND** The virtual work calculations are mostly correct on "Structure 2." Specifically, the moment equations for the real and virtual loads and the integration calculation are mostly correct with only minor errors (e.g. wrong sign, wrong moment arm, forgot to divide by the added exponent).	The virtual work calculations are almost entirely correct for both structures with no more than a total of two minor errors (e.g. wrong sign). **AND** The reactions are calculated correctly based on the results from the virtual work calculations used to solve for the redundant reaction.

Course: CVNG 3040 – Sustainability and Environmental Engineering
Performance Measure: Graded Assignment on Water Treatment Plant Clarifier Design

1 – Does not meet expectations	2 – Meets expectations	3 – Exceeds expectations
Dimensions of clarifier was calculated incorrectly or with significant math errors. **OR** Calculation of critical settling velocity was calculated incorrectly or with significant math errors.	Dimensions of clarifier calculated using correct procedure with only very minor math or unit errors. **AND** Calculation of critical settling velocity was correct with only very minor math or unit errors.	Dimensions of clarifier calculated correctly. **AND** Calculation of critical settling velocity was correct with no or very minor math errors.

Course: CVNG 3110 – Transportation Engineering
Performance Measure: Graded Assignment on Geometric Roadway Design

1 – Does not meet expectations	**2 – Meets expectations**	**3 – Exceeds expectations**
Students was not able to identify or formulate the trigonometric and geometric relationship between elements of a horizontal curve (radius of curve, length of curve, and central angle of the curve) **OR** Student recognized the trigonometric and geometric relationships between elements of a horizontal curve, but was not able to solve for all of the design elements	Students was able to identify and formulate the trigonometric and geometric relationship between elements of a horizontal (radius of curve, length of curve, and central angle of the curve) **AND** Student was able to solve for all of the design elements	Students was able to identify and formulate the trigonometric and geometric relationship between elements of a horizontal (radius of curve, length of curve, and central angle of the curve) **AND** Student was able to solve for all of the design elements **AND** Student developed the geometric design equations.

Course: CVNG 3130 – Hydraulic Engineering
Performance Measure: Final Exam Question on Backwater Modeling

1 – Does not meet expectations	2 – Meets expectations	3 – Exceeds expectations
The water surface profile classification is incorrect (e.g., M1, M2, M3, S1, S2, or S3). **OR** The elevation change along the water surface profile is applied in the wrong direction (upstream for subcritical flow and downstream for supercritical flow).	The water surface profile classification is correct, and the elevation change along the water surface profile is applied in the correct direction. **AND** Calculations for the direct step method are correct with no more than two minor math errors (e.g., missing exponent or error during calculator input).	The water surface profile classification is correct, and the elevation change along the water surface profile is applied in the correct direction. **AND** Calculations for the direct step method are correct with no math errors.

4) An ability to recognize ethical and professional responsibilities in civil engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Course: CVNG 3040 – Sustainability and Environmental Engineering
Performance Measure: Final Exam Question on Climate Change

1 – Does not meet expectations	2 – Meets expectations	3 – Exceeds expectations
Mechanisms of global water due to greenhouse gases were diagramed and explained inaccurately. **OR** Method of determining 400,000 years of carbon dioxide and temperatures on Earth were incorrect.	Mechanisms of global water due to greenhouse gases were diagramed and explained mostly completely and accurately. **AND** Method of determining 400,000 years of carbon dioxide and temperatures on Earth were mostly correct.	Mechanisms of global water due to greenhouse gases were diagramed and explained completely and accurately. **AND** Method of determining 400,000 years of carbon dioxide and temperatures on Earth were correct.

Course: CVNG 3120 – Transportation Engineering Lab
Performance Measure: Project on Transportation News

1 – Does not meet expectations	2 – Meets expectations	3 – Exceeds expectations
The presentation only discusses one aspect of a transportation project (e.g. only focuses on technology) **AND** The presentation does not take into account the impact of a project on users, and non-users	The prestation discusses at least two aspects of a project impact in economic, environmental, and societal contexts, **AND** The presentation takes into account the impact of project on users,	The presentation provides examples of project impact in economic, environmental, and societal contexts, **AND** Provides examples from a developing nations, adds a global perspective to the issue **AND** The presentation discusses the impact of project on users, and non-users.

Course: CVNG 3140 – Hydraulic Engineering Lab
Performance Measure: Social justice presentation including economic, environmental, and societal contexts

1 – Does not meet expectations	2 – Meets expectations	3 – Exceeds expectations
Lacks detail of the social justice issue from a local perspective related to their assigned viewpoint (i.e., activate levee to protect citizens of Cairo or not activate levee to protect farmland). **OR** Lacks historical context and relevant policies. **OR** Does not recognize the impact of inequity from the assigned viewpoint.	Details the social justice issue from a local perspective related to their assigned viewpoint (i.e., activate levee to protect citizens of Cairo or not activate levee to protect farmland). **AND** Provides some historical context and relevant policies. **AND** Identifies the impact of inequity from the assigned viewpoint.	Details the social justice issue from a local perspective related to their assigned viewpoint (i.e., activate levee to protect citizens of Cairo or not activate levee to protect farmland). **AND** Provides appropriate historical context and relevant policies. **AND** Identifies the impact of inequity from the assigned viewpoint. **AND** Highlights the balance between economic, environment and societal needs

7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Course: CVNG 4500 – Capstone Design I
Performance Measure: Assignment on Design Criteria

1 – Does not meet expectations	2 – Meets expectations	3 – Exceeds expectations
Students assembled the design criteria list, which include: constraints, assumptions, laws and codes. Only a few of the items were considered and was not adequate. Their senior design capstone project did not adhere to the design criteria and it was not consistent in the design of the engineered built system.	Students assembled the design criteria list, which include: constraints, assumptions, laws and codes. Some of the items were not considered. Their senior design capstone project only sometimes adhered to the design criteria and it was not consistent in the effective design of the engineered built system.	Students assembled the design criteria list, which include: constraints, assumptions, laws and codes. Their senior design capstone project continued to include adherence to the design criteria and used it effectively for the design of the engineered built system.

Course: CVNG 4510 – Capstone Design II
Performance Measure: Assignment on Pursuit of External Resources not Typically Taught in Classes

1 – Does not meet expectations	**2 – Meets expectations**	**3 – Exceeds expectations**
Students did not assemble a list of the resources that they were to pursue for senior design capstone class. However, they did not contact professionals in practice, city/county personnel. They limited their resources to items provided in their previous courses.	Students assembled a list of the resources that they were to pursue for senior design capstone class. However, they did not contact professionals in practice, city/county personnel. They only secured faculty advisors, and specialty resources (software and papers) available from external sources.	Students assembled a list of the resources that they were to pursue for senior design capstone class. They contacted professionals in practice, city/county personnel, faculty advisors, and specialty resources (software and papers) available from external sources