

BS in Civil Engineering Program

Year: 2023-2024

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A. Program History

The undergraduate Civil Engineering Program awarded its first Bachelor of Science degree in 1953. It has been accredited by EAC of ABET continuously since receiving its initial accreditation in 1961. The last ABET general review was in 2018.

B. Program Educational Objectives

Civil Engineering Program Educational Objectives

The following statements describe what the Department's undergraduate engineers are expected to attain a few years after graduation.

1. Increasing leadership and responsibility beyond entry level that meet the emerging and evolving demands of civil engineering.
2. Communication and project management skills for effective problem solving.
3. Engagement in life-long learning through professional activities, training, pursuing licensure and understanding of professional ethics, public safety, cost constraints, environmental impacts, sustainability, and policy implications.

Web Access Link: <https://www.lamar.edu/engineering/civil/abet-accreditation.html>

B.1 Process for Review of the Program Educational Objectives

The civil engineering program's educational objectives are reviewed periodically (usually annually at the spring advisory council meetings) to determine if revisions are required. The PEOs are reviewed by the graduating students, the ABET Evaluation committee and the Civil Engineering Advisory Council. The feedback from each constituent base (graduating students, faculty and CEEAC members--which include alumni and employers) are then used to revise PEOs as illustrated in Figure 2-1.

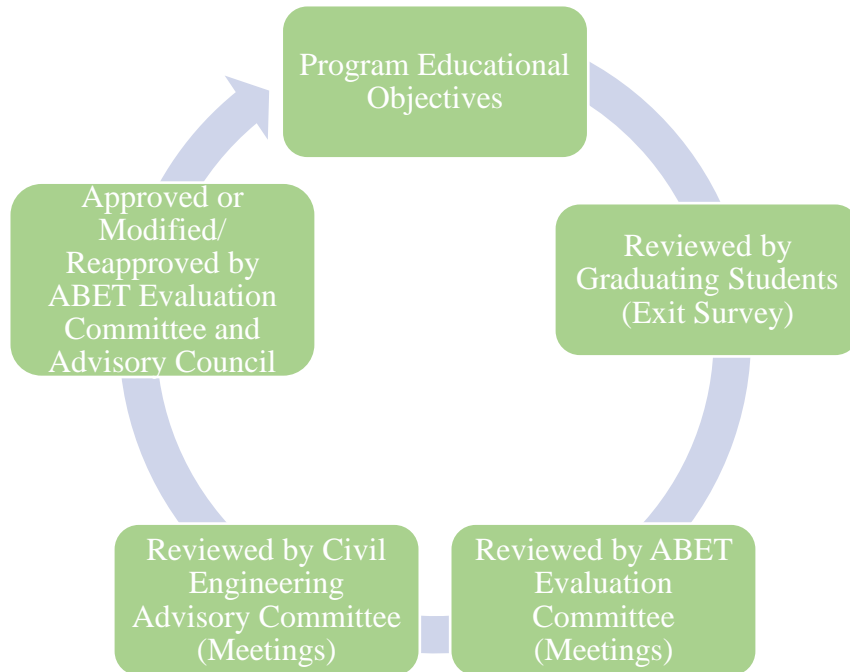


Figure 1 Program Educational Objectives Review Process

The annual PEO review schedule is summarized as follows:

- Graduating Student Exit Surveys (Appendix E) administered in both the Fall and Spring semester.
- ABET Evaluation committee reviews PEOs.
- Civil Engineering Advisory Council reviews PEOs.
- PEOs are approved or proposed changes are made and then later approved by the ABET Evaluation committee and Advisory Council.

C. Student Outcomes

In 2018, the BS CE Program ABET Committee adopted in verbatim the Student Outcomes as defined in Criterion 2 of the EAC of ABET Criteria. It also developed Performance Indicators for each Student Outcome. The adopted student outcomes and their corresponding Performance Indicators are shown below:

C.1 Student Outcomes

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and social contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The student outcomes are listed on the Department of Civil and Environmental Engineering website under the ABET tab (<https://www.lamar.edu/engineering/civil/abet-accreditation.html>).

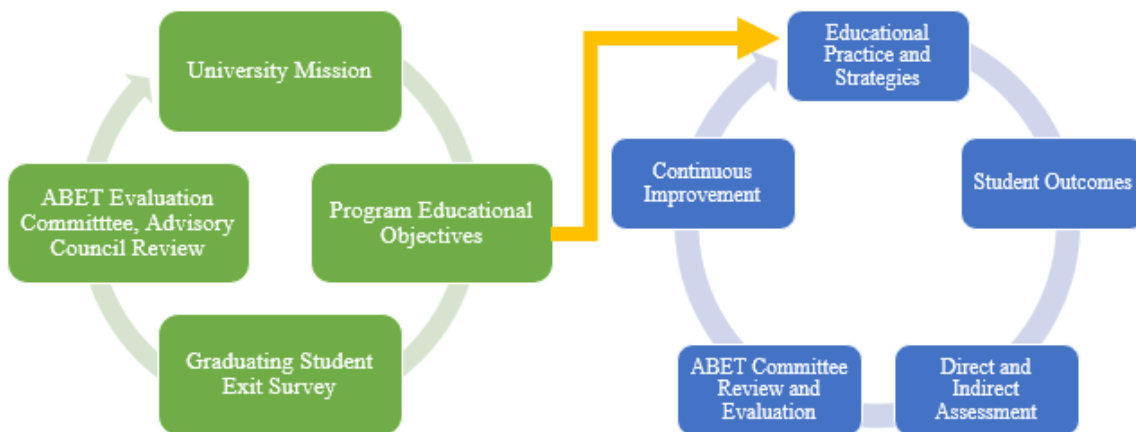


Figure 2 Framework for Continuous Improvement Process of BSCE Program

C.2 Process for Review of the Student Outcomes

1. Selection of student outcomes and courses where the assessment takes place is decided by the Faculty Committee at the beginning of each 3-year assessment cycle.
2. The course instructor uses a scoring rubric that defines the student outcome, the performance indicators, and the scoring criteria. The scoring rubrics for each student outcome are in Appendix E.

- Course instructors select the instruments that are used for direct assessment and map the assignment outcomes to the student outcomes. This includes oral presentation, written reports, examinations, quizzes, or homework.
- 3. Course Instructors create an assignment-student outcome map that clearly defines which instruments will be used for the assessment and how the outcomes of the assignment are aligned with the student outcome. The student outcome-assignment mapping documents are in Appendix E.
 - Performance Indicators are scored as Exemplary (4.0), Accomplished (3.0), Developing (2.0), and Beginning (1.0).
- 4. Assessment data with a representative sample of student work is forwarded to the Faculty Evaluation Committee for review.
 - The data is organized by cycle, academic year, course, student outcomes, and performance indicator. The data is saved on spreadsheet. Representative samples of student work are scanned and forwarded to the Faculty Evaluation committee. The raw assessment data and scanned representative sample of student work is in Appendix E.
- 5. Faculty Evaluation committee evaluates the data and provides recommendations for continuous improvement.
 - Continuous improvements involve program level changes to improve attainment of student outcomes. This includes specific course improvements, faculty professional development, facility improvements, hiring new faculty/staff, or other program level resource improvements.
 - Continuous improvements can be made at the individual course level and/or at the program level. In some cases, to address a deficiency in student achievement, improvements can be made to facilities, multiple BSCE program courses, and outside the classroom supplemental instructional methods.

Data Collection Frequency

Table 1 Summary of Data Source and Collection Frequency

Source of Data	Assessment Type	Program / Course Continuous Improvement	Frequency
Course assessment data	Direct	Program	Yearly
Graduating Student Exit Survey	Indirect	Program	Semester
Aggregated Pass/Fail FE data, Subject Matter FE Data	Supplemental	Program and Course	Yearly
Course Evaluations	Supplemental	Course	Semester
Advisory Council Feedback	Supplemental	Program	Semester
Course Grades and Student Performance	Supplemental	Course	Semester
Graduating Student Salary and Hiring Data	Supplemental	Program	Semester

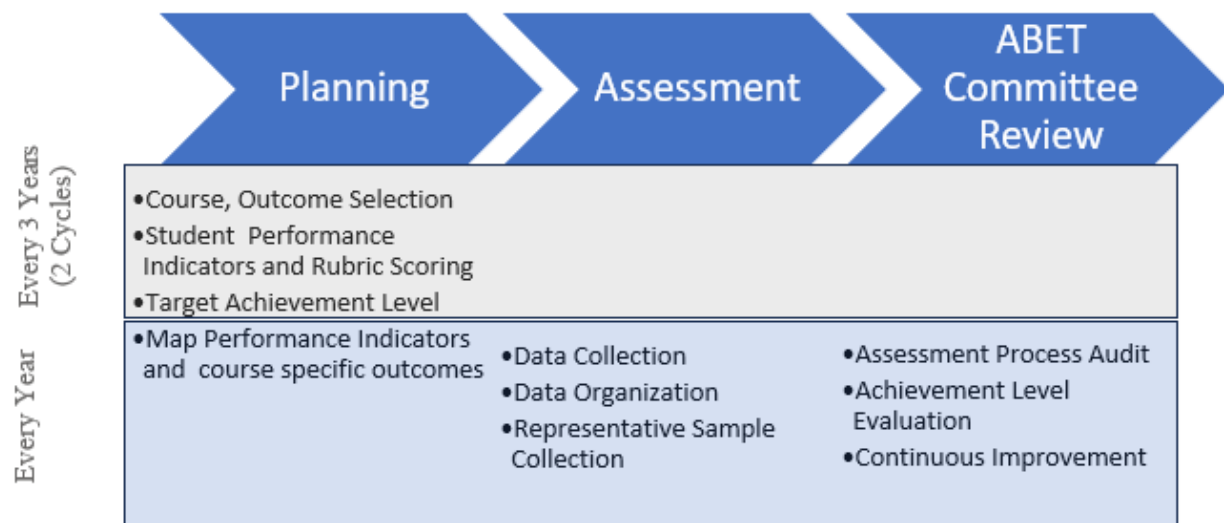


Figure 3 Summary of the planning, assessment, and evaluation process

D. Summary of Assessment Methods

D.1 Direct Assessment

Each student outcome is directly assessed once during each cycle through a variety of instruments (exams, quizzes, homework, reports and presentations, peer evaluations, and questionnaires), gathered from various BSCE courses. Table 4-3 shows the direct assessment data collection frequency and what the type of instrument used in the assessment (E: Exam, P: Presentation, PR: Project Report, PE: Peer Evaluations, SQ: Survey Questionnaire, LR: Lab Report, Q: Quiz, H: Homework). The department assessment committee evaluates the evidence during the end-of-semester or the beginning-of-the-semester faculty meetings held in spring and fall. Continuous Improvement recommendations are made at each of the abet committee meetings and recorded in meeting minutes (Appendix F).

Table 2. Direct Assessment Schedule and Summary of Instruments used for Assessment

Academic Year	Course	Course Name	Primary EAC Student Outcomes						
			1	2	3	4	5	6	7
2021/2022	CVEN 4110	Seminar				H	PR, PE		
2021/2022	CVEN 1201	Introduction to Civil Engineering					PR, PE		
2021/2022	CVEN 4313	Civil Engineering System Design Project (II), 4-3				PR	PR, PE		
2022/2023	CVEN 4313	Civil Engineering System Design Project (II)		PR	P, SQ				
2022/2023	CVEN 4380	Reinforced Concrete Design		E					
2022/2023	CVEN 3370	Water and Wastewater Treatment		PR					
2023/2024	CVEN 3360	Engineering Hydrology							PR
2023/2024	CVEN 3370	Water and Wastewater Treatment	PR						
2023/2024	CVEN 4212	Civil Engineering System Design Project (I)							PR
2023/2024	CVEN 4365	Introduction to Transportation Engineering	H, E, P						
2023/2024	CVEN 4350	Hydraulic Engineering	PR, E						
2023/2024	CVEN 3300	Engineering Materials Systems	PR, P						LR
2023/2024	CVEN 3390	Geotechnical Engineering							LR
E: Exam, P: Presentation, PR: Project Report, PE: Peer Evaluations, SQ: Survey Questionnaire, LR: Lab Report, Q: Quiz, H: Homework									

D.2 Indirect Assessment

The indirect assessment data is used as a secondary source to help support and supplement continuous improvement committee discussions. The data is collected, reviewed, and discussed at the ABET committee meetings. One source of indirect data is collected and discussed at the ABET committee meeting: 1) graduating student exit surveys. The exit surveys are used to inform program level changes and specifically address each student outcome. The course evaluations, rather, are not mapped to a specific student outcome, but are used by instructors to make course-specific continuous improvements based on the specific feedback received from the students. The graduating student exit surveys contain self-reported assessment questions regarding students'

perceptions of 1) how well they have attained each of the student outcomes using a Likert scale (1-5), and 2) how they view the program educational objectives (Approve/Disapprove).

D.3 Additional Data

- Course evaluations--Used by instructors as a supplemental instrument to continuously improve individual courses.
- NCEES FE data--Provides additional information for continuous improvement. However, like the course evaluations, this data source is not mapped to a specific student outcome and is highly variable because students are not required to take the exam. Nonetheless, it is used as program-level supplementary data source for continuous improvement, both at the course level (subject matter performance), and the program level (pass/fail).
- Graduating student salary and hiring data
- Advisory council feedback
- Course grades and student performance

D.4 Expected Level of Attainment

The student performance data is analyzed by reviewing the percentage of students who achieved an “accomplished” level (3.0 or above) to identify areas of improvement. The data is categorized by both student outcomes and performance indicators to identify specific sub-areas that need attention within the broader student outcomes.

At the start of cycle I in 2018, the Faculty Committee defined the Target Achievement Level. This level is considered met when 70% of the students assessed in a particular course receive a performance score of "accomplished" or "exemplary". These rubrics were designed to provide a reasonable benchmark for evaluating student performance in the BSCE program and to give constructive feedback for the purpose of continuous improvement.

E. Program Highlights since Last Report

- Nicholas Brake announced as interim Civil and Environmental Engineering department chair in March 2024
- Remodeled the Hydraulics Lab and Water Chemistry Labs
- Rehired adjunct instructors from the USACE to teach Engineering with Nature
- Remodeled classrooms in Cherry 2104, 2401 (pending completion Fall 2024)
- Hired adjunct instructor to teach Air Pollution and Green Engineering

- Evaluated SLO 1, 6, and 7 for SACS
- ABET mock accreditation visit in December 2023
- Completed and submitted ABET Self-Study Report
- Added CVEN 4370 GIS for Civil Engineers to the program.
- Implemented 17 program continuous improvement actions (summarized in section G)

F. Direct and Indirect Assessment Results

Direct Assessment: AY 2023-2024

Table 3 Direct Assessment Summary of Results

Degree: Bachelor of Science in Civil Engineering in Civil Engineering 2023-2024 Assessment Plan													
	Student Learning Outcome #1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.											
PLAN	Assessment Method(s)	Evaluations completed using scoring rubric shown in Appendix A. Direct evidence includes Homework, Exam, Presentations, Project Reports in CVEN 3370 4365 4350 3300											
	Proficiency	Minimum acceptable is 3 out of 4 (Accomplished performance indicator)											
DO	Benchmark	70% of students achieve the proficiency mentioned above											
	Results of Assessment	Outcome	4350	4365	4380	3370	4313	4110	1201	3300	3390	3360	4212
		1.1	85%	89%	-	100%	-	-	-	100%	-	-	-
		1.2	85%	95%	-	100%	-	-	-	100%	-	-	-
		1.3	85%	74%	-	100%	-	-	-	85%	-	-	-
Total	85%	71%	-	100%	-	-	-	85%	-	-	-		
STUDY	Analysis of Results	Term projects in each of the courses were assessed to measure level of attainment of student’s ability to identify and solve complex engineering problems in four different areas of civil engineering: Transportation, Hydraulics, Structures, and Environmental. Student Outcomes were attained across the four different courses. Attainment rate was higher than the benchmark of 70%. No further action is required.											

ACT	Improvement Plan for 2024-2025	Students attained the learning outcome. No continuous improvement is needed as a direct result of the assessment.											
Degree: Bachelor of Science in Civil Engineering in Civil Engineering 2023-2024 Assessment Plan													
	Student Learning Outcome #6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.											
PLAN	Assessment Method(s)	Evaluations completed using scoring rubric shown in Appendix A. Direct evidence includes lab reports in each of the two lab intensive courses—CVEN 3390 and 3300. Student outcome 6 was attained. No further action or follow up is required											
	Proficiency	Minimum acceptable is 3 out of 4 (Accomplished performance indicator)											
DO	Benchmark	70% of students achieve the proficiency mentioned above											
	Results of Assessment	6.1	-	-	-	-	-	-	-	100%	100%	-	-
		6.2	-	-	-	-	-	-	-	100%	100%	-	-
		6.3	-	-	-	-	-	-	-	100%	100%	-	-
		Total	-	-	-	-	-	-	-	100%	100%	-	-
S T U D Y	Analysis of Results	Student outcome 6 was attained. There was 100% attainment rate of outcome 6 across the two different courses and the different lab reports that were evaluated.											

ACT	Improvement Plan for 2024-2025	<p>Action: In a separate course, Professional Seminar, students will discuss different civil engineering resources-- codes, standards, journals, etc., and learn how to acquire the resources to be applied on their civil engineering design project. In addition, students at the junior level will be provided with this module.</p> <p>Follow up Plan: Work with instructors to deploy standard/code module at the junior and senior level courses so students know what codes are available and where to find them.</p>
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Indirect Assessment: AY 2023-2024

Degree: Bachelor of Science in Civil Engineering in Civil Engineering 2023-2024 Assessment Plan		
	Student Learning Outcome #1,6,7 Professional Educational Objectives	<ol style="list-style-type: none"> 1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. 6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. 7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. <ul style="list-style-type: none"> • Increasing leadership and responsibility beyond entry level that meet the emerging and evolving demands of civil engineering. • Communication and project management skills for effective problem solving. • Engagement in life-long learning through professional activities, training, pursuing licensure and understanding of professional ethics, public safety, cost constraints, environmental impacts, sustainability, and policy implications.
PLAN	Assessment Method(s)	Evaluation of graduating student exit survey.

S T U D Y	Analysis of Results	The student outcome was attained. 91% of students self-reported attainment of student outcomes 1, 6, and 7. 100% of students approved of the Professional Educational Objectives.
ACT	Improvement Plan for 2024-2025	No further action or follow up is required based upon the direct assessment of outcomes 1, 6, and 7.

Additional Data: AY 2023-2024

Table 3 Job offer and internship self-reported data from graduating student exit survey

Academic Year	2019	2020	2021	2022	2023	2024
FT Offer Before Graduation	20%	27%	31%	33%	42%	90%
Internship Experience	60%	45%	57%	53%	64%	100%

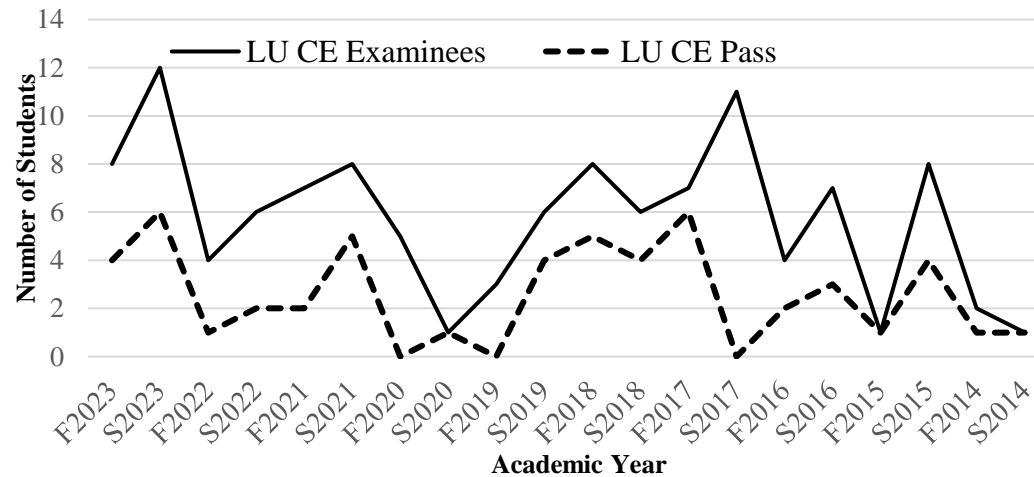


Figure 4: Summary of Supplemental Assessment Results: Student FE Pass/Fail Rate

G. Summary of Continuous Improvement Efforts since Last Report

AY 2023-2024

Action 1.

Action Taken	Program: Creation of the Engineering Institute for Energy and Petrochemical Industries (EPI). College Level Improvement.
Basis for Action	Enhance the curriculum and advance research to drive progress in the energy and petrochemical sectors. To achieve these goals, we will implement strategies that include increasing enrollment and retention to produce more industry-ready graduates, improving advising efforts for timely graduations, and ensuring an adequate supply of skilled professionals. Additionally, EPI will develop incentives to expand research opportunities for faculty and graduate students and provide state-of-the-art labs and facilities to prepare graduates for industry demands. This initiative will support the College of Engineering and the Energy and Petrochemical Institute in a coordinated effort to foster innovation and excellence. Through these endeavors, we aim to significantly contribute to the development of highly skilled professionals and industry relevant research, thereby driving growth and advancement in the energy and petrochemical industries.
Date	Spring 2023
Results	Implemented. Major Accomplishments to date include the addition of the following positions: <ul style="list-style-type: none">• Director of Co-ops and Internships• Director of Research• New Computer Engineering Faculty• Associate Director of Events and Visits• Associate Director of Marketing and Recruiting• Associate Director of Academic Student Success• Two Program Coordinators• Advisor/Student Support Specialist for Texas Academy• Sponsored Projects Coordinator• Outreach & Program Development Specialist• Post Doctoral Researcher

Action 2.

Action Taken	Program: Remodeled the Hydraulics lab. Replaced old cabinets and closets with new shelving, new workbenches, new lab equipment, new tools. Created a new flexible student learning space for the undergraduate students. Remodeled graduate student offices and the ASCE offices. Installed new TVs, whiteboards, desks, chairs, workbenches. Painted walls and installed two new whiteboards.
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	Remodeled student lounge for CEE students. Installed table, sofa, chairs, refrigerator, and microwave.
Basis for Action	Facility Improvement. Enhance ASCE engagement. Add new flexible spaces for students to study.
Date	Summer 2024
Results	Implemented

Action 3.

Action Taken	Program: Added 30 school of PE seats for FE examination preparation. https://www.schoolofpe.com/ ~\$10,000
Basis for Action	Improve undergraduate FE exam pass rate.
Date	Spring 2024
Results	Implemented.

Action 4

Action Taken	<p>Program: Remodeled classroom. Classrooms were upgraded with the installation of new televisions, computer and docking stations, worktables, touchscreen desktop and television, charging stations, and conference audio/visual hardware and software. This was done to improve the educational experience and classroom recording capabilities. Specifically, the following upgrades have been installed into the CEE classrooms.</p> <ul style="list-style-type: none"> • Dell Precision 7865 • Logitech Rally Plus UHD 4K Conference Camera System with Dual-Speakers and Mic Pods Set • Logitech Rally Mic Pod Boundary Microphone • Samsung Q80C 98" 4K HDR Smart QLED TV • Samsung WM85B Flip Pro 85" 4K Interactive Touchscreen LED Display • Samsung CU7000 Crystal UHD 85" 4K HDR Smart LED TV • Wacom Cintiq Pro 24 Creative Pen & Touch Display • Elmo MX-P3 Visual Presenter & Document Camera • Wacom Ergo Stand for Wacom Cintiq Pro 24
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	<ul style="list-style-type: none"> • Kanto Living PMX700 Pro Series Full-Motion Wall Mount for 42 to 100" Displays (Black) • Tilting Wall Mount for 37 to 100" TVs • Versatable Downview Computer Desk (Note: Please select the size) • Versatable Enclosed Classroom Desk (Note: Please select the size) (60x30") • Pearstone High-Speed HDMI Cable with Ethernet (Black, 6') • Pearstone DisplayPort to HDMI Cable (6.6') • Wacom Grip Pen • Belkin 12-Outlet Home/Office Surge Protector • Expo Markers Dry Erase Accessory Kit • Luxor MB7248WW Mobile Magnetic Reversible Whiteboard (72 x 48") • Kanto Living Rolling TV Cart with Height Adjustment for 60 to 100" Displays • 8-Port USB Type-C Multimedia Hub Adapter • (US Plug)(1 Pcs 2x6)4K HDMI Switch Splitter Extender 2x6 over Ethernet Cat5e/6 100M HDMI Switch 2 in 6 out with 2 Loop-out + 4 Channel RJ45 UTP out • Logitech Rally Mic Pod Hub for Rally Video-Conferencing Systems • Belden Cat 6 Bulk Ethernet Cable (1000', White) • Cable Runner • Plugable 12-Outlet Power Strip with USB Charging (6 ft)
Basis for Action	Improve undergraduate classrooms
Date	Summer 2024
Results	Implemented.

Action 5.

Action Taken	Program: College of Engineering added tutoring services for undergraduate math courses: MATH 2413, 2414, 2415, and 2320.
Basis for Action	Improve student performance and retention.
Date	Summer 2024

Results	Implemented.
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Action 6

Action Taken	Program: Added new BSCE course. CVEN 4375 GIS for Civil and Environmental Engineers
Basis for Action	Improve program
Date	Fall 2023
Results	Implemented.

Action 7.

Action Taken	Program: Upgraded Water Chemistry Laboratory. Added new laboratory equipment. pH and Conductivity meter, DO meter, HACH digestion block, Benchtop Muffle Furnace, General Purpose Heating and Drying Oven, VWR General Purpose 4L Benchtop Centrifuge, Thermo Scientific™ GENESYS™ 40/50 Vis/UV-Vis Spectrophotometer, Phipps & Bird PB-900 Series Programmable Jar Tester
Basis for Action	Improve undergraduate laboratory facilities
Date	Spring 2024
Results	Implemented.

Action 8.

Action Taken	Program: College of Engineering remodeling building. Improvements made to multiple classrooms, faculty and administrator office space, and student lounge space.
Basis for Action	Improve program
Date	Summer/Fall 2024
Results	Implemented.

Action 9.

Action Taken	Program: Upgraded Water Chemistry Laboratory. Added new laboratory equipment. pH and Conductivity meter, DO meter, HACH digestion block, Benchtop Muffle Furnace, General Purpose Heating and Drying Oven, VWR General Purpose 4L Benchtop Centrifuge, Thermo Scientific™ GENESYS™ 40/50 Vis/UV-Vis Spectrophotometer, Phipps & Bird PB-900 Series Programmable Jar Tester
Basis for Action	Improve undergraduate laboratory facilities
Date	Spring 2024
Results	Implemented.

Action 10.

Action Taken	Program/CVEN 3360: New tutoring section for each project and after exam review has been offered. Extended review sections were offered including review notes for students to follow. Added a field trip around campus to help student understand different drainage systems including retention pond, pervious concrete, and rain garden sites. Some of sites were past senior design project, and one site is funded by EPA research project. This activity brings the real-world project and provide opportunity for student to learn new standards and design criteria for pervious concrete.
Basis for Action	Satisfy EAC student outcome 7—apply new knowledge. Improve student project and exam performance. Enhance conceptual understanding through field experiences.
Date	Spring 2024
Results	Implemented. Student performance was improved by the additional tutoring services. Students were able to successfully apply new knowledge to design a pervious concrete system.

Action 11.

Action Taken	Program/CVEN 4350: One more computer project was added to help student to learn the Bentley software system, since some students need the knowledge for their senior projects.
Basis for Action	Improve course content. Satisfy EAC outcome 1 and BSCE program criteria. Add complex engineering problems to the curriculum.
Date	Spring 2024
Results	Implemented. Student able to successfully solve complex engineering problem using software taught in class. Attainment was greater than 70%.

Action 12.

Action Taken	Program/CVEN 4380: Improved course delivery by switching to a flipped classroom instruction. Pre-class video lectures were created, and videos of example problems were created. A recitation problem solving section was also added to the course. More time is now dedicated towards problem solving in class.
Basis for Action	Improve course content. EAC student outcome 2 was not satisfied in Fall 2022. Less than 70% attainment.
Date	Fall 2023
Results	Student performance improved. EAC student outcome 2 was greater than 70%.

Action 13.

Action Taken	CVEN 2370: Introduce to the class the new technologies in surveying: drone system and GNSS R2 Trimble. Updates the slides of AutoCAD and Surveying. Especially, some new functions of AutoCAD were introduced to the class, such as the "Look-up" feature in the dynamic blocks.
Basis for Action	Course Improvement. Introduce new survey technology and software features
Date	Fall 2023
Results	Implemented

Action 14.

Action Taken	CVEN 3390: Purchased new laboratory equipment. GeoJac direct shear, consolidometer, triaxial.
Basis for Action	Improve undergraduate laboratory facilities.
Date	Summer 2024
Results	Implemented.

Action 15.

Action Taken	CVEN 5320: Introduced new professional project management (PM) software - Microsoft Project to the class. Students were required to use this software to do scheduling and progress monitoring through a course project. Also, sponsored by the Center for Midstream Management and Science, a teaching module focusing on the new technology used in oil and gas project were introduced to the class.
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Basis for Action	Improve course content. Add new civil engineering applications.
Date	Fall 2023
Results	Implemented. Students learned how various aspects of oil and gas projects, and how such projects were managed.

Action 16.

Action Taken	CVEN 3311: Added laboratory equipment to the water chemistry lab for the Environmental Engineering course. This includes the following: <ul style="list-style-type: none"> • pH and Conductivity meter • DO meter • HACH digestion block • Benchtop Muffle Furnace • General Purpose Heating and Drying Oven • VWR General Purpose 4L Benchtop Centrifuge • Thermo Scientific™ GENESYS™ 40/50 Vis/UV-Vis Spectrophotometer • Phipps & Bird PB-900 Series Programmable Jar Tester
Basis for Action	Improve laboratory equipment.
Date	Fall 2023
Results	Implemented

Action 17.

Action Taken	CVEN 4365: Adjusted the teaching style--Adding more example explanations in the class. Also, added more lecture videos. Updated the slides according to the course evaluation feedback from students in the previous year. Updated the homework, quizzes, and tests. Also, updated the course project requirement. Introduced to the class a professional traffic simulation software VISSIM. Students were asked to use this software in a course project of signal design. With this knowledge, students can also use VISSIM in their senior design project.
Basis for Action	Improve course content. Satisfy EAC outcome 1 and BSCE program criteria. Add complex engineering problems to the curriculum.
Date	Fall 2023

Results	Compared with the last year, the course evaluations from Fall 2023 were improved. Students were able to successfully complete a complex engineering problem in Transportation Engineering.
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H. Appendix: Direct Assessment Rubric

Outcome 1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

Performance Indicator	1: Beginning	2: Developing	3: Accomplished	4: Exemplary	Score
Identify the type of complex engineering problem	<ul style="list-style-type: none"> Correctly identified few of the type of problems and did not fully understand the underlying variables and constraints. Correctly identify few of the underlying engineering, scientific, and mathematical principles required to solve problem. 	<ul style="list-style-type: none"> Correctly identified some of the type of problems but did not fully understand the underlying variables and constraints. Correctly identified some of the underlying engineering, scientific, and mathematical principles required to solve problem. 	<ul style="list-style-type: none"> Correctly identified many of the type of problems and the underlying variables and constraints. Correctly identified many of the underlying engineering, scientific, and mathematical principles required to solve the problem. 	<ul style="list-style-type: none"> Correctly identified most of the type of problems and the underlying variables and constraints. Correctly identified most of the underlying engineering, scientific, and mathematical principles required to solve the problem. 	
Develop and formulate a solution methodology to solve a complex engineering problem by applying scientific, engineering, and mathematical principles	<ul style="list-style-type: none"> Few parts of the solution methodology are developed and few of the underlying principles and formulations are applied correctly. Few of the variables and constraints are applied correctly 	<ul style="list-style-type: none"> Solution methodology is somewhat developed and some of the underlying principles are applied correctly. Some of the variables and constraints are applied correctly 	<ul style="list-style-type: none"> Many parts of the solution methodology are developed and many of the underlying principles are applied correctly. Many of the variables and constraints are applied correctly 	<ul style="list-style-type: none"> Most parts of the solution methodology are developed and most of the underlying principles are applied correctly. Most of the variables and constraints are applied correctly 	
Solve complex engineering problems	<ul style="list-style-type: none"> Few parts of the complex engineering problem are solved correctly 	<ul style="list-style-type: none"> Some parts of the complex engineering problem are solved correctly 	<ul style="list-style-type: none"> Many parts of the complex engineering problem are solved correctly 	<ul style="list-style-type: none"> Most parts of the complex engineering problem are solved correctly 	

Outcome 2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

Performance Indicator	1: Beginning	2: Developing	3: Accomplished	4: Exemplary	Score
Engineering design solution meets specified technical standard/code/manual requirements	<ul style="list-style-type: none"> • Applicable building codes and/or standard of practice are not adequately applied or referenced. • Technical design assumptions are not valid. • Major calculation errors observed. Engineering design calculations do not follow the state of practice. 	<ul style="list-style-type: none"> • Some applicable building codes and/or standard of practice may not be adequately applied or referenced. • Technical design assumptions are not valid. • Major errors are observed in the engineering design calculations. 	<ul style="list-style-type: none"> • Some applicable building codes and/or standard of practice may not be adequately applied or referenced. • Technical design assumptions are valid. • Some errors in the engineering calculations are observed. 	<ul style="list-style-type: none"> • Applicable building codes/standards/manual and/or standard of practice are adequately applied or referenced. • Technical design assumptions are valid. • Engineering calculations are valid and consistent with the state of practice. 	
Engineering design solution considers and satisfies specified public health, safety, or welfare needs and constraints.	<ul style="list-style-type: none"> • Constraints are not satisfied. Major mistakes are observed. • Impact to public health, safety, or welfare are not adequately described. 	<ul style="list-style-type: none"> • Constraints are mostly unsatisfied. Major mistakes are observed. • Impact to public health, safety, or welfare are described. 	<ul style="list-style-type: none"> • Constraints are mostly satisfied. Minor mistakes are observed. • Impact to public health, safety, or welfare are described. 	<ul style="list-style-type: none"> • Constraints are satisfied • Judgements are exceptionally justified, researched, and relevant literature is cited. 	
Engineering design solution considers and satisfies specified global, cultural, social, environmental, or economic needs	<ul style="list-style-type: none"> • Global, cultural, social, or economic needs are not adequately described. • Judgements are not properly justified and cited in literature. 	<ul style="list-style-type: none"> • Global, cultural, social, or economic needs are described. • Judgements are not properly justified and cited in literature. 	<ul style="list-style-type: none"> • Global, cultural, social, or economic needs are described. • Judgements may be lacking some detail and reference to existing literature. 	<ul style="list-style-type: none"> • Global, cultural, social, or economic needs are exceptionally described. • Judgements are exceptionally justified, researched, and relevant literature is cited. 	

Outcome 3: an ability to communicate effectively with a wide range of audiences

Performance Indicator	1: Beginning	2: Developing	3: Accomplished	4: Exemplary	Score
Ability to communicate orally to a wide range of audiences	<ul style="list-style-type: none"> • Presentation is not delivered concisely or clearly • Answers to impromptu questions are not correct and not founded. 	<ul style="list-style-type: none"> • Presentation is concise • Answers to impromptu questions are not correct or not founded. 	<ul style="list-style-type: none"> • Presentation is delivered concisely • Able to answer impromptu questions well, but some detail or info is lacking. 	<ul style="list-style-type: none"> • Presentation is delivered clearly and concisely • Able to answer impromptu questions exceptionally well 	
Ability to communicate in written form	<ul style="list-style-type: none"> • Abstract/Summary/Intro is not clear or present. • No findings address needs. No objectives are satisfied • Not well written or organized 	<ul style="list-style-type: none"> • Abstract/Summary/Intro is not clear. • Some findings address needs. Not all objectives are satisfied • Some sections are well-written, but overall lacks organization and flow 	<ul style="list-style-type: none"> • Abstract/Summary/Intro is clear. • Findings address needs and satisfy stated objectives • Overall well written and convincing but lacks some organization 	<ul style="list-style-type: none"> • Abstract/Summary/Intro is concise and very clear. • Findings address needs and satisfy stated objectives • Overall very well-written, organized, and convincing 	
Ability to communicate technical drawings, schematic, figures, and tables to a wide range of audiences	<ul style="list-style-type: none"> • Schematic/Drawing/Figure/Tables are not labeled, readable, and relevant to the project scope and needs • Schematic/Drawing/Figures/Tables are not comprehensive 	<ul style="list-style-type: none"> • Some of the Schematic/Drawing/Figure/Tables are labeled, readable, and relevant to the project scope and needs • Some of the Schematic/Drawing/Figures/Tables are comprehensive 	<ul style="list-style-type: none"> • Schematic/Drawing/Figure/Tables are mostly labeled, readable, and relevant to the project scope and needs • Schematic/Drawing/Figures/Tables are mostly comprehensive 	<ul style="list-style-type: none"> • Schematic/Drawing/Figure/Tables are labeled, readable, and relevant to the project scope and needs • Schematic/Drawing/Figures/Tables are comprehensive 	

Outcome 4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

Performance Indicator	1: Beginning	2: Developing	3: Accomplished	4: Exemplary	Score
Recognize ethical responsibilities in engineering situations	<ul style="list-style-type: none"> • Description of ethical responsibility is incomplete. • Provisions from Professional Code of Ethics and Conduct are not listed nor appropriate. 	<ul style="list-style-type: none"> • Description of ethical responsibility is incomplete. • Most of the appropriate provisions from the Professional Code of Ethics and Conduct are not referenced. 	<ul style="list-style-type: none"> • Description of ethical responsibility lacks detail. • Most of the appropriate provisions from the Professional Code of Ethics and Conduct are referenced. 	<ul style="list-style-type: none"> • Engineering situation that describes ethical responsibility is described in detail. • All appropriate provisions from Professional Code of Ethics and Conduct are referenced. 	
Recognize professional responsibilities in engineering situations	<ul style="list-style-type: none"> • Involved professional responsibility is incomplete. • Provisions from Professional Code of Ethics and Conduct are not listed or are none provided are appropriate. 	<ul style="list-style-type: none"> • Involved professional responsibility is incomplete. • Nearly all the appropriate provisions from the Professional Code of Ethics and Conduct are not mentioned. 	<ul style="list-style-type: none"> • Involved professional responsibility lacks detail. • Most of the appropriate provisions from the Professional Code of Ethics and Conduct are mentioned. 	<ul style="list-style-type: none"> • Engineering situation that describes involved professional responsibilities is described in detail. • Appropriate provisions from Professional Code of Ethics and Conduct are referenced. 	
Make informed judgments considering impact of engineering solutions.	<ul style="list-style-type: none"> • Questionable or no judgment that considers global, economic, environmental, and societal impacts • Little or no detail. 	<ul style="list-style-type: none"> • Questionable informed judgment that considers global, economic, environmental, and societal impacts • Little or no detail. 	<ul style="list-style-type: none"> • Appropriate informed judgment considering global, economic, environmental, and societal impacts • Some lack of detail and referencing. 	<ul style="list-style-type: none"> • Appropriate informed judgment considering global, economic, environmental, and societal impacts • Detailed justification and referencing. 	

Outcome 5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Performance Indicator	1: Beginning	2: Developing	3: Accomplished	4: Exemplary	Score
Members provide leadership and create a collaborative and inclusive environment	<ul style="list-style-type: none"> • Most members are not willing to positively contribute towards team objectives • Some members had a disproportionate amount of work. • Team roles are not well defined and understood. Leadership structure is not adequate. • There is some conflict between members 	<ul style="list-style-type: none"> • Most members are willing to, and positively contribute towards, team objectives • Some members had a disproportionate amount of work. • Team roles are not well defined and understood. Leadership structure is not adequate. • There is some conflict between members 	<ul style="list-style-type: none"> • Most members are willing to, and positively contribute towards, team objectives • Some members had a disproportionate amount of work. • Team roles are defined and understood with good leadership structure • Members mostly have a good attitude and team is functional 	<ul style="list-style-type: none"> • Each member is willing to, and positively contributes towards, team objectives • Workload is evenly distributed • Team roles are defined and understood with exceptional leadership structure • Members have a good attitude and team is exceptionally functional. 	

Outcome 5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

<p>Members establish goals, plan tasks, and meet objectives</p>	<ul style="list-style-type: none"> • Team members have not met regularly • Meeting minutes are constructed but lack clear action plans. • Team has unclear or unrealistic goals • No action plans and tasks have been constructed • Some objectives have been satisfied, but final work is incomplete 	<ul style="list-style-type: none"> • Team members have not met regularly • Meeting minutes are constructed but lack clear action plans. • Team has unclear or unrealistic goals • Action plans and tasks are not detailed and insufficient to meet objectives. • Objectives are mostly satisfied 	<ul style="list-style-type: none"> • Team members regularly schedule collaborative and inclusive meetings • Meeting minutes are constructed but lack clear action plans. • Team has somewhat clear established goals • Team constructs some plans and tasks to meet objectives, but not in detail. • Objectives are adequately satisfied 	<ul style="list-style-type: none"> • Team members regularly schedule collaborative and inclusive meetings • Detailed meeting minutes are constructed for communication and planning. • Team has clear established goals • Team constructs detailed plans and tasks to meet objectives • Objectives are adequately satisfied 	
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Outcome 6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Performance Indicator	1: Beginning	2: Developing	3: Accomplished	4: Exemplary	Score
Ability to develop and conduct appropriate experimentation	<ul style="list-style-type: none"> Few of objectives of the experiment are clearly presented. Few of the experimental procedures are specific and concise, follow applicable standards, and correctly applied to meet the objectives, and Few of obtained data points are reproducible. 	<ul style="list-style-type: none"> Some of objectives of the experiment are clearly presented. Some of the experimental procedures are specific and concise, follow applicable standards, and correctly applied to meet the objectives, and some of obtained data points are reproducible. 	<ul style="list-style-type: none"> Many of objectives of the experiment are clearly presented. Many of the experimental procedures are specific and concise, follow applicable standards, and correctly applied to meet the objectives, and the obtained data is reproducible. 	<ul style="list-style-type: none"> Most of objectives of the experiment are clearly presented. Most of the experimental procedures are specific and concise, follow applicable standards, and correctly applied to meet the objectives. Most of the he obtained data is reproducible. 	
Ability to analyze and interpret data	<ul style="list-style-type: none"> Few of the analyses are in the appropriate section. Interpretation is coherently written and convincing. Few of the data points are labeled and clearly presented. Few of the graphs, charts, and calculations are correctly prepared. 	<ul style="list-style-type: none"> Some of the analyses are in the appropriate section. Interpretation is coherently written and convincing. Some of the data points are labeled and clearly presented. Some of the graphs, charts, and calculations are correctly prepared. 	<ul style="list-style-type: none"> Many of the analyses are in the appropriate section. Interpretation is coherently written and convincing. Many of the data points are labeled and clearly presented. Many of the graphs, charts, and calculations are correctly prepared. 	<ul style="list-style-type: none"> Most analyses are in the appropriate section. Interpretation is coherently written and convincing. Most of the data is labeled and clearly presented. Most of the graphs, charts, and calculations are correctly prepared. 	
Ability to use engineering judgment to draw conclusions	<ul style="list-style-type: none"> Few of the engineering judgements are correctly justified using the data gathered and external references. Few of the conclusions are supported by the data in the written text. 	<ul style="list-style-type: none"> Some of the engineering judgements are correctly justified using the data gathered and external references. Some of the conclusions are supported by the data in the written text. 	<ul style="list-style-type: none"> Many of the engineering judgements are correctly justified using the data gathered and external references. Many of the conclusions are supported by the data in the written text. 	<ul style="list-style-type: none"> Most engineering judgements are correctly justified using the data gathered and external references. Most conclusions are supported by the data in the written text. 	

Outcome 7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Performance Indicator	1: Beginning	2: Developing	3: Accomplished	4: Exemplary	Score
Ability to acquire and apply new knowledge	<ul style="list-style-type: none"> • Little ability to conduct a review of research findings or standards of practice. • Little understanding of new concepts and knowledge. • Little understanding of core concepts to acquire and apply new knowledge 	<ul style="list-style-type: none"> • Some ability to conduct a review of research findings or standards of practice. • Some understanding of new concepts and knowledge • Some understanding of core concepts to acquire and apply new knowledge 	<ul style="list-style-type: none"> • A substantial review of research findings or standards is mostly complete, and many relevant and critical pieces of information are provided. • Substantial understanding of new concepts and knowledge, but some deficiencies are observed. • Substantial understanding of core concepts to acquire and apply new knowledge, but some deficiencies are observed. 	<ul style="list-style-type: none"> • A review of research findings or standards is mostly complete and most of the relevant and critical pieces of information are provided. • Mostly understands the new concepts and knowledge. • Mostly understands the core concepts to acquire and apply new knowledge 	
Ability to use appropriate learning strategies	<ul style="list-style-type: none"> • Little evidence of an ability to use appropriate learning strategies: reading written documents, peer to peer, webinar or other audio/video sources and documents. 	<ul style="list-style-type: none"> • Some evidence of an ability to use appropriate learning strategies: reading written documents, peer to peer, webinar or other audio/video sources and documents 	<ul style="list-style-type: none"> • Substantial evidence of an ability to use appropriate learning strategies: reading written documents, peer to peer, webinar or other audio/video sources and documents, but some deficiencies are observed. 	<ul style="list-style-type: none"> • Exceptional evidence of an ability to use appropriate learning strategies: reading written documents, peer to peer, webinar or other audio/video sources and documents. 	

I. Appendix: Indirect Assessment Student Exit Survey

Access Link: https://admissions.lamar.edu/register/engineering_senior_exit_survey