

## **Institutional Effectiveness Report 2020-21**

**Program:** Civil and Environmental Engineering MS

**College and Department:** College of Engineering – Civil Engineering

**Contact:** Ben Mohr

**Mission:** The mission of the civil engineering program is to offer the strong academic content necessary to produce well-educated graduates who become innovative and productive members of society. Graduates will possess both the problem-solving skills and the fundamentals of critical thinking and analysis that are crucial for success within the framework of the civil and environmental engineering profession.

### **Program Goals**

- PG 1: MS graduates will have the technical competence to be successful in the chosen sub-discipline of civil engineering professional practice or research.
- PG 2: MS graduates will have the skills to undertake technically sound analysis independently and present their work at professional meetings or publish their work in scholarly journals.
- PG 3: MS graduates will have the technical competence to successfully undertake further advanced study at the doctoral level in civil engineering or a related area, and pursue lifelong learning through professional education.

### **Student Learning Outcomes**

- SLO 1: MS graduates will demonstrate clear understanding of the chosen sub-discipline of civil engineering covered in course material in the graduate program.
- SLO 2: MS graduates will apply advanced methods in the development of solutions in the chosen sub-discipline of civil engineering.
- SLO 3: MS graduates will demonstrate the ability to conduct professional presentations or write scholarly manuscripts worthy of publication in peer reviewed journals.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

### **Assessment Methods**

- PG 1: MS graduates will have the technical competence to be successful in the chosen sub-discipline of civil engineering professional practice or research.

*Thesis and oral defense rubric:* CEE MS students are required to undertake thesis research or a project independently under the direction of a CEE faculty advisor and the student's graduate advisory committee. Students through this experience learn to manage a significant research or

project effort, acquire the technical knowledge and skills required for its successful completion, learn to pose the appropriate questions whose answers lead to the advancement of their research or project, and also learn to have meaningful periodic interaction with their advisory committee.

Communication skills are critical to achieving scholarly accomplishments; that is, they are critical to proper technical paper writing and its presentation at conferences, or publication in peer reviewed journals. Hence, at the onset of his/her research or project, a graduate student has to present a proposal on his/her proposed research or project to his/her graduate advisory committee for approval. In addition to judging the intellectual merit of the proposal, the advisory committee also evaluates the oral communication skills of the student and provides feedback to the student soon thereafter through a standardized form adopted by the CEE Department.

PG 2: MS graduates will have the skills to undertake technically sound analysis independently and present their work at professional meetings or publish their work in scholarly journals.

*Publications and Presentations:* A critical element of the process for facilitating a students' development in independent thinking is the requirement that each student work on a research project of real-world significance to the Civil Engineering discipline and to present their work at a peer-reviewed conference and/or publish it in a peer-reviewed journal.

PG 3: MS graduates will have the technical competence to successfully undertake further advanced study at the doctoral level in civil engineering or a related area, and pursue lifelong learning through professional education.

*Alumni Surveys:* Approximately every 5 years alumni are given a set of questionnaires to examine (1) the appropriateness and relevance of the curriculum structure to their activities after graduation, (2) the extent to which they acquire needed skills for job performance and the degree of engagement in professionally-related learning experience, and (3) whether the curriculum objectives and outcomes are met. The metric that has been established is that at least eighty percent of alumni respondents "agree" or "strongly agree" that the program provided them with adequate preparation. A lesser percentage and response on individual questions that constitute less than fifty percent combined "agree or strongly agree" would generate a concern, which would require a review and actions by department Graduate Affairs committee. The survey statements are as follows:

- a. The CEE MS degree has provided me with skills to be successful in civil engineering professional practice.
- b. The CEE MS degree has made me aware of the present day professional practice in my area of study in civil engineering.
- c. The CEE MS degree has provided me with the necessary skills to present work at professional meetings or publish work in scholarly journals.
- d. The CEE MS degree has provided me with skills to independently undertake technically sound analysis.

- e. The CEE MS degree has provided me with the technical competence needed to successfully undertake further advanced study at the doctoral level in civil engineering or a related area.
- f. The CEE MS degree has provided me with the technical competence to pursue lifelong learning through professional education.
- g. Would you recommend the TTU CEE MS degree program to other potential candidates in future?

The first six statements were framed as multiple choice (no opinion, strongly disagree, disagree, agree and strongly).

SLO 1: MS graduates will demonstrate clear understanding of the chosen sub-discipline of civil engineering covered in course material in the graduate program.

*Grades for Core Courses:* CEE MS students are required to complete sub-discipline courses and electives that provide both an in-depth and broad understanding of civil engineering to students.

SLO 2: MS graduates will apply advanced methods in the development of solutions in the chosen sub-discipline of civil engineering.

*Thesis and oral defense rubric:* CEE MS students are required to undertake thesis research or a project independently under the direction of a CEE faculty advisor and the student's graduate advisory committee. Students through this experience learn to manage a significant research or project effort, acquire the technical knowledge and skills required for its successful completion, learn to pose the appropriate questions whose answers lead to the advancement of their research or project, and also learn to have meaningful periodic interaction with their advisory committee.

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SLO 3: MS graduates will demonstrate the ability to conduct professional presentations or write scholarly manuscripts worthy of publication in peer reviewed journals.

*Publications and Presentations:* A critical element of the process for facilitating a students' development in independent thinking is the requirement that each student work on a research project of real-world significance to the Civil Engineering discipline and to present their work at a peer-reviewed conference and/or publish it in a peer-reviewed journal.

## Results

*SLO 1 - demonstrate clear understanding of the chosen sub-discipline of civil engineering covered in course material in the graduate program.*

### Summary of Grades and Five-Year Average of Course Enrollment in Core MS CEE Courses

#### *Water Resources and Environmental Engineering*

Course	Average Grades by academic year (Number enrolled)					Average number of students
	2016-17	2017-18	2018-19	2019-20	2020-21	
CEE 6520 – Open-Channel Hydraulics	3.40 (5)	4.00 (3)	4.00 (6)	4.00 (5)	N/A (0)	4.75
CEE 6610 – Applied Environmental Chemistry	3.89 (9)	N/A (0)	3.57 (7)	N/A (0)	4.00 (7)	7.67

#### *Structural Engineering and Structural Mechanics*

Course	Average Grades by academic year (Number enrolled)					Average number of students
	2016-17	2017-18	2018-19	2019-20	2020-21	
CEE 6350 – Finite Element Analysis	3.33 (3)	3.00 (7)	3.60 (4)	3.33 (6)	Pending (8)	5.6
CEE 6930 – Theory of Elasticity	3.25 (4)	3.33 (6)	3.09 (6)	3.10 (5)	3.50 (6)	5.4

#### *Transportation Engineering*

Course	Average Grades by academic year (Number enrolled)					Average number of students
	2016-17	2017-18	2018-19	2019-20	2020-21	
CEE 6410 – Traffic Control Systems	3.50 (3)	N/A (0)	N/A (0)	N/A (0)	N/A (0)	3.0
CEE 6470 – Transportation Demand Analysis	3.50 (2)	3.00 (2)	3.33 (3)	4.00 (2)	Pending (2)	2.2

#### *Civil Engineering Materials*

Course	Average Grades by academic year (Number enrolled)					Average number of students
	2016-17	2017-18	2018-19	2019-20	2020-21	
CEE 5190 – Advanced Mechanics of Materials	Unavailable (2)	4.00 (1)	4.00 (2)	4.00 (2)	4.00 (1)	1.6
CEE 6300 – Multiscale Analysis of Concrete	3.75 (4)	4.00 (3)	3.75 (7)	4.00 (5)	4.00 (4)	4.6

## Geotechnical Engineering

Course	Average Grades by academic year (Number enrolled)					Average number of students
	2016-17	2017-18	2018-19	2019-20	2020-21	
CEE 5810/6900 – Foundation Engineering	4.00 (4)	4.00 (1)	N/A (0)	N/A (0)	4.00 (6)	3.67
CEE 6800 – Advanced Soil Mechanics	Unavailable (3)	N/A (0)	3.40 (5)	N/A (0)	N/A (0)	4.0
CEE 6820 – Seepage and Slope Stability	N/A (0)	3.80 (5)	N/A (0)	3.50 (6)	N/A (0)	5.5

*SLO 2 - apply advanced methods in the development of solutions in the chosen sub-discipline of civil engineering.*

### Assessments of MS Proposal Presentations

Assessed by	Academic Year	Number of Students Evaluated	Number of Evaluations	Average Score <sup>1</sup>	
				<b>Content</b>	<b>Response to Questions and Comments</b>
Committee Members	2016-2017	2	6	4.00	3.33
	2017-2018	6	16	3.42	3.17
	2018-2019	6	16	3.03	2.95
	2019-2020	3	5	3.00	3.50
	2020-2021	3	9	3.22	3.44
Other Faculty	2016-2017	0	0	N/A	N/A
	2017-2018	0	0	N/A	N/A
	2018-2019	0	0	N/A	N/A
	2019-2020	2	2	3.50	3.00
	2020-2021	0	0	N/A	N/A

<sup>1</sup> Assessment scale: 1 = Not Acceptable, 2 = Below Expectations, 3 = Meets Expectations, 4 = Above Expectations

Assessments of MS Thesis Defense Presentations

Assessed by	Academic Year	Number of Students Evaluated	Number of Evaluations	Average Score <sup>1</sup>	
				<b>Content</b>	<b>Response to Questions and Comments</b>
Committee Members	2016-2017	5	13	3.80	3.53
	2017-2018	4	8	3.50	3.63
	2018-2019	7	15	3.26	3.33
	2019-2020	5	15	3.57	3.20
	2020-2021	7	15	3.55	3.64
Other Faculty	2016-2017	1	1	4.00	3.00
	2017-2018	2	2	4.00	4.00
	2018-2019	2	2	4.00	3.50
	2019-2020	3	3	4.00	4.00
	2020-2021	1	1	4.00	4.00

<sup>1</sup> Assessment scale: 1 = Not Acceptable, 2 = Below Expectations, 3 = Meets Expectations, 4 = Above Expectations

*SLO 3 - demonstrate the ability to conduct professional presentations or write scholarly manuscripts worthy of publication in peer reviewed journals.*

Assessments of MS Proposal Presentations

Assessed by	Academic Year	Number of Students Evaluated	Number of Evaluations	Average Score <sup>1</sup>		
				<b>Visual Aids</b>	<b>Presenter Preparation</b>	<b>Presentation Mechanics</b>
Committee Members	2016-2017	2	6	3.50	4.00	4.00
	2017-2018	6	16	3.36	3.36	3.39
	2018-2019	6	16	3.00	3.11	3.14
	2019-2020	3	5	3.67	3.33	3.67
	2020-2021	3	9	3.33	3.44	3.33
Other Faculty	2016-2017	0	0	N/A	N/A	N/A
	2017-2018	0	0	N/A	N/A	N/A
	2018-2019	0	0	N/A	N/A	N/A
	2019-2020	2	2	3.50	3.00	3.00
	2020-2021	0	0	N/A	N/A	N/A

<sup>1</sup> Assessment scale: 1 = Not Acceptable, 2 = Below Expectations, 3 = Meets Expectations, 4 = Above Expectations

### Assessments of MS Thesis Defense Presentations

Assessed by	Academic Year	Number of Students Evaluated	Number of Evaluations	Average Score <sup>1</sup>		
				<i>Visual Aids</i>	<i>Presenter Preparation</i>	<i>Presentation Mechanics</i>
Committee Members	2016-2017	5	13	3.80	3.83	3.67
	2017-2018	4	8	3.50	3.75	3.25
	2018-2019	7	15	3.55	3.88	3.60
	2019-2020	5	15	3.40	3.53	3.30
	2020-2021	7	15	3.60	3.67	3.60
Other Faculty	2016-2017	1	1	4.00	4.00	4.00
	2017-2018	2	2	3.50	4.00	4.00
	2018-2019	2	2	4.00	4.00	3.50
	2019-2020	3	3	3.67	3.67	4.00
	2020-2021	1	1	4.00	4.00	3.00

<sup>1</sup> Assessment scale: 1 = Not Acceptable, 2 = Below Expectations, 3 = Meets Expectations, 4 = Above Expectations

#### Modifications for Improvement:

For SLO 1, CEE 6200 has not been offered for several years now due to a faculty retirement. A new faculty member has been hired in General and Basic Engineering as coordinator of the Master of Science in Engineering Management program. This course has been offered for the first time in awhile in Fall 2021, cross-listed as ENGR 6200.

CEE 6410 has also not been offered for several years, but this was due to a faculty leave of absence. This course is anticipated to be offered in future years.

For SLO 2 and 3: It is noted that the number of students evaluated (for MS Defense) in some years has been lower than the actual number of students defending. Furthermore, since all MS students are required to have at least 3 committee members, the total number of evaluations conducted should be at least 3 times the number of students. However, this is often not the case, indicating that not all committee members are completing the survey. Therefore, going forward, to ensure that all thesis advisory committee members complete their evaluation of each student thereby providing full data sets for SLO 2 and 3 all surveys will be conducted electronically and monitored. The CEE department chair will not sign off on any thesis defense forms unless the entire committee has completed the evaluation. This can only be done for the MS Defense since the MS Proposal is only an internal, department requirement; as such, no university forms are submitted, making it difficult to ensure 100% completion of the proposal forms.

#### Appendices

1. Curriculum Maps
2. Thesis and Oral Defense Rubric
3. Alumni Survey

**Appendix 1: Curriculum Maps**

**Civil Engineering, MS (Thesis): Mapping of the Graduate Curriculum and Student Learning Objectives**

Course	Title	Student Outcomes		
		SLO 1: Sub-discipline course knowledge	SLO 2: Advanced methods in sub-discipline	SLO3: Communication Skills
Core Sub-Discipline Courses	6-9 credits minimum in subdiscipline	X	X	
Program of Study Courses	15-18 credits of elective courses approved by student's advisory committee	X	X	
CEE 6910	Graduate Seminar (1 credit)			X
CEE 6990	Research and Thesis (6 credits total)		X	X

**Civil Engineering, MS (Non-Thesis): Mapping of the Graduate Curriculum and Student Learning Objectives**

Course	Title	Student Outcomes		
		SLO 1: Sub-discipline course knowledge	SLO 2: Advanced methods in sub-discipline	SLO3: Communication Skills
Core Sub-Discipline Courses	6-9 credits minimum in subdiscipline	X	X	
Program of Study Courses	21-24 credits of elective courses approved by student's advisory committee	X	X	
CEE 6910	Graduate Seminar (1 credit)			X
CEE 6980	Directed Studies Project Work (3 credits)		X	X



Appendix 2: Thesis and Oral Defense Rubric

Master of Science in Civil and Environmental Engineering  
Oral Defense and Thesis Assessment Form

Candidate Name: \_\_\_\_\_ Sub-discipline: \_\_\_\_\_

Committee Member \_\_\_\_\_ Faculty \_\_\_\_\_ Student \_\_\_\_\_ (Please check one)

Date: \_\_\_\_\_

Evaluation of Oral Presentation

Oral Presentation Type (circle): Proposal      Thesis Defense

Graduates of the M.S. program in Civil and Environmental Engineering will be able to communicate their ideas effectively with their technical peers and with others outside their discipline. Please assess this candidate's oral presentation and written work using the following scale:

Not Acceptable	Below Expectations	Meets Expectations	Above Expectations
1	2	3	4

1 2 3 4      **Content:** appropriate, complete, concise, and logically organized; problem, approach and results clear; appropriate use of time.

1 2 3 4      **Visual aids:** readable & clear, concise wording, effective use of graphics, appropriate amount of information

1 2 3 4      **Presenter:** appears well-prepared, vocabulary technically correct and audience-appropriate

1 2 3 4      **Presentation mechanics:** good voice volume, enunciation, speed; free of hesitations, distracting mannerisms; good poise, eye contact

1 2 3 4      **Responses to questions and comments:** appropriate, direct, and complete

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Evaluation of Thesis Document

1 2 3 4      **Quality of English:** good grammatical form, voice, tense, punctuation. Concise presentation

1 2 3 4      **Technical content:** clear description of problem, state-of-the-art, technical approach, and results; relevant and timely references

1 2 3 4      **Technical writing:** good organization; clear description of problem; clear figures and tables

### **Appendix 3: Alumni Survey**

## **Alumni Survey**

The survey questions are listed below.

1. Did the CEE MS degree program provide you with the technical knowledge to be successful in civil engineering professional practice?
2. Did the CEE MS degree program provide you with the necessary communication skills to present work at professional meetings and/or publish work in scholarly journals?
3. Did the CEE MS degree program provide you with the ability to undertake technical work independently?
4. Did the CEE MS degree program provide you with the technical competence needed for advanced study at the doctoral level in civil engineering or a related area?
5. Did the CEE MS degree program provide you with the technical competence to pursue lifelong learning through continuing professional education?
6. Have you received any award from a professional civil engineering or related organization? If answered "yes," please provide details.
7. Would you recommend the TTU CEE MS degree program to other potential candidates in the future?