

# UNLV

UNIVERSITY OF NEVADA, LAS VEGAS

## Program Review Self-Study

Program Reviewed: Civil & Environmental Engineering

Degree(s): Ph.D. and M.S.E.

Program Chair: Dr. Sajjad Ahmad

Dean: Dr. Rama Venkat

Date of Report: October 13, 2020

UNLV | HOWARD R. HUGHES  
College of  
ENGINEERING

## GENERAL INSTRUCTIONS

**Please complete the program review self-study using this template.**

If this review is covering several degree levels, please be sure to address *each level* in your responses to the questions.

Send completed self-study electronically to:

- Nora Carroll, Academic Programs Analyst, [nora.carroll@unlv.edu](mailto:nora.carroll@unlv.edu), 702-895-1888.
- Gail Griffin, Executive Director of University Accreditation and Academic Programs, [gail.griffin@unlv.edu](mailto:gail.griffin@unlv.edu), 702-895-0482

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Should you have any concerns or questions about this feedback process, please feel free to contact Nora Carroll by email at [nora.carroll@unlv.edu](mailto:nora.carroll@unlv.edu) or by phone at 702-895-1888.

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# I. Program Description

## College/Program

1. **College or School:** Howard R. Hughes College of Engineering
2. **Unit:** Civil & Environmental Engineering and Construction (CEEC)
3. **Web Address:** <https://www.unlv.edu/ceec>
4. **Program(s) being reviewed:**
  - a) Degrees and their abbreviations:
    - Ph.D. in Civil & Environmental Engineering
    - Master of Science in Engineering (MSE) – Civil & Environmental Engineering

## Primary Individual Completing This Worksheet

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11. **Date of self-study:** October 12, 2020

## Other Faculty Involved in Writing This Report

12. **Names:**

## Catalog Description

13. **Insert the most recent catalog description(s) of the program(s).**

### **PhD in Civil & Environmental Engineering**

The CEEC Department at UNLV offers a number of areas of engineering leading to the Doctor of Philosophy (Ph.D.) - Civil and Environmental Engineering. Specific areas of engineering that are currently available include Construction, Geotechnical, Structural, Transportation, and Water Resources/Environmental. The PhD degree in a chosen area is awarded based on the scholarly contribution provided by the candidate in his/her area of research. It is expected that the PhD candidate should demonstrate in-depth knowledge in the subject matter of his/her chosen area of expertise. PhD students should follow the graduate rules and milestones of the program mentioned in CEEC Graduate Student Handbook.

### **MSE in Civil & Environmental Engineering**

The CECC Department at UNLV offers a number of areas of engineering options leading to the Master of Science in Engineering (MSE) - Civil & Environmental Engineering. Specific areas of engineering that are currently available include Construction, Geotechnical, Structural, Transportation, and Water Resources/ Environmental. MSE students should follow the graduate rules and milestones of the program mentioned in CEEC Graduate Student Handbook.

14. **Is this description correct? If not, what needs to be changed? Have changes been initiated in Curriculog?**

The department's MSE and PhD programs were started in 1992 and 1994 respectively. Since the establishment of the program, these descriptions had been recently changed by the department faculty to align with program goals and objectives.

## II. Alignment to Institutional Mission

### Program Mission

#### 15. What is the program's mission statement (or the department's, if the program does not have one)?

The mission of the PhD and MSE in Civil & Environmental Engineering Programs is to graduate quality students who have the ability to solve complex engineering and construction related problems. Doctoral and MSE graduates should have the ability to critically review pertinent-literature, develop research hypotheses, and create methodologies to solve research problems related to their areas of their expertise. Doctoral and MSE graduates should effectively communicate technical and research information through topical peer-reviewed outlets such as conference proceedings and journals.

### Department/Program Mission Alignment

#### 16. Briefly describe how this program is aligned to the mission of the University, as described in the most recent mission statement, UNLV Mission, <https://www.unlv.edu/toptier/vision>. How does this program support achieving the university's mission?

#### **UNLV's Top Tier Mission**

*“UNLV's diverse faculty, students, staff, and alumni promote community well-being and individual achievement through education, research, scholarship, creative activities, and clinical services. We stimulate economic development and diversification, foster a climate of innovation, promote health, and enrich the cultural vitality of the communities that we serve.”*

The PhD and MSE programs in CEEC department are closely aligned with and support UNLV's mission. The program faculty are actively engaged in research and scholarship. Some of them are the most productive faculty at UNLV in terms of external research expenditures and publications. More importantly, they use research funds to support graduate students in the program and engage them in research and scholarly activities. This provides valuable learning opportunities for the PhD and MSE students in the program. Additionally, the program has a strong record of preferred employment and exceptional postgraduate educational opportunities. Several of our PhD graduates are faculty members at four-year universities across the US and internationally. Most others are employed in top management and engineering positions in their relevant fields, and the majority reside in the Las Vegas metropolitan area. These alumni deepen CEEC's and UNLV's bonds with the Las Vegas metropolitan area and surrounding region. They provide future professional needs and offer feedback to help guide the programs to meet such needs.

## Core Themes

17. Briefly describe how this program supports UNLV’s Core Themes (the core themes can be found at: <https://www.unlv.edu/provost/nwccu/core-themes>).

### **Core Theme 1: Advance Student Achievement**

This core theme is derived from the first sentence of the mission statement:

*UNLV’s diverse faculty, students, staff, and alumni promote community well-being and individual achievement **through education**, research, scholarship, creative activities, and clinical services.*

Four metrics are used to document progress towards Core Theme 1 “Advance Student Achievement.” They are: 1) the number of enrolled PhD and MSE students, 2) the number of PhD and MSE students enrolled in graduate courses, 3) the graduation rate of PhD and MSE students, and 4) feedback from our doctoral and MSE students during alumni survey.

The first metric to document progress towards this theme was to increase the number of PhD and MSE student enrollment each year in our programs. The PhD and MSE student headcount data from 2010/2011 to 2019/2020 are shown in Table 1. On average, per fiscal year, there was about 11% and 3% increase in PhD and MSE student headcount respectively. This indicates that these programs are meeting the goals of student increasing enrollment numbers, as per UNLV’s goal (1% annual increase). UNLV goals of the metrics used in this report can be found at the following link ([https://www.unlv.edu/sites/default/files/page\\_files/3/Top-Tier-Strategic-Plan-8.24.2020.pdf](https://www.unlv.edu/sites/default/files/page_files/3/Top-Tier-Strategic-Plan-8.24.2020.pdf))

**Table 1.** Head count of PhD and MSE students

Fiscal year	PhD students		MSE students	
	Head count	% Change	Head count	% Change
2019/2020	41	17.1	40	2.6
2018/2019	35	29.6	39	-11.4
2017/2018	27	-10.0	44	18.9
2016/2017	30	-14.2	37	15.6
2015/2016	35	-12.5	32	0.0
2014/2015	40	2.6	32	-23.8
2013/2014	39	21.9	42	-12.5
2012/2013	32	52.4	48	37.1
2011/2012	21	10.5	35	-2.8
2010/2011	19	-	36	-
<b>Average</b>	<b>32/ Year</b>	<b>11%/Year</b>	<b>39/Year</b>	<b>3%/Year</b>

The second metric used to document progress towards this theme was to annually increase the number of graduate students enrolled in graduate-level courses. The PhD and MSE enrollment headcount data from 2010/2011 to 2019/2020 in 600 and 700 level courses are shown in Table 2. On average, per fiscal year, there was about 3% and 1% increase in enrollment in 600 and 700 level courses respectively. Our 600 and 700 level courses enrollment fluctuate significantly, but on average, the department is achieving graduate level course enrollment goal, as per UNLV’s goal (1% annual increase).

**Table 2.** Graduate level course enrollment

Fiscal year	600 – level course enrollment		700 – level course enrollment	
	Head count	% Change	Head count	% Change
2019/2020	50	16.2	198	-10.8
2018/2019	43	-35.8	222	-2.2
2017/2018	67	31.4	227	34.3
2016/2017	51	2.0	169	7.0
2015/2016	50	11.1	158	-17.7
2014/2015	45	-46.4	192	0
2013/2014	84	29.2	192	3.8
2012/2013	65	44.4	185	7.6
2011/2012	45	-29.7	172	-14.8
2010/2011	64	-	202	-
<b>Average</b>	<b>58/ Year</b>	<b>3%/Year</b>	<b>191/Year</b>	<b>1%/Year</b>

The third metric used to document progress towards this theme is to annually increase the number of PhD and MSE students’ graduations. In the past ten years, the department graduated a total of 50 PhD students, with on average of five graduates per year. The graduation data for PhD and MSE students and the percentage of change from 2010/2011 to 2019/2020 is shown in Table 3. The table shows that, on average, per fiscal year, there is a change of 40% and 6% in the number of PhD and MSE students graduating, respectively. This indicates that these programs are meeting the goals of student increasing graduation numbers, as per UNLV’s goal (3% annual increase).

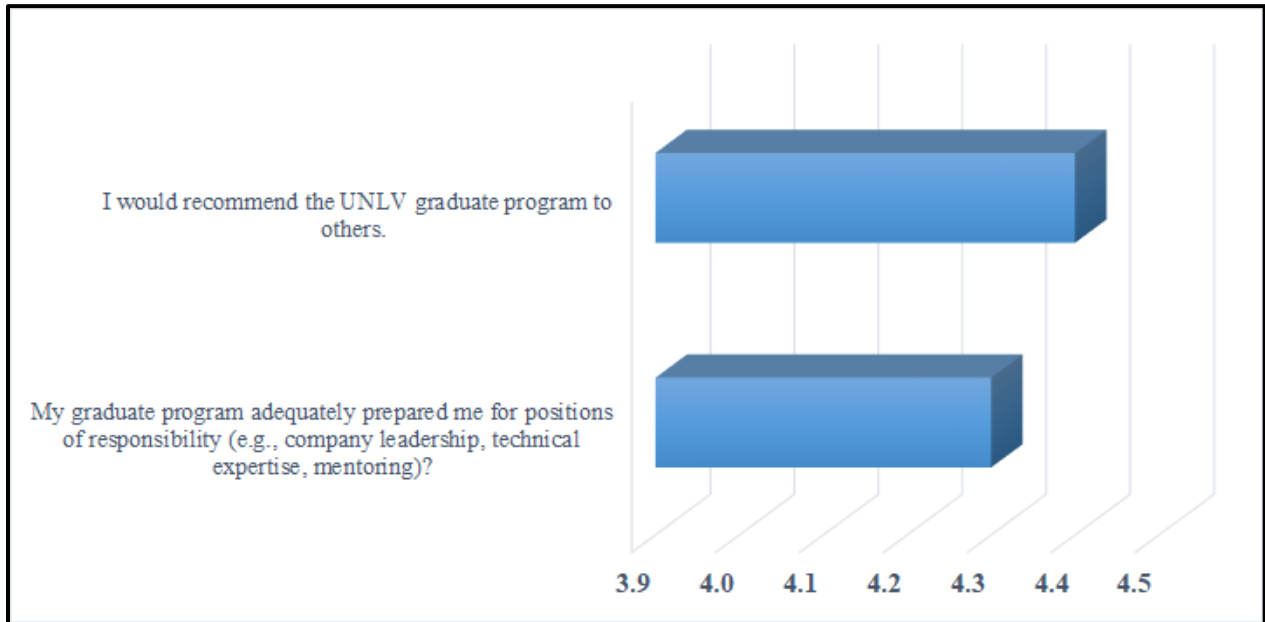
**Table 3.** Number of PhD and MSE graduates

Fiscal year	PhD graduates		MSE graduates	
	No.	% Change	No.	% Change
2019/2020	9	200.0	13	-48.0
2018/2019	3	-57.1	25	127.0
2017/2018	7	40.0	11	-21.4
2016/2017	5	-22.2	14	16.7
2015/2016	7	-28.6	12	-7.7
2014/2015	9	200.0	13	-31.6
2013/2014	3	50.0	19	11.8
2012/2013	2	-60.0	17	13.3
2011/2012	5	-	15	-6.2
2010/2011	0	-	16	-
<b>Average</b>	<b>5/ Year</b>	<b>40%/Year</b>	<b>16/Year</b>	<b>6%/Year</b>

The final metric to document progress towards this theme is an assessment done through a survey of alumni. The College of Engineering conducts alumni surveys every three years for all programs in the College. The most recent survey was conducted during fiscal year 2018/2019. It was conducted to determine whether our graduate students with College of Engineering degrees, are satisfied with our graduate programs. There were a total of 66 responses from graduate students. The average ratings of two critical questions related to this theme, are shown in Figure 1. The rating scale is 1 to 5; 1 represents “strongly disagree” and 5 represents “strongly agree.” This data analyzed included responses from MSE



and PhD civil engineering alumni. The average ratings for these questions are greater than 4.0 (agree), which shows that the programs meet this goal (required rating = 4.0).



**Fig. 1.** Satisfaction level of alumni with UNLV graduate degrees

### **Core Theme 2: Promote Research, Scholarship, Creative Activity**

This core theme is derived from the following section of UNLV’s mission statement:

*UNLV’s diverse faculty, students, staff, and alumni promote community well-being and individual achievement through education, research, scholarship, creative activities, and clinical services. We stimulate economic development and diversification, foster a climate of innovation, promote health, and enrich the cultural vitality of the communities that we serve.*

The indicators to address this theme were research expenditures, the success of graduate students measured in terms of their academic and professional careers, the number of peer-reviewed journals and conference papers published, and the citations numbers achieved by the department’s faculty.

Table 4 shows the research expenditures of CEEC department faculty from Fiscal Years 2010/2011 to 2019/2020. The data show that, on average, annually there was a 22 % increase in research expenditures by the CEEC faculty members. This shows that CEEC as a department is increasing research expenditures to achieve UNLV’s goals (21% annual increase).

**Table 4.** CEEC department annual research expenditures

Year	Research expenditures	% Change
2019	\$3,147,076	-10.6
2018	\$3,522,313	65.2
2017	\$2,131,697	-19.4
2016	\$2,644,613	-19.6
2015	\$3,287,440	-5.2
2014	\$3,468,405	48.1
2013	\$2,342,320	126.4
2012	\$1,034,543	36.2
2011	\$759,513	-22.1
2010	\$974,680	-
<b>Average</b>	<b>\$2,331,260/Year</b>	<b>22.1%/Year</b>

Tables 5 and 6 show the data of our PhD and MSE graduates who are placed in key positions in academia and professional practice. These data show that our PhD and MSE students have been successful in obtaining placements in academia and in practice, and subsequently progressing to increasing levels of rank, responsibility, and leadership.

**Table 5.** PhD and MSE graduates placed in the academia

No.	Graduation year	Recent key academic positions held
1	Spring 1996	Professor, Civil Engineering and Construction Engineering Management Department, California State University, Long Beach, CA
2	Spring 1998	Professor, Civil and Environmental Engineering Department, University of North Carolina Charlotte, NC
3	May 1999	Professor and Chair, Department of Civil Engineering at Boise State University
4	Summer 2005	Associate Professor, Civil Engineering Department, GITAM University, India
5	Fall 2007	Associate Professor, Civil Engineering Department, West Michigan University
6	Fall 2008	Assistant Professor, Civil and Geomatics Engineering Department, California State University, Fresno, CA
7	Fall 2008	Associate Professor, Civil Engineering Department, University of Alaska, Anchorage
8	Spring 2009	Associate Professor, Department of Civil Engineering, Tuskegee University, AL
9	Spring 2010	Assistant Professor, Civil Engineering Department, Huazhong University of Science & Technology of China
10	Spring 2011	Assistant Professor – Civil Engineering, Southern Illinois University. Carbondale
11	Spring 2012	Associate professor at California State Polytechnic University, Pomona, Civil and Environmental Engineering Department

No.	Graduation year	Recent key academic positions held
12	Spring 2013	Assistant Professor, Engineering and Technology Department, East Tennessee State University, TN.
13	Summer 2013	Associate Professor of Engineering Technology, Industrial and Engineering Technology, Southeastern Louisiana University
14	Spring 2015	Assistant Professor, Department of Water Resources Eng., University of Sulaimani, Sulaimaniyah, Kurdistan Region, Iraq
15	Spring 2015	Assistant Professor, CEEC department, University of Nevada Las Vegas.
16	Spring 2016	Assistant Professor of Construction Engineering, College of Engineering, Washington State University, WA
17	Spring 2017	Assistant Professor of Construction Engineering, College of Engineering, Washington State University, WA
18	Spring 2018	Assistant Professor, Physics and Engineering department, Slippery Rock University, Slippery Rock, PA
19	Spring 2018	Assistant Professor – Civil Engineering, NED University of Engineering and Technology, Karachi, Pakistan
20	Fall 2019	Assistant Professor, Civil & Environmental Engineering, Youngstown State University, OH.
21	Spring 2020	Assistant Professor of Construction Engineering, Civil & Environmental Engineering, Manhattan College, NY

**Table 6.** PhD and MSE graduates in leadership roles in professional practices

No.	Graduation year	Recent key professional roles
1	1993	National Director of Value Engineering, Pulte Homes, Dallas-Ft. Worth, TX
2	1993	Principal, Kimley-Horn and Associates, Las Vegas, NV (served on the Institute of Transp. Engineers, Board of Directors)
3	1995	Principal, Orth Rodgers & Associates, Las Vegas, NV; (President, Institute of Transportation Engineers, 2006)
4	Spring 1995	CEO, Spectrum, Wireless & Fiber Communications, Las Vegas, NV
5	1997	Head, Global Quality Digital Health at Eli Lilly and Company, Indiana

No.	Graduation year	Recent key professional roles
6	1997	Program Manager, FAA, Detroit, MI
7	1999	Engineering Manager, Siri International, Apple, San Francisco Bay Area, CA
8	1999	Manager, Traffic Engineering, Clark Co. Dept. of Public Works, NV
9	Fall 2000	Vice President, HJI Group International, Newport Beach, CA.
10	Spring 2002	President, Ben Mammina Development Group, Retired Vice President for Development, MGM, Las Vegas, NV
11	Spring 2002	Vice President, PENTA Corporation, Las Vegas
12	Fall 2002	Research Physical Scientist, EPA based at the NERL in Las Vegas, NV
13	Fall 2002	Senior Geotechnical Engineer, Tony Gee and Partners LLP, Ashford, Kent, UK
14	2003	Deputy City Attorney, City of Las Vegas, Nevada
15	Fall 2003	Director of Public Works, City of Boulder, NV
16	Fall 2003	Senior Researcher, Shell International E&P Inc., USA
17	Spring 2004	Deputy CEO, Regional Transportation Commission of Southern Nevada, Las Vegas, NV
18	Spring 2004	Director, Nevada Department of Transportation, Carson City, NV
19	Fall 2004	Director, WSP Las Vegas, NV
20	2005	Technical Manager, Atkins, Las Vegas, NV
21	2005	Manager, Traffic Division, City of Calgary, Canada
22	2006	Senior Leader, Mobility Coordination, Transportation Planning, City of Calgary, Canada
23	Spring 2006	Associate, NCE Las Vegas, NV
24	Spring 2008	Director of Engineering, McCarran Airport, Las Vegas, NV
25	Fall 2009	Chief Geo-structural Engineer, Morris-Shea Bridge Company, Inc., Savannah, Georgia
26	Spring 2013	Senior Engineer, Nova Geotechnical and Inspection Services, Las Vegas, NV
27	Fall 2014	Principal/Geotechnical Department Manager, Nova Geotechnical and Inspection Services
28	Spring 2015	Subject Matter Expert, NERC/WECC compliance, Bonneville Power Administration, Vancouver, WA

No.	Graduation year	Recent key professional roles
29	Spring 2015 (PhD)/Spring 2002 (MSE)	President, Ben Mammina Development Group, Retired Vice President for Development, MGM, Las Vegas, NV
30	Summer 2017	Laboratory Manager, Department of Civil Engineering, UNLV, Las Vegas, NV
31	Spring 2017	President, Nova Geotechnical and Inspection Services, Las Vegas, NV
32	Fall 2019	Senior Engineer, Nova Geotechnical and Inspection Services, Las Vegas, NV
33	Spring 2020	Hydrologist, U.S. Geological Survey, Las Vegas, NV
34	Spring 2020	Research Scientist, Public Services Department, City of Fayetteville, Fayetteville, NC

The final metric relates to the scholarship output of the faculty, as well as the graduate students. Table 7 shows the number of journal papers, peer-reviewed conference proceedings, and total number of citations of the department faculty, which includes efforts of graduate students working with them. The table shows that, on average, annually, there has been a 13% increase in journal publications, 16% increase in conference proceedings publications, and 24% increase in number of citations. These growths in scholarship clearly demonstrate that our faculty met and significantly exceeded UNLV's goals (3% annual increase for faculty journal publications).

**Table 7.** CEEC department faculty scholarly outputs

Year	Journal papers		Conference papers		Citations	
	No.	% Change	No.	% Change	No.	% Change
2019	73	25.9	52	-37.3	2947	0.4
2018	58	45.0	83	80.4	2936	41.0
2017	40	21.2	46	48.4	2082	11.8
2016	33	0.0	31	34.8	1863	17.1
2015	33	43.5	23	-8.0	1591	4.8
2014	23	-34.3	25	25.0	1518	34.7
2013	35	6.1	20	33.3	1127	50.9
2012	33	-19.5	15	-59.5	747	25.3
2011	41	24.2	37	27.6	596	28.4
2010	33	-	29	-	464	-
<b>Average</b>	<b>40/Year</b>	<b>13%/Year</b>	<b>36/Year</b>	<b>16%/Year</b>	<b>1785/Year</b>	<b>24%/Year</b>

*Note: The journal and conference paper counts do not include any duplication of papers published by multiple faculty of our department. Citation data were collected primarily from Google Scholar and Scopus.*

### **Core Theme 3: Create an Academic Health Center**

N/A

### **Core Theme 4: Foster Community Partnerships**

This core theme is derived from the following sentence from UNLV's mission statement:

**We stimulate economic development and diversification, foster a climate of innovation, promote health, and enrich the cultural vitality of the communities that we serve.**

One indicator related to this theme is the scholarships provided to the graduate students by professional companies, the construction industry, and the communities. Table 8 shows the amount of scholarship money available for graduate and undergraduate student scholarships provided by community partners over the last five years. These scholarships are also available for PhD and MSE civil engineering graduate students. The table shows that, on average, the local community has provided scholarships of about \$80,370 per year. Of this amount, about 9% was provided to graduate students, which helps in student retention and graduation. This scholarship amount received from the community shows that the department is successfully fostering community partnerships, as stated in UNLV's mission.

**Table 8.** CEEC department graduate and undergraduate scholarships data

Fiscal year	Total scholarships	Scholarships to graduate students	% of total scholarships to graduate students
2020/2021	\$83,000	\$13,000	15.8%
2019/2020	\$81,460	\$4,000	4.9%
2018/2019	\$81,250	\$9,000	11.1%
2017/2018	\$83,700	\$5,500	6.6%
2016/2017	\$72,500	\$6,000	8.2%
<b>Average</b>	<b>\$80,370</b>	<b>\$7,500</b>	<b>9.3%</b>

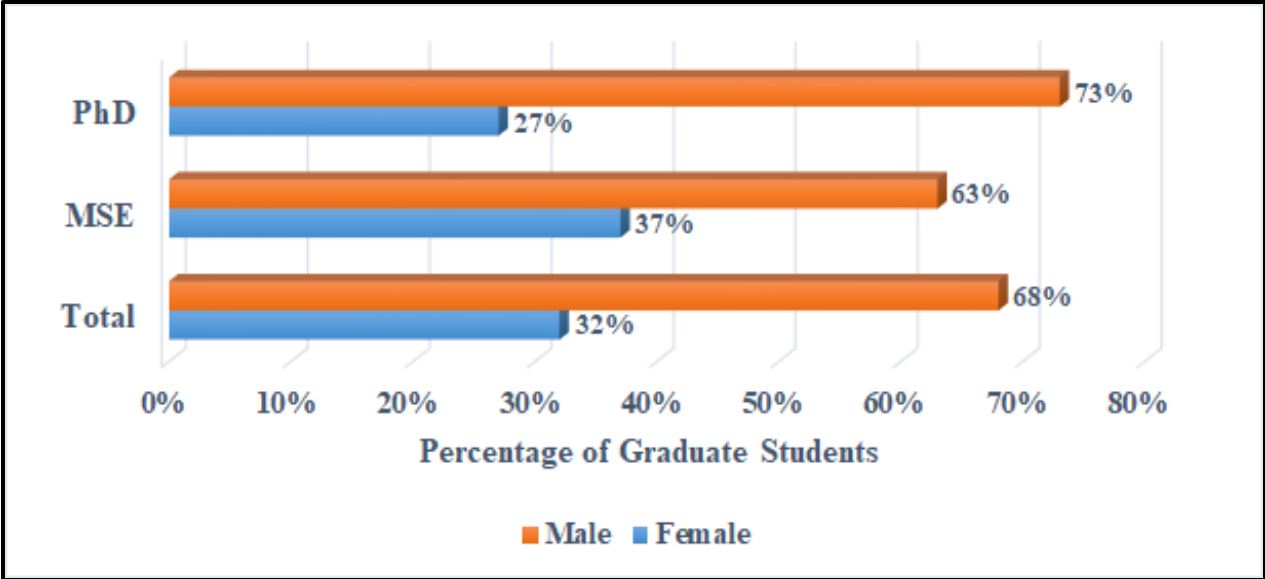
Another indicator for this theme is the participation of the graduate students in Graduate Professional Students Association (GPSA) in research forum. Members of the local communities also participate in this research forum to gain knowledge about the research conducted by the graduate students. The department's graduate students regularly participate in this forum and have won several research awards.

## **Excellence**

### **18. List and briefly describe five highlights or areas of excellence of the program.**

Five areas of excellence in our PhD and MS programs are as follows:

1. The department's graduate program has been consistently ranked in the top 100 civil engineering graduate programs in US News and World Report over the last five years. In 2020, our civil engineering graduate program is ranked 93<sup>rd</sup> in the US.
2. The department's graduates have been successful in securing academic positions in the institutions of higher education.
3. The department's graduates have been successful in securing executive level professional positions in both government and private companies, and elected to serve in leadership roles in professional organizations.
4. The department's faculty with graduate students had a highest research expenditure and published highest number of publications in the College of Engineering.
5. The department's graduate program is inclusive and diverse in terms of under-represented groups, with about 32% of our graduate students being women. Figure 2 and Table 9 depicts these data for our program in terms of gender and race (Fall 2020 data).



**Fig. 2.** Gender distribution of CEEC graduate students in Fall 2020 (PhD = 37 and MSE = 41)

**Table 9.** Race Distribution of Graduate Students (Fall 2020 data)

No.	Race	PhD level		Masters level		Total	
		No.	%	No.	%	No.	%
1	African American	3	8	3	7.0	6	8
2	Asian	13	35	17	41.5	30	38
3	Latino	9	24	4	10.0	13	17
4	White	12	33	17	41.5	29	37
<b>Total</b>		<b>37</b>	<b>100</b>	<b>41</b>	<b>100</b>	<b>78</b>	<b>100</b>

*Note: Students from Iran declared themselves as whites*

### III. External Demand for Program

#### Stakeholders

**19. Who are the main local and regional stakeholders of your educational programs? In other words, which employers and entities benefit from these programs, by hiring the graduates or admitting them to graduate and/or professional programs?**

The primary stakeholders for the program include engineering consulting and design firms; construction companies; general contractors; other private companies; county, city, and municipal offices or other government entities; utilities; the Nevada Department of Transportation (NDOT); and higher education institutions (students working in academia). While the department's graduates are employed across the US or internationally, a key focus is primarily on serving the local/regional needs, such as from, consulting and design firms, contractors, county, municipal, and state agencies.

**20. Describe the needs of these stakeholders for graduates of this program?**

Stakeholder needs vary, but generally are related to the life-cycle of infrastructure systems. These needs include policy, planning, design, construction, maintenance, and management considerations to support the needs of project owners, consultants, and contractors as well as investors. CEEC graduates have successfully stepped on these roles and over time, have grown into leadership roles, e.g. team leaders, managers, presidents and CEOs of organizations, and leaders of public agencies.

#### Needs for Graduates and Future Plans

**21. What are the anticipated placement needs for program graduates over the next 3-5 years? Cite sources of information (e.g. Occupational Outlook Handbook, <https://www.bls.gov/ooh/>, Nevada Workforce Research Data System, <http://npwr.nv.gov/reports/student-completion-and-workforce-part-ii/>).**

The market demand for civil engineers, environmental engineers, and construction management (CM) graduates is extremely strong in southern Nevada, and the prospects are even stronger over the next few years. The Bureau of Labor Statistics (BLS) reported that the demand for civil engineers in the U.S. will be 20,500 from 2018-2028, about a 6% annual increase in the coming years (<https://www.bls.gov/ooh/architecture-and-engineering/civil-engineers.htm>). The demand for environmental engineers for the next 8 years in the U.S. will be 2,900, an annual increase of about 5% (<https://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm>). It should be noted that these estimates were published prior to the onset in early 2020 of the global COVID-19 pandemic.

Most of our graduates with PhD or MSE degrees in the construction area work as construction managers. The BLS data show that the employment change for the 2019-2029 period for construction managers in the U.S. will be 40,400, which is an average demand increase of 8% annually (<https://www.bls.gov/ooh/management/construction-managers.htm>). The most recent employment data for Nevada for civil, environmental engineering, and construction managers stands at 2,690, 550, and 4,080, respectively ([https://www.bls.gov/oes/current/oes\\_nv.htm#11-0000](https://www.bls.gov/oes/current/oes_nv.htm#11-0000)). Discussions with engineering firms, state and local agencies, and professional organizations (e.g., Associated General Contractors, Las Vegas Chapter/Nevada Contractors Association) indicate a strong local demand in the long-term for civil and environmental engineering and CM graduates.

Employment opportunities for recent graduates (undergraduate and graduate) reflect the current demand. In career fair conducted by the College of Engineering in Spring 2020, there were more civil engineering and construction firms recruiting than were students seeking for career opportunities. These



firms have had difficulty in attracting graduates from our graduate and undergraduate programs, because most of our students are working part time or full time in local companies. Over the past five years, the PhD and MSE graduates' job placement was 100%. All of our PhD and MSE graduates received employment offers upon graduations or soon thereafter. Engineering and construction firms from across Nevada and other states in the western U.S. (Arizona, California, Colorado, Washington, etc.) continue to contact us seeking graduates from our programs. These clearly, indicate strong employment opportunities across the western United States. We note that there are uncertainties related to the US economy based on the current COVID-19 pandemic and the related implications for overall employment and in particular employment opportunities for our graduates. However, indications are that investments in infrastructure systems by federal, national, state, and local agencies as by the private sector will continue (and perhaps at increased levels) which in turn will lead to continued or greater levels of career opportunities for graduates from our programs.

## **22. What changes to the program, if any, will the anticipated placement needs for program graduates require?**

A strong commitment to recruiting PhD and MSE graduate students is necessary to sustain and increase enrollment in these program. The current enrollment in the PhD and MSE programs is healthy. The placement of our graduates is 100% and the recruitment commitment for these professionals from both private and public agencies is strong. However, to meet the demand from the public and private sectors, and from academia, the department needs to recruit and graduate more students in timely manner. It is also important that the program and course content continue to evolve and meet industry and stakeholder needs. CEEC faculty recently made overall changes in both PhD and MSE programs, covering admission to graduation requirements. Therefore, our degree contents and requirements are up-to-date with regard to prospective stakeholders and professional needs.

## **Success of Graduates**

### **23. What steps does the program take to facilitate the success of its graduates (e.g., internships, career fairs, orientation, employment)?**

The department adopts many approaches to ensure that our graduates are successful in their professional career. Many students in the program work in the industry during their studies as full or part-time employees – providing a direct link between students and the employers. The following list the steps initiated by the department or college to facilitate the success of our graduates.

- The department frequently invites industry professionals to deliver lectures and share their experiences in classes.
- The department also offers an extensive internship program that currently has an excess of student opportunities. The department has developed an internship course so that the graduate students can join the industry and gain valuable practical experience before completing their graduate study.
- The college hosts career fairs every semester for our students. Many prospective employers participate in this fair, and oftentimes, the number of opportunities exceed the number of students interested in such opportunities.
- The department leverages its strong relationships with the Industry Advisory Board members to help graduates from our programs secure career opportunities.
- The College of Engineering also has an Internship and Career Services Coordinator, who provides excellent helps students in a variety of ways.

- The faculty have very good academic networking in their areas, which helps our fresh PhD graduates to get academic jobs after their graduation.
- The department also sends PhD students to participate in various conferences for paper presentations to improve their professional development and to provide them quality opportunities to create / expand their professional networks.

#### 24. Describe the placements of recent graduates.

A survey of recent graduates (PhD and MSE) from Fiscal Year 2016/2017 to 2019/2020 reveals that 100% of the PhD graduates are working either in academia or industry (Table 10). Out of 22 PhD graduates, eight (36%) are working in academia and rest are working in public and private industry. Out of 59 MSE graduates, information was available for 55 students: eight of these students pursued PhD degrees (15%) and the rest are working in the public and private industry (Table 11).

**Table 10.** PhD graduates' placement data (Fall 2016 to Spring 2020)

No.	Graduation Date	Degree	Placement
1	Fall 2016	PhD	Industry
2	Fall 2016	PhD	Industry
3	Fall 2016	PhD	Industry
4	Spring 2017	PhD	Academia
5	Spring 2017	PhD	Industry
6	Fall 2017	PhD	Industry
7	Fall 2017	PhD	Industry
8	Spring 2018	PhD	Academia
9	Spring 2018	PhD	Academia
10	Fall 2018	PhD	Industry
11	Spring 2019	PhD	Academia
12	Spring 2019	PhD	Academia
13	Summer 2019	PhD	Academia
14	Summer 2019	PhD	Academia
15	Fall 2019	PhD	Industry
16	Fall 2019	PhD	Industry
17	Fall 2019	PhD	Academia
18	Fall 2019	PhD	Industry
19	Spring 2020	PhD	Academia
20	Spring 2020	PhD	Industry
21	Spring 2020	PhD	Industry
22	Summer 2020	PhD	Industry

**Table 11.** MSE graduates' placement data (Fall 2016 to Spring 2020)

No.	Graduation date	Degree	Placement
1	Fall 2016	MSE	Pursue PhD
2	Fall 2016	MSE	Industry
3	Fall 2016	MSE	Not Available
4	Fall 2016	MSE	PhD/ Academia
5	Fall 2016	MSE	Industry
6	Fall 2016	MSE	Industry

No.	Graduation date	Degree	Placement
7	Spring 2017	MSE	Industry
8	Spring 2017	MSE	Industry
9	Spring 2017	MSE	Industry
10	Spring 2017	MSE	Industry
11	Spring 2017	MSE	Industry
12	Spring 2017	MSE	Pursue PhD/ Industry
13	Summer 2017	MSE	Pursue PhD
14	Fall 2017	MSE	Industry
15	Fall 2017	MSE	Pursue PhD/ Industry
16	Fall 2017	MSE	Not Available
17	Fall 2017	MSE	Industry
18	Fall 2017	MSE	Industry
19	Spring 2018	MSE	Industry
20	Spring 2018	MSE	Industry
21	Spring 2018	MSE	Industry
22	Spring 2018	MSE	Industry
23	Spring 2018	MSE	Industry
24	Spring 2018	MSE	Industry
25	Fall 2018	MSE	Industry
26	Fall 2018	MSE	Not Available
27	Fall 2018	MSE	Not Available
28	Fall 2018	MSE	Industry
29	Fall 2018	MSE	Industry
30	Fall 2018	MSE	Industry
31	Fall 2018	MSE	Industry
32	Fall 2018	MSE	Pursue PhD/ Industry
33	Spring 2019	MSE	Industry
34	Spring 2019	MSE	Industry
35	Spring 2019	MSE	Industry
36	Spring 2019	MSE	Industry
37	Spring 2019	MSE	Industry
39	Spring 2019	MSE	Pursue PhD/Industry
40	Spring 2019	MSE	Industry
41	Spring 2019	MSE	Industry
42	Spring 2019	MSE	Industry
43	Spring 2019	MSE	Industry
44	Spring 2019	MSE	Industry
45	Spring 2019	MSE	Industry
46	Summer 2019	MSE	Industry
47	Summer 2019	MSE	Pursue PhD
48	Summer 2019	MSE	Industry
49	Fall 2019	MSE	Industry
50	Fall 2019	MSE	Industry
51	Fall 2019	MSE	Industry
52	Fall 2019	MSE	Industry
53	Fall 2019	MSE	Industry
54	Fall 2019	MSE	Industry

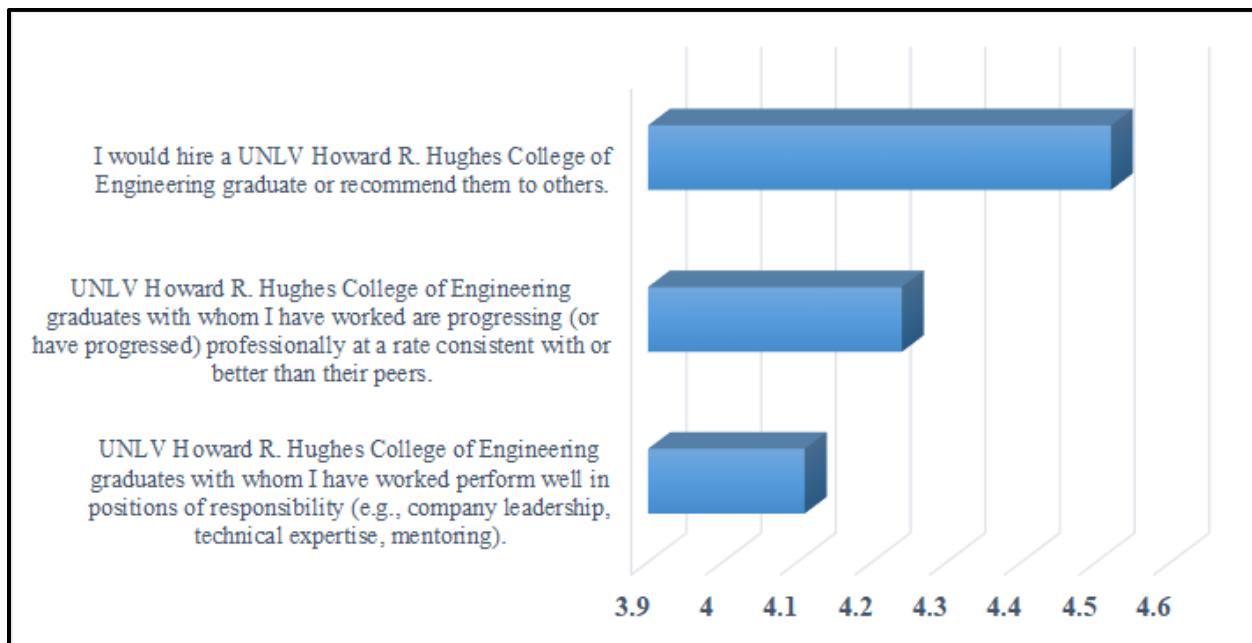
No.	Graduation date	Degree	Placement
55	Fall 2019	MSE	Industry
56	Spring 2020	MSE	Industry
57	Spring 2020	MSE	Industry
58	Spring 2020	MSE	Industry
59	Spring 2020	MSE	Industry

**25. If the program does not have placement information on graduates, what is the plan to gather that information?**

The department obtains placement information on every graduate through a Graduate Exit survey. However, some students may not have received employment at the time of the exit survey. So additional information is obtained from faculty advisors and explored through social media networks, such as LinkedIn, Research Gate. Every three years, the College conducts a survey of alumni – the responses to this survey also help obtain placement information of our graduates.

**26. As required by NSHE, discuss how the program assesses whether the graduates are meeting employer’s needs.**

Every three years, the College of Engineering conducts employer surveys for all programs in the College. This survey includes questions to help gauge the extent to which graduates from our undergraduate and graduate programs meet employers’ expectations. The most recent survey was conducted in 2018/2019 for which there were a total of 105 responses. This includes responses from the organization which hired our MSE and PhD civil engineering graduates. The average ratings of three critical questions related to this theme, are shown in Figure 3. The rating scale is 1 to 5; 1 representing “strongly disagree” and 5 representing “strongly agree.”. The average rating for all the questions is higher than 4.0, which indicates that the graduates from our program are meeting employer’s needs.



**Fig. 3.** Satisfaction level of employers with the quality of UNLV graduates

## IV. Relationship to Other Programs

### 27. What relationship does this program have to other programs (e.g., articulation, transfers, collaborations, partnerships) in the NSHE system?

The PhD and MSE degree program allow students to transfer up to a maximum of 9 credit hours of graduate courses taken within Nevada System of Higher Education (NSHE) institutions or from any accredited higher education institution.

### 28. What relationship does this program have to other programs at UNLV (e.g., collaborations, partnerships, affiliated faculty, General Education requirements)?

The department also offers BS-MSE integrated thesis track degree for our talented undergraduate students. The undergraduate students can enter to MSE program during their undergraduate study, if they have high overall GPA greater than 3.0/4.0. Recently, CEEC department in collaboration with UNLV School of Business started dual MBA/MSE degree program.

## V. Impact

### 29. What impact have these programs had at each of the following levels?

#### a) University

The Top Tier initiative and R1 designation include several performance measures which include metrics based on research scholarship, extramural funding, and PhD degrees conferred. The PhD and MSE programs in CEEC contribute significantly to attaining the goals identified for these metrics. In the last five years, CEEC faculty has graduated 22 PhD students. CEEC department is the one, among the four departments under the College of Engineering, which has graduated the highest number of PhD students in the last five years. In addition, the total research expenditure generated by the CEEC faculty working with our PhD and MSE students is the highest among all of the departments under the College of Engineering. The department faculty has also published the highest number of peer-reviewed journal papers and conference proceedings among all departments in the College of Engineering.

#### b) Community

The department's PhD and MSE programs are providing highly-skilled civil engineers in Southern Nevada engineering consulting firms, construction companies, and public agencies. A majority of the demand for highly-skilled engineers in Nevada is fulfilled by our graduate programs. Further, students in our graduate programs work on a number of basic and applied research topics related to critical societal concerns pertaining to the region's civil infrastructure systems; these include design and construction projects in environmental, transportation, water, waste water, structural, and geotechnical engineering. Outcomes from such efforts help decision makers in the region address current and emergent needs and challenges, as well as effectively plan for the future.

#### c) Discipline

Good quality civil infrastructure systems are essential to maintaining and improving the quality of lives of individuals and families (residents and visitors), economic competitiveness of businesses, and the prosperity and vitality of businesses and communities. However, aging infrastructure and inadequate resources are among key factors that threaten the ability of infrastructure system owners and operators to

preserve the extent and quality of the existing infrastructure system, and to improve on them. Such pressing concerns exist not only in the Las Vegas metropolitan region and the state of Nevada, but also across the nation and beyond. They will continue to pose serious challenges to communities and businesses in the upcoming decades. Thus, there is an urgent need to effectively and efficiently address the needs and challenges of civil infrastructure systems.

The department's Civil Engineering graduate program is one of the top 100 programs in the nation. Students in our graduate programs and alumni work, regionally, nationally and internationally to address the aforementioned needs and challenges. This helps the civil engineering discipline by improving the public health, safety, welfare, environmental, socio-cultural, and economic status of human beings, both nationally and internationally. Through the accompanying scholarship activities, they also help advance the state-of-the-art/science and the state-of-the practice in civil engineering and construction.

### **30. What are the benefits to UNLV of offering these programs?**

The major benefits of the department's PhD and MSE programs are:

- a. Meeting the needs of skilled civil engineers around the state, nation, and globe.
- b. Developing and graduating high quality students who become members of the faculty in institutions of higher education and who work on education and research initiatives
- c. Enabling the department faculty to apply for extramural funding and providing workforce to successfully complete UNLV research obligations to funding agencies.
- d. Providing top faculty in higher education institutions to conduct cutting-edge research and teaching.
- e. Meeting the top tier goals of UNLV by graduating PhD students, publishing peer-reviewed journals and conference papers, and bringing in research money, in order to conduct seamless research by our graduate students.
- f. Building a relationship with local engineering and construction communities to improve the social, cultural, and economic status of the state.
- g. Creating a skilled engineering workforce that has the ability to ethically and professionally solve engineering problems worldwide.
- h. Building relationships with decision makers, researchers, and practitioners, especially in the engineering and construction communities, to improve the social, cultural, environmental, and economic conditions across the state of Nevada, and beyond.

### **31. Provide at least three examples of the integration of teaching, research, and service at the program level (e.g., faculty mentoring leading to student presentations at conferences, service learning classes, community service activities involving students, or other noteworthy student activities and achievements).**

One of the examples of the integration of teaching, research, and service in our PhD and MSE program is the number of journal and conference papers published by the faculty with our graduate students. Table 7 in Section II, noted that on average, over the last ten years, our faculty has annually published 40 peer-reviewed journal papers and 36 conference proceedings co-authored with our graduate students.

The department's graduate students have earned several awards in the national, university, and college level. Table 12 shows some of our graduate students who won awards over the last five years.

**Table 12.** Awards received by CEEC graduate students (2016 to 2020)

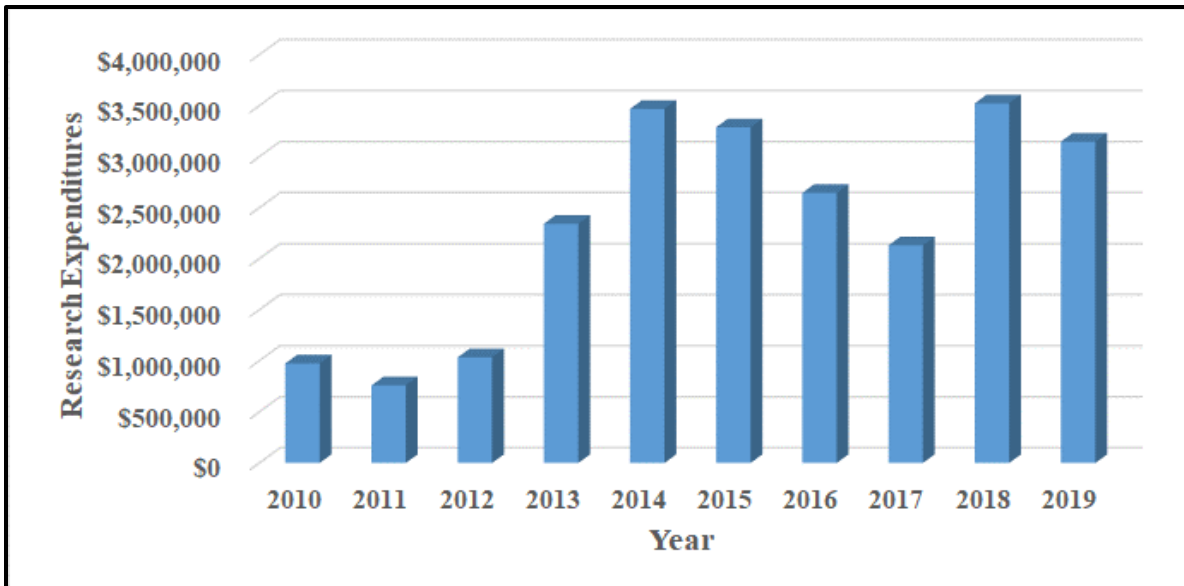
No.	Year	Degree program	Name of the award
1	2020	PhD	Lindau Nobel Laureate Program
2	2020	PhD	Grad Rebel Doctoral Finishing Fellowship - Graduate College
3	2020	PhD	COE Best Dissertation Award – 1 <sup>st</sup> Place
4	2019	MSE	CA-NV American Water Works Association Best Thesis Award – 1 <sup>st</sup> Place
5	2019	PhD	COE Best Dissertation Award – 1 <sup>st</sup> Place
6	2019	MSE	COE Best Thesis Award – 1 <sup>st</sup> Place
7	2018	PhD	UNLV Best Dissertation Award - 2 <sup>nd</sup> Place
8	2018	MSE	UNLV Thesis Award 1 <sup>st</sup> Place
9	2017	PhD	COE Best Dissertation 2 <sup>nd</sup> Place
10	2017	MSE	COE Best Thesis Award
11	2016	PhD	UNLV Best Dissertation Award – 1 <sup>st</sup> Place

The department’s graduate students take part in the research forum conducted by the Graduate Professional Society Association (GPSA) of UNLV. Our faculty also serve as judges in these research forums. Some of our graduate students have served as members and the treasurer of the GPSA.

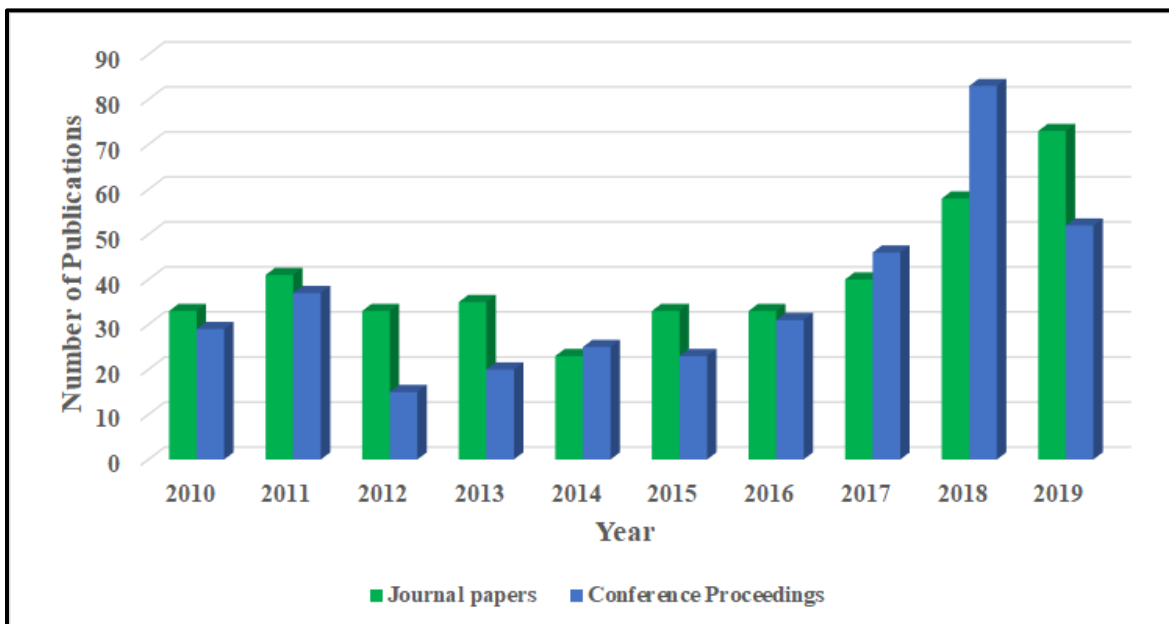
## VI. Productivity

### **32. Provide an indication of faculty productivity appropriate for your unit (lists of publications and other creative activities, grant proposals submitted and funded, installations designed, etc.) organized by category.**

CEEC faculty members are one of the top in the College of Engineering in terms of securing research funds and publishing topical peer-reviewed outlets. Figures 4 and 5 show an upward trend of our faculty’s research expenditures and publication records in the last ten years.



**Fig. 4.** Research expenditure of CEEC faculty



**Fig. 5.** Publication record of CEEC faculty

## VII. Program Resources

### Faculty Time

#### 33. Faculty and GA Resources

Table 13 shows the number of full time tenured and tenured-track faculty, part-time instructors (PTI), and graduate assistants (GA) provided by graduate college. The data shows that in the past 3 years, our



department has lost 3 tenure-track faculty position due to budget cut. The department has just one PTI, who teaches graduate courses.

**Table 13.** Tenured and tenure-track faculty and part time instructors' data

	Spring 2018	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020
Number of Tenured and Tenure-Track Faculty	20	20	20	18	18	17
Number of Faculty in Residence (FiRS), Lecturers, and Visiting Faculty	1	1	1	1	1	1
Number of State-Supported Graduate Assistants (GA) (provided by the Graduate College)	-	-	-	-	-	-
Number of Part Time Instructors (PTI)	1	0	1	1	1	1

Most of our graduate courses are taught by tenured or tenure-track faculty. In the last three years, the percentage of courses taught by our full time faculty per semester ranges from 78% to 100% (Table 14). So, students in our graduate courses have direct interactions with the full-time faculty members. This helps the students leverage the synergistic research experience of the faculty members.

**Table 14.** Personnel responsible for teaching graduate courses

	Spring 2018	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020
Percent of Courses and Laboratory/Discussion Sections Taught by Tenured and Tenure-Track Faculty	93%	100%	86%	89%	78%	92%
Percent of Courses and Laboratory/Discussion Sections Taught by FiRS, Lecturers, and Visiting Faculty	0%	0%	0%	0%	11%	0%
Percent of Courses and Laboratory/Discussion Sections Taught by State-Supported GA lines	0%	0%	7%	0%	0%	0%
Percent of Courses and Laboratory/Discussion Sections Taught by PTIs	7%	0%	7%	11%	11%	8%
Total	100%	100%	100%	100%	100%	100%
Number of Total Courses Offered Per Semester	15	16	14	9	9	12

Table 15 shows that the total number of graduate course credit hours taught by part-time instructors (PTI) in the department that ranges from 9 to 15 credit hours per semester within the last three years. The

department had engaged full time faculty to teach graduate level courses, so as to facilitate synergies between instructional and research / scholarship efforts.

**Table 15.** Number of credit hours taught by full time and part time faculty

	Spring 2018	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020
Student Credit Hours Taught by Tenured and Tenure-Track Faculty	296	210	207	114	177	138
Student Credit Hours Taught by FiRS, Lecturers, and Visiting Faculty	0	0	0	0	9	0
Student Credit Hours Taught by State-Supported GA Lines	0	0	18	0	0	0
Student Credit Hours Taught by PTIs	9	0	15	12	0	9

*Student credit hours are calculated using the following formula: # of Students X Course Credit Hours = Student Credit Hours*

### **Budget**

**34. Fill in the three tables below, and use this information to answer Questions 35 and 36.**

The tables are shown in the answers that follow.

**35. Are these resources sufficient to meet the degree program’s instructional and scholarship needs?**

Tables 16 and 17 show the revenues and expenditures of the department over the last three years. The resources are marginally adequate to meet the degree program’s scholarship needs. However, for instructional needs, the GAs provided (Table 18) are not adequate, and every semester the department has to spend the indirect cost recovery budget to hire Graders to fulfill instructional needs. Therefore, more state-funded GAs would help reduce the reliance on indirect cost recovery.

**Table 16.** CEEC department revenues

Revenues	Fiscal year (FY) 17–18	FY 18–19	FY 19–20
State Operating Account	\$57,066	\$57,530	\$57,530
Student Fees	\$40,239	\$48,142	\$53,396
Other	\$85,191	\$73,295	\$83,333
<b>Total Revenue</b>	<b>\$182,496</b>	<b>\$178,967</b>	<b>\$194,259</b>

**Table 17.** CEEC department expenditures

Expenses	FY 17–18	FY 18–19	FY 19–20
Salaries (faculty, staff, GAs, work-study students, etc.)	\$3,440,314	\$3,281,280	\$3,154,290

Operating Expenses (operational and instructional supplies, postage, telephones, equipment maintenance, software licensing, online electronic subscriptions, etc.)	\$133,194	\$114,929	\$115,479
Student Activities (recruitment, career services, general activities, etc.)	\$10,910	\$8,726	\$7,633
Other	-	-	-
<b>Total Expenditures</b>	<b>\$3,584,418</b>	<b>\$3,404,935</b>	<b>\$3,277,402</b>

**Table 18.** CEEC department graduate assistants

Graduate Assistantships	FY 17-18	FY 18-19	FY 19-20
Number of Graduate Assistantships Provided by the Graduate College/State	20	31	27
Number of Graduate Assistantships Funded by Grants	37	26	31
Total Number of Graduate Assistantships	57	57	58

**36. If not, approximately how much additional funding is needed for what specific activities? What funding sources could be reasonably increased to help the program attain its goals?**

The GA budget allocation for instructional needs provided by the College is \$223,000 for fiscal year 2020/2021. This budget is enough to hire 13 PhD GA positions. However, class enrollments have increased significantly in the last couple of years; some classes have to be offered in two sections, which requires more GAs for teaching lab courses and grading the students' work. In addition, the department needs to provide one GA for EGG 101- Introduction to Engineering and Computer Science, which is offered to all the first-year engineering students. This has put significant pressure on the department's GA work load; the department hired Graders to compensate this instructional work. Therefore, a reasonable GA budget amount should be at least equivalent to a hiring budget for 18 PhD students.

**General Education**

**37. If your program or unit offers General Education courses, estimate what portion of the unit's teaching resources are allocated to those courses.**

The department, along with the College of Engineering, offers one General Education course – EGG 101 Introduction to Engineering and Computer Science – which serves as a science elective. The department offers one section each semester, taught by a PTI appointed by the College of Engineering. However, we have to provide a GA from our GA budget for this purpose. Out of 13 GAs, we have to allocate about 8% of our GA resources to this course.

**38. Are there any factors that affect your unit's ability to offer courses for its majors' students? If so, please explain why.**

Due to the lack of full-time faculty in some areas, the department has not been able to offer enough 600 and 700 level graduate courses. Over the last three years, the department lost three faculty positions in Environmental, Geotechnical, and Structural engineering areas, which seriously impact the ability to offer courses in some of those areas.

### **Program Funding**

#### **39. Is funding from other sources sufficient to assist the program in achieving its outcomes? (Other sources include: differential tuition, grants and contracts, endowment income, and one-time gifts for student scholarships.)**

CEEC department is the most productive in terms of research grants in the College of Engineering. As noted earlier (Table 18), funds from such research efforts are used to support about 31 graduate students on research assistantships in 2019/20 academic year. So, these funds are vital to the graduate programs in CEEC. The reliance on such funding poses significant risks, should there be dips in extramural funding based on circumstances beyond the control of members of the CEEC faculty. Some of the funds from differential tuition cannot be used for scholarships for Graduate students. The department does not receive endowment funds to support graduate programs. The department is using about 9% of the one-time gifts for student scholarships for graduate students. Therefore, the funding from these sources is not enough to assist PhD and MSE programs in achieving their desired outcomes.

#### **40. If not, which funding streams could be increased to help the program attain its outcomes?**

NSHE policy does not allow the differential tuition to be used for graduate scholarships. However, the department would benefit significantly if these tuitions and funds from endowment accounts could be used to support various aspects of graduate education and research such as GA funding and research efforts including data acquisition, software, and hardware. The total value of one-time gift for student scholarships also needs to be increased. The department is working on to increase such funds available for scholarship amounts.

#### **41. What, if any, new donor revenue has been generated since the last program review?**

The amounts of funds for scholarships and indirect costs from grants and contracts have been consistent. The department is working to increase one-time scholarship gift contribution. However, the amount coming from differential tuition and the endowment is not under department's control.

#### **42. Discuss the unit's engagement in fundraising activities during the last five years to garner support for the program. Alternatively, explain the constraints that have prevented such actions.**

All of the fundraising activities are managed and coordinated by Dean's office. The department is also involved in fundraising activities. For example, the department organizes an annual golf tournament with advisory board members and the faculty to increase the scholarship funds. Additionally, the department has started contacting our alumni, as well as engineering and construction companies in order to raise funds that can be used to support for graduate students.

### **Program Resources**

#### **43. Is the quality and quantity of available consumable materials and supplies (e.g., office supplies or laboratory supplies) adequate? If not, please explain why.**

Yes, the quality and quantity of available consumable materials and supplies (e.g., office supplies or lab supplies) are adequate. However, the budget to buy key resources required for laboratory equipment for instructional and research purpose, is insufficient. The investments needed for such items are substantially higher than the revenues generated from the (relatively low) lab / course fees for the undergraduate and graduate courses.

**44. Is the quality and quantity of available technological resources (e.g., computers, large format displays, software) adequate? If not, please explain why.**

Due to the limited lab space available dedicated to our department, space is always the issue. There is less lab space dedicated for research and teaching graduate courses. There is no dedicated computer laboratory for our department graduate or undergraduate students. Further, the hardware, software, and peripheral items needed for the courses need to be upgraded or in some cases acquired. Some of our core labs in the areas such as environmental, geotechnical, structural, and construction, do not have enough space or equipment to provide a conducive teaching / learning environment or reasonable operational efficiency. Therefore, more lab space and lab equipment are needed for our department to improve our graduate program. The investments needed for some of these resources are substantially higher than the revenues generated from the (relatively low) lab / course fees for the courses.

**45. Is the quality and quantity of other types of necessary equipment adequate? If not, please explain why.**

As noted in the response to the proceedings questions, the quantity and quality of the lab equipment and computer resources are not adequate. These need to be significantly enhanced to improve the quality of our student learning experiences and also to grow the enrollments in our graduate programs. The department has labs for all five area of expertise. The following description shows the status of our lab, which is not enough for our growing number of undergraduate and graduate students, and research grants.

**Project Management and Construction Engineering Laboratory (PMCEL)**

The PMCE lab (approx. 600 ft<sup>2</sup>) is located in building B of the Thomas T. Beam Engineering Complex (TBE B-363) and managed by Dr. JinOuk Choi, Dr. Jeehee Lee, Professor Neil Opfer, Dr. Jay Park, and Dr. Pramen Shrestha (Figure 6). The lab has two sets of VR gears (Oculus Rift S), a Boston Dynamics Spot Mini (co-operated with Dr. Oh), a UAV-module (consists of a Pixhawk autopilot controller and four 920kv [RPM/V] brushless motors fitted with 9.5-inch propellers), a Canon EOS 5D Mark IV full-frame digital SLR camera, a higher resolution 320 x 240 IR infrared thermal imaging camera, Samsung Gear 360 4K VR camera, a black box DVR recorder, three laptops, and five desktops, an iPad, temperature sensors, toolsets (drills, hammers, cutters, etc.), storage boxes, a plotter for poster printing, a projector and a screen for seminars and meetings, storage area, and a drone enclosure cage net that allows a researcher to conduct in-flight testing. There is also office space available adjacent to *this* lab for our CEM graduate students.



**Fig. 6.** Project management and construction engineering lab

### **Environmental Laboratories and Equipment**

Environmental Engineering faculty at UNLV share facilities and equipment to maximize resources. Multiple environmental engineering laboratories are managed by Dr. Erica Marti, Dr. Eakalak Khan, and Dr. Jacimaria Batista (Figure 7). The research efforts in these laboratories focus on the detection of chemical contaminants and their attenuation by optimizing conventional and advanced water and wastewater treatment processes. The scale of the contaminants ranges from macroscopic particles to trace organic compounds (TOrcs). The research performed in these labs is generally aims to address concerns related to biological and chemical remediation of groundwater and soil, and the reuse of water for both nonpotable and potable applications. Recent projects have focused on perchlorate biodegradation, chromium removal, disinfection byproduct formation and mitigation, TOrc attenuation, nutrient removal, and bulk organic matter transformation/removal. The treatment technologies of interest include ion exchange, advanced oxidation, biofiltration, membrane filtration, and other advanced treatment processes.

The following is the list of key equipment in Dr. Marti's laboratory:

- Gas chromatograph/mass spectrometer (Thermo Scientific, Trace 1310 TSQ 8000 Evo Triple Quadrupole)
- Purge and trap concentrator (Teledyne Tekmar, Lumin)
- Solid-phase extraction unit (Dionex, AutoTrace 280)
- Sample extract concentration unit (Biotage, Turbovap LV)
- Ozone generator (Primozone, GM-1)

The following is the list of key equipment in Dr. Khan's laboratory:

- Total organic carbon/total nitrogen analyzer (OI Analytical, Aurora 1030)
- Liquid chromatograph/mass spectrometer (Thermo Finnigan, Quantum Ultra)
- Ion chromatograph (Thermo, ICS-2100)
- High performance liquid chromatograph-diode array detector (Agilent, 1100)
- Scanning ultraviolet-visible spectrophotometer (Hach, DR6000)
- Flow injection analyzer (OI Analytical, FS 3700)

The following is the list of key equipment in Dr. Batista's laboratory:

- High performance liquid chromatograph-UV detector (Dionex)
- Ion chromatograph (Dionex, ICS-2000)



- Total organic carbon analyzer (Shimadzu, 5000A)
- Atomic absorption spectrometer (PerkinElmer PinAAcle, 900T)
- Spectrofluorometer (Horiba, Aqualog)
- Scanning ultraviolet-visible spectrophotometer (Hach, DR5000)
- Luminometer (LuminUltra Photonmaster)
- Quanti-Tray System (IDEXX 2000)
- High concentration ozone analyzer (IN USA AFX H1)



**Fig. 7.** Environmental engineering laboratory

### **Geotechnical Engineering Laboratory**

The geotechnical engineering lab and equipment are managed by Dr. Moses Karakouzian (Figure 8). The lab has equipment and resources to conduct a number of important tests related to soil and material such as Weight-Volume Relationships, Specific Gravity of Soil Solids, Particle Size Analysis, Atterberg Limits, Proctor Compaction Test, Permeability, Geophysical Methods, Swell and Soluble Minerals Content, Consolidation, Unconfined Compression Test, Direct Shear Test.



**Fig. 8.** Geotechnical engineering laboratory

### **Transportation Research Center**

The Transportation Research Center (TRC), under the direction of PI Dr. Shashi Nambisan, is a multidisciplinary center for research in planning, operations, and management of sustainable transportation systems in rapidly growing urban areas. It promotes and conducts transportation research, education, and outreach for the safe, secure, and efficient movement of people and goods in collaboration with sponsors from federal, state, and local government agencies as well as from the private sector. TRC serves as a focal point at UNLV to facilitate multi-disciplinary initiatives by bringing together assets and resources from across UNLV, and developing partnerships with public and private sector entities and not-for-profit organizations. This includes leveraging the expertise and experience at various organized research units and centers and academic program across UNLV. The collective expertise and initiatives facilitated by UNLV include topics across the transportation system life cycle (policy, planning, design, construction, operations, maintenance, rehabilitation, and management) and across various transportation modes.

To date, faculty members, research staff, undergraduate and graduate students have successfully worked on more than one hundred and fifty basic and applied research projects. These projects have supported a wide range of sponsors including several federal, state and local government agencies as well as from the private sector. In the recent years, these efforts have addressed various hardware, software, and communications considerations and those related to data analytics in the broad domain of connected,



automated vehicles and infrastructure systems (CAVIS) UNLV's initiatives aim to build on these activities and create new opportunities for cross-disciplinary transportation research, scholarship, innovation, and creative activities and outreach initiatives to enhance the quality of living of individuals and families; improve the experience of visitors; increase the economic competitiveness/ vibrancy of public, private, and not-for-profit organizations, and expand the prosperity of communities.

The center offers a number of unique resources:

- FAST Jurisdictional Management Center (JMC): Partnership with the Freeway and Arterial System of Transportation (FAST), a department of the Regional Transportation Commission (RTC) of Southern Nevada. The FAST JMC is a multi-jurisdictional organization with participation from all local jurisdictional partners (cities of Las Vegas, Henderson, and North Las Vegas, Clark County, Nevada Department of Transportation, Nevada Highway Patrol). FAST manages Southern Nevada's freeway and arterial network transportation networks. FAST monitors traffic through extensive video imaging, CCTV, and inductive loop detection and controls traffic through signal systems, ramp meters, DMS and lane use control signs. TRC has a dedicated fiber connection with the FAST JMC which facilitates live traffic data streaming from FAST's Intelligent Transportation Network (ITS) network to the TRC to UNLV. This provides access in near real-time to a range of traffic operational data and road geometry data across the region's road network.
- Real-Time Intelligent Systems Laboratory, including key hardware and software as well as a connection to access real-time traffic data, using sensors and cameras deployed and managed by the FAST JMC.
- A Motion-based Interactive Driving Simulator Laboratory with a three degrees of freedom Simcraft driving simulator. This lab includes open-source simulation software and the 3D roadway network of Las Vegas Nevada. The software and visuals were developed in house.
- Two computer laboratories: The labs provide state-of-the art hardware and software for transportation research including high performance servers for traffic simulation. The laboratories combined provide space for more than 50 graduate students and professionals.
- Safe Community Partnership: An outreach program that brings traffic safety education to the community in order to influence safer driving decisions. This effective outreach and education program has strong ties within the community and local law enforcement.
- GIS and Remote Sensing Core Lab and Visualization Facility: The GIS-RS lab provides access to hardware and software systems, as well as key geo-spatial databases to support research and education, research, and outreach activities. These include ESRI software and data portals and high resolution satellite imagery. The Visualization Facility provides an integration of visualization tools and expertise to provide researchers, decision makers, and policy makers turn-key solutions for an array of visualization needs. Visualization Facility is built in the GIS and Remote Sensing Core lab and has a tiled display wall and large-screen projection system.

*Rail Transportation Engineering and Advanced Methodology ("RailTEAM") University Transportation Center (UTC)*

RailTEAM is a Tier-1 UTC selected in 2016 through a national competition by the US Department of Transportation (DOT). Its theme is "Improving Rail Transportation Infrastructure Sustainability and Durability." Dr. Hualiang Teng is the Director of this UNLV led consortium which includes the Virginia Polytechnic Institute and State University (VT) and the University of Delaware (UD) as members.

Improving the durability and viability of the railway infrastructure is critical to improving operational performance and safety of rail transportation, which in turn is vital to the nation's social well-being and economic growth. Within the thematic area of "Improving Durability and Extending the Life of Transportation Infrastructure," the RailTEAM UTC has the following main thrusts:

- Asset management and performance management: Developing advanced approaches for managing the “big data” that results from high-tech inspection systems to improve the performance and maintenance of critical railway components.
- Condition monitoring, remote sensing, and use of GPS: Providing timely and effective in situ monitoring of railway and rolling stock components that most frequently lead to derailments, slow orders, and other events that pose safety risks or interrupt operations.
- Application of new materials and technologies: Exploring new and materials and technologies for maintaining and re-conditioning rail surface, based on applying the science and physics of tribology, surface chemistry, and advanced grinding techniques.
- Construction methodologies and management: Providing guidelines for the more rigorous demands of high-speed rail infrastructure by bringing together global knowledge with the geological and topological information of the location of the railway, for such critical infrastructure as bridges and bridge bearings.

The RailTEAM UTC supports a number of graduate students in CEEC as well as those from other departments. It also plays a key role in graduate course offerings with a focus on rail transportation. RailTEAM’s education and research efforts include collaborative efforts with industry partners, including hand-on experiences for students at facilities such a railroad tracks operated by Union Pacific Railroad (Fig. 9) and the Nevada Railroad Museum at Boulder City (Nevada)



**Fig. 9.** Hands-on experiences of graduate students

## **Structural Engineering Laboratory**

The structural engineering laboratory and equipment are managed by Dr. Ying Tian (Figure 10). The lab includes a high-bay area fitted with a strong floor allowing large-scale structural testing. The main floor area of the laboratory is 75 ft long, 40 ft wide, and 20 ft high. The strong floor is comprised of a 32 ft long, 28 ft wide, and 4 ft thick reinforced concrete slab with a matrix of embedded anchors. The layout of floor anchors will allow for efficient structural testing. The lab is equipped with two steel reaction frames; each frame permits applying a vertical load of at least 200 kips. Various hydraulic actuators and cylinders are available to apply loading. The structural testing system also includes hydraulic closed-loop actuators for static and dynamic testing, hydraulic jacks, digital controllers, hydraulic pump, and a high-speed data acquisition system. Load cells, LVDTs, string pots, thermocouples, concrete moisture meters, and other types of sensors are available.



**Fig. 10.** Structural engineering laboratory

**46. Is the quality and quantity of available library and information resources adequate? If not, please explain why.**

Yes, the quality and quantity of available library and information resources are adequate.

**47. Are available program staff resources sufficient to attain the program's outcomes? If not, please explain why, stating what additional staff resources are needed and how they would be funded.**

CEEC graduate program at the current scale requires - one dedicated administrative assistant. Key activities in this regard include support for processing graduate applications and GA appointments, and tracking enrollment, retention, and graduations. It also includes handling travel related matters for faculty and graduate students. The college had provided us two administrative assistants, which is not enough. However, the department has hired a student worker to assist our administrative assistants.

## VIII. Size of Program

### 48. Discuss the headcount figures from the last five years. Are the trends in line with projections in your unit's strategic plan?

Table 19 shows the headcount of MSE and PhD students in the department since Fall 2010. The data show that the department has every semester, on average, about 35 PhD students. This is equivalent to a student-to-faculty ratio of 1.8, which seems healthy. It also shows that there has been no significant decrease in the PhD headcounts in the last five years. The MSE headcount over the last five years shows that MSE enrollment has ranged from 32 to 51. These headcount numbers fluctuate inversely with the number of degrees conferred.

**Table 19.** Headcount of PhD and MSE program

Term	MSE	Ph.D.
Fall 2010	35	19
Spring 2011	39	18
Fall 2011	35	21
Spring 2012	35	21
Fall 2012	47	34
Spring 2013	49	31
Fall 2013	39	40
Spring 2014	36	38
Fall 2014	37	42
Spring 2015	28	39
Fall 2015	35	31
Spring 2016	32	29
Fall 2016	35	28
Spring 2017	40	26
Fall 2017	43	33
Spring 2018	46	37
Fall 2018	41	40
Spring 2019	37	41
Fall 2019	40	36
Spring 2020	51	40
Fall 2020	38	37

*Source: PeopleSoft Table PS\_LV\_CNR\_STDNT\_CR, Office of Decision Support*

The PhD graduates over the last five years are about 5 per fiscal year (Table 20). Based on College of Engineering's projections, each department should graduate about 10 PhD students every fiscal year. The PhD graduates are close to this target in the recent fiscal year, the numbers are significantly lower in the

preceding years. The faculty have discussed in department’s faculty meetings with a goal to increase the number of PhD graduates conferred annually in coming years.

The number of MSE degree graduates fluctuate annually over the most recent five years in between 11 and 23 (Table 20). As previously mentioned, the number of graduates and the headcount vary inversely. However, based on the number of faculty members, the MSE enrollment should be around 60. Therefore, the College and department are preparing a strategic plan to recruit more MSE students into the program. We expect to have the ratio of MSE to PhD students of at least 1.5, which requires at least 60 MSE students, on average, every year.

**Table 20.** Number of PhD and MSE Graduates

Academic year	MSE degree count	PhD degree count
2009-10	14	9
2010-11	16	5
2011-12	15	2
2012-13	17	3
2013-14	19	9
2014-15	13	7
2015-16	12	5
2016-17	14	7
2017-18	11	5
2018-19	23	3
2019-20	12	9

**49. Does your program’s enrollment trend differ from national trends? If so, please explain why.**

Table 19 shown above, shows that department PhD and MSE headcount have been consistent over the last five years. Two metrics are used to compare our degree enrollments with the national trend: first, the enrollment of PhD and MSE students in the department is compared with the corresponding enrollments in other departments of the College of Engineering; second the enrollment in our programs are compared with the corresponding enrollments at our peer universities. Based on the American Society of Engineering Education (ASEE) database, in 2019, the enrollment of PhD and MSE students were 40 and 45, respectively, in our department. Table 21 shows the PhD and MSE enrollments in the other three departments under College of Engineering. The data indicate that the overall CEEC graduate program enrollment is higher than the enrollment in the other departments of our College. In terms of PhD program, only the Mechanical Engineering department has a higher enrollment. However, the MSE program enrollment is higher than the corresponding numbers in the other department.

**Table 21.** PhD and MSE headcount in departments at the College of Engineering

No.	Department	PhD	% Difference	MSE	% Difference
1	CEEC	40	-	45	-
2	Mechanical Engineering	44	-10%	23	+96%
3	Electrical Engineering	17	+135%	N/A	N/A
4	Computer Science	15	+167%	41	+10%

*Note: Data collected from American Society of Engineering Education, 2019.*

Next, the CEEC's PhD and MSE program enrollments are compared with those in corresponding programs at peer universities (Table 22). The peer universities considered are Utah State University (USU), the University of Nevada Reno (UNR), and the University of Houston (UH). The ASEE data for 2019 shows that the CEEC's PhD enrollment exceeded those of USU, and UH, but is lower than that at UNR. But, on average, our enrollment is higher than that the peer universities' enrollment by about 15%. However, CEEC's MSE enrollment is lower than those at our peer universities. On average, the department's MSE program enrollment is about 38% smaller than those in our peer universities' MSE programs. As mentioned previously, the department has been facing challenges to recruit MSE students. Therefore, the College and department are preparing a strategic plan to increase the graduate students' enrollment in our department, as well as across the entire college.

**Table 22.** PhD and MSE headcount of peer universities

No.	Name of the University	PhD	% Difference	MSE	% Difference
1	University of Nevada Las Vegas	40	-	45	-
2	Utah State University	29	+38%	56	-28%
3	University of Nevada Reno	51	-28%	59	-31%
4	University of Houston	30	+33%	70	-55%

*Note: Data collected from American Society of Engineering Education, 2019.*



## IX. Retention, Progression, Completion

### Major Course Offerings

#### 50. Does the program offer enough courses to meet enrollment demands? If not, please explain why.

The department has a total of 70 graduate 600 and 700 level Civil Engineering courses, out of which 36 (51%) are 700 level courses. These courses are offered in five different areas of expertise: Construction; Geotechnical; Structural; Transportation; and Water Resources/Environmental engineering. In addition, the department has also created 16 graduate level construction management courses. Table 23 depicts the total enrollment in these graduate courses over the last ten years. These data show that on average, the enrollments of 600- and 700-level courses over the last five years are 27 and 108 per semester respectively. The enrollment data from the last three years shows that the department offered five 600 level and four 700 level graduate civil engineering courses in Spring semester, and five 600 level and six 700 level civil engineering courses in Fall semester, respectively. The department also offered four 600 level and one 700 level in Spring semester, and five 600 level and one 700 level construction management courses in Fall semester, respectively. These data indicate that the department is offering an adequate number of courses to meet enrollment demands. However, in some specific areas, particularly geotechnical and structural engineering, the department was unable to offer an adequate number of graduate courses due to lack of faculty members in those areas.

**Table 23.** 600-and 700-level graduate courses' enrollment

Term	Level - 600	Level - 700
Fall 2010	32	108
Spring 2011	32	94
Fall 2011	27	82
Spring 2012	18	90
Fall 2012	38	94
Spring 2013	27	91
Fall 2013	46	97
Spring 2014	34	95
Fall 2014	11	119
Spring 2015	34	73
Fall 2015	27	81
Spring 2016	23	77
Fall 2016	17	91
Spring 2017	34	78
Fall 2017	25	117
Spring 2018	42	110
Fall 2018	12	124
Spring 2019	31	98
Fall 2019	25	99
Spring 2020	36	96

Source: PeopleSoft Table PS\_LV\_CNR\_ENRL, Office of Decision Support

**51. How many major courses have been added or eliminated in the last five years?**

Six 700 level graduate level courses **Added**

None **Eliminated**

**52. Why were these actions taken?**

These actions were taken due to two main reasons. One reason is that our department hired more faculty with different areas of expertise and these required adding 700 level graduate courses in the areas of the new faculty's expertise. Second reason is that our department, as previously noted in response to question 23 in section III, added three 700 level courses for internships to enrich the educational experiences of our graduate students with professional work and included these courses as part of the graduate degree programs.

**53. What additional actions should be taken to improve retention, progression, and graduation of students in the program?**

Table 24 shows the number of CEEC's PhD and MSE graduates conferred over the last ten years. The data indicates that, on average, the department graduates 6 PhD and 14 MSE students per academic year. This number is below the goal of the College of Engineering, especially for PhD graduates. The College of Engineering's goal of PhD graduates is about 10 per academic year per department. Therefore, the CEEC Graduate Affairs Committee is revisiting the graduate catalog, encouraging the faculty to advise the students regularly, and improving the graduation rate. The department is also trying to obtain more scholarships for graduate students, in the forms of state funded GAs and grant funded GAs, so that the students can complete their dissertations or theses on time. In addition, the faculty is working on to improve the quality of students into our programs by raising the bar of the admission requirements. The department's 2-year and 3-year cohort MSE graduation rates are about 37% and 57%, respectively, which needs to increase to at least 60% and 75%, respectively (Figure 11). The data also shows that the retention of the MSE students is also very good. In the last five years, the retention, progression, and graduation of the MSE students have improved.

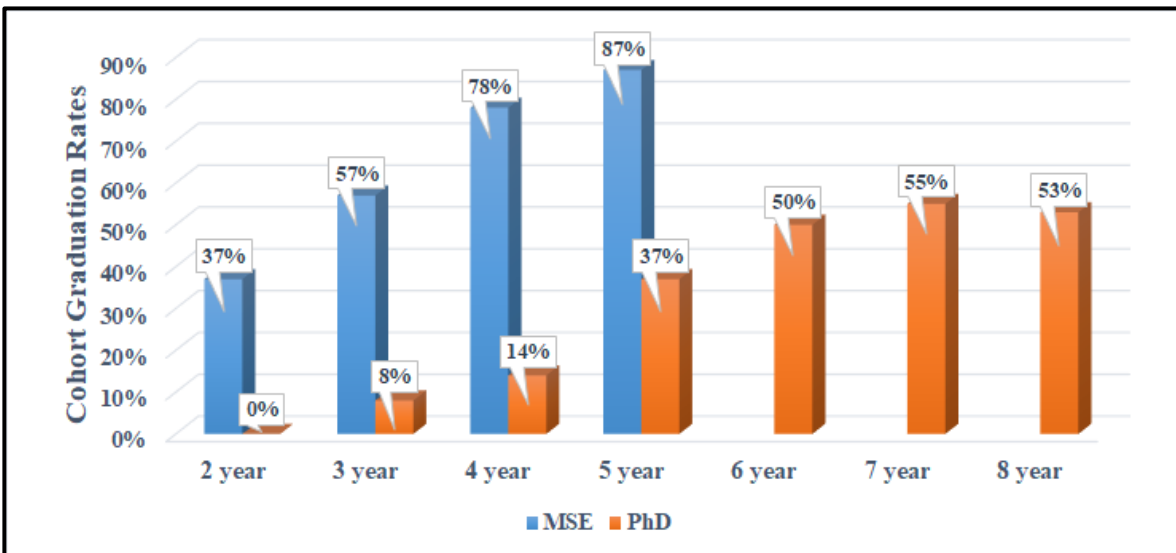
The PhD students' retention, progression, and graduation is not as good as the corresponding values for our MSE program. The 4-year and 6-year cohort PhD graduations are 14% and 50%, respectively (Figure 10). However, the CEEC faculty are now more focused on graduating PhD students in shorter time frames, because of the necessity to keep UNLV in the Carnegie R1 classification Tier 1 status, which we received in 2018.



**Table 24.** Number of PhD and MSE graduates conferred

Academic year	MSE degree count	PhD degree count
2009-10	14	9
2010-11	16	5
2011-12	15	2
2012-13	17	3
2013-14	19	9
2014-15	13	7
2015-16	12	5
2016-17	14	7
2017-18	11	5
2018-19	23	3
2019-20	12	9

Source: PeopleSoft Table PS\_LV\_CNR\_ENRL, Office of Decision Support



**Fig. 11.** Cohort graduation rates of PhD and MSE (Refer Table 24 and 25)

**54. Are there courses that represent barriers for progression and/or graduation, because students routinely have difficulty enrolling in, and/or completing those courses? If so, please explain why.**

There are no barriers for progression or graduation due to difficulty in enrolling in the courses. Last year, the department changed the prerequisites of all 86 graduate level courses to allow the graduate students to easily enroll in these courses. In addition, all of the graduate 700 level courses are offered after

5 pm, so that the graduate students working full-time in the industry can take these classes and minimize conflicts with their work schedules. The department is also offering an adequate number of 600 and 700 level courses every semester, so that the students have flexibility to take various types of Civil and Construction Engineering courses.

**55. If there are courses that represent barriers for progression and/or graduation, please describe financially-based and non-financially-based solutions to reduce “bottle-necks” in these courses.**

The CEEC Graduate Affairs Committee has already investigated related to “bottle-neck” courses in the graduate programs. None of the courses are found to be “bottle-necks” in the program. However, in some areas, such as, Geotechnical and Structural engineering, fewer 600 and 700 level courses are offered because the department has a lack of faculty members in those areas. Another constraint relates to the tradeoffs between undergraduate and graduate course offerings with a higher emphasis generally being place on the undergraduate program.

**56. Can any changes in sequencing of courses be made to facilitate student retention, progression, and graduation?**

The Department Chair, with the help of the Graduate Coordinator, is changing the sequencing of courses every semester to facilitate student retention, progression, and graduation. The department reviews the graduate courses every semester and decide on what existing courses to offer and what new courses to develop, so that the students can graduate on time.

**57. Please discuss whether the unit has any plans to provide any or more online courses within the next 2-3 years. If the unit does not have such plans, please explain why.**

The department has not offered any online Civil Engineering graduate courses. However, one Construction Management course (CEM 680: Sustainable Construction), which is also taken by most Civil Engineering students, is offered online. The department is considering providing more courses online; however, it will depend upon the demand for this type of course from the graduate students.

## **Curriculum**

**58. Is the program’s curriculum aligned with current developments in the discipline? If so, please explain how.**

Yes, the program’s curriculum is aligned with current developments in the discipline. To meet the new developments in the field, the department recently added three courses: CEE 710: Modular Construction; CEE 720: Information and Sensing Technology in Construction; and CEE 780: Advanced Reinforced Concrete Structure. Every year, the faculty members revise the existing course contents to meet the demands of the industry. The department has also updated our catalog recently, which had not been done in the last decade, and decided to keep internships as a part of the MSE and PhD programs. Therefore, two Internship courses, CEE 792 and CEE 793, were added in order to encourage the graduate students to enrich the educational experiences of our students and to better prepare them for professional opportunities and careers. The newly revised catalog can be found at this link:

PhD in Civil Engineering Catalog (<https://www.unlv.edu/degree/phd-civil-environmental-engineering>)

MSE in Civil and Environmental Engineering Catalog (<https://www.unlv.edu/degree/mse-civil-engineering>)

**59. If the program's curriculum is not aligned with current developments in the discipline, please explain what steps faculty are taking to modernize the curriculum.**

Not applicable

**Advising**

**60. How many full-time academic advisors are available at the College's Advising Center? Is this number sufficient?**

There are no academic advisors available at the College's Advising Center for graduate students. However, in our department, the Graduate Coordinator plays a role as an Academic Advisor when the students first admitted to the program. The students need to select their advisor within the first two semesters to seek advice and guidance to plan their study and meet degree requirements for timely graduation. The students are advised by the faculty based on their area of expertise. The department has faculty in five areas: 1) Construction; 2) Geotechnical; 3) Structural; 4) Transportation; and 5) Water Resources/ Environmental engineering. The rules of our academic advising can be found in "Graduate Student Handbook" at this link:

<https://www.unlv.edu/sites/default/files/degrees/handbooks/Handbook-MSE-CivilEnvironmentEngineeringConstruction.pdf>

**61. Describe any changes made to advising practices in the last five years based on the findings of assessment reports.**

Based on the assessment report, to increase the retention, progression, and graduation, the department faculty members have recently changed the following requirements, which are noted in the Graduate Student Handbook:

1. Graduate Students need to select their faculty advisor within the first two semesters.
2. The timeline provided in the Graduate Student Handbook needs to be followed, and any students who do not follow this guideline can be placed on probation by the Graduate Coordinator based on the discussions with the student's faculty advisory.
3. The major milestones for PhD students are the appointment of advisory committee, submission of Plan of Study, PhD Qualifying Exam, Proposal Defense, and Final Dissertation Defense. These milestones need to be completed within the timeframe provided in the Graduate Student Handbook.
4. The major milestones for MSE students includes their appointment of advisory committee, submission of Plan of Study, Thesis Prospectus, and defense of the final proposal, for MSE Thesis option students. For MSE Project Option students, the main milestones are appointment of faculty advisor, submission of Plan of Study, and submission of Final Culminating Experience Form. These milestones need to be completed on time, as mentioned in the Graduate Student Handbook.
5. A graduate student's Thesis or Dissertation Final Defense needs to be evaluated by their committee members, and the evaluation scores must be submitted to the Graduate Coordinator for assessment purposes.
6. Prior to graduation, the graduate students need to fill out the department's exit survey, to assist in assessing the program and student learning outcomes.

## Graduation Rates

### 62. Are the trends in 6-year cohort graduation close to the University's goal of 50% graduation rate?

Table 25 shows the cohort graduation rate of the PhD program. It shows that our department PhD 4-year and 5-year cohort average graduation rates are 14% and 37%, respectively. However, the faculty opined that the 5-year cohort graduation rate for PhD students should exceed 50%. Looking at individual year data, from 2010 to 2014, our 5-year cohort graduation exceeded more than 50% on three occasions; however, in 2011 and 2014, this rate dipped below 50%. Therefore, our department's goal is to get the 5-year PhD graduation rate to more than 50%. To achieve this goal, the faculty members are advising PhD students with more concrete effort, so as to assist students graduate in a timely manner.

**Table 25.** Cohort graduate rate of PhD students

Fall	Size	Yr 2 rate (%)	Yr 3 rate (%)	Yr 4 rate (%)	Yr 5 rate (%)	Yr 6 rate (%)	Yr 7 rate (%)	Yr 8 rate (%)
2010	2	0.0	0.0	0.0	50.0	50.0	50.0	50.0
2011	7	0.0	0.0	28.6	28.6	42.9	42.9	42.9
2012	12	0.0	16.7	41.7	66.7	66.7	66.7	66.7
2013	10	0.0	0.0	0.0	50.0	60.0	60.0	NA
2014	7	0.0	0.0	14.3	28.6	28.6	NA	NA
2015	2	0.0	0.0	0.0	0.0	NA	NA	NA
2016	5	0.0	20.0	N/A	NA	NA	NA	NA
2017	11	0.0	18.0	NA	NA	NA	NA	NA
2018	4	0.0	NA	NA	NA	NA	NA	NA
2019	3	NA	NA	NA	NA	NA	NA	NA
<b>Average</b>	<b>6</b>	<b>NA</b>	<b>8%</b>	<b>14%</b>	<b>37%</b>	<b>50%</b>	<b>55%</b>	<b>53%</b>

Source: PeopleSoft Table PS\_LV\_CNR\_DEGREES, Office of Decision Support, December 2019

The cohort graduation data of MSE students is shown in Table 26. It indicates that our MSE program's cohort graduation rate is higher than the corresponding number in our PhD program. The MSE students should be completing their degree in between 2 to 3 years. Comparing this number with the department's 2-year and 3-year cohort average graduation rates from 2010 to 2014, which are about 37% and 57%, respectively, the cohort graduation rate of MSE program is not satisfactory. While the department's MSE 3-year cohort graduation rate exceeds the University's goal of 50% for 6-year graduation, the faculty thinks that the MSE 2-year cohort graduation rate must exceed 50%. Looking at the individual year data, from 2010 to 2019, only in 2013, did the 2-year cohort graduation exceed 50%. Therefore, the department is now focused on improving this 2-year cohort graduation rate to more than 50% every cohort year. To accomplish this goal, the faculty members are instructed to advise students in a timely manner, and the department is also seeking extra funds to provide more financial help to graduate students.

**Table 26.** Cohort graduate rate of MSE students

Fall	Size	Yr 2 rate (%)	Yr 3 rate (%)	Yr 4 rate (%)	Yr 5 rate (%)
2010	13	23.1	61.5	69.2	69.2
2011	8	37.5	75.0	87.5	100.0
2012	18	38.9	55.6	66.7	72.2
2013	5	60.0	80.0	80.0	80.0
2014	11	36.4	54.5	81.8	90.9
2015	9	44.4	66.7	88.9	88.9
2016	8	25.0	75.0	75.0	NA
2017	13	46.2	61.5	NA	NA
2018	5	20.0	NA	NA	NA
2019	16	NA	NA	NA	NA
<b>Average</b>	<b>11</b>	<b>37%</b>	<b>57%</b>	<b>78%</b>	<b>84%</b>

Source: PeopleSoft Table PS\_LV\_CNR\_DEGREES, Office of Decision Support, December 2019

### 63. If not, what is being done to reach the 50% graduation goal?

Please see the response to #62.

## X. Quality

### Admission and Graduation Requirements

#### 64. List program admission requirements as they appear in the current UNLV academic catalog.

##### Admission Requirements

##### *PhD – Civil and Environmental Engineering*

There are two tracks in the PhD in Civil Engineering. One is a Post-Master's track and the other is a Post-Bachelor's track. The admission requirements for these two tracks are as follows:

- a. The applicant must submit a Statement of Purpose (SOP) of no more than two pages, indicating their interests in the area of specialization (construction, geotechnical, structural, transportation, and water resources/environmental) and objectives in working toward a Ph.D. degree. In addition, three letters of recommendation (LOR) must be submitted from individuals familiar with the applicant's knowledge, skills, and abilities. It is highly recommended that the LORs be written on official letterhead.
- b. International applicants must meet the English Proficiency requirements established in the UNLV Graduate Catalog.
- c. All applicants are required to take the GRE General Test and submit their scores to the University of Nevada, Las Vegas (code 4861). Successful applicants generally have a combined verbal and quantitative GRE score of at least 300, and an analytical writing score of at least 3.

##### Post-Master's Track

- a. The applicant to this track must have a Master of Science in Engineering degree or equivalent, with a major in Civil Engineering or a closely allied field. Students with non-engineering backgrounds will be required to complete a set of coursework requirements that will ensure successful completion of the PhD specialization. The CEEC Graduate Program Committee (GPC) and Graduate Coordinator make all final decisions after review of each applicant's records and admissions information.
- b. A minimum post-baccalaureate GPA of 3.20 on a 4.00 scale (4.00=A) or equivalent is required for admission.
- c. The CEEC GPC and Graduate Coordinator make all final decisions after review of each applicant's records and admissions information.

##### Post-Bachelor's Track

- a. The applicant to this track must have earned a Bachelor of Science in Engineering degree or equivalent with a major in Civil Engineering or a closely allied field. The CEEC GPC and Graduate Coordinator make all final decisions after the review of each applicant's records and admissions information.
- b. A minimum baccalaureate overall GPA of 3.20 on a 4.00 scale (4.00=A), and GPA of 3.5 for the last 60 credit hours are required for admission. The CEEC GPC and Graduate Coordinator make all final decisions after review of each applicant's records and admissions information.

##### *MSE – Civil and Environmental Engineering*

There are three tracks in the MSE in Civil and Environmental Engineering. One is Thesis, another is Project, and the third is the BS-MSE Thesis track. The admission requirements for these three tracks are as follows:

Admission to the program leading to the MSE degree in the Thesis and Project Tracks are open to those students completing the following requirements:

- a. Applications must include all documentation as required by the Graduate College. Applications should be submitted through the Grad Rebel Gateway system.
- b. The applicant must have a bachelor's degree in engineering or a closely-related discipline, with an overall GPA of 2.75 (4.00=A) and a GPA of 3.0 (4.00=A) for the last 60 credit hours (semester basis) of their undergraduate program. Applicants desiring to specialize in Environmental Engineering, who have baccalaureate degrees in the natural sciences may require at least an additional semester of full-time study to complete engineering prerequisite undergraduate course work; this may include Fluid Mechanics, Calculus Through Differential Equations, Engineering Physics, Chemistry, and Engineering Economics. Successful Environmental Engineering applicants are expected to complete a set of graduate courses in Engineering Hydrology, Hydraulics, Statistics, Water and Wastewater Treatment, and Wastewater Treatment Plant Design during their graduate study. The CEEC Graduate Program Committee (GPC) and Graduate Coordinator make all final decisions after review of each applicant's records and admissions information.
- c. The applicant must submit a Statement of Purpose (SOP) of no more than two pages, indicating their interests in the area of specialization (Construction, Geotechnical, Structural, Transportation, and Water Resources/Environmental), and objectives in working towards an MSE degree. In addition, two letters of recommendation (LOR) must be submitted from individuals familiar with the applicant's knowledge, skills, and abilities. It is highly recommended that LORs be written on official letterhead.
- d. International applicants must meet the English proficiency requirements established in the UNLV Graduate Catalog.
- e. All applicants are required to take the GRE General Test and submit the scores to the University of Nevada, Las Vegas (code 4861). Successful applicants generally have a combined verbal and quantitative GRE score of at least 300, and an analytical writing score of at least 3.
- f. All domestic and international applicants must review and follow the Graduate College Admission and Registration Requirements.

*Additional Requirements for the Integrated BS-MSE Thesis Track*

This program is designed to provide high-achieving CEEC undergraduate students with the opportunity to be exposed to graduate courses, and encourage them to continue with a graduate degree by reducing the time needed for degree completion. Up to six credit hours of approved graduate-level coursework with grades of B or better can be taken as technical electives during the senior year. Those credit hours will also be counted towards the graduate degree coursework. The following additional requirements must be satisfied:

- a. A minimum of two semesters of full-time enrollment in a BS of Civil and Environmental Engineering program at UNLV is required.
- b. A minimum of 90 credit hours of course work applicable to the BS of Civil and Environmental Engineering degree must be completed before beginning the joint degree program.
- c. An overall cumulative GPA of 3.20 or higher, and a cumulative GPA in math/science/engineering of 3.50 or higher are needed to begin the Integrated BS-MSE Thesis Track degree program.

Once a student has been admitted into the Integrated BS-MSE Thesis Track program, they must then submit an application for an MSE program in Civil Engineering. The student has to follow the normal application procedures found on the UNLV Graduate College website. Additionally:

- a. The student must meet all departmental and Graduate College application deadlines.
- b. The student should indicate in their application materials that they are participating in the Integrated BS-MSE Thesis Track program.
- c. The student should request a letter of nomination from a CEEC faculty member, and submit this letter along with a short resume (no more than 2 pages). The materials will be evaluated by three faculty members in the student's technical area of interest, or nearby areas.
- d. The student must choose the Integrated BS-M.S.E. Thesis Track.

## **Graduations Requirements**

### ***PhD – Civil and Environmental Engineering***

- a. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
- b. The student must submit and successfully defend his/her dissertation by the posted deadline. The defense must be advertised and is open to the public.
- c. After the thesis defense, the student must electronically submit a properly formatted pdf copy of their thesis to the Graduate College for format check. Once the thesis format has been approved by the Graduate College, the student will submit the approved electronic version to ProQuest. Deadlines for thesis defenses, format check submissions, and the final ProQuest submission can be found [here](#).

### ***MSE – Civil and Environmental Engineering***

#### **Thesis and BS-MSE Thesis Track**

- a. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
- b. The student must submit and successfully defend his/her dissertation by the posted deadline. The defense must be advertised and is open to the public.
- c. After the dissertation defense, the student must electronically submit a properly formatted pdf copy of their thesis to the Graduate College for format check. Once the dissertation format has been approved by the Graduate College, the student will submit the approved electronic version to ProQuest. Deadlines for dissertation defenses, format check submissions, and the final ProQuest submission can be found [here](#).

#### **Project Track**

- a. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
- b. The student must successfully complete a project and submit a project report.

## **65. List any updates that need to be made to the undergraduate or graduate academic catalogs. Have these changes been initiated in Curriculog?**

The Graduate Coordinator, with the help of faculty, has made changes to all graduate level academic catalogs over the last two years. These catalogs had not been revised for the last 10 years. Also, all courses offered with prefixes of CEE and CEM have been revisited by the faculty, and all new courses to be added have already been approved and added. Last semester, the faculty made changes to the



prerequisites of all CEE and CEM graduate courses, so that students will have flexibility to enroll in graduate level courses. No changes are necessary in the catalog or courses for a couple of years.

## **Outcomes and Assessment**

**66. Student Learning Outcomes and Program Assessment Plans and Reports by program concentration are listed at <http://provost.unlv.edu/Assessment/plans.html>. Attach the most recent assessment report in the Appendix.**

The Graduate Affairs Committee prepared the Student Learning Outcomes and Program Assessment Plans in 2019 of PhD and MSE degrees for the period 2019 - 2021. The Assessment Plans of these degrees are provided in Appendix A, and can be found in the link below, as well:

<https://sites.google.com/unlv.edu/assessment-reports-plans/plans>

The Graduate Coordinator has collected and analyzed assessment data and submitted the Program Assessment Reports of 2019 for PhD and MSE degrees according to the plan, which are provided in Appendix B, and can be found using this link:

<https://sites.google.com/unlv.edu/assessment-reports-plans/reports/engineering-reports>

**67. As a result of information gathered in your assessment reports, has the program revised its curriculum (e.g., changing prerequisites, adding or eliminating required or elective courses, or co-curricular experiences for the degree(s)) in the last five years? If so, what changes were made, and why?**

Significant changes have been made in the PhD and MSE catalogs over the last three years. In addition, there is a change in process of conducting assessments of the PhD and MSE programs. More data are being collected to assess the program and student learning outcomes. The Assessment Plan and Report attached in Appendices A & B show the depth and breadth of data collection and analysis for assessment. The major changes completed recently are:

- a. The Post-Bachelor PhD track has been added because it will help the department to recruit excellent undergraduate students directly into the PhD program.
- b. PhD and MSE programs have been divided into five areas of expertise: Construction; Geotechnical; Structural; and Transportation; and Water Resources/ Environmental. This assists to guide our graduate students into their areas of expertise from the very beginning.
- c. The course credit requirement was reduced to 24 credit hours from 27 credit hours for the PhD degree. This helps our PhD students to focus more on cutting edge research, rather than in just course work.
- d. The research methodology course (CEE 700) was made mandatory for all PhD students to ensure that all PhD students learn to conduct research for their dissertations.
- e. Graduate students are also required to take at least three courses in their area of expertise to get a degree in that area.
- f. The Non-Thesis Track MSE has been removed and was replaced by the Project Track. This maintains the quality of graduate education, and offers consistency over both the Project Track and Thesis Track MSE degrees.
- g. The thesis credit hour requirements for MSE Thesis Track students has been increased to 9 credit hours from 6 credit hours, so that students can spend more efforts on research to publish papers in top tier journal.
- h. PhD and MSE students are required to publish peer-reviewed conference proceeding papers or journal papers from their dissertation, thesis, or project work.

- i. The timelines for major milestones have been fixed to assist PhD and MSE students graduate on time, so that cohort graduation rates can be improved.
- j. Internship courses have been added to encourage graduate students to get industry experience before graduation. This will help the graduate students to gain valuable and required professional skills before they can enter the skilled workforce.

**68. Describe how the program has revised course content or pedagogical approaches based on findings in your assessment reports in the last five years?**

CEEC faculty members revised courses based on changing technology and development in the related areas. Based on the assessment data, the faculty have also reviewed the course requirements for the PhD and MSE degrees, and have been making changes as required. CEEC department, over the last two years, has made major changes in graduate program catalogs based on the findings of our assessment reports. The major changes have been highlighted in the response of preceding question.

**69. Describe how you have used the findings in one assessment report to improve student learning.**

CEEC faculty members review the assessment report every year and use the assessment data to improve the student learning outcomes. For example, the department added a student learning outcome, “an ability to acquire extensive engineering and construction knowledge in the area of their expertise” in 2019. The department made mandatory for PhD and MSE students to take at least three graduate level courses in their area of expertise to assess this student learning outcome.

The department also added the student learning outcome, “an ability to collect and analyze research data interpret and synthesize the findings through peer reviewed conference proceedings and journal papers.” The department required all PhD and MSE students to publish papers in a journal or conference proceedings from their dissertation, thesis, or project work to assess this student learning outcome.

## **XI. Conclusions, Self-Assessment**

### **Faculty Review of Self-Study**

#### **70. On what date did the program and/or department faculty review this self-study?**

The self-study was first reviewed by the Graduate Affairs Committee (GAC) members and then sent to all the CEEC faculty for review. The faculty was given a two-week time frame, from September 16 to 30, to review and send comments to the Graduate Coordinator.

#### **71. What are the top three priorities and/or needs for the future development of the program?**

The top three priorities for the future development of the program are to:

- a. Increase the enrollment of PhD and MSE students by 10% every year for the coming five years.
- b. Increase the 5-year cohort PhD graduation rate to 50% and 2-year cohort MSE graduation rate to 60%.
- c. Increase the journal publications of CEEC faculty with graduate students from 0.5 to 0.75 per year. (The ratio is taken as # of publications by graduate students/ # of graduate students).

#### **72. What are the strengths of the program?**

The top three strengths of our PhD and MSE programs are:

- a. Our graduates' placement rate is very high.
- b. Our graduates are successful in the academia and in the professional practices.
- c. CEEC department has a high standard of admission for graduate students; therefore, our admitted students are high caliber to conduct cutting edge and seamless research.

#### **73. What are the challenges facing the program?**

The top three challenges of our PhD and MSE programs are:

- a. Difficulty in recruiting quality MSE and PhD students from small applicant pool
- b. Marginal retention, progression, and graduation rates of our PhD students.
- c. Lack of financial scholarships for our graduate students to retain them in our program.

#### **74. Provide any additional comments about the program.**

CEEC graduate programs are progressing as one of the best graduate programs in our College of Engineering. Therefore, our Civil Engineering graduate program has been consistently ranked on the top 100 graduate programs in the country by US News and World Report. Recently, this report ranked our graduate program in 93<sup>rd</sup> position. In addition, 2019 Shanghai Academic Ranking of World Universities ranked our civil engineering program in the top 151-200 in the world. Our CEEC faculty members are also one of the productive faculty in the College of Engineering in terms of securing grant research and in publishing peer reviewed papers. In summary, our graduate program is performing well; however, to improve our ranking on the national stage, significant improvement is needed in the areas of: research; publications; PhD student recruitment, retention and graduation; and creating relationships with the industry and higher education institutions to make our program nationally visible and renowned.

## APPENDIX A: Assessment Plan

### PhD (2019-2021)

## 3-Year Academic Assessment Plan Cover Sheet

**(2019-2021)**

**Email to: [assessment@unlv.edu](mailto:assessment@unlv.edu)**

#### Program Information:

Program Assessed	PhD in Civil & Environmental Engineering
Department	Civil & Environmental Engineering & Construction
College	Howard R. Hughes College of Engineering
Department Chair	Dr. Sajjad Ahmad
Assessment Coordinator	Dr. Pramen P. Shrestha
Date Submitted	March 20, 2019
<b>Contact Person for This Plan</b>	
Name	Dr. Pramen P. Shrestha
Phone	702-895-3841
Email	Pramen.shrestha@unlv.edu

*Please address the following items:*

- *What are the student learning outcomes? Please provide a numbered list.*
  1. An ability to develop, evaluate, and assess new techniques, skills, and tools to solve complex engineering and construction related problems.
  2. An ability to acquire extensive engineering and construction knowledge in the area of their expertise (construction, geotechnical, structural, transportation, and water resources/environmental).
  3. An ability to critically read and analyze literature, develop research hypothesis, and create methodology to solve research problems related to the area of their expertise.
  4. An ability to collect and analyze research data interpret and synthesize the findings through peer reviewed conference proceedings and journal papers.
  5. Effectively communicate technical and research information.

- Curriculum map showing which courses will address which learning outcomes.

<b>PhD Requirements</b>	<b>SLO #1</b>	<b>SLO #2</b>	<b>SLO #3</b>	<b>SLO #4</b>	<b>SLO #5</b>
CEE and CEM 700 level Courses (Except CEE 700)	X	X			
CEE 700			X		
PhD Qualifying Exam		X			
Dissertation Final Defense				X	X
Journal & Conference Publications				X	X
Conference & Other Presentations					X

- Which learning outcomes will be assessed in each cycle year (i.e., assessment timeline)?

<b>Student Learning Outcomes</b>	<b>Assessment Frequency</b>
SLO # 1	Every Semester
SLO # 2	Every Semester
SLO # 3	Annually
SLO # 4	Every Semester/ Annually
SLO # 5	Every Semester/ Annually

- How will the learning outcomes be assessed? (Programs must use at least one direct assessment of student learning.)

SLO	Assessment Tools	Data Collection Frequency	Targeted Value (Annually)
1	Average grade of PhD students enrolled in CEE and CEM 700 level courses (except CEE 700)*	Semesterly	Average grade should be equal to or higher than 3.30/ 4.0
	Average cumulative GPA of graduating PhD students*	Semesterly	Average cumulative GPA should be equal to or higher than 3.30/ 4.0
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 or higher on the scale of 1 to 5 (5 being strongly agree and 1 being strongly disagree)
2	Average grade of PhD students enrolled in CEE and CEM 700 level courses (except CEE 700)*	Semesterly	Average grade should be equal to or higher than 3.30/ 4.0
	PhD Qualifying Exam Results*	Semesterly	80% Pass rate
	Average cumulative GPA of graduating PhD students*	Semesterly	Average cumulative GPA should be equal to or higher than 3.30/ 4.0
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 or higher
3	Average grade of PhD students enrolled in CEE 700 course*	Semesterly	Average grade should be equal to or higher than 3.30/ 4.0
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 or higher
4	Average evaluation score of Dissertation Final Defense*	Semesterly	Average score should be equal to or greater than 3.5 on the scale of 5.0
	No. of peer reviewed journal papers published by PhD students*	Annually	Ratio of total published papers by PhD students/Total PhD students = 0.25 or greater
5	Average evaluation score of Dissertation Final Defense*	Semesterly	Average score should be equal to or greater than 3.5 on the scale of 5.0
	No. of peer reviewed journal papers published by PhD students*	Annually	Ratio of total published papers by PhD students/Total PhD students = 0.25 or greater
	No. of conference or other presentations*	Annually	Ratio of total presentations by PhD students/ Total PhD students = 0.25 or greater
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 or higher

\* Direct Assessment

During the graduate student exit survey, the graduating students will be asked about their satisfaction towards graduate curriculum, quality of graduate courses, technical knowledge of graduate advisors and committee members, and support received from the chair, graduate coordinator, and administrative staffs during their study.

- *What is your plan for sharing the assessment results and acting on them (i.e., closing the loop)?*

The department will assess these SLOs using direct and indirect assessment tools either semesterly or annually. The assessment report will be submitted to UNLV Office of Academic Assessment every year. The Graduate Affair Committee will review the assessment results and take necessary actions, if some SLOs were not achieved. The assessment report will be disseminated to department faculty. The Graduate Coordinator will report to chair and faculty to improve the performance of the SLOs that fail to achieve desired results. Based on the lessons learned from assessment report, the PhD catalog will be revised to meet the required targets. Some of the strategies to meet the targets will be to emphasize more on the research and publish more journal and conference papers. Some of the solutions to be used if the target is not met for each of the assessment tool is provided below.

<b>Assessment</b>	<b>Target</b>	<b>Solutions</b>
Average grade in CEE and CEM 700 level courses	Grade above 3.30	Required students to take 600 level courses before taking 700 level courses
Average cumulative GPA	Cumulative GPA above 3.30	Required students to take fewer classes in every semester to increase their cumulative GPA
Graduate Student Exit Survey	Average rating 3.5 or higher	Improve the shortcomings in the program based on the students' feedback.
PhD Qualifying Exam Results	80% Pass rate	Required students to take the courses related to the committee members' expertise before taking PhD qualifying exam.
Average grade in CEE 700	Grade above 3.30	Required to conduct research before taking this course
Average Evaluation Score of Dissertation Final Defense	Average rating 3.5 or higher	Hold a workshop once a semester and inform 3 <sup>rd</sup> /4 <sup>th</sup> year PhD students on what to expect and how to prepare for the dissertation defense. Require all 3 <sup>rd</sup> or 4 <sup>th</sup> year PhD students to attend another CEEC student's dissertation defense.
No. of peer reviewed journal papers	Ratio is 0.25 or higher	Require all 3 <sup>rd</sup> or 4 <sup>th</sup> year PhD students to attend a writing workshop
No. of conference or other presentations	Ratio is 0.25 or higher	Require all 3 <sup>rd</sup> or 4 <sup>th</sup> year PhD students to participate in Rebel Grad Slam, GPSA Symposium, or College of Engineering poster competition.

# Assessment Plan for MSE (2019-2021)

## 3-Year Academic Assessment Plan Cover Sheet

(2019-2021)

Email to: [assessment@unlv.edu](mailto:assessment@unlv.edu)

### Program Information:

Program Assessed	M.S.E. - Civil & Environmental Engineering
Department	Civil & Environmental Engineering & Construction
College	Howard R. Hughes College of Engineering
Department Chair	Dr. Sajjad Ahmad
Assessment Coordinator	Dr. Pramen P. Shrestha
Date Submitted	March 20, 2019
<b>Contact Person for This Plan</b>	
Name	Dr. Pramen P. Shrestha
Phone	702-895-3841
Email	Pramen.shrestha@unlv.edu

Master of Science in Engineering (MSE) in Civil & Environmental Engineering has two tracks; Thesis track and Project Track. Students Learning Outcomes for these tracks are developed separately because Thesis track is research intensive degree whereas project track is project-based degree. Therefore, this assessment plan is divided into two parts.

### A. MSE Thesis Track Degree Assessment Plan

- *What are the student learning outcomes? Please provide a numbered list.*
  6. An ability to develop, evaluate, and assess new techniques, skills, and tools to solve complex engineering and construction related problems.
  7. An ability to acquire engineering and construction knowledge in the area of their expertise (construction, geotechnical, structural, transportation, and water resources/environmental).
  8. An ability to critically read and analyze literature, develop research hypothesis, and create methodology to solve research problems related to the area of their expertise.
  9. An ability to collect and analyze research data interpret and synthesize the findings through peer reviewed conference proceedings and journal papers.
  10. Effectively communicate technical and research information.



- Curriculum map showing which thesis components will address which learning outcomes.

<b>MSE Thesis Track Requirements</b>	<b>SLO #1</b>	<b>SLO #2</b>	<b>SLO #3</b>	<b>SLO #4</b>	<b>SLO #5</b>
CEE and CEM 700 level Courses (Except CEE 700)	X	X			
CEE 700			X		
Thesis Final Defense				X	X
Journal & Conference Publications				X	X
Conference & Other Presentations					X

- Which learning outcomes will be assessed in each cycle year (i.e., assessment timeline)?

<b><u>Student Learning Outcomes</u></b>	<b><u>Assessment Frequency</u></b>
SLO # 1	Every Semester
SLO # 2	Every Semester
SLO # 3	Annually
SLO # 4	Every Semester/ Annually
SLO # 5	Every Semester / Annually

- How will the learning outcomes be assessed? (Programs must use at least one direct assessment of student learning.)

SLO	Assessment Tools	Data Collection Frequency	Targeted Value (Annually)
1	Average grade of master students enrolled in CEE and CEM 700 level courses (except CEE 700)*	Semesterly	Average grade should be equal to or higher than 3.30/ 4.0
	Average cumulative GPA of graduating MSE Thesis track students*	Semesterly	Average cumulative GPA should be equal to or higher than 3.30/ 4.0
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 or higher on the scale of 1 to 5 (5 being strongly agree and 1 being strongly disagree)
2	Average grade of master students enrolled in CEE and CEM 700 level courses (except CEE 700)*	Semesterly	Average grade should be equal to or higher than 3.30/ 4.0
	Average cumulative GPA of graduating MSE Thesis track students*	Semesterly	Average cumulative GPA should be equal to or higher than 3.30/ 4.0
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 or higher
3	Average grade of Master Thesis students enrolled in CEE 700 course*	Semesterly	Average grade should be equal to or higher than 3.30/ 4.0
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 or higher
4	Average evaluation score of Thesis Final Defense*	Semesterly	Average score should be equal to or greater than 3.5 on the scale of 5.0
	No. of peer reviewed conference proceedings or journal papers published by MSE students*	Annually	Ratio of total published papers/Total MSE thesis track students = 0.25.
5	Average evaluation score of Thesis Final Defense*	Semesterly	Average score should be equal to or greater than 3.5 on the scale of 5.0
	No. of conference and other presentations*	Annually	Ratio of total presentations by MSE students/ Total MSE students = 0.15
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 or higher

\* Direct Assessment

During the graduate student exit survey, the graduating students will be asked about their satisfaction towards graduate curriculum, quality of graduate courses, technical knowledge of graduate advisors and committee members, and support received from the chair, graduate coordinator, and administrative staffs during their study.

**B. MSE Project Track Degree Assessment Plan**

- *What are the student learning outcomes? Please provide a numbered list.*
  1. An ability to develop, evaluate, and assess new techniques, skills, and tools to solve complex engineering and construction related problems.
  2. An ability to acquire engineering and construction knowledge in the area of their expertise (construction, geotechnical, structural, transportation, and water resources/environmental).
  3. Effectively communicate technical information.
- *Curriculum map showing which degree components will address which learning outcomes.*

<b>MSE Project Track Requirements</b>	<b>SLO #1</b>	<b>SLO #2</b>	<b>SLO #3</b>
CEE and CEM 700 level courses	X	X	
Journal & Conference Publications			X
Conference & Other Presentations			X

- *Which learning outcomes will be assessed in each cycle year (i.e., assessment timeline)?*

<b><u>Student Learning Outcomes</u></b>	<b><u>Assessment Frequency</u></b>
SLO # 1	Every Semester
SLO # 2	Every Semester
SLO # 3	Every Semester / Annually

- *How will the learning outcomes be assessed? (Programs must use at least one direct assessment of student learning.)*

<b>SLO</b>	<b>Assessment Tools</b>	<b>Frequency</b>	<b>Targeted Value</b>
<b>1</b>	Average grade of master students enrolled in CEE and CEM 700 level courses*	Semesterly	Average grade should be equal to or higher than 3.30/ 4.0
	Average cumulative GPA of graduating MSE project track students*	Semesterly	Average cumulative GPA should be equal to or higher than 3.30/ 4.0
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 on the scale of 1 to 5 (5 being strongly agree and 1 being strongly disagree)
<b>2</b>	Average grade of MSE students enrolled in CEE and CEM 700 level courses*	Semesterly	Average grade should be equal to or higher than 3.30/ 4.0
	Average cumulative GPA of graduating MSE project track students*	Semesterly	Average cumulative GPA should be equal to or higher than 3.30/ 4.0
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 or higher.
<b>3</b>	No. of peer reviewed conference proceeding or journal papers published by MSE project track students*	Annually	Ratio of total published papers by MSE project track students/ Total MSE project track students = 0.10
	No. of conference or other presentations *	Annually	Ratio of no. of presentations by MSE students/ Total MSE students = 0.15
	Graduate Student Exit Survey	Semesterly	Average rating should be 3.5 or higher

\* Direct Assessment

During the graduate student exit survey, the graduating students will be asked about their satisfaction towards graduate curriculum, quality of graduate courses, technical knowledge of graduate advisors and support received from the chair, graduate coordinator, and administrative staffs during their study.

- *What is your plan for sharing the assessment results and acting on them (i.e., closing the loop)?*

The department will assess these student learning outcomes using direct and indirect assessment tools either semesterly or annually. The assessment report will be submitted to UNLV Office of Academic Assessment every year. The Graduate Affair Committee will review the assessment results and take necessary actions, if some SLOs were not achieved. The assessment report will be disseminated to department faculty. The Graduate Coordinator will report to chair and faculty to improve the performance of the SLOs that fail to achieve desired results. Based on the lessons learned from

assessment report, the MSE catalog will be revised to meet the required assessment targets. Some of the strategies to be used are increased focus on research publications and presentations for thesis track. For project track, the emphasis will be to provide practical knowledge and inviting professionals in the class to improve the communication skills of graduate students. Students of both tracks will be required to get published their work in journal or conference proceedings before graduating. Some of the solutions to be used if the target is not met for each of the assessment tool is provided below.

<b>Assessment</b>	<b>Target</b>	<b>Solutions</b>
Average grade in CEE and CEM 700 level courses	Grade above 3.30	Required students to take 600 level courses before taking 700 level courses
Average cumulative GPA	Cumulative GPA above 3.30	Required students to take fewer classes in every semester to increase their cumulative GPA
Graduate Student Exit Survey	Average rating 3.5 or higher	Improve the shortcomings in the program based on the students' feedback.
Average grade in CEE 700	Grade above 3.30	Required to conduct research before taking this course
Average evaluation score of Thesis Final Defense	Average rating 3.5 or higher	Hold a workshop once a semester and inform 3 <sup>rd</sup> semester master students on what to expect and how to prepare for the thesis defense. Require all final semester MSE thesis track students to attend another CEEC student's thesis defense.
No. of peer reviewed journal or conference proceeding papers	Ratio is 0.25/0.10 or higher	Require all MSE students to attend a writing workshop
No. of conference or other presentations	Ratio is 0.15 or higher	Require all MSE students to participate in Rebel Grad Slam, GPSA Symposium, or College of Engineering poster competition.

## APPENDIX B: Assessment Report

### PhD - 2019

#### Annual Academic Assessment Report Cover Sheet

Assessment reports are due the 1<sup>st</sup> Wednesday after the Fall Term

Email to: [assessment@unlv.edu](mailto:assessment@unlv.edu)

**Program Information:**

Program Assessed	Ph.D. in Civil & Environmental Engineering
Department	Civil & Environmental Engineering & Construction
College	Howard R. Hughes College of Engineering
Department Chair	Dr. Sajjad Ahmad
Assessment Coordinator	Dr. Pramen P. Shrestha, Graduate Coordinator
Date Submitted	December 23, 2019
Contact Person for This Report	
Name	Dr. Pramen P. Shrestha
Phone	702-895-3841
Email	Pramen.shrestha@unlv.edu

Please attach a narrative (not to exceed 4 pages, excluding appendices) addressing the following:

- **What are the student learning outcomes? Please provide a numbered list.**
  1. *An ability to develop, evaluate, and assess new techniques, skills, and tools to solve complex engineering and construction related problems.*
  2. *An ability to acquire extensive engineering and construction knowledge in the area of their expertise (construction, geotechnical, structural, transportation, and water resources/environmental).*
  3. *An ability to critically read and analyze literature, develop research hypothesis, and create methodology to solve research problems related to the area of their expertise.*
  4. *An ability to collect and analyze research data interpret and synthesize the findings through peer reviewed conference proceedings and journal papers.*
  5. *Effectively communicate technical and research information.*

- **Which learning outcomes were assessed?**

*All the five outcomes were assessed.*

- **How were they assessed? (Programs must use at least one direct assessment of student learning.)**

*Student outcome SLO #1 was measured using two direct assessments and one indirect assessment.*

- *Average GPA of PhD students enrolled in CEE and CEM 700 level courses (except CEE 700)*
- *Average cumulative GPA of graduating PhD students*
- *Rating of Graduate Student Exit Survey (PhD students)*

*Student outcome SLO #2 was measured using two direct assessments and one indirect assessment*

- *Average GPA of PhD students enrolled in CEE and CEM 700 level courses (except CEE 700)*
- *PhD Qualifying Exam Passing Rate*
- *Rating of Graduate Student Exit Survey (PhD students)*

*Student outcome SLO #3 was measured using one direct assessment and one indirect assessment.*

- *Average GPA of PhD students enrolled in CEE 700 course*
- *Rating of Graduate Student Exit Survey (PhD students)*

*Student outcome SLO #4 was measured using two direct assessments and one indirect assessment.*

- *Average evaluation score of Dissertation Final Defense*
- *No. of peer-reviewed journal papers published by PhD students*
- *Rating of Graduate Student Exit Survey (PhD students)*

*Student outcome SLO #5 was measured using three direct assessments and one indirect assessment*

- *Average evaluation score of Dissertation Final Defense*
- *No. of peer-reviewed journal papers published by PhD students*
- *No. of conference or other presentations by PhD students*
- *Rating of Graduate Student Exit Survey (PhD students)*

- **What was learned from the assessment results?**

*The direct and indirect assessments results showed that all five student learning outcomes exceeded the expectations (Refer Table 1 through 6). The assessment results showed that the PhD program is performing as expected.*

*Table 7 shows the analysis of some extra data collected during Graduate Exit Survey to show that the PhD program is performing as expected. All the questions asked to the PhD graduating students about the curriculum, quality of program, and academic and non-academic support had the average rating greater than expected (expected rating was equal to or more than 3.5 on the scale of 5.0)*

- **How did the program respond to what was learned?**

*No response is required. In Spring 2020, our department is inviting external reviewers to review our PhD program. Based on the reviewers' comments, the program will be improved, if required.*

**Table 1. Results of Data Collected to Measure Student Learning Outcome # 1.**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Average GPA of PhD students enrolled in CEE and CEM 700 level courses (except CEE 700)	32	3.81	Spring & Fall 2019	3.30	Greater than expected value
Average cumulative GPA of PhD graduates	7	3.87	Spring & Fall 2019	3.30	Greater than expected value
Graduate Exit Survey – PhD students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagree and 5 being strongly agreed)- Refer Table 6	7	4.7	Spring & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations.*



**Table 2. Results of Data Collected to Measure Student Learning Outcome # 2.**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Average GPA of PhD students enrolled in CEE and CEM 700 level courses (except CEE 700)	32	3.81	Spring & Fall 2019	3.30	Greater than expected value
PhD Qualifying Exam results (% Passing)	11 (2 students result not received)	81%	Spring & Fall 2019	80%	Greater than expected value
Graduate Exit Survey – PhD students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagree and 5 being strongly agreed) – Refer Table 6	7	4.6	Spring & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations.*

**Table 3. Results of Data Collected to Measure Student Learning Outcome # 3.**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Average GPA of PhD student enrolled in CEM 700 course	8	4.0	Fall 2019	3.30	
Graduate Exit Survey – PhD students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagreed and 5 being strongly agreed) – Refer Table 6	7	4.7	Spring & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations.*

**Table 4. Results of Data Collected to Measure Student Learning Outcome # 4.**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Dissertation committee members average evaluation score on the scale of 1 to 5: 1 being poor and 5 being excellent)	7	4.24	Spring & Fall 2019	3.5	Greater than expected value
# of journal papers published by PhD students/ Total PhD students	38*	0.90	2019	0.25	Greater than expected value
Graduate Exit Survey – PhD students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagreed and 5 being strongly agreed) – Refer Table 6	7	4.7	Spring & Fall 2019	3.5	Greater than expected value

\* 38 peer reviewed journal papers were published by the faculty with PhD students in 2019 (Total PhD Students= 42)

Note: All the outcomes exceeded the expectations.

**Table 5. Results of Data Collected to Measure Student Learning Outcome # 5**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Dissertation committee members average evaluation score on the scale of 1 to 5: 1 being poor and 5 being excellent)	7	4.24	Spring & Fall 2019	3.5	
# of journal papers published by PhD students/ Total PhD students	38*	0.90	2019	0.25	Greater than expected value
# of conference or other presentations by PhD students/Total PhD students	35**	0.83	2019	0.25	
Graduate Exit Survey – PhD students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagree and 5 being strongly agreed) – Refer Table 6	7	4.4	Spring & Fall 2019	3.5	Greater than expected value

\* 38 peer reviewed journal papers were published by the faculty with PhD students in 2019 (Total PhD Students= 42)

\*\* 35 conference and other presentations were made by the PhD students in 2019 (Total PhD Students = 42)

Note: All the outcomes exceeded the expectations.

**Table 6. Results of Rating of PhD Student’s Satisfaction with SLO #1, #2, #3, #4, and #5  
(1 represents “Strongly Dissatisfied and 5 represents “Strongly Satisfied”)**

<b>Assessment Metrics</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
SLO # 1: "During my PhD study, I improved my ability to develop, evaluate, and assess new techniques, skills, and tools to solve complex engineering and construction related problems."	7	4.7	Spring & Fall 2019	3.5	Greater than expected value
SLO # 2: "During my PhD study, I gained engineering and construction knowledge in the area of my expertise (construction, geotechnical, structural, transportation, and water resources/environmental)."	7	4.6	Spring & Fall 2019	3.5	Greater than expected value
SLO # 3: "My PhD study increased my ability to critically read and analyze literature, develop research hypothesis, and create methodology to solve research problems related to engineering and construction in the area of my expertise."	7	4.7	Spring & Fall 2019	3.5	Greater than expected value
SLO # 4: "During PhD study, I collected and analyzed research data, interpreted and synthesized the findings through peer reviewed conference proceedings and journal papers."	7	4.7	Spring & Fall 2019	3.5	Greater than expected value
SLO # 5: "During my PhD study, I effectively communicated technical and research information."	7	4.4	Spring & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations.*

**Table 7. Results of Rating of PhD Student’s Satisfaction with Curriculum, Program Quality, Academic and Non-Academic Support, etc. (1 represents “Strongly Dissatisfied” and 5 represents “Strongly Satisfied”)**

<b>Assessment Metrics</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Appropriateness of PhD curriculum	7	4.0	Spring & Fall 2019	3.5	Greater than expected value
Appropriateness of CEE and CEM 600 and 700 level course	7	4.1	Spring & Fall 2019	3.5	Greater than expected value
Quality of faculty teaching graduate level courses	7	4.4	Spring & Fall 2019	3.5	Greater than expected value
Level of technical knowledge of advisory committee chair	7	4.6	Spring & Fall 2019	3.5	Greater than expected value
Level of technical knowledge of advisory committee members	7	4.6	Spring & Fall 2019	3.5	Greater than expected value
Level of academic support provided by your advisor	7	4.6	Spring & Fall 2019	3.5	Greater than expected value
Level of academic support provided by your committee members	7	4.6	Spring & Fall 2019	3.5	Greater than expected value
Overall academic experience	7	4.1	Spring & Fall 2019	3.5	Greater than expected value
Level of support provided by Chair	7	4.0	Spring & Fall 2019	3.5	Greater than expected value
Level of support provided by Graduate Coordinator	7	4.6	Spring & Fall 2019	3.5	Greater than expected value
Level of support provided by administrative staff	7	4.3	Spring & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations.*

# 2019 MSE Assessment Report

## Annual Academic Assessment Report Cover Sheet

Assessment reports are due the 1<sup>st</sup> Wednesday after the Fall Term

Email to: [assessment@unlv.edu](mailto:assessment@unlv.edu)

### Program Information:

Program Assessed	M.S.E.- Civil & Environmental Engineering
Department	Civil & Environmental Engineering & Construction
College	Howard R. Hughes College of Engineering
Department Chair	Dr. Sajjad Ahmad
Assessment Coordinator	Dr. Pramen P. Shrestha, Graduate Coordinator
Date Submitted	December 23, 2019
Contact Person for This Report	
Name	Dr. Pramen P. Shrestha
Phone	702-895-3841
Email	Pramen.shrestha@unlv.edu

Please attach a narrative (not to exceed 4 pages, excluding appendices) addressing the following:

### A. MSE Thesis Track Degree Assessment Plan

- **What are the student learning outcomes? Please provide a numbered list.**
  1. *An ability to develop, evaluate, and assess new techniques, skills, and tools to solve complex engineering and construction related problems.*
  2. *An ability to acquire engineering and construction knowledge in the area of their expertise (construction, geotechnical, structural, transportation, and water resources/environmental).*
  3. *An ability to critically read and analyze literature, develop research hypothesis, and create methodology to solve research problems related to the area of their expertise.*
  4. *An ability to collect and analyze research data interpret and synthesize the findings through peer reviewed conference proceedings and journal papers.*
  5. *Effectively communicate technical and research information.*

- **Which learning outcomes were assessed?**

*All the five outcomes were assessed.*

- **How were they assessed? (Programs must use at least one direct assessment of student learning.)**

*Student outcome SLO #1 was measured using two direct assessments and one indirect assessment.*

- *Average GPA of MSE students enrolled in CEE and CEM 700 level courses (except CEE 700)*
- *Average cumulative GPA of graduating MSE Thesis track students*
- *Rating of Graduate Student Exit Survey (MSE Thesis track students)*

*Student outcome SLO #2 was measured using two direct assessments and one indirect assessment*

- *Average GPA of MSE students enrolled in CEE and CEM 700 level courses (except CEE 700)*
- *Average cumulative GPA of graduating MSE Thesis track students*
- *Rating of Graduate Student Exit Survey (MSE Thesis track students)*

*Student outcome SLO #3 was measured using one direct assessment and one indirect assessment.*

- *Average GPA of MSE Thesis students enrolled in CEE 700 course*
- *Rating of Graduate Student Exit Survey (MSE Thesis track students)*

*Student outcome SLO #4 was measured using two direct assessments.*

- *Average evaluation score of Thesis Final Defense*
- *No. of peer-reviewed journal and conference proceedings papers published by MSE students*

*Student outcome SLO #5 was measured using three direct assessments and one indirect assessment*

- *Average evaluation score of Thesis Final Defense*
- *No. of peer-reviewed journal papers published by MSE students*
- *No. of peer-reviewed conference and other presentations by MSE students*
- *Rating of Graduate Student Exit Survey (MSE Thesis track students)*

- **What was learned from the assessment results?**

*All the direct and indirect assessment metrics used to measure five student learning outcomes exceeded the expectations (Refer Table 1 through 5). It was learned that our MSE Thesis track is performing as expected.*

*Table 11 shows the analysis of some extra data collected during Graduate Exit Survey to show that the MSE program is performing as expected. All the questions asked to the MSE graduating students about the curriculum, quality of program, and academic and non-academic support had the average rating greater than expected (expected rating was equal to or more than 3.5 on the scale of 5.0)*

- **How did the program respond to what was learned?**

*No response is required. In Spring 2020, our department is inviting external reviewers to review our MSE program. Based on the reviewers' comments, the program will be improved, if required.*



## **B. MSE Project Track/Non-Thesis Degree Assessment Plan**

- **What are the student learning outcomes? Please provide a numbered list.**

1. *An ability to develop, evaluate, and assess new techniques, skills, and tools to solve complex engineering and construction related problems.*
2. *An ability to acquire engineering and construction knowledge in the area of their expertise (construction, geotechnical, structural, transportation, and water resources/environmental).*
3. *Effectively communicate technical information.*

- **Which learning outcomes were assessed?**

*All the three outcomes were assessed.*

- **How were they assessed? (Programs must use at least one direct assessment of student learning.)**

*Student outcome SLO #1 was measured using two direct assessments and one indirect assessment.*

- *Average GPA of MSE students enrolled in CEE and CEM 700 level courses (except CEE 700)*
- *Average cumulative GPA of graduating MSE Project/ Non-Thesis track students*
- *Rating of Graduate Student Exit Survey (MSE Project/ Non-Thesis track students)*

*Student outcome SLO #2 was measured using two direction assessments and one indirect assessment*

- *Average GPA of MSE students enrolled in CEE and CEM 700 level courses (except CEE 700)*
- *Average cumulative GPA of graduating MSE Project or Non-Thesis track students*
- *Rating of Graduate Student Exit Survey (MSE Project/ Non-Thesis track students)*

*Student outcome SLO #3 was measured using two direct assessments and one indirect assessment*

- *No. of peer-reviewed conference proceeding or journal papers by MSE students*
- *No. of peer-reviewed conference and other presentations by MSE students*
- *Rating of Graduate Student Exit Survey (MSE Project/ Non-Thesis track students)*

- **What was learned from the assessment results?**

*All the direct and indirect assessment metrics used to measure three student learning outcomes exceeded the expectations (Refer Tables 7 through 9). It was learned that our MSE Project/Non-Thesis track is performing as expected.*

*Table 11 shows the analysis of some extra data collected during Graduate Exit Survey to show that the MSE program is performing as expected. All the questions asked to the graduating MSE students about the curriculum, quality of program, and academic and non-academic support had the average rating greater than expected (expected rating was equal to or more than 3.5 on the scale of 5.0)*

- **How did the program respond to what was learned?**

*No response is required. In Spring 2020, our department is inviting external reviewers to review our MSE program. Based on the reviewers' comments, the program will be improved, if required.*

**Table 1. Results of Data Collected to Measure Student Learning Outcome # 1 (MSE Thesis Track).**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Average GPA of MSE students enrolled in CEE and CEM 700 level courses (except CEE 700)	58	3.72	Spring & Fall 2019	3.30	Greater than expected value
Average cumulative GPA of MSE Thesis track graduates	13	3.82	Spring & Fall 2019	3.30	Greater than expected value
Graduate Exit Survey – MSE Thesis Track students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagree and 5 being strongly agreed) –Refer Table 6	13	4.8	Spring & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations*

**Table 2. Results of Data Collected to Measure Student Learning Outcome # 2 (MSE Thesis Track).**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Average GPA of MSE students enrolled in CEE and CEM 700 level courses (except CEE 700)	58	3.72	Spring & Fall 2019	3.30	Greater than expected value
Average cumulative GPA of MSE Thesis track graduates	13	3.82	Spring, Summer & Fall 2019	3.30	Greater than expected value
Graduate Exit Survey – MSE Thesis Track students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagree and 5 being strongly agreed)- Refer Table 6	13	4.8	Spring, Summer, & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations*

**Table 3. Results of Data Collected to Measure Student Learning Outcome # 3 (MSE Thesis Track).**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Average GPA of MSE Thesis track students enrolled in CEE 700 course	12	3.83	Fall 2019	3.30	Greater than expected value
Graduate Exit Survey –MSE Thesis Track students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagreed and 5 being strongly agreed)- Refer Table 6	13	4.7	Spring, Summer, & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations*

**Table 4. Results of Data Collected to Measure Student Learning Outcome # 4 (MSE Thesis Track).**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Thesis committee members average evaluation score on the scale of 1 to 5: 1 being poor and 5 being excellent)	13	4.04	Spring, Summer & Fall 2019	3.5	Greater than expected value
# of Journal or conference papers published by MSE students/ Total MSE students	16*	0.36	2019	0.25	Greater than expected value
Graduate Exit Survey –MSE Thesis Track students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagreed and 5 being strongly agreed)- Refer Table 6	13	4.8	Spring, Summer & Fall 2019	3.5	Greater than expected value

\* 16 peer reviewed journal and conference papers were published by the faculty with MSE students in 2019 (Total MSE Students = 44)

Note: All the outcomes exceeded the expectations.

**Table 5. Results of Data Collected to Measure Student Learning Outcome # 5 (MSE Thesis Track).**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Thesis committee members average evaluation score on the scale of 1 to 5: 1 being poor and 5 being excellent)	13	4.04	Spring & Fall 2019	3.5	Greater than expected value
# of Journal or conference papers published/ Total MSE students	16*	0.36	2019	0.25	Greater than expected value
# of conference or other presentations by MSE students/Total MSE students	13**	0.30	2019	0.15	Greater than expected value
Graduate Exit Survey –MSE Thesis track students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagree and 5 being strongly agreed) – Refer Table 6	13	4.8	Spring, Summer, & Fall 2019	3.5	Greater than expected value

\* 16 peer reviewed journal and conference papers were published by the faculty with MSE students in 2019 (Total MSE Students = 44)

\*\*13 conference and other presentations were made by MSE students in 2019 (Total MSE Students = 44)

Note: All the outcomes exceeded the expectations.

**Table 6. Results of Rating of Thesis Track MSE Student’s Satisfaction with SLO #1, #2, #3, #4, and #5  
(1 represents “Strongly Dissatisfied” and 5 represents “Strongly Satisfied”)**

<b>Assessment Metrics</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
SLO # 1: "During my MSE study, I improved my ability to develop, evaluate, and assess new techniques, skills, and tools to solve complex engineering and construction related problems."	13	4.8	Spring, Summer, & Fall 2019	3.5	Greater than expected value
SLO # 2: "During my MSE study, I gained engineering and construction knowledge in the area of my expertise (construction, geotechnical, structural, transportation, and water resources/environmental)."	13	4.8	Spring, Summer, & Fall 2019	3.5	Greater than expected value
SLO # 3: "My MSE study increased my ability to critically read and analyze literature, develop research hypothesis, and create methodology to solve research problems related to engineering and construction in the area of my expertise."	13	4.7	Spring, Summer, & Fall 2019	3.5	Greater than expected value
SLO # 4: "During MSE study, I collected and analyzed research data, interpreted and synthesized the findings through peer reviewed conference proceedings and journal papers."	13	4.8	Spring, Summer, & Fall 2019	3.5	Greater than expected value
SLO # 5: "During my MSE study, I effectively communicated technical and research information."	13	4.8	Spring, Summer, & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations.*

**Table 7. Results of Data Collected to Measure Student Learning Outcome # 1 (MSE Project/Non-Thesis Track).**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Average GPA of MSE students enrolled in CEE and CEM 700 level courses (except CEE 700)	58	3.72	Spring & Fall 2019	3.30	Greater than expected value
Average Cumulative GPA of MSE Project/Non-Thesis track graduates	9	3.52	Spring & Fall 2019	3.30	Greater than expected value
Graduate Exit Survey – MSE Project/Non-Thesis track students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagree and 5 being strongly agreed)- Refer Table 10	9	4.4	Spring & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations.*



**Table 8. Results of Data Collected to Measure Student Learning Outcome # 2 (MSE Project/Non-Thesis Track).**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Average GPA of MSE students enrolled in CEE and CEM 700 level courses (except CEE 700)	58	3.72	Spring & Fall 2019	3.30	Greater than expected value
Average cumulative GPA of MSE Project/Non-Thesis track graduates	9	3.52	Spring & Fall 2019	3.30	Greater than expected value
Graduate Exit Survey – MSE Project/Non-Thesis Track Students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagree and 5 being strongly agreed) – Refer Table 10	9	4.4	Spring & Fall 2019	3.5	Greater than expected value

**Table 9. Results of Data Collected to Measure Student Learning Outcome # 3 (MSE Project/Non-Thesis Track).**

<b>Assessment Instruments</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
# of Journal or conference papers published by MSE students/ Total MSE students	16*	0.36	2019	0.10	Greater than expected value
# of conference or other presentations by MSE students/Total MSE students	13**	0.30	2019	0.15	
Graduate Exit Survey –MSE Project/Non-Thesis track students (Rating of this question provide by the graduates on the scale of 1 to 5; 1 being strongly disagree and 5 being strongly agreed) – Refer Table 10	9	4.3	Spring & Fall 2019	3.5	Greater than expected value

\* 16 peer reviewed journal and conference papers were published by the faculty with MSE students in 2019 (Total MSE Students = 44)

\*\* 13 conference and other presentations were made by MSE students in 2019 (Total MSE Students = 44)

Note: All the outcomes exceeded the expectations.

**Table 10. Results of Rating of Non-Thesis Track MSE Student’s Satisfaction with SLO# 1, # 2, and # 3  
(1 represents “Strongly Dissatisfied” and 5 represents “Strongly Satisfied”)**

<b>Assessment Metrics</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
SLO # 1: "During my MSE study, I improved my ability to develop, evaluate, and assess new techniques, skills, and tools to solve complex engineering and construction related problems."	9	4.8	Spring & Fall 2019	3.5	Greater than expected value
SLO # 2: "During my MSE study, I gained engineering and construction knowledge in the area of my expertise (construction, geotechnical, structural, transportation, and water resources/environmental)."	9	4.8	Spring & Fall 2019	3.5	Greater than expected value
SLO # 3: "During my MSE study, I effectively communicated technical information."	9	4.7	Spring & Fall 2019	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations.*

**Table 11. Results of Rating of MSE Student’s Satisfaction with Curriculum, Program Quality, Academic and Non-Academic Support, etc. – Thesis & Non-Thesis Track (1 represents “Strongly Dissatisfied” and 5 represents “Strongly Satisfied”)**

<b>Assessment Metrics</b>	<b>Sample Size</b>	<b>Average Value</b>	<b>Data Collection Date</b>	<b>Expected Value</b>	<b>Measured vs. Expected</b>
Appropriateness of MSE curriculum	22	4.3	Spring, Summer & Fall 2018	3.5	Greater than expected value
Appropriateness of CEE and CEM 600 and 700 level course	22	4.4	Spring, Summer & Fall 2018	3.5	Greater than expected value
Quality of faculty teaching graduate level courses	22	4.5	Spring, Summer & Fall 2018	3.5	Greater than expected value
Level of technical knowledge of advisory committee chair	22	4.8	Spring, Summer & Fall 2018	3.5	Greater than expected value
Level of technical knowledge of advisory committee members	13	4.8	Spring, Summer & Fall 2018	3.5	Greater than expected value
Level of academic support provided by your advisor	22	4.6	Spring, Summer & Fall 2018	3.5	Greater than expected value
Level of academic support provided by your committee members	13	4.5	Spring, Summer & Fall 2018	3.5	Greater than expected value
Overall academic experience	22	4.1	Spring, Summer & Fall 2018	3.5	Greater than expected value
Level of support provided by Chair	22	4.5	Spring, Summer & Fall 2018	3.5	Greater than expected value
Level of support provided by Graduate Coordinator	22	4.6	Spring, Summer & Fall 2018	3.5	Greater than expected value
Level of support provided by administrative staff	22	4.5	Spring, Summer & Fall 2018	3.5	Greater than expected value

*Note: All the outcomes exceeded the expectations.*