

January 11, 2017

MEMORANDUM

TO: State Board of Regents

FROM: David L. Buhler

SUBJECT: University of Utah – Master of Science in Construction Engineering (online)

Issue

The University of Utah (UU) requests approval to offer a Master of Science in Construction Engineering effective Fall Semester, 2017. The proposed program was approved by the institutional Board of Trustees October 11, 2016.

Background

In July 2016, the Board of Regents approved a baccalaureate degree in Construction Engineering at the University of Utah. This newly proposed graduate degree program provides an opportunity for students who earn the bachelor's degree in construction engineering, as well as degrees in related fields, to pursue advanced preparation in the construction engineering field.

An expanded and improved physical infrastructure for public and commercial use is needed to respond to population growth and assist with economic development throughout the world. The UU reported that three independent changes in the construction industry will alter the manner in which infrastructure systems are designed and built. These changes are: 1) increases in the number of design/build projects, 2) utilization of 3-dimensional Building Information Modeling software; and 3) increases in sustainable/resilient development requirements. From beginning planning to final operation and maintenance, engineers are needed to ensure successful projects. Construction Engineers are educated to understand and solve the complexities that arise during the engineering and construction phases.

The institution plans to develop program courses for on-line delivery, enabling the program to serve populations in diverse locations. Several other tier-one institutions offer similar programs in construction engineering at the baccalaureate and graduate levels.

While the Utah Department of Workforce Services does not track Construction Engineers as a separate occupational group, it does project Civil Engineers, a related group, to have an annual average job growth rate of 3.6% between 2012 - 2022 and a median income of \$74,820 per year. Another related occupational group, Construction Managers, is projected to have a 2.9% growth rate and annual average median income of \$77,580.

Policy Issues

The proposed program has been developed through established institutional procedures and Board of Regents policy. Chief academic officers as well as faculty in related departments from the Utah System of Higher Education institutions have reviewed the proposal and have provided input.

Commissioner's Recommendation

The Commissioner recommends the Board of Regents approve the Master of Science in Construction Engineering.

David L. Buhler
Commissioner of Higher Education

DLB/BKC
Attachment

Program Description – Full Template
University of Utah
Master of Science, Construction Engineering
8/01/2017

Section I: The Request

University of Utah requests approval to offer a Master of Science (MS) in Construction Engineering, effective Fall 2016. This program was approved by the institutional Board of Trustees on October 11, 2016.

Section II: Program Description

Complete Program Description

Physical infrastructure (roads, buildings, water distribution and treatment, etc.) is needed to promote population and economic development throughout the world. From beginning planning to final operation and maintenance, engineers are needed to ensure successful projects. Construction Engineers are educated to understand and solve the complexities that arise during the engineering and construction phases. This comprehensive approach includes initial design through the completion of the exterior building façade. The Construction Engineering degree will teach students to work in both public and private industry positions, improving graduate's skills to meet this growing trend.

Purpose of Degree

According to the American Institute of Steel Construction, three independent movements are converging to radically alter the manner in which infrastructure systems are designed and constructed. These factors represent the emergence of: 1) design/build projects, 2) 3-dimensional Building Information Modeling (BIM) software; and 3) sustainable/resilient development requirements. The national trend for Construction Engineering is very evident in both the public and private sectors. (e.g. \$1.59 billion dollar I-15 reconstruction project, 12300 South Design Buld Project in Draper and Riverton Utah, both using the design/build process in order to maximize cost saving and innovative design). The Construction Engineering degree requires a hybrid education consisting of a civil engineering foundation coupled with experiential learning in architecture and construction practices. By providing the degree online, the institution anticipates being able to serve all of Utah and the surrounding region to enhance the capabilities of those working in the construction industry.

Institutional Readiness

The Department of Civil and Environmental Engineering is proposing a Master of Science degree in Construction Engineering. This program is anticipated to be online and compete nationally with other programs emerging in this growing area. Creation of a MS degree was first discussed in the department's Executive Committee and faculty meetings prior to submitting the Engineering Initiative Proposal in February 2015. This proposed graduate program will compliment a recently approved bachelor of science (BS) in Construction Engineering offered by the University of Utah. Civil and Environmental Engineering faculty formally voted to approve both efforts. Continued discussion aimed at providing a quality educational experience has occurred in frequent faculty meetings before and after the Engineering Initiative approval, including a departmental retreat held during the fall of 2015.

These new degrees will fit naturally within the department since it already offers several elective courses that can support the program. Furthermore, it is anticipated that two or three of the new courses may be

used as electives for existing graduate programs in Civil Engineering. Civil Engineering has also been working with the College of Engineering Dean's Office, UOnline, and support offices to promote the best degree/education options for Construction Engineering. The Department of Civil & Environmental Engineering has also been in contact with more than 17 local large construction firms who support this effort and agree to provide assistance or service on the Industry Advisory Board. The creation of the Construction Engineering BS and MS in Construction Engineering is not expected to adversely affect the existing Bachelor of Science in Civil Engineering program or other programs within the university.

The recently approved undergraduate BS Construction Engineering degree will prepare graduates to apply knowledge of mathematics through differential and integral calculus, probability and statistics, general chemistry, and calculus-based physics; to analyze and design construction processes and systems in a construction engineering specialty field, applying knowledge of methods, materials, equipment, planning, scheduling, safety, and cost analysis; to explain basic legal and ethical concepts and the importance of professional engineering licensure in the construction industry; to explain basic concepts of management topics such as economics, business, accounting, communications, leadership, decision and optimization methods, engineering economics, engineering management, and cost control. When a student applies for the MS in Construction Engineering, their coursework and education will build on the foundation from their undergraduate Construction Engineering degree. An undergraduate background in Civil and Environmental Engineering will also be suitable experience for the MS program.

If students want to complete the MS degree in Construction Engineering without the BS in Construction or Civil Engineering or closely related field, their committee will determine missing knowledge and assign appropriate additional coursework to prepare the student to be ready for the MS program.

Departmental Faculty

In addition to the faculty listed below, funding provided through the Engineering and Computer Science Initiative will provide 4-5 adjunct faculty who will be hired part-time from industry. This will allow the department to provide instruction from top individuals in industry and promote increased relationships for the program. The department will follow ABET accreditation requirements in faculty hires.

Department Faculty Category	Dept Faculty Headcount – Prior to Program Implementation	Faculty Additions to Support Program	Dept Faculty Headcount at Full Program Implementation
With Doctoral Degrees (Including MFA and other terminal degrees, as specified by the institution)			
Full-time Tenured	21.5	1	22.5
Full-time Non-Tenured	1	2	3
Part-time Tenured	0	0	0
Part-time Non-Tenured	0	0	0
With Master's Degrees			
Full-time Tenured	0	0	0
Full-time Non-Tenured	0	0	0
Part-time Tenured	0	0	0
Part-time Non-Tenured	0	0	0
With Bachelor's Degrees			

Full-time Tenured	0	0	0
Full-time Non-Tenured	0	0	0
Part-time Tenured	0	0	0
Part-time Non-Tenured	0	0	0
Other			
Full-time Tenured	0	0	0
Full-time Non-Tenured	0	0	0
Part-time Tenured	0	0	0
Part-time Non-Tenured	4	4	8
Total Headcount Faculty in the Department			
Full-time Tenured	22.5	3	25.5
Full-time Non-Tenured	0	0	0
Part-time Tenured	0	0	0
Part-time Non-Tenured	4	4	8
Total Department Faculty FTE <i>(As reported in the most recent A-1/S-11 Institutional Cost Study for "prior to program implementation" and using the A-1/S-11 Cost Study Definition for the projected "at full program implementation.")</i>	22.5	4	26.5

Staff

The institution has targeted funds from the Engineering and Computer Science Initiative to be used to hire one staff person. This person will serve as the online coordinator in the department, advise the online students, be a point of contact for the UOnline office, marketing and promoting online education, and coordinate the creation and recording of classes. One teaching assistant was also budgeted in the request.

Library and Information Resources

The library has verified it has sufficient resources available to provide for faculty or student needs relative to the proposed program.

Admission Requirements

Admissions will be completed online through Apply Yourself (Admissions Office software). Requirements include the Graduate Record Exam (GRE) or Professional Engineer License. Professional track applicants who have graduated from an ABET accredited program with a BS degree in engineering or a closely related field and a GPA of 3.20 or higher are not required to take the GRE.

Student Advisement

The new staff hire will advise using technology for face-to-face appointments, telephone calls, email correspondence, open house events, or company presentations (marketing events with industry partners). A faculty advisor from the three new hires will also be assigned to each student.

Justification for Graduation Standards and Number of Credits

The MS Construction Engineering degree will require 30 credits of graduate-level coursework with a minimum cumulative GPA of 3.0 for the program of study according to University guidelines. These are standard requirements for course-only MS degrees within the department and elsewhere around the country.

External Review and Accreditation

This program was presented to the College of Engineering advisory board for input. Additionally, the Department Chair of Civil and Environmental Engineering met with several construction professionals to seek input regarding program content. The next step involves the creation of an Industry Advisory Board (IAB). The IAB will be created from construction firms around the globe to provide input, meeting three times each year to review the specifics of the program in consultation with department faculty and the department chair.

Projected Program Enrollment and Graduates; Projected Departmental Faculty/Students

Data Category	Current – Prior to New Program Implementation	PROJ YR 1	PROJ YR 2	PROJ YR 3	PROJ YR 4	PROJ YR 5
Data for Proposed Program						
Number of Graduates in Proposed Program	X	0	15	25	25	25
Total # of Declared Majors in Proposed Program	X	15	30	50	50	50
Departmental Data – For All Programs Within the Department						
Total Department Faculty FTE (as reported in Faculty table above)	22.5	23.5	24.5	24.5	25.5	26.5
Total Department Student FTE (Based on Fall Third Week)	296	306	321	346	371	396
Student FTE per Faculty FTE (ratio of Total Department Faculty FTE and Total Department Student FTE above)	13.15:1	13.6:1	14.26:1	15.37:1	16.48:1	17.6:1
Program accreditation-required ratio of Student FTE/Faculty FTE, if applicable: (Provide ratio here: _____)	-	-	-	-	-	-

Expansion of Existing Program

This is a new degree aimed at a new audience even though it does have some common elements with the Civil and Environmental Engineering curriculum.

Section III: Need

Program Need

The proposal was submitted as part of the Engineering and Computer Science Initiative and was approved by the Dean of Engineering for funding. The decision to provide the program online is responsive to the needs of working professionals who work both in-state as well as out-of-state.

According to the American Institute of Steel Construction, three independent movements are converging to radically alter the manner in which infrastructure systems are designed and constructed. These factors represent the emergence of: 1) design/build projects, 2) 3-dimensional Building Information Modeling (BIM) software; and 3) sustainable/resilient development requirements. These factors have transformed the often contentious nature of architect-engineer-contentious dynamics into a more seamless collaborative team effort. This integrated approach has already begun to revolutionize the delivery of projects designed and constructed to meet client needs for timely delivery of high quality, economically sensitive projects that minimize environmental and energy impacts.

In speaking with several local construction firms the institution believes demand for project managers with engineering backgrounds will continue to grow. In light of 2015 legislation raising the gas tax for infrastructure improvements and the law allowing local communities the option of raising sales taxes to help pay for transit, it is believed the combination of transportation and construction engineering will present opportunities for growth. This is also part of a national movement with a few large universities already addressing long-term needs for individuals prepared in the construction engineering field.

Labor Market Demand

While the Utah Department of Workforce Services does not track Construction Engineers as a separate occupational group, it does project Civil Engineers, a related group, to have an annual average job growth rate of 3.6% between 2012 - 2022 and a median income of \$74,820 per year. Another related occupational group, Construction Managers, is projected to have a 2.9% growth rate and annual average median income of \$77,580.

Student Demand

Currently the department offers four construction related courses that will be used in the Construction Engineering program. These courses are well populated by existing students. In speaking with several local construction firms it is understood that the demand for project managers with engineering backgrounds will continue to grow.

Similar Programs

There are no other master degree level construction engineering degrees offered in the state. The program is not expected to adversely impact related programs in civil engineering or construction management since the new program is expected to address unique labor market needs that are not being met by these existing programs.

Collaboration with and Impact on Other USHE Institutions

It is not anticipated that there will be an impact on the other USHE Institutions.

Benefits

This degree will benefit the community and state by attracting students and building the University of Utah's reputation. The ability to offer online courses and attract students across the state, providing rural areas access to higher education. Furthermore, it will help build a national reputation as a leader in engineering education.

Consistency with Institutional Mission

The University of Utah contributes to the quality of life and economic development at the local, state, and national levels. This proposed program fits within this mission. It is one more link that enhances the development of workforce talent for STEM and STEM-oriented occupations.

Section IV: Program and Student Assessment

Program Assessment

The proposed program will prepare students for successful careers in engineering related to design/build construction and project management. Specifically, graduates will be educated in the heavy and highway construction, underground utilities, and building structural frame segments of the construction industry. Graduate training is designed to instill independent and critical thinking, develop problem solving technical skills, and provide the foundation for life-long learning.

Program graduates will have:

1. An understanding of competencies within well-defined principles of construction engineering at levels clearly exceeding undergraduate expectations.
2. The ability to apply their understanding to the design, analysis and construction of infrastructure systems.
3. Effective oral and written technical communication skills.
4. The skills and understanding required for life-long learning and professional development.
5. An understanding of ethical responsibilities related to society and civic engagement.

Expected Standards of Performance

Program outcomes will be routinely monitored by the Industry Advisory Board to maintain relevancy with practicing construction professionals. Likewise, course content will be developed that contribute to these outcomes. It is expected that graduates will maintain a 3.0 GPA, choosing classes with the help of their faculty advisor that will prepare them for the marketplace.

Section V: Finance

Department Budget

This budget is an estimate and does not adjust for inflation.

Three-Year Budget Projection							
Departmental Data	Current Departmental Budget – Prior to New Program Implementation	Departmental Budget					
		Year 1		Year 2		Year 3	
		Addition to Budget	Total Budget	Addition to Budget	Total Budget	Addition to Budget	Total Budget
Personnel Expense							
Salaries and Wages	2,164,973	342,000	2,421,973	0	2,421,973	0	2,421,973
Benefits	669,008	118,070	780,278	0	780,278	0	780,278
Total Personnel Expense	\$2,833,981	\$460,070	\$3,202,251	\$0	\$3,202,251	\$0	\$3,202,251
Non-Personnel Expense							
Travel	1,000	0	1,000	0	1,000	0	1,000
Capital	0	0	0	0	0	0	0
Library	0	0	0	0	0	0	0
Current Expense	84,100	19,930	104,030	0	104,030	0	104,030
Total Non-Personnel Expense	85,100	19,930	105,030	0	105,030	0	105,030
Total Expense (Personnel + Current)	\$2,919,081	\$480,070	\$3,207,281	\$0	\$3,207,281	\$0	\$3,207,281
Departmental Funding							
Appropriated Fund	2,443,576	480,000	3,307,281	0	2,443,576	0	2,443,576
Other:	13,813	0	13,813	0	13,813	0	13,813
Special Legislative Appropriation	0	0	0	0	0	0	0
Grants and Contracts	0	0	0	0	0	0	0
Special Fees / Differential Tuition	376,432	0	376,432	0	376,432	0	376,432
Total Revenue	\$2,833,821	\$480,000	\$3,307,281	\$0	\$3,307,281	\$0	\$3,307,281
Difference							
Revenue-Expense	\$-85,260	\$0	\$6,540	\$0	\$6,540	\$0	\$6,540

Departmental Instructional Cost / Student Credit Hour* (as reported in institutional Cost Study for "current" and using the same Cost Study Definition for "projected")	\$	\$	\$	\$	\$	\$	\$
---	----	----	----	----	----	----	----

* Projected Instructional Cost/Student Credit Hour data contained in this chart are to be used in the Third-Year Follow-Up Report and Cyclical Reviews required by R411.

Funding Sources

Funding from the Engineering and Computer Science Initiative will be used to support this program along with differential tuition generated by engineering courses.

Reallocation

No reallocation of resources is necessary.

Impact on Existing Budgets

None. This program will be managed without diverting existing budgets.

Section VI: Program Curriculum

All Program Courses (with New Courses in Bold)

Students will take a subset of the classes listed below for a total of 30 credits to graduate. The courses will be offered on a yearly or every-other-year rotation based on enrollments and student graduation needs.

Course Prefix and Number	Title	Credit Hours
CVEEN 6840	Construction Finance and Accounting	3
CVEEN 6855	Commercial Construction	3
CVEEN 6860	Residential Construction	3
CVEEN 6865	Principles of Design-Build Project Delivery	3
CVEEN 6870	Design-Build Contract & Risk Management	3
CVEEN 6875	Environmental Regulations	3
CVEEN 6880	Façade Engineering II	3
CVEEN 6885	Utilities Construction and Rehabilitation	3
CVEEN 6890	Advanced Computer-Aided Construction	3
	Entrepreneurial Engineering	3
CVEEN 6810	Cost Estimating	3
CVEEN 6820	Project Scheduling	3
CVEEN 6830	Project Management	3
CVEEN 6850	Engineering Law and Contracts	3
CVEEN 5500	Sustainable Materials	3

Course Prefix and Number	Title	Credit Hours
	Sub-Total	30
Elective Courses		
Sub-Total		
Track/Options (if applicable)		
Sub-Total		
	Total Number of Credits	30

Program Schedule

A tentative schedule of new classes is provided.

<u>Fall-odd years</u> CVEEN 6840 CVEEN 6860 CVEEN 6810	<u>Spring-even years</u> CVEEN 6855 CVEEN 6830	<u>Summer-even years</u> CVEEN 6875 Entrepreneurial Engineering
<u>Fall-even years</u> CVEEN 6865 CVEEN 6890 CVEEN 6820	<u>Spring-odd years</u> CVEEN 6880 CVEEN 6885 CVEEN 6850	<u>Summer-odd years</u> CVEEN 6870

Section VII: Faculty

A search committee has been organized and a job description will soon be created. New faculty hires will be recording online classes, mentoring with the Center for Teaching and Learning Education, and finalizing the curriculum for the new degree.