

**CONNECTICUT BOARD OF REGENTS FOR HIGHER EDUCATION**  
**CONCEPT PAPER FOR NEW ACADEMIC PROGRAM** (Public Higher Education Institutions) -12/12/17

**SECTION 1: GENERAL INFORMATION** <sup>1 2</sup>

<b>Institution:</b> Central Connecticut State University	<b>Date of Submission to BOR Office:</b>
Most Recent NEASC Institutional Accreditation Action and Date: 2013	
<b>Program Characteristics</b> Name of Program: Civil Engineering Degree: Title of Award (e.g. Master of Arts) Master of Science in Civil Engineering (MSCE) Certificate: (specify type and level) Anticipated Program Initiation Date: Fall 2018 Anticipated Date of First Graduation: Spring 2020 Modality of Program: X On ground    Online    Combined If "Combined", % of fully online courses? Total # Cr the Institution Requires to Award the Credential (i.e. include program credits, GenEd, other): 30	<b>Program Credit Distribution</b> # Cr in Program Core Courses: 6 # Cr of Electives in the Field: 18 # Cr of Free Electives: 0 # Cr Special Requirements (include internship, etc.): 6 Thesis <u>Total # Cr in the Program (sum of all #Cr above): 30</u> From "Total # Cr in the Program" above, enter #Cr that are part of/belong in an already approved program(s) at the institution: 9 in initial concentration
Type of Approval Action Being Sought: Licensure and Accreditation	
Suggested CIP Code No. (optional) 14.0801    Title of CIP Code Civil Engineering, General	
If establishment of the new program is concurrent with discontinuation of related program(s), please list for each program: Program Discontinued: MS Engineering Technology Civil/Construction    CIP: 15.0201 <b>DHE# (if available):</b> Phase Out Period 3 years    Date of Program Termination Spring 2021	
Institution's Unit (e.g. School of Business) and Location (e.g. main campus) Offering the Program: School of Engineering, Science, and Technology at CCSU main Campus.	
Program Accreditation: <ul style="list-style-type: none"> <li>• If seeking specialized/professional/other accreditation, name of agency and intended year of review: Engineering Accreditation Commission of Accreditation Board for Engineering and Technology (EAC of ABET)</li> <li>• If program prepares graduates eligibility to state/professional license, please identify: Professional Engineering (PE) licensure requires continuing education credits beyond the B.S. degree in engineering. Master of Science in Civil Engineering (MSCE) would satisfy these requirements.</li> </ul> (As applicable, the documentation in this request should addresses the standards of the identified accrediting body or licensing agency)	
<b>Institutional Contact for this Proposal:</b> Peter F. Baumann, Ph.D.	Title: Professor and Chair, Engineering Department Tel.: 860-832-0086 e-mail: <a href="mailto:baumannp@ccsu.edu">baumannp@ccsu.edu</a>

**BOR-AC REVIEW and Follow Up** (For BOR Office Use Only - please leave blank)

BOR Concept Paper Sequence Number (to be assigned): Summary of BOR-AC Comments and Recommendations: Log of Follow Up Steps: Expected Date of Full Proposal:
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<sup>1</sup> This Concept Paper can be considered the first draft of your new program proposal. Providing accurate and concrete information will facilitate further steps. Please neglect cells that have been shaded with a pattern or text that has been crossed out. These items can be completed in the full proposal document.

<sup>2</sup> Further details and information may be required at the institution level (e.g., Academic Dean, Provost) or system level (e.g., officer in charge of a centralized programmatic database). As appropriate, this additional information should be included in this Concept Paper.

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**SECTION 2: PROGRAM PLANNING ASSESSMENT (To be used in BOR Review Only)**

**Alignment of Program with Institutional Mission, Role and Scope**

*(Please provide objective and concise statements)*

Proposal:

The Engineering Department within the School of Engineering, Science, and Technology at Central Connecticut State University will transition its Master of Science in Engineering Technology (MSET) degree program with two specializations into two associated Master of Science in Engineering degrees specifically a Master of Science in Civil Engineering (MSCE) and a Master of Science in Mechanical Engineering (MSME). A working framework of the proposed MSCE degree and its tracks of concentration are contained herein along with core requirements and some anticipated courses that could be included as electives within the tracks. This proposed degree, bearing three tracks of concentration, can be initiated through one track by current faculty and one additional faculty member. With continued growth, additional supporting faculty members can be added, two for each track, toward full-scale program implementation. The initial program track planned is "Structures" for the MSCE. We believe that this implementation plan will ease transition towards the more encompassing Master of Science degree in Civil Engineering.

We anticipate that these Master of Science programs in Engineering will be very successful graduate programs for our Department and School at CCSU, and a point of pride for the System in general. We respectfully request CSCU Board of Regents approval and support in moving forward.

Rationale (Justification Points):

The Master of Science in Engineering degrees (MSCE and MSME) will draw students from a larger number of in-State graduates and professionals holding B.S. in Engineering degrees, as well as, being more attractive beyond the local area and internationally.

The current Master of Science in Engineering Technology (MSET) tends to draw only from the Bachelor of Science in Engineering Technology programs at CCSU and a Master's degree is generally not sought out by professionals having that B.S. Also, CCSU transitioned its B.S. in Civil Engineering Technology degree into a B.S. in Civil Engineering eliminating the primary source of students for the Civil Specialization of the MSET.

The CCSU MSET was developed prior to CSU offering any engineering degrees and certainly the Master of Science in engineering programs (MSCE and MSME) are more appropriate as a follow-up to our very successful and more analytical engineering degrees now offered. Many of our graduates have needed to seek these degrees at other institutions.

The MSCE and MSME offerings could also be available for full-time students, as well as part-time professionals, to foster Graduate Assistantships not utilized previously to further support the programs, Department, and School.

With MSCE and MSME programs in place, faculty with graduate students will be able to undertake more challenging research including industrial community outreach through company-sponsored projects. The new Engineering Building facilities plan at CCSU would certainly support this endeavor.

All the points above are consistent with the stated goals and mission statements of the School of Engineering, Science, and Technology and CCSU, particularly with regards to satisfying the workforce development needs of the State addressed below.

These programs provide educational advancement, and learning centered environment to enhance the economic productivity, and to engage students and faculty in the discovery, application, and dissemination of knowledge. The advancement of the knowledge base, and professional achievements of transforming students from generalist to specialists in their respective fields, are centered about finding solutions to technological, human, and environmental challenges, all geared towards

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improving the quality of life. All of which are consistent with the mission of the University and School, in preparing students to be thoughtful, responsible and successful citizens.

Mission of The School of Engineering, Science, and Technology:

The School of Engineering, Science & Technology will strive to provide an innovative and unique educational experience to every student, develop the most qualified engineers, scientists and technologists. The School will maintain academic excellence in a wide variety of traditional disciplines and develop innovative disciplines in emerging fields, creating interdisciplinary educational and research programs, and building the infrastructure to support the expansion of programs.

The School will be a leader in developing cross-disciplinary initiatives that combine and expand the talents of its students and faculty in all disciplines and prepares our graduates for a multidisciplinary world through a flexible and diverse curriculum; and, meets the needs for a well-educated and skilled workforce.

The School of Engineering, Science, and Technology will provide premier undergraduate and graduate programs in engineering, technology, computing, life and physical sciences, and mathematics. The School will provide a technology-rich, and interdisciplinary learning environment that offers students a rewarding academic experience through experiential and active learning that embraces the concept of "thinking, learning, and doing."

The School will strive to serve a student population that mirrors the diversity of the region and includes many international students. The School aspires to be a leading force in offering a number of creative outreach programs designed to encourage and support all students to pursue careers in science and engineering.

**Addressing Identified Needs**

- How does the program address CT workforce needs and/or the wellbeing of CT society/communities? *(Succinctly present as much factual evidence and evaluation of stated needs as possible)*

**State of Connecticut market feasibility** – The State of Connecticut Occupational Projections: 2014-2024 for labor market information estimated that employment of mechanical engineers and civil engineers is strong and is projected to grow over the next decade. Their data ranked civil engineering as highly demanded in openings, and mechanical engineering among the highly demanded in growth. The State of Connecticut employment projections are shown in **Error! Reference source not found..** The need for professionals with higher credentials (M.S.) should correlate well.

Table 1: State of Connecticut Occupational Projections: 2014-2024

Occupational Title	Estimated Employment 2014	Projected Employment 2024	10 Year Net Change	10 Year Percent Change	Annual Growth Openings	Annual Total Openings	Median Annual Wage	Minimum Education
Mechanical Engineers	6,066	7,323	1,257	20.7	126	318	83,259	Bachelor's degree
Civil Engineers	3,947	4,150	203	5.1	20	136	88,951	Bachelor's degree

<http://www1.ctdol.state.ct.us/lmi/projections2014.asp>

- How does the program make use of the strengths of the institution (e.g. curriculum, faculty, resources) and of its distinctive

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character and/or location?

**Institutional Strength** – These programs will definitely make use of the strengths of our institution. CCSU is the only university in the System offering engineering degrees, specifically in civil engineering and mechanical engineering. All permanent full-time faculty members possess an earned engineering doctorate which is required for teaching at the graduate level. Our new planned engineering building will provide needed laboratory space and equipment for research.

- Please describe any transfer agreements with other institutions under the BOR that will become instituted as a result of the approval of this program *(Please highlight details in the Quality Assessment portion of this application, as appropriate)* None.
- Please indicate what similar programs exist in other institutions within your constituent unit <sup>3</sup>, and how unnecessary duplication is being avoided

Central Connecticut State University is centrally located within the highly technical greater Hartford region which is an advantage over the only other State supported university offering these degrees (UCONN). Also advantageous is our desire to offer both day and evening courses considerate of both traditional full-time students, as well as, industry professionals seeking higher credentials. The fact that many companies reimburse employees for graduate studies makes it plausible for students employed in local industry to take advantage of this financial incentive in order to take evening classes. In addition, many of the envisioned research projects will involve faculty and students collaborating side-by-side with local industry, which in turn paves the way for funding through contracts and grants from industry.

- Please provide a description/analysis of employment prospects for graduates of this proposed program

**National market feasibility** – The federal Employment Projections program in the U.S. Department of Labor’s Bureau of Labor Statistics provides the national data on civil and mechanical engineering disciplines employment and forecasts for future hiring needs. As shown in **Error! Reference source not found.**, these projections include growth and replacement openings. The growth is expected to be 8.3% in civil engineering, and 5.3 % in mechanical engineering. According to the DOL data, the earnings for both disciplines are also expected to remain very strong. The need for professionals with higher credentials (M.S.) should correlate well.

Table 2: National occupational employment and job openings data, projected 2014 and projected 2024, and worker characteristics, 2014 (Numbers in thousands)

Occupational Title	Employment		Employment Change, 2014-24		Job openings due to growth and replacements, 2014-24	Typical education needed for entry
	2014	2024	Number	Percent		
Mechanical Engineers	277.5	292.1	14.6	5.3	102.5	BS
Civil Engineers	281.4	305.0	23.6	8.4	106.7	BS
<a href="https://www.bls.gov/data/#projections">https://www.bls.gov/data/#projections</a>						

<sup>3</sup> Constituent units are: the Connecticut Community College System, the Connecticut State University System, Charter Oak State College, and the University of Connecticut

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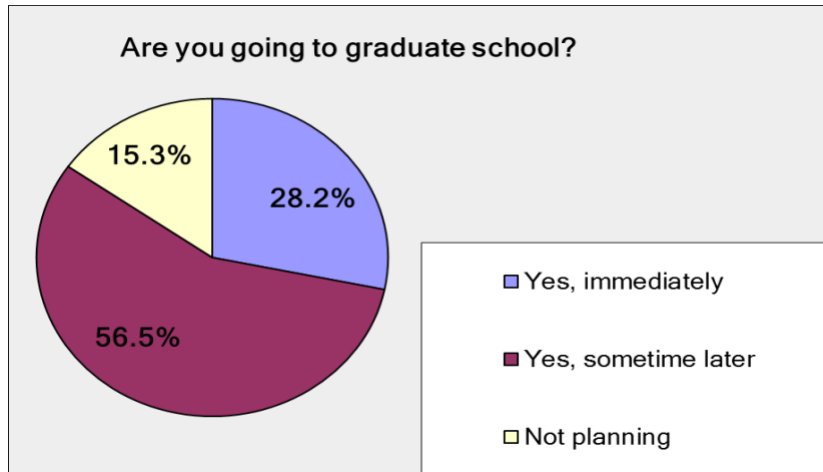
**Cost Effectiveness and Availability of Adequate Resources**

*(Please provide a short narrative that generally considers projections of program enrollment and graduation, revenues and expenses, existing and needed resources, including faculty and administrative cost, and any major cost implications)*

**Applicant Pool** – Analysis of the exit interview data below for our B.S. graduates shows that the majority are either pursuing a master degree immediately after graduation or in the near future. Additionally, B.S. programs at University of Connecticut, University of Hartford, University of New Haven, and U.S. Coast Guard Academy are potential feeder schools within the State.

**CCSU – FA 13 - FA 16 ME Program Exit Interview Questionnaire**

Are you going to graduate school?		
Answer Options	Response Percent	Response Count
Yes, immediately	28.2%	24
Yes, sometime later	56.5%	48
Not planning	15.3%	13
<i>answered question</i>		<b>85</b>



**Cost Effectiveness** – For estimate purposes, taking into account the current cumulative number of CCSU BSCE graduates, and only those desiring to pursue an M.S. immediately, and only the fraction that would qualify for admissions:

$$88 \times 0.282 \times 0.42 = 11 \text{ MSCE students}$$

Current per term tuition fees for Connecticut resident (graduate): \$5,696.00; non-resident (graduate): \$11,984.00. Even with the conservative assumption that all MSCE students are full time CT residents the total per academic year revenue (with no financial aid) could be estimated roughly as:

$$\$5,698.00 \times 2 \text{ terms} \times 11 \text{ students} = \$125,356 \text{ gross revenue per year}$$

According to the CCSU Contract ([http://www.csuaaup.org/wp-content/uploads/2017/08/June\\_29\\_17\\_Ratified\\_Contract.pdf](http://www.csuaaup.org/wp-content/uploads/2017/08/June_29_17_Ratified_Contract.pdf)) an Associate Professor has a minimum annual salary of \$73,707. Since the fringe benefit rate depends on the retirement plan, the faculty member chooses, and the state retirement plan is 62% of salary, as is the Hybrid Plan, and The Alternate Retirement Plan is 20.41% of salary, the average fringe benefit rate could be estimated as  $(62\% + 20.41\%)/2 = 41.205\%$

$$(\$73,707 + \$73,707 \times 0.41205) \times 1 \text{ full time associate professors} = \$104,078$$

This amount could be considered as a major annual cost investment.

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The net revenue can be calculated as:

$$\$125,356 - \$104,078 = \$21,278$$

These results clearly demonstrate feasibility of the program offering.

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**SECTION 3: PROGRAM QUALITY ASSESSMENT**

**Overall Learning Goal/Principal Learning Outcome for the Program:**

**Learning Outcomes - L.O.** *(Please list up to seven of the most important student learning outcomes for the program and concisely describe assessment methodologies to be used in measuring the outcomes. If the program will seek external accreditation or qualifies graduates to opt for a professional/occupational license, please frame outcomes in attention to such requirements. With as much detail as possible, please map these learning outcomes to courses listed under the "Curriculum" section of this application)*

The graduate programs in mechanical and civil engineering at CCSU have the following objectives:

1. To provide students in-depth understanding and expertise in specific areas of concentration in mechanical or civil engineering.
2. To train students to do original scientific research in specific areas of interest, and to disseminate findings through refereed journal articles, conference proceedings and presentations.
3. To graduate students who are successful contributors to addressing the current and future challenges facing the society, while adhering to the highest moral and ethical standards.

The graduate programs in civil and mechanical engineering at CCSU have the following learning outcomes:

1. Ability to use computational methods, skills, computers and modern technical tools in engineering practice.
2. Ability to identify, formulate and solve technical problems using engineering analysis.
3. Ability to conduct research, design experiments, analyze and interpret data, and optimize engineering design.
4. Ability to design a system, component or process to meet desired needs.
5. Knowledge of contemporary issues and understanding the impact of engineering/ technical solutions within a global perspective.
6. Ability to communicate effectively in oral, written, visual and graphical modes.

**Program Administration** *(Describe qualifications and assigned FTE load of administrator/faculty member responsible for the day-to-day operations of the proposed academic program. Identify individual for this role by name or provide time frame for prospective hiring)*

Dr. Peter F. Baumann – Current Chair of the Engineering Department would have overall responsibility for Program Administration assisted by a dynamic MSCE Program Coordinator needing 3 FTE load credits per semester to be responsible for the day-to-day operations of the new proposed academic program. Dr. Young Moo Sohn is recommended to fulfill this role. Currently there are no additional FTE chair load credits expected due to increased department size.

**Faculty** *(Please complete the faculty template provided below to include current full-time members of the faculty who will be teaching in this program and, as applicable, any anticipated new positions/hires during the first three years of the program and their qualifications)*

How many new full-time faculty members, if any, will need to be hired for this program?

The program will require one new full-time faculty members for initial concentration planned as delineated in CCSU 5-year academic plan. With program growth two additional concentrations are conceived in advance needing 2 new full-time faculty members each.

What percentage of the credits in the program will they teach?

New faculty will teach 20% of this new program and will be assigned courses in the baccalaureate program normally covered by other faculty eager to also teach at the graduate level.

What percent of credits in the program will be taught by adjunct faculty?

0%

Describe the minimal qualifications of adjunct faculty, if any, who will teach in the program:

Minimum qualifications will be in line with the requirements of our Graduate School, i.e., an Engineering Doctorate in Civil Engineering or a closely related field.

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**Special Resources** *(Provide a brief description of resources that would be needed specifically for this program and how they will be used, e.g. laboratory equipment, specialized library collections, etc. Please include these resources in the Resources and Cost Analysis Projection sheet for BOR review)*

One full time faculty members at the rank of Assistant/Associate Professor for teaching of additional graduate courses. If successful, two additional concentrations can be added requiring two full time faculty members at the rank of Assistant/Associate Professor for each concentration.

This program will utilize laboratory space and equipment within the new planned engineering building at CCSU.

Additional library collection of books on civil and structural engineering may be needed.

Some additional software in support of this concentration may be needed.

Coverage of costs associated with the maintenance of research and other equipment including repair, service contracts, and calibration, will be required for program success.

We would seek to establish a Graduate Fee, which would initially support a Graduate Assistant for this program.



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**Curriculum**

(Please provide details as available and keep in mind the summary of Program Credit Distribution completed in Section 1. Modify this format as needed)

Course Number and Name	L.O. # <sup>4</sup>	Pre-Requisite	Cr Hrs	Course Number and Name	L.O. #	Cr Hrs
<b>Program Core Courses</b>				<b>Other Related/Special Requirements</b>		
ENGR 501 – Engineering Analysis	2	MSCE Admission	3			
ENGR 592 – Methods of Engineering Research ( <b>existing</b> ) or CE 5XX Optimal Design in Civil Engineering Systems	3	MSCE Admission	3			
CE 697 – Civil Engineering Thesis I	5	MSCE Admission	3			
CE 699 – Civil Engineering Thesis II	1-6	CE 697	3			
<b>Core Course Prerequisites</b>				<b>Elective Courses in the Field (18 Cr. in a Concentration Area)</b>		
CE 697 – Civil Engineering Thesis I			3	<i>Structures (18 Cr.)</i>		
				ENGR 557 – Advanced Mechanics of Materials		3
				CE 571 – Advanced Concrete Design ( <b>existing</b> )		3
				CE 5XX – Finite Element Methods for CE Structures		3
				CE 5XX – Dynamics of Structures		3
				CE 5XX – Advanced Foundation Engineering		3
				CE 5XX – Bridge Engineering		3
				CE 5XX – Advanced Steel Structure Design		3
				CE 6XX – Design of Prestressed Concrete Structures		3
				CE 6XX – Loads for Buildings and Other Structures		3
				CE 6XX – Earthquake Engineering		3
				CE 6XX – Plastic Design of Steel Structures		3
				<i>Transportation (18 Cr.)</i>		
				CE 550 – Global Positioning Systems Applications ( <b>existing</b> )		3
				CE 554 – Intelligent Transportation Systems		3
				CE 5XX – Transportation Planning and Travel Demand		3
				CE 6XX – Traffic Operations, Simulation, and Control		3
				CE 6XX – Highway and Street Design		3
				CE 6XX – Transportation Network Analysis		3
				CE 6XX – Public Transportation		3

<sup>4</sup> From the Learning Outcomes enumerated list provided at the beginning of Section 3 of this application

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		Systems	
		CE 6XX – Transportation System Management	3
		CE 6XX – Pavement Design	3
		ME 658 – Emerging Energy Systems	3
		CE 6XX – Advanced Transportation Analysis	3
		<i>Environmental &amp; Water Resources Engineering (18 Cr.)</i>	
		CE 5XX – Analysis of Water and Wastewater Processes	3
		CE 5XX – Design of Water Treatment Systems	3
		CE 5XX – Design of Wastewater Treatment	3
		CE 5XX – Evaluating Non-Point Source Pollution	3
		CE 5XX – Environmental Statistics and Risk Analysis	3
		CE 5XX – Physical Modeling of Hydraulic Structures	3
		CE 5XX – Stream Habitat and Watershed Protection	3
		CE 5XX – Groundwater Hydrology and Remediation	3
		CE 5XX – Design of Waste Containment and Processing Systems	3
		CE 5XX – Modeling Watershed Hydrology	3
		CE 6XX – Contaminant Transport Analysis	3
		CE 6XX – Engineering Design for Sustainability	3
		CE 6XX – Hydraulics of River and Channel Systems	3
		CE 6XX – Vadose Zone Hydrology	3

**Total Other Credits Required to Issue Credential** (e.g. GenEd/Liberal Arts Core/Liberal Ed Program)

**Program Outline** (Please provide a summary of program requirements including total number of credits for the degree, special admission requirements, capstone or special project requirements, etc. Indicate any requirements and arrangements for clinical affiliations, internships, and practical or work experience.)

This program at Central Connecticut State University will require all applicants to have the equivalent of a BS in Civil Engineering with a minimum 3.0/4.0 cumulative GPA.

Graduation with an MSCE diploma requires completion of 30 credit hours including a six-credit, two-course thesis capstone sequence.

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**Full-Time Faculty Teaching in this Program** (Note: If you anticipate hiring new faculty members for this program you may list "to be hired" under name and title. Provide required credentials, experience, and other responsibilities for each new position anticipated over the first three years of implementation of the program)

Faculty Name and Title	Institution of Highest Degree	Area of Specialization/Pertinent Experience	Other Administrative or Teaching Responsibilities
Dr. Nidal A. Al-Masoud, Professor	University of Buffalo, Ph.D., 2002	Mechanical Engineering/ 17 yrs. teaching, 13 yrs. professional practice	Coordinator BS Mechanical Engineering
Dr. Luz Amaya-Bower, Asst. Professor	City University of New York, Ph.D., 2010	Mechanical Engineering/ 7 yrs. teaching, 3 yrs. professional practice	
Dr. Clifford Anderson, Assoc. Professor	University of New Mexico, Ph.D., 2004	Civil Engineering/ 12 yrs. teaching, 30 yrs. professional practice	Coordinator BS Civil Engineering
Dr. Swamy Basim, Assoc. Professor	New Jersey Institute of Technology, Ph.D., 1999	Civil Engineering/ 27 yrs. teaching, 12 yrs. professional practice	
Dr. Peter F. Baumann, Professor & Chair	NYU Polytechnic School of Engineering, Ph.D., 1997	Materials Engineering/ 16 yrs. teaching, 20 yrs. professional practice	Engineering Department Chair
Dr. Cairn S. Ely, Asst. Professor	University of Connecticut, Ph.D., 2012	Environmental Engineering/ 4 yrs. teaching, 8 yrs. professional practice	
Dr. Faris Malhas, Professor	University of Wisconsin- Madison, Ph.D., 1988	Structural Engineering/ 32 yrs. teaching, 3 yrs. professional practice	
Dr. Young M. Sohn, Asst. Professor	Purdue University, Ph.D., 2012	Structural Engineering/ 4 yrs. teaching, 5 yrs. professional practice	
Dr. Bin (Brenda) Zhou, Assoc. Professor	The University of Texas at Austin, Ph.D., 2009	Civil Engineering/ 9 yrs. teaching, 1 yr. professional practice	
To be hired, Asst./Assoc. Professor		Civil Engineering/ Minimum 3 yrs. professional practice (For MSCE)	