

**SOUTHERN ASSOCIATION OF COLLEGES AND SCHOOLS  
COMMISSION ON COLLEGES  
SUBSTANTIVE CHANGE PROSPECTUS  
UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE**

**Doctor of Philosophy in Civil Engineering**

<b>Name of Institution:</b> University of North Carolina at Charlotte	
<b>Location:</b> 9201 University City Blvd., Charlotte, NC 28223	
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<b>Date Submitted:</b> December 13, 2018	

## List of Degrees

[List of degrees](#) that the institution is authorized to grant. As a subset of each degree, list majors available.

## List of Existing Approved Off-campus Sites and Addresses

List of [existing approved off-campus sites](#), their addresses, and programs. This is where 50% or more of the courses in a program is offered.

## Abstract

The Doctor of Philosophy in Civil Engineering (Ph.D. in Civil Engineering) will provide doctoral-level education for students seeking civil engineering careers in practice, research, and teaching/academia. The program is a terminal research degree that lays emphasis on the mastery of discipline-specific concepts relevant to the resilience of critical facilities and civil infrastructure. Emphasis will be placed on demonstrating mastery of knowledge in a specific subject area of civil engineering through advanced research skills and the ability to synthesize, create innovative ideas, and ultimately make original contributions to the discipline. The proposed date for implementation is August 2019. The projected number of students for the first cohort is eight.

Demand for a Ph.D. in Civil Engineering is broadly framed by the nexus of infrastructure and the economy. According to the American Society of Civil Engineers ([ASCE](#)), “The United States needs to invest \$1.4 trillion in infrastructure between 2016 and 2025 and \$5.2 trillion by 2040; without such investments, the U.S. economy could lose almost \$4 trillion and 2.5 million jobs by 2025 and \$14.2 trillion and 5.8 million jobs by 2040 due to lost productivity. As a result, future federal, state, and local investments to repair and enhance ailing infrastructure may drive demand for civil engineers.” While Ph.D. in Civil Engineering programs are common in states similar in size to North Carolina, North Carolina ranks last in terms of CE Ph.D. programs relative the population (see Hanover Research Report, Request to Plan, Appendix 1, Tables 8-9). Furthermore, Charlotte is the 17th largest city in the U.S. and is the only city in the top 33 by population without a Ph.D. in Civil Engineering program. The closest CE Ph.D. program is 100 miles away at the University of South Carolina in Columbia, South Carolina.

UNC Charlotte is uniquely qualified to offer a Ph.D. in Civil Engineering because the university already offers a Master of Science degree in civil engineering, an inter-institutional Ph.D. program with NC State, and the current interdisciplinary Ph.D. program (Infrastructure and Environmental Systems) in which the Civil Engineering and Environmental Department participates. The Ph.D. in Civil Engineering fits with strategic plans for both the department and the University. The new degree is endorsed by the department and college [industry advisory boards](#) and its inclusion reflects a complete set of degrees in civil engineering to students in the Charlotte region and beyond. Therefore, prospective students from any of the following categories will serve as the primary target audience for the program: (a) graduating seniors currently enrolled in the Department of Civil and Environmental Engineering; (b) alumni who have received a bachelor’s degree in civil engineering within the last ten years; and (c) alumni who have received a master’s degree in civil engineering within the last ten years.

The Ph.D. in Civil Engineering program requires successful completion of at least 74 approved graduate credits beyond the baccalaureate degree. Up to 30 approved credits from graduate courses taken during the student’s master’s degree, which may have been taken at another university, and transferred into the program. Concentrations will include: 1) environmental and geo-environmental, 2) structural and

geotechnical, and 3) transportation engineering. Instruction will be delivered in a traditional, face-to-face format, on the UNC Charlotte campus.

The program will be administered in a face-to-face format on-campus by the Department of Civil and Environmental Engineering, in the William States Lee College of Engineering (COE). The Department of Civil and Environmental Engineering is currently housed in the Energy Production and Infrastructure Center (EPIC) building and is integral to the vision of interdisciplinary research and education in energy funded by the North Carolina General Assembly: \$76 million for the building and recurring funds for programming, faculty and staff.

There are several strengths that qualify UNC Charlotte to offer the Ph.D. in Civil Engineering. For example, the Department of Civil and Environmental Engineering has more than 20 years of participation in the inter-institutional Ph.D. program with North Carolina State University (NCSU) and 13 years of leading the interdisciplinary Infrastructure and Environmental Systems (INES) Ph.D. program at UNC Charlotte. In addition, the Department of Civil and Environmental Engineering faculty have demonstrated the ability to build, support, enhance, lead, and sustain a Ph.D. program that is relevant to local, regional, state, national and international students and employers.

### **Determination of Need and Program Approval**

The need for a Ph.D. in Civil Engineering was established by consultations with faculty and the chair of the Civil, Construction, and Environmental Engineering Department at North Carolina State University (NCSU) to ensure that the target market and student demand do not significantly overlap. We have developed a program that complements rather than duplicates NCSU's program. In contrast to the Ph.D. program at NCSU, where a majority of students tend to favor heavy theoretical and computational research, the proposed UNC Charlotte program is focused on field and experimental research. A higher percentage of research activity at UNC Charlotte is funded by private sector/industry sources in comparison to NCSU. The proposed Ph.D. in Civil Engineering program supports the COE goal of meeting the Charlotte area's demand for engineering graduates and assisting to create a pipeline of specially trained civil engineers with knowledge of the energy industry. The program complements NCSU's interdisciplinary nuclear energy physical infrastructure program by focusing in power transmission line and energy-related solid and liquid waste management research activities. NCSU produces doctoral graduates whose employment objectives are focused on faculty positions at national and international research universities. We anticipate that graduates from this program will be employed by a wider range of employers including industry. In keeping with our niche as North Carolina's urban research university, the Ph.D. in Civil Engineering focuses on access to quality education and providing specially trained civil engineers to industry, and particularly to the energy industry in the Charlotte area.

### **Student Demand**

Student demand was evaluated by an external consultant (Hanover Research). Results indicated that international students represent a key audience, with enrollment having increased 11.5% nationwide between 2009 and 2014. Student demand is particularly strong and growing for the transportation specialization. Overall, doctoral enrollments in civil engineering fields increased between 2011 and 2015. The demand for civil/environmental engineering expertise experienced a 16.2% average annual growth during this period.

Student demand for a Ph.D. in Civil Engineering at UNC Charlotte was also assessed by surveying a pool of prospective students in the summer of 2015. The survey consisted of asking a set of questions to a diverse pool of students. The survey invitation was sent to the following potential students:

- Graduating seniors currently enrolled in the Department of Civil and Environmental Engineering;
- Alumni who have received a bachelor's degree in civil engineering within the last ten years; and
- Alumni who have received a master's degree in civil engineering within the last ten years.

The combined survey results for all survey participants (527 surveyed, 57 responded) indicate that more than 90% of the respondents are in favor of offering a Ph.D. in Civil Engineering at UNC Charlotte, and 90% of the respondents would consider UNC Charlotte if they were to pursue the degree. Because of the lack of such a degree offered within a distance of 100 miles from Charlotte, some of these students are seeking Ph.D. degrees from other universities and some are pursuing the multi-disciplinary Ph.D. offered via the INES program at UNC Charlotte. Overall, the survey results demonstrate that the proposed Ph.D. in Civil Engineering program has a suitable pool of potential students for recruitment and that students welcome the opportunity to pursue a Ph.D. in Civil Engineering at UNC Charlotte.

### Assessment of Need

The Ph.D. in Civil Engineering is consistent with the William States Lee College of Engineering vision of providing quality educational experiences and discovering and disseminating knowledge that serves the citizens and industries of local, national and international communities. The program will also fulfill the state's mandate for EPIC to drive innovation within electrical, civil and mechanical engineering disciplines with new advancements in the energy fields while educating a new generation of engineering professionals. Disciplines critical to the energy industry are electrical engineering, mechanical engineering, and civil engineering. Currently, the University is able to meet the state mandate in just two of the three fundamental engineering disciplines. All three levels (B.S., M.S., and Ph.D.) are vital for EPIC, industry, and the state to succeed.

In an economic impact analysis study demonstrating the collective value of the UNC System (16 public baccalaureate-granting institutions), the return on investment findings by Economic Modeling Specialists International (EMSI) (2015) recognized UNC Charlotte for a 440% average return on investment for taxpayers, yielding a 5.4 benefit-cost ratio or \$5.40 returned to the region for every dollar spent for the fiscal year 2012 - 2013. For the same period, start-up companies and UNC Charlotte alumni currently employed in Charlotte region contributed \$2.1 billion and \$1.4 billion, respectively.

The University has strengthened its partnership with high-technology specialty and technology intensive industries including physical facility procurement companies (e.g., AECOM and AREVA), energy utilities (e.g., Duke Energy), manufacturing companies (e.g., Siemens and Westinghouse), design and construction management firms (e.g., CB&I), and research development and demonstration institutions (e.g., EPRI) in the Charlotte region. UNC Charlotte, through EPIC, has already invested heavily in infrastructure and research facilities to support the doctoral-level education and research in civil engineering. With a well-established engineering program, excellent research and instructional facilities, partnership with technology intensive industry employers and healthy return on investment, UNC Charlotte is a desirable, unique, and cost effective place to initiate the proposed Ph.D. in Civil Engineering.

The need for a terminal degree in civil engineering is also related to recent efforts by the American Society of Civil Engineering (ASCE), which is the primary professional organization for civil engineers and is supported by many employers in consulting, government and industry. Consistent with [ASCE Policy 465](#), the master's degree in civil engineering is emerging as the entry-level degree. A bachelor's degree is not enough for entry into the profession. As such, those seeking to distinguish themselves from entry-level status will be more likely to pursue a Ph.D. The market for jobs in industry will increase, even for Ph.D. graduates, especially given that the Bureau of Labor Statistics has forecasted the civil engineering job growth rate to be 20% over the coming decade; this is twice as much as the national average and four to five times that of any other engineering sub-discipline. In the future, master's degrees will focus more on providing the required technical expertise primarily through coursework, and the proposed Ph.D. degree in Civil Engineering will emphasize advanced studies and industry relevant research. Demand for Ph.D. graduates in civil engineering is not limited to the research and development (R&D) industry, community colleges and universities, but also to filling the increasing demand of these graduates from civil engineering consulting and contracting companies.

### Program Planning

The proposed Ph.D. in Civil Engineering is closely aligned with a number of our University goals including those which:

- a. Deliver high quality, affordable, and effective educational programs that produce educated and responsible citizens and a competitive workforce,
- b. Stimulate increased research, creative activities, and community engagement with a focus on programs and partnerships that address the major needs of the Charlotte region, and
- c. Enhance opportunities for learning and working together in a socially and culturally diverse world.

Moreover, as North Carolina's urban research university, the proposed Ph.D. in Civil Engineering enables UNC Charlotte to meet its institutional mission which is to:

*"Leverage its location in the state's largest city to offer internationally competitive programs of research and creative activity, exemplary undergraduate, graduate, and professional programs, and a focused set of community engagement initiatives. Maintain a particular commitment to addressing the cultural, economic, educational, environmental, health, and social needs of the greater Charlotte region"*

The new degree supports one of the College's goal, to meet the Charlotte area's demand for a graduate program while assisting EPIC in creating a pipeline of specially trained civil engineers with knowledge of the energy industry. The new degree is also consistent with the William States Lee College of Engineering's vision to provide quality educational experiences, discovery and dissemination of knowledge that serves the citizens and industries of local, national and international communities.

The Ph.D. in Civil Engineering is reflected in the Department of Civil and Environmental Engineering's 2015-2020 strategic plan, which is endorsed by the Department and college industry advisory boards. It reflects a natural evolution to offer a complete set of degrees to the citizens in the Charlotte region and beyond.

### Program Approval

The approval process for graduate courses establishes the review procedures for all new and modified courses. This process begins with review and approval at the departmental level, proceeds through collegiate curriculum committees and deans before reaching the Graduate Council; this is a subcommittee of the Faculty Council and consists entirely of faculty. The Graduate Council is also responsible for ensuring the quality and content of the curriculum, as well as the resulting [course and curriculum approvals](#). Finally, any proposals to establish new courses or programs (or modification of existing courses or programs) are reviewed by the Faculty Executive Committee and the Faculty Council for approval and implementation consideration.

The Ph.D. in Civil Engineering program received input from faculty, administrators, and industry advisory boards at UNC Charlotte throughout the development of the proposal. In addition to the UNC Charlotte campus review process, the UNC System approval process now involves distribution of proposed new graduate programs to all institutions in the UNC System for review and comment prior to action by the UNC System Board of Governors. Comments, suggestions, and questions received during this review process were addressed and incorporated at each step of the review process. [The UNC System Board of Governors](#) approved the Ph.D. in Civil Engineering on July 27, 2018.

### **Program Details**

The UNC Charlotte Ph.D. in Civil Engineering will provide research intensive doctoral-level education for students seeking civil engineering careers in practice, research and teaching/academia. The program will focus on the mastery of civil engineering discipline-specific concepts relevant to the resilience of critical facilities and civil infrastructure. Emphasis will be placed on demonstrating mastery of knowledge in a specific subject area of civil engineering through advanced research and synthesis skills, and the creation of innovative ideas. The program also requires students to have mastery and understanding of complex systems and critical infrastructure in order to make original contributions to the advancement of knowledge in critical facilities and civil infrastructure. Our evaluation plans for the proposed Ph.D. in Civil Engineering encompass the criteria to evaluate the quality and effectiveness of the program as well as the Student Learning Outcomes (SLO).

### Student Learning Outcomes

The Student Learning Outcomes of the Ph.D. in Civil Engineering are outlined below:

**SLO #1:** Students will analyze and evaluate advanced topics in civil engineering through written reports.

**SLO #2:** Students will communicate technical information through written reports.

**SLO #3:** Students will analyze and evaluate advanced topics in civil engineering through oral presentation.

**SLO #4:** Students will communicate technical information through oral presentation.

The [SLO assessment plan](#) for the program is included.

## Course Requirements

The doctoral degree is awarded for depth of knowledge in a field and completion of scholarly research that advances the knowledge base in the area of concentration. This level of achievement is demonstrated by a successful completion of appropriate coursework and a dissertation defense. The Ph.D. in Civil Engineering will require a minimum of 74 credit hours of study inclusive of 18 credit hours of dissertation research post Bachelor's degree in civil engineering. Applicants who hold a relevant master's degree in civil engineering, either from UNC Charlotte or another institution, may be eligible to pursue the Ph.D. in Civil Engineering with advanced standing. Eligibility for this accelerated option must be made at the time of admission to the program, and is subject to review by the Graduate School. Under the advanced standing option, students must complete 44 credit hours, including 18 credit hours of dissertation research. Students must also complete the Responsible Conduct of Research course (GRAD 8002) and the Academic Integrity course (GRAD 8990). [Descriptions](#) of these courses and a [Schedule of Course Offerings](#) are provided.

### Required Courses (20 credits)

- GRAD 8002\* Responsible Conduct of Research (2 credits)
- GRAD 8990\* Academic Integrity (0 credits)
- CEGR 8999\* Dissertation Research (18 credits)

*Concentration (15 credits at the 8000 level for students with advanced standing, 45 credits with 30 credits at the 8000 level for students without advanced standing), to be chosen from the following*

### Environmental and Geo-Environmental Engineering Concentration

*(Courses designated with \*\* are cross-listed at 6000/8000 level)*

- CEGR 5090 Water Treatment Principles (3 credits)
- CEGR 5142 Water Treatment Engineering (3 credits)
- CEGR 5144 Engineering Hydrology (3 credits)
- CEGR 5145 Groundwater Resources Engineering (3 credits)
- CEGR 5147 Storm water Management (3 credits)
- CEGR 5242 Wastewater Treatment Design (3 credits)
- CEGR 5247 Sustainability (3 credits)
- CEGR 5264 Landfill Design (3 credits)
- CEGR 6090/8090\*\* Drinking Water Treatment Processes (3 credits)*
- CEGR 6090/8090\*\* Unsaturated Flow Modeling (3 credits)*
- CEGR 6090/8090\*\* Applied Environmental Microbiology (3 credits)*
- CEGR 6090/8090\*\* Environmental Organic Chemistry (3 credits)*
- CEGR 6141/8141\*\* Water Quality Modeling (3 credits)*
- CEGR 6173/8173\*\* Environmental Aquatic Chemistry (3 credits)*
- CEGR 6243/8243\*\* Physical Processes in Environmental Systems (3 credits)*
- CEGR 6244/8244\*\* Chemical Fate and Transport (3 credits)*
- CEGR 6245/8245\*\* Chemical & Biological Process in Environmental Systems (3 credits)*
- CEGR 6090/8090\*\* Research Methods and Experiments (3 credits)*
- CEGR 6090/8090\*\* Renewable Energy (3 credits)*
- CEGR 6252/8252 Soil Dynamics (3) –Offered on an “as needed” basis*

### **Structural and Geotechnical Engineering Concentration**

*(Courses designated with \*\* are cross-listed at 6000/8000 level)*

CEGR 5108	Finite Element Analysis & Applications (3 credits)
CEGR 5122	Power Plant Design (3 credits)
CEGR 5126	Codes, Loads and Nodes (3 credits)
CEGR 5222	Structural Steel Design II (3 credits)
CEGR 5223	Timber Design (3 credits)
CEGR 5224	Advanced Structural Analysis (3 credits)
CEGR 5226	Reinforced Concrete Design II (3 credits)
CEGR 5270	Earth Press & Retaining Structure (3 credits)
CEGR 5271	Pavement Design (3 credits)
CEGR 5278	Geotechnical Engineering II (3 credits)
<i>CEGR 6090/8090**</i>	<i>Introduction to Structures in Fires (3 credits)</i>
<i>CEGR 6090/8090**</i>	<i>Power Transmission Structure Design (3 credits)</i>
<i>CEGR 6090/8090**</i>	<i>Discrete Element Method Theory &amp; Applications in Engineering (3 credits)</i>
<i>CEGR 6090/8090**</i>	<i>Advanced Concrete Material (3 credits)</i>
<i>CEGR 6090/8090**</i>	<i>Pre-stressed Concrete (3 credits)</i>
<i>CEGR 6090/8090**</i>	<i>Structural Systems (3 credits)</i>
<i>CEGR 6090/8090**</i>	<i>Forensic Investigations (3 credits)</i>
<i>CEGR 6124/8124**</i>	<i>Masonry Design (3 credits)</i>
<i>CEGR 6125/8125**</i>	<i>Structural Strengthening (3 credits)</i>
<i>CEGR 6128/8128**</i>	<i>Structural Optimization (3 credits)</i>
<i>CEGR 6129/8129**</i>	<i>Structural Dynamics (3 credits)</i>
<i>CEGR 6251/8251**</i>	<i>Foundation Engineering (3 credits)</i>
<i>CEGR 6254/8254**</i>	<i>Experimental Soil Mechanics (3 credits)</i>
<i>CEGR 6255/8255**</i>	<i>Slope Stability and Earth Structures (3 credits)</i>
<i>CEGR 6268/8268**</i>	<i>Advanced Soil Mechanics (3 credits)</i>

### **Transportation Engineering Concentration**

*(Courses designated with \*\* are cross-listed at 6000/8000 level)*

CEGR 5090	Railway Dynamics (3 credits)
CEGR 5090	Airport Terminal Design (3 credits)
CEGR 5161	Advanced Traffic Engineering (3 credits)
CEGR 5162	Transportation Planning (3 credits)
CEGR 5168	Airport Planning and Design (3 credits)
CEGR 5185	Geometric Design of Highways (3 credits)
CEGR 5262	Traffic Engineering (3 credits)
<i>CEGR 6090/8090**</i>	<i>Connected and Autonomous Vehicles (3 credits)</i>
<i>CEGR 6161/8161**</i>	<i>Traffic Control and Operation (3 credits)</i>
<i>CEGR 6162/8162**</i>	<i>Computer Applications for Transportation Engineers (3 credits)</i>
<i>CEGR 6163/8163**</i>	<i>GIS for Civil Engineers (3 credits)</i>
<i>CEGR 6164/8164**</i>	<i>Traffic Safety (3 credits)</i>
<i>CEGR 6166/8166**</i>	<i>Urban Transportation Networks (3 credits)</i>
<i>CEGR 6182/8182**</i>	<i>Transport Systems Analysis (3 credits)</i>
<i>CEGR 6183/8183**</i>	<i>Intelligent Transportation Systems (3 credits)</i>



### Additional Coursework Requirement (9 credits)

Each student must take an additional 9 credit hours at the 8xxx-level, either in an area outside the concentration or outside the department. The coursework will be selected by the student, subject to the approval by the Ph.D. academic advisor.

### Program Admission and Graduation

Application to the proposed doctoral program will follow existing Graduate School and Department of Civil and Environmental Engineering admissions processes. The UNC Charlotte application process is completely online. To apply for graduate studies in the Department of Civil and Environmental Engineering, all applicants must submit the following application materials to the UNC Charlotte Office of Graduate Admissions:

- Graduate School Application for Admission (online)
- Application Fee (payable online)
- Unofficial transcripts from all previous college-level institution(s) attended (submitted online); if admitted, official transcripts must be submitted to the Graduate School prior to joining the program. Certified translations (if needed) and degree certifications are required if the degree was earned outside the U.S.
- Official TOEFL scores
- A minimum TOEFL score of 220 (computer-based), 557 (paper-based), or 83 (internet-based) or a minimum IELTS band score of 6.5 required from any applicant whose native language is not English.
- A statement of purpose (essay indicating research interest and potential faculty advisor) submitted online as part of the application submission process
- Three recommendations (submitted online by recommenders)

In addition to the general requirements for admission to the Graduate School, the Department of Civil and Environmental Engineering seeks the following from applicants to the doctoral program:

#### *Applicants with a Master's Degree in CE - Eligible to Pursue the Ph.D. Degree with Advanced Standing:*

- An earned master's degree in civil engineering (Master of Science in CE, MSCE or Master of Science in Engineering, MSE with emphasis in civil engineering)
- A master's degree GPA of 3.0 or better
- A satisfactory score (>50<sup>th</sup> percentile) from the aptitude portion of the GRE

#### *Applicants with a Bachelor's Degree in CE - Eligible to Pursue the Ph.D. Degree:*

- An earned bachelor's degree in civil engineering (Bachelor of Science in CE, BSCE) from an ABET or internationally accredited college or university in civil engineering
- A bachelor's degree GPA of 3.0 or better
- A satisfactory score from the aptitude portion of the GRE

The Department of Civil and Environmental Engineering accepts the transfer of related doctoral level courses (maximum of 6 credit hours) taken at another institution or from UNC Charlotte prior to

admission to the Ph.D. in Civil Engineering. These courses must be part of the recommended list of courses in the doctoral student's area of concentration. Further, these credit hours cannot be counted toward another degree.

### Graduation

To earn the degree, a student with a master's degree is expected to satisfactorily complete all 44 credit hours of required courses and a student with a bachelor's degree must complete 74 credit hours; both groups must achieve an overall GPA of 3.0. Students who fail to maintain satisfactory progress toward their program or who do not achieve commendable or satisfactory grades in all their graduate coursework are subject to suspension and/or termination from their program of study and/or the Graduate School. Per the policy of the Graduate School, no course older than six years may be applied towards a master's degree (including transfer credit). No more than six semester hours of graduate transfer credit may be applied toward the degree.

### Definition of a Credit Hour

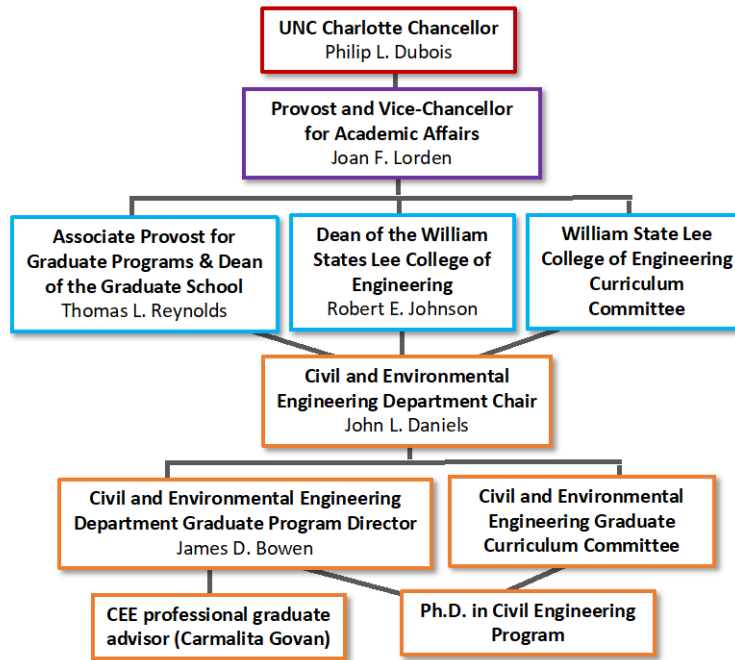
The course and curriculum development process is governed by the [Standing Rules of the Faculty Council](#). Faculty members in academic departments develop and complete the [required steps in Curriculog, the University's online course and curriculum change system](#), for new courses and revisions to courses. As part of the proposal, faculty are asked to provide a [draft catalog copy](#) for the course that includes the amount of credit to be awarded. Graduate faculty must also submit a [draft course syllabus](#) that includes the number of credits. The departmental and collegiate curriculum committees are responsible for verifying the credit hours for new courses and revisions to courses based on documentation of the amount of work expected by faculty in the class.

Existing and new courses represent best practices of credit calculations nationwide by following the federal definition of Carnegie Units. It is recommended that faculty members include the [Suggested Standard Syllabus Policies](#) (p. 2). All departments are required to verify that the credit awarded for new courses conform to federal and Commission policy and will indicate such through required steps and documentation submitted during the Curriculog course proposal process.

### Program Oversight

The proposed Ph.D. in Civil Engineering program will be administered within the Department of Civil and Environmental Engineering that is part of the William States Lee College of Engineering (COE), as illustrated by the organizational chart below. The Department of Civil and Environmental Engineering has a Graduate Program Director who will direct recruiting, admissions, advising, and oversight of graduate students within the Ph.D. in Civil Engineering program. A professional graduate advisor assists the Graduate Program Director in advising and recruiting. Faculty committees (e.g. civil and environmental engineering graduate curriculum committee) assist with curriculum, recruiting, admissions, and student advising. The Graduate Program Director will report to the Department of Civil and Environmental Engineering Department Chair, who has ultimate responsibility for all programs within the department. The Department of Civil and Environmental Engineering Chair reports to the Dean of the College of Engineering. Overall administration of all University graduate programs is provided by the Dean of the Graduate School. Oversight of the graduate curriculum is provided by the College's graduate curriculum committee. The Dean of College of Engineering reports to the Provost, who in turn reports to the Chancellor.

**Figure 1. Organizational Chart for the Doctoral Program in Civil Engineering**



Ph.D. in Civil Engineering Organizational Chart

The following describes a governance structure and processes of the Civil Engineering program

- *Graduate School:* The Graduate School is responsible for setting policy regarding the operation of all graduate programs of the University of North Carolina at Charlotte. These policies cover minimum admission standards and performance requirements for successful completion of graduate degree programs. The Ph.D. in Civil Engineering program will be subject to the rules and policies of the Graduate School. The Graduate School is responsible for collecting the material for applicants to the program and forwarding completed application packets to the Civil Engineering Program Director.
- *Dean of the Graduate School:* At UNC Charlotte, the Dean of the Graduate School is the administrative officer with primary responsibility for the supervision of graduate programs. The Dean is responsible for the executive and administrative affairs of the Graduate School in accordance with policies determined by the UNC Charlotte Graduate Council, the Graduate Faculty, and the Faculty Council. It is anticipated that the Dean of the Graduate School will communicate with the Dean of the College of Engineering on important programmatic issues. The Graduate Dean's primary duties include the following:
  - Final admission of students;
  - Approval of programs of study; and
  - Admission of students to candidacy.

- *Dean of The William States Lee College of Engineering:* The College Dean has the administrative responsibility for supervision of all departments and programs housed within the College.
- *Civil and Environmental Engineering Program Director*
  - Recommends operating budgets and supervises expenditures;
  - Chair meetings of the Department of Environmental Engineering;
  - Communicates assessment of the program and personnel to the chairs of participating departments and the Dean of the College of Engineering and the Graduate School;
  - Oversees recruitment efforts for the program;
  - Coordinates the scheduling of courses;
  - Assures proper maintenance of graduate student records;
  - Represents the program to external constituencies.
- *Civil and Environmental Engineering Faculty:* The Ph.D. in Civil Engineering Faculty will be comprised of those members of the Graduate Faculty at UNC Charlotte who will participate in the program as advisors and instructors in component courses. It is expected that the credentials presented by a civil engineering program graduate faculty member will include a list of journal publications, externally funded research grants and prior experience in supervising master's theses and/or doctoral dissertations, as well as a research program relevant to the goals of the program.
- *Civil and Environmental Engineering Professional Graduate Advisor:*
  - Assists the program director with advising and recruitment.
  - Works with graduate students to evaluate and track their progress toward graduation.
  - Collaborates with faculty members in the Civil and Environmental Engineering Department to provide additional information/services/programming to graduate students.

## **Faculty Qualifications**

All Civil and Environmental Engineering faculty members are qualified to teach, chair and serve on graduate student committees, and fully engage in all graduate matters within their colleges and the University as appointed regular graduate faculty following the procedures for appointment as stated by the Graduate Council. No new faculty hires are needed to implement the proposed Ph.D. in Civil Engineering. The program will facilitate increased research productivity and external funding acquisition with the present faculty workforce.

The faculty members expected to teach in the Ph.D. in Civil Engineering program are identified in the [faculty roster](#). This demonstrates that faculty possess the required credentials or demonstrated competencies and achievements to teach in the program.

The percentage of courses taught by part-time faculty ranges from 5-10%. No graduate assistants will teach in this program. This demonstrates that both the number and percentage of full-time faculty is adequate to perform the basic functions of the academic programs.

## Library and Learning Resources

[J. Murrey Atkins Library](#) is the primary library at the University of North Carolina at Charlotte and will be the main library for the Ph.D. in Civil Engineering program. The Atkins library has 91 employees, including 35 faculty members and 56 support staff. The Atkins Library facilities contain approximately 285,000 square feet, most of which is devoted to the Library's million-volume collection. The Library's main collections consist of the following materials:

<b>Books</b>	1,370,351
<b>Serial Titles</b>	86,331
<b>Licensed Databases</b>	660
<b>Ebooks</b>	892,234

Current library holdings in the J. Murrey Atkins Library at UNC Charlotte are adequate to support the instructional and research needs of the Ph.D. in Civil Engineering program. The library has been systematically acquiring electronic back volumes of journals to fill gaps in the collection. However, gaps in the collection can be managed through interlibrary loan. The following is a brief analysis of the library's current relevant holdings:

<b>Books</b>	15,796
<b>Government Documents</b>	247 + 10 (websites)
<b>Electronic Books</b>	16,931
<b>Journals</b>	704
<b>Library Subscriptions</b>	74 (e-videos)
<b>Databases</b>	22

Enrolled students can request research assistance in person, by telephone, chat, text, or email from the library's homepage. [Research Guides](#) are available electronically 24/7 for assistance with a specific course or particular subject area. The J. Murrey Atkins Library has a librarian available to train students on the use EndNote citation management software. Currently, the library provides EndNote to the Bachelor and Master of Science students, and will continue to provide training for doctoral students. In addition, discipline-specific, [research librarians](#) are available to assist students. Additional library staffing will not be needed to support the Ph.D. in Civil Engineering program.

Atkins Library has an Engineering Librarian who is available to help students connect to local resources. This person also works closely with students currently enrolled in the Bachelor and Master of Science in Civil Engineering programs. The Engineering Librarian will continue to work with students in the Ph.D. in Civil Engineering program. The Engineering Librarian will also work with Department of Civil and Environmental Engineering faculty to create a list of core and supplementary titles for the program. This list will be revisited as new courses are added or new texts are published. Books will be purchased in electronic (e-book) format whenever possible. Titles that are not available or cost-effective to purchase as e-books will be purchased in print with the option for students to have books shipped to their house or to have chapters scanned and emailed to them. This offers an economical way to add high-priced texts to the collection. The acquisition of e-books is a top priority for the library. The library's current database subscriptions should remain sufficient to serve the Ph.D. in Civil Engineering program as it grows.

There are no plans to formally partner with other libraries within the UNC system to provide services to civil engineering students. Students who are able to visit other UNC-system libraries may check out

items through [UNC's Cooperative Direct Borrowing Agreement](#). In addition, students may visit these libraries and use the databases in-house. Students enrolled in the Ph.D. in Civil Engineering program will have off-campus access to all of the resources provided on-campus through the Atkins Library's homepage.

The following is a brief analysis of the library's current relevant holdings for civil and environmental engineering:

<b>Catalog Searches Performed</b>	<b>Total Results</b>	<b>Results Less Than 3 Years Old</b>
Civil Engineering	5515	743
Structural Engineering	4129	613
Environmental Engineering	13329	1696
Water Engineering	4063	424
Transportation Engineering	6293	553
Geotechnical Engineering	1213	375

<b>Subject heading is exact</b>	<b>Books/eBooks total</b>	<b>Books/eBooks &lt; 5 years old</b>
1. Environmental Engineering	8,676/3,620	1,291/1,260
2. Geoenvironmental Engineering	13/6	4/3
3. Geotechnical Engineering	1,199/947	515/509
4. Structural Engineering	1,554/669	289/272
5. Transportation Engineering	1,150/324	209/167

### **InCites Journal Citation Reports**

<u>Category</u>	<u>Library Subscriptions</u>
Civil Engineering	24 of top 25 journals
Environmental Engineering	25 of top 25 journals
Engineering, Geological	20 of top 25 journals
Transportation Science and Technology	25 of top 25 journals
Transportation	23 of top 25 journals

### Use of Technology

Multiple UNC Charlotte departments are involved in fostering, training, and supporting the use of technology to enhance student learning. The primary mission of the Center for Teaching and Learning (CTL) is to help faculty develop meaningful and pedagogically sound approaches to their teaching. The Center provides professional development workshops, software, and support to allow faculty to teach effectively with technology. Working in conjunction with the Center are the [Information Technology Services department](#) (ITS), the Library, and IT departments in each of the colleges.

ITS provides the [software](#) and [training](#) for students to make the best use of the extensive technology resources available on campus. In addition, a wide variety of professionally developed training courses is provided through the [Skillport System](#). The Library's Information Commons (IC) staff provide online resources and classes for students in the Library. The curriculum ranges from foundational instruction

for the first-year writing program to differentiated instruction in upper-level and graduate courses. The college IT groups provide dedicated local support for faculty and students to help them make the best use of the technology in discipline-specific ways. Assistance provided by the college IT groups includes helping faculty find pedagogically appropriate technologies for their classroom instruction, tailoring computer labs to specific instructional needs, and assisting students with their needs.

[Audiovisual Integration Support for Learning Environments \(AISLE\)](#) provides support for the video conferencing facilities that support both traditional educational programs and distance learning programs, and state-of-the-art technology for the classrooms on campus, ensuring that faculty have access to modern tools such as smartboards and video capture.

ITS and the [Center for Teaching and Learning](#) provide a comprehensive suite of online technology resources that support instruction on campus, online, and through distance education. The principal vehicle for this delivery is our Learning Management System (LMS). This integrated platform (Canvas) is the center point for the delivery of technology in support of teaching. Every student enrolled at the University automatically has access to Canvas; this provides students with structured access to faculty email, course announcements and feedback. In addition, the LMS is the single point of entry for other important learning tools such as Video Content Management, Document Collaboration, Secure Testing, Synchronous Learning (WebEx), integrated response systems (clickers), and plagiarism detection. The Center for Teaching and Learning provides training to faculty who teach online and blended courses. The Center offers courses on Canvas, course design, Quality Matters, etc.

## **Student Support Services**

The [Graduate School's](#) role is to foster excellence in all dimensions of post-baccalaureate studies as the primary advocate for graduate education and for graduate students at the University. It administers student admissions, financial aid, orientation, professional development, student mentoring, peer advising, funding support, and training for Teaching Assistants.

- The Graduate School strategically plans, implements, and evaluates services and programs to facilitate student enrollment and success. This unit collaborates with many offices in Academic Affairs, such as the Office of Financial Aid and the Office of the Registrar, to facilitate seamless services for graduate students. The Graduate School also coordinates with graduate program directors in each program to ensure that admitted students receive the faculty support needed to be successful.
- The [Center for Graduate Life](#) (CGL) provides graduate students with centralized space dedicated to their needs and creates a stronger graduate community by promoting shared experiences, discourse, and activities designed to support interdisciplinary learning. Professional development courses and workshops, which are provided by CGL, support the development of “core competencies” in teaching, research, writing, leadership and ethics of graduate students. Mentoring support, teaching assistant training, and personal development programs are also offered through the Center.
- Consistent with the institution’s mission of promoting student learning and development of its students, the [Graduate and Professional Student Government](#) works closely with the Assistant Dean for Student Affairs in The Graduate School to promote student self-governance and student leadership.

The Graduate School partners with many units on campus to offer services that enrich and support the graduate student community. Working with offices in the divisions of Academic Affairs and Student Affairs, students have access to a broad range of services that support their educational experience and success. Examples of university-level student support programs, services, and activities that support student learning and success include, but are not limited to:

- [Dean of Students](#) Office manages a variety of activities such as women’s programs, new student programs, volunteer outreach, student conduct, off-campus student services, SAFE mentoring program, sorority and fraternity life, Niner Nation Family program, and veteran students outreach.
- [Disability Services](#) ensures access to academic programs and campus facilities by providing verification of medical documentation, academic accommodations, counseling, testing, note-taking, and scholarships.
- [University Career Center](#) offers career assessment, internships, co-ops, service learning, job preparation, and job interview opportunities. This center connects industry and community partners with graduate students in a variety of ways.
- [Writing Resources Center](#) offers one-to-one writing instruction in writing across the disciplines from first-year to graduate, presentations, and workshops. Consultations, on-line services, and a library of writing-related instructional materials are also available. The WRC hires graduate students as tutors, helping to meet the need for advanced writing assistance.

## **Physical Resources**

The proposed program will not have an impact on current physical facilities or equipment. The primary infrastructure (i.e. testing and modeling laboratories, computing resources and software, classrooms, and office space) currently exists to implement the Ph.D. in Civil Engineering program. The existing INES Ph.D. program provides evidence of our present capabilities and capacity. The following existing facilities and equipment are available:

### High-Bay Structures Lab

The EPIC Building houses the High-Bay Structures Lab, a three-story, 7500 square-foot space for testing full-scale or model structures and foundations under large static or quasi-dynamic loads. This facility is one of only ten such laboratories in the U.S. The Lab features interior and exterior strong-floor foundations; two 32-ft tall, 1.2 million pound capacity strong walls in an L-shaped plan; three geotechnical test pits (12ft square x 5ft deep, 12ft square x 10ft deep, and 10ft in diameter x 10ft deep); two free-standing structural steel reactions frames (one spanning over the geotechnical test pits); two tandem/independent 30-ton overhead cranes that run the length of the lab; and a second-level mezzanine with control room and observation area. Numerous actuators and jacks, pumps and hoses, supporting hydraulic equipment, data acquisition systems, sensors/instrumentation, and a wealth of heavy-lifting equipment and tools are available for use in the lab. The High-Bay Lab is also supported by a fabrication/machine shop, an exterior courtyard, and numerous nearby rooms for specialized testing.

### ISERRT Center



The Infrastructure Security and Emergency Responder Research and Training (ISERRT) Center’s mission is to make positive contributions to the security and resilience of infrastructure, personnel, and related assets through basic and applied research, education, and training. ISERRT Center personnel developed and operate two open-arena blast/impact/ballistics/fire testing facilities, the ISERRT Facility in Gastonia NC and the military-grade ISERRT-M Facility in Maxton NC.

The Physical Security Lab supports modeling efforts, field testing of structures, and testing of structures and components conducted at the ISERRT or ISERRT-M Facilities. Further, the Lab is the “learning community” base for all students involved in physical security research. Other structural and materials facilities include the following: Experimental Structural Dynamics and Health Monitoring Lab, Construction Materials Development Lab, Structural Materials Testing Lab, and Visualization Lab.

## **Financial Support**

The United States Department of Education has imposed no limitations, suspensions, or terminations with respect to the Title IV student financial aid programs. UNC Charlotte operates on the electronic transfer/advance payment method with respect to its federal funds and has not been placed on the reimbursement method. It has not been obligated to post a letter of credit on behalf of the U.S. Department of Education or other financial regulatory agency. There have been no complaints filed with the Department of Education regarding UNC Charlotte, and there are no impending litigation issues with respect to financial aid activities. The University is not aware of any infractions to regulations that would jeopardize Title IV funding.

The North Carolina Legislature, as part of the overall State budget, allocates funding for the University of North Carolina system, including UNC Charlotte. Within the UNC Charlotte budget, the State allocates a building reserve fund to cover maintenance and operation of existing facilities (housekeeping, maintenance, information technology, utilities, security, etc.), administered by UNC Charlotte’s division of Business Affairs. Day-to-day operating costs (office supplies, phone service, student workers, etc.) are funded through the division of Academic Affairs, under the direction of the Provost. The year one budget for the Ph.D. in Civil Engineering is included as **Table I**.

**Table 1. Summary of Estimated Additional Costs for Proposed Program (Year 1)**

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM					
INSTITUTION	UNC Charlotte	DATE	14-Dec-17		
Program (CIP, Name, Level)	14.0801, Civil Engineering, Doctorate				
Degree(s) to be Granted	Ph.D. in Civil Engineering	Program Year	Year 1 (2018-2019)		
Differential tuition requested per student per academic yr		\$0			
Projected annual FTE students		2			
Projected annual differential tuition		\$0			
Percent differential tuition for financial aid					
Differential tuition remainder		0			
ADDITIONAL FUNDS REQUIRED - BY SOURCE					
	Reallocation of Present Institutional Resources (CEE Dept)	Enrollment Increase Funds	Graduate Assistant Support Program (GASP)	Other New Allocations, Research Grants	Total
EPA/SPA Regular Salaries					
Graduate Program Director Stipend	10,000	0	0	0	10,000
EPA Academic Salaries					
	0	0	0	0	0
Social Security	0	0	0	0	0
State Retirement	0	0	0	0	0
Medical Insurance	0	0	0	0	0
Graduate Stipends and Payments					
RA/TA Salary, 2 at \$22000	33,000			11,000	44,000
Tuition Award, 2 at \$11054	0		22,108	0	22,108
Fee Payment, 2 at \$4961	7,442			2,481	9,922
Supplies and Materials	(Identify)	0	0	0	0
Current Services	(Identify)	0	0	0	0
Travel	\$6,747	3,253	0	0	10,000
Communications	\$2,000	0	0	0	2,000
Printing and Binding	\$2,000	0	0	0	2,000
Advertising	\$1,000	0	0	0	1,000
Fixed Charges	(Identify)	0	0	0	0
Capital Outlay (Equipment)	(Identify)	0	0	0	0
Libraries	0	603		0	603
<b>TOTAL ADDITIONAL COSTS</b>	<b>62,189</b>	<b>3,856</b>	<b>22,108</b>	<b>13,481</b>	<b>101,633</b>

Narrative:

**Year 1, Budget Narrative**

EPA/SPA Regular Salaries Stipends

The Ph.D. in Civil Engineering will be operated and administered in the Civil and Environmental Engineering Department. The program will be led by the Graduate Program Director, who also manages the Master’s program in the Department. The Director will receive an annual stipend of \$10,000. The amount is in keeping with stipend amounts paid by the Department for Program duties. The College of Engineering does not utilize a tuition differential. Funding for the stipend will come from reallocation of funds currently directed towards the Master’s program.

### Graduate Stipends, Tuition Payments, Fee Payments

For budgeting purposes, it is projected that eight students will join the Ph.D. in Civil Engineering program in year one, which will increase overall Ph.D. enrollment by two students (6 of 8 are assumed to transfer from the INES Ph.D. program). Teaching assistant (TA) support will represent 75% (6 of 8) of student stipends, with the remainder paid through grant supplied research assistant (RA) support. The Graduation Assistant Support Plan (GASP) run by the graduate school will fund 100% of tuition payments. In-state students are assumed to represent 50% of the total student enrollment.

Fee payments are allocated to the Civil and Environmental Engineering Department (via Teaching Assistants) and to research grants (via research assistants) using the same percentages as that for student stipends. Tuition and fees are based upon those of the current academic year (2017-2018) with an annual 2.0% inflation rate. Teaching and research assistant stipends are inflated at this same 2% rate.

### Travel

Funds will be used to support travel by the Graduate Program Director for recruiting and program development and to support student educational travel awards.

### Communications, Printing and Binding, Advertising, Library

Funding is needed for the production, publication, and distribution of program promotional materials in trade publications, mass media, and at academic conferences. These funds will also support preparation, printing, and distribution of annual reports and other program documents. As enrollment increases, funding will also be needed to support the library's acquisition of reference materials beyond those available at the outset of the program.

Facility renovations are not required to deliver this program. There will be no expenditures to external institutions or organizations for contractual or support services. Funding for equipment necessary to deliver the program has been expended and equipment is in place to deliver the program.

## **Evaluation and Assessment**

### Student Learning Outcomes

As part of the Annual Report, departments must submit an annual [Student Learning Outcomes Assessment Plan and Report](#). For each program, this report documents student learning outcome assessment plans (which consist of student learning outcomes, effectiveness measures, assessment methodology, and performance outcomes), assessment data, changes that will be made based on assessment data, and the impact of changes on student learning. Student learning outcomes for programs offered through the online delivery mode are the same as for programs offered face-to-face. Student Learning Outcomes Assessment Plans and Reports from all colleges at both the undergraduate and graduate levels and from online and face-to-face delivery modes are required.

UNC Charlotte utilizes a decentralized model for student learning outcomes assessment. Assessment Leads are appointed to oversee student learning outcomes assessment. Assessment Leads work with department chairs on the development of SLO assessment plans and evaluation rubrics, documentation of assessment data, and the use of assessment data for continuous improvement. The Director of Assessment in the Office of Assessment and Accreditation provides training and guidance to the Assessment Leads. The Executive Director of the Office of Assessment and Accreditation chairs the Academic Affairs Assessment Team (AAAT), which oversees SLO assessment processes at UNC Charlotte.

### Planning

Each year, each division develops expected outcomes and measurement plans to assess the accomplishment of its goals and objectives. Upon completion, the units subsumed in each division will align their plans with the division plans. At the division level, vice chancellors use [report templates](#) and scorecards to note the accomplishment of division goals and objectives and continuous improvement. The Institutional Effectiveness Oversight Committee (IEOC) uses these completed reports and scorecards to annually review and prepare a [University scorecard](#) of findings to the Chancellor for discussion with his Cabinet.

As indicated previously, all colleges and departments within Academic Affairs complete five-year strategic plans. In addition, colleges and departments submit an Annual Report that highlights the major accomplishments for the year. The [Strategic Plan and Annual Report](#) from the William States Lee College of Engineering is provided. This report is used to complete the [Academic Affairs Annual Highlights](#).